

SECTION 00 0101 - PROJECT TITLE PAGE

PROJECT NAME:

Central Detroit Christian Piety Hill Kingston Place
1550 Taylor Street, Detroit MI, 48207

OWNER:

Piety Hill 2
Detroit, MI 48207

ARCHITECT:

Berardi + Partners, LLC
1398 Goodale Blvd., Columbus, Ohio 43212

GENERAL CONTRACTOR:

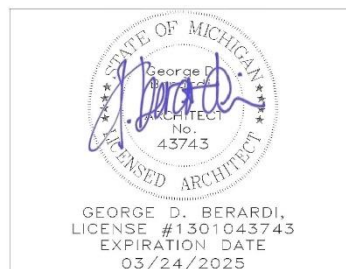
G. Fisher Construction Co.
31313 Northwestern Highway #206
Farmington Hills, Michigan 48334

CIVIL ENGINEER:

Civil Engineer
n/a

SYSTEMS ENGINEER:

Berardi + Partners, LLC
Detroit, MI



BERARDI+

ARCHITECTURE | INTERIOR DESIGN | ENGINEERING

SECTION 00 0102 - PROJECT INFORMATION

PART 1 GENERAL

1.01 PROJECT IDENTIFICATION

- A. Project Name: Central Detroit Christian Piety Hill Kingston Place , located at 1550 Taylor Street, Detroit MI, 48207.
- B. Project Number: 20132C.
- C. The Owner, hereinafter referred to as Owner: Piety Hill 2

1.02 PROJECT DESCRIPTION

- A. Summary Project Description: See cover sheet of drawings for project summary.
- B. Contract Scope: Construction, demolition, renovation, hazardous material removal, site acquisition, construction financing, and facility operations during occupancy.
- C. Contract Terms: Lump sum (fixed price, stipulated sum).

1.03 TAXES

- A. The project is subject to all applicable local, state and federal sales taxes.

1.04 OWNER OCCUPANCY

- A. Owner intends to occupy the Project upon Substantial Completion.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- C. Schedule the Work to accommodate Owner occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

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

1.06 PROCUREMENT TIMETABLE

- A. The Owner reserves the right to change the schedule or terminate the entire procurement process at any time.

1.07 Performance required during bidding.

- A. By submitting a bid for any Section of the work for this project, each sub-contractor must have actually read all of Divisions 00 & 01 prior to reading the technical specifications covering their specific work and reviewing the drawings.
- B. Notify in a timely manner to the Architect/Engineer any discrepancies or inconsistencies in the construction drawings and specifications which will impair or prevent achieving the final design requirements of the Project.
- C. Submit any product of equal to or greater performance for prior approval. Review 'Submittal Requirements' identified by this project manual.

1.08 Performance required during construction.

- A. Reread all of Division 00 & 01 and review the drawings prior to submittal of shop drawings and initiating any related construction.
- B. Submit shop drawings, product data and other information required to accurately portray the performance of the product in accordance with the Contract Documents.
- C. Manufacturer's Installation Requirements (Manuals) are referenced as part of project requirements in order to ensure the accurate installation and safe/efficient operation of their products.
- D. Notify Prime Contractor if any work prior to the installation of your work is not at a quality standard to receive your Work.
- E. Follow the directions of the Prime Contractor.
- F. Complete the Work in a prescribed manner and time frame to achieve the desired results required by the Contract Documents.

1.09 Job Site Safety.

- A. Notify the Prime Contractor of any unsafe conditions.
- B. Follow the manufacturer's operations manual for any operation of equipment and required rough-in services for installation of product. Rough-ins services which may not be shown by the drawings will be required to be provided as part of the Contract.
- C. Do not drink or consume any matter labeled unsafe or mind altering, while completing the prescribed work for project within your required category of the work.

1.10 Reference Standards.

- A. All common standards, laws and protocols which represent quality and are within the boundaries of the common understanding within the industry shall be applied to the project. If you don't know what the limits of your work scope are ask before preparing a bid.

1.11 DOCUMENTATION REQUIRED PRIOR TO CONSTRUCTION START

- A. The following must be documented by the Prime Contractor to the Architect that prior to proceeding with the Work they have contracted with sub-contractors and suppliers that they possess the ability to:
 - 1. Read, comprehend and speak the English language
 - 2. Understand that their contractual obligation to perform the Work is governed by both the Project Manual (Specifications) and Drawings, together with all referenced instructions and those standards and codes common to the Construction Industry or specific trade;

1.12 PROCUREMENT DOCUMENTS

- A. Availability of Documents: Complete sets of procurement documents may be obtained:
 - 1. Documents may be downloaded from the Architect's File Transmission Protocol (FTP) site or Cloud. Contact the Architect for specific requirements for access.
 - 2. From Owner at the Project Manager's address listed above.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 00 0110 - TABLE OF CONTENTS

PROCUREMENT AND CONTRACTING REQUIREMENTS

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- 01 7000 - Execution and Closeout Requirements
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- 01 7900 - Demonstration and Training

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END OF SECTION

SECTION 00 2113 - INSTRUCTIONS TO BIDDERS

SUMMARY

1.01 DOCUMENT INCLUDES

INVITATION

2.01 BID SUBMISSION

2.02 INTENT

- A. The intent of this Bid request is to obtain an offer to perform work to complete all work as indicated in the Project Manual and Drawings for a Stipulated Sum contract, in accordance with the Contract Documents.

2.03 WORK IDENTIFIED IN THE CONTRACT DOCUMENTS

- A. Work of this proposed Contract comprises building construction, including all general construction work.

2.04 CONTRACT TIME

- A. Identify Contract Time in the Bid Form. The completion date in the Agreement shall be the Contract Time added to the commencement date.

BID DOCUMENTS AND CONTRACT DOCUMENTS

3.01 DEFINITIONS

- A. Bid Documents: Contract Documents supplemented with Invitation To Bid, Instructions to Bidders, Information Available to Bidders, Bid Form Supplements To Bid Forms and Appendices identified.
- B. Contract Documents: Defined in AIA A201 Article 1 including issued Addenda.
- C. Bid, Offer, or Bidding: Act of submitting an offer under seal.
- D. Bid Amount: Monetary sum identified by the Bidder in the Bid Form.

3.02 CONTRACT DOCUMENTS IDENTIFICATION

- A. The Contract Documents are identified as Project Number 20132C, as prepared by Architect who is located at 1398 Goodale Blvd., Columbus, Ohio, and with contents as identified in the Table of Contents.

3.03 AVAILABILITY

- A. Bid Documents may be obtained from the Architect.
- B. Bid Documents are made available only for the purpose of obtaining offers for this project. Their use does not grant a license for other purposes.

3.04 INQUIRIES/ADDENDA

- A. Direct questions to Berardi + Partners, Inc..
- B. Addenda may be issued during the bidding period. All Addenda become part of the Contract Documents. Include resultant costs in the Bid Amount.
- C. Verbal answers are not binding on any party.
- D. Clarifications requested by bidders must be in writing not less than 7 days before date set for receipt of bids. The reply will be in the form of an Addendum, a copy of which will be forwarded to known recipients.

3.05 PRODUCT/ASSEMBLY/SYSTEM SUBSTITUTIONS

- A. Where the Bid Documents stipulate a particular product, substitutions will be considered up to 10 days before receipt of bids.
- B. Submit substitution requests by completing the form in Section 00 4325 - Substitution Request Form - During Procurement; see this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.
- C. When a request to substitute a product is made, Architect may approve the substitution and will issue an Addendum to known bidders.
- D. The submission shall provide sufficient information to determine acceptability of such products.
- E. Provide complete information on required revisions to other work to accommodate each proposed substitution.
- F. Provide products as specified unless substitutions are submitted in this manner and accepted.

SITE ASSESSMENT

4.01 SITE EXAMINATION

- A. Examine the project site before submitting a bid.
- B. A visit to the project site has been arranged for bidders as indicated above.

QUALIFICATIONS

5.01 EVIDENCE OF QUALIFICATIONS

- A. To demonstrate qualification for performing the Work of this Contract, bidders may be requested to submit written evidence of financial position, license to perform work in the State and AIA Form A305.

5.02 SUBCONTRACTORS/SUPPLIERS/OTHERS

- A. Owner reserves the right to reject a proposed subcontractor for reasonable cause.
- B. Refer to General Conditions.

BID SUBMISSION

6.01 SUBMISSION PROCEDURE

- A. Bidders shall be solely responsible for the delivery of their bids in the manner and time prescribed.
- B. Submit one copy of the executed offer on the Bid Forms provided, signed and sealed with the required security in a closed opaque envelope, clearly identified with bidder's name, project name and Owner's name on the outside.
- C. Improperly completed information, irregularities in security deposit, may be cause not to open the Bid Form envelope and declare the bid invalid or informal.
- D. An abstract summary of submitted bids will be made available to all bidders following bid opening.

6.02 BID INELIGIBILITY

- A. Bids that are unsigned, improperly signed or sealed, conditional, illegible, obscure, contain arithmetical errors, erasures, alterations, or irregularities of any kind, may at the discretion of the Owner, be declared unacceptable.
- B. Bid Forms, Appendices, and enclosures that are improperly prepared may, at the discretion of Owner, be declared unacceptable.
- C. Failure to provide security deposit, bonding or insurance requirements may, at the discretion of Owner, be waived.

20132C / Central Detroit Christian Piety Hill Kingston Place	00 2113 - 1	Instructions to Bidders

BID ENCLOSURES/REQUIREMENTS

7.01 SECURITY DEPOSIT

- A. Bids shall be accompanied by a security deposit as follows:
 - 1. Bid Bond in the amount of \$ _____ on AIA A310 Bid Bond Form.
- B. Endorse the Bid Bond in the name of the Owner as obligee, signed and sealed by the principal (Contractor) and surety.
- C. The security deposit will be returned after delivery to the Owner of the required Performance and Payment Bond(s) by the accepted bidder.
- D. Include the cost of bid security in the Bid Amount.
- E. If no contract is awarded, all security deposits will be returned.

7.02 PERFORMANCE ASSURANCE

- A. Accepted Bidder: Provide a Performance and Payment bond using AIA document A312.
- B. Include the cost of performance assurance bonds in the Bid Amount.

7.03 BID FORM REQUIREMENTS

- A. Complete all requested information in the Bid Form and Appendices.

7.04 SCHEDULE OF VALUES

- A. Submit a schedule of values as described in Section 01 2100. Schedule of values shall indicate a break out of material costs per line item.

7.05 EVIDENCE OF QUALIFICATIONS

- A. Submit completed document AIA A305.

7.06 FEES FOR CHANGES IN THE WORK

- A. Include in the Bid Form, the overhead and profit fees on own Work and Work by subcontractors, applicable for Changes in the Work, whether additions to or deductions from the Work on which the Bid Amount is based.
- B. Include in the Bid Form, the fees proposed for subcontract work for changes (both additions and deductions) in the Work. Contractor shall apply fees as noted, to the subcontractor's gross (net plus fee) costs on additional work.

7.07 BID FORM SIGNATURE

- A. The Bid Form shall be signed by the bidder, as follows:
 - 1. Sole Proprietorship: Signature of sole proprietor in the presence of a witness who will also sign. Insert the words "Sole Proprietor" under the signature. Affix seal.
 - 2. Partnership: Signature of all partners in the presence of a witness who will also sign. Insert the word "Partner" under each signature. Affix seal to each signature.
 - 3. Corporation: Signature of a duly authorized signing officer(s) in their normal signatures. Insert the officer's capacity in which the signing officer acts, under each signature. Affix the corporate seal. If the bid is signed by officials other than the president and secretary of the company, or the president/secretary/treasurer of the company, a copy of the by-law resolution of their board of directors authorizing them to do so, must also be submitted with the Bid Form in the bid envelope.

7.08 SELECTION AND AWARD OF Alternates

- A. Bids will be evaluated on the total of the base bid price and all of the Alternates. After determination of the successful bidder, consideration will be given to which Alternates will be included in the Work.

OFFER ACCEPTANCE/REJECTION

8.01 DURATION OF OFFER

- A. Bids shall remain open to acceptance and shall be irrevocable for a period of thirty (30) days after the bid closing date.

8.02 ACCEPTANCE OF OFFER

- A. Owner reserves the right to accept or reject any or all offers.
- B. After acceptance by Owner, Architect on behalf of Owner, will issue to the successful bidder, a written Bid Acceptance.

END OF SECTION

SECTION 00 3100 - AVAILABLE PROJECT INFORMATION

PART 1 GENERAL

1.01 EXISTING CONDITIONS

- A. Certain information relating to existing surface and subsurface conditions and structures is available to bidders and will be part of the Contract Documents, as follows:
- B. Site and Utility Survey: Included in the drawings, to provide location and sizes for all utilities of public record, location of and existing improvements, and detailed topographic information.
- C. Geotechnical Report: Included as part of this project specification.
 - 1. The report is available for bidders' information, but is not a warranty of subsurface conditions. The contractor is entitled to rely upon the factual information contained therein, such as locations and depths of tests or explorations made at the site and materials encountered at each location, all as of the dates made. The contractor is not entitled to rely upon the nonfactual information contained therein such as interpretations, opinions, or extrapolations of data; nor is the contractor entitled to rely upon the completeness of the information for the contractor's purposes.
 - 2. Bidders should visit the site and acquaint themselves with all existing conditions. Prior to bidding, bidders may make their own subsurface investigations to satisfy themselves as to site and subsurface conditions, but all such investigations shall be performed only under time schedules and arrangements approved in advance by the General Contractor.
 - 3. It shall be specified that all of the recommendation of the SDoil Engineer associated with site preparation, foundation design, and other related systems shall be incorporated by the General Contractor, whether they may have in part or in total been incorporated as part of this Project Manual or Construction Documents.
 - 4. If conditions are encountered in the field during construction which vary from the facts of this report, the "original" Soils Engineer may be contacted through the office of the Architect, immediately as necessary to examine such changed conditions in the field and make the appropriate recommendations in light of the contract documents.
 - 5. This report, by its nature, cannot reveal all conditions that exist on site. Should subsurface conditions be found to vary substantially from his report, changes in the design and construction of foundations will be made with resulting expenditures for additional engineering and architectural design to the original project scope and the original Contract Price accruing to the Owner.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

3.01 OBTAINMENT OF PERMITS

- A. The following permits are known to be required and shall be obtained by the Contractor:
 - 1. Full / Blanket Building Permit including all trade / subcontractor permits..

END OF SECTION

SECTION 00 5000 - CONTRACTING FORMS AND SUPPLEMENTS

PART 1 GENERAL

1.01 AGREEMENT AND CONDITIONS OF THE CONTRACT

- A. See Section 00 5200 - Agreement Form for the Agreement form to be executed.
- B. See Section 00 7200 - General Conditions for the General Conditions.
- C. See Section 00 7300 - Supplementary Conditions for the Supplementary Conditions.
- D. The Agreement is based on AIA A101, 2017
- E. The General Conditions are based on AIA A201, 2017.

1.02 FORMS

- A. Use the following forms for the specified purposes unless otherwise indicated elsewhere in the Contract Documents.
- B. Bond Forms:
 - 1. Bid Bond Form: AIA A310.
 - 2. Performance and Payment Bond Form: AIA A312.
- C. Clarification and Modification Forms:
 - 1. Architect's Supplemental Instructions Form: AIA G710.
 - 2. Construction Change Directive Form: AIA G714.
 - 3. Change Order Form: AIA G701.
- D. Closeout Forms:
 - 1. Certificate of Substantial Completion Form: AIA G704.
 - 2. Affidavit of Payment of Debts and Claims Form: AIA G706.
 - 3. Contractor's Affidavit of Release of Liens Form: AIA G706A
 - 4. Separate Release or Waivers of Liens from Subcontractors and material and equipment suppliers, accompanied by a list thereof.

1.03 REFERENCE STANDARDS

- A. AIA A101 - Standard Form of Agreement Between Owner and Contractor where the basis of Payment is a Stipulated Sum 2017.
- B. AIA A201 - General Conditions of the Contract for Construction 2017.
- C. AIA A310 - Bid Bond 2010.
- D. AIA A312 - Performance Bond and Payment Bond 2010.
- E. AIA G701 - Change Order 2017.
- F. AIA G704 - Certificate of Substantial Completion 2017.
- G. AIA G706A - Contractor's Affidavit of Release of Liens 1994.
- H. AIA G710 - Architect's Supplemental Instructions 2017.
- I. AIA G714 - Construction Change Directive 2017.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 00 7100 - CONTRACTING DEFINITIONS

PART 1 GENERAL

1.01 APPLICABILITY:

- A. These definitions are integral to the Agreement, for the portions of the work which are managed throughout the process of construction, or in the case of 'design assist' by the Contractor in conjunction with the Owner, the Architect and Project Engineers.

1.02 DEFINITIONS - DESIGN-BUILD DOCUMENTS

- A. Contract Documents: As defined in the Conditions of the Contract and as follows:
 - 1. At the time of execution of the Agreement, the Contract Documents consist of the following:
 - a. The Agreement and Conditions of the Contract, and other documents listed on the Table of Contents under the heading Contracting Requirements.
 - b. The Proposal and Proposal Exhibits, except for provisions that contradict the requirements of the Conceptual Documents and that are not specifically accepted by the Owner by means of written Modification prior to execution of the Agreement.
 - 2. From time to time after execution of the Agreement, upon approval by the Owner, the following types of documents will be incorporated into the Contract Documents:
 - a. Drawings and other documents documenting the design.
 - b. Construction drawings and specifications detailing the execution of the design. All drawings, plans, specifications, other instructions including manufacturer's requirements for installation and any other documents which provide direction for completing the work schedules for the completion of the project.
- B. Project Program: The Owner's requirements for size, arrangement, organization, and location of functional spaces, description of space functions, identification of fittings, equipment, and furnishings, description of the physical and environmental requirements for each space, together with a description of the image, goals, or "mission" of the project.
- C. Proposal: The Proposal Form and Exhibits, which comprise the information prepared by the prospective Design-Builder to show their method of complying with the Conceptual Documents.

1.03 DEFINITIONS - TIME PERIODS AND MILESTONE DATES

- A. Proposal Period: The time period during which prospective Proposers prepare their Proposals.
 - 1. Substantiation specified to occur during the Proposal period are intended to accompany the Proposal.
- B. Preliminary Design: The time period during which the design criteria are finalized and preliminary drawings and written descriptions are prepared to illustrate the proposed design of the work or a portion of the work to the Owner, as described in the Conditions of the Contract.
- C. Design Development: The time period during which the form, arrangement, size, and materials of the work or a portion of the work are determined as described in the Conditions of the Contract.
- D. Construction Documents: The time period during which process working drawings, specifications, and other documents describing the work or a portion of the work are prepared in sufficient detail to allow accurate and complete construction.
- E. Construction: The time period from the beginning of work on the project site until final payment as defined in the Conditions of the Contract.
- F. Substantial Completion: The date as defined in the Conditions of the Contract. Date of Substantial Completion is the due date for the following:
 - 1. Design-Builder or Architect's complete punchlist of items to be completed.
 - 2. Owner's complete punchlist of items to be completed.
 - 3. Compliance with requirements of governing authorities, for submittals, inspections, and permits.
 - 4. Compliance with Owner's requirements for access to areas occupied by the Owner.
 - 5. Final cleaning.
 - 6. Maintenance manuals.
 - 7. Warranties.
 - 8. Spare parts and extra materials.
 - 9. Maintenance supplies and tools.
 - 10. Project record documents.
 - 11. Final site survey.
- G. Closeout: The time period during which all details of both construction and commissioning are completed.
 - 1. The Closeout period is the time from Date of Substantial Completion until final payment, both as defined by the Conditions of the Contract.
 - 2. Before and during the Closeout period, the Owner will ascertain whether the completed project complies with the Contract Documents.
 - 3. Contractor is responsible for operation and maintenance of the project until the end of the Closeout period; except for those areas the owner has moved into. Once the owner has moved into an area the contractor's responsibilities for operation and maintenance of that area will decrease.
 - 4. Training of Owner's personnel in operation and maintenance occurs during the Closeout period, unless specifically indicated otherwise for certain items.
- H. Occupancy: The time period during which the project is occupied for its intended purpose.
 - 1. The Occupancy period begins at Date of Substantial Completion, as defined by the Conditions of the Contract.
 - 2. Move-in will occur before the end of the Closeout period.
 - 3. Design-Builder is responsible for operation and maintenance of the project until the end of the Closeout period.
- I. Correction Period: The time period defined by the Conditions of the Contract.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

20132C / Central Detroit Christian Piety Hill Kingston Place	00 7100 - 1	Contracting Definitions

SECTION 00 7200 - GENERAL CONDITIONS

FORM OF GENERAL CONDITIONS

1.01 The General Conditions applicable to this contract is attached following this page.

RELATED REQUIREMENTS

2.01 SECTION 01 4216 - Definitions.

END OF SECTION

20132C / Central Detroit Christian Piety Hill Kingston Place	00 7200 - 1	General Conditions

SECTION 00 7300 - SUPPLEMENTARY CONDITIONS

PART 1

1.01 Scope

A. Description

1. The following supplements modify, change, delete from or add to the "General Conditions of the Contract for Construction," AIA Document A201, 2007 edition. Where any article of the General Conditions is modified or any paragraph, subparagraph or clause thereof is modified or deleted by these Supplementary Conditions, the unaltered provisions of that article, paragraph, subparagraph or clause shall remain in effect.

PART 2

2.01 Supplements

A. Article 1 - General Provisions

1. Add the following clause to subparagraph 1.2.3:
 - a. 1.2.3.1 The specifications are, in part, of the brief or "streamlined" type and include incomplete sentences. Omissions of words or phrases such as "The Contractor shall", "as noted on the drawings", "according to the drawings", "a", "an", "the" and "all" are intentional.
 - 1) Omitted words or phrases shall be supplied by inference in same manner as they are when "note" occurs on the drawings. Words "shall" or "shall be" shall be supplied by inference where a colon(:) is used within sentence or phrases. Words "as per" shall mean "in accordance with". Words "provide" and "work" shall mean furnish, install and connect up complete, in operative conditions and use, all materials, equipment, apparatus and required appurtenances of the particular item to which it has reference. Whenever words "approved" "satisfactory", "directed", "submitted", "inspected", or similar words or phrases are used, it shall be assumed that the word "Architect" follows the verb as the object of the clause, such as "approved by the Architect" and "submitted to the Architect". Where a manufacturer's name is mentioned, words "as manufactured by" or "as made by" shall be understood.
2. Add the following clause to subparagraph 1.6.1:
 - a. Reproduction of any portion of the Architect's Construction Documents for use as Submittals for Shop Drawings is not acceptable.

B. Article 3 – Contractor

1. Add the following clause to subparagraph 3.3.1:
 - a. 3.3.1.1 The Contractor shall review any specified construction or installation procedure, including those recommended by Manufacturers and shall advise the Architect:
 - 1) the specified procedure deviates from good construction practice
 - 2) following the procedure, will affect any warranties, including the Contractor's general warranty.
 - 3) any objections that the Contractor may have to the procedure
 - 4) the Contractor proposes any alternative procedure which the Contractor is willing to warrant.
2. Add the following subparagraphs to paragraph 3.4:
 - a. 3.4.3 Products are generally specified by ASTM or other referenced standard, and/or by manufacturer's name and model number or trade name. When specified only by reference standard, the Contractor may select any product or manufacturer as specified as being equally acceptable. The Contractor has the option of using any product and manufacturer combination listed. (When only one product and manufacturer is specified, this is the basis of the Contract, without substitution or exception).
3. Add the following clause to subparagraph 3.4.5:
 - a. 3.4.5.1 The Contractor shall disclose the existence and extent of any financial interest, whether direct or indirect, he has in Subcontractors or Material Suppliers which he may propose for this project.
4. 3.4.6 Substitutions will not be considered if:
 - a. they are indicated or implied on shop drawings submissions without the formal request required in subparagraph 3.4.4.
 - b. for their implementation they require a substantial revision of the Contract Documents in order to accommodate their use.
 - c. They appear to be merely for the decrease in expenditures on behalf of the Contractor without a corresponding reduction in costs to the Owner.
5. 3.4.7 All Contractors and subcontractors employed on the work shall be required to conform to the governing labor laws and the various acts amendatory thereto, and all other laws, ordinances and legal requirements applicable thereto.
6. 3.4.8 The Contractor or his subcontractors shall not discriminate in hiring or any matter of employment by reason of sex, race, color, religion, ancestry, or national origin. Submission of a bid on this project is implied acceptance of the inclusion of this clause and all Contract Documents.
7. Add the following clauses to subparagraph 3.18.1:
 - a. 3.18.1.1 The Contractor is solely responsible for all citations and penalties arising out of, or resulting from, the performance of the work under his Contract.
 - b. The Contractor shall indemnify and hold harmless the Owner, the Architect, and their agents and employees from and against all claims, damages, losses and expenses, including attorney's fees, arising out of such Occupational Safety and Health Act violations and other applicable ordinances, rules, and regulations outlined in Article 10.

C. Article 4 - Administration of the Contract

1. Arbitration: Delete all references to arbitration from the General Conditions.
2. Add the following clause to subparagraph 4.2.4:
 - a. 4.2.4.1 Any direct communication between the Owner and Contractor that affects the performance or administration of the Contract shall be made or confirmed in writing, with copies to the Architect, and any

- such communications that represent a modification of the Contract requirements shall be documented appropriately.
3. 4.2.4.2 Any communications among the Architect and Subcontractors shall be confirmed in writing to the Contractor.
- D. Article 5 – Subcontractors
1. "5.2.1 (Delete the first sentence of this paragraph and substitute the following.) Each bidder, within 20 calendar days after award of the Contract, shall submit on a sheet of their Company Letterhead, for review by the Owner and Architect, a complete list of major subcontractors and manufacturers furnishing and/or installing materials and products specified on this project. The list shall be complete with names, addresses, city, state and zip code."
- E. Article 7 - Changes in the Work
1. In the first sentence of subparagraph 7.3.6, delete the words "a reasonable allowance for overhead, and profit" and substitute "an allowance for profit in accordance with the schedule set forth in subparagraphs 7.3.10".
 2. Add the following subparagraph to paragraph 7.3:
 - a. 7.3.10 In subparagraphs 7.3.3 and 7.3.6 the allowance for profit included in the total cost to the Owner, shall be based on the following schedule:
 - 1) For the Contractor, for work performed by the Contractor's own forces, the percentage equal to the current percentage for the Contractor's overhead and profit.
 - 2) For the Contractor, for work performed by his subcontractor, five percent (5%) of the amount due the subcontractor.
 - 3) For the Contractor, for materials supplied by his material supplier, five percent (5%) of the amount due the material supplier.
 - 4) Cost to which profit is to be applied shall be determined in accordance with subparagraphs 7.3.6 and 7.3.7.
 - 5) In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and subcontracts. Labor and materials shall be itemized in the manner prescribed above. Separate labor breakdowns shall be submitted for foremen, mechanics, apprentices and laborers. Where major cost items are subcontracts, they shall be itemized also. In no case will a change involving over \$500.00 be approved without such itemization
 - 6) For deduct Change Orders not signed by the Contractor, the Architect will hold funds equal to the deduct until signed.
- F. Article 8 – Time
1. Revise subparagraph 8.1.2 to read as follows:
 - a. "The date of commencement of the work is the date established in a notice to proceed. If there is no notice to proceed, it shall be the date established in the Agreement. The date shall not be postponed by the failure to act of the Contractor or of persons or entities for whom the Contractor is responsible."
 2. Add the following subparagraphs to paragraph 8.2:
 - a. 8.2.4 Each prime Contractor, subcontractor, and/or material company shall furnish sufficient labor forces, construction plant and equipment, temporary heat, enclosures, etc., required for their work and protection unless specified elsewhere, and shall work such hours, including night shifts and overtime operations as may be necessary to insure the prosecution of the work in accordance with the approved current progress schedule. If, in the opinion of the Architect, the Contractor falls behind the progress schedule, the Contractor shall take such steps as may be necessary to improve his progress without additional cost to the Owner. Failure of the Contractor to comply with the requirements of the Architect under this provision shall be grounds for determination by the Architect that the Contractor is not prosecuting the work with such diligence as will insure completion within the time specified. Upon such determination, the Owner shall have the right, without limiting any other right he may have to either not approve reduction of retainage or to terminate the Contractor's right to proceed with the work or any separable part thereof.
 - b. 8.2.5 Timely performance is an expressed condition of the contract and any delay in the Contractor's performance may excuse the Owner from his obligation to perform. Failure to abide by the time condition may be treated as a breach of contract.
 3. Delete subparagraph 8.3.2 and replace with the following:
 - a. 8.3.2 The Contractor agrees that whether or not any delay shall be the basis for a modification of time, he shall have no claim against the Owner or Architect for an increase in the contract price, nor a claim against the Owner or Architect for a payment or allowance of any kind for damage, loss or expense resulting from delays, or acceleration, or any other modification of schedule; nor shall the Contractor have any claim for damage, loss or expense resulting from interruptions to or suspension of, his work to enable other Contractors to perform their work. The only remedy available to the Contractor shall be a modification of time.
- G. Article 9 - Payments and Completion
1. Revise clause 9.3.1.1 to read as follows:
 - a. "Such applications may not include requests for payment on account of changes ...".
 2. Add the following to clause 9.3.1.1:
 - a. Such applications shall not include Change Orders that have been issued but have not been fully executed.
 3. Add the following subparagraphs to paragraph 9.8.2:
 - a. 9.8.2.1 If the initial inspection requested by the Contractor to establish Substantial Completion determines the Project is not substantially complete, the Contractor shall pay for additional re-inspections by the Architect, at no expense to the Owner.

4. In subparagraph 9.8.3, add the following:
 - a. "The payment shall be sufficient to increase the total payments to ninety-five percent (95%) of the contract sum, less such amounts as the Architect shall determine for all incomplete work and unsettled claims."
- H. Article 10 - Protection of Persons and Property
 1. Add the following clauses to subparagraph 10.1.1:
 - a. 10.1.1.1 If the Owner believes in good faith that the Contractor is not fulfilling his responsibilities under Article 10 of the General Conditions, the owner may, but is not required, to order the Contractor to immediately cease work until such time as the Contractor comes within compliance. If the Owner believes in good faith that the Contractor has failed to come within compliance within seven (7) days of receiving the notice to cease work, the Owner may terminate the Contract obligations under Article 14 of the General Conditions. Nothing contained herein shall be deemed to shift the responsibility of the safety of persons and property from the Contractor to any other person or entity, and the Owner and the Architect specifically disavow same.
 - b. 10.1.1.2 The Contractor shall indemnify and hold harmless the Owner and Architect for any claim or demand made against either or both which arises out of an actual or claimed violation of Article 10, including all reasonable attorneys' fees and costs of litigation.
 - c. 10.1.1.3 The Owner reserves the right to hire an independent third party safety consultant to review and advise on all related safety activities pursuant to the job. This does not relieve in any manner any contractor the specific duty for compliance in regard to any local, state, or federal regulation pertaining to safety on the job-site. Any fines generated as a result of a contractor's non-compliance with a local, state or federal safety regulation shall be the responsibility of the contractor. Any fine issued to the owner (or any party other than the responsible contractor) as a result of a contractor's non-compliance shall be the responsibility of the contractor.
 2. Add the following clauses to subparagraph 10.2.1:
 - a. 10.2.1.4 All work, materials, apparatus and fixtures, which may be caused by weather (rain, winds, storms, frost and heat).
 - b. 10.2.1.5 Excavated banks, trenches and the building from damage from rainwater, spring water, groundwater, backing up of drains or sewers and all other water admitted to the work by his operation. He shall provide all pumps and other equipment and enclosures to provide this protection.
 3. Revise Subparagraph 10.2.5 as follows:
 - a. The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Clauses 10.2.1.2, 10.2.1.3 and 10.2.1.4 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Clauses 10.2.1.2, 10.2.1.3 and 10.2.1.4. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Paragraph 3.18.
- I. Article 11 - Insurance and Bonds
 1. Prior to the commencement of any work and prior to the performance of any service, the Contractor shall procure and pay for the following insurance coverages, and he shall maintain them in force after his work is completed and accepted for final payment and throughout the one (1) year guarantee period. The insurers and policies shall be subject to the Owner's approval.
 2. The types and amounts of insurance to be provided for by the Contractor shall be as follows:
 - a. Workmen's Compensation
 - 1) Statutory Workmen's Compensation and Occupational Disease Insurance with all elective employments covered and all excluded employments covered on a voluntary basis where permissible,
 - 2) The Workmen's Compensation policy shall contain the following endorsement, unless specifically prohibited by compensation insurance authorities having jurisdiction:
 - (a) "Whereas, Contractor may undertake to perform work for the Owner; and, whereas, said Owner may exercise some degree of jurisdiction or control over the employees of Contractor engaged in such work, it is agreed that, subject to the conditions and limitations of this policy, said Owner is named as an additional insured employer under this policy, but only as respects employees of Contractor whose names appear on the payroll records of Contractor while performing such work for said company."
 - b. Bodily Injury and Property Damage Liability
 - 1) The liability policy shall be on a comprehensive liability form and shall include, but not be limited to, coverage for all operations of the Contractor, including automobile, premises, contractual liability, completed operations liability, personal injury liability and coverage as respects the explosion, collapse and underground hazards.
 - 2) The Contractor shall effect and maintain insurance covering himself or his agents, the Owner or its assignee and the Architect/Engineer against all claims, demands or actions arising under the Indiana Workmen's Compensation Law against all other claims, demands or actions for injury to, or death of, persons and damage to property, and will furnish the Owner with certificates showing the following coverages in complete satisfaction to the Owner.
 - 3) Worker's Compensation Insurance, Occupational Disease Insurance and Employer's Liability Insurance for all employees engaged in the work under this agreement.
 - (a) Employer's Liability \$500,000 each Accident, Disease Aggregate
 - 4) Commercial General Liability Insurance, including Contractor's Protective Liability, Completed Operations, Blanket Contractual and Personal Injury Liability, and Coverage as Respects the Explosion, Collapse, and Underground Hazards:

- (a) Each Occurrence \$1,000,000
 - (b) Personal Injury \$1,000,000
 - (c) General Aggregate \$2,000,000
 - (d) Products/Completed Operations
 - (e) Aggregate \$2,000,000
 - (f) Automobile Liability \$1,000,000 Occurrence
 - (g) Excess Liability \$5,000,000 Each occurrence
 - (h) \$5,000,000 Aggregate
 - (i) The combination of Primary and Excess Limits shall meet and/or exceed the above required limits. The insurance coverage provided should meet the exposures relating to the type of work performed.
- c. Automobile Insurance: Contractors shall maintain a comprehensive automobile form of insurance with minimum limits of \$1,000,000 combined single limit applying to bodily injury and property damage liability. The automobile insurance must include coverage for all owned, nonowned and hired automobiles.
 - d. Umbrella Liability Insurance: An umbrella policy shall be furnished in the minimum amount of \$5,000,000. The above underlying primary limits of liability for both comprehensive general liability and comprehensive automobile liability may be reduced only if an excess umbrella policy is obtained with a minimum limit of \$5,000,000 and then only to the extent to the minimum required for primary coverage under such excess contract.
 - e. Aircraft Liability Insurance: If any aircraft is to be used by the Contractor in connection with this contract either as a conveyance to and from the location of the job site or for use in the course of construction, liability insurance in the amounts acceptable to the Owner shall be obtained by the Contractor and this liability coverage shall be shown on the insurance certificate. If the Contractor will not be using aircraft as described above, then the Contractor shall have the following statement on his certificate of insurance:
 - 1) "No aircraft is intended for use and said insurance for same is not required."
 - f. Proof of Carriage of Insurance: The Contractor shall not commence work under this contract until he has obtained all insurance required, as specified herein, and has filed with the Architect three (3) certificates of insurance described herein, evidencing the carriage of insurance and the requisite amounts placed with satisfactory carriers licensed in the State of Insert State here, and countersigned by a resident Insert State here agent. Should any coverage approach expiration during the contract period, it shall be renewed prior to its expiration and certificates again filed with the Architect. Said certificates are to contain the following:
 - 1) "It is hereby agreed that the Owner shall be notified ten (10) days prior to cancellation of any insurance, material alteration and/or election not to renew."
 - 2) All insurance shall be maintained in full force and effect until the contract has been fully and completely performed.
 - g. Owner's Insurance
 - 1) Owner's Liability Insurance: The Owner shall be responsible for and at their option may maintain such insurance that will protect them from their contingent liability to others for damages because of bodily injury, including theft, and property damages which may arise from operations under any contracts that may be awarded as specified herein.
 - 2) Property/Builder's Risk Insurance: The Owner shall maintain "All Risk" (Builder's Risk Completed Value Form Insurance) insurance which shall include, but not be limited to, fire, lightning, extended coverage perils, vandalism and malicious mischief, collapse, water damage from bursting pipes, and theft of building materials from the job site upon the renovation/remodeling which is the subject of this contract. Coverage shall include items of labor and materials connected therewith whether in or within 100 feet of the structure insured, materials in place or to be used as part of the permanent construction, including surplus materials, protective fences, bridges, or temporary structures, miscellaneous materials and supplies incidental to the work, and such scaffolding, staging, towers, forms, and equipment as are not owned or rented by the Contractor, the cost of which is included in the cost of the work. The policy shall insure the Owner and shall also include the interest of the Contractor during course of construction until completed and accepted by the Owner. Coverage shall not be voided by partial occupancy until the work is completed and accepted by the Owner.
 - 3) Loss, if any, is to be adjusted both with and payable to the Owner as trustees for the insureds as their interest may appear, except in such cases as may require payment of all or a portion of such insurance to be made to the mortgagee, as his interest may appear. Any deductibles shall be paid by the Owner.
 - 4) Exclusions: The insurance does not cover any tools owned by mechanics, any tools, equipment, scaffolding, staging, towers, and forms owned or rented by the Contractor, the capital value of which is not included in the cost of the work, or Contractor's sheds or other structures that are erected for housing the workmen.

J. Article 13 - Miscellaneous Provisions

- 1. Delete subparagraph 13.5.5 and substitute the following:
 - a. "All equipment shall be inspected and tested under operating conditions. The Architect and/or Owner reserve the right to be present at said testing. Contractor shall give the Architect and Owner at least thirty-six (36) hours advance notice by facsimile prior to scheduling said tests and operations. If inspection or tests show defects, they shall be corrected and inspections and tests repeated until proven satisfactory. Neither the observations of the Architect in administration of the Contract, nor inspections, tests or approvals by persons other than the Contractor, shall relieve the Contractor from obligations to perform

- the Work in accordance with the Contract Documents."
2. Add the following paragraphs:
 - a. "13.8 NON-DISCRIMINATION
 - b. "13.8.1 During the performance of this Contract, the Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, creed, sex or national origin. The Contractor will take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to their race, color, religion, creed, sex, or national origin. Such actions shall include, but not to be limited to, the following: employment, up-grading, demotion or transfer, recruitment advertising, layoffs or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this clause.
 - c. "A13.8.2 The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, creed, sex, or national origin.@
 - d. A13.8.3 The Contractor will send to each labor union or representative of workers with which the Contractor has a collective bargaining agreement or other contract or understanding, a notice to be provided by or at the direction of the federal government, advising the labor union or workers' representative of the Contractor's commitments under the Contract and shall post copies of the notice in conspicuous places available to employees and applicants for employment.@
 - e. A13.8.4 The Contractor will include the provisions of this clause in every subcontract or purchase order entered into in connection with the Work and will require subcontractors to include such provisions in any sub-subcontracts or purchase orders entered into in connection with the Work.@
 - f. A13.8.5 (HUD projects only) The Contractor and all subcontractors will comply with all provisions of Executive Order 11246 (30 FR 12319, September 28, 1965), as amended, the rules, regulations, and relevant orders of the Secretary of Labor, and the regulations of HUD.@
 - K. Article 14 - Termination or Suspension of the Contract
 1. Add the following clause to 14.2.1:
 - a. 14.2.1.5 the Contractor is adjudged a bankrupt.
 - L. Article 15 - Additional Articles
 1. Add the following clauses:
 - a. 15.1 The General Contractor shall be responsible to contact the Architect as necessary to determine Sales Tax requirements for the project. Sale Taxes shall be included in all presentations of project costs, unless otherwise specified by the Owner that the project is to be treated as tax exempt.
 - b. 15.2 HUD SECTION 3 CLAUSE (HUD PROJECTS ONLY)
 - c. 15.2.1 The requirements of Section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 1701u (ASection 3") will govern the work to be performed under this Contract. The purpose of Section 3 is to ensure that employment and other economic opportunities generated by HUD assistance or HUD-assisted projects covered by Section 3 shall, to the greatest extent feasible, be directed to low- and very low-income persons and to business concerns that employ low- and very low-income persons, particularly persons who are recipients of HUD assistance for housing.
 - d. 15.2.2 The parties to this contract agree to comply with HUD's regulations in 24 CFR part 135, which implement Section 3 (the "Regulations") and hereby certify that they are under no contractual or other impediment that would prevent their compliance with the Regulations.
 - e. 15.2.3 The Contractor agrees to send to each labor organization or representative of workers with which the Contractor has a collective bargaining agreement or other understanding, if any, a notice advising the labor organizations or workers' representative of the Contractor's commitments to hiring low-income persons in accordance with the Regulations and will post copies of the notice in conspicuous places at the work site where both employees and applicants for training and employment positions can see the notice. The notice shall describe the hiring preference and shall set forth the minimum number of job titles subject to hire, the availability of apprenticeship and training positions, the qualification for each, the name and location of the person(s) taking applications for each of the positions, and the anticipated date the work will begin.
 - f. 15.2.4 The Contractor agrees to include the low-income hiring requirement in every subcontract for Work in connection with the Project and agrees to take appropriate action, as provided in an application provision of the subcontract or in the Regulations upon a finding that the subcontractor is in violation of the low-income hiring requirements set forth in the Regulations. The Contractor will not subcontract with any subcontractor where the Contractor has notice or knowledge that the subcontractor has been found in violation of the Regulations.
 - g. 15.2.5 The Contractor hereby certifies that any vacant employment positions, including training positions, that are filled (1) after the contractor is selected but before the Contract is executed, and (2) with persons other than those to whom employment opportunities must be directed, were not filled to circumvent the Contractor's obligations to comply with the Regulations.
 - h. 15.2.6 The Contractor's noncompliance with the Regulations may result in sanctions, termination of this Contract for default, and debarment or suspension from future contracts and from future HUD-assisted contracts.
 - i. 15.2.7 The Contractor agrees to abide by the requirements of Section 3 and the Regulations and will also cause such requirements to be inserted in any subcontracts entered into with third parties for covered by this Contract.
 - j. 15.3 PREVAILING WAGE CLAUSE (HUD PROJECTS ONLY)

- k. 15.3.1 The Contractor and all subcontractors shall pay all laborers and mechanics employed or working upon the site of the Work, unconditionally and not less often than once a week, the full amount of wages and bona fide fringe benefits due at the time of payment, computed at rates not less than those contained in the wage determination of the Secretary of Labor in effect on the date of the Contract and attached hereto. The Contractor shall provide the appropriate wage determination (including any additional classification and wage rates conformed under 29 C.F.R./Part 5.5 (a)(1)(ii)), and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the Work in a prominent and accessible place where it can be easily seen by the workers. The Contractor will follow HUD and Department of Labor guidelines in determining the job classifications, wages, and fringe benefits that apply and in making timely payments to employees.
 - l. 15.3.2 The Contractor will maintain payrolls and basic records relating to payrolls during the course of the Work and preserve for a period of three years thereafter for all laborers and mechanics working at the site of the Work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or cost anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in the Section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made, and actual wages paid.
 - m. 15.3.3 The Contractor agrees to include the provisions of this clause in every subcontract entered into in connection with the Work and to require each subcontractor to include such provisions in any sub-subcontracts made in connection with the Work.
 - n. 15.3.4 The Contractor and all subcontractors will comply with all regulations of HUD and of the Department of Labor that are applicable to the Project with respect to the payment of wages and fringe benefits under the Davis-Bacon Act.
- M. Correlation, Intent and Interpretation
 - 1. The specifications, drawings and directions furnished by the Architect are intended to cooperate and agree. The drawings and specifications shall be interpreted by the Architect according to spirit and intent of same, without any extra charge whatsoever, and if any discrepancies or variations appear between any of the drawings or specifications, such discrepancies shall be interpreted by the Architect.
 - 2. Anything shown on the plans and not mentioned in the specifications or vice versa must be furnished by the Contractor without extra compensation. Furthermore, if any materials or work is required which is absolutely necessary to carry out the full meaning and intent of the plans and specifications, the Contractor hereby agrees to consider and allow for the same as fully as if they are so noted and to perform the work without extra charge or claim for extra compensations.
- N. Drawings
 - 1. No dimensions are to be presumed by the Contractor, nor are the drawings to be scaled on the job. If there appears to be a variation between the written dimension and the scale of the drawing, the written dimension will govern in all cases.
- O. Progress Schedule
 - 1. The General Contractor shall provide a progress schedule (such as bar chart) for Architect's review and shall update same as required throughout the course of the project. This schedule shall show the order in which the Contractor proposes to perform the work and dates contemplated for starting and completing the work within the Time of Completion specified in the Notice to Proceed. The information provided on the form shall be realistic and consistent with the Schedule of Amounts for Contract Payments.
- P. Progress Meeting
 - 1. The Owner may request at will that all principals of performing Contractors be gathered in meeting for the purpose of discussion relating to work progress, coordination of operation delays, clarification, time schedules, etc. Notification will be issued by authorized person and attendance will be mandatory one (1) per week (maximum). Contractor shall conduct scheduled progress meetings at monthly intervals. Coordinate dates of meetings with review of payment requests. Attendees shall include: HUD Inspector (if applicable), Project Manager, Project Superintendent, Inspecting Architect, Owner representative, subcontractors, and other concerned parties.
- Q. Field Measurements
 - 1. The Contractor shall obtain his own lines and/or grades, and shall assume all responsibility for the accuracy of same. He shall reconcile all measurements and conditions on the site of proposed work.
- R. Alternate Construction
 - 1. In case quantitative alternates are accepted, the substitute materials and/or items shall be used so that the resulting design and arrangement shall resemble that in the base bid as nearly as possible.
- S. Adjustment to Building Conditions
 - 1. The locations and arrangement of the various parts of the installations are indicated on the drawings and the parts shall be installed as approximately shown thereon. Any change necessary to pass immovable obstructions shall be made by the Contractor without additional cost. Under no circumstances shall any sizes be decreased or radical changes be made in any part of the installation without the written consent of the Architect.
- T. Permits and Fees
 - 1. The General Contractor shall obtain and pay for the general building permit and shall obtain the occupancy permit. All other required permits (mechanical, plumbing, electrical, etc.), as well as tap fees, etc. shall be obtained and paid for by the respective Contractor responsible for the work. Each Contractor shall arrange for all required inspections of his work and submit documentation to the General Contractor that they have been completed.
- U. Codes

1. All work on this project shall be in accordance with all applicable federal, state and local codes and regulations having jurisdiction over this project.
- V. Record Drawings/Operation & Maintenance Manual
 1. At the completion of the project, each Contractor shall submit two (2) sets of plans and specifications which have been marked in red to indicate all changes made documenting construction which deviates from the original contract documents. These shall constitute the As-built drawings. The Contractor shall furnish a minimum of two (2) complete hard-copy sets and two (2) complete electronic (CD) sets of operation/maintenance manuals to the Architect for Owner's use, the Contractor's files, and Architect's files. Each subcontractor shall cooperate with the General Contractor and provide full information (including complete cut sheets) of all equipment, fixtures, etc., included within their scope of work.
- W. Schedule of Values
 1. Before the first Application for Payment, the Contractor shall submit to the Architect a schedule of values allocated to the various portions of the work, supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used only as a basis for the Contractor's applications for payment.
- X. Barricades and Warnings
 1. Contractor shall construct and maintain all barricades as required to provide protection to the public and to the work. Danger signals, warning signs, red flags, lanterns and lights shall be provided and maintained as needed. All the above shall comply with all applicable codes and ordinances.
- Y. Construction Signs
 1. Within ten (10) days of commencing work, the General Contractor will furnish and erect one (1) construction sign at the site located as directed by the Architect. The sign shall be 8'-0" x 6'-0" with the design and layout as directed by the Architect. The layout will be issued to the Contractor at the pre-construction conference. No other sign or advertising device will be permitted on the premises except upon the express approval of the Architect and subject to mutual agreement with the Owner concerning extent and arrangement of such device.
- Z. "Or Equal"
 1. Where phrase "or equal", or "or equal as approved by the Architect" or "or Architect approved equal" occurs in the Contract Documents, do not assume that material, equipment or methods will be approved as equal by the Architect unless the item has been approved for this work in writing by the Architect.
- AA. Colors
 1. Unless the precise color is specifically described in the Contract Documents, whenever a choice of color is desired, submit accurate color charts and samples to the Architect for review and selection.
- BB. Availability of Specified Items
 1. Verify, prior to bidding, that all specified items will be available in the time table required for orderly and timely installation so as not to impede the progress of the work.
 2. In the event specified item or items will not be available, so notify the Architect a minimum of ten (10) working days prior to receipt of bids.
- CC. Project Superintendent
 1. The project superintendent shall be satisfactory to the Owner; thus, the Contractor shall assign a superintendent only after the Owner has reviewed the superintendent's qualifications, is aware of who the superintendent will be and approves of such. A change in the superintendent can occur only after written authorization of the Owner.
- DD. Pre-Construction Conference
 1. A pre-construction conference will be scheduled by the Architect. The meeting shall include the General Contractor (including the Project Manager and Project Superintendent), the Architect (including the Inspecting Architect), the Owner, subcontractors, suppliers, utility representatives, and other concerned parties. At the time of the pre-construction conference, but not later than ten (10) days after official notification of the Contract Award, the Contractor shall submit the following to the Architect.
 - a. _____ Certificate of Liability Insurance
 - b. _____ Schedule of Construction (Bar Graph Preferred)
 - c. _____ Schedule of Values
 2. The meeting agenda will include discussion of:
 - a. Critical sequencing, use of the premises
 - b. Utility installation and Coordination
 - c. Change Order procedures
 - d. Use of Standard Field Report
 - e. Exchange of contact information
 - f. Engineering/Construction Requirements
 - g. Draws and Draw schedules
 - h. Equal Opportunity and Labor Standards
 - i. Notice of anticipated completion (90 days) policy and delivery procedures
- EE. Anchor Bolts, Sleeves, etc.
 1. Where any apparatus to be installed requires anchor bolts, these shall be furnished and set to template by the respective Contractors whose apparatus requires same. Where conduits pass through walls, floors or roof, sleeves consisting of sheet metal or steel pipe 1" larger than the required opening and extending flush with finished face shall be set by the Contractor requiring their use. Same Contractor to seal sleeve as required by any and all local or state codes.
- FF. Equipment, Final Connections, etc.
 1. Unless otherwise shown and/or selected, all special furnishings and/or equipment will be furnished and installed by the equipment contractor. Each equipment vendor shall furnish all switches, outlet boxes, trim,

safety devices, tail pieces, etc., unless specifically noted otherwise. Unless otherwise noted, the Contractor will bring services to indicated locations and make final connections to all equipment and this will include labor and material from the rough-in location to tail pieces, outlet boxes, etc.

GG. Lead Paint

1. No lead-based paint shall be used on this project, and no new material or product that contains leadbased paint shall be used on this project.

HH. Asbestos Materials

1. No asbestos or asbestos containing materials or products shall be used on this project. Further, the Architect and/or the Owner shall have the right to demand from the Contractor, subcontractor, material supplier and/or manufacturer a dated, signed and notarized certification stating that the building product contains no asbestos materials. Failure or refusal on the part of the Contractor, subcontractor, material supplier or manufacturer to furnish said certification shall be just cause to withhold future payments or release of retainage to the Contractor.

II. Occupational Safety & Health Act

1. Each Contractor and all Subcontractors are hereby reminded that this Project is subject to the procedures and regulations of the Williams-Steiger Occupational Safety & Health Act, current edition with pertinent amendments. Along with the obligation to comply with those procedures and regulations, pay particular attention to and comply with the requirements of the Hazardous Communications Act. Each Subcontractor is responsible to obtain from the General Contractor (and acknowledge receipt of same) written Safety and Hazardous Communication Program material as required by OSHA pursuant to title 29CFR, subpart D, part 1296.59.

JJ. Hazardous Materials

1. Any hazardous materials uncovered and/or discovered by any Sub-Contractor during the course of the work are to be completely removed and disposed of by the Sub-Contractor. All Work, including disposal shall be in complete conformance with all Federal, State and local regulations.

KK. Material Safety Data Sheets

1. Each Subcontractor is required to deliver all material safety data sheets pertaining to material Subcontractor brings on-site to General Contractor at General Contractor=s on-site office.

LL. Liquidated Damages

1. The Contract amount will be reduced by .25% per day or \$200.00 (whichever is greater) for each day the work remains incomplete after the contract date set forth in their contract. Acts of God@, such as weather, will be taken into consideration when reviewing the completion date. If the work is being manned properly with skilled, experienced labor on a timely basis, there should be no need for liquidated damages to be incurred. Typically, this clause has not been exercised except when nonperformance appears to be intentional and scheduled building completion dates are put in peril. The completion days will not begin to run until the Contractor has been notified to commence.

MM. Cleaning Up

1. Cleaning up is critical, both during the course of the work and when the work is completed. Each Subcontractor is responsible for cleaning his work area daily, including removing all rubbish from the buildings and placing same in the large waste containers located throughout the project, provided by the General Contractor. In the event Subcontractor does not satisfactorily complete daily cleanup or cleaning at the conclusion of the work, the General Contractor will cause the required cleanup to be completed and the Subcontractor will be charged. At completion of the work of all trades, the Contractor shall remove all temporary protection and clean adjacent surfaces.
2. The Contractor shall be responsible for cleaning and polishing floors; cleaning all painted, decorated or stained surfaces; cleaning and polishing all hardware and cleaning all tile work, fixtures and equipment, etc. Reference Cleaning: Section 01569

NN. Substantial Completion

1. Prior to final acceptance and at the request of the Contractor, the Owner/Architect may inspect and prepare a comprehensive Punch List for each of the respective phases or all of the Work. It shall be the responsibility of each Contractor to complete all items of the Owner/Architect's Punch List prior to application for final payment.

OO. Payments and Completion

1. Within forty-five (45) days after approval by Architect, the Owner will pay to the Contractor ninety percent (90%) of the value of all work performed and all materials suitably stored on the site, up to the first day of the month less the aggregate of previous payments. No payments will be made for materials stored off site. In order to be considered timely, Contractor shall submit copies of the following to Architect no more than four (4) working days after the first day of the month:
 - a. _____ Six (6) copies of invoice utilizing latest revised addition of the AIA Documents G702 & G703 for conventional projects, and HUD form 92448 AContractor=s Requisition@ for HUD projects.
 - b. _____ Six (6) Partial Waivers of Liens from General Contractor, all Subcontractors, & Material Suppliers
2. After final review and acceptance of the work by the Architect and the Owner, the Contractor shall submit for final payment. Final payment will be paid sixty (60) days after the following close out documents are received:
 - a. _____ Six (6) sets of Final Request for Payment, AIA Documents G702 and G703 for conventional projects, and HUD form 92448 AContractor=s Requisition@ for HUD projects.
 - b. _____ Six (6) Final Waivers of Lien from General Contractor, all Subcontractors, & Major Material Suppliers
 - c. _____ Two (2) copies of all manufacturer's warranties
 - d. _____ Two (2) sets of all operation/maintenance manuals
 - e. _____ Two (2) copies of record drawings ("as-builts")
 - f. _____ Two (2) copies (including one original) of fully executed Certificate of Occupancy (if applicable)

- g. _____ Two (2) copies of Contractor's affidavit of payment of debts and claims, AIA Document G706.
- h. _____ Two (2) copies of Contractor's affidavit of release (waiver) of liens, AIA Document G706A.
- i. _____ Two (2) copies of Consent of surety company to final payment, AIA Document G707.
- j. _____ Two (2) copies of Evidence of completion requirements of governing authorities.
- k. _____ Two (2) copies of Certificate of Occupancy (if temporary note why and when permanent CO is to be issued).
- l. _____ Two (2) copies of Certificate of Inspection from all required agencies and departments having jurisdiction.
- m. _____ Two (2) copies of HUD Form No. 2485 B Permission to Occupy (if applicable).

PP. Warranties and Guarantees

- 1. The Contractor shall guarantee the quality of construction for a period of one (1) year (minimum) against defects in workmanship and materials. The Contractor will, at his own expense, make any and all repairs that may be necessary as a result of defects in workmanship and/or materials supplied by the Contractor. The guarantee period shall begin on the date of substantial completion of the project as declared by the Architect. The Contractor's guarantee for construction shall be submitted to the Architect for the Owner on the Contractor's company letterhead in the form prescribed by the Architect. Refer to individual specification sections for additional guarantee requirements.
- 2. The Contractor shall assemble two (2) copies of all manufacturer's warranties for all guaranteed products and materials for this project. These warranties are not to supersede or exempt the Contractor's guarantee for construction but to act in conjunction with such guarantee.

QQ. Debriefing Meeting

- 1. A post-construction Debriefing Meeting will be scheduled by the Owner. The meeting shall include the General Contractor (including the Project Manager and Project Superintendent), the Architect (including the Inspecting Architect), and the Owner.

END OF SECTION 00800

SECTION 01 1000 - SUMMARY

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: Central Detroit Christian Piety Hill Kingston Place
- B. Owner's Name: Piety Hill 2 .
- C. Architect's Name: Berardi + Partners, Inc..
- D. The Project consists of the construction of [_____].

1.02 CONTRACT DESCRIPTION

1.03 WORK BY OWNER

- A. Owner will supply and install the following:
- B. Owner will supply the following for installation by Contractor:

1.04 OWNER OCCUPANCY

- A. Owner intends to occupy the Project upon Substantial Completion.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- C. Schedule the Work to accommodate Owner occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

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

1.06 Job Requirements

- A. The requirements set forth in Division I shall apply to all Contractors and/or Subcontractors. Throughout the body of the specifications, the terms "General Contractor", "Contractor", "Plumbing Contractor", "HVAC Contractor", "Mechanical Contractor", "Electrical Contractor", "Subcontractor", etc. are used and these terms shall indicate general and specific areas of responsibility. No "request for extra" will be entertained from any Contractor which arise out of interpretation of this language. The work will be bid and pursued under one (1) general construction contract. Products not specified but meeting the specifications may be incorporated in the work provided they are approved in advance of the Architect.
- B. Throughout the body of the specifications, from time to time, work required in one section and/or division of work is referred to from another section and/or division of work. Contractors are required to refer to all divisions of these specifications. The Contractor shall notify the Architect of the existence of any discrepancies found between the information contained in these plans and specification and actual field conditions. Notifications shall be in writing seven (7) business days prior to the Initiation of Work. Failure to do so indicates acceptance buy the Contractor of the information listed.

1.07 Special Requirements

- A. The Contractor will submit a work schedule.
- B. All work, except as noted otherwise, shall be performed between 7:00 am to 5:00 pm. Monday through Friday, excluding official state holidays. At each building and at the end of each day, remove all waste material, e.g. boxes, packing, debris, etc., and leave the area broom clean. Nails, sheet metal cut-offs and other sharp material shall be cleaned up regularly during the work. No such material shall remain at the end of the day.
- C. Workman shall park their vehicles where directed. No parking will be permitted on access roads and mobilization areas. Fire lanes shall be kept clear at all times to maintain access to the existing buildings on the site.
- D. All Contractors shall be licensed as required by local and state agencies. Contractors shall verify these requirements with the respective governing agencies.

PART 2 PRODUCTS - NOT USED

END OF SECTION

SECTION 01 2000 - PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Price and Contract Time.
- C. Change procedures.

1.02 RELATED REQUIREMENTS

- A. Section 00 5200 - Agreement Form: Contract Sum, retainages, payment period, monetary values of unit prices.
- B. Section 01 2100 - Allowances: Payment procedures relating to allowances.
- C. Section 01 2200 - Unit Prices: Monetary values of unit prices; Payment and modification procedures relating to unit prices.

1.03 SCHEDULE OF VALUES

- A. Form to be used:
 - 1. For HUD projects use HUD form 2328.
 - 2. For conventional projects use AIA Document G703 and the Project Manual table of contents as a guide to establish line items for the Schedule of Values.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. Submit Schedule of Values in duplicate within 15 days after date of Owner/Contractor Agreement.
- E. Format: Utilize Table of Contents and Project Manual. Identify each line item with number and title of the specification Section. Identify site mobilization, bonds and insurance, and Labor and Material.
- F. Revise schedule to list approved Change Orders, with each Application for Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Monthly unless otherwise stipulated in the contract agreement. .
- B. Form to be used:
 - 1. For HUD projects use HUD form 2328.
 - 2. For conventional projects use AIA Document G703 and the Project Manual table of contents as a guide to establish line items for the Schedule of Values.
- C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- D. Forms filled out by hand will not be accepted.
- E. For each item, provide a column for listing each of the following:
 - 1. Item Number.
 - 2. Description of work.
 - 3. Scheduled Values.
 - 4. Previous Applications.
 - 5. Work in Place and Stored Materials under this Application.
 - 6. Authorized Change Orders.
 - 7. Total Completed and Stored to Date of Application.
 - 8. Percentage of Completion.
 - 9. Balance to Finish.
 - 10. Retainage.
- F. Execute certification by signature of authorized officer.
- G. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
- H. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
- I. Submit one electronic and three hard-copies of each Application for Payment.
- J. Include the following with the application:
 - 1. Transmittal letter as specified for submittals in Section 01 3000.
 - 2. Construction progress schedule, revised and current as specified in Section 01 3000.
 - 3. Partial release of liens from major subcontractors and vendors.
 - 4. Affidavits attesting to off-site stored products.
- K. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of the submittal. Show application number and date, and line item by number and description.

1.05 MODIFICATION PROCEDURES

- A. For minor changes not involving an adjustment to the Contract Price or Contract Time, Architect will issue instructions directly to Contractor.
- B. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
 - 1. The document will describe the required changes and will designate method of determining any change in Contract Price or Contract Time.
 - 2. Promptly execute the change.
- C. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within [] days.

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- D. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Price and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01 6300.
 - E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
 - 1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's approved price quotation.
 - 2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
 - 3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
 - 4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs and pricing consistent with line item costs already established by the contract.
 - F. Substantiation of Costs: Provide full information required for evaluation.
 - 1. Provide following data:
 - a. Quantities of products, labor, and equipment.
 - b. Taxes, insurance, and bonds.
 - c. Overhead and profit.
 - d. Justification for any change in Contract Time.
 - e. Credit for deletions from Contract, similarly documented.
 - 2. Support each claim for additional costs with additional information:
 - a. Origin and date of claim.
 - b. Dates and times work was performed, and by whom.
 - c. Time records and wage rates paid.
 - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
 - 3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
 - G. Execution of Change Orders: Contractor will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
 - H. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Price.
 - I. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
 - J. Promptly enter changes in Project Record Documents.
- 1.06 APPLICATION FOR FINAL PAYMENT
- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Price, previous payments, and sum remaining due.
 - B. Application for Final Payment will not be considered until the following have been accomplished:
 - 1. All closeout procedures specified in Section 01 7000.
- END OF SECTION

SECTION 01 2500 - SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage) Current Edition.
- B. CSI/CSC Form 13.1A - Substitution Request (After the Bidding/Negotiating Phase) Current Edition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
 - 2. Agrees to provide the same warranty for the substitution as for the specified product.
 - 3. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension that may subsequently become apparent.
 - 5. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
- C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
 - 1. Forms indicated in the Project Manual are adequate for this purpose, and must be used.
- D. Limit each request to a single proposed substitution item.
 - 1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

- A. Submittal Form (before award of contract):
 - 1. Submit substitution requests by completing CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage). See this form for additional information and instructions.
 - 2. Other substitution forms may be used pending approval from the Architect, but shall include at minimum the same information as the referenced CSI form.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. Submittal Form (after award of contract):
 - 1. Submit substitution requests by completing CSI/CSC Form 13.1A - Substitution Request. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.
 - 2. Other substitution forms may be used pending approval from the Architect, but shall include at minimum the same information as the referenced CSI form.
- B. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
 - 1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
 - 2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
 - 3. Bear the costs engendered by proposed substitution of:
 - a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.

3.04 RESOLUTION

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

3.05 ACCEPTANCE

END OF SECTION

SECTION 01 2700 - UNIT PRICES

PART 1

1.01 The following unit prices shall be included in each Contractor's bid and shall be used to add to or deduct from the Contractor's Base Bid. All prices shall be for complete cost of item fully installed. Refer to separate specification sections for detailed descriptions. Unit prices will not be used for additional work if, in the opinion of the Architect, the values seem out of line with current costs.

A. Unit Price 1

1. On-site excavation of earth: \$_____/cu.yd.

B. Unit Price 2:

1. Off-site borrow, clean granular backfill material, in place and compacted: \$_____/cu.yd.

C. Unit Price 3:

1. (Insert Unit Prices as applicable)

END OF SECTION

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SECTION 01 3000 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General administrative requirements.
- B. Electronic document submittal service.
- C. Preconstruction meeting.
- D. Progress meetings.
- E. Construction progress schedule.
- F. Contractor's daily reports.
- G. Coordination drawings.
- H. Submittals for review, information, and project closeout.
- I. Number of copies of submittals.
- J. Requests for Interpretation (RFI) procedures.
- K. Submittal procedures.

1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - Product Requirements: General product requirements.
- B. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.
- C. Section 01 7800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 REFERENCE STANDARDS

- A. AIA G716 - Request for Information 2004.

1.04 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Comply with requirements of Section 01 7000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to Architect:
 - 1. Requests for Interpretation (RFI).
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Design data.
 - 6. Manufacturer's instructions and field reports.
 - 7. Applications for payment and change order requests.
 - 8. Progress schedules.
 - 9. Coordination drawings.
 - 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
 - 11. Closeout submittals.

1.05 PROJECT COORDINATOR

- A. Project Coordinator: Owner's Representative.
- B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for site access, traffic, and parking facilities.
- C. During construction, coordinate use of site and facilities through the Project Coordinator.
- D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 01 1000 - Summary.
- F. Coordinate field engineering and layout work under instructions of the Project Coordinator.
- G. Make the following types of submittals to Architect through the Project Coordinator:
 - 1. Requests for Interpretation.
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Design data.
 - 6. Manufacturer's instructions and field reports.
 - 7. Applications for payment and change order requests.
 - 8. Progress schedules.
 - 9. Coordination drawings.
 - 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
 - 11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
 - 1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
 - 2. Contractor and Architect are required to use this service.

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3. It is Contractor's responsibility to submit documents in allowable format.
 4. Subcontractors, suppliers, and Architect's consultants will be permitted to use the service at no extra charge.
 5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
 6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
 7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
- 3.02 PRECONSTRUCTION MEETING**
- A. Schedule meeting before starting construction at a time convenient to the Owner and Architect. Hold the conference at the Project Site to review responsibilities and personnel assignments of the Owner, Architect, Consultants, Contractor, major subcontractors and other concerned parties
 - B. Attendance Required:
 1. Owner.
 2. Architect.
 3. Contractor.
 - C. Agenda:
 1. Project documents.
 2. Execution of Owner-Contractor Agreement.
 3. Submission of executed bonds and insurance certificates.
 4. Distribution of Contract Documents.
 5. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 6. Submission of initial Submittal schedule.
 7. Designation of personnel representing the parties to Contract Owner and .
 8. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 9. Scheduling.
 10. Use of Premises including parking availability.
 11. Office, work and storage areas.
 12. Equipment deliveries and priorities.
 13. Safety procedures, first aid and project Security.
 14. Preparation of record documents.
 15. Housekeeping.
 16. Working hours
 - D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
- 3.03 PREINSTALLATION CONFERENCES**
- A. Conduct a preinstallation conference at the Project Site before each construction activity that requires coordination with other construction.
 - B. Attendees: The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the Architect of scheduled meeting dates.
 - C. Review the progress of other construction activities and preparations for the particular activity under consideration at each preinstallation conference.
 - D. Record significant discussions and agreements and disagreements of each conference, and the approved schedule. Promptly distribute the record of the meeting to everyone concerned, including the Owner and the Architect.
- 3.04 PROGRESS MEETINGS**
- A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.
 - B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
 - C. Attendance Required:
 1. Contractor.
 2. Owner.
 3. Architect.
 4. Special consultants.
 5. Contractor's superintendent.
 6. Major subcontractors.
 - D. Agenda:
 1. Review minutes of previous meetings.
 2. Review of work progress.
 3. Field observations, problems, and decisions.
 4. Identification of problems that impede, or will impede, planned progress.
 5. Review of submittals schedule and status of submittals.
 6. Review of RFIs log and status of responses.
 7. Maintenance of progress schedule.
 8. Corrective measures to regain projected schedules.
 9. Planned progress during succeeding work period.
 10. Maintenance of quality and work standards.
 11. Effect of proposed changes on progress schedule and coordination.
 12. Other business relating to work.

- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
- 3.05 **COORDINATION MEETINGS**
- A. Conduct project coordination meetings as required. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special preinstallation meetings.
 - B. Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.
- 3.06 **CONSTRUCTION PROGRESS SCHEDULE - See Section 01 3216**
- A. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
 - B. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
 - C. Within 10 days after joint review, submit complete schedule.
 - D. Submit updated schedule with each Application for Payment.
- 3.07 **DAILY CONSTRUCTION REPORTS**
- A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.
 - B. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
 - 1. Date.
 - 2. High and low temperatures, and general weather conditions.
 - 3. List of subcontractors at Project site.
 - 4. List of separate contractors at Project site.
 - 5. Approximate count of personnel at Project site.
 - 6. Major equipment at Project site.
 - 7. Material deliveries.
 - 8. Safety, environmental, or industrial relations incidents.
 - 9. Meetings and significant decisions.
 - 10. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
 - 11. Testing and/or inspections performed.
 - 12. Signature of Contractor's authorized representative.
- 3.08 **COORDINATION DRAWINGS**
- A. Provide information required by Project Coordinator for preparation of coordination drawings.
 - B. Review drawings prior to submission to Architect.
- 3.09 **REQUESTS FOR INTERPRETATION (RFI)**
- A. Definition: A request seeking one of the following:
 - 1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in the Contract Documents.
 - 2. A resolution to an issue which has arisen due to field conditions and affects design intent.
 - B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
 - C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of the Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
 - 1. Prepare a separate RFI for each specific item.
 - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
 - b. Do not forward requests which solely require internal coordination between subcontractors.
 - 2. Prepare in a format and with content acceptable to Owner.
 - a. Use AIA G716 - Request for Information .
 - 3. Prepare using software provided by the Electronic Document Submittal Service.
 - 4. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
 - D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
 - 1. Include in each request Contractor's signature attesting to good faith effort to determine from the Contract Documents information requiring interpretation.
 - 2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
 - a. Approval of submittals (use procedures specified elsewhere in this section).
 - b. Approval of substitutions (see Section - 01 6000 - Product Requirements)
 - c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
 - d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
 - 3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
 - 4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, the Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.

- a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.
 - E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
 1. Official Project name and number, and any additional required identifiers established in Contract Documents.
 2. Discrete and consecutive RFI number, and descriptive subject/title.
 3. Issue date, and requested reply date.
 4. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
 5. Annotations: Field dimensions and/or description of conditions which have engendered the request.
 6. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
 - F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
 - G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
 1. Indicate current status of every RFI. Update log promptly and on a regular basis.
 2. Note dates of when each request is made, and when a response is received.
 3. Highlight items requiring priority or expedited response.
 4. Highlight items for which a timely response has not been received to date.
 - H. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
 1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
 - I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
 1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
 2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
 3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
 4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.
- 3.10 SUBMITTAL SCHEDULE
- A. Submit to Architect for review a schedule for submittals in tabular format.
 1. Submit at the same time as the preliminary schedule specified in Section - 01 3216 - Construction Progress Schedule.
 2. Coordinate with Contractor's construction schedule and schedule of values.
 3. Format schedule to allow tracking of status of submittals throughout duration of construction.
 4. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
 5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
 - a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.
- 3.11 SUBMITTALS FOR REVIEW
- A. When the following are specified in individual sections, submit them for review:
 1. Product data.
 2. Shop drawings.
 3. Samples for selection.
 4. Samples for verification.
 - B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in the contract documents.
 - C. Samples will be reviewed for aesthetic, color, or finish selection.
 - D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.
- 3.12 SUBMITTALS FOR INFORMATION
- A. When the following are specified in individual sections, submit them for information:
 1. Design data.
 2. Sustainability design submittals and reports.
 3. Certificates.
 4. Test reports.
 5. Inspection reports.
 6. Manufacturer's instructions.

7. Manufacturer's field reports.
 8. Other types indicated.
 - B. Submit for Architect's knowledge as contract administrator or for Owner.
- 3.13 SUBMITTALS FOR PROJECT CLOSEOUT
- A. Submit Correction Punch List for Substantial Completion.
 - B. Submit Final Correction Punch List for Substantial Completion.
 - C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 7800 - Closeout Submittals:
 1. Project record documents.
 2. Operation and maintenance data.
 3. Warranties.
 4. Bonds.
 5. Other types as indicated.
 - D. Submit for Owner's benefit during and after project completion.
- 3.14 NUMBER OF COPIES OF SUBMITTALS
- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
 - B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
 1. After review, produce duplicates.
 2. Retained samples will not be returned to Contractor unless specifically so stated.
- 3.15 SUBMITTAL PROCEDURES
- A. General Requirements:
 1. Use a single transmittal for related items.
 2. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 3. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
 - a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
 4. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
 - a. Deliver submittals to Architect at email address.
 5. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - a. For each submittal for review, allow 10 business days excluding delivery time to and from the Contractor.
 - b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 5days.
 - c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.
 6. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
 7. Provide space for Contractor and Architect review stamps.
 8. When revised for resubmission, identify all changes made since previous submission.
 9. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
 10. Submittals not requested will be recognized, and will be returned "Not Reviewed",
 - B. Product Data Procedures:
 1. Submit only information required by individual specification sections.
 2. Collect required information into a single submittal.
 3. Do not submit (Material) Safety Data Sheets for materials or products.
 - C. Shop Drawing Procedures:
 1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related work.
 2. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
 - D. Samples Procedures:
 1. Transmit related items together as single package.
 2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
 - E. Transmit each submittal with approved form.
- 3.16 SUBMITTAL REVIEW
- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
 - B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
 - C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
 - D. Architect's and consultants' actions on items submitted for review:
 1. Authorizing purchasing, fabrication, delivery, and installation:
 - a. "Reviewed", or language with same legal meaning.
 - b. "Furnish as corrected", or language with same legal meaning.
 - 1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
 2. Not Authorizing fabrication, delivery, and installation:
 - a. "Revise and Resubmit".

- 1) Resubmit revised item, with review notations acknowledged and incorporated.
- b. "Rejected".
 - 1) Submit item complying with requirements of Contract Documents.

END OF SECTION

SECTION 01 3114 - COORDINATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Services of a coordinator for facility services construction.

1.02 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: Responsibilities of separate contractors.
- B. Section 01 3000 - Administrative Requirements: Additional requirements for coordination.
- C. Section 01 6000 - Product Requirements: Spare parts and maintenance materials.
- D. Section 01 7000 - Execution and Closeout Requirements: Starting of Systems. Systems Demonstration.
- E. Section 01 7800 - Closeout Submittals: Project record documents.

1.03 MECHANICAL AND ELECTRICAL COORDINATOR

- A. Employ and pay for services of a person, technically qualified and administratively experienced in field coordination of the type of work required to be coordinated, for the duration of the Work.

1.04 SUBMITTALS

- A. Submit name, address, and telephone number of coordinator and name of principal officer for review.
- B. Submit coordination drawings and schedules prior to submitting shop drawings, product data, and samples.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 COORDINATION REQUIRED

- A. Coordinate the work listed below:
 - 1. Fire Suppression: Division 21.
 - 2. Plumbing: Division 22.
 - 3. Heating, Ventilating, and Air Conditioning: Division 23.
 - 4. Integrated Automation: Division 25.
 - 5. Electrical: Division 26.
 - 6. Communications: Division 27.
 - 7. Electronic Safety and Security: Division 28.
 - 8. Site Utilities: Division 33.
- B. Coordinate progress schedules, including dates for submittals and for delivery of products.
- C. Conduct meetings among subcontractors and others concerned, to establish and maintain coordination and schedules, and to resolve coordination matters in dispute.
- D. Participate in progress meetings. Report on progress of work to be adjusted under coordination requirements, and any required changes in schedules. Transmit minutes of meetings and reports to concerned parties.

3.02 COORDINATION DOCUMENTS

- A. Prepare coordination drawings to organize installation of products for efficient use of available space, for proper sequence of installation, and to identify potential conflicts.
- B. Prepare a master schedule identifying responsibilities for activities that directly relate to this work, including submittals and temporary utilities; organize by specification section.
- C. Identify electrical power characteristics and control wiring required for each item of equipment.
- D. Maintain documents for the duration of the work, recording changes due to site instructions, modifications or adjustments.
- E. After Architect review of original and revised documents, reproduce and distribute copies to concerned parties.
- F. MEPT Coordination Drawings: The General Contractor will be responsible to submit a set of Coordination Drawings set for all MEPT systems for the project. The Coordination Drawings Set will address coordination of all MEPT disciplines with structure and ceiling plans to assure sprinkler heads are centered in the acoustical tile and clear of any light fixtures projection below the ceiling, HVAC registers, life safety and fire alarm devise as well as all IT devises to assure coordination with walls, floors and ceiling type and locations of all devises, in similar fashion coordination of all plumbing cleanouts in floor and walls, and coordinate location of all access panels for mechanical systems and/or all annunciators panels.

3.03 COORDINATION OF SUBMITTALS

- A. Review shop drawings, product data, and samples for compliance with Contract Documents and for coordination with related work. Transmit copies of reviewed documents to Architect.
- B. Check field dimensions and clearances and relationship to available space and anchors.
- C. Check compatibility with equipment and work of other sections, electrical characteristics, and operational control requirements.
- D. Check motor voltages and control characteristics.
- E. Coordinate controls, interlocks, wiring of switches, and relays.
- F. Coordinate wiring and control diagrams.
- G. When changes in the work are made, review their effect on other work.
- H. Verify information and coordinate maintenance of record documents.

3.04 COORDINATION OF SUBSTITUTIONS AND MODIFICATIONS

- A. Review proposals and requests for substitution prior to submission to Architect.
- B. Verify compliance with Contract Documents and for compatibility with work of other sections.
- C. Submit with recommendation for action.

3.05 OBSERVATION OF WORK

- A. Observe work for compliance with Contract Documents.
- B. Maintain a list of observed deficiencies and defects; promptly submit.

3.06 DOCUMENTATION

- A. Observe and maintain a record of tests. Record:
 - 1. Specification section number and product name.

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2. Name of Contractor, subcontractor.
 3. Name of testing agency and name of inspector.
 4. Name of manufacturer's representative present.
 5. Date, time, and duration of tests.
 6. Type of test, and results.
 7. Retesting required.
- B. Submit copies of documentation to Architect upon request.
- 3.07 EQUIPMENT START-UP
- A. Verify utilities, connections, and controls are complete and equipment is in operable condition as required by Section 01 7000.
 - B. Observe start-up and adjustments, test run, record time and date of start-up, and results.
 - C. Observe equipment demonstrations made to Owner; record times and additional information required for operation and maintenance manuals.
- 3.08 INSPECTION AND ACCEPTANCE OF EQUIPMENT
- A. Prior to inspection, verify that equipment is tested, operational, clean, and ready for operation.
 - B. Assist Architect with review. Prepare list of items to be completed and corrected.
- END OF SECTION

SECTION 01 3216 - CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preliminary schedule.
- B. Construction progress schedule, bar chart type.

1.02 REFERENCE STANDARDS

- A. AGC (CPSM) - Construction Planning and Scheduling Manual 2004.
- B. M-H (CPM) - CPM in Construction Management - Project Management with CPM 2015.

1.03 SUBMITTALS

- A. Within 10 days after date of Agreement, submit preliminary schedule.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 10 days after joint review, submit complete schedule.
- D. Submit updated schedule with each Application for Payment.

1.04 QUALITY ASSURANCE

- A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with one years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

1.05 SCHEDULE FORMAT

- A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.
- B. Diagram Sheet Size: Maximum 22 x 17 inches (560 x 432 mm).

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

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

3.02 CONTENT

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by specification section number.
- C. Identify work of separate stages and other logically grouped activities.
- D. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- E. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.
- F. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

- A. Include a separate bar for each major portion of Work or operation.
- B. Identify the first work day of each week.

3.04 NETWORK ANALYSIS

- A. Prepare network analysis diagrams and supporting mathematical analyses using the Critical Path Method.
- B. Illustrate order and interdependence of activities and sequence of work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.
- C. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:
 - 1. Preceding and following event numbers.
 - 2. Activity description.
 - 3. Estimated duration of activity, in maximum 15 day intervals.
 - 4. Earliest start date.
 - 5. Earliest finish date.
 - 6. Actual start date.
 - 7. Actual finish date.
 - 8. Latest start date.
 - 9. Latest finish date.
 - 10. Total and free float; float time shall accrue to Owner and to Owner's benefit.
 - 11. Monetary value of activity, keyed to Schedule of Values.
 - 12. Percentage of activity completed.
 - 13. Responsibility.
- D. Analysis Program: Capable of compiling monetary value of completed and partially completed activities, accepting revised completion dates, and recomputation of all dates and float.
- E. Required Reports: List activities in sorts or groups:
 - 1. By preceding work item or event number from lowest to highest.
 - 2. By amount of float, then in order of early start.

3.05 REVIEW AND EVALUATION OF SCHEDULE

- A. Participate in joint review and evaluation of schedule with Architect at each submittal.
- B. Evaluate project status to determine work behind schedule and work ahead of schedule.
- C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.06 UPDATING SCHEDULE

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

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- C. Annotate diagrams to graphically depict current status of Work.
 - D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
 - E. Indicate changes required to maintain Date of Substantial Completion.
 - F. Submit reports required to support recommended changes.
- 3.07 DISTRIBUTION OF SCHEDULE
- A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.
 - B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.
- END OF SECTION

SECTION 01 3553 - SECURITY PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Security measures including formal security program, entry control, personnel identification, guard service, and miscellaneous restrictions.

1.02 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: use of premises and occupancy.
- B. Section 01 5000 - Temporary Facilities and Controls: Temporary lighting.

1.03 SECURITY PROGRAM

- A. Protect Work , existing premises and Owner's operations from theft, vandalism, and unauthorized entry.
- B. Initiate program at project mobilization.
- C. Maintain program throughout construction period until Owner occupancy.

1.04 ENTRY CONTROL

- A. Restrict entrance of persons and vehicles into Project site and existing facilities.
- B. Allow entrance only to authorized persons with proper identification.

1.05 PERSONNEL IDENTIFICATION

- A. Provide identification badge to each person authorized to enter premises.
- B. Badge To Include: Personal photograph, name, assigned number , expiration date and employer.
- C. Require return of badges at expiration of their employment on the Work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Submittals.
- B. Quality assurance.
- C. References and standards.
- D. Testing and inspection agencies and services.
- E. Control of installation.
- F. Mock-ups.
- G. Tolerances.
- H. Manufacturers' field services.
- I. Defect Assessment.

1.02 RELATED REQUIREMENTS

- A. Document 00 3100 - Available Project Information: Soil investigation data.
- B. Document 00 7200 - General Conditions: Inspections and approvals required by public authorities.
- C. Section 01 2100 - Allowances: Allowance for payment of testing services.
- D. Section 01 4216 - Definitions.
- E.

1.03 REFERENCE STANDARDS

- A. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation 2017.
- B. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry 2019.
- C. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection 2021.
- D. IAS AC89 - Accreditation Criteria for Testing Laboratories 2020.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Testing Agency Qualifications:
 - 1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.
- C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents, or for Owner's information.
 - 1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
 - 2. Include required product data and shop drawings.
 - 3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
 - 4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.
- D. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.
 - j. Compliance with Contract Documents.
 - k. When requested by Architect, provide interpretation of results.
 - 2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents, or for Owner's information.
- E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
 - 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
- F. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- G. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.

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1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents.
- 1.05 Quality Assurance
- A. Testing Agency Qualifications:
 1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 3. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.
 - B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
 - C. Contractor's Quality Control (CQC) Plan:
 1. Prior to start of work, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:
 - a. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority.
 - b. Management Approach: Define, describe, and include in the plan specific methodologies used in executing the work.
 - 1) Management and control of documents and records relating to quality.
 - 2) Communications.
 - 3) Coordination procedures.
 - 4) Resource management.
 - 5) Process control.
 - 6) Inspection and testing procedures and scheduling.
 - 7) Control of noncomplying work.
 - c. Owner will not make a separate payment for providing and maintaining a Quality Control Plan. Include associated costs in Bid price.
 - d. Acceptance of the plan is required prior to start of construction activities not including mobilization work. Owner's acceptance of the plan will be conditional and predicated on continuing satisfactory adherence to the plan. Owner reserves the right to require Contractor to make changes to the plan and operations, including removal of personnel, as necessary, to obtain specified quality of work results.
 - D. Quality-Control Personnel Qualifications. Engage a person with requisite training and experience to implement and manage quality assurance (QA) and quality control (QC) for the project.
- 1.06 REFERENCES AND STANDARDS
- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
 - B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
 - C. Obtain copies of standards where required by product specification sections.
 - D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
 - E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
 - F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.
- 1.07 Testing and Inspection Agencies and Services
- A. Owner will employ services of an independent testing agency to perform certain specified testing; payment for cost of services will be derived from allowance specified in Section 01 2100; see Section 01 2100 and applicable sections for description of services included in allowance.
 - B. As indicated in individual specification sections, Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.
 - C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- PART 2 PRODUCTS - NOT USED
- PART 3 EXECUTION
- 3.01 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.

3.02 MOCK-UPS

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.
- D. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- E. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- F. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
 - 1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
 - 2. Make corrections as necessary until Architect's approval is issued.
- G. Accepted mock-ups shall be a comparison standard for the remaining Work.
- H. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.03 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

- A. See individual specification sections for testing required.
- B. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
 - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 - 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 - 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 - 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
 - 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 - 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not complying with specified requirements.
- B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 4216 - DEFINITIONS

PART 1 GENERAL

1.01 SUMMARY

- A. Other definitions are included in individual specification sections.

1.02 DEFINITIONS

- A. Furnish: To supply, deliver, unload, and inspect for damage.
- B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.
- C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.
- D. Provide: To furnish and install.
- E. Supply: Same as Furnish.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 4533 - CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Code-required special inspections.
- B. Testing services incidental to special inspections.
- C. Submittals.
- D. Manufacturers' field services.
- E. Fabricators' field services.

1.02 RELATED REQUIREMENTS

- A. Document 00 3100 - Available Project Information: Soil investigation data.
- B. Document 00 7200 - General Conditions: Inspections and approvals required by public authorities.

1.03 DEFINITIONS

- A. Code or Building Code: ICC (IBC), 2015 Edition of the International Building Code and specifically, Chapter 17 - Special Inspections and Tests.
- B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
- C. International Accreditation Service, Inc. (IAS).
- D. National Institute of Standards and Technology (NIST).
- E. Special Inspection:
 - 1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved contract documents and the referenced standards.
 - 2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

1.04 REFERENCE STANDARDS

- A. ACI 318 - Building Code Requirements for Structural Concrete 2019, with Errata (2021).
- B. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2016.
- C. AISC 341 - Seismic Provisions for Structural Steel Buildings 2016 (Revised 2020).
- D. AISC 360 - Specification for Structural Steel Buildings 2016 (Revised 2021).
- E. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction 2019.
- F. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection 2021.
- G. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing 2021.
- H. ASTM E605/E605M - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members 1993, with Editorial Revision (2015).
- I. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members 2019.
- J. AWCI 117 - Technical Manual 12-B; Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire-Resistive Materials; an Annotated Guide 2014.
- K. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020.
- L. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel 2018.
- M. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel 2018.
- N. IAS AC89 - Accreditation Criteria for Testing Laboratories 2020.
- O. IAS AC291 - Accreditation Criteria for Special Inspection Agencies 2017.
- P. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.05 SUBMITTALS

- A. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency shall:
 - 1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Submit certification that Special Inspection Agency is acceptable to AHJ.
- B. Testing Agency Qualifications: Prior to the start of work, the Testing Agency shall:
 - 1. Submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Submit certification that Testing Agency is acceptable to AHJ.
- C. Special Inspection Reports: After each special inspection, Special Inspector shall promptly submit two copies of report; one to Architect and one to the AHJ.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of Special Inspector.
 - d. Date and time of special inspection.
 - e. Identification of product and specifications section.

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- f. Location in the Project.
 - g. Type of special inspection.
 - h. Date of special inspection.
 - i. Results of special inspection.
 - j. Compliance with Contract Documents.
 2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.
 - D. Fabricator Special Inspection Reports: After each special inspection of fabricated items at the Fabricator's facility, Special Inspector shall promptly submit two copies of report; one to Architect and one to AHJ.
 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of Special Inspector.
 - d. Date and time of special inspection.
 - e. Identification of fabricated item and specification section.
 - f. Location in the Project.
 - g. Results of special inspection.
 - h. Verification of fabrication and quality control procedures.
 - i. Compliance with Contract Documents.
 - j. Compliance with referenced standard(s).
 - E. Test Reports: After each test or inspection, promptly submit two copies of report; one to Architect and one to AHJ.
 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test or inspection.
 - h. Date of test or inspection.
 - i. Results of test or inspection.
 - j. Compliance with Contract Documents.
 - F. Certificates: When specified in individual special inspection requirements, Special Inspector shall submit certification by the manufacturer, fabricator, and installation subcontractor to Architect and AHJ, in quantities specified for Product Data.
 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect and AHJ.
 - G. Manufacturer's Field Reports: Submit reports to Architect and AHJ.
 1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents.
 - H. Fabricator's Field Reports: Submit reports to Architect and AHJ.
 1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents.
- 1.06 SPECIAL INSPECTION AGENCY
- A. Owner will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling required by the building code .
 - B. The Contractor will coordinate with the Owner's Special Inspection Agency all required inspections and shall be responsible to arrange, schedule and notify the Special Inspection Agency accordingly.
 - C. The Special Inspection Agency may employ and pay for services of an independent testing agency to perform testing and sampling associated with special inspections and required by the building code.
 - D. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.
- 1.07 TESTING AND INSPECTION AGENCIES
- A. Owner may employ services of an independent testing agency to perform additional testing and sampling associated with special inspections but not required by the building code .
 - B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.
- 1.08 QUALITY ASSURANCE
- A. Special Inspection Agency Qualifications:
 1. Independent firm specializing in performing testing and inspections of the type specified in this section.
 2. Accredited by IAS according to IAS AC291.
 - B. Testing Agency Qualifications:
 1. Independent firm specializing in performing testing and inspections of the type specified in this section.
 2. Accredited by IAS according to IAS AC89.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SPECIAL INSPECTIONS FOR STEEL CONSTRUCTION

- A. High-Strength Bolt, Nut and Washer Material:

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1. Verify identification markings comply with ASTM standards specified in the approved contract and to AISC 360, Section A3.3; periodic.
 2. Submit manufacturer's certificates of compliance; periodic.
 - B. High-Strength Bolting Installation: Verify items listed below comply with AISC 360, Section M2.5.
 1. Snug tight joints; periodic.
 - C. Structural Steel and Cold Formed Steel Deck Material:
 1. Structural Steel: Verify identification markings comply with AISC 360, Section M3.5; periodic.
 2. Other Steel: Verify identification markings comply with ASTM standards specified in the approved contract documents; periodic.
 3. Submit manufacturer's certificates of compliance and test reports; periodic.
 - D. Weld Filler Material:
 1. Verify identification markings comply with AWS standards specified in the approved contract documents and to AISC 360, Section A3.5; periodic.
 2. Submit manufacturer's certificates of compliance; periodic.
 - E. Welding:
 1. Structural Steel and Cold Formed Steel Deck:
 - a. Complete and Partial Joint Penetration Groove Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
 - b. Multipass Fillet Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
 - c. Single Pass Fillet Welds Less than 5/16 inch (7.94 mm) Wide: Verify compliance with AWS D1.1/D1.1M; periodic.
 - d. Plug and Slot Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
 - e. Single Pass Fillet Welds 5/16 inch (7.94 mm) or Greater: Verify compliance with AWS D1.1/D1.1M; continuous.
 - f. Floor and Roof Deck Welds: Verify compliance with AWS D1.3/D1.3M; continuous.
 2. Reinforcing Steel: Verify items listed below comply with AWS D1.4/D1.4M and ACI 318, Section 3.5.2.
 - a. Verification of weldability; periodic.
 - b. Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames as well as boundary elements of special structural walls of concrete and shear reinforcement; continuous.
 - c. Shear reinforcement; continuous.
 - d. Other reinforcing steel; periodic.
 - F. Steel Frame Joint Details: Verify compliance with approved contract documents.
 1. Details, bracing and stiffening; periodic.
 2. Member locations; periodic.
 3. Application of joint details at each connection; periodic.
- 3.02 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION
- A. Reinforcing Steel, Including Prestressing of Tendons and Placement: Verify compliance with approved contract documents and ACI 318, Sections 3.5 and 7.1 through 7.7; periodic.
 - B. Reinforcing Steel Welding: Verify compliance with AWS D1.4/D1.4M and ACI 318, Section 3.5.2; periodic.
 - C. Design Mix: Verify plastic concrete complies with the design mix in approved contract documents and with ACI 318, Chapter 4 and 5.2; periodic.
 - D. Specified Curing Temperature and Techniques: Verify compliance with approved contract documents and ACI 318, Sections 5.11 through 5.13; periodic.
 - E. Concrete Strength in Situ: Verify concrete strength complies with approved contract documents and ACI 318, Section 6.2, for the following.
 - F. Formwork Shape, Location and Dimensions: Verify compliance with approved contract documents and ACI 318, Section 6.1.1; periodic.
- 3.03 SPECIAL INSPECTIONS FOR MASONRY CONSTRUCTION
- A. Masonry Structures Subject to Special Inspection:
 1. Empirically designed masonry, glass unit masonry and masonry veneer in structures designated as "essential facilities".
 2. Engineered masonry in structures classified as "low hazard..." and "substantial hazard to human life in the event of failure".
 - B. Verify each item below complies with approved contract documents and the applicable articles of TMS 402/602.
 1. Inspections and Approvals:
 - a. Verify compliance with the required inspection provisions of the approved contract documents; periodic.
 - b. Verify approval of submittals required by contract documents; periodic.
 2. Compressive Strength of Masonry: Verify compressive strength of masonry units prior to start of construction unless specifically exempted by code; periodic.
 3. Slump Flow and Visual Stability Index (VSI): Verify compliance as self consolidating grout arrives on site; continuous.
 4. Joints and Accessories: When masonry construction begins, verify:
 - a. Proportions of site prepared mortar; periodic.
 - b. Construction of mortar joints; periodic.
 - c. Location of reinforcement, connectors, prestressing tendons, anchorages, etc; periodic.
 5. Structural Elements, Joints, Anchors, Protection: During masonry construction, verify:
 - a. Size and location of structural elements; periodic.
 - b. Type, size and location of anchors, including anchorage of masonry to structural members, frames or other construction; periodic.
 - c. Size, grade and type of reinforcement, anchor bolts and prestressing tendons and anchorages; periodic.

- d. Welding of reinforcing bars; continuous.
- 6. Grouting Preparation: Prior to grouting, verify:
 - a. Grout space is clean; periodic.
 - b. Correct placement of reinforcing, connectors, prestressing tendons and anchorages; periodic.
 - c. Correctly proportioned site prepared grouts and prestressing grout for bonded tendons; periodic.
 - d. Correctly constructed mortar joints; periodic.
- 7. Preparation of Grout Specimens, Mortar Specimens and Prisms: Observe preparation of specimens; periodic.
- 3.04 SPECIAL INSPECTIONS FOR PREFABRICATED WOOD CONSTRUCTION
 - A. High Load Diaphragms: Verify compliance of each item below with approved contract documents.
 - 1. Grade and thickness of sheathing.
 - 2. Nominal size of framing members at adjacent panel edges.
 - 3. Nail or staple diameter and length.
 - 4. Number of fastener lines.
 - 5. Fastener spacing at lines and at edges.
 - B. Metal Plate Connected Wood Trusses with Clear Span of 60 feet (18.3 m) or More: Verify compliance of each item below with approved contract documents in general and with approved truss submittal package in particular.
 - 1. Temporary restraint and bracing.
 - 2. Permanent individual truss member restraint and bracing.
- 3.05 SPECIAL INSPECTIONS FOR SOILS
 - A. Materials and Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
 - 1. Design bearing capacity of material below shallow foundations; periodic.
 - 2. Design depth of excavations and suitability of material at bottom of excavations; periodic.
 - 3. Materials, densities, lift thicknesses; placement and compaction of backfill: continuous.
 - 4. Subgrade, prior to placement of compacted fill; periodic.
 - B. Testing: Classify and test excavated material; periodic.
- 3.06 SPECIAL INSPECTIONS FOR CAST-IN-PLACE DEEP FOUNDATIONS
 - A. Materials, Equipment and Final Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
 - 1. Element length; continuous.
 - 2. Element diameters and bell diameters; continuous.
 - 3. Embedment into bedrock; continuous.
 - 4. End bearing strata capacity; continuous.
 - 5. Placement locations and plumbness; continuous.
 - 6. Type and size of hammer; continuous.
 - B. Drilling Operations: Observe and maintain complete and accurate records for each element; continuous.
 - C. Material Volume: Record concrete and grout volumes.
 - D. Concrete Elements Associated with Cast-in-Place Deep Foundations: Perform additional inspections as required by the Special Inspections for Concrete Construction article of this section.
- 3.07 SPECIAL INSPECTIONS FOR VERTICAL MASONRY FOUNDATION ELEMENTS
 - A. Vertical Masonry Foundation Elements are subject to the same special inspection requirements listed in the "Special Inspections for Masonry Construction" Article of this section.
- 3.08 SPECIAL INSPECTIONS FOR SPRAYED FIRE RESISTANT MATERIALS
 - A. Sprayed Fire Resistant Materials, General:
 - 1. Verify compliance of sprayed-fire resistant materials with specific fire-rated assemblies indicated in approved contract documents, and with applicable requirements of the building code.
 - 2. Perform special inspections after rough installation of electrical, mechanical, plumbing, automatic fire sprinkler and suspension systems for ceilings.
 - B. Physical and visual tests: Verify compliance with fire resistance rating.
 - 1. Condition of substrates; periodic.
 - 2. Thickness of sprayed fire resistant material; periodic.
 - 3. Density of sprayed fire resistant material in pounds per cubic foot (kg per sq m); periodic.
 - 4. Bond strength (adhesion and cohesion); periodic.
 - 5. Bond strength (cohesion); periodic.
 - 6. Condition of finished application; periodic.
 - C. Structural member surface conditions:
 - 1. Inspect structural member surfaces before application of sprayed fire resistant materials; periodic.
 - 2. Verify preparation of structural member surfaces complies with approved contract documents and manufacturer's written instructions; periodic.
 - D. Application:
 - 1. Ensure minimum ambient temperature before and after application complies with the manufacturer's written instructions; periodic.
 - 2. Verify area where sprayed fire resistant material is applied is ventilated as required by the manufacturer's written instructions during and after application; periodic.
 - E. Thickness: Verify that no more than 10 percent of thickness measurements taken from sprayed fire resistant material are less than thickness required by fire resistance design in approved contract documents. In no case shall the thickness of the sprayed fire resistant material be less than the minimum below.
 - 1. Minimum Allowable Thickness: Tested according to ASTM E605/E605M, periodic.
 - a. Design thickness 1 inch (25 mm) or greater: Design thickness minus 1/4 inch (6.4 mm).
 - b. Design thickness greater than 1 inch (25 mm): Design thickness minus 25 percent.

- F. Density: Verify density of sprayed fire resistant material is no less than density required by the fire resistance design in the approved contract documents.
- G. Bond Strength: Verify adhesive and cohesive bond strength of sprayed fire resistant materials is no less than 150 pounds per square foot (7.18 kPa) when in-place samples of the cured material are tested according to ASTM E736/E736M and as described below.
- 3.09 SPECIAL INSPECTIONS FOR MASTIC AND INTUMESCENT FIRE RESISTANT COATINGS
 - A. Verify mastic and intumescent fire resistant coatings comply with AWCI 117 and the fire resistance rating indicated on approved contract documents.
- 3.10 SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE
 - A. Structural Steel: Comply with the quality assurance plan requirements of AISC 341.
 - B. Structural Wood:
 - 1. Field gluing; continuous.
 - 2. Nailing, bolting, anchoring and other fastening of components within the seismic force-resisting system; periodic.
 - C. Cold Formed Steel Light Frame Construction:
 - 1. Field welding; periodic.
 - 2. Screw attachment, bolting, anchoring and other fastening of components within the main seismic force-resisting system; periodic.
 - D. Designated Seismic System Verification: Verify label, anchorage or mounting complies with certificate of compliance provided by manufacturer or fabricator.
 - E. Seismic Isolation System:
 - 1. Fabrication and installation of isolator units; periodic.
 - 2. Fabrication and isolation of energy dissipation devices; periodic.
 - F. Structural Observations for Seismic Resistance: Visually observe structural system for general compliance with the approved contract documents; periodic.
- 3.11 SPECIAL INSPECTIONS FOR WIND RESISTANCE
 - A. Structural Wood:
 - 1. Field gluing of components in the main wind force-resisting system; continuous.
 - 2. Nailing, bolting, anchoring and other fastening of components within the main wind force-resisting system; periodic.
 - B. Cold Formed Steel Light Frame Construction:
 - 1. Field welding; periodic.
 - 2. Screw attachment, bolting, anchoring and other fastening of components within the main wind force-resisting system; periodic
 - C. Structural Observations for Wind Resistance: Visually observe structural system for general compliance with the approved contract documents; periodic.
- 3.12 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES
 - A. Special Inspection Agency shall:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified reference standards.
 - 3. Ascertain compliance of materials and products with requirements of Contract Documents.
 - 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. Submit reports of all tests or inspections specified.
 - B. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
 - C. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.
- 3.13 TESTING AGENCY DUTIES AND RESPONSIBILITIES
 - A. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. Submit reports of all tests or inspections specified.
 - B. Limits on Testing or Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the work.
 - C. On instructions by Architect, perform re-testing required because of non-compliance with specified requirements, using the same agency.
 - D. Contractor will pay for re-testing required because of non-compliance with specified requirements.
- 3.14 CONTRACTOR DUTIES AND RESPONSIBILITIES
 - A. Contractor Responsibilities, General:
 - 1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
 - 2. Cooperate with agency and laboratory personnel; provide access to the work, to manufacturers' facilities, and to fabricators' facilities.
 - 3. Provide incidental labor and facilities:

- a. To provide access to work to be tested or inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
 - c. To facilitate tests or inspections.
 - d. To provide storage and curing of test samples.
 - 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
 - 5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 - B. Contractor Responsibilities, Seismic Force-Resisting Systems: Submit written statement of responsibility for each item listed to AHJ and Owner prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.
 - C. Contractor Responsibilities, Wind Force-Resisting Systems: Submit written statement of responsibility for each item listed to AHJ and Owner prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.
- END OF SECTION

SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary utilities.
- B. Temporary telecommunications services.
- C. Temporary sanitary facilities.
- D. Temporary Controls: Barriers, enclosures, and fencing.
- E. Security requirements.
- F. Vehicular access and parking.
- G. Waste removal facilities and services.
- H. Project identification sign.
- I. Field offices.

1.02 RELATED REQUIREMENTS

- A. Section 01 3553 - Security Procedures.

1.03 TEMPORARY UTILITIES

- A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
- B. Existing facilities may not be used.
- C. New permanent facilities may be used.
- D. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.04 TELECOMMUNICATIONS SERVICES

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:
 - 1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
 - 2. Telephone Land Lines: One line, minimum; one handset per line.
 - 3. Email: Account/address reserved for project use.

1.05 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. New permanent facilities may be used during construction operations
- C. Maintain daily in clean and sanitary condition.
- D. At end of construction, return facilities to same or better condition as originally found.

1.06 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
- C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 FENCING

- A. Provide 6 foot (1.8 m) high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.08 SECURITY - See Section 01 3553

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

1.09 VEHICULAR ACCESS AND PARKING

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and Owner.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.10 WASTE REMOVAL

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers with lids. Remove trash from site periodically.
- C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.11 PROJECT IDENTIFICATION

- A. Provide project identification sign of design and construction indicated on drawings.
- B. Erect on site at location indicated.
- C. No other signs are allowed without Owner permission except those required by law.

1.12 FIELD OFFICES

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.
- B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
- C. Locate offices a minimum distance of 30 feet (10 m) from existing and new structures.

1.13 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

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

- B. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 5713 - TEMPORARY EROSION AND SEDIMENT 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. Performance bond.
- E. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.02 RELATED REQUIREMENTS

- A. Section 31 1000 - Site Clearing: Limits on clearing; disposition of vegetative clearing debris.
- B. Section 31 2200 - Grading: Temporary and permanent grade changes for erosion control.
- C. Section 32 1123 - 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 2021.
- 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.
- D. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles 2015a.
- E. ASTM D4751 - Standard Test Methods for Determining Apparent Opening Size of a Geotextile 2021a.
- 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 2015.

1.04 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. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.
- 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.
- E. Provide to Owner a Performance Bond covering erosion and sedimentation preventive measures only, in an amount equal to 100 percent of the cost of erosion and sedimentation control work.
- F. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.
- G. 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 25 years.
- H. 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.
- I. 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.
- J. 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.
- K. 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.
- L. Open Water: Prevent standing water that could become stagnant.
- M. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

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- B. Erosion and Sedimentation Control Plan:
 1. Submit not less than 30 days prior to anticipated start of clearing, grading, or other work involving disturbance of ground surface cover.
 2. Include:
 - a. Site plan identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
 - b. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.
 - c. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.
 - d. Schedule of temporary preventive measures, in relation to ground disturbing activities.
 - e. Other information required by law.
 - f. Format required by law is acceptable, provided any additional information specified is also included.
 3. Obtain the approval of the Plan by authorities having jurisdiction.
 4. Obtain the approval of the Plan by Owner.
- C. 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.
- D. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Mulch: Use one of the following:
 1. Straw or hay.
 2. Erosion control matting or netting.
- B. 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.
- C. Bales: Air dry, rectangular straw bales.
 1. Cross Section: 14 by 18 inches (350 by 450 mm), minimum.
 2. Bindings: Wire or string, around long dimension.
- D. Bale Stakes: One of the following, minimum 3 feet (1 m) long:
 1. Steel U- or T-section, with minimum mass of 1.33 pound per linear foot (1.98 kg per linear m).
 2. Wood, 2 by 2 inches (50 by 50 mm) in cross section.
- E. 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 (0.600 mm), 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 (450 N), minimum, in cross-machine direction; 124 pounds-force (550 N), 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 (245 N), minimum, when tested in accordance with ASTM D4533/D4533M.
 7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.
- F. Silt Fence Posts: One of the following, minimum 5 feet (1500 mm) long:
- G. Gravel: See Section 32 1123 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. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.
- B. Construction Entrances: Traffic-bearing aggregate surface.
 1. Width: As required; 20 feet (7 m), minimum.
 2. Length: 50 feet (16 m), 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.
- C. Linear Sediment Barriers: Made of silt fences.
 1. Provide linear sediment barriers:
 - a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
 2. Space sediment barriers with the following maximum slope length upslope from barrier:
 - a. Slope of Less Than 2 Percent: 100 feet (30 m).
 - b. Slope Between 2 and 5 Percent: 75 feet (23 m).
 - c. Slope Between 5 and 10 Percent: 50 feet (15 m).

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- d. Slope Between 10 and 20 Percent: 25 feet (7.5 m).
 - e. Slope Over 20 Percent: 15 feet (4.5 m).
 - D. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:
 - 1. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.
 - 2. Straw bale row blocking entire inlet face area; anchor into pavement.
 - E. Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.
 - F. Temporary Splash Pads: Stone aggregate over filter fabric; size to suit application; provide at downspout outlets and storm water outlets.
 - G. Soil Stockpiles: Protect using one of the following measures:
 - 1. Cover with polyethylene film, secured by placing soil on outer edges.
 - 2. Cover with mulch at least 4 inches (100 mm) thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches (150 mm) of straw or hay.
 - H. Mulching: Use only for areas that may be subjected to erosion for less than 6 months.
 - I. Temporary Seeding: Use where temporary vegetated cover is required.
- 3.04 INSTALLATION
- A. Traffic-Bearing Aggregate Surface:
 - 1. Excavate minimum of 6 inches (150 mm).
 - 2. Place geotextile fabric full width and length, with minimum 12 inch (300 mm) overlap at joints.
 - 3. Place and compact at least 6 inches (150 mm) of 1 1/2 to 3 1/2 inch (40 to 90 mm) 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 (405 mm) high barriers with minimum 36 inch (905 mm) long posts spaced at 6 feet (1830 mm) maximum, with fabric embedded at least 4 inches (100 mm) in ground.
 - 3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch (710 mm) high barriers, minimum 48 inch (1220 mm) long posts spaced at 6 feet (1830 mm) maximum, with fabric embedded at least 6 inches (150 mm) in ground.
 - 4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet (6 m), use nominal 32 inch (810 mm) high barriers with woven wire reinforcement and steel posts spaced at 4 feet (1220 mm) maximum, with fabric embedded at least 6 inches (150 mm) in ground.
 - 5. Install with top of fabric at nominal height and embedment as specified.
 - 6. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches (460 mm), with extra post.
 - 7. 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 (300 mm) high with post spacing not more than 4 feet (1220 mm).
 - C. Straw Bale Rows:
 - 1. Install bales in continuous rows with ends butting tightly, with one bale at each end of row turned uphill.
 - 2. Install bales so that bindings are not in contact with the ground.
 - 3. Embed bales at least 4 inches (100 mm) in the ground.
 - 4. Anchor bales with at least two stakes per bale, driven at least 18 inches (450 mm) into the ground; drive first stake in each bale toward the previously placed bale to force bales together.
 - 5. Fill gaps between ends of bales with loose straw wedged tightly.
 - 6. Place soil excavated for trench against bales on the upslope side of the row, compacted.
 - D. Mulching Over Large Areas:
 - 1. Dry Straw and Hay: Apply 2-1/2 tons per acre (6350 kg per hectare); anchor using dull disc harrow or emulsified asphalt applied using same spraying machine at 100 gallons of water per ton of mulch.
 - 2. Erosion Control Matting: Comply with manufacturer's instructions.
 - E. Mulching Over Small and Medium Areas:
 - 1. Dry Straw and Hay: Apply 4 to 6 inches (100 to 150 mm) depth.
 - 2. Erosion Control Matting: Comply with manufacturer's instructions.
 - F. Temporary Seeding:
 - 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 (0.5 kg per 100 sq m).
 - 4. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1000 sq ft (6 to 8 kg per 100 sq m).
 - 5. Incorporate fertilizer into soil before seeding.
 - 6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch (12 to 25 mm) 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.
- 3.05 MAINTENANCE
- A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches (13 mm) or more rainfall at the project site, and daily during prolonged rainfall.

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- B. Repair deficiencies immediately.
 - C. Silt Fences:
 - 1. Promptly replace fabric that deteriorates unless need for fence has passed.
 - 2. Remove silt deposits that exceed one-third of the height of the fence.
 - 3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
 - D. Straw Bale Rows:
 - 1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.
 - 2. Remove silt deposits that exceed one-half of the height of the bales.
 - 3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
 - E. Clean out temporary sediment control structures weekly and relocate soil on site.
 - F. Place sediment in appropriate locations on site; do not remove from site.
- 3.06 CLEAN UP
- A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Architect.
 - B. Clean out temporary sediment control structures that are to remain as permanent measures.
 - C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.
- END OF SECTION

SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Section 01 2500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- B. Section 01 4000 - Quality Requirements: Product quality monitoring.
- C. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.
- D. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 REFERENCE STANDARDS

- A. 16 CFR 260.13 - Guides for the Use of Environmental Marketing Claims; Federal Trade Commission; Recycled Content Current Edition.
- B. CAN/CSA Z809 - National Standard for Sustainable Forest Management; CSA International Inc. 2016.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

1.05 QUALITY ASSURANCE

- A. Health Product Declarations (HPD): Complete, published declaration with full disclosure of known hazards, prepared using one of the HPDC (HPD-OLT) online tools.
- B. Manufacturer's Inventory of Product Content: Publicly available inventory of every ingredient identified by name and Chemical Abstract Service Registration Number (CAS RN).
 - 1. For ingredients considered a trade secret or intellectual property, the name and CAS RN may be omitted, provided the ingredient's role, amount, and GreenScreen Benchmark are given.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by the Contract Documents.
- B. Use of products having any of the following characteristics is not permitted:
 - 1. Made outside the United States, its territories, Canada, or Mexico.
 - 2. Made using or containing CFC's or HCFC's.
 - 3. Made of wood from newly cut old growth timber.
- C. Where other criteria are met, Contractor shall give preference to products that:
 - 1. If used on interior, have lower emissions, as defined in Section 01 6116.
 - 2. If wet-applied, have lower VOC content, as defined in Section 01 6116.
 - 3. Are extracted, harvested, and/or manufactured closer to the location of the project.
 - 4. Have longer documented life span under normal use.
 - 5. Result in less construction waste. See Section 01 7419

2.02 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.03 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

- A. See Section 01 2500 - Substitution Procedures.

3.02 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
 - D. Transport and handle products in accordance with manufacturer's instructions.
 - E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
 - F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
 - G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
 - H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.
- 3.03 STORAGE AND PROTECTION
- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 7419.
 - B. Store and protect products in accordance with manufacturers' instructions.
 - C. Store with seals and labels intact and legible.
 - D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
 - E. For exterior storage of fabricated products, place on sloped supports above ground.
 - F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
 - G. Comply with manufacturer's warranty conditions, if any.
 - H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
 - I. Prevent contact with material that may cause corrosion, discoloration, or staining.
 - J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
 - K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.
- END OF SECTION

SECTION 01 6116 - VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. VOC restrictions for product categories listed below under "DEFINITIONS."
- B. All products of each category that are installed in the project must comply; Owner's project goals do not allow for partial compliance.

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Submittal procedures.
- B. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.

1.03 DEFINITIONS

- A. VOC-Restricted Products: All products of each of the following categories when installed or applied on-site in the building interior:
- B. Interior of Building: Anywhere inside the exterior weather barrier.

1.04 REFERENCE STANDARDS

- A. CAL (CHPS LEM) - Low-Emitting Materials Product List; California Collaborative for High Performance Schools (CHPS); current edition at www.chps.net/.
- B. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers 2017, v1.2.
- C. CRI (GLCC) - Green Label Testing Program - Approved Product Categories for Carpet Cushion; Carpet and Rug Institute; Current Edition.
- D. CRI (GLP) - Green Label Plus Testing Program - Certified Products Current Edition.
- E. GreenSeal GS-11 - Paints; Green Seal, Inc.; 1993.
- F. GreenSeal GS-36 - Adhesives for Commercial Use 2013.
- G. SCAQMD 1113 - Architectural Coatings 1977 (Amended 2016).
- H. SCAQMD 1168 - Adhesive and Sealant Applications 1989 (Amended 2017).
- I. SCS (CPD) - SCS Certified Products Current Edition.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Evidence of Compliance: Submit for each different product in each applicable category.
- C. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

1.06 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All VOC-Restricted Products: Provide products having VOC content of types and volume not greater than those specified in State of California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions From Various Sources Using Small-Scale Environmental Chambers.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Current GREENGUARD Children & Schools certification; www.greenguard.org.
 - b. Current SCS Indoor Advantage Gold certification; www.scs-certified.com.
 - c. Product listing in the CHPS Low-Emitting Materials Product List at www.chps.net/manual/lem_table.htm.
 - d. Current certification by any other agencies acceptable to CHPS.
 - e. Report of laboratory testing performed in accordance with CHPS requirements for getting a product listed in the Low-Emitting Materials Product List; report must include laboratory's statement that the product meets the specified criteria.
 - 2. Product data submittals showing VOC content are NOT acceptable forms of evidence.
- B. Paints and Coatings: Provide products having VOC content as specified in Section 09 9000.
- C. Carpet Cushion: Provide products having VOC content not greater than that required for CRI Green Label certification.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Current Green Label Certification.
 - b. Report of laboratory testing performed in accordance with requirements.
- D. Composite Wood and Agrifiber Products and Adhesives Used for Laminating Them: Provide products having no added urea-formaldehyde resins.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Published product data showing compliance with requirements.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

- A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.
- B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

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SECTION 01 7000 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Pre-installation meetings.
- C. Cutting and patching.
- D. Surveying for laying out the work.
- E. Cleaning and protection.
- F. Starting of systems and equipment.
- G. Demonstration and instruction of Owner personnel.
- H. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- I. General requirements for maintenance service.

1.02 SCOPE

- A. Job Requirements: Immediately on discovery of the need for clarification of the Construction Documents, Contractor shall submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents. Do not overlook the requirements for the Certified Progress Surveys and the Final Property Survey.
- B. Existing Condition Verification: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical, electrical, plumbing, site utility systems and other construction affecting the Work. Verify the location and points of connection of utility services. The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities and other construction that may affect the Work. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services. Furnish location data for work related to Project that must be performed by public utilities serving Project site. Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction. Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.03 CONSTRUCTION LAYOUT

- A. Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
 - 1. Engage a land surveyor to lay out the Work using accepted surveying practices.
 - a. establish benchmarks and control points to set lines and levels at each tory of construction and elsewhere as needed to locate each element of project.
 - b. Establish dimensions within tolerances indicated. **Do not scale drawings to obtain required dimensions.**
 - c. Inform installers of lines and levels to which they must comply.
 - d. Check the location, level and plumb, of every major elements as the work progresses.
 - e. Close site surveys with an error of closure equal to or less than the standard established by authority having jurisdiction.
 - 2. Locate and la out site improvements, including pavements, grading, fill and topsoil placement, utility slopes and invert elevations.
 - 3. Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
 - 4. Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, and weather conditions

1.04 RELATED REQUIREMENTS

- A. Section 4600 - 4600: Materials for protection of installed work.
- B. Section 01 7900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections
- C. Section 07 8400 - Firestopping.

1.05 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2019.

1.06 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
 - 1. On request, submit documentation verifying accuracy of survey work.
 - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
 - 3. Submit surveys and survey logs for the project record.
- C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate Contractor.

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1.07 QUALIFICATIONS

- A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities.
- B. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State in which the Project is located. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.
- C. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.08 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
- F. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
- G. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
- H. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
- I. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.
- J. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.09 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

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 01 6000 - 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 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

- A. Verify locations of survey control points, existing benchmarks and property corners prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- F. Utilize recognized engineering survey practices.
- G. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.
- H. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations; and all other required infrastructure or project elements.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, ground floor elevations, and other required building components.
- I. Periodically verify layouts by same means.
- J. Maintain a complete and accurate log of control and survey work as it progresses.
- K. On completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

3.05 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.

3.06 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 07 8400, 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.

3.07 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.

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- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.
- 3.08 PROTECTION OF INSTALLED WORK
 - A. See Section 01 7610 for temporary protective covering materials.
 - B. Protect installed work from damage by construction operations.
 - C. Provide special protection where specified in individual specification sections.
 - D. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
 - E. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
 - F. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
 - G. Protect work from inclement weather that may cause deterioration or damage to any installed construction. This includes framing work that may be subject to wet conditions which over time could develop into an environmentally hazardous condition.
 - H. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.
 - I. 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.
 - J. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.
- 3.09 PROTECTION OF EXISTING WORK
 - A. See Section 01 7610 for temporary protective covering materials.
 - B. Protect existing installed work, materials, systems, finishes etc. from damage by construction operations.
 - C. Provide special protection where specified in individual specification sections.
 - D. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
 - E. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
 - F. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
 - G. 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.
 - H. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.
- 3.10 SYSTEM STARTUP
 - A. Coordinate schedule for start-up of various equipment and systems.
 - B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
 - C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
 - D. Verify that wiring and support components for equipment are complete and tested.
 - E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
 - F. Submit a written report that equipment or system has been properly installed and is functioning correctly.
- 3.11 DEMONSTRATION AND INSTRUCTION
 - A. See Section 01 7900 - Demonstration and Training.
- 3.12 ADJUSTING
 - A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- 3.13 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 other areas as required.
 - 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.
- 3.14 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. Certificate of Substantial Completion will be issued if work is deemed substantially complete, occupiable and has no latent defects related to health or life safety and a Certificate of Occupancy has been issued by the governing authorities.
 - G. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
 - H. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
 - I. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.
- 3.15 MAINTENANCE
- A. Provide service and maintenance of all installed components, equipment and systems.
 - B. Provide service and maintenance as indicated in specification sections, or if not indicated, according to manufacturer recommendations.
 - C. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
 - D. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
 - E. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
 - F. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.
- END OF SECTION

SECTION 01 7123 - FIELD ENGINEERING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Field engineering services by Contractor.
- B. Land surveying services by Contractor.

1.02 DESCRIPTION OF SERVICES

- A. Specific services listed in this section are in addition to, and do not supersede, general Execution and Closeout Requirements.
- B. Sole responsibility for establishing all locations, dimensions and levels of items of work.
- C. Sole responsibility for provision of all materials required to establish and maintain benchmarks and control points, including batter boards, grade stakes, structure elevation stakes, and other items.
- D. Keeping a transit, theodolite, or TST (total station theodolite with electronic distance measurement device); leveling instrument; and related implements such as survey rods and other measurement devices, at the project site at all times.
- E. Provision of facilities and assistance necessary for Architect to check lines and grade points placed by Contractor.
 - 1. Performance of excavation or embankment work until after all cross-sectioning necessary for determining payment quantities for Unit Price work have been completed and accepted by Architect.
- F. Preparation and maintenance of daily reports of activity on the work. Submission of reports containing key progress indicators and job conditions to Architect.
 - 1. Major equipment and materials installed as part of the work.
 - 2. Location of areas in which construction was performed.
 - 3. Work performed, including field quality control measures and testing.
 - 4. Weather conditions.
 - 5. Instructions received from Architect or Owner, if any.
- G. Preparation and maintenance of professional-quality, accurate, well organized, legible notes of all measurements and calculations made while surveying and laying out the work.

1.03 REFERENCE STANDARDS

- A. FGDC-STD-007.1 - Geospatial Positioning Accuracy Standards - Part 1: Reporting Methodology 1998.
- B. FGDC-STD-007.2 - Geospatial Positioning Accuracy Standards - Part 2: Standards for Geodetic Networks 1998.
- C. FGDC-STD-007.4 - Geospatial Positioning Accuracy Standards - Part 4: Architecture, Engineering, Construction, and Facilities Measurement 2002.
- D. State Plane Coordinate System for the State in which the Project is located.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Submit in addition to items required in Section 01 7000 - Execution and Closeout Requirements.
- C. Certificates: Submit a certificate signed by the land surveyor or professional engineer certifying the location and elevation of improvements
- D. Informational Submittals: Submit the following:
 - 1. Field Engineering: Submit daily reports, with content as indicated in this section.
 - 2. Final property survey.
 - 3. Project Record Documents: Submit a record of work performed and record survey data as required under "Submittals" and "Project Closeout" Sections.

1.05 QUALITY ASSURANCE

- A. Land Surveyor's Qualifications: Engage a land surveyor registered in the state where the project is located, to perform required land surveying services.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. Notify Owner's Representative and Architect of any discrepancies immediately in writing before proceeding to lay out the work. Locate and protect existing benchmarks and base line. Preserve permanent reference points during construction.
- B. Existing Utilities and Equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify existing conditions.

3.02 FIELD ENGINEERING

- A. Maintain field office files, drawings, specifications, and record documents.
- B. Coordinate field engineering services with Contractor's subcontractors, installers, and suppliers as appropriate.
- C. Prepare layout and coordination drawings for construction operations.
- D. Check and coordinate the work for conflicts and interferences, and immediately advise Architect and Owner of all discrepancies of which Contractor is aware.
- E. Cooperate as required with Architect and Owner in observing the work and performing field inspections.
- F. Review and coordinate work on a regular basis with shop drawings and Contractor's other submittals.
- G. Check the location, line and grade of every major element as the work progresses. Notify the Architect when deviations from required lines or grades exceed allowable tolerances. Include in such notifications a thorough explanation of the problem, and a proposed plan and schedule for remedying the deviation. Do not proceed with remedial work without Owner's concurrence of the remediation plan.

3.03 LAND SURVEYING

- A. General: Follow standards for geospatial positioning accuracy.
 - 1. FGDC-STD-007.1 as amended by Authority Having Jurisdiction.
 - 2. FGDC-STD-007.2 as amended by Authority Having Jurisdiction.

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3. FGDC-STD-007.4 as amended by Authority Having Jurisdiction.
 - B. Coordinate survey data with the State Plane Coordinate System of the State in which the Project is located.
 - C. Contractor is responsible for the restoration of all property corners and control monuments damaged or destroyed by construction-related activities. Any disturbed monuments must be replaced at Contractor's expense by a surveyor licensed in the State in which the Project is located, and approved by the Architect.
 1. Temporarily suspend work at such points and for such reasonable times as the Owner may require for resetting monuments. The Contractor will not be entitled to any additional compensation or extension of time.
- 3.04 CONSTRUCTION SURVEYING
- A. General: Perform surveying as applicable to specific items necessary for proper execution of work.
 1. Alignment Staking: Provide alignment stakes at 50 foot (15.24 m) intervals on tangent, and at 25 foot (7.62 m) intervals on curves.
 2. Slope Staking: Provide slope staking at 50 foot (15.24 m) intervals on tangent, and at 25 foot (7.62 m) intervals on curves. Re-stake at every ten-foot difference in elevation.
 3. Structure: Stake out structures, including elevations, and check prior to and during construction.
 4. Pipelines: Stake out pipelines including elevations, and check prior to and during construction.
 5. Site Utilities: Stake out utility lines including elevations, and check prior to and during construction.
 6. Road: Stake out roadway elevations at 50 foot (15.24 m) 50-foot intervals on tangent, and at 25 foot (7.62 m) intervals on curves.
 7. Easement Staking: Provide easement staking at 50 foot (15.24 m) intervals on tangent, and at 25 foot (7.62 m) intervals on curves. If required by project conditions, provide wooden laths with flagging at 100 foot (30.48 m) intervals.
 - B. Record Log: Maintain a log of layout control work. Record any deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used.
 - C. Accuracy:
 1. Establish Contractor's temporary survey references points for Contractor's use to at least second-order accuracy (e.g., 1:10000). Set construction staking used as a guide for the work to at least third-order accuracy (e.g., 1:5000). Provide the absolute margin for error specified below on the basis established by such orders.
 - a. Accuracy of other staking shall be plus or minus 0.04 feet (12.2 mm) horizontally and plus or minus 0.02 feet (6.1 mm) vertically.
 - b. Include an error analysis sufficient to demonstrate required accuracy in survey calculations.
 2. Owner reserves the right to check the Contractor's survey, measurements, and calculations. The requirement for accuracy will not be waived, whether this right is exercised or not.
- 3.05 REPORTS
- A. Submit two copies of Contractor's daily reports at Architect's field office (or electronically) by 9:00 AM the next working day after the day covered in the associated report. Daily report shall be signed by responsible member of Contractor's staff, such as project manager or superintendent, or foreman designated by Contractor as having authority to sign daily reports.
- 3.06 RECORDS
- A. Maintain at the Site a complete and accurate log of control and survey work as it progresses.
 1. Organize and record survey data in accordance with recognized professional surveying standards, Laws and Regulations, and prevailing standards of practice in the State in which the Project is located. Record Contractor's surveyor's original field notes, computations, and other surveying data in Contractor-furnished hard-bound field books. Contractor is solely responsible for completeness and accuracy of survey work, and completeness and accuracy of survey records, including field books. Survey records, (including field books) may be rejected by Owner due to failure to organize and maintain survey records in a manner that allows reasonable and independent verification of calculations, and/or allows identification of elevations, dimensions, and grades of the work.
 2. Illegible notes or data, and erasures on any page of field books, are unacceptable. Do not submit copied notes or data. Corrections by ruling or lining out errors will be unacceptable unless initialed by the surveyor. Violation of these requirements may require re-surveying the data questioned by Architect.
 - B. Submit three copies of final property survey to Owner. Include on the survey a certification, signed by the surveyor, that principal metes, bounds, lines, and levels of the Project are accurately positioned as shown on the survey. Include the following information:
- 3.07 CLOSEOUT ACTIVITIES
- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
 - B. See Section 01 7900 - Demonstration and Training, for additional requirements.
- END OF SECTION

SECTION 01 7610 - TEMPORARY PROTECTIVE COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary protective coverings for installed floors, walls, other surfaces, and framing.

PART 2 PRODUCTS

2.01 GENERAL

- A. Provide materials that are easily removed without damage to the surfaces covered and with the following characteristics:
 - 1. Water resistant.
 - 2. Vapor permeable.
 - 3. Impact resistant where necessary.
 - 4. Slip resistant where necessary

2.02 MATERIALS

- A. Sheet Materials:
 - 1. Corrugated polypropylene sheet.
 - 2. Recycled paperboard/plastic composite sheet.
 - 3. Recycled paperboard sheet.
 - 4. Plywood, 1/2 inch (13 mm) thick nominal.
- B. Rolled Materials:
 - 1. Self-adhering polyethylene film.
 - 2. Recycled cellulose fiberboard paper.
 - 3. Laminated glass fiber reinforced kraft paper.
 - 4. Rosin coated paper.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Trim or overlap sheet materials to fit area to be covered.
- C. Roll out and cut rolled materials to fit area to be covered.
- D. Stretch self-adhering film materials to completely cover surface.

3.02 REMOVAL

- A. Remove protective coverings prior to Date of Substantial Completion. Reuse or recycle materials if possible.

END OF SECTION

SECTION 01 7800 - CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Individual Product Sections: Specific requirements for operation and maintenance data.
- C. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
 - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 - 4. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site two sets of the following record documents to be provided to the owner; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Addenda.
 - 3. Change Orders and other modifications to the Contract.
 - 4. Reviewed shop drawings, product data, and samples.
 - 5. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Field changes of dimension and detail.
 - 2. Details not on original Contract drawings.
 - 3. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
 - a. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - 1) Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - 2) Accurately record information in an understandable drawing technique.
 - 3) Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - b. Content: Types of items requiring marking include, but are not limited to, the following:
 - 1) Dimensional changes to Drawings.
 - 2) Revisions to details shown on Drawings.
 - 3) Depths of foundations below first floor.
 - 4) Locations and depths of underground utilities.
 - 5) Revisions to routing of piping and conduits.
 - 6) Revisions to electrical circuitry.
 - 7) Actual equipment locations.
 - 8) Duct size and routing.
 - 9) Locations of concealed internal utilities.
 - 10) Retain Work Change Directive in first subparagraph below if using EJDC Document 1910-8.
 - 11) Changes made by Change Order or Construction Change Directive.
 - 12) Changes made following Architect's written orders.
 - 13) Details not on the original Contract Drawings.
 - 14) Field records for variable and concealed conditions.
 - 15) Record information on the Work that is shown only schematically.

- c. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
 - d. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - e. Mark important additional information that was either shown schematically or omitted from original Drawings.
 - f. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
 - F. Record Specifications:
 - 1. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 2. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 3. Delete two subparagraphs below if provisions are too elaborate, or revise to suit Project.
 - 4. Retain first subparagraph below with or without subparagraph above, where this record is desired.
 - a. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
 - b. Note related Change Orders, Record Product Data, and Record Drawings where applicable.
 - G. As Built Survey:
 - 1. General Contractor shall be responsible for contracting with surveying company to complete an as built survey to document final construction and site conditions.
 - 2. Survey requirements shall meet ALTA standards: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - a. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - H. Record Product Data:
 - 1. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - a. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - b. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - c. If possible, a Change Order proposal should include resubmitting updated Product Data. This eliminates the need to mark up the previous submittal.
 - d. Note related Change Orders, Record Specifications, and Record Drawings where applicable.
 - 2.
- 3.02 OPERATION AND MAINTENANCE DATA
- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
 - B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
 - C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
 - D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
- 3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES
- A. For Each Product, Applied Material, and Finish:
 - B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
 - C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
 - D. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- 3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS
- A. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with engineering data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
 - B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
 - C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
 - D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

- E. Provide servicing and lubrication schedule, and list of lubricants required.
 - F. Include manufacturer's printed operation and maintenance instructions.
 - G. Include sequence of operation by controls manufacturer.
 - H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
 - I. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
 - J. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
 - K. Additional Requirements: As specified in individual product specification sections.
- 3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS
- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
 - B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
 - C. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
 - D. Prepare data in the form of an instructional manual.
 - E. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; [2 1/2] inch (____) mm maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
 - F. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
 - G. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
 - H. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
 - I. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
 - J. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
 - K. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
 - L. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
 - M. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
 - N. In addition to hard printed copies of all instruction manuals provide same information digitally to the owner on CD or DVD in standard software format. Clearly label contents of each disk.
- 3.06 WARRANTIES AND BONDS
- A. Unless otherwise specified in respective specification section the General Contractor and each Subcontractor shall warrant all materials and workmanship for a period of 12 months beginning at the date of Substantial Completion or Permission to Occupy.
 - 1. Any defective materials or workmanship shall be corrected or replaced without cost to the Owner during the warranty period.
 - B. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
 - C. Verify that documents are in proper form, contain full information, and are notarized.
 - D. Co-execute submittals when required.
 - E. Retain warranties and bonds until time specified for submittal.
 - F. Manual: Bind in commercial quality 8-1/2 by 11 inch (216 by 279 mm) three D side ring binders with durable plastic covers.
 - G. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
 - H. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
 - I. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- END OF SECTION

SECTION 01 7900 - DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

- A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
 - 1. All software-operated systems.
 - 2. HVAC systems and equipment.
 - 3. Plumbing equipment.
 - 4. Electrical systems and equipment.
 - 5. Landscape irrigation.
- C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
 - 1. Items specified in individual product Sections.

1.02 SUBMITTALS

- A. See Section 01 3000 - 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.
- B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
 - 1. Submit to Commissioning Authority for review and inclusion in overall training plan.
 - 2. Submit not less than four weeks prior to start of training.
 - 3. Revise and resubmit until acceptable.
 - 4. Provide an overall schedule showing all training sessions.
 - 5. Include at least the following for each training session:
 - a. Identification, date, time, and duration.
 - b. Description of products and/or systems to be covered.
 - c. Name of firm and person conducting training; include qualifications.
 - d. Intended audience, such as job description.
 - e. Objectives of training and suggested methods of ensuring adequate training.
 - f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
 - g. Media to be used, such as slides, hand-outs, etc.
 - h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
 - 1. Include applicable portion of O&M manuals.
 - 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
 - 3. Provide one extra copy of each training manual to be included with operation and maintenance data.
- D. Training Reports:
 - 1. Identification of each training session, date, time, and duration.
 - 2. Sign-in sheet showing names and job titles of attendees.
 - 3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.
 - 4. Include Commissioning Authority's formal acceptance of training session.
- E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
 - 1. Format: DVD Disc.
 - 2. Label each disc and container with session identification and date.

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

3.01 DEMONSTRATION - GENERAL

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.
- C. Demonstration may be combined with Owner personnel training if applicable.
- D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
 - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
 - E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
 1. Perform demonstrations not less than two weeks prior to Substantial Completion.
- 3.02 TRAINING - GENERAL
- A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.
 - B. Conduct training on-site unless otherwise indicated.
 - C. Owner will provide classroom and seating at no cost to Contractor.
 - D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.
 - E. Provide training in minimum two hour segments.
 - F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.
 - G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.
 - H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
 1. The location of the O&M manuals and procedures for use and preservation; backup copies.
 2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
 3. Typical uses of the O&M manuals.
 - I. Product- and System-Specific Training:
 1. Review the applicable O&M manuals.
 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
 3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
 4. Provide hands-on training on all operational modes possible and preventive maintenance.
 5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
 6. Discuss common troubleshooting problems and solutions.
 7. Discuss any peculiarities of equipment installation or operation.
 8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
 9. Review recommended tools and spare parts inventory suggestions of manufacturers.
 10. Review spare parts and tools required to be furnished by Contractor.
 11. Review spare parts suppliers and sources and procurement procedures.
 - J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.
- END OF SECTION

SECTION 02 4100 - DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Abandonment and removal of existing utilities and utility structures.

1.02 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 1000 - Summary: Sequencing and staging requirements.
- C. Section 01 1000 - Summary: Description of items to be salvaged or removed for re-use by Contractor.
- D. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- E. Section 01 6000 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- F. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- G. Section 01 7419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.
- H. Section 31 2323 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.03 REFERENCE STANDARDS

- A. 29 CFR 1926 - Safety and Health Regulations for Construction Current Edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2019.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Site Plan: Showing:
 - 1. Areas for temporary construction and field offices.
 - 2. Areas for temporary and permanent placement of removed materials.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Fill Material: As specified in Section 31 2323 - Fill.

PART 3 EXECUTION

3.01 SCOPE

- A. Remove the entire building designated on the drawings.
- B. Remove portions of existing buildings as indicated on the drawings.
- C. Within area of new construction, remove foundation walls and footings to a minimum of 2 feet (600 mm) below finished grade.
- D. Outside area of new construction, remove foundation walls and footings to a minimum of 2 feet (600 mm) below finished grade.
- E. Break up concrete slabs on grade within site boundaries to permit natural moisture drainage; leave pieces not larger than 1 square yard (1 square meter).
- F. Remove other items indicated, for salvage, relocation, and recycling.
- G. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 2200.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with other requirements specified in Section 01 7000.
- B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Comply with applicable requirements of NFPA 241.
 - 3. Use of explosives is not permitted.
 - 4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 5. Provide, erect, and maintain temporary barriers and security devices.
 - 6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 - 7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 8. Do not close or obstruct roadways or sidewalks without permit.
 - 9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
 - 10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- C. Do not begin removal until receipt of notification to proceed from Owner.
- D. 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.
- E. 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.
- F. Perform demolition in a manner that maximizes salvage and recycling of materials.
 - 1. Comply with requirements of Section 01 7419 - Waste Management.
 - 2. Dismantle existing construction and separate materials.

3. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

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 Owner.
- 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 Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.
- H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.04 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Remove from site all materials not to be reused on site; comply with requirements of Section 01 7419 - Waste Management.
- C. Leave site in clean condition, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete formwork.
- B. Floors and slabs on grade.
- C. Concrete reinforcement.
- D. Joint devices associated with concrete work.
- E. Miscellaneous concrete elements, including equipment pads, light pole bases, flagpole bases, thrust blocks, and manholes.
- F. Concrete curing.

1.02 REFERENCE STANDARDS

- A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; American Concrete Institute International; 2010.
- B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2009).
- C. ACI 301 - Specifications for Structural Concrete; American Concrete Institute International; 2010 (Errata 2012).
- D. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International; 2004 (Errata 2007).
- E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.
- F. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 2010.
- G. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 2010.
- H. ACI 308R - Guide to Curing Concrete; American Concrete Institute International; 2001 (Reapproved 2008).
- I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2011.
- J. ACI 347 - Guide to Formwork for Concrete; American Concrete Institute International; 2004.
- K. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.
- L. ASTM A497/A497M - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete; 2007.
- M. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Billet-Steel Bars for Concrete Reinforcement; 2015.
- N. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.
- O. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2014.
- P. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2014.
- Q. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2013.
- R. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2012.
- S. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.
- T. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.
- U. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.
- V. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2013.
- W. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2012.
- X. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2014.
- Y. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2013.
- Z. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2014.
- AA. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures; 2014.
- BB. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2013).
- CC. 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; 2011.
- DD. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2011.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
- C. Samples: Submit samples of underslab vapor retarder to be used.
- D. Sustainable Design Submittal: If any fly ash, ground granulated blast furnace slag, silica fume, rice hull ash, or other waste material is used in mix designs to replace Portland cement, submit the total volume of concrete cast in place, mix design(s) used showing the quantity of portland cement replaced, reports showing successful cylinder testing, and temperature on day of pour if cold weather mix is used; use LEED New Product Content Form.

1.04 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Follow recommendations of ACI 305R when concreting during hot weather.
- C. Follow recommendations of ACI 306R when concreting during cold weather.
- D. For slabs required to include moisture vapor reduction admixture (MVRA), do not proceed with placement unless manufacturer's representative is present for every day of placement.

1.05 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

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PART 2 PRODUCTS

2.01 FORMWORK

- A. Formwork Design and Construction: Comply with guidelines of ACI 347 to provide formwork that will produce concrete complying with tolerances of ACI 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 of concrete surface.

2.02 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
 - 1. Type: Deformed billet-steel bars.
- B. Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain type.
 - 1. Form: Coiled Rolls.
 - 2. Mesh Size: 6 x 6.
- C. Reinforcement Accessories:
 - 1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.
 - 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, Type I - Normal Portland type.
 - 1. Acquire all cement for entire project from same source.
- B. Fine and Coarse Aggregates: ASTM C 33.
 - 1. Acquire all aggregates for entire project from same source.
- C. Fly Ash: ASTM C618, Class C or F.
- D. Calcined Pozzolan: ASTM C618, Class N.
- E. Silica Fume: ASTM C1240, proportioned in accordance with ACI 211.1.
- F. Fiber Reinforcement: ASTM C1116/C1116M.
 - 1. Fiber Length: 1.5 inch, nominal.
 - 2. Products:
 - a. Forta Corporation; FORTA-FERRO: www.forta-ferro.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

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. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.
- D. Water Reducing Admixture: ASTM C494/C494M Type A.
- E. Moisture Vapor Reduction Admixture (MVRA): Liquid, inorganic admixture free of volatile organic compounds (VOCs) and formulated to close capillary systems formed during curing to reduce moisture vapor emission and transmission, with no adverse effect on concrete properties.
 - 1. Provide admixture in slabs to receive adhesively applied flooring.
 - 2. Show that concrete properties are not adversely affected by testing in accordance with ASTM C494/C494M and submitting independent agency test reports.
 - 3. Show successful initial and long-term application of adhered flooring by submitting details of ten (10) completed projects along with owner and contractor contact information for verification by Architect.
 - 4. Admixture manufacturer shall provide a warranty guaranteeing to remove and replace failed flooring and apply a moisture vapor barrier coating over failed slabs; term of warranty shall be for the lifetime of the concrete construction from the date at which installation of flooring is approved by admixture manufacturer.
 - 5. Contractor shall submit certification that he has received, understands, and will comply with admixture manufacturer's prerequisites for issuance of manufacturer's warranty; failure to comply with admixture manufacturer's prerequisites will result in assignment of warranty remedy costs to Contractor.

2.05 ACCESSORY MATERIALS

- A. Underslab Vapor Retarder ASTM E1745, Class A, with a permeance of less than 0.01 as tested after mandatory conditioning; and stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs.
 - 1. Installation: Comply with ASTM E1643.
 - 2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, double-sided tapes, for sealing the vapor barrier at the perimeter, and for sealing seams and penetrations in vapor retarder.
 - 3. Products:
 - a. Vapor Block 15 mil, by Raven Industries: www.ravenind.com
 - b. Stego Industries, LLC; Stego Wrap Vapor Barrier 15 -mil (Class A): www.stegoindustries.com.
 - c. W.R. Meadows, Inc.; PERMINATOR Class A – 15 mils: www.wrmeadows.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
 - 1. ASTM C1107/C1107M; Grade A, B, or C.
 - 2. Minimum Compressive Strength at 48 Hours, ASTM C109/C109M: 2,000 pounds per square inch.
 - 3. Flowable Products:

- a. ProSpec, an Oldcastle brand; C-1107 Construction Grout: www.prospec.com.
 - b. The QUIKRETE Companies; QUIKRETE® Exterior Use Anchoring Cement: www.quikrete.com.
 - c. SpecChem, LLC; SC Precision Grout: www.specchemllc.com.
 - d. W. R. Meadows, Inc.; 588-10K: www.wrmeadows.com.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
 - 2.06 BONDING AND JOINTING PRODUCTS
 - A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
 - B. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
 1. Material: ASTM D1751, cellulose fiber.
 - C. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with minimum 1 inch diameter holes for conduit or rebars to pass through at 6 inches on center; ribbed steel stakes for setting.
 - 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. Provide type compatible with scheduled finish floor materials (if any).
 - B. Curing Compound, Non-dissipating: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C309.
 1. Application: Use at all interior slabs scheduled to remain exposed.
 2. Vehicle: Water-based.
 3. Gloss: High.
 4. Products:
 - a. L&M Construction Chemicals, Inc., a subsidiary of Laticrete International, Inc.; Dress & Seal WB: www.lmcc.com.
 - b. L&M Construction Chemicals, Inc., a subsidiary of Laticrete International, Inc.; Dress & Seal WB 30: www.lmcc.com.
 - c. The QUIKRETE Companies; QUIKRETE® Acrylic Concrete Cure & Seal: www.quikrete.com.
 - C. Moisture-Retaining Sheet: ASTM C171.
 - D. Polyethylene Film: ASTM D2103, 4 mil thick, clear.
 - E. Water: Potable, not detrimental to concrete.
 - 2.08 CONCRETE MIX DESIGN
 - A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
 1. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with ACI 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 Architect for preparing and reporting proposed mix designs.
 - C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
 - D. Fiber Reinforcement: Add to mix at rate of 1.5 pounds per cubic yard, or as recommended by manufacturer for specific project conditions.
 - E. Normal Weight Concrete:
 1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: As scheduled.
 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. Silica Fume Content: Maximum 5 percent of cementitious materials by weight.
 - 2.09 MIXING
 - A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685. 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**
- 3.02 PREPARATION**
- A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
 - B. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
 1. Use latex bonding agent only for non-load-bearing applications.
 - C. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade in accordance with ASTM E1643 and follow manufacturer's written instructions.
 1. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as shown on the drawings. Do not use sand.
 2. Following leveling and tamping of granular base for slabs on grade, place vapor barrier sheeting with longest dimension parallel with direction of pour and face laps away from the expected direction of the placement whenever possible.
 3. 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.

4. Overlap joints 6 inches and seal with manufacturer's seam tape.
 5. Apply seam tape to a clean and dry vapor barrier.
 6. Seal all penetrations (including pipes) per manufacturer's instructions.
 7. Avoid the use of non-permanent stakes driven through vapor retarder.
 8. If non-permanent stakes are driven through vapor retarder, repair as recommended by vapor retarder manufacturer.
 9. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.
- 3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS
- A. Comply with requirements of ACI 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.
 - C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.
- 3.04 PLACING CONCRETE
- A. Place concrete in accordance with ACI 304R.
 - B. Place concrete for floor slabs in accordance with ACI 302.1R.
 - C. Notify Architect not less than 48 hours prior to commencement of placement operations.
 - D. Ensure reinforcement, inserts, waterstops, 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 the 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.
 - D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch 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 in 10 ft.
 2. Under Seamless Resilient Flooring: 1/4 inch in 10 ft.
 3. Under Carpeting: 1/4 inch in 10 ft.
 - 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. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch 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.
 - C. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
 1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI 302.1R; thick floor coverings include quarry tile, ceramic tile, and terrazzo with full bed setting system.
 2. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, thin set quarry tile, and thin set ceramic tile.
 3. Decorative Exposed Surfaces: "Steel trowel" as described in ACI 302.1R; use steel-reinforced plastic trowel blades instead of steel blades to avoid black-burnish marks; decorative exposed surfaces include surfaces to be stained or dyed, pigmented concrete, surfaces to be polished, and all other slab surfaces.
 4. Exterior slabs - broom finish (11.7.4), Class C tolerance (11.9.3) with tooled picture frame edges.
- 3.08 CURING AND PROTECTION
- A. Comply with requirements of ACI 308R. 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. 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.
 2. 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 01 4000.
 - B. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
 - C. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
 - D. Compressive Strength Tests: ASTM C39/C39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd or less of each class of concrete placed.
 - E. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

- F. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.
 - G. Slab Testing: Cooperate with manufacturer of specified moisture vapor reduction admixture (MVRA) to allow access for sampling and testing concrete for compliance with warranty requirements.
- 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 conforming to 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.
- 3.12 SCHEDULE - CONCRETE TYPES AND FINISHES
- A. The following classes of concrete are required (3.2):
 - 1. Class I - footings, piers: Minimum $f'_c=3000$ psi.
 - 2. Class II - interior slabs on grade, and all interior concrete not otherwise identified. Minimum $f'_c=3500$ psi; water-reducer required. Minimum cement content 517 lbs. per cubic yard.
 - 3. Class III - exterior slabs on grade, retaining walls, basement walls and all exterior concrete not otherwise identified. Minimum $f'_c=4000$ psi; air-entraining admixture and water-reducer required. Maximum water-cement ratio: 0.48, air content: 5 + 1.5% (3.4.1).
 - 4. Class IV - backfill below footings. Minimum $f'_c=1500$ psi (lean mix).
 - 5. Class V - topping over precast concrete slabs, fill in stair pans and treads. Minimum $f'_c=3500$ psi, with water-reducing admixture and #8 coarse aggregate. Minimum cement content 611 lbs. per cubic yard.
 - B. Class IV concrete may be site mixed: all other concrete is to be ready-mixed (7.1 And 7.2). All admixtures are to be added at the batch plant, except that superplasticizer, if used, is to be added at the site.
 - C. Concrete used for floors (Classes II and V) is to have a minimum three-day compressive strength of 1800 psi (3.14.2).
 - D. Slump:
 - 1. Design concrete mixes for a maximum slump of 4 inches, unless a superplasticizer is to be used.
 - 2. If a superplasticizer is to be used, design mixes for a slump of 2 inches - 3 inches before its addition; maximum slump permitted after its addition is 8 inches.

SECTION 03 5400 - CAST GYPSUM BASED UNDERLAYMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Liquid-applied self-leveling floor underlayment.

1.02 REFERENCE STANDARDS

- A. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete 2020.
- B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- C. ASTM E492 - Standard Test Measurement for Laboratory Measurement of Impact Floor-Ceiling Assemblies Using the Tapping Machine.
- D. ASTM C627 - Standard Test Method for Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester.
- E. ASTM F2419 - Standard Test Method for Installation of Thick Poured Gypsum Concrete and Preparation of Surface to Receive Resilient Flooring.
- F. ASTM F2873 - Standard Practice for the Installation of Self-Leveling Underlayment and the Preparation of Surface to Resilient Flooring.
- G. ASTM D4263 - Standard Test method for Indicating Moisture in Concrete by the Plastic Sheet Method.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data sheets documenting physical characteristics and product limitations of underlayment materials. Include information on surface preparation, environmental limitations, and installation instructions.
- C. Acoustical Data: Submit sound tests according to IBC code criteria, Section 1207, for ASTM E492 (IIC) and ASTM E90 (STC).
- D. Shop Drawings: Plans indicating substrates, sound mats, locations, and average depths of gypsum-based underlayment based on survey of substrate conditions.

1.04 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the work of this section, and approved by manufacturer.
- B. Coordinate application of underlayment with requirements of floor-covering products and adhesives, to ensure compatibility of products.
- C. Underlayment mix shall be tested for a slump using a 2"x4" cylinder resulting in a patty size of 8 ½" - 9 ½".

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Keep dry and protect from direct sun exposure, freezing, and ambient temperature greater than 105 degrees F (41 degrees C).
- C. Comply with manufacturer's written instructions.

1.06 FIELD CONDITIONS

- A. Do not install underlayment until floor penetrations and peripheral work are complete.
- B. Maintain minimum ambient temperatures of 50 degrees F (10 degrees C) 24 hours before, during and 72 hours after installation of underlayment.
- C. During the curing process, ventilate spaces to remove excess moisture.

PART 3 EXECUTION

2.01 EXAMINATION

- A. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

2.02 PREPARATION

- A. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.
- B. Vacuum clean surfaces.
- C. Prime substrate in accordance with manufacturer's instructions. Allow to dry.
- D. Close floor openings.

2.03 APPLICATION

- A. Install underlayment in strict accordance with manufacturer's instructions.
- B. Pump or pour material onto substrate. Do not retemper or add water.
 - 1. Pump, move, and screed while the material is still highly flowable.
 - 2. Be careful not to create cold joints.
 - 3. Wear spiked shoes while working in the wet material to avoid leaving marks.
- C. Place to indicated thickness, with top surface level to 1/8 inch in 10 ft (1:1000).
- D. Sound Mat Installation
 - 1. Sound mat should be laid flat without wrinkles.
 - 2. Sound mat should be loose laid without fasteners per manufacturer's recommendations.

2.04 CURING

- A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.
- B. Air cure in accordance with manufacturer's instructions.

2.05 PREPARATION FOR INSTALLATION OF FINISH FLOORING

- A. Sealing: **Seal all areas** with manufacturer's recommended sealer for the scheduled finish flooring material. Any floor areas where the surface has been damaged shall be cleaned and sealed regardless of floor covering to be used. Where floor goods manufacturer's require special adhesive or installation

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systems, their requirements supersede these recommendations.

2.06 FIELD QUALITY CONTROL

- A. Perform Slump Test for each batch of material and document results providing documentation to the General Contractor and the Architect: Gypsum based underlayment "Green" mix shall be tested for slump as it's being pumped using a 2 inch by 4 inch (50 mm by 101 mm) cylinder resulting in a patty size of 8 inches (203 mm) plus or minus 1 inch (25 mm) diameter.
- B. Perform the following compression test for each batch of material and document results providing documentation to the General Contractor and the Architect:
 - 1. Field Samples: At least one set of 3 molded cube samples shall be taken from each day's pour during the gypsum based underlayment "Green" application. Cubes shall be tested as recommended by the manufacturer in accordance with modified ASTM C 472. Test results shall be provided to architect, owner and contractor.

2.07 PROTECTION

- A. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.
- B. Do not permit traffic over unprotected floor underlayment surfaces.
 - 1. Protection From Heavy Loads: During construction, place temporary wood planking over gypsum based underlayment wherever it will be subject to heavy wheeled or concentrated loads.

END OF SECTION

SECTION 04 2000 - UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete block.
- B. Mortar and grout.
- C. Reinforcement and anchorage.
- D. Flashings.
- E. Lintels.
- F. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2020.
- C. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement 2016, with Editorial Revision (2018).
- D. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units 2016a.
- E. ASTM C91/C91M - Standard Specification for Masonry Cement 2018.
- F. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar 2018.
- G. ASTM C150/C150M - Standard Specification for Portland Cement 2021.
- H. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes 2018.
- I. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2019a.
- J. ASTM C404 - Standard Specification for Aggregates for Masonry Grout 2018.
- K. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry 2019a.
- L. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing 2017.
- M. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2016.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.

1.05 QUALITY ASSURANCE

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

1.06 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depth of 8 inches (200 mm).
 - 2. Special Shapes: Provide nonstandard blocks configured for corners.
 - 3. Load-Bearing Units: ASTM C90, normal weight.
 - a. Hollow block, as indicated.
 - b. Exposed Faces: Manufacturer's standard color and texture where indicated.

2.02 MORTAR AND GROUT MATERIALS

- A. Masonry Cement: ASTM C91/C91M, Type S.
- B. Portland Cement: ASTM C150/C150M, Type I; color to produce approved color sample.
- C. Hydrated Lime: ASTM C207, Type S.
- D. Mortar Aggregate: ASTM C144.
- E. Grout Aggregate: ASTM C404.
- F. Water: Clean and potable.
- G. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
 - 1. Color: Standard gray.

2.03 REINFORCEMENT AND ANCHORAGE

- A. Manufacturers:
 - 1. Blok-Lok Limited: www.blok-lok.com/#sle.
 - 2. Hohmann & Barnard, Inc; X-Seal Anchor: www.h-b.com/#sle.
 - 3. WIRE-BOND www.wirebond.com/#sle.
- B. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi) (280 MPa), deformed billet bars; galvanized.
- C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
- D. Single Wythe Joint Reinforcement: ASTM A951/A951M.
 - 1. Type: Truss or ladder.
 - 2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.
 - 3. Size: 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width to provide not less than 5/8 inch (16 mm) of mortar coverage on each exposure.
- E. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.

1. Anchor plates: Not less than 0.075 inch (1.91 mm) thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
 2. Wire ties: Manufacturer's standard shape, 0.1875 inch (4.75 mm) thick.
 3. Vertical adjustment: Not less than 3-1/2 inches (89 mm).
- 2.04 FLASHINGS
- A. Metal Flashing Materials:
 1. Prefabricated Metal Flashing: Smooth fabricated 12 oz/sq ft (3.66 kg/sq m) copper flashing for surface mounted conditions.
 - B. Combination Asphaltic Flashing Materials - Copper:
 1. Copper/Asphalt Flashing: 3 oz/sq ft (0.915 kg/sq m) copper sheet coated with elastic asphalt compound on both sides.
- 2.05 ACCESSORIES
- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
 - B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.
 - C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
- 2.06 MORTAR AND GROUT MIXING
- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
 1. Masonry below grade and in contact with earth: Type S.
- PART 3 EXECUTION
- 3.01 EXAMINATION
- A. Verify that field conditions are acceptable and are ready to receive masonry.
 - B. Verify that related items provided under other sections are properly sized and located.
 - C. Verify that built-in items are in proper location, and ready for roughing into masonry work.
- 3.02 PREPARATION
- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
 - B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.
- 3.03 COLD AND HOT WEATHER REQUIREMENTS
- A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.
- 3.04 COURSING
- A. Establish lines, levels, and coursing indicated. Protect from displacement.
 - B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
 - C. Concrete Masonry Units:
 1. Bond: Running.
 2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
 3. Mortar Joints: Concave.
- 3.05 PLACING AND BONDING
- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
 - B. Lay hollow masonry units with face shell bedding on head and bed joints.
 - C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
 - D. Remove excess mortar and mortar smears as work progresses.
 - E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.
 - F. Interlock intersections and external corners, except for units laid in stack bond.
 - G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
 - H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
 - I. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.
- 3.06 REINFORCEMENT AND ANCHORAGE - GENERAL, SINGLE WYTHE MASONRY, and CAVITY WALL MASONRY
- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches (400 mm) on center.
 - B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.
 - C. Place continuous joint reinforcement in first and second joint below top of walls.
 - D. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch (16 mm) mortar cover on each side.
 - E. Lap joint reinforcement ends minimum 6 inches (150 mm).
- 3.07 MASONRY FLASHINGS
- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
 1. Extend flashings full width at such interruptions and at least 6 inches (152 mm), minimum, into adjacent masonry or turn up flashing ends at least 1 inch (25.4 mm), minimum, to form watertight pan at nonmasonry construction.
 2. Remove or cover protrusions or sharp edges that could puncture flashings.
 3. Seal lapped ends and penetrations of flashing before covering with mortar.
 - B. Install flashing in accordance with manufacturer's instructions and BIA Technical Notes No. 7.

- C. Extend metal flashings through exterior face of masonry and terminate in an angled drip with hemmed edge. Install joint sealer below drip edge to prevent moisture migration under flashing.
 - D. Support flexible flashings across gaps and openings.
- 3.08 LINTELS
- A. Install loose steel lintels over openings.
- 3.09 CONTROL AND EXPANSION JOINTS
- A. Do not continue horizontal joint reinforcement through control or expansion joints.
 - B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- 3.10 TOLERANCES
- A. Install masonry within the site tolerances found in TMS 402/602.
 - B. Maximum Variation from Alignment of Columns: 1/4 inch (6 mm).
 - C. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).
 - D. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.
 - E. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.
 - F. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).
- 3.11 CUTTING AND FITTING
- A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.
 - B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.
- 3.12 FIELD QUALITY CONTROL
- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
- 3.13 CLEANING
- A. Clean soiled surfaces with cleaning solution.
- 3.14 PROTECTION
- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.
- END OF SECTION

SECTION 05 5000 - METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated steel items.
- B. Prefabricated ladders and ship ladders.
- C. Steel pipe bollards.

1.02 REFERENCE STANDARDS

- A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements 2018.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.
- D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.
- F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.
- G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.
- H. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.
- I. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2012.
- J. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020.
- K. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 1999 (Ed. 2004).
- L. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic") 2002 (Ed. 2004).
- M. SSPC-SP 2 - Hand Tool Cleaning 2018.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A 36/A 36M.
- B. Plates: ASTM A283/A283M.
- C. Pipe: ASTM A 53/A 53M Grade B Schedule 40, black finish.
- D. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.
- E. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- F. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

- A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.
 - 1. Side Rails: 3/8 x 2 inches (9 x 50 mm) members spaced at 20 inches (500 mm).
 - 2. Rungs: one inch (25 mm) diameter solid round bar spaced 12 inches (300 mm) on center.
 - 3. Space rungs 7 inches (175 mm) from wall surface.
- B. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.
- C. Lintels: As detailed; prime paint finish.
- D. Elevator Hoistway Divider Beams: Beam sections; prime paint finish.

2.04 PREFABRICATED LADDERS

- A. Prefabricated Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
 - 1. Components: Manufacturer's standard rails, rungs, treads, handrails, returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.

2.05 FINISHES - STEEL

- A. Prime paint steel items.
 - 1. Exceptions: Galvanize items to be embedded in concrete, items to be embedded in masonry, and items specified for [] finish.
 - 2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.

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- E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements.
- F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components as indicated on drawings.
- D. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.

3.04 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).
- C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

SECTION 05 5213 - PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall mounted handrails.
- B. Stair railings and guardrails.
- C. Free-standing railings at steps.

1.02 REFERENCE STANDARDS

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).
- B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.
- D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.
- F. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire 2012.
- G. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire (Metric) 2012.
- H. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube 2016.
- I. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube 2020.
- J. ASTM B483/B483M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Tube and Drawn Pipe for General Purpose Applications 2021.
- K. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings 2021.
- L. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings 2000 (Reapproved 2006).

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Handrails and Railings:
 - 1. C.R. Laurence Company, Inc; CRL Welded Post Railing Systems (WRS): www.crl-arch.com/#sle.
 - 2. KaneSterling www.sterlingdula.com/#sle.
 - 3. Superior Aluminum Products: www.superioraluminum.com
 - 4. The Wagner Companies: www.wagnercompanies.com/#sle.
- B. Non-Weld Pipe Fittings:

2.02 RAILINGS - GENERAL REQUIREMENTS

- A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E985 and applicable local code.
- B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot (1095 N/m) applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.
- C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds (890 N) applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.
- D. Allow for expansion and contraction of members and building movement without damage to connections or members.
- E. Dimensions: See drawings for configurations and heights.
- F. Provide anchors and other components to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
- G. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.03 ALUMINUM MATERIALS

- A. Aluminum Pipe: Schedule 40; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.
- B. Solid Bars and Flats: ASTM B211 (ASTM B211M).
- C. Non-Weld Mechanical Fittings: Slip-on cast aluminum, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.
- D. Exposed Fasteners: No exposed bolts or screws.

2.04 STEEL RAILING SYSTEM

- A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.
- B. Steel Pipe: ASTM A 53/A 53M Grade B Schedule 40, black finish.
- C. Non-Weld Mechanical Fittings: Slip-on, galvanized malleable iron castings, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.
- D. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

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- E. Exposed Fasteners: No exposed bolts or screws.
 - F. Galvanizing: In accordance with requirements of ASTM A123/A123M.
- 2.05 FABRICATION
- A. Accurately form components to suit specific project conditions and for proper connection to building structure.
 - B. Fit and shop assemble components in largest practical sizes for delivery to site.
 - C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.
 - D. Welded Joints:
 - 1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
 - 2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
 - 3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- 2.06 ALUMINUM FINISHES
- A. Where indicated as Clear Anodized provide Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.
 - B. Superior Performance Organic Coating System: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system.
 - C. Color: To be selected by Architect from manufacturer's standard line.
 - D. Touch-Up Materials: As recommended by coating manufacturer for field application.
- PART 3 EXECUTION
- 3.01 EXAMINATION
- A. Verify that field conditions are acceptable and are ready to receive work.
- 3.02 PREPARATION
- A. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.
- 3.03 INSTALLATION
- A. Install in accordance with manufacturer's instructions.
 - B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
 - C. Anchor railings securely to structure.
- 3.04 TOLERANCES
- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per floor level, non-cumulative.
 - B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
 - C. Maximum Out-of-Position: 1/4 inch (6 mm).
- END OF SECTION

SECTION 05 7000 - DECORATIVE METAL RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Railing and guardrail assemblies.
- B. Wall-mounted handrails.

1.02 REFERENCE STANDARDS

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).
- B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- C. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.
- E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.
- F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- H. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings 2021.
- I. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings 2000 (Reapproved 2006).
- J. AWS C3.4M/C3.4 - Specification for Torch Brazing 2016.
- K. AWS C3.5M/C3.5 - Specification for Induction Brazing 2016 (Amended 2017).
- L. AWS C3.9M/C3.9 - Specification for Resistance Brazing 2009.
- M. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020.
- N. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel 2017.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer's product data including description of materials, components, finishes, fabrication details, glass, anchors, and accessories.
- C. Shop Drawings: Indicate railing system elevations and sections, details of profile, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, brazed connections, transitions, and terminations.
- D. Samples: Submit one (1) of each item below for each type and condition shown.
 - 1. Railing: 12 inch (305 mm) long section of handrail illustrating color, finish and connection detail.
- E. Test Reports: Submit test reports from an independent testing agency showing compliance with specified design and performance requirements.
- F. Maintenance Data: Manufacturer's instructions for care and cleaning.
- G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in installing decorative stairs and railing systems and acceptable to manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in factory provided protective coverings and packaging.
- B. Protect materials against damage during transit, delivery, storage, and installation at site.
- C. Inspect materials upon delivery for damage. Repair damage to be indistinguishable from undamaged areas; if damage cannot be repaired to be indistinguishable from undamaged parts and finishes, replace damaged items.
- D. Prior to installation, store materials and components under cover, in a dry location.

1.06 FIELD CONDITIONS

- A. Do not install railings until project is enclosed and ambient temperature of space is minimum 65 degrees F (18.3 degrees C) and maximum 95 degrees F (35 degrees C).
- B. Maintain ambient temperature of space at minimum 65 degrees F (18.3 degrees C) and maximum 95 degrees F (35 degrees C) for 24 hours before, during, and after railing installation.

1.07 WARRANTY

- A. Warranty: Manufacturer's standard one year warranty against defects in materials, fabrication, finishes, and installation commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Decorative Metal Railings:
 - 1. Couturier Iron Craft, Inc: www.couturierironcraft.com/#sle.
 - 2. C. R. Laurence Company, Inc: www.crl-arch.com/#sle.
 - 3. Global Glass Railings; Hercules system (base mounted): www.architecturalglassrailings.com/#sle.
 - 4. Superior Aluminum Products, Inc: www.superioraluminum.com/#sle.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 RAILING SYSTEMS

- A. Railing Systems - General: Factory- or shop-fabricated in design indicated, to suit specific project conditions, and for proper connection to building structure, and in largest practical sizes for delivery to site.

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1. Performance Requirements: Design and fabricate railings and anchorages to resist the following loads without failure, damage, or permanent set; loads do not need to be applied simultaneously.
 - a. Lateral Force: 75 lb (333 N) minimum, at any point, when tested in accordance with ASTM E935.
 - b. Distributed Load: 50 lb/ft (0.73 kN per m) minimum, applied in any direction at the top of the handrail, when tested in accordance with ASTM E935.
 - c. Concentrated Loads on Intermediate Rails: 50 psf (0.22 kgs per sq m), minimum.
 - d. Concentrated Load: 200 lbs (888 N) minimum, applied in any direction at any point along the handrail system, when tested in accordance with ASTM E935.
 - e. Handrails: Comply with applicable accessibility requirements of ADA Standards.
 2. Assembly: Join lengths, seal open ends, and conceal exposed mounting bolts and nuts using slip-on non-weld mechanical fittings, flanges, escutcheons, and wall brackets.
 3. Joints: Tightly fitted and secured, machined smooth with hairline seams.
 4. Field Connections: Provide sleeves to accommodate site assembly and installation.
 5. Welded and Brazed Joints: Make exposed joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.
 - a. Ease exposed edges to small uniform radius.
 - b. Welded Joints:
 - 1) Carbon Steel: Perform welding in accordance with AWS D1.1/D1.1M.
 - 2) Stainless Steel: Perform welding in accordance with AWS D1.6/D1.6M.
 - c. Brass/Bronze Brazed Joints:
 - 1) Perform torch brazing in accordance with AWS C3.4M/C3.4.
 - 2) Perform induction brazing in accordance with AWS C3.5M/C 3.5.
 - 3) Perform resistance brazing in accordance with AWS C3.9M/C3.9.
 - B. Metal Tube Railing: Engineered, post supported railing system with metal infill.
 1. Configuration: as drawn.
 2. Decorative Flanges for Embedded Posts: Circular, collared cover plate without screw holes.
 3. Wall Mounted Components: Components necessary to support railing with 1-1/2 inch (38 mm) clearance from wall, and as follows:
 4. Fasteners: Concealed.
- 2.03 MATERIALS
- A. Aluminum Components: ASTM B221 or ASTM B221M.
 1. Tubes: Schedule 40 pipe.
 2. High Performance Organic Finish: AAMA 2604; multiple coats, thermally cured fluoropolymer system.
- 2.04 ACCESSORIES
- A. Non-Weld Mechanical Fittings for Aluminum Railings: In-line aluminum fittings, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.
 - B. Welding Fittings: Factory- or shop-welded from matching pipe or tube; joints and seams ground smooth.
 - C. Anchors and Fasteners: Provide anchors and other materials to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
 1. For anchorage to concrete, provide inserts to be cast into concrete for bolting anchors.
 2. For anchorage to masonry, provide brackets to be embedded in masonry for bolting anchors.
 3. For anchorage to stud walls, provide backing plates for bolting anchors.
 4. Exposed Fasteners: No exposed bolts or screws.
 - D. Carbon Steel Bolts and Nuts: ASTM A307.
- PART 3 EXECUTION
- 3.01 EXAMINATION
- A. Verify that substrate and site conditions are acceptable and ready to receive work.
 - B. Verify field dimensions of locations and areas to receive work.
 - C. Notify Architect immediately of conditions that prevent satisfactory installation.
 - D. Do not proceed with work until detrimental conditions have been corrected.
 - E. Furnish components to be installed in other work to installer of that other work, including but not limited to blocking, sleeves, inserts, anchor bolts, embedded plates and supports for attachment of anchors.
- 3.02 PREPARATION
- A. Review installation drawings before beginning installation. Coordinate diagrams, templates, instructions and directions for installation of anchorages and fasteners.
 - B. Clean surfaces to receive units. Remove materials and substances detrimental to the installation.
- 3.03 INSTALLATION
- A. Comply with manufacturer's drawings and written instructions.
 - B. Install components plumb and level, accurately fitted, free from distortion or defects and with tight joints, except where necessary for expansion.
 - C. Anchor securely to structure.
 - D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
 - E. Isolate dissimilar materials with bituminous coating, bushings, grommets or washers to prevent electrolytic corrosion.
- 3.04 TOLERANCES
- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per floor level, non-cumulative.
 - B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
 - C. Maximum Out-of-Position: 1/4 inch (6 mm).
- 3.05 CLEANING
- A. Remove protective film from exposed metal surfaces.

- B. Metal: Clean exposed metal finishes with potable water and mild detergent, in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents or other substances that may damage the material or finish.

3.06 PROTECTION

- A. Protect installed components and finishes from damage after installation.
- B. Repair damage to exposed finishes to be indistinguishable from undamaged areas.
 - 1. If damage to finishes and components cannot be repaired to be indistinguishable from undamaged finishes and components, replace damaged items.

END OF SECTION

SECTION 06 1000 - ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Structural dimension lumber framing.
- B. Non-structural dimension lumber framing.
- C. Rough opening framing for doors, windows, and roof openings.
- D. Sheathing.
- E. Subflooring.
- F. Roof-mounted curbs.
- G. Preservative treated wood materials.
- H. Miscellaneous framing and sheathing.
- I. Communications and electrical room mounting boards.
- J. Concealed wood blocking, nailers, and supports.

1.02 RELATED REQUIREMENTS

- A. Section 01 7610 - Temporary Protective Coverings.
- B. Section 07 2500 - WEATHER BARRIERS: Water-resistive barrier over sheathing.

1.03 REFERENCE STANDARDS

- A. AWC (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings 2018.
- B. APA PRP-108 - Performance Standards and Qualification Policy for Structural-Use Panels (Form E445); 2001.
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- F. AWPA U1 - Use Category System: User Specification for Treated Wood 2018.
- G. PS 1 - Structural Plywood 2009 (Revised 2019).
- H. PS 2 - Performance Standard for Wood-Based Structural-Use Panels 2010.
- I. PS 20 - American Softwood Lumber Standard 2020.
- J. SPIB (GR) - Grading Rules 2014.
- K. WWPA G-5 - Western Lumber Grading Rules 2017.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.
- C. Structural Composite Lumber: Submit manufacturer's published structural data including span tables, marked to indicate which sizes and grades are being used; if structural composite lumber is being substituted for dimension lumber or timbers, submit grading agency structural tables marked for comparison.
- D. Samples: For rough carpentry members that will be exposed to view, submit two samples, illustrating wood grain, color, and general appearance.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
 - 2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
 - 3. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.
- B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Grading Agency: Western Wood Products Association; WWPA G-5.
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.
- D. Stud Framing (2 by 2 through 2 by 6 (50 by 50 mm through 50 by 150 mm)):
 - 1. Species: Any allowed under referenced grading rules and meeting requirements stipulated on the drawings or elsewhere in the project manual.
 - 2. Grade: No. 2.
- E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.

2.03 EXPOSED DIMENSION LUMBER

- A. Grading Agency: Western Wood Products Association; WWPA G-5.
- B. Sizes: Nominal sizes as indicated on drawings.
- C. Surfacing: S4S.
- D. Moisture Content: S-dry or MC19.

2.04 STRUCTURAL COMPOSITE LUMBER

- A. At Contractor's option, structural composite lumber may be substituted for concealed dimension lumber and timbers.

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- B. Structural Composite Lumber: Factory fabricated beams, headers, and columns, of sizes and types indicated on drawings; structural capacity as published by manufacturer.
 - 1. Beams: Use laminated veneer lumber, laminated strand lumber, or parallel strand lumber with manufacturer's published E (modulus of elasticity): 1,800,000 psi (12,410 MPa), minimum.
 - 2. Manufacturers:
 - a. Boise Cascade Company: www.bc.com/#sle.
 - b. Weyerhaeuser Company: www.weyerhaeuser.com/#sle.
- 2.05 CONSTRUCTION PANELS
- A. Subfloor/Underlayment Combination: Any PS 2 type, rated Single Floor.
 - 1. Bond Classification: Exterior.
 - 2. Span Rating: 24.
 - 3. Performance Category: 3/4 PERF CAT.
 - 4. Thickness: 3/4 inches (19 mm), nominal.
 - 5. Edges: Tongue and groove.
 - B. Subflooring: APA PRP-108: Rated Sheathing.
 - 1. Exposure Class: Exterior.
 - 2. Span Rating: 32/16 inches (812/406 mm).
 - 3. Thickness: 3/4 inch (19 mm), nominal.
 - C. Roof Sheathing: APA PRP-108, Rated Sheathing, Exterior Exposure Class, and as follows:
 - 1. Span Rating: 24/0 (610/0).
 - 2. Thickness: 7/16" nominal.
 - D. Roof Sheathing: Oriented strand board wood structural panel; PS 2.
 - 1. Grade: Sheathing.
 - 2. Performance Category: 1/2 PERF CAT.
 - 3. Span Rating: 32/16.
 - 4. Edges: Square with panel clips.
 - 5. Exposure Time: Sheathing will not delaminate or require sanding due to moisture absorption from exposure to weather for up to 500 days.
 - 6. Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches (406 mm) and 24 inches (610 mm) on center, respectively.
 - 7. Manufacturers:
 - a. Huber Engineered Woods, LLC; AdvanTech Sheathing: www.huberwood.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
 - E. Wall Sheathing: APA PRP-108, Structural I Rated Sheathing, Exterior Exposure Class, and as follows:
 - 1. Span Rating: 24/0 (610/0).
 - F. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- 2.06 ACCESSORIES
- A. Fasteners and Anchors:
 - 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
 - 2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
 - B. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.
 - 1. For contact with preservative treated wood in exposed locations, provide minimum G185 (Z550) galvanizing complying with ASTM A653/A653M.
 - C. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions.
 - D. Sill Gasket on Top of Foundation Wall: 1/4 inch (6 mm) thick, plate width, closed cell plastic foam from continuous rolls. Provide [] manufactured by [].
 - E. Subfloor Adhesives: Waterproof, air cure type, cartridge dispensed.
 - F. Water-Resistive Barrier: As specified in Section 07 2500.
- 2.07 FACTORY WOOD TREATMENT
- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 - 1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.
 - B. Preservative Treatment:
 - 1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
 - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - b. Treat lumber exposed to weather.
 - c. Treat lumber in contact with roofing, flashing, or waterproofing.
 - d. Treat lumber in contact with masonry or concrete.
- PART 3 EXECUTION
- 3.01 PREPARATION
- A. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.
- 3.02 INSTALLATION - GENERAL
- A. Select material sizes to minimize waste.

- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
 - C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.
 - D. Schedule framing and allocate manpower so that exposure to inclement weather is minimized in duration to prevent damage to framing materials that may occur from prolonged exposure to moisture, snow or wind. If necessary provide temporary protective coverings - see Section 01 7610 and 01 7000.
- 3.03 FRAMING INSTALLATION
- A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.
 - B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.
 - C. Install structural members full length without splices unless otherwise specifically detailed.
 - D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AWC (WFCM) Wood Frame Construction Manual.
 - E. Install horizontal spanning members with crown edge up and not less than 1-1/2 inches (38 mm) of bearing at each end.
 - F. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.
 - G. Provide bridging at joists in excess of 8 feet (2.3 m) span at mid-span. Fit solid blocking at ends of members.
 - H. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.
- 3.04 BLOCKING, NAILERS, AND SUPPORTS
- A. Provide framing and blocking members as indicated to support finishes, fixtures, specialty items, and trim.
 - B. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
 - C. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
 - D. Provide the following specific non-structural framing and blocking:
 - 1. Cabinets and shelf supports.
 - 2. Wall brackets.
 - 3. Handrails.
 - 4. Grab bars.
 - 5. Towel and bath accessories.
 - 6. Wall-mounted door stops.
 - 7. Chalkboards and marker boards.
 - 8. Wall paneling and trim.
 - 9. Joints of rigid wall coverings that occur between studs.
- 3.05 ROOF-RELATED CARPENTRY
- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
 - B. Provide wood curb at all roof openings except where specifically indicated otherwise. Form corners by alternating lapping side members.
- 3.06 INSTALLATION OF CONSTRUCTION PANELS
- A. Subflooring/Underlayment Combination: Glue and nail to framing; staples are not permitted.
 - B. Subflooring: Glue and nail to framing; staples are not permitted.
 - C. Space or gap subflooring in accordance with the manufacturer's instructions.
 - D. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
 - 1. At long edges provide solid edge blocking where joints occur between roof framing members.
 - 2. Nail panels to framing; staples are not permitted.
 - E. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails or screws.
 - 1. Provide 1/8" gap minimum between panel ends and edges. Use a spacer tool to assure accurate and consistent spacing.
 - 2. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges and ends.
 - F. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
 - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 - 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 - 3. Install adjacent boards without gaps.
 - G. Wall Sheathing and Roof Sheathing with Laminated Water-Resistive Barrier and Air Barrier: Secure to studs as recommended by manufacturer.
 - 1. Install with laminated water-resistive and air barrier on exterior side of sheathing.
 - 2. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
 - 3. Use only mechanically attached and drainable EIFS and exterior insulation with wall sheathing with laminated water-resistive and air barrier.
 - 4. Apply manufacturer's standard seam tape to joints between sheathing panels. Use tape gun or hard rubber roller as recommended by manufacturer.

3.07 TOLERANCES

- A. Framing Members: 1/4 inch (6 mm) from true position, maximum.
- B. Surface Flatness of Floor: 1/8 inch in 10 feet (1 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.
- C. Variation from Plane (Other than Floors): 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

3.08 CLEANING

- A. Waste Disposal: Comply with the requirements of Section 01 7419 - Construction Waste Management and Disposal.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
 - 3. Do not burn scraps that have been pressure treated.
 - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 1500 - WOOD DECKING

PART 2 PRODUCTS

1.01 WOOD MATERIALS

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

END OF SECTION

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SECTION 06 2000 - FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Finish carpentry items.
- B. Installation of wood door frames, glazed frames.
- C. Wood casings and moldings.
- D. Exterior woodwork
- E. Installation of hardware and attachment accessories.
- F. Installation of window sills.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 06 4100 - Architectural Wood Casework: Shop fabricated custom cabinet work.
- C. Section 09 9123 - Interior Painting: Painting of finish carpentry items.
- D. Section 12 3530 - Residential Casework: Shop fabricated cabinet work.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- B. AWI (QCP) - Quality Certification Program Current Edition.
- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).
- D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 4.0 2021.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
 - 2. Include certification program label.
- C. Samples: Submit one sample of wood trim 4 inch (____) mm long.
- D. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

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. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- B. Quality Certification:
 - 1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
 - 2. Provide labels or certificates indicating that the work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
 - 3. Provide designated labels on shop drawings by certification program.
 - 4. Provide designated labels on installed products by certification program.
 - 5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect work from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI/AWMAC/WI (AWS) for Custom Paint Grade.
- C. Exterior Woodwork Items:
 - 1. Materials indicated to be wrapped with aluminum shall be spruce pine fur.
 - 2. Wood exposed to the weather shall be select cedar, either smooth or rough sawn as indicated on the drawings.
 - 3. Fascia's, frieze boards, door and window trim, and corner trim (as applicable and as indicated on the drawings).
 - 4. Exterior decking: composite decking with concealed fastener system. Basis of design is TimberTech Azek Harvest collection.
- D. Cellular PVC Trim: Extruded, expanded PVC; UV-resistant, heat-stabilized, and rigid material.
 - 1. Density: 31 pounds per cubic foot (500 kg/cu m), minimum.
 - 2. Composition: Cellular PVC formulation.
 - 3. Finishes: Natural White, painted in accordance with manufacturer's specification and instructions.
 - 4. Surface Patterns: Smooth
 - 5. Trimboard sizes: See drawings.
 - 6. Flame Spread: ASTM E84, 75, maximum.
 - 7. Manufacturers:
 - a. AZEK Building Products, Inc; Traditional Trim: www.azek.com/#sle.
 - b. CertainTeed Certa Trim, www.certainteed.com
 - c. Versatex Trimboard, www.versatex.com
 - d. Fypon LLC; www.fypon.com/#sle.

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- E. Interior Woodwork Items: (see drawings for wood species and finish)
 - 1. Moldings, Bases, Casings, and Miscellaneous Trim
 - 2. Door and Glazed Light Frames.
 - 3. Window Sills: as indicated on drawings.
 - 4. Stairs, Balustrades, and Handrails.
 - 5. Loose Shelving.
 - 6. False Box Beams.
- 2.02 WOOD-BASED COMPONENTS
 - A. Wood fabricated from old growth timber is not permitted.
- 2.03 FASTENINGS
 - A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
 - B. Fasteners: Of size and type to suit application; concealed.
 - 1. Exterior composite decking: Stainless steel or type recommended by manufacturer for concealed fastener system.
 - 2. Exterior pvc trim: Size and type recommended by manufacturer.
 - 3. Exterior wood: Hot dip galvanized.
- 2.04 FABRICATION
 - A. Shop assemble work for delivery to site, permitting passage through building openings.
 - B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
- PART 3 EXECUTION
- 3.01 EXAMINATION
 - A. Verify adequacy of backing and support framing.
- 3.02 INSTALLATION
 - A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
 - B. Set and secure materials and components in place, plumb and level.
 - C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim to conceal larger gaps.
 - D. PVC trim products:
 - 1. Install in accordance with the manufacturer's published installation instructions.
 - 2. Allow for expansion and contraction in accordance with manufacturer's installation instructions.
 - 3. Use fastener's recommended by the manufacturer for the application and substrate of project. Install in strict compliance with manufacturer instructions. All fasteners shall be set and filled.
- 3.03 PREPARATION FOR SITE FINISHING
 - A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.
- 3.04 TOLERANCES
 - A. Maximum Variation from True Position: 1/16 inch (1.6 mm).
 - B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.79 mm).
- END OF SECTION

SECTION 07 1900 - WATER REPELLENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water repellents applied to exterior, masonry surfaces.
- B. Water repellents applied to exterior concrete masonry surfaces.
- C. Water repellents applied to above grade masonry where indicated on the drawings.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

- A. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units 2021.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.
- D. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

1.06 MOCK-UP

- A. Prepare a representative surface 36 inch by 36 inch (0.91 m by 0.91 m) in size using specified materials and preparation and application methods on surfaces identical to those to be coated; approved mock-up constitutes standard for workmanship.

1.07 FIELD CONDITIONS

- A. Protect liquid materials from freezing.
- B. Do not apply water repellent when ambient temperature is lower than 50 degrees F (10 degrees C) or higher than 100 degrees F (38 degrees C).

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Silane, Siloxane, Silane-Siloxane Blend, and Siliconate Water Repellents:
 - 1. Tnemec Company, Inc: www.tnemec.com.
 - 2. BASF Construction Chemicals: www.buildingsystems.basf.com.
 - 3. Sherwin-Williams Company: www.sherwin-williams.com.
 - 4. Pecora Corporation: www.pecora.com.
 - 5. PROSOCO, Inc: www.prosoco.com.

2.02 MATERIALS

- A. Water Repellent: Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.
 - 1. Applications: Vertical surfaces and non-traffic horizontal surfaces.
 - 2. Number of Coats: Two.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify joint sealants are installed and cured.
- C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

3.02 PREPARATION

- A. Protection of Adjacent Work:
 - 1. Protect adjacent landscaping, property, and vehicles from drips and overspray.
 - 2. Protect adjacent surfaces not intended to receive water repellent.
- B. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.
- C. Do not start work until masonry mortar substrate is cured a minimum of 60 days.
- D. Remove loose particles and foreign matter.
- E. Remove oil and foreign substances with a chemical solvent that will not affect water repellent.

3.03 APPLICATION

- A. Apply water repellent in accordance with manufacturer's instructions, using procedures and application methods recommended as producing the best results.
- B. Apply at rate recommended by manufacturer, continuously over entire surface.
- C. Apply two coats, minimum.
- D. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.

END OF SECTION

SECTION 07 2100 - THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation at perimeter foundation wall and underside of floor slabs.
- B. Batt insulation and vapor retarder in exterior wall, ceiling, and roof construction.
- C. Insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

- A. Section 07 2500 - WEATHER BARRIERS: Separate air barrier and vapor retarder materials.

1.03 REFERENCE STANDARDS

- A. ASTM C240 - Standard Test Methods for Testing Cellular Glass Insulation Block 2021.
- B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.
- C. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation 2021a.
- D. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).
- E. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2019.
- F. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation 2014 (Reapproved 2019).
- G. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- I. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C 2019a.
- J. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components 2019.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.05 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.
- B. Insulation in Wood Framed Walls: Batt insulation with separate vapor retarder.
- C. Insulation in Wood Framed Ceiling Structure: Batt insulation with no vapor retarder.

2.02 FOAM BOARD INSULATION MATERIALS

- A. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with either natural skin or cut cell surfaces.
 - 1. Flame Spread Index (FSI): Class B - 26 to 75, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 - 3. Type and Thermal Resistance, R-value (RSI-value): Type IV, 5.0 (0.88) per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature.
 - 4. Complies with fire resistance requirements shown on the drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
 - 5. Board Thickness: 1-1/2 inches (37.5 mm).
 - 6. Manufacturers:
 - a. Owens Corning Corp: www.owenscorning.com.
 - b. Kingspan Insulation LLC; GreenGuard XPS TYPE IV 25 PSI: www.trustgreenguard.com/#sle.

2.03 BATT INSULATION MATERIALS

- A. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used, at Contractor's option; unless specifically indicated one or the other.
- B. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
 - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 - 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 - 4. Facing: Unfaced.
 - 5. Manufacturers:
 - a. CertainTeed Corporation: www.certainteed.com/#sle.
 - b. Johns Manville: www.jm.com/#sle.
 - c. Owens Corning Corp: www.owenscorning.com.
- C. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
 - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
 - 3. Manufacturers:
 - a. Johns Manville; MinWool Sound Attenuation Fire Batts: www.jm.com/#sle.
 - b. Knauf Insulation; EcoBatt Insulation: www.knaufinsulation.com/#sle.
 - c. ROCKWOOL (ROXUL, Inc); COMFORTBATT: www.rockwool.com/#sle.

2.04 ACCESSORIES

- A. Sheet Vapor Retarder: Specified in Section 07 2500.
- B. Flashing Tape: Special polyolefin film with high performance adhesive or type as recommended by manufacturer.
 - 1. Application: Interior window and door sill flashing tape.
 - 2. Width: As required for application and by manufacturer. [] inch ([] mm)
- C. Joint Tape: Specified self-adhering type, or manufacturer's recommended tape of required width for application.
- D. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.
- E. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.
- F. Adhesive: Type recommended by insulation manufacturer for application.
- G. Spray foam insulation: Non-expanded foam spray for application into cracks around exterior doors and windows, closely spaced framing members, holes and penetrations.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 GENERAL

- A. Provide complete insulation package for proposed structure including foundation, walls, floors, attics and any assembly exposed to the exterior.
- B. Insulate all crevices at exterior openings and penetrations either with batt insulation or non expanding foam.
- C. Fill all holes in top and bottom wall plates of attics and crawl spaces with nonexpanding foam.

3.03 BOARD INSTALLATION AT FOUNDATION PERIMETER

3.04 BATT INSTALLATION

- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
- B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- E. At wood framing, place vapor retarder on warm side of insulation by stapling at 6 inches (150 mm) on center. Lap and seal sheet retarder joints over member face.
- F. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over member face.
- G. Tape seal tears or cuts in vapor retarder.
- H. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane. Tape seal in place.

3.05 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.

3.06 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including aluminum wrapped trim / fascias., aluminum wrapped trim / fascias., aluminum wrapped trim / fascias., aluminum wrapped trim / fascias., and aluminum wrapped trim / fascias..
- B. Aluminum soffits.
- C. Sealants for joints within sheet metal fabrications.
- D. Precast concrete splash pads.

1.02 RELATED REQUIREMENTS

- A. Section 04 2000 - Unit Masonry: Metal flashings embedded in masonry.
- B. Section 06 1000 - Rough Carpentry: Field fabricated roof curbs.
- C. Section 07 3113 - Asphalt Shingles: Non-metallic flashings associated with shingle roofing.
- D. Section 07 7200 - Roof Accessories: Manufactured metal roof curbs.
- E. Section 07 9200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.03 REFERENCE STANDARDS

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).
- B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- D. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- E. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- F. CDA A4050 - Copper in Architecture - Handbook current edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- C. Samples: Submit one sample illustrating metal finish color.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

- A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch (0.6 mm) thick base metal, shop pre-coated with PVDF coating.
 - 1. Color: As selected by Architect from manufacturer's standard colors.
- B. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 20 gage (0.032 inch) (0.81 mm) thick; plain finish shop pre-coated with fluoropolymer coating.

2.02 ACCESSORIES

- A. Fasteners: Same material and finish as flashing metal.
- B. Sealant: Type as specified in Section 07 9005.

2.03 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.
- F. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

2.04 GUTTER AND DOWNSPOUT FABRICATION

- A. Gutters: Profile as indicated.
- B. Downspouts: Profile as indicated.
- C. Gutters and Downspouts: Size indicated.
- D. Accessories: Profiled to suit gutters and downspouts.
 - 1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
 - 2. Gutter Supports: Spikes and ferrules.
 - 3. Downspout Supports: Straps.
 - 4. Valley splash guards: Prefinished aluminum in same gage as gutters secured to outer edge of 90 degree inside corners at bottom of roof valleys. Scribe to inside face of outer gutter edge to form a 90 degree 'L' approximately 6" in height with chamfered top corners.
- E. Splash Pads: Precast concrete or solid plastic type, of size and profiles indicated; minimum 3000 psi (21 MPa) at 28 days, with minimum 5 percent air entrainment.
- F. Downspout Boots: Plastic.
- G. Downspout Extenders: Same material and finish as downspouts.
- H. Seal metal joints.

2.05 VINYL SOFFITS

- A. Profile: Board Style, Ventilating Triple 3-Inch; 3-1/3 inches wide, solid; 9 inch exposure; with hidden vents. Basis of design is Certainteed Vinyl Carpentry Triple 3-1/3" InvisiVent Super Ventilated Soffit providing 10.0 square inches of net free ventilation per square ft.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

3.03 INSTALLATION

- A. Comply with drawing details.
- B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- C. Apply plastic cement compound between metal flashings and felt flashings.
- D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- E. Seal metal joints watertight.
- F. Secure gutters and downspouts in place with concealed fasteners.
- G. Connect downspouts to downspout boots, and grout connection watertight.
- H. Set splash pads under downspouts.

END OF SECTION

SECTION 07 7100 - ROOF SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufactured roof specialties, including copings, fascias, gravel stops, and vents.

1.02 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.
- C. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.
- D. Samples: Submit two appropriately sized samples of coping and gravel stop.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Roof Edge Flashings and Copings:
 - 1. Architectural Products Co; [____]: www.archprod.com/#sle.
 - 2. Metal-Era Inc; [____]: www.metalera.com/#sle.

END OF SECTION

SECTION 07 8100 - APPLIED FIRE PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fireproofing of interior structural steel not exposed to damage or moisture.

1.02 RELATED REQUIREMENTS

- A. Section 05 1200 - Structural Steel Framing.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- B. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members 2019.
- C. ASTM E760/E760M - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members 1992 (Reapproved 2020).
- D. ASTM E937/E937M - Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members 1993 (Reapproved 2020).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with placement of ceiling hanger tabs, mechanical component hangers, and electrical components.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittals procedures.
- B. Product Data: Provide data indicating product characteristics.
- C. Test Reports: Reports from reputable independent testing agencies for proposed products, indicating compliance with specified criteria, conducted under conditions similar to those on project, as follows:
 - 1. Bond strength.
 - 2. Bond impact.
 - 3. Compressive strength.
 - 4. Fire tests using substrate materials similar those on project.
- D. Manufacturer'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 of documented experience.

1.07 FIELD CONDITIONS

- A. Do not apply fireproofing when temperature of substrate material and surrounding air is below 40 degrees F (4 degrees C) or when temperature is predicted to be below said temperature for 24 hours after application.
- B. Provide ventilation in areas to receive fireproofing during application and 24 hours afterward, to dry applied material.
- C. Provide temporary enclosure to prevent spray from contaminating air.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.
 - 1. Include coverage for fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering.
 - 2. Reinstall or repair failures that occur within warranty period.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Applied Fireproofing:
 - 1. GCP Applied Technologies: www.gcpat.com/#sle.
 - 2. Isolatek International Inc: www.isolatek.com.
 - 3. Southwest Fireproofing Products Company: www.sfrm.com/#sle.

2.02 FIREPROOFING ASSEMBLIES

- A. Provide assemblies as indicated on drawings.

2.03 MATERIALS

- A. Applied Fireproofing Material for Interior Applications, Concealed: Manufacturer's standard factory mixed material, which when combined with water is capable of providing indicated fire resistance, and complying with following requirements:
 - 1. Composition: Gypsum-based; not mineral-fiber-based.
 - 2. Bond Strength: 150 pounds per square foot (7.2 kPa), minimum, when tested in accordance with ASTM E736/E736M when set and dry.
 - 3. Dry Density: As required by fire resistance design.
 - 4. Compressive Strength: 8.33 pounds per square inch (57.4 kPa), minimum.
 - 5. Effect of Impact on Bonding: No cracking, spalling or delamination, when tested in accordance with ASTM E760/E760M.
 - 6. Corrosivity: No evidence of corrosion, when tested in accordance with ASTM E937/E937M.
 - 7. Surface Burning Characteristics: Maximum flame spread index of 0 (zero) and maximum smoke developed index of 0 (zero), when tested in accordance with ASTM E84.

2.04 ACCESSORIES

- A. Primer Adhesive: Of type recommended by applied fireproofing manufacturer.
- B. Water: Clean, potable.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive fireproofing.
- B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.

- C. Verify that ducts, piping, equipment, or other items that would interfere with application of fireproofing have not been installed.
 - D. Verify that voids and cracks in substrate have been filled.
 - E. Verify that projections have been removed where fireproofing will be exposed to view as a finish material.
- 3.02 PREPARATION
- A. Perform tests as recommended by fireproofing manufacturer in applications where adhesion of fireproofing to substrate is in question.
 - B. Remove incompatible materials that could effect bond by scraping, brushing, scrubbing, or sandblasting.
 - C. Prepare substrates to receive fireproofing in strict accordance with instructions of fireproofing manufacturer.
 - D. Apply fireproofing manufacturer's recommended bonding agent on primed steel.
 - E. Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.
 - F. Close off and seal duct work in areas where fireproofing is being applied.
- 3.03 APPLICATION
- A. Apply primer adhesive in accordance with manufacturer's instructions.
 - B. Apply fireproofing in uniform thickness and density as necessary to achieve required ratings.
- 3.04 CLEANING
- A. Remove excess material, overspray, droppings, and debris.
 - B. Remove fireproofing from materials and surfaces not required to be fireproofed.
- END OF SECTION

SECTION 07 8400 - FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Firestopping systems.
- B. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

- A. Section 07 8100 - Applied Fire Protection.

1.03 REFERENCE STANDARDS

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2020.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).
- C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems 2015 (Reapproved 2019).
- D. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus 2020.
- E. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies 2013 (Reapproved 2017).
- F. ITS (DIR) - Directory of Listed Products current edition.
- G. FM (AG) - FM Approval Guide current edition.
- H. SCAQMD 1168 - Adhesive and Sealant Applications 1989 (Amended 2017).
- I. UL 1479 - Standard for Fire Tests of Penetration Firestops Current Edition, Including All Revisions.
- J. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems Current Edition, Including All Revisions.
- K. UL (DIR) - Online Certifications Directory Current Edition.
- L. UL (FRD) - Fire Resistance Directory Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- D. Sustainable Design Submittal: Submit VOC content documentation for all non-preformed materials.
- E. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- G. Certificate from authority having jurisdiction indicating approval of materials used.
- H. Installer Qualification: Submit qualification statements for installing mechanics.

1.05 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated, ASTM E119, and ASTM E814.
 - 1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
 - 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
 - 3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.
- 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 and:
 - 1. Verification of minimum three years documented experience installing work of this type.
- D. Coordination: Cross-coordinate rated and structural assemblies with penetrating products shown on plans and shop drawings of work by other divisions.

1.06 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Firestopping Manufacturers:
 - 1. 3M Fire Protection Products: www.3m.com/firestop/#sle.
 - 2. A/D Fire Protection Systems Inc: www.adfire.com/#sle.
 - 3. Hilti, Inc: www.us.hilti.com/#sle.
 - 4. Tremco Commercial Sealants & Waterproofing; TREMstop Acrylic: www.tremcosealants.com/#sle.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

- A. Manufacturers:
 - 1. A/D Fire Protection Systems Inc.: www.adfire.com.
 - 2. 3M Fire Protection Products: www.3m.com/firestop.
 - 3. Nelson FireStop Products: www.nelsonfirestop.com.
 - 4. Specified Technologies, Inc.: www.stifirestop.com.
- B. Firestopping Materials: Any materials meeting requirements.
- C. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.
- D. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials for tested firestopping assembly.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
 - 1. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.
- B. Membrane Penetration Firestopping: For all membrane penetrations, provide firestopping systems that have been tested according to ASTM E814 to have a pressure differential of .01" of water, and with fire resistance, F and T Rating not less than the required fire rating of penetrated assembly.
- C. Non-standard firestopping applications: for plumbing cleanouts, electrical panels, and other non-standard penetrations in rated and/or structural bearing wall membranes, provide listed systems with supporting fire engineering determination for modifications and submit for approval to local building and fire authorities.

2.04 FIRESTOPPING SYSTEMS

- A. Firestopping: Any material meeting requirements.
 - 1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by Owner's Independent Testing Agency.
- C. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- D. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

- A. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 9200 - JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Joint backings and accessories.

1.02 REFERENCE STANDARDS

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer 2015.
- B. ASTM C834 - Standard Specification for Latex Sealants 2017.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- E. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants 2018.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
- C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- D. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

1.04 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
 - 1. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
 - 2. Pecora Corporation: www.pecora.com/#sle.
 - 3. Sika Corporation: www.usa-sika.com/#sle.
 - 4. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.

2.02 JOINT SEALANT APPLICATIONS

- A. Scope:
 - 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
 - a. Wall expansion and control joints.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Joints between different exposed materials.
 - d. Openings below ledge angles in masonry.
 - e. Other joints indicated below.
 - 2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - b. Other joints indicated below.
 - 3. Do not seal the following types of joints.
 - a. Intentional weepholes in masonry.
 - b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
 - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - d. Joints where installation of sealant is specified in another section.
 - e. Joints between suspended panel ceilings/grid and walls.
- B. Type E-1 - Exterior Joints: Use non-sag silyl-terminated polyether/polyurethane sealant, unless otherwise indicated.
- C. Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, other similar items.
- D. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

2.03 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products with levels of volatile organic compound (VOC) content as indicated in Section 01 6116.

2.04 NONSAG JOINT SEALANTS

- A. Type I-1 - Use at interior kitchens and bathroom counters and plumbing fixtures. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
 - 1. Color: Selected by Architect and Owner.

20132C / Central Detroit Christian Piety Hill Kingston Place	07 9200 - 1	Joint Sealants

2. Manufacturers:
 - a. Pecora Corporation: 898 NST; www.pecora.com/#sle.
 - b. Sika Corporation; Sikasil GP: www.usa-sika.com/#sle.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
 - B. Type E-1 - Hybrid Urethane Sealant: Use at exterior general purpose joints. ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
 1. Movement Capability: Plus and minus 35 percent, minimum.
 2. Color: Match adjacent finished surfaces.
 3. Manufacturers: Basis of design is Dymonic FC by Tremco Commercial Sealants and Waterproofing; www.tremcosealants.com/#sle
 - a. Franklin International Inc; Titebond WeatherMaster ULTIMATE MP Sealant: www.titebond.com/#sle.
 - b. Sherwin-Williams Company; Stampede 100 Low-Modulus Hybrid Urethane Sealant: www.sherwin-williams.com/#sle.
 - c. Sherwin-Williams Company; Stampede 1H Hybrid Sealant: www.sherwin-williams.com/#sle.
 - C. Type E-2 - Non-Sag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
 1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Hardness Range: 40 to 50, Shore A, when tested in accordance with ASTM C661.
 - D. Type I-2 - Use at interior general purpose joints. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
 1. Color: Standard colors matching finished surfaces, Type OP (opaque).
 2. Grade: ASTM C834; Grade - Minus 18 Degrees C.
 3. Manufacturers:
 - a. Sherwin-Williams Company; White Lightning 3006 Siliconized Acrylic Latex Caulk: www.sherwin-williams.com/#sle.
 - b. Tremco Commercial Sealants & Waterproofing; Tremflex 834: www.tremcosealants.com/#sle.
- 2.05 ACCESSORIES
- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
 1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
 2. Open Cell: 40 to 50 percent larger in diameter than joint width.
 - B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
 - C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
 - D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
 - E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.
- PART 3 EXECUTION
- 3.01 EXAMINATION
- A. Verify that joints are ready to receive work.
 - B. Verify that backing materials are compatible with sealants.
 - C. Verify that backer rods are of the correct size.
- 3.02 PREPARATION
- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
 - B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
 - C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
 - D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- 3.03 INSTALLATION
- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
 - B. Perform installation in accordance with ASTM C1193.
 - C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
 - D. Install bond breaker backing tape where backer rod cannot be used.
 - E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
 - F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
 - G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- 3.04 POST-OCCUPANCY
- A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.
- END OF SECTION



System No. F-C-1009 XHEZ.F-C-1009 Through-penetration Firestop Systems

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Design/System/Construction/Assembly Usage Disclaimer

- Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Certified products, equipment, system, devices, and materials.
- Authorities Having Jurisdiction should be consulted before construction.
- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
- Only products which bear UL's Mark are considered Certified.

XHEZ - Through-penetration Firestop Systems

XHEZ7 - Through-penetration Firestop Systems Certified for Canada

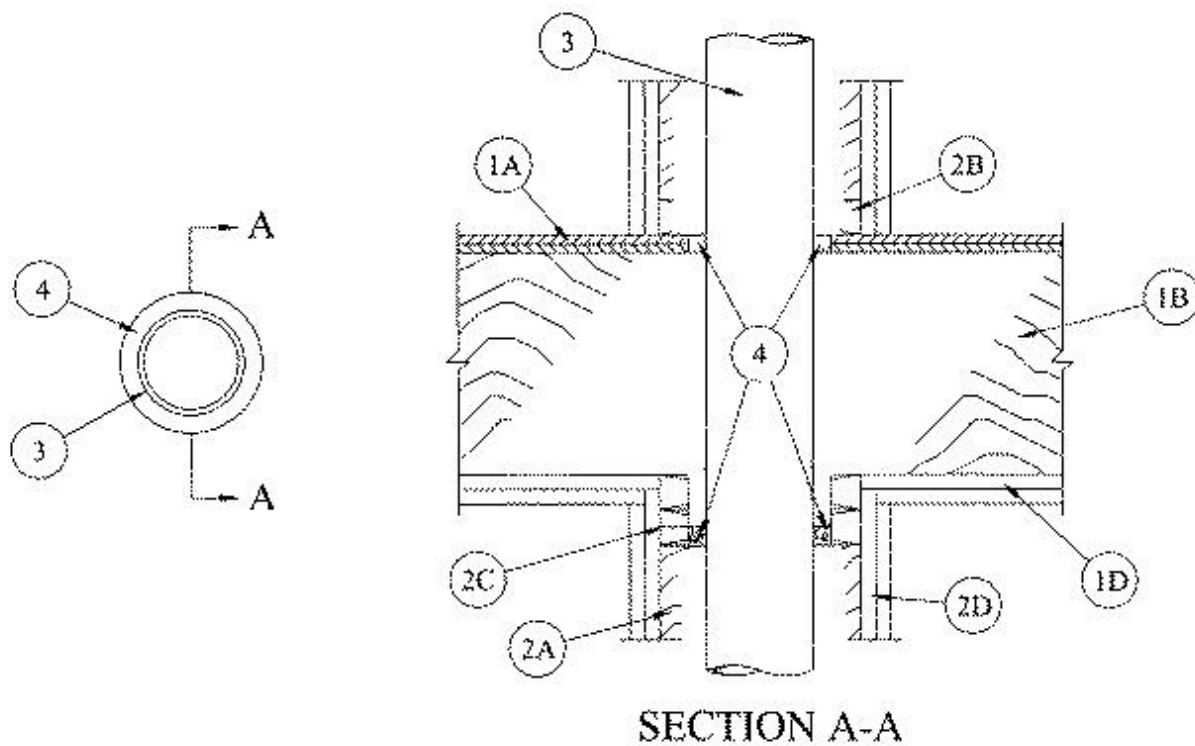
[See General Information for Through-penetration Firestop Systems](#)

[See General Information for Through-penetration Firestop Systems Certified for Canada](#)

System No. F-C-1009

December 27, 2013

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating — 1 and 2 Hr (See Item 1)	F Rating — 1 and 2 Hr (See Item 1)
T Rating — 1/4 Hr	FT Rating — 1/4 Hr
L Rating At Ambient — Less Than 1 CFM/sq ft	FH Rating — 1 and 2 Hr (See Item 1)
L Rating At 400 F — 4 CFM/sq ft	FTH Rating — 1/4 Hr
	L Rating At Ambient — Less Than 1 CFM/sq ft
	L Rating At 400 F — 4 CFM/sq ft



1. Floor-Ceiling Assembly — The 1 or 2 hr fire-rated solid or trussed lumber joist floor-ceiling assembly shall be constructed of the materials and in the manner specified in the individual L500 Series Floor-Ceiling Designs in the UL Fire Resistance Directory. **The F Rating of the firestop system is equal to the rating of the floor-ceiling assembly.** The general construction features of the floor-ceiling assembly are summarized below:

A. Flooring System — Lumber or plywood subfloor with finish floor of lumber, plywood or **Floor Topping Mixture*** as specified in the individual Floor-Ceiling Design. Diam of opening to be max 1 in. larger than diam of pipe. As an alternate, the opening may be square-cut with a max dimension 1 in. greater than the diam of the pipe.

B. Wood Joists* — Nom 10 in. deep (or deeper) lumber, steel or combination lumber and steel joists, trusses or **Structural Wood Members*** with bridging as required and with ends firestopped.

C. Furring Channels — (Not Shown) —(As required) Resilient galvanized steel furring installed in accordance with the manner specified in the individual L500 Series Designs in the Fire Resistance Directory.

D. Gypsum Board* — Thickness, type, number of layers and fasteners shall be as specified in the individual Floor-Ceiling Design. Diam of opening to be max 1 in. larger than diam of pipe.

2. Chase Wall — (Optional) - The through penetrant (Item 3) may be routed through a 1 or 2 hr fire-rated single, double or staggered wood stud/gypsum board chase wall having a fire rating consistent with that of the floor-ceiling assembly. Depth of chase wall to be min 1 in. greater than the diameter of the through penetrant. The chase wall shall be constructed of the materials and in the manner specified in the individual U300 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

A. Studs — Nom 2 by 4 in., 2 by 6 in. or double nom 2 by 4 in. lumber studs. Nom 2 by 4 in. studs are allowed for through-penetrants (Item 3) not exceeding nom 2 in. diam.

B. Sole Plate — Nom 2 by 4 in., 2 by 6 in. or parallel 2 by 4 in. lumber plates, tightly butted. Diam of opening is to be max 1 in. larger than diam of pipe. As an alternate, the opening may be square-cut with a max dimension 1 in. greater than the diam of the pipe. Plates may be discontinuous over opening, terminating at two opposing edges of opening. Max length of discontinuity to be 1 in. greater than diam of through penetrant.

C. Top Plate — The double top plate shall consist of two nom 2 by 4 in., 2 by 6 in. or two sets of parallel 2 by 4 in. lumber plates, tightly butted. Diam of opening is to be max 1 in. larger than diam of pipe. As an alternate, the opening may be square-cut with a max dimension 1 in. greater than the diam of the pipe. Plates may be discontinuous over opening, terminating at two opposing edges of opening. Max length of discontinuity to be 1 in. greater than diam of through penetrant.

D. Steel Plate — When lumber plates are discontinuous, nom 1-1/2 in. wide No. 20 gauge (or heavier) galv steel plates shall be installed to connect each discontinuous lumber plate and to provide a form for the fill material. Steel plates sized to lap 2 in. onto each discontinuous lumber plate and secured to lumber plates with steel screws or nails.

E. Gypsum Board* — Thickness, type, number of layers and fasteners shall be as specified in individual Wall and Partition Design.

3. Through Penetrants — One metallic pipe, conduit or tubing to be installed within the firestop system. Pipe, conduit or tubing to be rigidly supported on both sides of floor assembly. The annular space within the firestop system shall be min 0 in. (point contact) to max 1 in.. The following types and sizes of metallic pipes or conduits may be used:

- A. **Steel Pipe** — Nom 4 in. diam (or smaller) Schedule 10 (or heavier) steel pipe.
- B. **Iron Pipe** — Nom 4 in. diam (or smaller) cast or ductile iron pipe.
- C. **Conduit** — Nom 4 in. diam (or smaller) steel electrical metallic tubing or steel conduit.
- D. **Copper Tubing** — Nom 4 in. diam (or smaller) Type L (or heavier) copper tubing.
- E. **Copper Pipe** — Nom 4 in. diam (or smaller) Regular (or heavier) copper pipe.

4. Fill, Void or Cavity Material* — Sealant — Min 3/4 in. thickness of fill material applied within the annulus, flush with the top surface of the floor or the sole plate. Min 5/8 in. thickness of fill material applied within the annulus, flush with bottom surface of ceiling or lower top plate.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CP601S, CFS-S SIL GG, CP606 or FS-One Sealant. (Note: L Ratings apply only when FS-ONE Sealant is used.)

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**System No. F-C-2030
XHEZ.F-C-2030
Through-penetration Firestop Systems**

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Through-penetration Firestop Systems

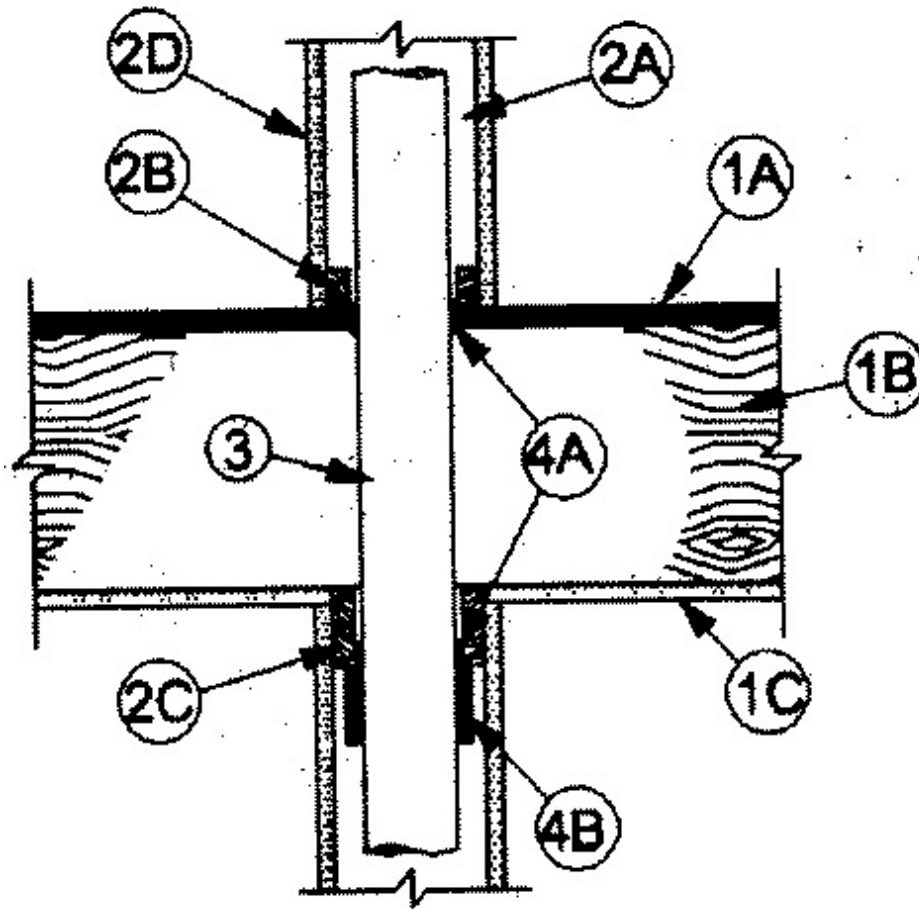
See General Information for Through-penetration Firestop Systems

System No. F-C-2030

May 23, 2008

F Ratings — 1 and 2 Hr (See Item 1)

T Ratings — 0, 3/4, 1, 1-1/2 and 2 Hr (See Item 3)



1. Floor-Ceiling Assembly — The 1 or 2 hr fire-rated solid or trussed lumber joist floor-ceiling assembly shall be constructed of the materials and in the manner specified in the individual L500 Series Floor-Ceiling Designs in the UL Fire Resistance Directory. **The F Rating of the firestop system is equal to the rating of the floor-ceiling and wall assemblies.** The general construction features of the floor-ceiling assembly are summarized below:

A. Flooring System — Lumber or plywood subfloor with finish floor of lumber, plywood or **Floor Topping Mixture*** as specified in the individual Floor-Ceiling Design. Diam of opening shall be 1 in. (25 mm) larger than the nom diam of through-penetrant (Item 3).

B. Joists — Nom 10 in. (254 mm) deep (or deeper) lumber, steel or combination lumber and steel joists, trusses or **Structural Wood Members*** with bridging as required and with end firestopped.

C. Gypsum Board* — Thickness, type, number of layers and fasteners shall be as specified in the individual Floor-Ceiling Design. Diam of opening shall be 1 in. (25 mm) larger than the nom diam of through-penetrant (Item 3).

D. Furring Channels — (Not Shown) (As required) - Resilient galvanized steel furring installed in accordance with the manner specified in the individual L500 Series Designs in the Fire Resistance Directory.

2. Chase Wall — (Optional) - The through penetrant (Item 3) may be routed through a 1 or 2 hr fire-rated single, double or staggered wood stud/gypsum wallboard chase wall having a fire rating consistent with that of the floor-ceiling assembly. The chase wall shall be constructed of the materials and in the manner specified in the individual U300 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

A. Studs — Nom 2 by 6 in. (51 by 152 mm) or double nom 2 by 4 in. (51 by 102 mm) lumber studs.

B. Sole Plate — Nom 2 by 6 in. (51 by 152 mm) (or larger) or parallel 2 by 4 in. (51 by 102 mm) lumber plates, tightly butted. Diam of opening shall be 1 in. (25 mm) larger than the nom diam of through-penetrant (Item 3).

C. Top Plate — The double top plate shall consist of two nom 2 by 6 in. (51 by 152 mm) (or larger) or parallel 2 by 4 in. (51 by 102 mm) lumber plates, tightly butted. Diam of opening shall be 1 in. (25 mm) larger than the nom diam of through-penetrant (Item 3).

D. Gypsum Board* — Thickness, type, number of layers and fasteners shall be as specified in individual Wall and Partition Design.

3. Through-Penetrants — One nom 1-1/2 in. (38 mm), 2 in. (51 mm), 3 in. (76 mm) or 4 in. (102 mm) diam nonmetallic pipe to be installed within the firestop system. Diam of opening through flooring system and through sole and top plates of chase wall to be max 2-1/8 in. (54 mm), 2-5/8 in. (67 mm), 4 in. (102 mm) or 5 in. (127 mm) for

nom 1-1/2 in. (38 mm), 2 in. (51 mm), 3 in. (76 mm) or 4 in. (102 mm) diam nonmetallic pipe sizes, respectively. Pipe to be rigidly supported on both sides of the floor-ceiling assembly. The T Rating is dependent on the size of the through-penetrant. For 2 hr rated assemblies, the T Rating is 2 hr for 1-1/2 in. (38 mm) diam (and smaller) pipes and 1-1/2 hr for pipes greater than 1-1/2 in. (38 mm) diam. For 1 hr rated assemblies, the T rating is 1 hr for 1-1/2 in. (38 mm) diam (and smaller) pipes, 3/4 hr for 2 in. (51 mm) diam pipes and 0 hr for pipes greater than 2 in. (51 mm) diam. The following types of nonmetallic pipes may be used:

A. **Polyvinyl Chloride (PVC) Pipe** — Schedule 40 solid-core or cellular core PVC pipe for use in closed (process or supply) or vented (drain, waste or vent) piping system.

B. **Chlorinated Polyvinyl Chloride (CPVC) Pipe** — SDR17 CPVC pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.

C. **Acrylonitrile Butadiene Styrene (ABS) pipe** — Schedule 40 solid-core or cellular core ABS pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.

D. **Flame Retardant Polypropylene (FRPP) Pipe** — Schedule 40 FRPP pipe for use in closed (process or supply) or vented (drain, waste or vent) piping system.

4. **Firestop System** — The details of the firestop system shall be as follows:

A. **Fill, Void or Cavity Material* — Sealant** — Min 3/4 in. (19 mm) thickness of fill material to be installed within the annular space between the pipe and the flooring (Item 1A) or sole plate. Min 5/8 in. (16 mm) thickness applied within the annular space, flush with the bottom surface of ceiling or lower top plate.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant

B. **Firestop Device* — Firestop Collar** — Firestop collar shall be installed in accordance with the accompanying installation instructions. Collar to be installed and latched around the pipe and secured to underside of ceiling or chase wall top plate (Item 2C) using the anchor hooks provided with the collar. (Minimum 2 anchor hooks for 1-1/2 (38 mm) and 2 in. (51 mm) diam pipes and 3 anchor hooks for 3 in. (76 mm) diam pipes). The anchor hooks are to be secured to the ceiling with min 3/16 in. (5 mm) diam steel toggler bolts or to the chase wall top plate with min No. 12 by min 1 in. (25 mm) long steel wood screws in conjunction with steel washers.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CP 643 50/1.5"N, CP643 63/2"N, CP 643 90/3"N or CP643 110/4"N Firestop Collar

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System No. F-C-3012
XHEZ.F-C-3012
Through-penetration Firestop Systems

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Through-penetration Firestop Systems

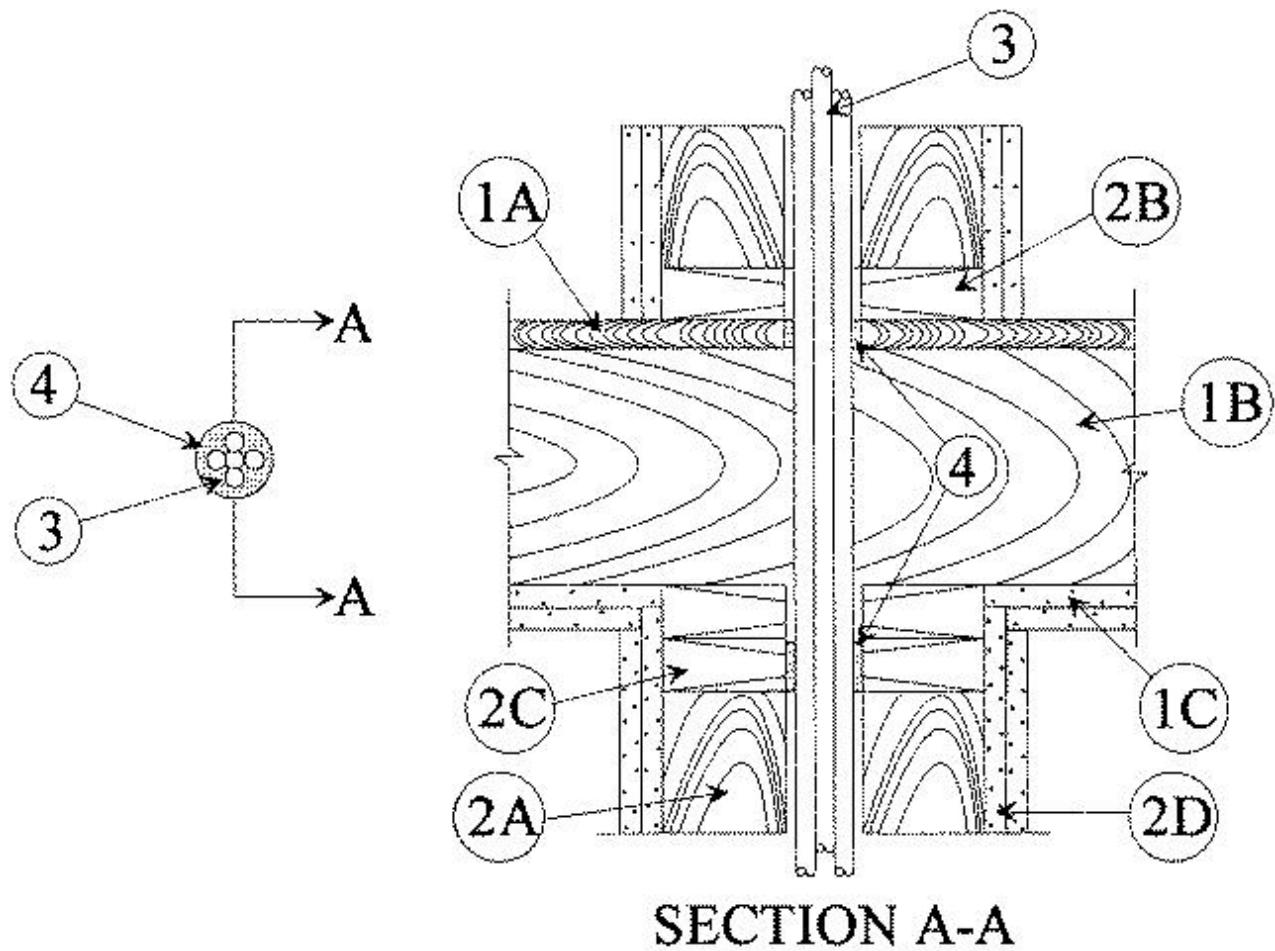
See General Information for Through-penetration Firestop Systems

System No. F-C-3012

December 23, 2008

F Ratings — 1 and 2 Hr (See Item 1)

T Ratings — 0, 1 and 1-3/4 Hr (See Item 3)



1. Floor-Ceiling Assembly — The 1 or 2 hr fire-rated solid or trussed lumber joist floor-ceiling assembly shall be constructed of the materials and in the manner specified in the individual L500 Series Floor-Ceiling Designs in the UL Fire Resistance Directory. The general construction features of the floor-ceiling assembly are summarized below:

A. Flooring System — Lumber or plywood subfloor with finish floor of lumber, plywood or **Floor Topping Mixture*** as specified in the individual Floor-Ceiling Design. Max diam of opening for 1 or 2 hr assembly is 2-1/2 in. (64 mm) or 2 in. (51 mm), respectively.

B. Wood Joists* — Nom 10 in. (254 mm) deep (or deeper) lumber, steel or combination lumber and steel joists, trusses or **Structural Wood Members*** with bridging as required and with ends firestopped.

C. Furring Channels — (Not Shown) — (As required) - Resilient galvanized steel furring installed in accordance with the manner specified in the individual L500 Series Designs in the Fire Resistance Directory.

D. Gypsum Board* — Thickness, type, number of layers and fasteners shall be as specified in the individual Floor-Ceiling Design. Max diam of opening for 1 or 2 hr assembly is 2-1/2 in. (64 mm) or 2 in. (51 mm), respectively.

The F Rating of the firestop system is equal to the rating of the floor-ceiling assembly.

2. Chase Wall — (Optional) - The through penetrant (Item 3) shall be routed through a fire-rated single, double or staggered wood stud/gypsum wallboard chase wall having a fire rating consistent with that of the floor-ceiling assembly. The chase wall shall be constructed of the materials and in the manner specified in the individual U300 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

A. Studs — Nom 2 by 6 in. (51 by 152 mm) or double nom 2 by 4 in. (51 by 102 mm) lumber studs.

B. Sole Plate — Nom 2 by 6 in. (51 by 152 mm) or parallel 2 by 4 in. (51 by 102 mm) lumber plates, tightly butted. Max diam of opening for 1 or 2 hr rated assembly is 2-1/2 in. (64 mm) or 2 in. (51 mm), respectively.

C. Top Plate — The double top plate shall consist of two nom 2 by 6 in. (51 by 152 mm) or two sets of parallel 2 by 4 in. (51 by 102 mm) lumber plates, tightly butted. Max diam of opening for 1 or 2 hr rated assembly is 2-1/2 in. (64 mm) or 2 in. (51 mm), respectively.

D. Gypsum Board* — Thickness, type, number of layers and fasteners shall be as specified in individual Wall and Partition Design.

3. Cables — In 1 hr fire-rated assemblies, aggregate cross-sectional area of cables in opening to be max 45 percent of the cross-sectional area of the opening (max 2 in. (51 mm) diam bundle). Cables to be rigidly supported on both sides

of floor assembly. Any combination of the following types and sizes of copper conductors may be used:

- A. RG 59 coaxial cable with single copper conductor, cellular polyethylene cellular foam insulation and polyvinyl chloride (PVC) jacket.
- B. Max 8/C No. 22 AWG telephone cable with polyvinyl chloride (PVC) jacketing.
- C. Max 2/C No. 12 AWG cable with polyvinyl chloride (PVC) insulation and jacketing.
- D. Max 3/C with ground No. 2/0 AWG aluminum or copper Type SER cable with polyvinyl chloride (PVC) insulation.
- E. Max 3/C with ground No. 2/0 AWG Type NM cable with polyvinyl chloride (PVC) insulation.
- F. Max 3/C No. 12 AWG MC (BX) cable with polyvinyl chloride (PVC) insulation.
- G. Max 1 in. diam metal clad TEK cable with PVC jacket.
- H. Max 4/C with ground No. 300 kcmil (or smaller) aluminum SER cable with PVC insulation and jacket.
- I. **Through Penetrating Product*** - Any cables, **Metal-Clad Cable+** or **Armored Cable+** currently Classified under the **Through Penetrating Products** category.

See **Through Penetrating Product** (XHLY) category in the Fire Resistance Directory for names of manufacturers.

The T Rating is 1 and 1-3/4 hr for 1 and 2 hr rated assemblies, respectively, for cables 3A through 3G. The T Rating is 0 hr for cables 3H and 3I.

4. Fill, Void or Cavity Material* — Sealant — Min 3/4 in. (19 mm) thickness of fill material applied within the annulus, flush with top surface of floor or sole plate. Min 5/8 in. (16 mm) thickness of fill material also applied within the annulus, flush with bottom surface of ceiling or lower top plate.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS611A Sealant or FS-One Sealant

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**System No. F-C-5004
XHEZ.F-C-5004
Through-penetration Firestop Systems**

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Through-penetration Firestop Systems

See General Information for Through-penetration Firestop Systems

System No. F-C-5004

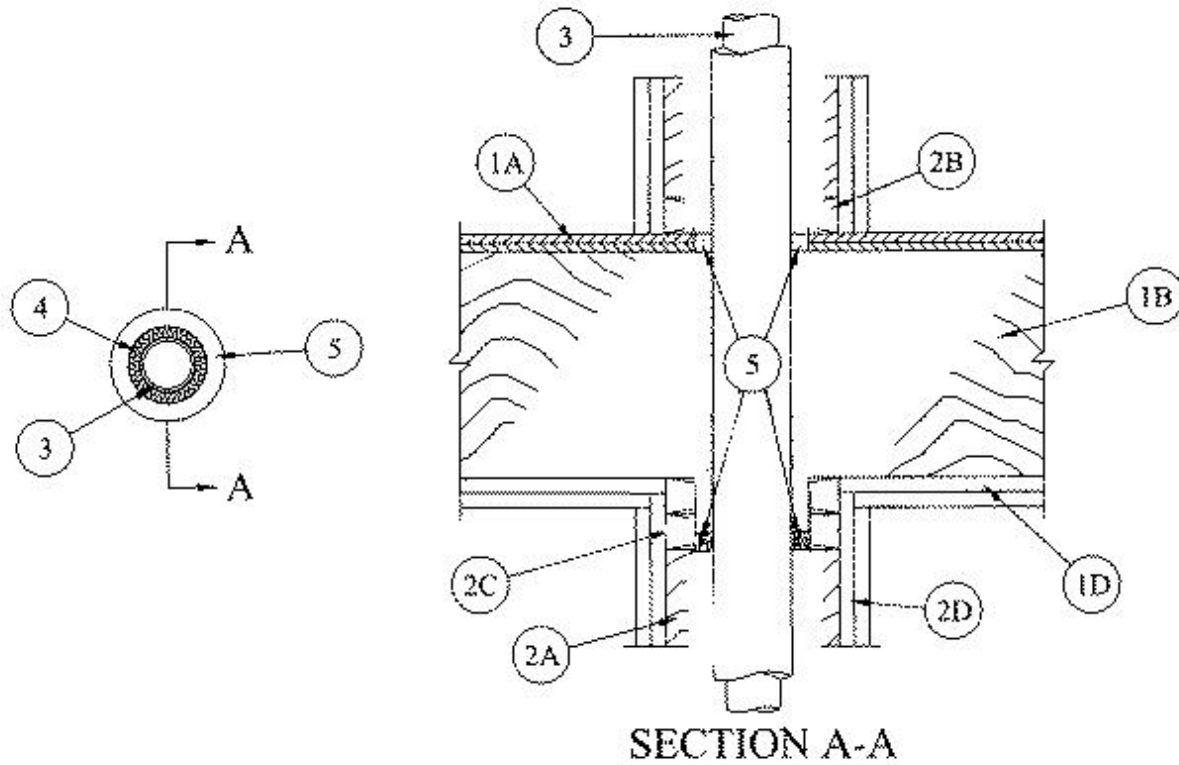
May 23, 2008

F Ratings — 1 and 2 Hr (See Item 1)

T Ratings — 1 and 1-3/4 Hr (See Item 1)

L Rating At Ambient — 4 CFM/Sq Ft (See Item 4)

L Rating At 400 F — Less Than 1 CFM/Sq Ft (See Item 4)



1. Floor-Ceiling Assembly — The 1 or 2 hr fire-rated solid or trussed lumber joist floor-ceiling assembly shall be constructed of the materials and in the manner specified in the individual L500 Series Floor-Ceiling Designs in the UL Fire Resistance Directory. **The F Rating of the firestop system is equal to the rating of the floor-ceiling assembly. The T Rating is 1 and 1-3/4 hr for 1 and 2 hr rated assemblies, respectively.** The general construction features of the floor-ceiling assembly are summarized below:

A. Flooring System — Lumber or plywood subfloor with finish floor of lumber, plywood or **Floor Topping Mixture*** as specified in the individual Floor-Ceiling Design. Max diam of floor opening is 3-1/2 in. (89 mm).

B. Wood Joists* — Nom 10 in (254 mm) deep (or deeper) lumber, steel or combination lumber and steel joists, trusses or **Structural Wood Members*** with bridging as required and with ends firestopped.

C. Furring Channels — (Not Shown) — (As required) - Resilient galvanized steel furring installed in accordance with the manner specified in the individual L500 Series Designs in the Fire Resistance Directory.

D. Gypsum Board* — Thickness, type, number of layers and fasteners shall be as specified in the individual Floor-Ceiling Design. Max diam of floor opening is 3-1/2 in. (89 mm).

2. Chase Wall — (Optional) - The through penetrant (Item 3) may be routed through a fire-rated single, double or staggered wood stud/gypsum wallboard chase wall having a fire rating consistent with that of the floor-ceiling assembly. The chase wall shall be constructed of the materials and in the manner specified in the individual U300 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

A. Studs — Nom 2 by 6 in. (51 by 152 mm) or double nom 2 by 4 in. (51 by 102 mm) lumber studs.

B. Sole Plate — Nom 2 by 6 in. (51 by 152 mm) or parallel 2 by 4 in. (51 by 102 mm) lumber plates, tightly butted. Max diam of opening shall be 3-1/2 in. (89 mm).

C. Top Plate — The double top plate shall consist of two nom 2 by 6 in. (51 by 152 mm) or two sets of parallel 2 by 4 in. (51 by 102 mm) lumber plates, tightly butted. Max diam of opening is 3-1/2 in. (89 mm).

D. Gypsum Board* — Thickness, type, number of layers and fasteners shall be as specified in the individual Wall and Partition Design.

3. Through Penetrants — One metallic pipe or tubing to be installed within the firestop system. Pipe or tubing to be rigidly supported on both sides of floor assembly. The following types and sizes of metallic pipes or tubing may be used:

A. Steel Pipe — Nom 2 in. (51 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.

B. Copper Tubing — Nom 2 in. (51 mm) diam (or smaller) Type L (or heavier) copper tubing.

C. Copper Pipe — Nom 2 in. (51 mm) diam (or smaller) Regular (or heavier) copper pipe.

4. Pipe Covering* — Nom 1/2 in. (13 mm) thick hollow cylindrical heavy density (min 3.5 pcf (56 kg/m³)) glass fiber units jacketed on the outside with an all service jacket. Longitudinal joints sealed with metal fasteners or factory-applied self-sealing lap tape. Transverse joints secured with metal fasteners or with butt tape supplied with the product. A nom annular space of 1/8 in. (3 mm) is required within the firestop system.

See **Pipe and Equipment Covering — Materials** (BRGU) category in the Building Materials Directory for names of manufacturers. Any pipe covering material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.

4A. Tube Insulation — Plastics+ — Nom 3/4 in. (19 mm) thick acrylonitrile butadiene/polyvinyl chloride (AB/PVC) flexible foam furnished in the form of tubing. An annular space of min 1/8 in. (3 mm) to max 3/8 in. (10 mm) is required within the firestop system.

See **Plastics+** (QMFZ2) category in the Recognized Component Directory for names of manufacturers. Any Recognized Component tube insulation material meeting the above specifications and having a UL 94 Flammability Classification of 94-5VA may be used.

(Note: L Ratings apply only when glass fiber insulation is used).

5. Fill, Void or Cavity Material* — Sealant — Min 3/4 in. (19 mm) thickness of fill material applied within the annulus, flush with top surface of floor or sole plate. Min 5/8 in. (16 mm) thickness of fill material also applied within the annulus, flush with bottom surface of ceiling or lower top plate.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-One Sealant

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System No. F-C-7013 XHEZ.F-C-7013 Through-penetration Firestop Systems

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Through-penetration Firestop Systems

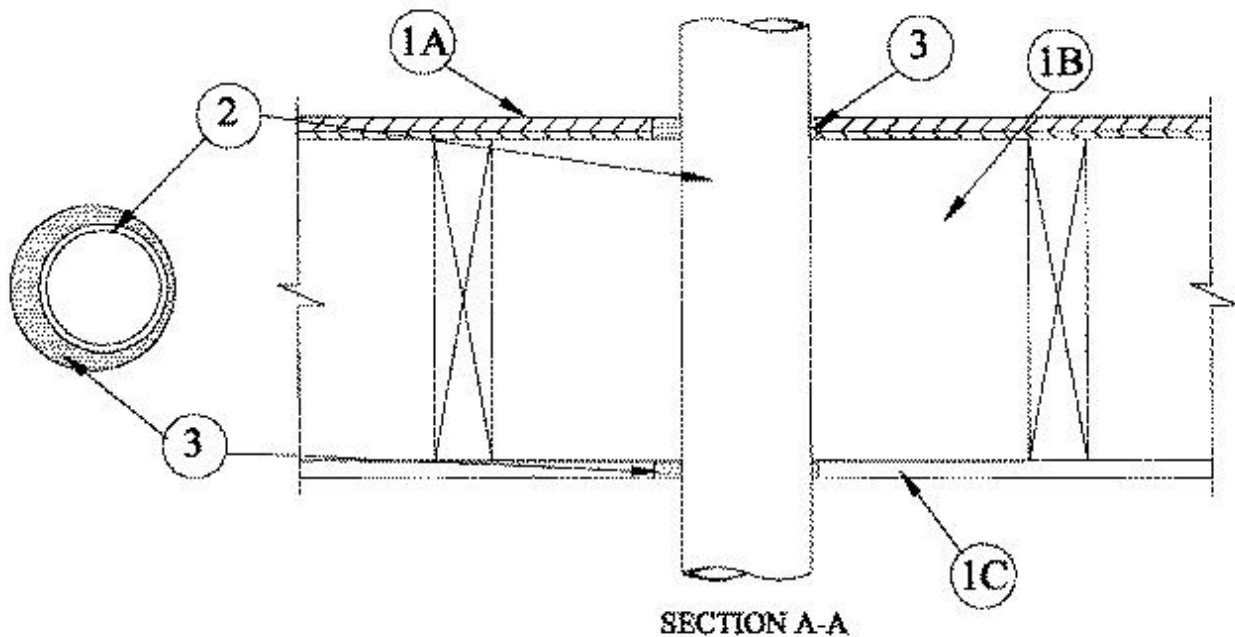
[See General Information for Through-penetration Firestop Systems](#)

System No. F-C-7013

May 23, 2008

F Rating — 1 Hr

T Rating — 0 Hr



1. Floor-Ceiling Assembly — The 1 hr fire-rated solid or trussed lumber joist floor-ceiling assembly shall be constructed of the materials and in the manner specified in the individual L500 Series Floor-Ceiling Designs in the UL Fire Resistance Directory. The general construction features of the floor-ceiling assembly are summarized below:

A. Flooring System — Lumber or plywood subfloor with finish floor of lumber, plywood or **Floor Topping Mixture*** as specified in the individual Floor-Ceiling Design. Max diam of opening shall be 5-1/4 in. (133 mm).

B. Wood Joist* — Nom 10 in. (254 mm) deep (or deeper) lumber, steel or combination lumber

and steel joists, trusses or **Structural Wood Members*** with bridging as required and with ends firestopped.

C. Gypsum Board* — Nom 4 ft (1.2 m) wide by 5/8 in. (16 mm) thick as specified in the individual Floor-Ceiling Design. Max diam of opening shall be 5-1/4 in. (133 mm).

1.1 Chase Wall — (Not shown, Optional) The through penetrants (Item 2) may be routed through a 1 hr fire-rated single, double or staggered wood stud/gypsum wallboard chase wall having a fire rating consistent with that of the floor-ceiling assembly. The chase wall shall be constructed of the materials and in the manner specified in the individual U300 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

A. Studs — Nom 2 by 6 in. (51 by 152 mm) lumber or double nom 2 by 4 in. (51 by 102 mm) lumber studs.

B. Sole Plate — Nom 2 by 6 in. (51 by 152 mm) lumber or parallel 2 by 4 in. (51 by 102 mm) lumber plates, tightly butted. Max diam of opening shall be 5-1/4 in.

C. Top Plate — The double top plate shall consist of two nom 2 by 6 in. (51 by 152 mm) lumber plates or two sets of nom 2 by 4 in. (51 by 102 mm) lumber plates tightly butted. Max diam of opening is 5-1/4 in. (133 mm).

D. Gypsum Board* — Thickness, type, number of layers and fasteners shall be as specified in individual Wall and Partition Design.

2. Steel Duct — Nom 4 in. (102 mm) diam (or smaller) No. 28 gauge (or heavier) steel duct to be installed either concentrically or eccentrically within the firestop system. The annular space between duct and periphery of opening shall be min of 1/4 in. to max 3/4 in. Steel duct to be rigidly supported on both sides of floor-ceiling assembly.

3. Fill, Void or Cavity Materials*-Sealant — Min 3/4 in. (19 mm) thickness of sealant applied within the annular space, flush with top surface of floor or sole plate. Min 5/8 in. (16 mm) thickness of sealant applied within annular space, flush with bottom surface of gypsum board or lower top plate.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant

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System No. F-C-8009
XHEZ.F-C-8009
Through-penetration Firestop Systems

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Through-penetration Firestop Systems

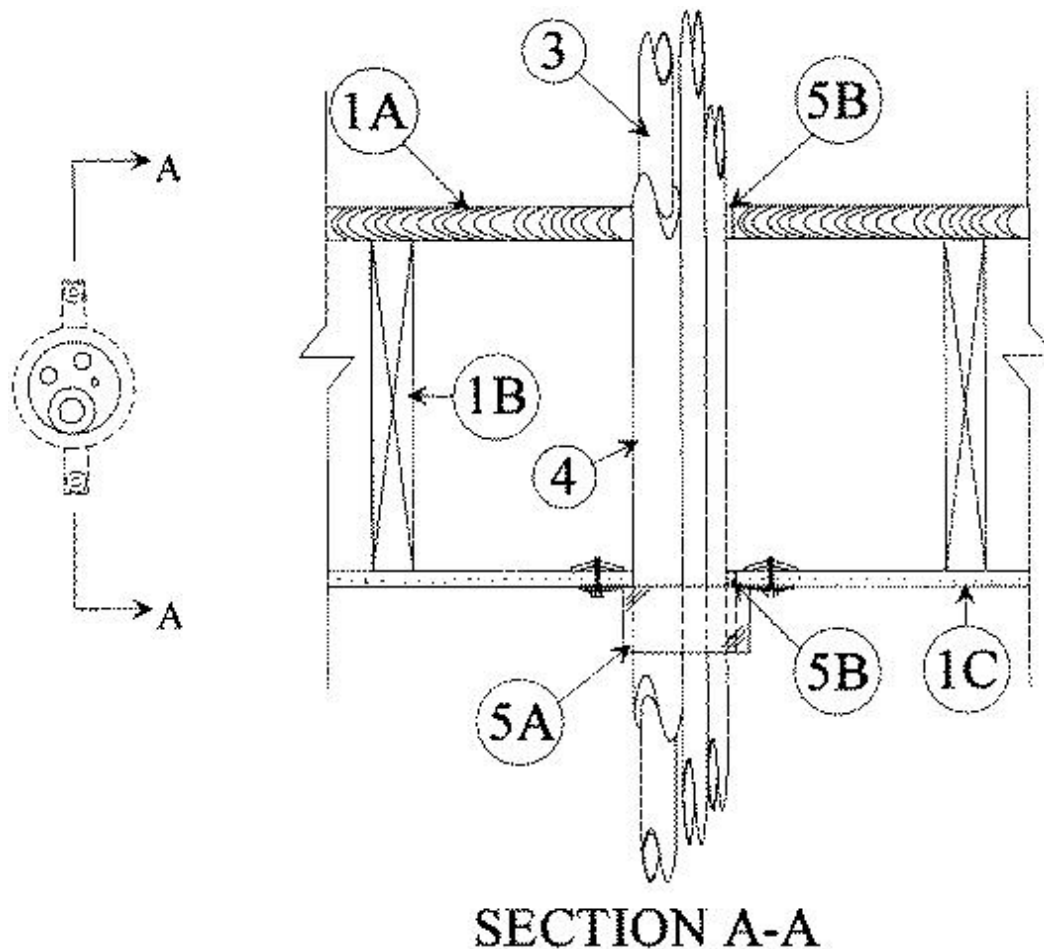
See General Information for Through-penetration Firestop Systems

System No. F-C-8009

May 23, 2008

F Rating — 1 Hr

T Rating — 1 Hr



1. Floor-Ceiling Assembly — The 1 hr fire-rated wood joist floor-ceiling assembly shall be constructed of the materials and in the manner specified in the individual L500 Series Floor-Ceiling Designs in the UL Fire Resistance Directory, as summarized below:

A. Flooring System — Lumber or plywood subfloor with finish floor of lumber, plywood or **Floor Topping Mixture*** as specified in the individual Floor-Ceiling Design. Max diam of opening is 3 in. (76 mm).

B. Wood Joists — Nom 10 in. (254 mm) deep (or deeper) lumber, steel or combination lumber and steel joists, trusses or **Structural Wood Members*** with bridging as required and with ends firestopped.

C. Gypsum Board* — Thickness, type, number of layers and fasteners shall be as specified in the individual Floor-Ceiling Design. Max diam of opening in ceiling [when chase wall (Item 2) is not provided] is 3 in. (76 mm).

2. Chase Wall — (Optional, Not Shown) — The through penetrant (Item 3) may be routed through a 1 hr fire-rated single, double or staggered wood stud/gypsum wallboard chase wall constructed of the materials and in the manner specified in the individual U300 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

A. Studs — Nom 2 by 6 in. (51 by 152 mm) lumber or double nom 2 by 4 in. (51 by 102 mm) lumber studs.

B. Sole Plate — Nom 2 by 6 in. (51 by 152 mm) lumber or parallel 2 by 4 in. (51 by 102 mm) lumber plates, tightly butted. Max diam of opening shall be 3 in. (76 mm).

C. Top Plate — The double top plate shall consist of two nom 2 by 6 in. (51 by 152 mm) lumber plates or 2 sets of parallel nom 2 by 4 in. (51 by 102 mm) lumber, tightly butted. Max diam of opening is 3 in. (76 mm).

D. Gypsum Board* — Thickness, type, number of layers and fasteners shall be as specified in individual Wall and Partition Design.

3. Through Penetrants — Pipe, cable and tubing to be bundled and rigidly supported on both sides of floor assembly. A nom annular space of min 0 in. (point contact) to max 1/2 in. (13 mm) is required within the firestop system. The following types and sizes of pipe, cable and tubing are to be used in the firestop system in sufficient quantities to fill the firestop device:

A. Type PJT thermoset cable, 5/C No. 18 AWG copper conductor, plastic insulation and jacket.

B. Polyvinyl Chloride (PVC) Pipe — Nom 1-1/2 in. (38 mm) diam (or smaller) Schedule 40 solid core PVC pipe for use in closed (process or supply) or vented (drain, waste or vent) piping

systems.

C. **Copper Tubing** — Nom 3/4 in. (19 mm) diam (or smaller) Type L (or heavier) copper tubing.

D. **Copper Tubing** — Nom 1/2 in. (13 mm) diam (or smaller) Type L (or heavier) copper tubing.

4. **Tube Insulation — Plastics+** — Nom 1/2 in. (13 mm) thick acrylonitrile butadiene/polyvinyl chloride (AB/PVC) flexible foam furnished in the form of tubing. Insulation to be installed only on one through reverant having a max nom diam of 3/4 in. (19 mm).

See **Plastics+** (QMFZ2) category in the Recognized Component Directory for names of manufacturers. Any Recognized Component tube insulation material meeting the above specifications and having a UL94 Flammability Classification of 94-5VA may be used.

5. **Firestop System** — The firestop system shall consist of the following:

A. **Firestop Device* — Firestop Collar** — Firestop collar shall be installed in accordance with the accompanying installation instructions. Collar to be installed and latched around the penetrants and secured to underside of gypsum wallboard ceiling using the anchor hooks provided with the collar. The anchor hooks are to be secured to the surface of the ceiling with min 3/16 in. diam min 2-1/2 in. long toggle bolts.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CP 64-3 90/3"N, CP 64-3 63/2"N, CP 64-3 50/1-1/2"N .

B. **Fill, Void or Cavity Material* — Sealant** — Min 3/4 in. (19 mm) thickness of fill material applied within the annulus, flush with top surface of floor or sole plate. Min 5/8 in. (16 mm) thickness of fill material applied within the annulus, flush with bottom surface of ceiling or lower top plate. Caulk to be forced into interstices of penetration group to max extent possible at top surface of floor or sole plate and bottom surface of ceiling or lower top plate.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS611A or FS-ONE Sealant

+Bearing the UL Recognized Component Mark

*Bearing the UL Classification Marking

Last Updated on 2008-05-23

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System No. F-C-8026
XHEZ.F-C-8026
Through-penetration Firestop Systems

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XHEZ - Through-penetration Firestop Systems

XHEZ7 - Through-penetration Firestop Systems Certified for Canada

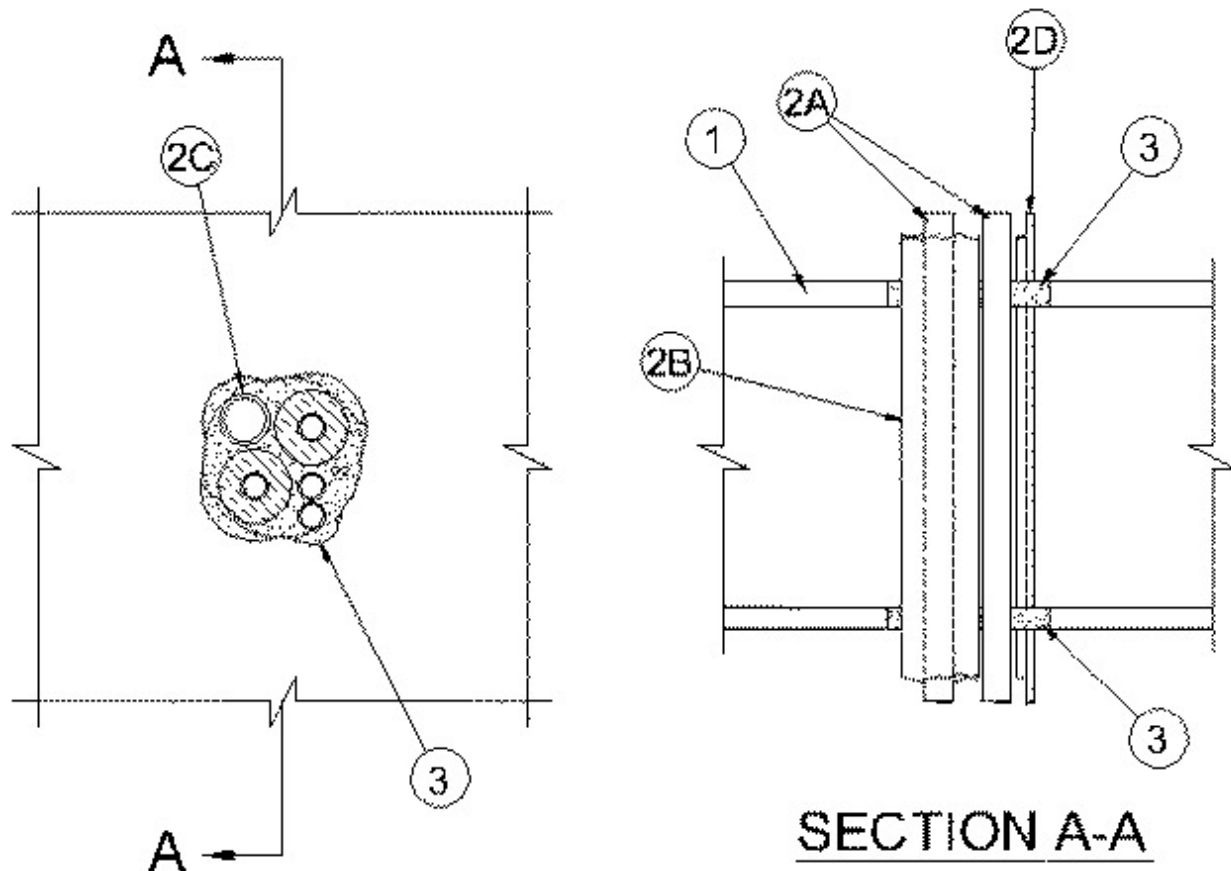
[See General Information for Through-penetration Firestop Systems](#)

[See General Information for Through-penetration Firestop Systems Certified for Canada](#)

System No. F-C-8026

January 21, 2015

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating — 1 Hr	F Rating — 1 Hr
T Rating — 1 Hr	FT Rating — 1 Hr
	FH Rating — 1 Hr
	FTH Rating — 1 Hr



System tested with a pressure differential of 2.5 Pa between the exposed and the unexposed surfaces with the higher pressure on the exposed side.

1. Floor-Ceiling Assembly — The 1 hr fire-rated solid or trussed lumber joist floor-ceiling assembly shall be constructed of the materials and in the manner specified in the individual L500 Series Floor-Ceiling Designs in the UL Fire Resistance Directory. The general construction features of the floor-ceiling assembly are summarized below:

A. Flooring System — Lumber or plywood subfloor with finish floor of lumber, plywood or **Floor Topping Mixture*** as specified in the individual Floor-Ceiling Design. Max diam of opening shall be 5 in. (127 mm).

B. Wood Joists* — Nom 10 in. (254 mm) deep (or deeper) lumber, steel or combination lumber and steel joists, trusses or Structural Wood Members* with bridging as required and with ends firestopped.

C. Gypsum Board* — Nom 4 ft (122 cm) wide by 5/8 in. (16 mm) thick as specified in the individual Floor-Ceiling Design. Gypsum board secured to wood joists or furring channels as specified in the individual Floor-Ceiling Design.

1A. Chase Wall — (Optional, Not Shown) - The through penetrants (Item 2) may be routed through a 1 hr fire rated single, double or staggered wood stud/gypsum board chase wall. Depth of chase wall stud cavity to be min 1/2 in. (13 mm) greater than diameter of opening cut in sole and top plates to accommodate the through penetrant (Item 2). The chase wall shall be constructed of the materials and in the manner specified in the individual U300 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

A. Studs — Nom 2 by 4 in. (51 by 102 mm), 2 by 6 in. (51 by 152 mm) or double nom 2 by 4 in. (51 by 102 mm) lumber studs.

B. Sole Plate — Nom 2 by 4 in. (51 by 102 mm), 2 by 6 in. (51 by 152 mm) or parallel 2 by 4 in. (51 by 102 mm) lumber plates, tightly butted. Max diam of opening is 5 in. (127 mm).

C. Top Plate — The double top plate shall consist of two nom 2 by 4 in. (51 by 102 mm), two nom 2 by 6 in. (51 by 102 mm) or two sets of parallel 2 by 4 in. (51 by 102 mm) lumber plates, tightly butted. Max diam of opening is 5 in. (127 mm).

D. Gypsum Board* — Thickness, type, number of layers and fasteners shall be as specified in the individual Wall and Partition Design.

2. Through Penetrants — One or more pipes, conduits, tubing and cables to be installed concentrically or eccentrically within the opening. The space between any penetrant, except nonmetallic pipes and uninsulated metallic pipes to be min 0 in. (point contact) to max 1 in. (25 mm). The space between any penetrants and the periphery of the opening shall be min 0 in. (point contact) to max 1 in. (25 mm). Pipes, conduits, tubing and cables to be rigidly supported on both sides of floor-ceiling assembly.

A. Metallic Penetrants — One or more metallic pipes, conduits or tubing to be installed within the firestop system. The following types and sizes of metallic pipes, conduits or tubing may be used:

A1. **Steel Pipe** — Nom 3/4 in. (19 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.

A2. **Conduit** — Nom 3/4 in. (19 mm) diam (or smaller) steel electrical metallic tubing (EMT) or 3/4 in. (19 mm) diam galv steel conduit.

A3. **Copper Tube** — Nom 3/4 in. (19 mm) diam (or smaller) Type L (or heavier) copper tube.

A4. **Copper Pipe** — Nom 3/4 in. (19 mm) diam (or smaller) Regular (or heavier) copper pipe.

B. Tube Insulation - Plastics+ — Nom 3/4 in. (19 mm) thick acrylonitrile butadiene/polyvinyl chloride (AB/PVC) flexible foam furnished in the form of tubing. Tube insulation to be installed on one or more of the metallic pipes or tubes (Item 2A).

See **Plastics+** (QMFZ2) category in the Plastics Recognized Component Directory for names of manufacturers. Any Recognized Component tube insulation material meeting the above specifications and having a UL 94 Flammability Classification of 94-5VA may be used.

C. Nonmetallic Through Penetrants — One nonmetallic pipe to be installed within the firestop system. Pipe shall be spaced a min 1-1/2 in. (38 mm) from non-uninsulated metallic through penetrants. The following types and sizes of metallic pipes may be used:

C1. **Polyvinyl Chloride (PVC) Pipe** — Nom 1-1/4 in. (32 mm) diam (or smaller) Schedule 40 solid core PVC pipe for use in closed (process or supply) or vented (drain, waste or vent) piping system.

C2. **Chlorinated Polyvinyl Chloride (CPVC) Pipe** — Nom 1-1/4 in. (32 mm) diam (or smaller) SDR13.5 CPVC pipe for use in closed (process or supply) piping systems.

D. Cables — Max of two 4 pair No. 18 AWG (or smaller) cable with PVC insulation and jacket materials.

3. Fill, Void or Cavity Materials* - Sealant — Min 3/4 in. (19 mm) thickness of sealant applied within the annulus flush with the top surface of the floor or sole plate and min 5/8 in. (16 mm) thickness of sealant applied within the annulus flush with the bottom surface of gypsum board or top plate. A min 1/4 in. (6 mm) diameter bead of sealant applied at the bundle/subflooring or sole plate interface and the bundle/gypsum board or top plate interface at point contact locations.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant or FS-ONE_MAX Intumescent Sealant

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Last Updated on 2015-01-21

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System No. W-L-1058
XHEZ.W-L-1058
Through-penetration Firestop Systems

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XHEZ - Through-penetration Firestop Systems

XHEZ7 - Through-penetration Firestop Systems Certified for Canada

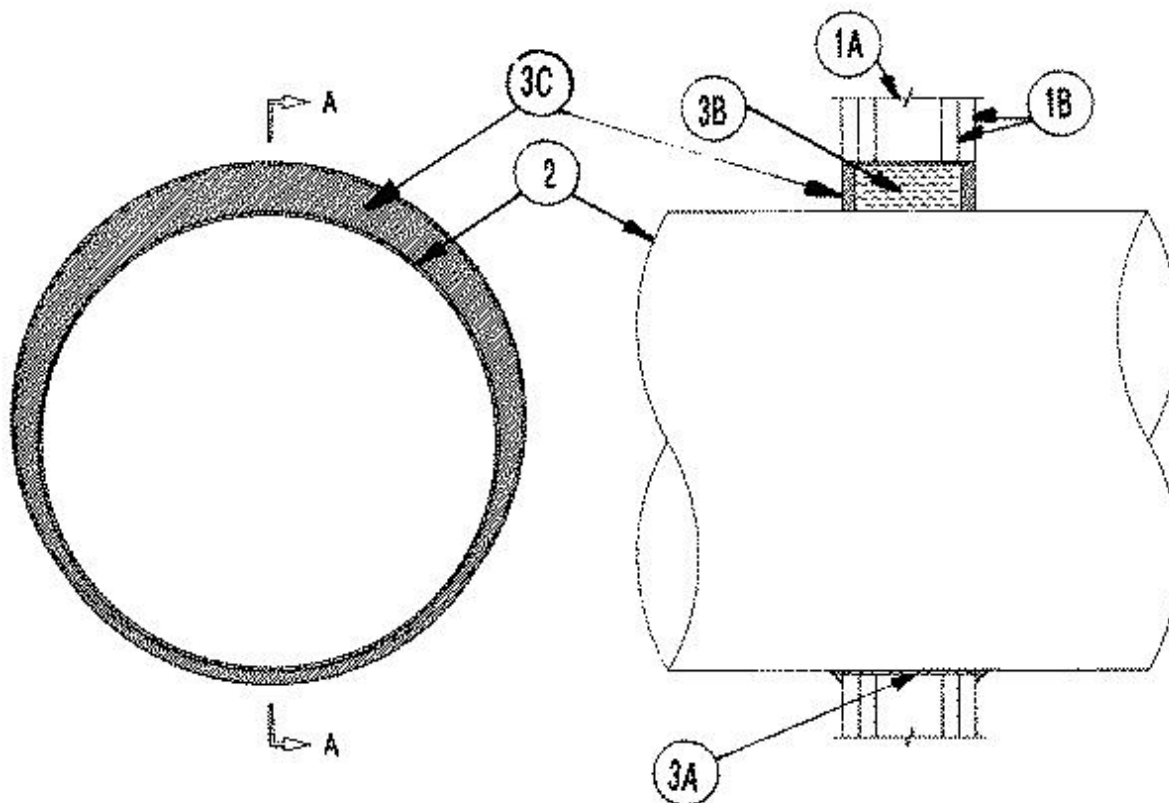
[See General Information for Through-penetration Firestop Systems](#)

[See General Information for Through-penetration Firestop Systems Certified for Canada](#)

System No. W-L-1058

January 23, 2015

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating — 2 Hr	F Rating — 2 Hr
T Rating — 0 and 1/4 Hr (See Item 2)	FT Rating — 0 and 1/4 Hr (See Item 2)
	FH Rating — 2 Hr
	0 and 1/4 Hr (See Item 2)



SECTION A-A

1. Wall Assembly — The fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300 or U400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC.

B. Gypsum Board* — Two layers of nom 5/8 in. (16 mm) thick gypsum wallboard, as specified in the individual Wall and Partition Design. Max diam of opening is 14-1/2 in. (368 mm) for wood stud walls and 20 in. (508 mm) for steel stud walls. Diam of circular through opening to be min 3/8 in. (5 mm) to max 2-3/4 in. (70 mm) larger than diam of through penetrants (Item 2).

2. Through-Penetrants — One metallic pipe or tubing to be installed either concentrically or eccentrically within the firestop system. Pipe or tubing to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes or tubing may be used:

A. Steel Pipe — 17-1/4 in. (438 mm) diam (or smaller) by 0.125 (3.2 mm) (or heavier) steel pipe. The annular space shall be min 0 to max 2-3/4 in. (70 mm). **The T, FT and FTH Rating is 1/4 hr when steel pipe is used.**

B. Copper Tubing — Nom 4 in. (102 mm) diam (or smaller) Type L (or heavier) copper tubing. The annular space shall be min 0 to max 3 in. (76 mm). **The T, FT and FTH rating is 0 hr when copper tubing is used.**

C. Copper Pipe — Nom 4 in. (102 mm) diam (or smaller) regular (or heavier) copper pipe. The annular space shall be min. 0 to max 3 in. (76 mm). **The T, FT and FTH rating is 0 hr when copper pipe is used.**

3. Firestop System — The firestop system shall consist of the following:

A. Steel Wire Mesh — No. 8 steel wire mesh having a min 1 in. (25 mm) lap along the longitudinal seam. Length of steel wire mesh to be 4-3/4 in., (121 mm) centered and formed to fit periphery of through opening.

B. Packing Material — Min 4-1/2 in. (114 mm) thickness of flexible urethane sheet or mineral wool insulation firmly packed into opening as a permanent form. Packing material to be recessed from both surfaces of wall as required to accommodate the required thickness of fill material.

C. Fill, Void or Cavity Material* — Sealant — Min 1/4 in. (6 mm) thickness of fill material applied within the annulus, flush with both surfaces of wall. At the point contact location between pipe and wall, a min 1/2 in. (13 mm) diam bead of caulk shall be applied at the wall/pipe interface on both surfaces of wall assembly.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-One Sealant or FS-ONE MAX
Intumescent Sealant

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System No. W-L-1164
XHEZ.W-L-1164
Through-penetration Firestop Systems

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XHEZ - Through-penetration Firestop Systems

XHEZ7 - Through-penetration Firestop Systems Certified for Canada

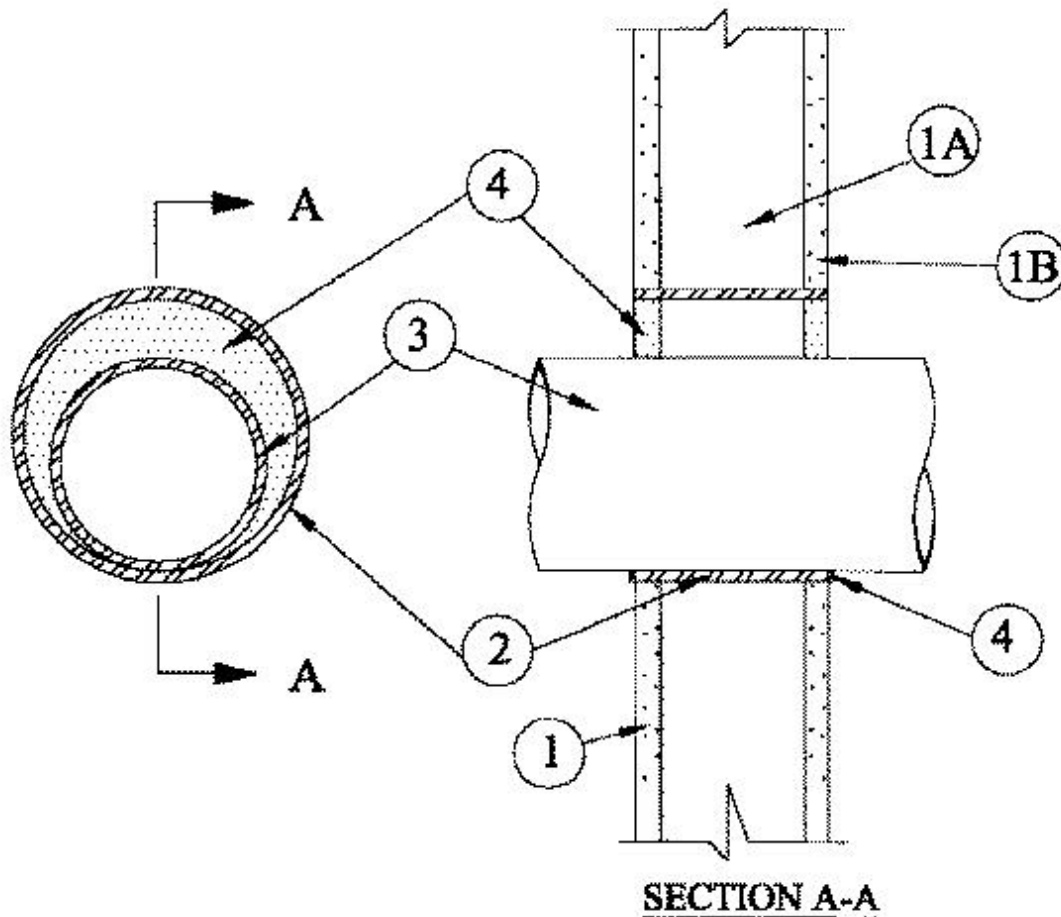
[See General Information for Through-penetration Firestop Systems](#)

[See General Information for Through-penetration Firestop Systems Certified for Canada](#)

System No. W-L-1164

January 22, 2015

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings — 1 and 2 Hr (See Item 1 and 4)	F Ratings — 1 and 2 Hr (See Items 1 and 4)
T Rating — 0 Hr	FT Rating — 0 Hr
	FH Ratings — 1 and 2 Hr (See Items 1 and 4)
	FTH Rating — 0 Hr



1. Wall Assembly — The 1 or 2 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner described in the individual U300, U400, V400 or W400 Series Wall or Partition Design in the UL Fire Resistance Directory and shall include the following construction features:

A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC. When steel studs are used and the diam of opening exceeds the width of stud cavity, the opening shall be framed on all sides using lengths of steel stud installed between the vertical studs and screw-attached to the steel studs at each end. The framed opening in the wall shall be 4 to 6 in. (102 to 152 mm) wider and 4 to 6 in. (102 to 152 mm) higher than the diam of the penetrating item such that, when the penetrating item is installed in the opening, a 2 to 3 in. (51 to 76 mm) clearance is present between the penetrating item and the framing on all four sides.

B. Gypsum Board* — The gypsum wallboard type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Design. Max diam of opening in steel stud walls is 32 in. (813 mm). Max diam of openings in wood stud walls is 14-1/2 in. (368 mm).

The hourly F, FH Ratings of the firestop system are equal to the hourly fire rating of the wall assembly in which it is installed.

2. Steel Sleeve — Nom 32 in. (813 mm) diam (or smaller) Schedule 40 (or heavier) steel pipe sleeve friction fit in nom 32 in. (813 mm) diam circular opening cut through gypsum board layers. Length of steel sleeve to be equal to thickness of wall.

3. Through-Penetrant — One metallic pipe, conduit or tubing installed either concentrically or eccentrically within the firestop system. The annular space between pipe, conduit or tubing and the steel sleeve shall be min of 0 in. (point contact) to max 1-7/8 in. (48 mm) Pipe, conduit or tubing to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes, conduits or tubing may be used:

A. Steel Pipe — Nom 30 in. (762 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.

B. Iron Pipe — Nom 30 in. (762 mm) diam (or smaller) service weight (or heavier) cast iron soil pipe or Class 50 (or heavier) ductile iron pressure pipe.

C. Conduit — Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing.

D. Copper Tubing — Nom 6 in. (152 mm) diam (or smaller) Type L (or heavier) copper tubing.

E. Copper Pipe — Nom 6 in. (152 mm) diam (or smaller) Regular (or heavier) copper pipe.

4. Fill, Void or Cavity Material*-Sealant — Min 5/8 in. (16 mm) and 1-1/4 in. (32 mm) thickness of fill material applied within annulus, flush with both surfaces of wall assembly for 1 or 2 hr rated walls, respectively. Min 1/2 in. (13 mm) diam bead of caulk applied to the penetrant/gypsumboard interface at the point contact location on both sides of wall.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant or FS-ONE MAX Intumescent Sealant

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System No. W-L-2078 XHEZ.W-L-2078 Through-penetration Firestop Systems

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Through-penetration Firestop Systems

[See General Information for Through-penetration Firestop Systems](#)

System No. W-L-2078

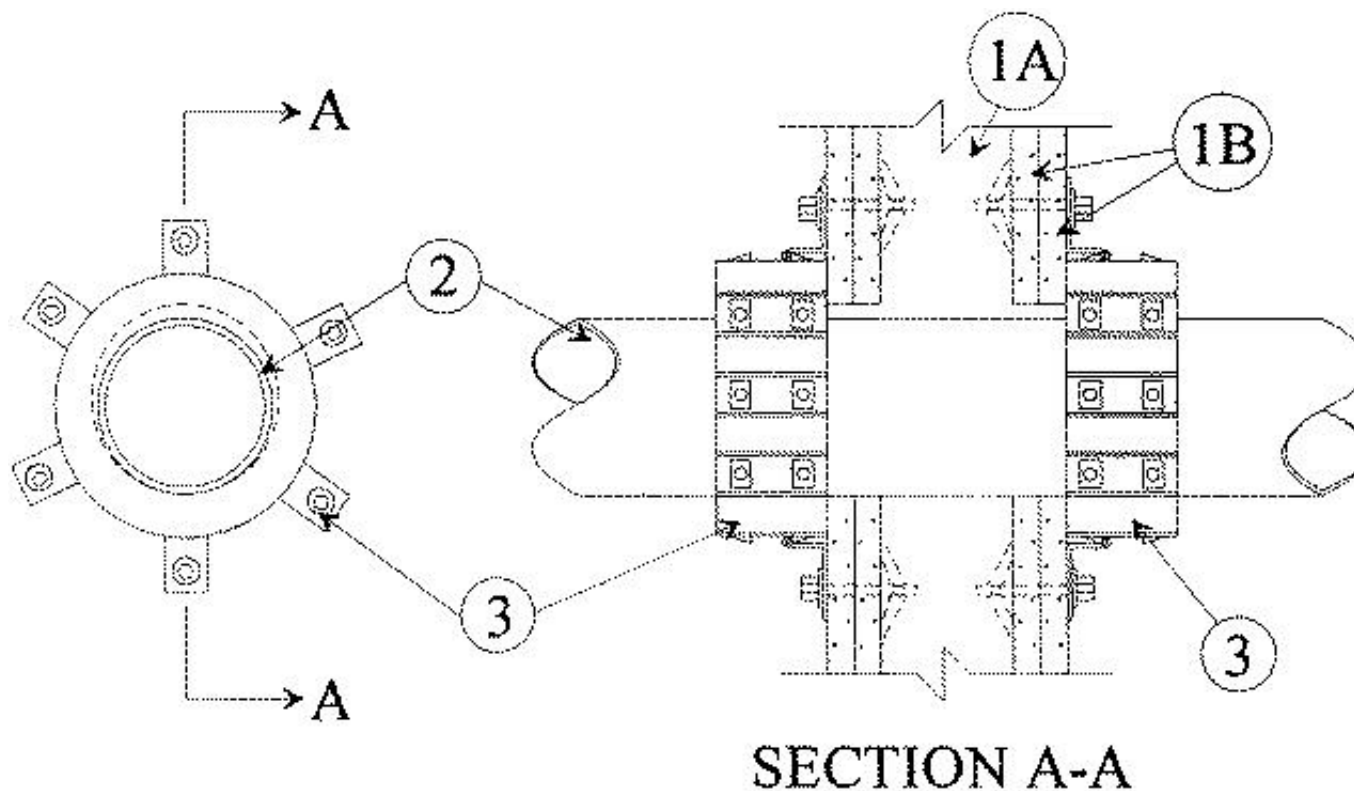
November 29, 2005

F Ratings — 1 and 2 Hr (See Item 1)

T Ratings — 0, 1 and 2 Hr (See Items 2 and 3)

L Rating At Ambient — 3 CFM/sq ft

L Rating At 400 F — Less Than 1 CFM/sq ft



SECTION A-A

1. Wall Assembly — The fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400 or V400 Series Wall and Partition Designs in the UL fire Resistance Directory and shall include the construction features noted below:

A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. lumber spaced max 16 in. OC. Steel studs to be min 2-1/2 in. wide and spaced max 24 in. OC.

B. Gypsum Board* — Nom 5/8 in. thick gypsum board, as specified in the individual Wall and Partition Design. Max diam of opening is 11-1/2 in.

The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.

2. Through-Penetrants — One nonmetallic pipe, conduit or tubing to be installed within the firestop system. The annular space between pipe and periphery of opening shall be min 0 in. (point contact) to max 1/2 in. Pipe or conduit to be rigidly supported on both sides of the wall assembly. The following types and sizes of nonmetallic pipes may be used:

A. Polyvinyl Chloride (PVC) Pipe — Nom 10 in. diam (or smaller) Schedule 40 solid-core or cellular core PVC pipe for use in closed (process or supply) or vented (drain, waste or vent) piping system.

B. Chlorinated Polyvinyl Chloride (CPVC) Pipe — Nom 10 in. diam (or smaller) SDR13.5 CPVC pipe for use in closed (process or supply) piping systems.

C. Acrylonitrile Butadiene Styrene (ABS) Pipe — Nom 6 in. diam (or smaller) Schedule 40 solid-core or cellular core ABS pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems

D. Flame Retardant Polypropylene (FRPP) Pipe — Nom 6 in. diam (or smaller) Schedule 40 FRPP pipe for use in closed (process or supply) or vented (drain, waste or vent) piping system.

E. Polyvinylidene Fluoride (PVDF) Pipe — Nom 4 in. diam (or smaller) PVDF pipe for use in closed (process or supply) or vented (drain, waste or vent) piping system.

When max 6 in. diam pipe is used, T Rating is equal to the hourly fire rating of the wall. When nom 8 in. or 10 in. diam pipe is used, T Rating is 0 hr.

3. Firestop Device* — Firestop Collar — Firestop collar shall be installed in accordance with the accompanying installation instructions. Collar to be installed and latched around the pipe and secured to both sides of the wall using the anchor hooks provided with the collar. (Minimum two anchor hooks for 1-1/2 and 2 in. diam pipes, three anchor hooks for 3 and 4 in. diam pipes, four anchor hooks for 6 in. diam pipes, ten anchor hooks for 8 in. diam pipes and twelve anchor hooks for 10 in. diam pipes). The anchor hooks are to be secured to the surface of wall with 3/16 in. diam by 2-1/2 in. long steel toggle bolts along with washers. As an alternate for pipe sizes of nom 4 in. diam or less, min No. 10 by 1-1/2 in. long drywall or laminate screws with min 3/4 in. steel washers may be used. **When the drywall or laminate screw is used, T Rating shall not exceed 1 hr.**

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CP 643 50/1.5"N, CP 643 63/2"N, CP 643 90/3"N, CP 643 110/4"N, CP 643 160/6"N, CP 644 200/8" and CP 644 250/10" Firestop Collars

4. Fill, Void or Cavity Material* — Sealant - (Not Shown) — Min 1/2 in. thickness of sealant applied within the annular space for nom 8 in. and 10 in. diam pipes, flush with each side of wall. Sealant in annular space is optional for max 6 in. diam pipes. A min 1/4 in. thickness of sealant is required within the annular space, flush with each side of wall, to attain the L Ratings for max 6 in. diam pipes.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-One Sealant

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System No. W-L-3065 XHEZ.W-L-3065 Through-penetration Firestop Systems

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XHEZ - Through-penetration Firestop Systems

XHEZ7 - Through-penetration Firestop Systems Certified for Canada

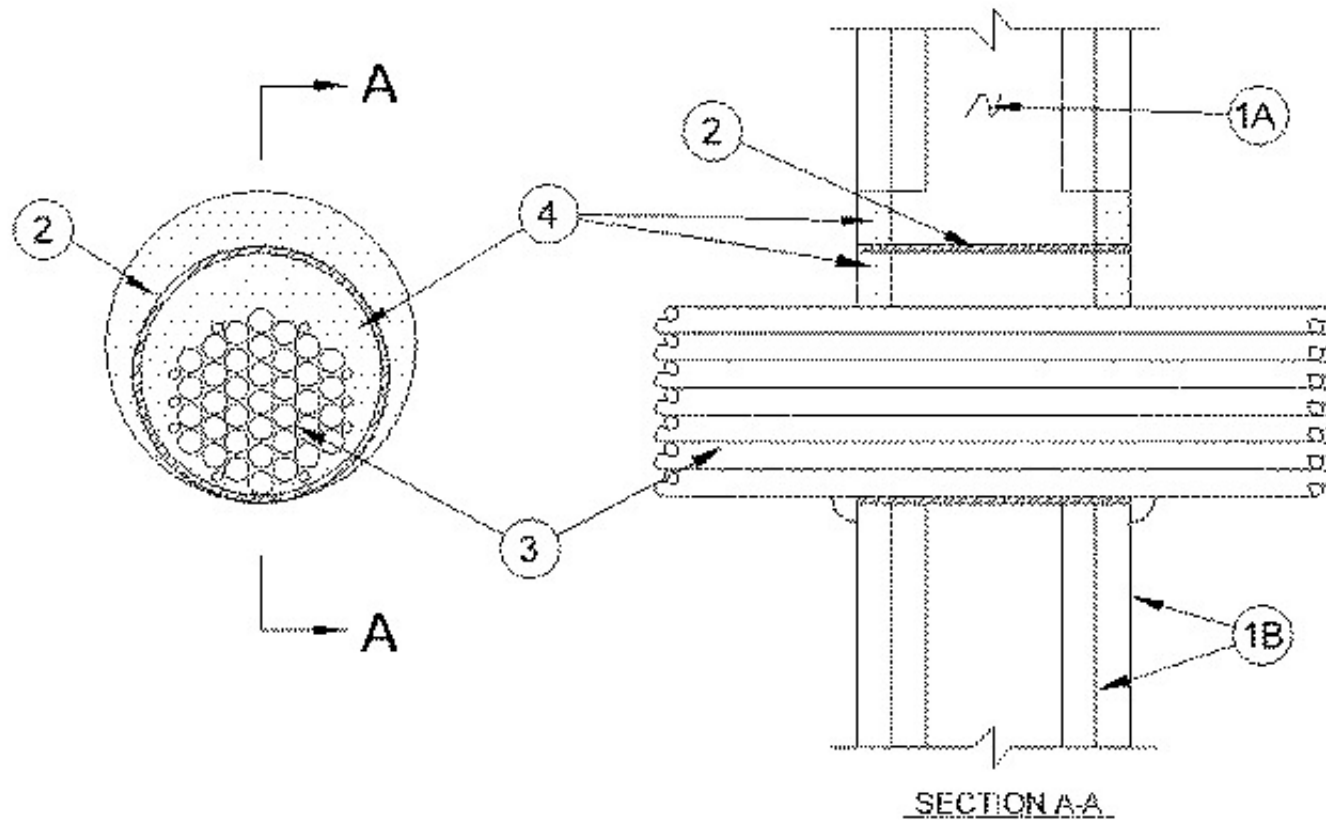
[See General Information for Through-penetration Firestop Systems](#)

[See General Information for Through-penetration Firestop Systems Certified for Canada](#)

System No. W-L-3065

February 06, 2014

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating — 1 and 2 Hr (See Item 1)	F Rating — 1 and 2 Hr (See Item 1)
T Rating — 0 and 3/4 Hr (See item 3)	FT Rating — 0 and 3/4 Hr (See item 3)
L Rating At Ambient — 15 CFM/sq ft	FH Rating — 1 and 2 Hr (See Item 1)
L Rating At 400 F — 8 CFM/sq ft	FTH Rating — 0 and 3/4 Hr (See item 3)
	L Rating At Ambient — 15 CFM/sq ft
	L Rating At 400 F — 8 CFM/sq ft



1. Wall Assembly — The 1 or 2 fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400 or V400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC.

B. Gypsum Board* — Nom 5/8 in. (16 mm) thick gypsum board, with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U300, U400 or V400 Series Design in the UL Fire Resistance Directory. Max diam of opening is 5-1/2 in. (138 mm) when sleeve (Item 2) is employed. Max diam of opening is 4 in. (102 mm) when sleeve (Item 2) is not employed.

The F Rating of the firestop system is equal to the fire rating of the wall assembly.

2. Metallic Sleeve — (Optional) - Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing (EMT) or Schedule 5 (or heavier) steel pipe or min 0.016 in. thick (0.41 mm, No. 28 ga) galv steel sleeve installed flush with wall surfaces. The annular space between steel sleeve and periphery of opening shall be min 0 in. (0 mm, point contact) to max 1 in. (25mm). When Schedule 5 steel pipe or EMT is used, sleeve may extend up to 18 in. (457 mm) beyond the wall surfaces. As an option when Schedule 5 steel pipe or EMT is used, sleeve may extend continuously beyond one wall surface. When cable bundle penetrates wall assembly at an angle of 45 degrees, no metallic sleeve is used.

3. Cables — Aggregate cross-sectional area of cable in opening to be max 45 percent of the cross-sectional area of the opening. The annular space between the cable bundle and the periphery of the opening to be min 0 in. (point contact) to max 1 in. (25 mm). When sleeve is continuous on one side of wall (see Item 2), the cable fill may be 0 to 45% and the max annular space is not limited. Cables to be rigidly supported on both sides of the wall assembly. Cable bundle, using cables described below, may penetrate the wall at an angle not greater than 45 degrees. Any combination of the following types and sizes of copper conductor cables may be used:

- A. Max 7/C No. 12 AWG with polyvinyl chloride (PVC) insulation and jacket.
- B. Max 25 pair No. 24 AWG telephone cable with PVC insulation and jacket.
- B1. Max 4 pr No. 22 AWG Cat 5 or Cat 6 computer cables.
- C. Type RG/U coaxial cable with polyethylene (PE) insulation and PVC jacket having a max outside diameter of ½ in. (13 mm).
- C1. Max RG 6/U coaxial cable with fluorinated ethylene insulation and jacketing.
- D. Multiple fiber optical communication cable jacketed with PVC and having a max OD of 5/8 in. (16 mm).
- E. Through Penetrating Products*— Max three copper conductor No. 8 AWG **.Metal-Clad Cable+**.

AFC CABLE SYSTEMS INC

- F. Max 3/C (with ground)(or smaller) No. 8 AWG copper conductor cable with PVC insulation and jacketing.
- G. Max 3/4 in. (19 mm) diam copper ground cable with or without a PVC jacket.
- H. Fire Resistive Cables* - Max 1-1/4 in. (32 mm) diam single conductor or multi conductor Type MI cable. A min 1/8 in. (3 mm) separation shall be maintained between MI cables and any other types of cable.
- I. Max 4/C with ground 300 kcmil (or smaller) aluminum SER cable with PVC insulation and jacket.
- J. **Through Penetrating Product*** - Any cables, **Metal-Clad Cable+** or **Armored Cable+** currently Classified under the **Through Penetrating Products** category.
- K. Maximum 3/C No. 8 AWG metal-clad cable.
- L. Maximum 5/8 diam fiber-optic cable with PVC jacket.

For cable bundle penetrating the wall assembly at an angle of 45 degrees, the T rating is ¾ hr for a 2 hr wall assembly.

See **Through Penetrating Product** (XHLTY) category in the Fire Resistance Directory for names of manufacturers.

4. Fill, Void or Cavity Material*— Sealant or Putty — Fill material applied within the annulus, flush with each end of the steel sleeve or wall surface. Fill material installed symmetrically on both sides of the wall. A min 5/8 in. (16 mm) thickness of sealant is required for the 1 or 2 hr F Rating . An additional 1/2 in. (13 mm) diam bead of fill material shall be applied at the interface of sleeve with gypsum board.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CP601S, CP606, FS-One Sealants or CP618 Putty

5. Packing Material — (Optional, Not Shown) — Mineral wool forming material may be used as a backer for the fill material (Item 4). When used, it shall be firmly packed into annular space within the sleeve as a permanent form and recessed from end of sleeve to accommodate the required thickness of fill material.

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System No. W-L-5047
XHEZ.W-L-5047
Through-penetration Firestop Systems

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XHEZ - Through-penetration Firestop Systems

XHEZ7 - Through-penetration Firestop Systems Certified for Canada

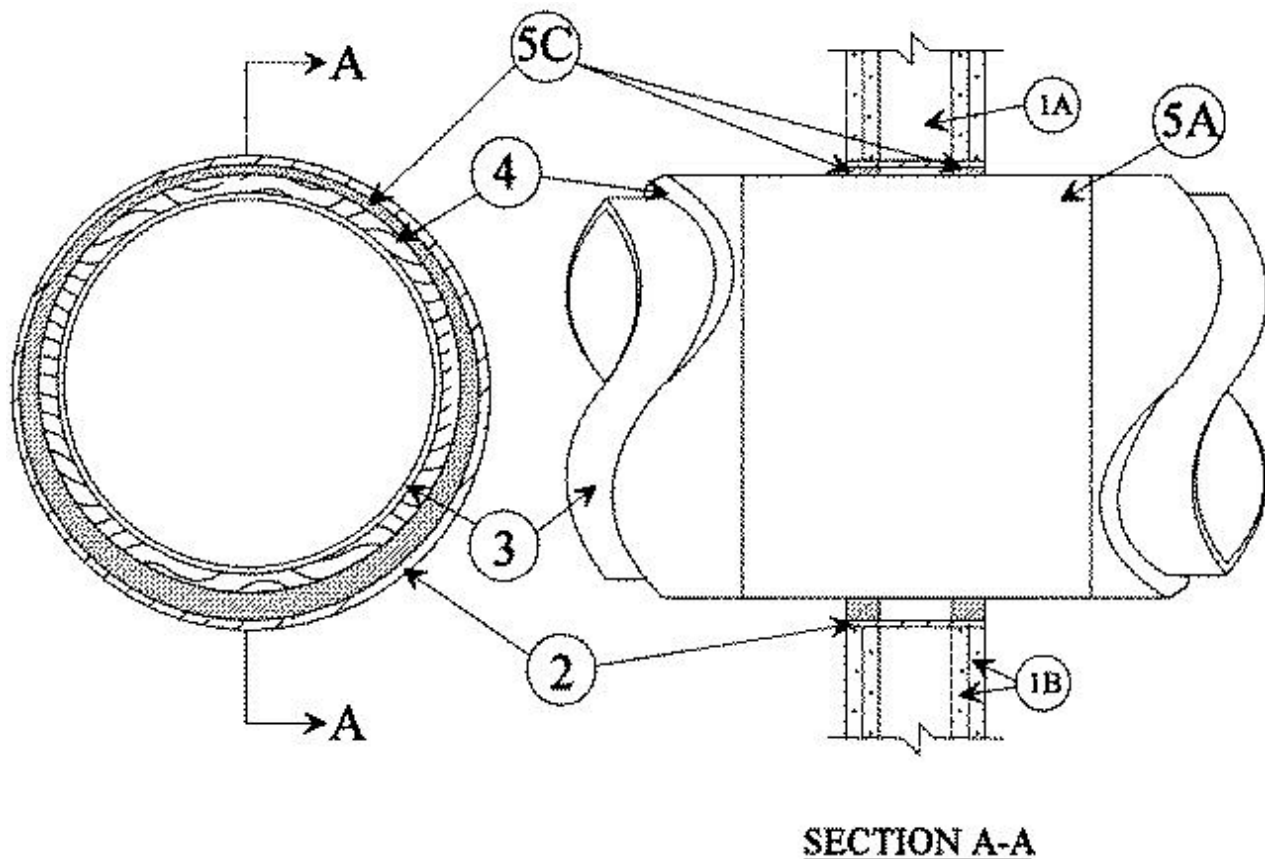
[See General Information for Through-penetration Firestop Systems](#)

[See General Information for Through-penetration Firestop Systems Certified for Canada](#)

System No. W-L-5047

January 27, 2015

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating — 1 & 2 Hr (See Item 1)	F Rating — 1 & 2 Hr (See Item 1)
T Rating — 0 & 1-1/2 Hr (See Item 1)	FT Rating — 0 & 1-1/2 Hr (See Item 1)
	FH Rating — 1 & 2 Hr (See Item 1)
	FTH Rating — 0 & 1-1/2 Hr (See Item 1)

**SECTION A-A**

1. Wall Assembly — The fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC. When steel studs are used and the diam of opening exceeds the width of the stud cavity, the opening shall be framed on all sides using lengths of studs installed between the vertical studs and attached to the studs at each end. The framed opening in the wall shall be 4 to 6 in. (102 to 152 mm) wider and 4 to 6 in. (102 to 152 mm) higher than the diam of the metallic sleeve (Item 2) such that a clearance of 2 to 3 in. (51 to 76 mm) is present between the sleeve and the framing on all four sides.

B. Gypsum Board* — Two layers of nom 5/8 in. (16 mm) thick gypsum board, as specified in the individual Wall and Partition Design. Max diam of opening is 14-1/2 in. (368 mm) for wood stud walls and 30 in. (762 mm) for steel stud walls.

The hourly F, FH Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed. The T, FT, FTH Rating is 0 hr when installed in 1 hr wall assembly or when optional metallic sleeve (Item 2) is used. The T, FT, FTH Rating is 1-1/2 hr when installed in 2 hr wall assembly and optional sleeve is not used.

2. Metallic Sleeve (Optional) — Nom 30 in. (762 mm) diam (or smaller) Schedule 40 (or thinner) steel pipe cast into wall assembly with joint compound and installed flush with wall surfaces.

3. Through Penetrants — One metallic pipe or tubing to be positioned within the firestop system. Pipe or tubing to be rigidly supported on both sides of floor or wall assembly. The following types and sizes of metallic pipes or tubing may be used:

- A. Steel Pipe** — Nom 20 in. (508 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.
- B. Iron Pipe** — Nom 20 in. (508 mm) diam (or smaller) cast or ductile iron pipe.
- C. Copper Tubing** — Nom 6 in. (152 mm) diam (or smaller) Type L (or heavier) copper tubing.
- D. Copper Pipe** — Nom 6 in. (152 mm) diam (or smaller) Regular (or heavier) copper pipe.

4. Pipe Covering* — 1 to 3 in. (25 to 76 mm) thick hollow cylindrical heavy density (min 3.5 pcf or 56 kg/m³) glass fiber units jacketed on the outside with an all service jacket. Longitudinal joints sealed with metal fasteners of factory-applied self-sealing lap tape. Transverse joints secured with metal fasteners or with butt tape supplied with the product. Pipe covering to terminate 6 in. (152 mm) from each side of the assembly.

5. Firestop System — The firestop system shall consist of the following:

A. Pipe Covering Materials* — Nom 1 to 3 in. (25 to 76 mm) thick unfaced mineral fiber pipe insulation sized to the outside diam of pipe or tube and extending 6 in. (152 mm) beyond each surface of the wall surface. Pipe insulation secured with min 18 AWG steel wire 3 in. (76 mm)

beyond each surface of the wall assembly. When steel sleeve is not used, the annular space shall be min 1/4 in. (6 mm) to max 3 in. (76 mm), or when sleeve is used, min 1 in. (25 mm) to max 2-1/4 in. (57 mm).

INDUSTRIAL INSULATION GROUP L L C — High Temperature Pipe Insulation 1200, High Temperature Pipe Insulation BWT or High Temperature Pipe Insulation Thermaloc

B. Sheathing Material* — All service jacket material shall be wrapped around the outer circumference of the pipe covering material (Item 4A) with kraft side exposed. Longitudinal joints sealed with metal fasteners or self-sealing lap tape.

See **Sheathing Material** (BVDV) category in the Building Materials Directory for names of manufacturers. Any sheathing material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.

C. Fill, Void or Cavity Material* — Sealant — Min 5/8 in. or 1-1/4 in. (16 mm or 32 mm) thickness of fill material applied within the annulus flush with both surfaces of wall, for 1 or 2 hr walls, respectively.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant or FS-ONE MAX Intumescent Sealant-

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System No. W-L-7040 XHEZ.W-L-7040 Through-penetration Firestop Systems

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Through-penetration Firestop Systems

[See General Information for Through-penetration Firestop Systems](#)

System No. W-L-7040

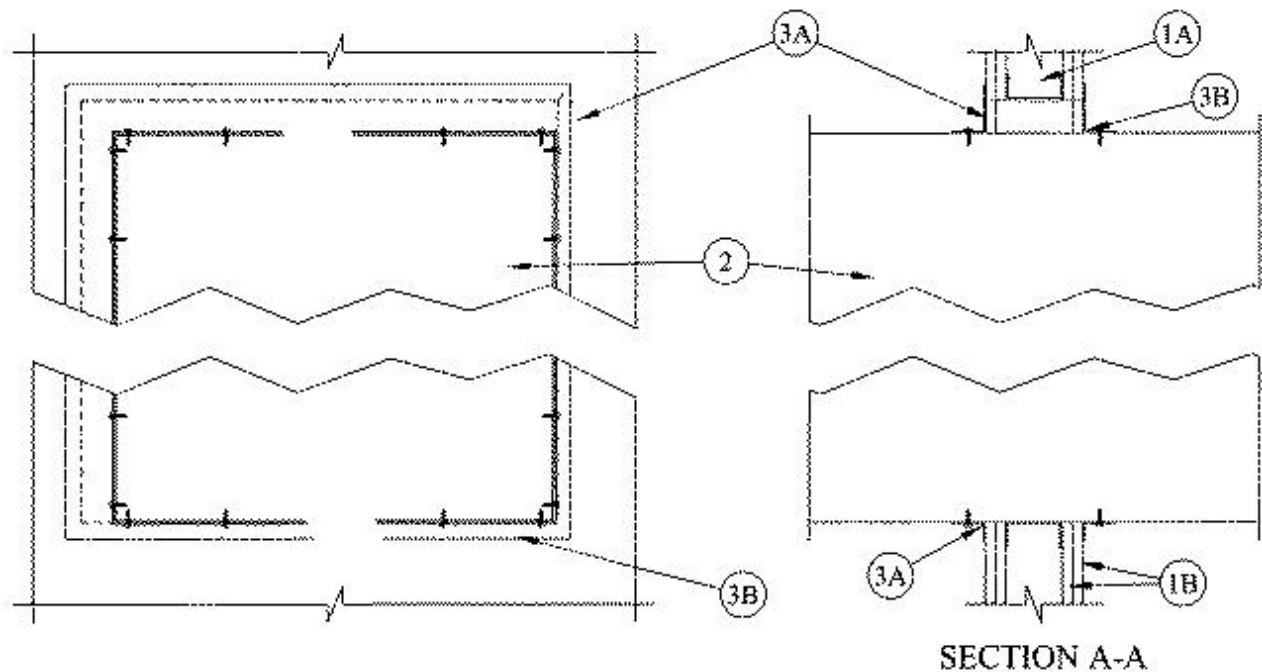
August 27, 2010

F Ratings — 1 and 2 Hrs (See Items 1 and 3)

T Rating — 0 Hr

L Rating at Ambient — Less Than 1 CFM/sq ft

L Rating at 400 F — Less Than 1 CFM/sq ft



1. Wall Assembly — The fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300 or U400 Series Wall and Partition Designs in the Fire Resistance Directory and shall include the following construction features:

A. **Studs** — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. lumber spaced 16 in. OC. Steel studs to be min 2-1/2 in. wide and spaced max 24 in. Additional framing members shall be used to completely frame around opening.

B. **Gypsum Board*** — Nom 5/8 in. thick with square or tapered edges. The gypsum wallboard type, number of layers and sheet orientation shall be as specified in the individual Wall and Partition Design Number. Max area of opening is 1300 in. with the dimension of 50 in. **The hourly F rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.**

2. **Steel Duct** — Nom 24 in. by 48 in. (or smaller) No. 24 gauge (or heavier) galv steel duct to be installed within the firestop system. The annular space shall be min 0 (point contact) in. to a max 2 in. Duct to be rigidly supported on both sides of the wall assembly.

3. **Firestop System** — The firestop system shall consist of the following:

A. **Fill, Void or Cavity Material*—Sealant** — Min 5/8 in. thickness of fill material applied within annulus flush with both surfaces of wall. At point contact location, a min 1/2 in. diam bead of fill material shall be applied to the wall/duct interface on both surfaces of wall.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant, CP601S Elastomeric Firestop Sealant or CP606 Flexible Sealant.

B. **Steel Retaining Angle** — No. 18 MSG (0.048 in.) galv steel angles cut to fit contour of duct with a 2 in. overlap on the duct and a min 1 in. overlap on the gypsum board assembly on both surfaces of wall. 2 in. leg of angle secured to duct with min No. 8 by 3/4 in. long sheet metal screws, spaced a max of 6 in. OC. When bead of fill material is used at joint contact locations, angles shall be installed prior to full material curing.

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System No. W-L-7042
XHEZ.W-L-7042
Through-penetration Firestop Systems

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XHEZ - Through-penetration Firestop Systems

XHEZ7 - Through-penetration Firestop Systems Certified for Canada

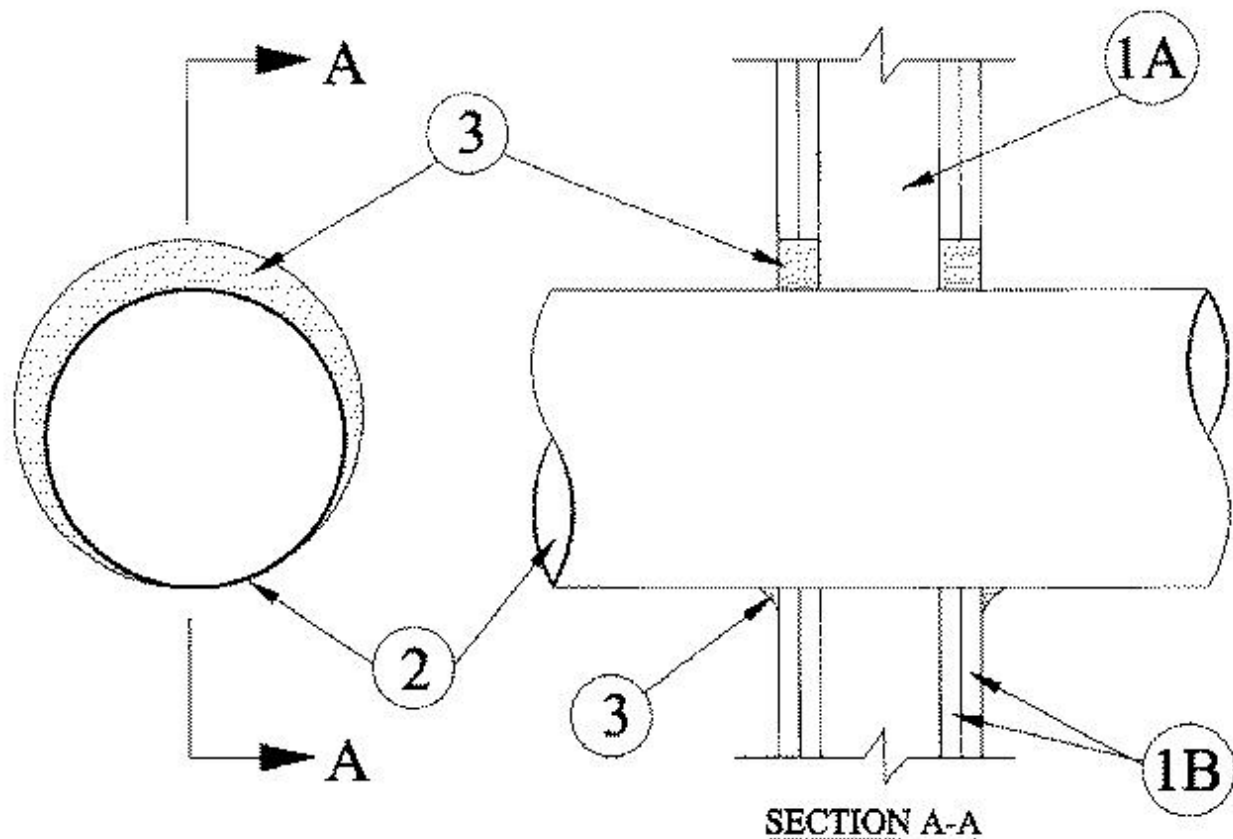
[See General Information for Through-penetration Firestop Systems](#)

[See General Information for Through-penetration Firestop Systems Certified for Canada](#)

System No. W-L-7042

January 27, 2015

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings - 1 and 2 Hr (See Items 1 and 3)	F Ratings - 1 and 2 Hr (See Items 1 and 3)
T Rating - 0 Hr	FT Rating - 0 Hr
	FH Ratings - 1 and 2 Hr (See Items 1 and 3)
	FTH Rating - 0 Hr



1. Wall Assembly — The 1 or 2 hr fire rated wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features.

A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced 24 in. (610 mm) OC.

B. Gypsum Board* — For 1 hr assembly, one layer of min 5/8 in. (16 mm) thick wallboard as required in the individual Wall and Partition Design. For 2 hr assembly, two layers of min 5/8 in. (16 mm) thick wallboard as required in the individual Wall and Partition Design. Max diam of opening is 14-1/2 in. (368 mm) for wood stud walls and 21-3/4 in. (552 mm) for steel stud walls.

The hourly F and FH Ratings of the firestop system are equal to the hourly fire rating of the wall assembly in which it is installed.

2. Through Penetrant — Galv steel duct to be installed concentrically or eccentrically within the firestop system. The annular space between the duct and periphery of opening shall be 0 in. (0 mm, point contact) and max 1-1/2 in. (64 mm) Duct to be rigidly supported on both sides of wall assembly.

A. Spiral Wound HVAC Duct — Nom 20 in. (502 mm) diam (or smaller) No. 24 MSG (or heavier) galv steel spiral wound duct.

B. Sheet Metal Duct — Nom 12 in. (305 mm) diam (or smaller) No. 28 MSG (or heavier) galv sheet steel duct.

3. Fill, Void or Cavity Material*—Sealant — Min 5/8 in. (16 mm) and 1-1/4 in. (32 mm) thickness of fill material applied within annulus, flush with both surfaces of wall assembly for 1 or 2 hr rated walls, respectively. At the point contact location between duct and wallboard, a min 1/2 in. (13 mm) diam bead of sealant shall be applied at the wallboard/duct interface on both surfaces of wall assembly.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CP601S Elastomeric Firestop Sealant, FS-ONE Sealant, FS-ONE MAX Intumescent Sealant or CP606 Flexible Firestop Sealant

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Through-penetration Firestop Systems

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 - Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
 - When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
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Through-penetration Firestop Systems

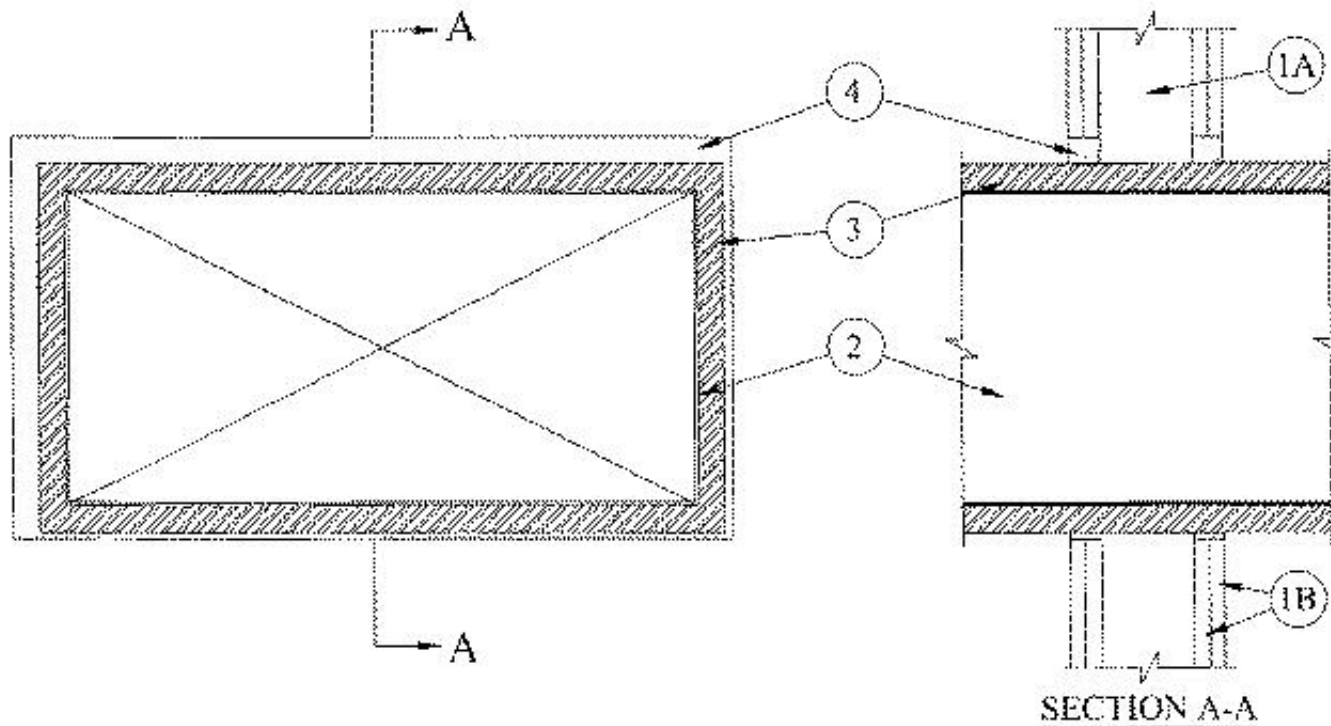
[See General Information for Through-penetration Firestop Systems](#)

System No. W-L-7059

March 02, 2001

F Ratings — 1 and 2 Hr

T Ratings — 1/2 and 3/4 Hr



1. Wall Assembly — The 1 or 2 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400 Series Wall or Partition Design in the UL Fire Resistance Directory and shall include the following construction features:

A. Studs — Wall framing shall consist of channel studs. Steel studs to be min 2-1/2 in. wide and spaced max 24 in. OC. The opening in the wall to accommodate the steel duct (Item 2) shall be framed on all sides using lengths of studs installed between the vertical studs and attached to the studs at each end. The framed opening in the wall shall be a nom 6 in. wide and 12 in. higher than the width and height of the steel duct.

B. Wallboard, Gypsum* — 5/8 in. thick, 4 ft wide with square or tapered edges. The gypsum wallboard type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U300 or U400 Series Design in the UL Fire Resistance Directory. Max area of opening is 395 sq. in. with max dimensions of 26-3/4 in. for steel studs.

2. Steel Duct — Nom 24 in. by 12 in. (or smaller) No. 24 gauge (or heavier) steel duct to be installed eccentrically within the framed opening. The annular space shall be min 1 in. to max 1-3/4 in. Steel duct to be rigidly supported on both sides of wall assembly.

3. Batts and Blankets* — Max 1-1/2 in. thick glass fiber batt or blanket (min 3/4 pcf) jacketed on the outside with a foil-scrim-kraft facing. Longitudinal and transverse joints sealed with aluminum foil tape. During the installation of the fill material, the batt or blanket shall be compressed 50% such that the annular space within the firestop system shall be min 1/4 in. to max 1.

See **Batts and Blankets** - (BKNV) category in the Building Materials Directory for names of manufacturers. Any batt or blanket meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index 50 or less may be used.

4. Fill, Void or Cavity Material* - Sealant — Min 5/8 in. or 1-1/4 in. thickness of fill material applied within annulus, flush with both surfaces of wall for 1 or 2 hr walls, respectively. If voids develop after the fill materials cures, the voids shall be sealed with additional fill material.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant

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Last Updated on 2001-03-02

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System No. W-L-7153
XHEZ.W-L-7153
Through-penetration Firestop Systems

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XHEZ - Through-penetration Firestop Systems

XHEZ7 - Through-penetration Firestop Systems Certified for Canada

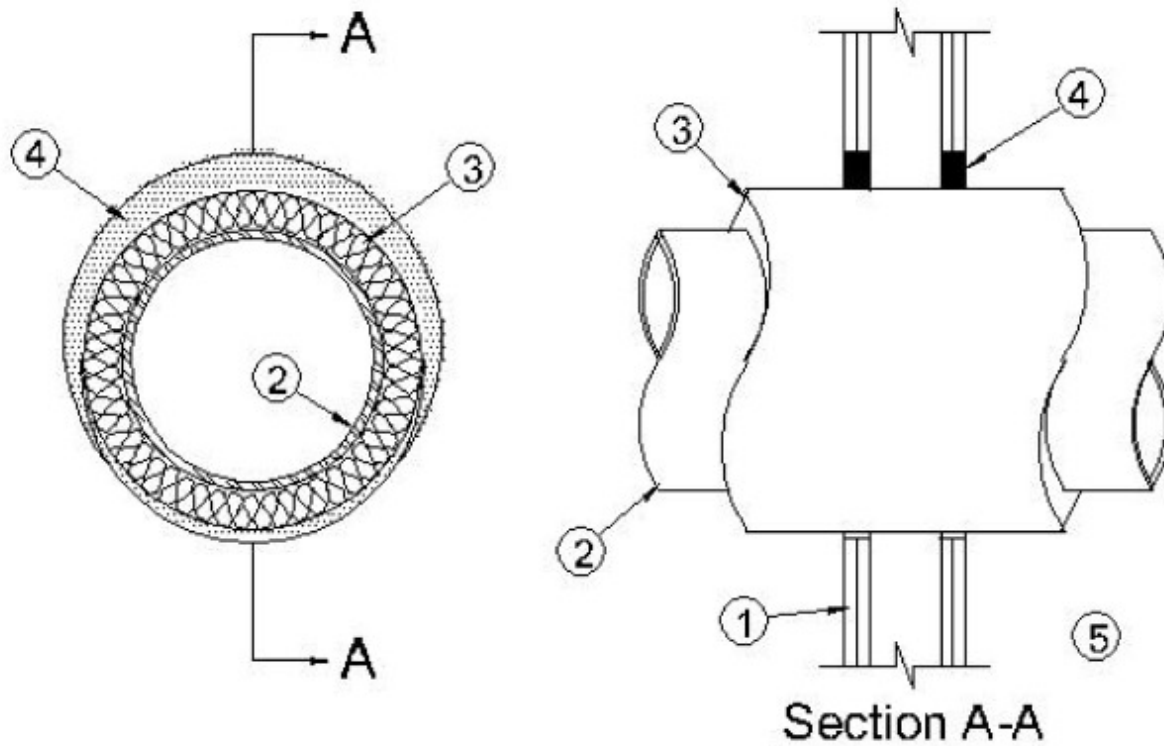
[See General Information for Through-penetration Firestop Systems](#)

[See General Information for Through-penetration Firestop Systems Certified for Canada](#)

System No. W-L-7153

January 27, 2015

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings - 1 and 2 Hr (See Item 1)	F Ratings - 1 and 2 Hr (See Item 1)
T Rating - 1/2 Hr	FT Rating - 1/2 Hr
	FH Ratings - 1 and 2 Hr (See Item 1)
	FTH Rating - 1/2 Hr



1. Wall Assembly — The 1 or 2 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400, V400 or W400 Series Wall or Partition Design in the UL Fire Resistance Directory and shall include the following construction features:

A. Studs — Wall framing shall consist of channel studs. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC.

B. Wallboard, Gypsum* — 5/8 in. (16 mm) thick, 4 ft (122 cm) wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Design in the UL Fire Resistance Directory. Max diam of opening is 23-1/2 in. (597 mm).

The hourly F and FH Ratings of the firestop system are equal to the hourly fire rating of the wall assembly in which it is installed.

2. Steel Duct — Galv steel duct to be installed concentrically or eccentrically within the firestop system. Duct to be rigidly supported on both sides of wall assembly.

A. Spiral Wound HVAC Duct — Nom 20 in. (508 mm) diam (or smaller) No. 24 MSG (or heavier) galv steel spiral wound duct.

B. Sheet Metal Duct — Nom 12 in. (305 mm) diam (or smaller) No. 28 MSG (or heavier) galv sheet steel duct.

3. Duct Insulation* — Nom 1-1/2 in. (38 mm) thick glass fiber batt or blanket (min 3/4 pcf or 56 kg/m³) jacketed on the outside with a foil-scrim-kraft facing. Longitudinal and transverse joints sealed with aluminum foil tape. During the installation of the fill material, the batt or blanket shall be compressed 50% such that the annular space within the firestop system shall be min 1/4 in. (6 mm) to max 1 in. (25 mm).

See **Batts and Blankets** - (BKNV) category in the Building Materials Directory for names of manufacturers. Any batt or blanket meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index 50 or less may be used.

4. Fill, Void or Cavity Material* — Sealant — Min 5/8 in. (16 mm) or 1-1/4 in. (32 mm) thickness of fill material applied within annulus, flush with both surfaces of wall for 1 or 2 hr walls, respectively. If voids develop after the fill materials cures, the voids shall be sealed with additional fill material.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant or FS-ONE MAX Intumescent Sealant

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Last Updated on 2015-01-27

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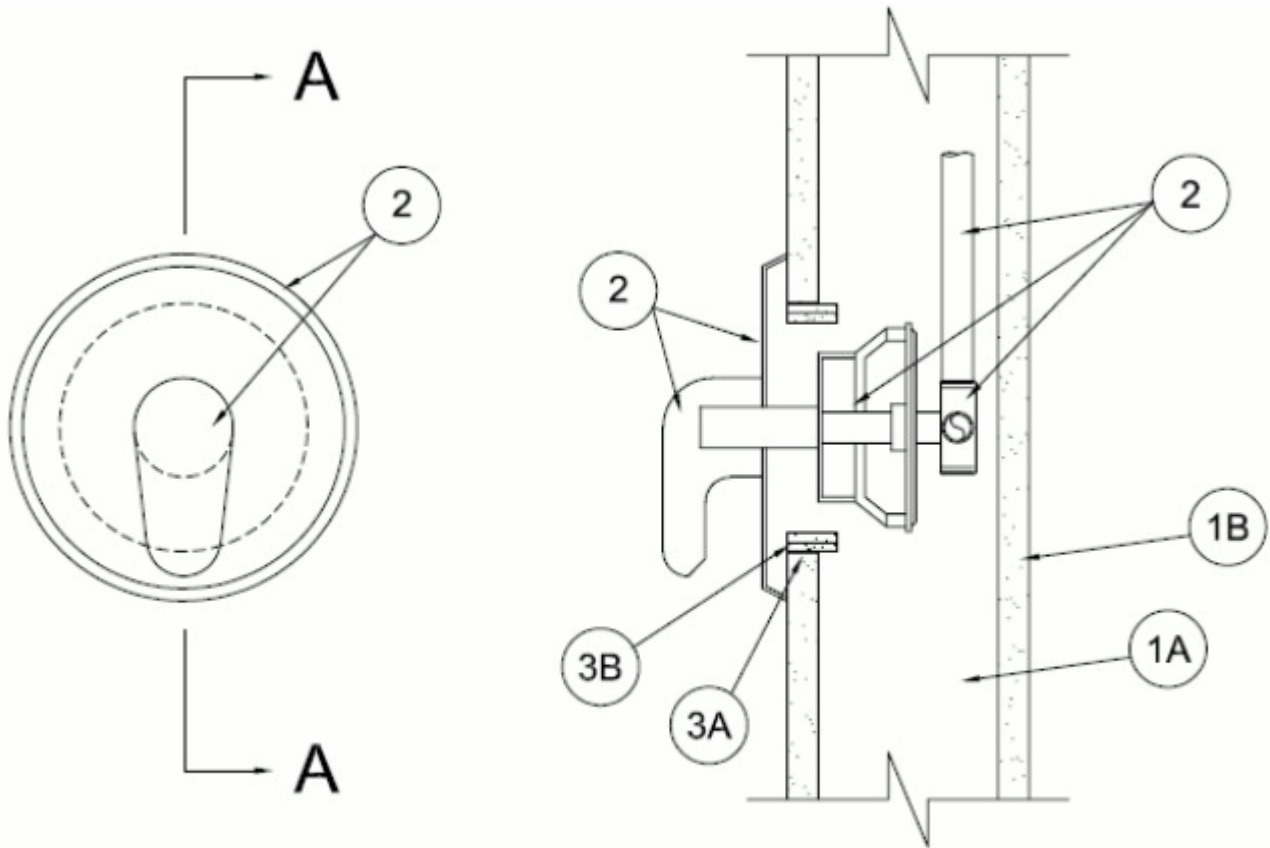
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SECTION A-A

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System No. W-L-8069 XHEZ.W-L-8069 Through-penetration Firestop Systems

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XHEZ - Through-penetration Firestop Systems

[See General Information for Through-penetration Firestop Systems](#)

System No. W-L-8069

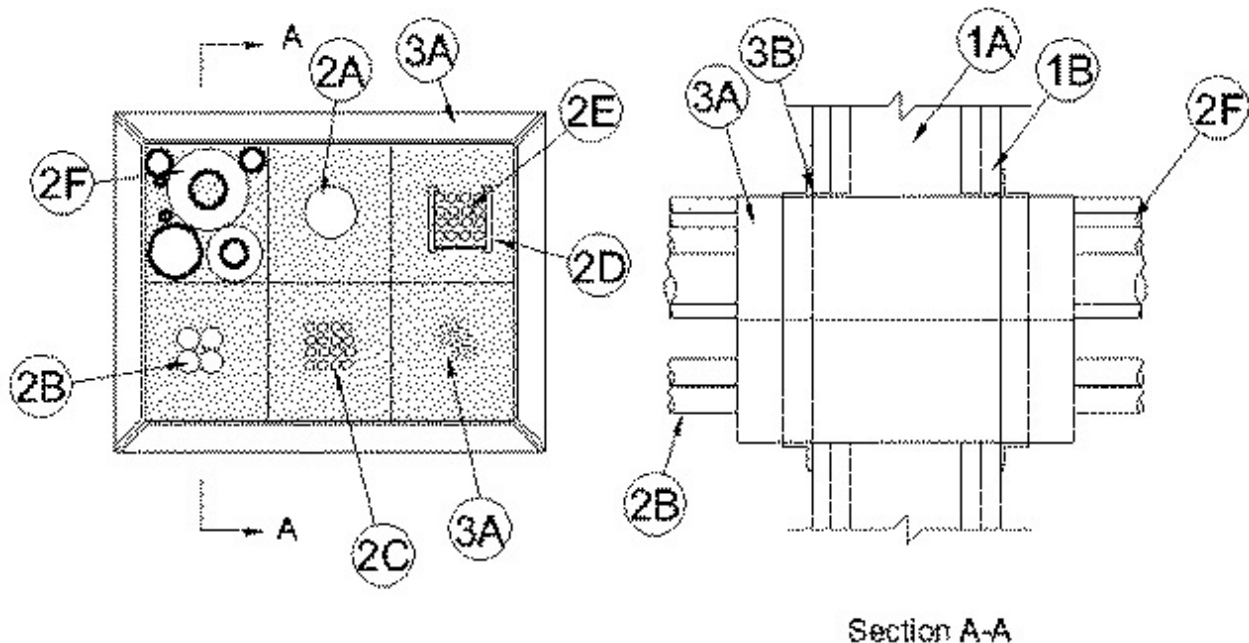
June 23, 2015

F Ratings — 1, 2, 3 and 4 Hr (See Item 1)

T Rating — 0 Hr

L Rating At Ambient — 4 CFM/sq ft. (See Item 3B)

L Rating At 400 F — Less Than 1 CFM/sq ft. (See Item 3B)



1. Wall Assembly — The 1, 2, 3 or 4 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U300, U400 or V400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall include the following construction features:

A. Studs — Wall framing may consist of either wood or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 3-1/2 in. (89 mm) wide spaced max 24 in. (610 mm) OC.

B. Gypsum Board* — The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Design in the UL Fire Resistance Directory. Max area of opening is 98.5 in.² (635 cm²) with a max dimension of 12-1/8 in. (308 mm) for square devices. Max diam of opening is 2-1/4 in. (57 mm) for nom 2 in. (51 mm) round devices and 4-1/4 in. (108 mm) for 4 in. (102 mm) round devices.

The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.

2. Through-Penetrants — One or more metallic pipes, conduits or tubes, nonmetallic pipes, conduits or tubes, cables, cables within cable trays, and miscellaneous combinations of penetrants, as described below, may be installed within each firestop device (Item 3A) as further specified below. Through penetrants to be rigidly supported on both sides of wall assembly. The following types and sizes of through-penetrants may be used:

A. Metallic Penetrants — One or more metallic pipe, tubing or conduit may be installed concentrically or eccentrically within each firestop device (Item 3A). If multiple through penetrants are installed within the firestop device, a min 1/4 in. (6 mm) annular space is required between the through penetrants. Through penetrants to be rigidly supported on both sides of floor or wall assembly. The following types and sizes of through penetrants may be used:

A1. Steel Pipe — Nom 3 in. (76 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.

A2. Iron Pipe — Nom 3 in. (76 mm) diam (or smaller) cast or ductile iron pipe.

A3. Copper Tubing — Nom 3 in. (76 mm) diam (or smaller) Type L (or heavier) copper tube.

A4. Copper Pipe — Nom 3 in. (76 mm) diam (or smaller) Regular (or heavier) copper pipe.

A5. Conduit — Nom 3 in. (76 mm) diam (or smaller) steel electrical metallic tubing (EMT) or rigid steel conduit.

A6. Through-Penetrating Product* - Flexible Metal Piping — Nom 1-1/4 in. (32 mm) diam (or smaller) steel flexible metal piping.

OMEGA FLEX INC — TracPipe Flexible Gas Piping

B. Nonmetallic Penetrants — One or more nonmetallic pipes, conduits or tubes, as described in a single line item below, may be installed within each firestop device (Item 3A):

B1. Polyvinyl Chloride (PVC) Pipe — One nom 2 in. (51 mm) diam (or smaller) Schedule 40 solid core PVC pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.

B2. Rigid Nonmetallic Conduit+ — One nom 2 in. (51 mm) diam (or smaller) Schedule 40 PVC conduit installed in accordance with the National Electrical Code (NFPA No. 70).

See **Rigid Nonmetallic, Schedule 40 and 80 PVC Conduit** (DZYR) category in the Electrical Construction Equipment Directory for names of manufacturers.

B3. Chlorinated Polyvinyl Chloride (CPVC) Pipe — One nom 2 in. (51 mm) diam (or smaller) SDR11 CPVC pipe for use in closed (process or supply) piping systems.

B4. Crosslinked Polyethylene (PEX) Tubing — One nom 2 in. (51 mm) diam (or smaller) SDR 9 PEX tubing for use in closed (process or supply) piping systems.

B5. Electrical Nonmetallic Tubing (ENT)+ — Max four nom 1-1/4 in. (32 mm) diam (or smaller) ENT installed in accordance with the National Electrical Code (NFPA No. 70).

See **Electrical Nonmetallic Tubing** (FKHU) category in the Electrical Construction Equipment Directory for names of manufacturers.

B6. Optical Fiber/Communications/Signaling/Coaxial Cable Raceways+ — Max four nom 1-1/4 in. (32 mm) diam (or smaller) plenum rated raceways installed in accordance with the National Electrical Code (NFPA No. 70).

See **Optical Fiber/Communications/Signaling/Coaxial Cable Raceway** (QAZM) category in the Electrical Construction Equipment Directory for names of manufacturers.

B7. Acrylonitrile Butadiene Styrene (ABS) Pipe — Nom 2 in. (51 mm) diam (or smaller) Schedule 40 cellular core ABS for use in closed (process or supply) or vented (drain, waste or vent) piping systems.

C. Cables — The cable loading within the loading area of each firestop device module may represent a 0 to 100 percent visual fill. The min bundle diam shall be 1/2 in. (13 mm) if a single firestop device (Item 3A) is installed in the opening. If multiple firestop devices are ganged together, there is no min bundle size. Any combination of the following types and sizes of cables may be used:

C1. Max 2/C No. 18 AWG copper conductor thermostat cable with polyvinyl chloride (PVC) insulation and jacket materials.

C2. Max 4 pair No. 24 AWG copper conductor Cat5e or Cat 6 telephone cable with PVC insulation and jacket materials.

C3. Max RG/U (or smaller) coaxial cable with foam high density polyethylene insulation and PVC jacket materials.

C4. Max 3/C (with ground) No. 14 AWG (or smaller) nonmetallic sheathed (Romex) cable with PVC insulation and jacket materials.

C5. Max 1/C No. 8 AWG copper conductor cable with PVC insulation and nylon jacket materials.

C6. Max 12 core No. 26 AWG shielded multi coax cable with foam high density polyethylene insulation and PVC jacket.

C7. Max 48MM62.5 micron fiber optic cables with having a min FT-6 rating.

C8. Max 62.5/125 micron micron fiber optic cables with having a min Riser rating.

C9. Max 1/C 3/0 AWG copper conductor cable with PVC insulation and jacket materials.

C10. Max three copper conductors (with ground) No. 12 AWG **Metal Clad Cable+**.

C11. Max four copper conductors No. 2 AWG **Metal Clad Cable+**.

AFC CABLE SYSTEMS INC

C12. Max 1/C 2/0 AWG non halogen copper conductor cable.

C13. Max 300 pair No. 24 AWG copper conductor telephone cable with PVC insulation and jacket materials.

C14. Max 30 pair No. 22 copper conductor shielded switchboard cable with PVC insulation and jacket materials.

C15. Max RG/6 (or smaller) coaxial cable with fluorinated ethylene (FE) or PVC insulation and jacket materials.

C16. Max RG/U (or smaller) coaxial cable with fluorinated ethylene (FE) or PVC insulation and jacket materials.

C17. Max 7/C No. 12 AWG copper conductors with PVC insulation and jacket materials.

C18. Max 4 pair No. 23 AWG copper conductor Cat 6 telephone cable with PVC insulation and jacket materials.

C19. Max three copper conductors (with ground) No. 12 AWG steel Armored Cable+.

C20. Max 04-02 2 5M fiber optic cables having a max diameter of 0.450 in. (11.4 mm).

C21. Max 1/C No. 750 kcmil copper conductors with PVC insulation and fabric jacket materials.

C22. Max 3/C with ground No. 2/0 AWG aluminum conductor SER cable with cross linked polyethylene (XLPE) insulation and PVC jacket.

D. Cable Tray* — Nom 2 in. (51 mm) wide by 2 in. (51 mm) high (or smaller) welded wire basket cable tray formed from min 0.23 in. (5.8 mm) thick steel wires in the longitudinal direction and 0.19 in. (4.8 mm) wires in the transverse direction. Transverse wires shall be spaced max 4 in. (102 mm) OC. One cable tray may be installed within each firestop device (Item 4A). When installed within the 4 by 4 by 10 in. (64 by 64 by 254 mm) firestop device, the annular space between the cable tray and the periphery of the device shall be min 1/2 in. (13 mm) to max 1-1/2 in. (38 mm). The cables described in Item E below may be installed within the cable tray.

E. Cables — Cable fill within cable tray shall be a nom 2 in. (100 % visual fill). If three or more firestop devices (Item 4A) are ganged together, the cable fill may be less than 2 in. Any combination of the following types and sizes of cables may be used within the cable tray:

E1. Max 4 pair No. 23 AWG copper conductor Cat5e or Cat 6 telephone cable with PVC insulation and jacket materials.

F. Mixed Penetrants — One of the following groupings of mixed penetrants may be installed within each firestop device:

F1. Air Conditioning (AC) Line Set — One or more AC line set, consisting of multiple metallic pipes, tube insulation, nonmetallic pipes and cables bundled within firestop device in any combination unless otherwise noted.

1. **Copper Tubing** — Nom 3/4 in. (19 mm) diam (or smaller) Type L (or heavier) copper tube.

2. **Tube Insulation - Plastic++** — Nom 1/2 in. (13 mm) thick or smaller) acrylonitrile butadiene/polyvinyl chloride (AB/PVC) flexible foam furnished in the form of tubing with skin may be used on the copper tubes. If multiple insulated through penetrants are installed within the firestop device, the insulated through penetrants may be bundled together.

See **Plastics+** (QMFZ2) category in the Plastics Recognized Component Directory for names of manufacturers. Any Recognized Component tube insulation material meeting the above specifications and having a UL 94 Flammability Classification of 94-5VA may be used.

3. **Polyvinyl Chloride (PVC) Pipe** — One nom 1 in. (25 mm) diam (or smaller) Schedule 40 solid core PVC pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.

4. **Thermostat Cable** — Max 2/C No. 18 AWG copper conductor thermostat cable with polyvinyl chloride (PVC) insulation and jacket materials.

F2. Mixed Grouping — One or more metallic pipes, nonmetallic pipes and cables bundled within firestop device in any combination unless otherwise noted.

1. **Copper Tubing** — Nom 1 in. (25 mm) diam (or smaller) Type L (or heavier) copper tube.

2. **Electrical Nonmetallic Tubing (ENT)+** — One nom 1-1/4 in. (32 mm) diam (or smaller) ENT installed in accordance with Article 362 of the National Electrical Code (NFPA No. 70).

See **Electrical Nonmetallic Tubing** (FKHU) category in the Electrical Construction Equipment Directory for names of manufacturers.

3. **Optical Fiber/Communications/Signaling/Coaxial Cable Raceways+** — One nom 1-1/4 in. (32 mm) diam (or smaller) plenum rated raceway installed in accordance with the National Electrical Code (NFPA No. 70).

See **Optical Fiber/Communications/Signaling/Coaxial Cable Raceway** (QAZM) category in the Electrical Construction Equipment Directory for names of manufacturers.

4. **Power Cable** — Max 1/C No. 750 kcmil copper conductors with PVC insulation and fabric jacket materials.

5. **Thermostat Cable** — Max 2/C No. 18 AWG copper conductor thermostat cable with polyvinyl chloride (PVC) insulation and jacket materials.

F3. Mixed Grouping — One or more flexible metal pipes and a max of two nonmetallic tubes or raceways bundled within firestop device in any combination.

1. **Through-Penetrating Product* - Flexible Metal Piping** — Nom 1-1/4 in. (32 mm) diam (or smaller) steel flexible metal piping.

OMEGA FLEX INC — TracPipe Flexible Gas Piping

2. **Electrical Nonmetallic Tubing (ENT)+** — Two nom 1-1/4 in. (32 mm) diam (or smaller) ENT installed in accordance with Article 362 of the National Electrical Code (NFPA No. 70).

See **Electrical Nonmetallic Tubing** (FKHU) category in the Electrical Construction Equipment Directory for names of manufacturers.

3. Optical Fiber/Communications/Signaling/Coaxial Cable

Raceways+ — Two nom 1-1/4 in. (32 mm) diam (or smaller) plenum rated raceway installed in accordance with the National Electrical Code (NFPA No. 70).

See **Optical Fiber/Communications/Signaling/Coaxial Cable Raceway** (QAZM) category in the Electrical Construction Equipment Directory for names of manufacturers.

3. Firestop System — The firestop system shall consist of the following:

A. Firestop Device* — A max of six square firestop devices may be ganged together for 1 and 2 hr rated assemblies. A max of three square firestop devices may be ganged together for 3 and 4 hr rated assemblies. As an alternate, one round device may be centered in a round opening. Each device consists of a nom 2-1/2 by 2-1/2 by 10 in. (64 by 64 by 254 mm), a nom 4 by 4 by 10 in. (102 by 102 by 254 mm), a nom 2 in. (51 mm) diam by 10 in. (254 mm) or a nom 4 in. (102 mm) diam by 10 in. (254 mm) powder coated steel transit incorporating internal intumescent material, foam plugs and mounting flanges. Firestop device(s) to be installed within opening with ends projecting an equal distance beyond each surface of wall assembly in accordance with the accompanying installation instructions. The annular space between device(s) and periphery of opening shall be min 0 in. (0 mm, point contact) to max 1/8 in. (3 mm). Firestop device(s) secured in place by means of fill material (Item 3B) and steel split mounting flanges sized to accommodate the firestop device. Steel split mounting flanges installed on both sides of wall after installation of fill material, and secured together with supplied steel set screws. Nom 1 in. (25 mm) thick foam plugs cut to accommodate the through penetrants and installed flush with each end of device on both sides of wall assembly. The foam plug in one or both ends of the device is optional except when L Rating is required (See Item 3B).

3M COMPANY — 3M Fire Barrier Pass-Through Device

B. Fill, Void or Cavity Materials* - Putty or Caulk — Min 1/8 in. (3 mm) bead of fill material shall be applied at interface of gypsum board and firestop devices immediately prior to the installation of the mounting flanges. As an option, foam plugs may be recessed into device and the recess filled with putty or caulk flush with the ends of the device. L Rating applies only when fill material is applied at interface of gypsum board and device(s) prior to mounting flanges and with both ends of firestop device(s) filled with nominal 1/8 in. (3.2 mm) of Moldable Putty+.

3M COMPANY — Moldable Putty+, CP 25WB+, IC 15WB+, 3000 WT. CP 25WB+ not suitable for use with CPVC pipes.

+ Bearing the UL Listing Mark

++ Bearing the UL Recognized Component Mark

* Bearing the UL Classification Mark

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SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Fire-rated hollow metal doors and frames.
- C. Thermally insulated hollow metal doors with frames.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware.
- B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.

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. SDI - Steel Door Institute.
- G. UL - Underwriters Laboratories.

1.04 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.
- C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2018.
- D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.
- 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 2020.
- 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 2021a.
- 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 2018a.
- I. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames 2016.
- J. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- K. ITS (DIR) - Directory of Listed Products current edition.
- 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 2007.
- O. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames 2014.
- P. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2019.
- Q. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2017.
- R. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2013.
- S. UL (DIR) - Online Certifications Directory Current Edition.
- T. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

1.05 SUBMITTALS

- A. See Section 01 3000 - 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.

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. 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 company: www.assaabloydss.com/#sle.
 - 2. Therma Tru
 - 3. De La Fontaine Inc: www.delafontaine.com.
 - 4. Republic Doors: www.republicdoor.com.
 - 5. Steelcraft, an Allegion brand: www.allegion.com/us.

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2.02 DESIGN CRITERIA

A. Requirements for Hollow Metal Doors and Frames:

1. Steel used for fabrication of doors and frames shall comply with one or more of the following requirements; Galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, Commercial Steel (CS) Type B for each.
 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
 4. Door Edge Profile: steel.
 5. Typical Door Face Sheets: 2 panel.
 6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers 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 Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
 - a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, and at least A60/ZF180 (galvannealed) for corrosive locations.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; 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. Exterior Doors: Thermally insulated.

1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level heavy duty.
 - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 2 panel.
 - d. Door Face Metal Thickness: 20 gage, 0.032 inch (0.8 mm), minimum.
2. Door Thickness: 1-3/4 inch (44.5 mm), nominal.

B. 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 2 - Seamless.
 - d. Door Face Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
 - e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
2. Door Thickness: 1-3/4 inch (44.5 mm), nominal.

C. Fire-Rated Doors:

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 2 - Seamless.
 - d. Door Face Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
 - a. Provide units listed and labeled by UL (DIR) or ITS (DIR).
 - b. Attach fire rating label to each fire rated unit.
3. Door Thickness: 1-3/4 inch (44.5 mm), nominal.

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 gage, 0.042 inch (1.0 mm), minimum.
3. Frame Finish: Factory primed and field finished.
4. Weatherstripping: Separate, see Section 08 7100.

C. Interior Door Frames, Non-Fire Rated: Knock-down type.

1. Terminated Stops: Provide at interior doors; closed end stop terminated 6 inch (150 mm), maximum, above floor at 45 degree angle.
2. Frame Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
3. Frame Finish: Factory finished.

D. Door Frames, Fire-Rated: Knock-down type.

1. Fire Rating: Same as door, labeled.
2. Terminated Stops: Provide at interior doors; closed end stop terminated 6 inch (150 mm), maximum, above floor at 45 degree angle.
3. Frame Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
4. Frame Finish: Factory finished.

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2.05 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

- A. Glazing: As specified in Section 08 8000, factory installed.
- B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- C. 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.
- D. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.
- E. Threshold: Therma Tru barrier free/ADA compliant.

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.
- D. Verify necessary flashings are in place at exterior doors before installation.

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. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Install door hardware as specified in Section 08 7100.
- E. Comply with glazing installation requirements of Section 08 8000.
- F. At exterior doors install necessary flashing at head of door appropriate to the detail and adjacent materials.
- G. Coordinate installation of electrical connections to electrical hardware items.
- H. 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.

3.06 SCHEDULE

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

END OF SECTION

SECTION 08 1433 - STILE AND RAIL HARDBOARD DOORS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Interior stile and rail hardboard doors.
 - 2. Shop priming, Factory finishing stile and rail hardboard doors.
 - 3. Factory fitting stile and rail hardboard doors to frames and factory machining for hardware.
- B. Related Sections include the following:
 - 1. Division 6 Section "Finish Carpentry, Interior Architectural Woodwork" for wood door frames.
 - 2. Division 6 Section "Interior Architectural Woodwork" for requirements for veneers from the same flitches for both architectural woodwork and stile and rail hardboard doors.

1.03 SUBMITTALS

- A. Product Data: For each type of door. Include details of construction.
 - 1. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data, including those for stiles, rails, panels, and moldings (sticking); and other pertinent data.
 - 1. Indicate dimensions and locations of mortises and holes for hardware.
 - 2. Indicate requirements for veneer matching.
 - 3. Indicate doors to be factory finished and finish requirements.
 - 4. Indicate fire ratings for fire doors.
- C. Samples for Initial Selection: For factory-finished doors.
- D. Samples for Verification: Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edgings representing typical range of color and grain for each species of veneer and solid lumber required. Finish sample with same materials proposed for factory-finished doors.
- E. Product Certificates: Signed by door manufacturers.
- F. Warranty: Special warranty specified in this Section.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain stile and rail doors through one source from a single manufacturer.
- B. Quality Standard for Doors of Stock Design and Construction: Comply with WDMA I.S.6, "Industry Standard for Wood Stile and Rail Doors," unless more stringent requirements are specified.
 - 1. Mark, label, or otherwise identify stile and rail hardboard doors as complying with WDMA I.S.6, and include panel design number if applicable.
- C. Fire-Rated Wood Doors and Frames: Doors and frames complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.
 - 1. Test Pressure: After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches (1000 mm) or less above the sill.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in opaque plastic bags or cardboard cartons.
- C. Mark each door on top and bottom edge with opening number used on Shop Drawings.

1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.07 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, and have warped (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
 - 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 2. Warranty shall be in effect during the following period of time from date of Substantial Completion:
 - a. Interior Doors: Five years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Basis-of-Design Product: The design for each stile and rail door is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.02 MATERIALS

- A. General: Use only materials that comply with referenced quality standards unless more stringent requirements are specified.
 - 1. Assemble interior doors, frames, and sidelites, including components, with either dry-use or wet-use adhesives complying with ASTM D 5572 for finger joints and ASTM D 5751 for joints other than finger joints.
- B. Low-Emitting Materials:
 - 1. Provide doors made with adhesives and composite wood products that do not contain urea-formaldehyde resins.

- C. Panel Products: Any of the following:
 - 1. Particleboard made from wood particles, with binder containing no urea-formaldehyde resin, complying with ANSI A208.1, Grade M-2.
 - 2. Particleboard made from straw, complying with ANSI A208.1, Grade M-2.
 - 3. Medium-density fiberboard made from wood fiber, with binder containing no urea-formaldehyde resin, complying with ANSI A208.2, Grade MD.
 - 4. Medium-density fiberboard made from agricultural waste fiber, complying with ANSI A208.2, Grade MD.
 - 5. Hardboard, complying with AHA A135.4.
 - 6. Veneer core plywood, made with adhesive containing no urea-formaldehyde resin.
- 2.03 STILE AND RAIL DOORS OF STOCK DESIGN AND CONSTRUCTION
 - A. Manufacturer – Basis of Design:
 - 1. Molded Panel Series doors as manufactured by Masonite International Corporation with panel configuration as shown on the drawings.
 - B. Interior Doors:
 - 1. Door facings are to be bonded to stiles, rails and core forming a 3 ply structural attachment.
 - 2. Wood Materials for Opaque Finish: Manufacturer's standard materials and cut for stiles and rails; with panels of same species or wood-base construction materials, as standard with manufacturer.
 - 3. Interior Door Types:
 - a. Raised panel doors both rated and unrated as depicted on the drawings.
 - C. Door Frames:
 - 1. Wood jambs shall be fabricated as flat jamb with doorstop applied or 2-piece split jamb. Hinge jamb preparations for 1 3/8" thick doors to be machined for standard weight radius ;mortise 3 1/2" hinges and 1 3/4" doors machined to accept 4" hinges. Strike jamb preparations shall be machined for scheduled hardware.
- 2.04 INTERIOR FIRE-RATED DOOR FRAMES
 - A. Manufacturers:
 - 1. Masonite International Corporation.
 - B. Frames, complete with casings, fabricated from solid fire-retardant-treated wood or from veneered fire-retardant particleboard, fire-retardant medium-density fiberboard, or mineral board.
- 2.05 FABRICATION
 - A. Fabricate stile and rail hardboard doors in sizes indicated for Project-site fitting.
 - B. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
 - 1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/2 inch (13 mm) from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 3/8 inch (10 mm) from bottom of door to top of threshold.
 - a. Comply with NFPA 80 for fire-rated doors.
 - 2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
 - 3. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) on lock edge; trim stiles and rails only to extent permitted by labeling agency.
 - C. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W Series standards, and hardware templates.
 - 1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 - D. Glazed Openings: Glaze doors at factory with glass of type and thickness indicated, complying with Division 8 Section "Glazing." Install glass using manufacturer's standard elastomeric glazing sealant complying with ASTM C 920. Secure glass in place with removable wood stops.
 - E. Glazed Openings: Trim openings indicated for glazing with solid wood moldings, with one side removable.
 - F. Transom and Side Panels: Fabricate panels to match adjoining doors in materials, finish, and quality of construction.
 - G. Exterior Doors: Factory treat exterior doors after fabrication with water-repellent preservative to comply with WDMA I.S.4. Flash top of outswinging doors with manufacturer's standard metal flashing.
- 2.06 SHOP PRIMING
 - A. Doors for Opaque Finish: Shop apply one coat of wood primer specified in Division 9 Section "Painting" to faces and edges of doors, including mortises and cutouts.
- 2.07 Finishes:
 - A. Doors shall receive smooth hardboard facing with manufacturer's factory applied prime paint.
- PART 3 EXECUTION
- 3.01 EXAMINATION
 - A. Examine doors and substrates, with Installer present, for suitable conditions where wood stile and rail doors and fire-rated wood door frames will be installed.
 - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
 - 2. Reject doors with defects.
 - B. Proceed with installation only after unsatisfactory conditions have been corrected.
- 3.02 INSTALLATION
 - A. Install fire-rated wood door frames level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
 - 1. Countersink fasteners, fill surface flush, and sand smooth.
 - B. Hardware: For installation, see Division 8 Section "Door Hardware."

- C. Install wood doors to comply with manufacturer's written instructions and with referenced quality standard, and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
 - D. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted with fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.
 - 1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold.
 - a. Comply with NFPA 80 for fire-rated doors.
 - 2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
 - 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.
 - G. Field-Finished Doors: Refer to the following for finishing requirements:
 - 1. Division 9 Section "Painting."
- 3.03 ADJUSTING AND PROTECTING
- A. Operation: Rehang or replace doors that do not swing or operate freely.
 - B. Finished Doors: Replace doors that are damaged or 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 081433

SECTION 08 3100 - ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall access door and frame units.
- B. Ceiling access door and frame units.

1.02 RELATED REQUIREMENTS

- A. Section 23 3300 - Air Duct Accessories: Access doors in ductwork.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate exact position of each access door and/or panel unit.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

- A. Wall-Mounted Units:
 - 1. Location: As indicated on drawings.
 - 2. Material: Steel.
 - 3. Size: 12 inch by 12 inch (305 mm by 305 mm).
 - 4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
- B. Wall-Mounted Units in Wet Areas:
 - 1. Location: As indicated on drawings.
 - 2. Material: Steel, hot-dipped zinc, or zinc-aluminum-alloy coated.
 - 3. Size: 12 inch by 12 inch (305 mm by 305 mm).
 - 4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
- C. Fire-Rated Wall-Mounted Units:
 - 1. Location: As indicated on drawings.
 - 2. Wall Fire-Rating: As indicated on drawings.
 - 3. Material: Steel.
 - 4. Size: 12 inch by 12 inch (305 mm by 305 mm).
 - 5. Door/Panel: Insulated double-surface panel, with tool-operated spring or cam lock and no handle.
- D. Ceiling-Mounted Units:
 - 1. Location: As indicated on drawings.
 - 2. Material: Steel.
 - 3. Size - Lay-In Grid Ceilings: To match module of ceiling grid.
 - 4. Size - Other Ceilings: 12 inch by 12 inch (305 mm by 305 mm).
 - 5. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
- E. Fire-Rated Ceiling-Mounted Units:
 - 1. Location: As indicated on drawings.
 - 2. Ceiling Fire-Rating: As indicated on drawings.
 - 3. Material: Steel.
 - 4. Size: 12 inch by 12 inch (305 mm by 305 mm).
 - 5. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

2.02 WALL AND CEILING MOUNTED UNITS

- A. Manufacturers:
 - 1. ACUDOR Products Inc: www.acudor.com/#sle.
 - 2. Babcock-Davis: www.babcockdavis.com/#sle.
 - 3. Cendrex, Inc: www.cendrex.com/#sle.
 - 4. Cesco Products; www.cescoproducts.com.
 - 5. Karp Associates, Inc: www.karpinc.com.
 - 6. Milcor by Commercial Products Group of Hart & Cooley, Inc: www.milcorinc.com.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings are correctly sized and located.

3.02 PREPARATION

3.03 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

SECTION 08 7100 - DOOR HARDWARE

PART 2 PRODUCTS

1.01 DESIGN AND PERFORMANCE CRITERIA

- A. Provide specified door hardware to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
- B. Provide individual items of single type, of same model, and by same manufacturer.
- C. Provide door hardware products that comply with the following requirements:
 - 1. Applicable provisions of federal, state, and local codes.
 - 2. Fire-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
 - 3. Hardware on Fire-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for application indicated.

1.02 FINISHES

END OF SECTION

Central Detroit Christian - Kingston
8840 2nd Avenue, Detroit, Michigan 48207

Hardware Set No. 001

For use on door #(s):

001A 001B

Each To Have:

Qty	Description	Catalog Number	Finish	Mfr
3 EA	HINGE	RC1542 4 X 4	652	HAGER
1 EA	CLOSER	5400	ALM	HAGER
1 EA	PANIC DEVICE	4701 RIM/ARCHER KEY IN LEVER	ALM	HAGER
1 EA	GASKETING	726S	BLK	HAGER
1 EA	DOOR BOTTOM	331	BLK	NGP

Hardware Set No. 002

For use on door #(s):

**100A 100B 100C 200A 200B 300A
300B**

Each To Have:

Qty	Description	Catalog Number	Finish	Mfr
3 EA	HINGE	RC1542 4 x 4	652	HAGER
1 EA	CLOSER	5400	ALM	HAGER
1 EA	PULL PLATE	36N 4 x 16	630	HAGER
1 EA	PUSH PLATE	80S 4 x 16	630	HAGER
1 EA	GASKETING	726S	BLK	HAGER
1 EA	DOOR BOTTOM	331	BLK	NGP

Hardware Set No. 003

For use on door #(s):

003 008

Each To Have:

Qty	Description	Catalog Number	Finish	Mfr
3 EA	HINGE	RC1542 4 X 4	652	HAGER
1 EA	CLOSER	5400	ALM	HAGER
1 EA	STOREROOM LOCK	2580 ARCHER	652	HAGER
1 EA	GASKETING	726S	BLK	HAGER
1 EA	DOOR BOTTOM	331	BLK	NGP

Hardware Set No. 004

For use on door #(s):

002 004 005 007

Each To Have:

Qty	Description	Catalog Number	Finish	Mfr
3 EA	HINGE	RC1542 4 X 4	652	HAGER
1 EA	CLOSER	5400	ALM	HAGER
1 EA	PASSAGE SET	2510 ARCHER	652	HAGER
1 EA	GASKETING	726S	BLK	HAGER
1 EA	DOOR BOTTOM	331	BLK	NGP

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Hardware Set No. 005

For use on door #(s):
006

Each To Have:

Qty	Description	Catalog Number	Finish	Mfr
6 EA	HINGE	RC1542 4 X 4	652	HAGER
2 EA	ROLLER LATCH	335	626	IVES
1 EA	DOUBLE DUMMY	2527 ARCHER	652	HAGER
2 EA	HINGE DOOR STOP	212	652	HAGER

Hardware Set No. 006

For use on door #(s):
012A

Each To Have:

Qty	Description	Catalog Number	Finish	Mfr
3 EA	HINGE	RC1542 4 X 4	652	HAGER
1 EA	CLOSER	5400	ALM	HAGER
1 EA	PRIVACY SET	2540 ARCHER	652	HAGER
1 EA	GASKETING	726S	BLK	HAGER
1 EA	DOOR BOTTOM	331	BLK	NGP

Hardware Set No. 007

For use on door #(s):
012B

Each To Have:

Qty	Description	Catalog Number	Finish	Mfr
3 EA	HINGE	RC1542 4 X 4	652	HAGER
1 EA	PASSAGE SET	2510 ARCHER	652	HAGER
1 EA	FLEXIBLE DOOR STOP	211	652	HAGER

Hardware Set No. U01

For use on door #(s):
U100

Each To Have:

Qty	Description	Catalog Number	Finish	Mfr
3 EA	HINGE	RC1542 4 X 4	652	HAGER
1 EA	CLOSER	5400	ALM	HAGER
1 EA	ENTRY LOCK	2553 ARCHER	652	HAGER
1 EA	DEADLOCK	3115	652	HAGER
1 EA	FLEXIBLE DOOR STOP	211	652	HAGER
1 EA	GASKETING	726S	BLK	HAGER
1 EA	DOOR BOTTOM	331	BLK	NGP
1 EA	THRESHOLD	412S	MIL	HAGER
1 EA	DOOR VIEWER	1759 (185 DEG.)	626	HAGER

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Hardware Set No. U02

For use on door #(s):
U106

Each To Have:

Qty	Description	Catalog Number	Finish	Mfr
3 EA	HINGE	BY PREHUNG DOOR MANF.	652	B/O
1 EA	PASSAGE SET	2510 ARCHER	652	HAGER
1 EA	FLEXIBLE DOOR STOP	211	652	HAGER

Hardware Set No. U03

For use on door #(s):
U102 U103 U104 U105

Each To Have:

Qty	Description	Catalog Number	Finish	Mfr
3 EA	HINGE	BY PREHUNG DOOR MANF.	652	B/O
1 EA	PRIVACY SET	2540 ARCHER	652	HAGER
1 EA	FLEXIBLE DOOR STOP	211	652	HAGER

Hardware Set No. U04

For use on door #(s):
U107

Each To Have:

Qty	Description	Catalog Number	Finish	Mfr
1 EA	BI-FOLD SET	9861 – 5' BI-FOLD SET	ALM	HAGER
2 EA	PULLS	305D	652	HAGER

Hardware Set No. U05

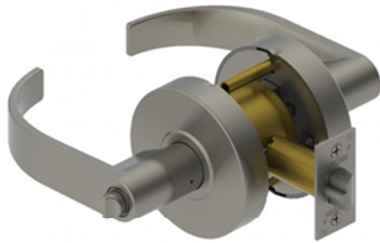
For use on door #(s):
U108

Each To Have:

Qty	Description	Catalog Number	Finish	Mfr
1 EA	BI-FOLD SET	9861 – 4' BI-FOLD SET	ALM	HAGER
2 EA	PULLS	305D	652	HAGER

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HAGER
US260
Satin Chrome

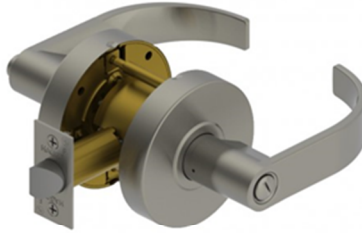


ARCHER LEVER

Smaller images supercede the lock function and finish

2553 Entry-F109

HAGER
US260
Satin Chrome

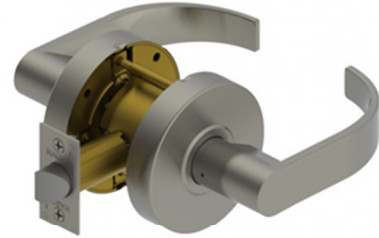


ARCHER LEVER

Smaller images supercede the lock function and finish

2540 Privacy-F76A

HAGER
US260
Satin Chrome

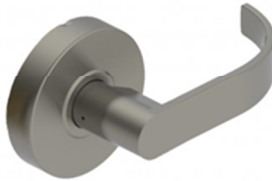


ARCHER LEVER

Smaller images supercede the lock function and finish

2510 Passage-F75

HAGER
US260
Satin Chrome



ARCHER LEVER

Smaller images supercede the lock function and finish

2527 Dummy - Double

HAGER
US260
Satin Chrome

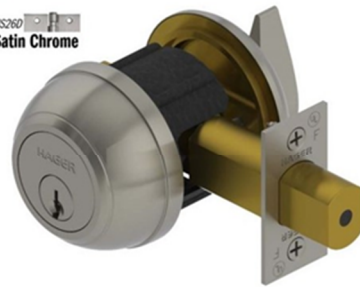


ARCHER LEVER

Smaller images supercede the lock function and finish

2580 Storeroom-F86

HAGER
US260
Satin Chrome



3115 SINGLE CYLINDER-E2151

HAGER
Sprayed Aluminum (ALM)



4700 SERIES RIM DEVICE

Smaller image of finish supercedes larger image

4700

HAGER
Sprayed Aluminum (ALM)



Smaller images supercede the door closer finish and arm

5400 Series

HAGER
US260
Satin Chrome



Wire Pull
Smaller image of finish supercedes larger image

305D

HAGER
US320
Satin Stainless



Pull Plate
Smaller image of finish supercedes larger image

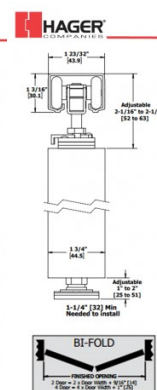
36N

HAGER
US320
Satin Stainless



Square Corner-Beveled Push Plate
Smaller image of finish supercedes larger image

80S



Heavy Duty Aluminum Box Track and Hardware



9861-Bi-Fold

Central Detroit Christian - Kingston
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END OF SECTION

SECTION 08 9100 - LOUVERS

PART 2 PRODUCTS

1.01 LOUVERS

- A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.

END OF SECTION

20132C / Central Detroit Christian Piety Hill Kingston Place	08 9100 - 1	Louvers

SECTION 09 0561 - COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This section applies to floors identified in contract documents that are receiving the following types of floor coverings:
 - 1. Resilient tile and sheet.
 - 2. Broadloom carpet.
 - 3. Carpet tile.
 - 4. Thin-set ceramic tile and stone tile.
- B. Preparation of new and existing concrete floor slabs for installation of floor coverings.
- C. Testing of concrete floor slabs for moisture and alkalinity (pH).
- D. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
 - 1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.
- E. Patching compound.
- F. Remedial floor coatings.
- G. Remedial floor sheet membrane.
- H. Preparation of new and existing wood-based floors and subfloors for installation of new floor coverings.

1.02 REFERENCE STANDARDS

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens) 2021.
- B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete 2020.
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2021.
- D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2016a.
- E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.04 SUBMITTALS

- A. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
 - 1. Moisture and alkalinity (pH) limits and test methods.
 - 2. Manufacturer's required bond/compatibility test procedure.
- B. Testing Agency's Report:
 - 1. Description of areas tested; include floor plans and photographs if helpful.
 - 2. Summary of conditions encountered.
 - 3. Moisture and alkalinity (pH) test reports.
 - 4. Copies of specified test methods.
 - 5. Recommendations for remediation of unsatisfactory surfaces.
 - 6. Submit report to Architect.
 - 7. Submit report not more than two business days after conclusion of testing.
- C. Adhesive Bond and Compatibility Test Report.

1.05 QUALITY ASSURANCE

- A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
 - 1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
- C. Contractor's Responsibility Relating to Independent Agency Testing:
 - 1. Provide access for and cooperate with testing agency.
 - 2. Confirm date of start of testing at least 10 days prior to actual start.
 - 3. Allow at least 4 business days on site for testing agency activities.
 - 4. Achieve and maintain specified ambient conditions.
 - 5. Notify Architect when specified ambient conditions have been achieved and when testing will start.
- D. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

1.07 FIELD CONDITIONS

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F (18 degrees C) or more than 85 degrees F (30 degrees C).
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
 - 1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
 - 2. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

- A. Perform following operations in the order indicated:
 - 1. Preliminary cleaning.
 - 2. Moisture vapor emission tests; 3 tests in the first 1000 square feet (100 square meters) and one test in each additional 1000 square feet (100 square meters), unless otherwise indicated or required by flooring manufacturer.
 - 3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 - 4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 - 5. Specified remediation, if required.
 - 6. Patching, smoothing, and leveling.
 - 7. Other preparation specified.
 - 8. Adhesive bond and compatibility test.
 - 9. Protection.
- B. Remediations:
 - 1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
 - 2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
 - 3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 PRELIMINARY CLEANING

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
- B. Do not use solvents or other chemicals for cleaning.

3.03 MOISTURE VAPOR EMISSION TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.
- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet (1.4 kg per 93 square meters) per 24 hours.
- F. Report: Report the information required by the test method.

3.04 INTERNAL RELATIVE HUMIDITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F2170 Procedure A and as follows.
- D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.
- F. Report: Report the information required by the test method.

3.05 ALKALINITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
- C. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
- D. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch (25 mm) in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.

- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.
- 3.06 PREPARATION
- A. See individual floor covering section(s) for additional requirements.
 - B. Comply with requirements and recommendations of floor covering manufacturer.
 - C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
 - D. Do not fill expansion joints, isolation joints, or other moving joints.
- 3.07 ADHESIVE BOND AND COMPATIBILITY TESTING
- A. Comply with requirements and recommendations of floor covering manufacturer.
- END OF SECTION

SECTION 09 2116 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Acoustic insulation.
- C. Gypsum sheathing.
- D. Cementitious backing board.
- E. Gypsum wallboard.
- F. Joint treatment and accessories.
- G. Textured finish system.

1.02 RELATED REQUIREMENTS

- A. Section 07 2500 - WEATHER BARRIERS: Water-resistive barrier over sheathing.

1.03 REFERENCE STANDARDS

- A. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.
- B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 1999 (Reaffirmed 2016).
- C. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017.
- D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.
- E. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.
- F. 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 2020.
- G. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base 2019.
- H. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2017.
- I. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel 2017.
- J. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing 2018.
- K. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units 2021.
- L. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.
- M. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels 2019, with Editorial Revision (2020).
- N. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2016.
- O. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).
- P. ASTM E413 - Classification for Rating Sound Insulation 2016.
- Q. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015 (Reapproved 2021)e1.
- R. GA-216 - Application and Finishing of Gypsum Panel Products 2018.
- S. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association 2016.
- T. UL (FRD) - Fire Resistance Directory Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
- C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
- 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. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
 - 1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft (0.24 kPa) with maximum mid-span deflection of L/240.
 - 2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- D. Shaft Walls at Elevator Shafts: Provide completed assemblies with the following characteristics:
 - 1. Air Pressure Within Shaft: Intermittent loads of 5 lbf/sq ft (0.24 kPa) with maximum mid-span deflection of L/240.
 - 2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- E. Fire Rated Assemblies: Provide completed assemblies with the following characteristics:
 - 1. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 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.

20132C / Central Detroit Christian Piety Hill Kingston Place	09 2116 - 1	Gypsum Board Assemblies

4. Lafarge North America Inc: www.lafargenorthamerica.com.
 5. National Gypsum Company: www.nationalgypsum.com/#sle.
 6. PABCO Gypsum: www.pabco gypsum.com/#sle.
 7. Temple-Inland Building Product by Georgia-Pacific, LLC: www.temple.com.
 8. USG Corporation: www.usg.com/#sle.
- 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.
 - a. Use Glass-mat faced gypsum panels above shower surrounds from top of surround to ceiling.
 - b. Use Glass-mat faced gypsum panels anywhere panels may be exposed to becoming wet from inclement weather during construction.
 3. Unfaced fiber-reinforced gypsum panels as defined in ASTM C1278/C1278M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
 4. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
 5. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 6. Glass-Mat-Faced Products (non paper faced): Provide where indicated on plans.
 - a. Georgia-Pacific Gypsum; DensArmor Plus.
 - b. Georgia-Pacific Gypsum; DensArmor Plus Fireguard C.
 - c. National Gypsum Company; Gold Bond eXP Interior Extreme Gypsum Panel.
 - d. Temple-Inland Building Product by Georgia-Pacific, LLC; GreenGlass Interior Gypsum Board.
 - e. National Gypsum Company; Gold Bond eXP Fire-Shield Interior Extreme Gypsum Panel.
 - f. USG Corporation; USG Sheetrock Brand Glass-Mat Panels Mold Tough.
- C. Backing Board For Wet Areas: One of the following products:
1. Application: Surfaces behind tile in wet areas including bathrooms without showers..
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. ANSI Cement-Based Board behind tile: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
 - a. Thickness: 1/2 inch (12.7 mm).
 - b. Products:
 - 1) Custom Building Products: www.custombuildingproducts.com/#sle.
 - 2) National Gypsum Company; PermaBase Brand Cement Board.
 - 3) National Gypsum Company; PermaBase Flex Brand Cement Board.
 - 4) USG Corporation: www.usg.com/#sle.
- D. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
1. Application: Vertical surfaces behind thinset tile, except in wet areas.
 2. Edges: Tapered.
 3. Products:
 - a. American Gypsum Company; M-Bloc.
 - b. American Gypsum Company; M-Bloc Type X.
 - c. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board.
 - d. Georgia-Pacific Gypsum; DensArmor Plus.
 - e. National Gypsum Company; Gold Bond XP Gypsum Board.
- E. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.
 2. Thickness: as indicated on drawings .
 3. Edges: Tapered.
- F. Exterior Sheathing Board **and board at shower enclosure walls and ceilings for a distance of 4' from back wall:** Sizes to minimize joints in place; ends square cut.
1. Application: Exterior sheathing and shower walls unless otherwise indicated.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. Fungal Resistance: No fungal growth when tested in accordance with ASTM G21.
 4. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
 5. Core Type: Type X, as indicated.
 6. Type X Thickness: 5/8 inch (16 mm).
 7. Edges: Square.
 8. Glass Mat Faced Products:
 - a. CertainTeed Corporation; GlasRoc Brand.
 - b. Georgia-Pacific Gypsum; DensGlass Sheathing.
 - c. National Gypsum Company; Gold Bond eXP Sheathing.

2.03 ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: [3 5/8"] inch ([_____] mm).

- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- C. Water-Resistive Barrier: As specified in Section 07 2500.
- D. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
 - 1. Types: As detailed or required for finished appearance.
- E. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 - 1. Fiberglass Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
 - 2. Paper Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
 - 3. Joint Compound: Drying type, vinyl-based, ready-mixed.
 - 4. Joint Compound: Setting type, field-mixed.
- F. High Build Drywall Surfer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
- G. Textured Finish Materials: Latex-based compound; plain.
 - 1. Primer: Of type recommended by texture finish manufacturer.
 - 2. USG Sheetrock Brand Ceiling Spray Texture-QT Poly, medium polystyrene aggregate.
- H. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping 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 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.

3.03 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 Non-Rated: 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. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
- D. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- E. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
 - 1. Paper-Faced Sheathing: Immediately after installation, protect from weather by application of water-resistive barrier.
- F. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- G. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.
- H. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For non-rated assemblies, install as follows:
 - 1. Single-Layer Applications: Screw attachment.
 - 2. Double-Layer Application: Install base layer using screws. Install face layer using adhesive.
- I. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
- B. Corner Beads: Install at external corners, using longest practical lengths.

3.05 JOINT TREATMENT

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.
- B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 1: Fire 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. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-216.
 - 1. Level 1 for ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistive-rated assemblies and sound-rated assemblies.
 - 2. Level 2 where water-resistant gypsum backing board panels form substrates for tile, and where indicated.
 - 3. Level 3 for gypsum board surfaces to receive medium texture.
 - 4. Level 4 for gypsum board surfaces to be painted flat or to receive wallcoverings.
 - 5. Level 5 for gypsum board surfaces to be painted gloss or semi-gloss.
- E. Where Level 5 finish is indicated, spray apply high build drywall surfer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.
- F. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.06 PENETRATIONS

- A. Fill openings created by penetrating items in unrated assemblies and draftstopping. Where exposed, finish to match level of remaining wall.

3.07 TEXTURE FINISH

- A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample.

3.08 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.

END OF SECTION

SECTION 09 3000 - TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Cementitious backer board as tile substrate.
- D. Ceramic accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 9005 - Joint Sealers.

1.03 REFERENCE STANDARDS

- A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium) 2019.
- B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar 2017.
- C. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 2017.
- D. ANSI A108.1c - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 1999 (Reaffirmed 2021).
- E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive 2019.
- F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar 2020.
- G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy 1999 (Reaffirmed 2019).
- H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout 1999 (Reaffirmed 2019).
- I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout 1999 (Reaffirmed 2019).
- J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework 2017.
- K. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.
- L. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar 1999 (Reaffirmed 2019).
- M. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2005 (Reaffirmed 2021).
- N. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation 2010 (Reaffirmed 2016).
- O. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation 2014.
- P. ANSI A118.13 - American National Standard Specifications for Bonded Sound Reduction Membranes for Thin-Set Ceramic Tile Installation 2014.
- Q. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar 2012.
- R. ANSI A136.1 - American National Standard for Organic Adhesives for Installation of Ceramic Tile 2008 (Reaffirmed 2013).
- S. ANSI A137.1 - American National Standard Specifications for Ceramic Tile 2021.
- T. ASTM E492 - Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine 2009, with Editorial Revision (2016).
- U. ASTM E2179 - Standard Test Method for Laboratory Measurement of the Effectiveness of Floor Coverings in Reducing Impact Sound Transmission Through Concrete Floors 2021.
- V. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2019.

1.04 SUBMITTALS

- A. See Section 01 3000 - 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, and setting details.
- D. Samples: minimum one sample per tile specified illustrating pattern and color variations.
- E. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of and ANSI A108/A118/A136 and TCNA (HB) on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
- C. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

1.06 MOCK-UP

- A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.
- B. Construct tile mock-up where indicated on drawings, incorporating all components specified for the location.

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1. Minimum size of mock-up is indicated on drawings.
 2. Approved mock-up may remain as part of the Work.
- 1.07 DELIVERY, STORAGE, AND HANDLING
- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.
- 1.08 FIELD CONDITIONS
- A. Do not install solvent-based products in an unventilated environment.
 - B. Maintain ambient and substrate temperature of 50 degrees F (10 degrees C) during installation of mortar materials.
- PART 2 PRODUCTS
- 2.01 TILE
- A. Manufacturers:
 1. American Olean Corporation: www.americanolean.com/#sle.
 2. Dal-Tile Corporation: www.daltile.com/#sle.
 3. Emser Tile, LLC: www.emser.com/#sle.
 4. Summitville Tiles, Inc: www.summitville.com.
 5. Substitutions: See Section 01 6000 - Product Requirements.
 - B. Ceramic Mosaic Tile, Glazed Wall Tile, Quarry Tile, Porcelain : ANSI A137.1, standard grade.
 - C. Furnish tile complying with "Standard Grade" requirements unless otherwise indicated or specified on drawings.
- 2.02 TRIM AND ACCESSORIES
- A. Ceramic Accessories: Glazed finish, same color and finish as adjacent field tile; same manufacturer as tile.
- 2.03 SETTING MATERIALS
- A. Manufacturers:
 1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
 2. Bostik Inc: www.bostik-us.com/#sle.
 3. Custom Building Products: www.custombuildingproducts.com/#sle.
 4. LATICRETE International, Inc: www.laticrete.com/#sle.
 5. MAPEI: www.mapei.com/us2.
 - B. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.
 1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.
 2. Products:
 - a. ARDEX Engineered Cements; S 28: www.ardexamericas.com/#sle.
 - b. Custom Building Products; Complete Contact-LFT Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: www.custombuildingproducts.com/#sle.
 - c. LATICRETE International, Inc; LATICRETE 254 Platinum: www.laticrete.com/#sle.
 3. MAPEI: Keraflex Super
 - C. Organic Adhesive: ANSI A136.1, thinset mastic type.
 1. Use Type I in areas subject to prolonged moisture exposure.
 2. Products:
 - a. ARDEX Engineered Cements; ARDEX D14: www.ardexamericas.com/#sle.
 - b. Custom Building Products; ReliaBond Ceramic Tile Adhesive - Type 1: www.custombuildingproducts.com/#sle.
 - c. LATICRETE International, Inc; LATICRETE 15 Premium Mastic: www.laticrete.com/#sle.
 3. MAPEI: Type 1 Tile Adhesive.
- 2.04 GROUTS
- A. Manufacturers:
 1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
 2. Bostik Inc: www.bostik-us.com/#sle.
 3. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.
 4. Merkrete, by Parex USA, Inc: www.merkrete.com/#sle.
 5. Substitutions: See Section 01 6000 - Product Requirements.
 6. MAPEI: www.mapei.com/us.
 - B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
 1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
 2. Use sanded grout for joints 1/8 inch (3.2 mm) wide and larger; use unsanded grout for joints less than 1/8 inch (3.2 mm) wide.
 3. Color(s): As indicated on drawings.
 4. MAPEI: Ultracolor Plus FA
 5. Products:
 - a. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.
 - b. Merkrete, by Parex USA, Inc; Merkrete Pro Grout: www.merkrete.com/#sle.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
 - C. Stain Resistant Grout Additive: Liquid admixture for sanded and unsanded cement-based grouts; mix with dry grout material in place of water.
 1. Applications: throughout.
 2. Products:
 - a. H.B. Fuller Construction Products Inc. Grout Boost Advanced Pro; www.groutboost.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- 2.05 Maintenance Materials
- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
 1. Applications: Between tile and plumbing fixtures.
 2. Color(s): As selected by Architect from manufacturer's full line.

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3. Products:
 - a. ARDEX Engineered Cements; ARDEX SX: www.ardexamericas.com/#sle.
 - b. Custom Building Products; Commercial 100% Silicone Caulk: www.custombuildingproducts.com/#sle.
 - c. LATICRETE International, Inc; LATICRETE LATASIL: www.laticrete.com/#sle.
 - d. Merkrete, by Parex USA, Inc; Merkrete Colored Caulking: www.merkrete.com/#sle.
 4. MAPEI: Mapesil T
 - B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
 1. Composition: Water-based colorless silicone.
- 2.06 ACCESSORY MATERIALS
- A. Underlayment at Floors: Specifically designed for bonding to thin-set setting mortar; not primarily a waterproofing material and having the following characteristics:
 1. Sound Reduction: Comply with ANSI A118.13 bonded membrane, ASTM E2179, ASTM E492, ANSI A118.13 bonded membrane, ASTM E2179, ASTM E492, ANSI A118.13 bonded membrane, ASTM E2179, and ASTM E492.
 2. Water Resistance: Comply with ANSI A118.10, bonded waterproofing.
 3. MAPEI: Mapesonic RM
 - B. Cementitious Backer Board: ANSI A118.9; High density, cementitious, glass fiber reinforced, 1/2 inch (13 mm) thick; 2 inch (50 mm) wide coated glass fiber tape for joints and corners. See Section 092116.
- PART 3 EXECUTION
- 3.01 EXAMINATION
- A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
 - B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
 - C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.
 - D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.
- 3.02 PREPARATION
- A. Protect surrounding work from damage.
 - B. Vacuum clean surfaces and damp clean.
 - C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
 - D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.
 - E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.
- 3.03 INSTALLATION - GENERAL
- A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
 - 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. Form internal angles square and external angles bullnosed.
 - F. Install ceramic accessories rigidly in prepared openings.
 - G. Sound tile after setting. Replace hollow sounding units.
 - H. Keep control and expansion joints free of mortar, grout, and adhesive.
 - I. Keep expansion joints free of adhesive or grout. Apply sealant to joints.
 - J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
 - K. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
 - L. 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.
 - M. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.
- 3.04 INSTALLATION - FLOORS - THIN-SET METHODS
- A. Over exterior concrete substrates, install in accordance with TCNA (HB) Method F102, with standard grout.
 - B. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
 1. Use uncoupling membrane under all tile unless other underlayment is indicated.
 2. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.
 - C. Over wood substrates, install in accordance with TCNA (HB) Method F142, with standard grout, unless otherwise indicated.
 - D. Over wood substrate with backer board underlayment, install in accordance with TCNA (HB) Method F144, for cementitious backer boards, with standard grout.
- 3.05 INSTALLATION - SHOWERS AND BATHTUB WALLS
- A. At tiled shower receptors install in accordance with TCNA (HB) Method B415, mortar bed floor, and W244, thin-set over cementitious backer unit walls.
 - B. At bathtub walls install in accordance with TCNA (HB) Method B412, over cementitious backer units with waterproofing membrane.

- C. Grout with standard grout as specified above.
 - D. Seal joints between tile work and other work with silicone type sealant specified in Section 07 9005.
- 3.06 INSTALLATION - WALL TILE
- A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.
 - B. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.
 - C. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.
 - D. Over wood studs without backer install in accordance with TCNA (HB) Method W231, mortar bed, with membrane where indicated.
- 3.07 CLEANING
- A. Clean tile and grout surfaces.
- 3.08 PROTECTION
- A. Do not permit traffic over finished floor surface for 4 days after installation.
- 3.09 SCHEDULE
- A. See drawings for specific tile products scheduled for installation.
- END OF SECTION

SECTION 09 5100 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Acoustical units.

1.02 REFERENCE STANDARDS

- A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2017.
- 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 2020.
- D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2019.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning.
- C. Product Data: Provide data on suspension system components.
- D. Samples: Submit two samples ____by____ inch (____by____ mm) in size illustrating material and finish of acoustical units.

1.04 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc: www.armstrong.com.
 - 2. Acoustic Ceiling Products, Inc: www.acpideas.com.
 - 3. CertainTeed Corporation: www.certainteed.com.
 - 4. USG: www.usg.com.
- B. Suspension Systems:
 - 1. Same as for acoustical units.

2.02 ACOUSTICAL UNITS

- A. Manufacturers:
 - 1. Acoustical Tile: Basis-of-Design Product: Subject to compliance with requirements, provide Suprafine by Armstrong with Second Look II 24" x 48", white, or comparable product by one of the following
 - 2.
 - a. Armstrong World Industries, Inc: www.armstrong.com.
 - b. Acoustic Ceiling Products, Inc.: www.acpideas.com.
 - c. CertainTeed Corporation: www.certainteed.com.
 - d. USG: www.usg.com.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- B. Acoustical Units - General: ASTM E1264, type III Class A.
 - 1. Flame Spread Rating: 25 or less (ASTM E84). To meet Federal Spec. SS-S-118a, Class 25.
 - 2. Comply with "Acoustical and Insulating Materials Association" (AIMA) "Performance Data Bulletin".
 - 3. Provide panels that are sag resistant and manufactured for environment with humidity levels up to 100%.
 - 4. Edge: Beveled tegular.
 - 5. Surface Color: White.
 - 6. VOC Content: Certified as Low Emission by one of the following :
 - a. GreenGuard Children and Schools; www.greenguard.org.
 - b. Product listing in the CHPS Low-Emitting Materials Product List at; www.chps.net/manual/lem_table.htm.

2.03 SUSPENSION SYSTEM(S)

- A. Manufacturers:
 - 1. Armstrong World Industries, Inc: www.armstrong.com.
 - 2. Acoustic Ceiling Products, Inc.: www.acpideas.com.
 - 3. CertainTeed Corporation: www.certainteed.com.
 - 4. Chicago Metallic Corporation: www.chicagometallic.com.
 - 5. Hunter Douglas Contract: www.hunterdouglascontract.com.
 - 6. USG: www.usg.com.
 - 7. Substitutions: See Section 01 6000 - Product Requirements.
- B. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
- C. Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; intermediate-duty.
 - 1. Profile: Tee; 15/16 inch (24 mm) wide face.
 - 2. Finish: White painted.
- D. At vinyl faced panels use exposed Aluminum Suspension System Type [____]: Extruded aluminum; intermediate-duty.
 - 1. Profile: Tee; 15/16 inch (24 mm) wide face.
 - 2. Finish: Painted white.

2.04 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Perimeter Moldings: Same material and finish as grid.
 - 1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.
- C. 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. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, ASTM C636/C636M, ASTM E580/E580M, ASTM C636/C636M, and ASTM E580/E580M and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.
- D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- E. 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.
- F. 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.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches (150 mm) of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.
- J. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
 - 2. Overlap and rivet corners.

3.03 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 units after above-ceiling work is complete.
- E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- F. Cutting Acoustical Units:
 - 1. Cut to fit irregular grid and perimeter edge trim.
 - 2. Make field cut edges of same profile as factory edges.

3.04 ATTIC STOCK

- A. Provide one additional box of replacement acoustical ceiling tile to the owner for future use.

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.

END OF SECTION

SECTION 09 6500 - RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Static control resilient sheet flooring.
- B. Resilient tile flooring.
- C. Static control resilient tile flooring.
- D. Resilient base.
- E. Resilient stair accessories.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).
- B. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile 2004 (Reapproved 2018).
- C. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile 2020.
- D. ASTM F1861 - Standard Specification for Resilient Wall Base 2021.
- E. ASTM F2034 - Standard Specification for Sheet Linoleum Floor Covering 2018.
- F. FS RR-T-650 - Treads, Metallic and Nonmetallic, Skid Resistant; Federal Specifications and Standards; Revision E, 1994.
- G. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2019.
- H. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings 2011.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Shop Drawings: Indicate seaming plans and floor patterns.
- D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- E. Verification Samples: Submit two samples, 6 x 9 inch (x mm) in size illustrating color and pattern for each resilient flooring product specified. For heat welding rod, submit manufacturer's standard size, but not less than 9 inches long, of each color specified.
- F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect roll materials from damage by storing on end.

1.06 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 TILE FLOORING

- A. Vinyl Composition Tile[CHOICE TEXT]: Homogeneous, with color extending throughout thickness.
 - 1. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
 - 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648, NFPA 253, ASTM E 648, or NFPA 253.
 - 3. Size: 12 by 12 inch (305 by 305 mm).
 - 4. VOC Content Limits: As specified in Section 01 6116.
 - 5. Thickness: 0.125 inch (3.2 mm).
- B. Vinyl Tile (**vinyl plank**): Printed film type, with transparent or translucent wear layer.
 - 1. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
 - 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648, NFPA 253, ASTM E 648, or NFPA 253.
 - 3. Common Area:
 - a. Plank Tile Size: by inch (by mm).
 - b. Wear Layer Thickness: .020 inch (mm).
 - c. Total Thickness: .096 inch (mm).
 - 4. Living Units:
 - a. Plank Tile Size: by inch (by mm).
 - b. Wear Layer Thickness: 0.012 inch.
 - c. Total Thickness: 0.08 inch.

2.02 STAIR COVERING

- A. Stair Tread / Riser Combination: Rubber tread with integrated riser for the visually impaired; full width and depth of stair tread in one piece; tapered thickness; nosing not less than 1-5/8 inch (41 mm) deep.
 - 1. Manufacturers:
 - a. Burke Flooring; Endura Stair Treads: www.burkeflooring.com/#sle.
 - b. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
 - c. Roppe Corp: www.roppe.com/#sle.
 - 2. Minimum Requirements: Comply with FS RR-T-650 requirements corresponding to type specified.
 - 3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648, NFPA 253, ASTM E 648, or NFPA 253.
 - 4. Nominal Thickness: 0.1875 inch (4.75 mm).

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5. Nosing: Square.
6. Striping: 2 inch (24 mm) wide contrasting color abrasive strips.
7. Color: As indicated on drawings.
8. Manufacturers: Basis of design is Johnsonite, Inc; Product: standard raised round tread/riser visually impaired (virtr-rd): www.johnsonite.com. Other equivalent products are acceptable subject to approval from the Architect:

2.03 RESILIENT BASE

- A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
 1. Manufacturers:
 - a. Burke Flooring; Commercial Wall Base - TS: www.burkeflooring.com/#sle.
 - b. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
 - c. Roppe Corp: www.roppe.com/#sle.
 2. Height: 4 inch (100 mm).
 3. Thickness: 0.125 inch (3.2 mm).
 4. Finish: Satin.
 5. Length: Roll.
 6. Color: As indicated on drawings.
 7. Accessories: Premolded external corners and internal corners.

2.04 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- C. Moldings, Transition and Edge Strips: Same material as flooring.
- D. Filler for Coved Base: Plastic.
- E. Sealer and Wax: Types recommended by flooring manufacturer.

2.05 ATTIC STOCK

- A. Provide the following "attic stock" additional product materials at the conclusion of construction for storage on site by the owner:
 1. All unused flooring materials to be left onsite - materials must be clearly labeled.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- 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 resilient base.
- C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.
 1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Remove existing resilient flooring and flooring adhesives; follow the recommendations of RFCI (RWP).
- B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- C. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.
- D. Prohibit traffic until filler is fully cured.

3.03 Installation - General

- A. Starting installation constitutes acceptance of sub-floor conditions.
- B. Install in accordance with manufacturer's written instructions.

3.04 Installation - Sound Control Underlayment

- A. Install in accordance with underlayment manufacturer's instructions.

3.05 Installation - Sheet Flooring

- A. Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns at seams.
- B. Seams are prohibited in bathrooms, kitchens, toilet rooms, and custodial closets.
- C. Cut sheet at seams in accordance with manufacturer's instructions.
- D. Seal seams by heat welding where indicated.

3.06 Installation - Tile Flooring

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.
- C. Install plank tile with a random offset of at least 6 inches (152 mm) from adjacent rows.

3.07 Installation - Resilient Base

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.
- B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

3.08 Installation - Stair Coverings

- A. Install stair coverings in one piece for full width and depth of tread.
- B. Adhere over entire surface. Fit accurately and securely.

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3.09 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

3.10 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 6813 - TILE CARPETING

PART 2 PRODUCTS

1.01 MATERIALS

A. Tile Carpeting, Type []: Tufted, manufactured in one color dye lot.
END OF SECTION

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SECTION 09 6816 - SHEET CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet, direct-glued.
- B. Carpet, stretched in with cushion underlay.
- C. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied carpet.
- C. Section 03 5400 - Cast Gypsum Based Underlayment.

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 2019a, with Editorial Revision (2020).
- 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 2019.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Samples: Submit one samples illustrating color and pattern for each carpet and cushion material specified.
- D. Submit two, 4 inch () mm) long samples of edge strip for each color specified.
- E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet with minimum three years documented experience.

1.06 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.
- B. Maintain minimum 70 degrees F (21 degrees C) ambient temperature 24 hours prior to, during and 24 hours after installation.
- C. Ventilate installation area during installation and for 72 hours after installation.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Carpet shall be subject to compliance with requirements and as shown on the Drawings. Drawings show manufacture, style, color, texture, and distributor for each carpet type.

2.02 CARPET

- A. All carpet must meet the acceptance criterion of Federal Standard DOCF1-70 for flammability or Class II, 0.22 watts/cm2 per the International Building Code, whichever is greater.
- B. All carpet must meet HUD UM-44D requirements.
- C. Carpet:
 - 1. Product: [] manufactured by [].
 - 2. Roll Width: [] ft () mm).
 - 3. Color: as selected by Architect. .
 - 4. Pattern: as selected by Architect.
 - 5. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
 - 6. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
 - 7. VOC Content: Comply with Section 01 6116.

2.03 ACCESSORIES

- A. Sub-Floor Filler: Type recommended by carpet manufacturer.
- B. Adhesives:
 - 1. Compatible with materials being adhered; as recommended by carpet manufacturer and to comply with flammability requirements for installed carpet. .
- C. Seam Adhesive: Recommended by carpet manufacturer.
- D. Carpet Edge Guard: Extruded or molded heavy-duty vinyl or rubber of size and profile indicated; minimum 2-inch-wide anchorage flange; manufacturer's standard colors.
- E.
- F.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.
- B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesives to sub floor surfaces.
- C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and alkalinity (pH).

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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 sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.
 - C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
 - D. Clean substrate.
- 3.03 INSTALLATION - GENERAL
- A. Starting installation constitutes acceptance of sub-floor conditions.
 - B. Install carpet and cushion in accordance with manufacturer's instructions and CRI 104 (Commercial).
 - C. Verify carpet match before cutting to ensure minimal variation between dye lots.
 - D. Lay out carpet and locate seams in accordance with shop drawings.
 1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
 2. Do not locate seams perpendicular through door openings.
 3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
 4. Locate change of color or pattern between rooms under door centerline.
 5. Provide monolithic color, pattern, and texture match within any one area.
 - E. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.
 - F. Install carpet edge guard where edge of carpet is exposed; anchor guards to substrate.
- 3.04 DIRECT-GLUED CARPET
- A. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to cut edges of woven carpet immediately.
 - B. Apply contact adhesive to floor uniformly at rate recommended by manufacturer. After sufficient open time, press carpet into adhesive.
 - C. Apply seam adhesive to the base of the edge glued down. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.
 - D. Roll with appropriate roller for complete contact of adhesive to carpet backing.
 - E. Trim carpet neatly at walls and around interruptions.
- 3.05 CLEANING
- A. Remove excess adhesive from floor and wall surfaces without damage.
 - B. Clean and vacuum carpet surfaces.
- END OF SECTION

SECTION 09 9000 - PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Walls, ceilings, base trim, casings, doors and frames.
 - 2. On roof where visible paint all pipes, ducts and chimneys that penetrate the roof to match roof color.
 - 3. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - 4. Elevator pit ladders.
 - 5. Exposed surfaces of steel lintels and ledge angles.
 - 6. Prime surfaces to receive wall coverings.
 - 7. Mechanical and Electrical:
 - a. In finished areas, paint all insulated and exposed pipes, unless otherwise indicated.
 - b. In finished areas, paint shop-primed items.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne, and lead items.
 - 6. Marble, granite, slate, and other natural stones.
 - 7. Floors, unless specifically so indicated.
 - 8. Ceramic and other tiles.
 - 9. Glass.
 - 10. Acoustical materials, unless specifically so indicated.
 - 11. Concealed pipes, ducts, and conduits.

1.02 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this section.

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 2019.
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.
- D. SSPC (PM1) - Good Painting Practice: SSPC Painting Manual, Vol. 1; Society for Protective Coatings; Fourth Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of all products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Paint and Coatings: 1 gallon (4 L) of each color.
 - 3. Label each container with color in addition to the manufacturer's label.
 - 4. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and by manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

- C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 45 degrees F (7 degrees C) for interiors; 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.
- E. Minimum Application Temperature for Varnish Finishes: 65 degrees F (18 degrees C) for interior or exterior, unless required otherwise by manufacturer's instructions.
- F. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
- B. Provide all paint and coating products from the same manufacturer to the greatest extent possible.
- C. Paints:
 - 1. Base Manufacturer: Sherwin Williams Company.
 - 2. Benjamin Moore & Co: www.benjaminmoore.com/#sle.
 - 3. PPG Paints: www.ppgpaints.com/#sle.
 - 4. Pratt & Lambert Paints: www.prattandlambert.com/#sle.
- D. Transparent Finishes:
 - 1. Base Manufacturer: Sherwin Williams Company.
- E. Stains:
 - 1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- F. Primer Sealers: Same manufacturer as top coats.
- G. Block Fillers: Same manufacturer as top coats.
- H. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL

- A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
 - 1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 - 4. Supply each coating material in quantity required to complete entire project's work from a single production run.
 - 5. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
- B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
- C. Volatile Organic Compound (VOC) Content:
 - 1. Provide coatings that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - b. Architectural coatings VOC limits of State in which the project is located.
 - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- E. Colors: To be selected from manufacturer's full range of available colors.
 - 1. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
 - 2. Extend colors to surface edges; colors may change at any edge as directed by Architect.
 - 3. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - EXTERIOR

- A. CONCRETE - (Cementitious Siding, Flexboard, Transite Board, Shingles (Non-Roof), Common Brick, Stucco, Tilt-up, Precast, and Poured-in-place Cement)
 - 1. Latex Systems
 - a. Satin Finish
 - 1) 1st Coat: S-W Loxon Interior / Exterior Acrylic Masonry Primer, A24W8300 (8 mils wet, 3.2 dry)
 - 2) 2nd Coat: S-W A-100 Exterior Latex Satin, A82 Series
 - 3) 3rd Coat: S-W A-100 Exterior Latex Satin, A82 Series (4 mils wet, 1.4 mils dry per coat)
- B. MASONRY (Concrete Masonry Units [CMU]- Cinder or Concrete Block)
 - 1. Latex Systems
 - a. Semi-Gloss Finish
 - 1) 1st Coat: S-W PrepRite Block Filler, B25W25 (16 mils wet, 8 mils dry)
 - 2) 2nd Coat: S-W Metalatex Acrylic Semi-Gloss, B42 Series
 - 3) 3rd Coat: S-W Metalatex Acrylic Semi-Gloss, B42 Series (4 mils wet, 1.5 mils dry per coat)
- C. CONCRETE- (Concrete Floors, Patios, Porches, Steps & Platforms)
 - 1. Acrylic System Water-Based

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- a. Floor Finish
 - 1) 1st Coat: S-W Porch & Floor Enamel, A32-100 Series
 - 2) 2nd Coat: S-W Porch & Floor Enamel, A32-100 Series (4mils wet; 1.4 mils dry per coat)
 - 3) 1st Coat: S-W Sher-Crete Flexible Concrete Waterproofer, A5 Series
 - 4) 2nd Coat: S-W Sher-Crete Flexible Concrete Waterproofer, A5 Series (14-18 mils wet per coat)
- D. METAL - (Aluminum, Galvanized)
 - 1. Latex Systems
 - a. Gloss Finish
 - 1) 1st Coat: S-W A-100 Exterior Latex Gloss, A8W10051 Series
 - 2) 2nd Coat: S-W A-100 Exterior Latex Gloss, A8W10051 Series (4 mils wet, 1.3 mils dry per coat)
- E. METAL - (Misc. Iron, Ornamental Iron, Structural Iron & Steel, Ferrous Metal)
 - 1. Latex Systems
 - a. Gloss Finish
 - 1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
 - 2) 2nd Coat: S-W A-100 Exterior Latex Gloss, A8W10051 Series
 - 3) 3rd Coat: S-W A-100 Exterior Latex Gloss, A8W10051 Series (4 mils wet, 1.3 mils dry per coat)
- F. WOOD- Decks, Exterior Trim (including pressure treated lumber) (Floors, Platforms)
 - 1. Acrylic Water-Based Floor System
 - a. Floor Finish
 - 1) 1st Coat: S-W Porch & Floor Enamel, A32-100 Series
 - 2) 2nd Coat: S-W Porch & Floor Enamel, A32-100 Series (4mils wet; 1.4 mils dry per coat)
 - 2. Stain Systems
 - a. Solid Color Acrylic Latex
 - 1) 1st Coat: S-W DeckScapes Ext. Acrylic Solid Color Deck Stain, A15-150 Series
 - 2) 2nd Coat: S-W DeckScapes Ext. Acrylic Solid Color Deck Stain, A15-150 Series (200-400 s/f per gal.)
 - b. Semi-Transparent Stain
 - 1) 1st Coat: S-W DeckScapes Ext. Waterborne Deck Stain, A15T15 Series
 - 2) 2nd Coat: S-W DeckScapes Ext. Waterborne Deck Stain, A15T15 Series (100-300 s/f per gal)
 - c. Clear Stain
 - 1) 1st Coat: S-W DeckScapes Ext. Waterborne Clear, A15T260
 - 2) 2nd Coat: S-W DeckScapes Ext. Waterborne Clear, A15T260 (150-300 sq/ft gal)
- G. WOOD (Siding, Trim, Shutters, Sashes, Hardboard-Bare/Primed)
 - 1. Latex Systems
 - a. Satin Finish
 - 1) 1st Coat: S-W A-100 Exterior Latex Wood Primer, B42W41 (4 mils wet, 1.4 mils dry)
 - 2) 2nd Coat: S-W A-100 Exterior Latex Satin, A82 Series
 - 3) 3rd Coat: S-W A-100 Exterior Latex Satin, A82 Series (4 mils wet, 1.4 mils dry per coat)
 - 2. Stain - Water Reducible Systems
 - a. Semi-Transparent
 - 1) 1st Coat: S-W WoodScapes Polyurethane Stain, A15T5
 - 2) 2nd Coat: S-W WoodScapes Polyurethane Stain, A15T5 (100-350 sq ft/gal)
 - b. Solid Color
 - 1) 1st Coat: S-W WoodScapes Solid Color Stain, A15 Series
 - 2) 2nd Coat: S-W WoodScapes Solid Color Stain, A15 Series (200-400 sq ft/gal)
- H. ARCHITECTURAL PVC, PLASTIC, FIBERGLASS (due to the variety of substrate, check for compatibility)
 - 1. Latex Systems
 - a. Satin Finish
 - 1) 1st Coat: S-W Multi-Purpose Latex Primer, B51-450 Series(4 mils wet, 1.4 mils dry)
 - 2) 2nd Coat: S-W A-100 Exterior Latex Satin, A82 Series
 - 3) 3rd Coat: S-W A-100 Exterior Latex Satin, A82 Series (4 mils wet, 1.4 mils dry per coat)
- I. DRYWALL (Gypsum Board, Exterior Drywall)
 - 1. Latex Systems
 - a. Semi-Gloss Finish
 - 1) 1st Coat: S-W Exterior Latex Wood Primer B42W81(4 mils wet, 1.4 mils dry)
 - 2) 2nd Coat: S-W Metalatex Acrylic Semi-Gloss, B42 Series
 - 3) 3rd Coat: S-W Metalatex Acrylic Semi-Gloss, B42 Series (4 mils wet, 1.5 mils dry per coat)
 - b. Satin Finish
 - 1) 1st Coat: S-W Exterior Latex Wood Primer B42W81 (4 mils wet, 1.4 mils dry)
 - 2) 2nd Coat: S-W A-100 Exterior Latex Satin, A82 Series
 - 3) 3rd Coat: S-W A-100 Exterior Latex Satin, A82 Series (4 mils wet, 1.4 mils dry per coat)
 - c. Flat Finish
 - 1) 1st Coat: S-W Exterior Latex Wood Primer B42W81(4 mils wet, 1.4 mils dry)
 - 2) 2nd Coat: S-W A-100 Exterior Latex Flat, A6 Series
 - 3) 3rd Coat: S-W A-100 Exterior Latex Flat, A6 Series (4 mils wet, 1.4 mils dry per coat)
- J. VINYL SIDING* EIFS, SYNTHETIC STUCCO
 - 1. Latex Systems
 - a. Satin Finish
 - 1) 1st Coat: S-W A-100 Exterior Latex Satin, A82 Series
 - 2) 2nd Coat: S-W A-100 Exterior Latex Satin, A82 Series (4 mils wet, 1.4 mils dry per coat)

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2.04 PAINT SYSTEMS - INTERIOR

- A. CONCRETE - (Walls & Ceilings, Poured Concrete, Precast Concrete, Unglazed Brick, Cement Board, Tilt-Up, Cast-In-Place)
- B. Latex Systems
 - 1. Semi-Gloss Finish
 - a. 1st Coat: S-W Loxon Concrete & Masonry Primer A24W8300 (7 mils wet, 3 mils dry)
 - b. 2nd Coat: S-W ProMar 400 Zero VOC Latex Semi-Gloss B31W4600
 - c. 3rd Coat: S-W ProMar 400 Zero VOC Latex Semi-Gloss B31W4600 (4 mils wet, 1.3 mils dry per coat)
- C. Concrete Stain (Water Base)
 - 1. Flat Finish Opaque
 - a. 1st Coat: S-W H&C Concrete Stain Solid Color Water Based
 - b. 2nd Coat: S-W H&C Concrete Stain Solid Color Water Based (50-300 sq/ft per gallon)
- D. CONCRETE- FLOORS
 - 1. Acrylic System
 - a. Gloss Finish
 - 1) 1st Coat: S-W Porch & Floor Enamel, A32-100 series
 - 2) 2nd Coat: S-W Porch & Floor Enamel, A32-100 series (4 mils wet, 1.4 mils dry)
 - 3) Alternate
 - 4) 1st Coat: S-W Sher-Crete Flexible Concrete Waterproofer, A5 Series
 - 5) 2nd Coat: S-W Sher-Crete Flexible Concrete Waterproofer, A5 Series (14-18 mils wet per coat)
- E. MASONRY - (CMU - Concrete, Split, Scored, Smooth, Fluted)
 - 1. Latex Systems
 - a. Semi-Gloss Finish
 - 1) 1st Coat: S-W PrepRite® Block Filler, B25W25 (75-125 sq ft/gal)
 - 2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Semi-Gloss B31W4600
 - 3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Semi-Gloss B31W4600 (4 mils wet, 1.3 mils dry per coat)
 - 2. Concrete Stain (Water Base)
 - a. Flat Finish Opaque
 - 1) 1st Coat: S-W H&C Concrete Stain Solid Color Water Based
 - 2) 2nd Coat: S-W H&C Concrete Stain Solid Color Water Based (50-300 sq/ft per gallon)
 - F. METAL - (Aluminum, Galvanized)
 - 1. Latex Systems
 - a. Gloss Finish
 - 1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
 - 2) 2nd Coat: S-W ProMar® 400 Latex Gloss Enamel, B21W400 Series
 - 3) 3rd Coat: S-W ProMar® 400 Latex Gloss Enamel, B21W400 Series (4 mils wet, 1.5 mils dry per coat)
 - b. Semi-Gloss Finish
 - 1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
 - 2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Semi-Gloss B31W4600
 - 3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Semi-Gloss B31W4600 (4 mils wet, 1.3 mils dry per coat)
 - c. Eg-Shel / Satin Finish
 - 1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
 - 2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Eg-Shel B20W4600
 - 3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Eg-Shel B20W4600 (4 mils wet, 1.5 mils dry per coat)
 - G. WOOD- (Walls, Ceilings, Doors, Trim,)
 - 1. Latex Systems
 - a. Semi-Gloss Finish
 - 1) 1st Coat: S-W SW Multi-Purpose Interior / Exterior Latex Primer B51-450 Series (4 mils wet, 1.4 mils dry)
 - 2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Semi-Gloss B31W4600
 - 3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Semi-Gloss B31W4600 (4 mils wet, 1.3 mils dry per coat)
 - b. Eg-Shel / Satin Finish
 - 1) 1st Coat: S-W SW Multi-Purpose Interior / Exterior Latex Primer B51-450 Series (4 mils wet, 1.4 mils dry)
 - 2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Eg-Shel B20W4600
 - 3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Eg-Shel B20W4600 (4 mils wet, 1.5 mils dry per coat)
 - 2. At Wood Handrails:
 - a. 1st Coat: S-W SW Multi-Purpose Interior / Exterior Latex Primer B51-450 Series (4 mils wet, 1.4 mils dry)
 - b. 2nd and 3rd Coat: S-W B65W181 Hydrogloss Single Component Water Base Urethane
 - 3. Stain & Varnish
 - a. Clear Finish
 - 1) 1st Coat: S-W Minwax 250 VOC Oil Stain (Optional)
 - 2) 2nd Coat: S-W Wood Classics® Waterborne Polyurethane Varnish, Gloss or Satin

- 3) 3rd Coat: S-W Wood Classics® Waterborne Polyurethane Varnish, Gloss or Satin (4 mils wet, 1.0 mil dry per coat)
 - 4) 1st Coat: S-W Minwax 250 VOC Oil Stain (Optional)
 - 5) 2nd Coat: S-W Minwax High Build Polyurethane, Gloss, Semi-Gloss, Satin
 - 6) 3rd Coat: S-W Minwax High Build Polyurethane, Gloss, Semi-Gloss, Satin (4 mils wet, 1.3 mils dry per coat)
- H. DRYWALL (Walls, Ceilings, Gypsum Board, Plaster Board, etc.)
1. Latex Systems
 - a. Gloss Finish
 - 1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer B28W2600 (4 mils wet, 1.2 mils dry)
 - 2) 2nd Coat: S-W ProMar® 400 Latex Gloss, B21W400 Series
 - 3) 3rd Coat: S-W ProMar® 400 Latex Gloss, B21W400 Series (4 mils wet, 1.5 mils dry per coat)
 - b. Semi-Gloss Finish
 - 1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer B28W2600 (4 mils wet, 1.2 mils dry)
 - 2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Semi-Gloss B31W4600
 - 3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Semi-Gloss B31W4600 (4 mils wet, 1.3 mils dry per coat)
 - c. Eg-Shel / Satin Finish
 - 1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer B28W2600 (4 mils wet, 1.2 mils dry)
 - 2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Eg-Shel B20W4600
 - 3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Eg-Shel B20W4600 (4 mils wet, 1.6 mils dry per coat)
 - d. Flat Finish
 - 1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer B28W2600 (4 mils wet, 1.2 mils dry)
 - 2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Flat B30W4600
 - 3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Flat B30W4600 (4 mils wet, 1.4 mils dry per coat)
- 2.05 ACCESSORY MATERIALS
- A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.
 - B. Patching Material: Latex filler.
 - C. Fastener Head Cover Material: Latex filler.
 - D. Wood Filler: Solvent base, tinted to match surface finish color.
- 2.06 ATTIC STOCK
- A. Provide the following "attic stock" additional product materials at the conclusion of construction for storage on site by the owner:
 1. All unused paint materials to be left onsite - materials must be clearly labeled
- 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 are below the following maximums:
 1. Gypsum Wallboard: 12 percent.
 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
 3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
- 3.02 PREPARATION
- A. Clean surfaces thoroughly and correct defects prior to coating 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 mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
 - D. Seal surfaces that might cause bleed through or staining of topcoat.
 - E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
 - F. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
 - G. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.
 - H. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
 - I. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-SP 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).
 - J. Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned.

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- Prime paint entire surface; spot prime after repairs.
- K. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 - L. Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
 - M. Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.
 - N. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.
 - O. Exterior Wood to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior calking compound after sealer has been applied. Prime concealed surfaces.
- 3.03 APPLICATION
- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
 - B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.
 - C. Apply products in accordance with manufacturer's instructions.
 - D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
 - E. Apply each coat to uniform appearance.
 - F. Sand wood surfaces lightly between coats to achieve required finish.
 - G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
 - H. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
 - I. 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.
- 3.05 PROTECTION
- A. Protect finished coatings until completion of project.
 - B. Touch-up damaged coatings after Substantial Completion.
- END OF SECTION

SECTION 10 1400 - SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Room and door signs.
- B. Interior directional and informational signs.
- C. Emergency evacuation maps.
- D. Building identification signs.

1.02 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
 - 2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
 - 3. Submit for approval by Owner through Architect prior to fabrication.
- D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

1.04 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 to prevent damage before installation.
- B. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Flat Signs: A. Basis-of-Design Product: Subject to compliance with requirements, provide Stratus style, brushed silver as manufactured by Intersign Corporation, Chatanooqa Tn.; or comparable product by an approved supplier.
- B. Dimensional Letter Signs:
- C. Other Signs - []:

2.02 SIGNAGE APPLICATIONS

- A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
 - 1. All signs shall comply with ADA and include Braille.
 - 2. Comply with ADA section 4.30 regarding character dimensions and borders. Finishes shall be high contrast between the text and sign background with specific light reflectance characteristics as stipulated in ADA 4.30.5.
 - 3. Required accessible elements shall be identified by the International Symbol of Accessibility at the following locations:
 - a. Accessible parking spaces.
 - b. Accessible areas of refuge.
- B. At each door to an egress stairway, exit passageway and exit discharge, provide a tactile sign stating EXIT or STAIR and complying with ICC A117.1. Provide sign adjacent to each door to an egress stairway, an exit passageway and the exit discharge.
- C. At areas for assisted rescue, signage shall be provided as follows:
 - 1. Each door providing access to an area of refuge from an adjacent floor area shall be identified by a sign complying with ICC A117.1, stating: AREA OF REFUGE, and including the International Symbol of Accessibility. Where exit sign illumination is required by Section 1011.2, the area of refuge sign shall be illuminated. Additionally, tactile signage complying with ICC A117.1 shall be located at each door to an area of refuge.
 - 2. Each door providing access to an area of refuge shall be provided with signage instructions on the use of the area under emergency conditions and shall be posted adjoining and aligned with the communications system. See drawings for system mounting height. The instructions shall include all of the following:
 - a. Directions to find other means of egress. (Provide arrow pointing in the direction of shortest distance to other exit stating "to other exit")
 - b. Persons able to use the exit stairway do so as soon as possible,
 - c. unless you are assisting others.
 - d. Wait here and use intercom for emergency assistance.
 - e. Push button on intercom, speak and wait for assistance.
- D. Provide approximately 3 3/4" x 4 3/4" signs at each unit door with three digit numbers.

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- E. Supply and install one a 4 3/4" x 113/4" directional sign at each floor in clear view of the elevator and or entrance (to be coordinated with the architect) indicating the unit numbers located to each side of the building corridor, with directional arrows pointing to the side the units can be found.
 - F. Provide 8 1/2" x 11" evacuation signs by the local building officials and fire marshal. Provide a holder to receive the evacuation drawing (provided by the Architect). Provide a clear matte finish plexiglass cover with a perimeter frame consistent with the specified style.
 - G. Supply and install one each approximately 4 5/8" x 10" sign with the following verbiage and graphic: (X) indicates quantity)
 - 1. At each office (confirm office name with owner)
 - 2. Community Room
 - 3. Women
 - 4. Men
 - 5. Property Manager
 - 6. Bike Storage
 - 7. Maintenance
 - 8. Laundry
 - 9. Tenant Storage (3)
 - 10. Mechanical (3)
 - H. Verify sign list, quantity and exact verbiage with owner through submittal process prior to fabrication.
 - I. Provide and post in a conspicuous place in each section and on each floor of the facility an emergency evacuation sign showing the floor plan indicating all exits and designating egress route from location of sign. Comply with requirements of local code officials.
 - J. Stairway floor number signs.
 - K. A sign shall be provided at each floor landing in interior vertical exit enclosures connecting more than three stories designating the floor level, the terminus of the top and bottom of the stair enclosure and the identification of the stair. The signage shall also state the story of, and the direction to the exit discharge and the availability of roof access from the stairway for the fire department. The sign shall be located 5 feet (1524 mm) above the floor landing in a position which is readily visible when the doors are in the open and closed positions.
 - L. Assembly occupancy spaces with an occupant load of 50 or more shall have the occupant load posted in a conspicuous place, near the main exit or exit access doorway from the room or space.
 - M. Building Address / Identification Signs:
 - 1. Use individual metal letters.
 - 2. Mount on outside wall in location indicated on drawings.
 - N. Exterior Monument Sign: See drawings.
- 2.03 SIGN TYPES
- A. Basis of Design: Stratus style, brushed silver as manufactured by Intersign Corporation, Chatanooga Tn.
- 2.04 DIMENSIONAL LETTERS
- A. Metal Letters:
 - 1. Mounting: Tape adhesive.
- 2.05 ACCESSORIES
- A. Tape Adhesive: Double sided tape, permanent adhesive.
- PART 3 EXECUTION
- 3.01 INSTALLATION
- A. Install in accordance with manufacturer's instructions.
 - B. Install neatly, with horizontal edges level.
 - C. Protect from damage until Substantial Completion; repair or replace damaged items.
- END OF SECTION

SECTION 10 2800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Residential toilet, shower, and bath accessories.

1.02 RELATED REQUIREMENTS

- A. Section 08 8300 - Mirrors: Other mirrors.
- B. Section 09 3000 - Tiling: Ceramic washroom accessories.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip; 1999 (Reapproved 2009).
- C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2015a (Reapproved 2019).
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
- F. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium 2017.
- G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Franklin Brass and AJ Washroom.
- B. Commercial Toilet, Shower, and Bath Accessories:
 - 1. American Specialties, Inc: www.americanspecialties.com/#sle.
 - 2. Bradley Corporation: www.bradleycorp.com/#sle.
 - 3. Georgia-Pacific Professional: www.blue-connect.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.
 - 1. Grind welded joints smooth.
 - 2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
- B. Stainless Steel Sheet: ASTM A666, Type 304.
- C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- D. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- E. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- F. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.

2.04 TOILET ACCESSORIES

- A. Living Units: (unless otherwise noted items listed are Franklin Brass Kinley Series)
 - 1. Medicine Cabinet: Jensen 615.
 - 2. Towel Bars (not over 30" in length): KIN24-SN.
 - 3. Toilet paper Holder - KIN62-SN; KIN20-SN.
 - 4. Robe Hook - KIN35-SN.
 - 5. Shower Curtain rod - Franklin Brass 161-5.
 - 6. Grab bars - Franklin Brass 1 1/2" diameter (powder coated) with snap flanges (concealed fasteners).
 - a. At retrofit conditions provide Franklin Brass grab bar anchor for non-stud mount #FB549.
 - 7. Shower Seats: Surface Mounted Retractable Shower Seat, 3/4" thick, one-piece high density white polymer.
 - a. Removable shower seats: Franklin Brass SF598; non slip blow molded polyethylene seat with back; aluminum legs with rubber feet.
 - b. Built in shower seats: Reversible folding shower seat and frame; phenolic resin seat with 304 stainless steel brackets. Provide Franklin Brass 5181.
 - 8. Provide a weighted shower curtain in all roll in shower units. Provide "Premium Shower Curtain" by Clarion Bathware; 44 Amsler Ave. Shippensburg, PA 16254; Telephone: 1 800 576-9228.
 - 9. Mirror: 1/4" plate glass mirror with pencil edge; size per plans.
- B. Public Bathrooms:
 - 1. Paper towel dispenser - AJ Washroom U2304-S2.
 - 2. Paper Holders - Franklin Brass Century 5508BSF
 - 3. Robe Hook - Franklin Brass Century 5502SF.

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4. Wall Mounted Soap Dispenser - Franklin Brass 1920, Satin.
5. Grab bars - Franklin Brass 1 1/2" diameter (powder coated) with snap flanges (concealed fasteners).
 - a. At retrofit conditions provide Franklin Brass grab bar anchor for non-stud mount #FB549.
6. Mirror, 1/4" plate glass - size per plans.

2.05 LAUNDRY ROOM ACCESSORIES

- A. Ironing Board: Nutone #AVAD40WN with Nutone surface mount collar #AVDSMN. Install with with bottom of surface mount collar at 24" a.f.f. per manufacturer's recommendations.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. Verify that field measurements are as indicated on drawings.

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.
- D. Mounting Heights and Locations: As required by accessibility regulations, as indicated on drawings, and as follows:

END OF SECTION

PART 2 PRODUCTS
END OF SECTION

SECTION 10 2819 - TUB AND SHOWER ENCLOSURES

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SECTION 10 4400 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

- A. NFPA 10 - Standard for Portable Fire Extinguishers 2017, with Errata (2018).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.
- C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Extinguishers:
 - 1. Ansul, a Tyco Business; Cleanguard: www.ansul.com/#sle.
 - 2. Pyro-Chem, a Tyco Business: www.pyrochem.com/#sle.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Fire Extinguisher Cabinets and Accessories:
 - 1. Ansul, a Tyco Business: www.ansul.com/#sle.
 - 2. Larsen's Manufacturing Co: www.larsensmfg.com/#sle.
 - 3. Potter-Roemer: www.potterroemer.com/#sle.
 - 4. Pyro-Chem, a Tyco Business: www.pyrochem.com/#sle.

2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
 - 1. Class: A:B:C type.
 - 2. Size: 10 pound (4.54 kg).
 - 3. Finish: Baked polyester powder coat red color.
 - 4. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to [] degrees F ([] degrees C).

2.03 KITCHEN FIRE EXTINGUISHERS

- A. Wet Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gauge.
 - 1. Class: K type.
 - 2. Size: 1.6 gallons (6 L).
 - 3. Finish: Polished stainless steel.
 - 4. Temperature range: Minus 20 degrees F (Minus 29 degrees C) to 120 degrees F (49 degrees C).

2.04 FIRE EXTINGUISHER CABINETS

- A. Cabinet Configuration: Recessed type.
 - 1. Size to accommodate accessories.
 - 2. Trimless type.
 - 3. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.
- B. Door: 0.036 inch (0.9 mm) metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinge.
- C. Door Glazing: Acrylic plastic, clear, 1/8 inch (3 mm) thick, flat shape and set in resilient channel glazing gasket.
- D. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- E. Weld, fill, and grind components smooth.
- F. Finish of Cabinet Exterior Trim and Door: No. 4 - Brushed stainless steel.
- G. Finish of Cabinet Interior: White colored enamel.

2.05 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, chrome-plated.
- B. Lettering: { } "FIRE EXTINGUISHER" decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, [] inches ([] mm) from finished floor to inside bottom of cabinet.
- C. Secure rigidly in place.

D. Place extinguishers in cabinets.
END OF SECTION

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SECTION 10 5723 - CLOSET AND UTILITY SHELVING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall mounted wire closet shelving.
- B. Accessories.

1.02 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, with installation instructions.
- C. Shop Drawings: Provide drawings prepared specifically for this project; show dimensions of shelving and attachment to substrates.

1.03 QUALITY ASSURANCE

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

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products under cover and elevated above grade.
- C. Store flat to prevent warpage and bending.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wire Storage Shelving:
 - 1. ClosetMaid Corporation : www.closetmaid.com/#sle.
 - 2. Organized Living; freedomRail: www.organizedliving.com.
 - 3. RubberMaid Closet and Organization Products : www.rubbermaidcloset.com/#sle.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SHELVING APPLICATIONS

- A. Shelf Depth: 12 inches (305 mm), unless otherwise indicated.

2.03 MATERIALS

- A. Wire Shelving: Factory-assembled coated wire mesh shelf assemblies for wall-mounting, with all components and connections required to produce a rigid structure that is free of buckling and warping.
 - 1. Construction: Cold-drawn steel wire with average tensile strength of 100,000 psi (690 MPa) resistance welded into uniform mesh units, square, rigid, flat, and free of dents or other distortions, with wires trimmed smooth.
 - 2. Coating: PVC or epoxy, applied after fabrication, covering all surfaces.
 - 3. PVC Coating: 9 to 11 mils (0.23 to 0.028 mm) thick.
 - 4. Epoxy Coating: Non-toxic epoxy-polyester powder coating baked-on finish, 3 to 5 mils (0.76 to 1.27 mm) thick.
 - 5. Standard Mesh Shelves: Cross deck wires spaced at 1 inch (25.4 mm).
- B. Hanging Rod: Tubular steel, [3/4"] inch ([] mm) diameter, with end caps on open ends.
 - 1. Finish: Epoxy powder coat.
 - 2. Wall Thickness: 20 gage, 0.035 inch (0.89 mm).
 - 3. Provide corner hanging rods and hanging rod connectors where required.
- C. Wall-Mounted Standards: Vertically slotted channel standards with double-tab cantilever brackets to suit shelving; factory finished to match shelving.
- D. Mounting Hardware: Provide manufacturer's standard mounting hardware; include support braces, wall brackets, back clips, end clips, poles, and other accessories for complete and secure installation; factory finished to match shelving.
 - 1. Provide intermediate support wall bracket for rod and shelf at any span 4' or more.
- E. Fasteners: As recommended by manufacturer for mounting substrates.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Inspect areas to receive shelving, to verify that spaces are properly prepared to receive shelf units, and are of dimensions indicated on shop drawings.
- B. Verify appropriate fastening hardware.
- C. Do not begin installation until substrates have been properly prepared.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

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 in accordance with manufacturer's instructions, with shelf surfaces level.
- B. Cap exposed ends of cut wires.
- C. Install back clips, end clips at side walls, and support braces at open ends. Install intermediate support braces as recommended by manufacturer but in no case exceeding 48" between supports.
- D. Mounting Heights: See drawings.

3.04 CLEANING

- A. Clean soiled surfaces after installation.

3.05 PROTECTION

- A. Protect installed work from damage.

B. Touch-up, repair, or replace damaged products before Substantial Completion in a manner that eliminates evidence of replacement.

END OF SECTION

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SECTION 11 3013 - RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Kitchen appliances.

1.02 RELATED REQUIREMENTS

- A. Section 22 1005 - Plumbing Piping: Plumbing connections for appliances.
- B. Section 26 0583 - Wiring Connections: Electrical connections for appliances.

1.03 REFERENCE STANDARDS

- A. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.
- C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).
- C. Gas Appliances: Bearing design certification seal of American Gas Association (AGA).

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five (5) year manufacturer warranty on refrigeration system of refrigerators.
- C. Provide ten (10) year manufacturer warranty on magnetron tube of microwave ovens.
- D. Electric Range: 4 year limited warranty on surface burner elements.
- E. Provide ten (10) year manufacturer warranty on tub and door liner of dishwashers.

PART 2 PRODUCTS

2.01 KITCHEN APPLIANCES

- A. All Equipment Eligible for Energy Star Rating shall be Energy Star Rated.
- B. All ranges shall be provided with, and have installed an anti-tip bracket.
- C. Apartment Units: Shall receive one each as follows: (all colors to be selected during construction)
 - 1. Unit Refrigerator all units: GE Model # GTE16DTNLWW; 15.6 cubic ft top freezer refrigerator, Energy Star, ADA compliant.
 - 2. Standard Unit Range: GE 30" free standing electric range, Model # JBS16ODMWW, 5.0 cubic ft oven capacity, standard clean.
 - 3. Handicap Unit Range: GE 30" Drop-In electric range, Model JD630DFWW, self clean oven, ceramic glass cooktop, front controls.
 - 4. Grease Shield: Baked on enamel finish over steel to match color of range with matching fasteners.
 - 5. Range Hood: GE non-vented standard range hood, model # JN327HWW, vertical and rear exhaust.
 - a. At handicap unit provide remote switching as shown on electric drawings.
 - 6. Dishwasher at Standard Units: GE Model # GSD2100VWW, built in dishwasher with 2 level wash system and two stage filtration.
 - 7. Dishwasher at Handicap Units: GE ADA compliant dishwasher Model # GDT226SGLWW, 3 level wash and autosense cycle.
 - 8. Disposal: "Badger 1, 1/3 HP. Plug-in connection. Wire to wall switch.
- D. Public Kitchen and Meeting Room shall receive the following:
 - 1. Refrigerator: GE Model GTE17GTNRSS Energy Star 16.6 cubic ft top freezer, stainless steel, ADA Compliant.
 - 2. Dishwasher at Handicap Units: GE ADA compliant dishwasher Model # GDT226SGLWW, 3 level wash and autosense cycle.
 - 3. Disposal: "Badger 5XP, 3/4 HP. Plug-in connection. Wire to wall switch.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify utility rough-ins are provided and correctly located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.03 ADJUSTING

- A. Adjust equipment to provide efficient operation.

3.04 CLEANING

- A. Remove packing materials from equipment and properly discard.
- B. Wash and clean equipment.

END OF SECTION

SECTION 12 3200 - MANUFACTURED WOOD CASEWORK

PART 2 PRODUCTS

1.01 CASEWORK, GENERAL

- A. Quality Standard: AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

1.02 FABRICATION

- A. Assembly: Shop assemble casework items for delivery to site in units easily handled and to permit passage through building openings.
- B. Construction: As required for selected grade.
- C. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

END OF SECTION

SECTION 12 3530 - RESIDENTIAL CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Kitchen cabinets.
- B. Vanity cabinets.
- C. Casework hardware.

1.02 RELATED REQUIREMENTS

- A. Section 12 3600 - Countertops.

1.03 REFERENCE STANDARDS

- A. BHMA A156.9 - American National Standard for Cabinet Hardware 2015.
- B. KCMA A161.1 - Performance and Construction Standard for Kitchen and Vanity Cabinets 2017.
- C. KCMA (DIR) - Directory of Certified Cabinet Manufacturers Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions and construction details.
- C. Shop Drawings: Indicate casework locations, large scale plans, elevations, clearances required, rough-in and anchor placement dimensions and tolerances.

1.05 QUALITY ASSURANCE

- A. Products: Complying with KCMA A161.1 and KCMA Certified.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Residential Casework: Basis of design manufacturers listed below:
 - 1. Living Units: Brighton as manufactured by Smart Cabinetry; color to be selected.
 - 2. Common Areas: Brighton as manufactured by Smart Cabinetry; color to be selected.
 - 3. Other manufacturers offering equivalent products may be acceptable pending approval from the Architect:
 - a. Advanta Cabinets
 - b. Kraftmaid Cabinetry, Inc: www.kraftmaid.com.
 - c. Wellborn Cabinet, Inc: www.wellborn.com.
 - d. Masco
 - e. Substitutions: See Section 01 6000 - Product Requirements.

2.02 COMPONENTS

- A. Cabinet Construction: Softwood lumber framing and particle board, tempered hardboard gables.
- B. Countertops: As specified in Section 12 3600.
- C. Door and Drawer Fronts: Solid wood.
- D. Bolts, Nuts, Washers and Screws: Of size and type to suit application.
- E. Concealed Joint Fasteners: Threaded steel.
- F. Special Components:
 - 1. Provide plumbing piping shield at common area vanities as detailed on the drawings to match cabinets.
 - 2. Provide vertical divider panels where shown to match cabinets at edge of dishwashers or other below counter spaces.

2.03 HARDWARE

- A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
- B. Adjustable Shelf Supports: Standard side/ back-mounted system using 1 inch (25 mm) spacing adjustments.
- C. Drawer and Door Pulls: [Bar Pulls 304 Grade Stainless Steel 6 3/4" length; 5" center to center; Outwater Plastics Part number Pull-200128-SS.].
- D. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with satin finish. Where shown on drawings.
- E. Drawer Slides:
 - 1. Type: Full extension.
 - 2. Static Load Capacity: Residential/Light Commercial grade.
 - 3. Mounting: Side mounted.
 - 4. Stops: Integral type.
- F. Hinges: European style concealed self-closing type, steel with satin finish.

2.04 FABRICATION

- A. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.
- B. Fabricate corners and joints without gaps or inaccessible spaces or areas where dirt or moisture could accumulate.
- C. Form smooth edges. Form material for countertops, shelves, and drain boards from continuous sheets.
- D. Provide cutouts for plumbing fixtures, appliances, and fixtures and fittings. Prime paint contact surfaces of cut edges.
- E. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.05 FINISHES

- A. Exposed To View Surfaces: Stain, seal and varnish of selected color.
- B. Interior Surfaces: Plastic Laminate of manufacturer's standard color.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of support framing.
- B. Field Measurements: Verify casework dimensions by field measurements confirming casework can be installed in compliance with the original design and referenced standards.

3.02 INSTALLATION

- A. Install casework, components and accessories in accordance with manufacturer's instructions.
- B. Use anchoring devices to suit conditions and substrate materials encountered.

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- C. Set casework items plumb and square, securely anchored to building structure.
 - D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (1 mm). Use filler strips; not additional overlay trim for this purpose.
 - E. Close ends of units, back splashes, shelves and bases.
- 3.03 ADJUSTING
- A. Adjust doors, drawers, hardware, fixtures, and other moving or operating parts to function smoothly.
- 3.04 CLEANING
- A. Clean casework, countertops, shelves, and hardware.
- 3.05 PROTECTION
- A. Do not permit finished casework to be exposed to continued construction activity.
- END OF SECTION

SECTION 12 3600 - COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for architectural cabinet work.
- B. Countertops for manufactured casework.
- C. Wall-hung counters and vanity tops.

1.02 RELATED REQUIREMENTS

- A. Section 12 3530 - Residential Casework.
- B. Section 22 4000 - Plumbing Fixtures: Sinks.

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard 2016.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).
- D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 4.0 2021.
- E. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
- F. PS 1 - Structural Plywood 2009 (Revised 2019).

1.04 SUBMITTALS

- A. See Section 01 3000 - 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 ; combine with shop drawings of cabinets and casework specified in other sections.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

1.05 QUALITY ASSURANCE

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. 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.

PART 2 PRODUCTS

2.01 COUNTERTOPS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
 - 1. Laminate Sheet: NEMA LD 3, Grade HGS.
 - a. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 - b. NSF approved for food contact.
 - c. Finish: Matte or suede, gloss rating of 5 to 20.
 - d. Surface Color and Pattern: As selected by Architect from the manufacturer's full line.
 - 2. Exposed Edge Treatment: Postformed laminate; front edge substrate built up to minimum 1-1/4 inch (32 mm) thick with raised radiused edge, integral coved backsplash with radiused top edge.
 - 3. Provide rounded outside corners.
 - 4. Back and End Splashes: Same material, same construction; except at handicap units which shall be self edge.
 - 5. Underside of countertops: Seal with low VOC sealant.

2.02 MATERIALS

- A. Wood-Based Components:
 - 1. Wood fabricated from old growth timber is not permitted.
- B. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.
- C. 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.
- D. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- E. Joint Sealant: Mildew-resistant silicone sealant, color as selected by Architect .

2.03 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.
 - 4. Provide radiused outside corners.
- 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.

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2. Height: 4 inches (102 mm) standard. Provide 6" height at accessible units and public use common areas unless otherwise indicated.

- C. Wall-Mounted Counters: Provide skirts, 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. Field Measurements: Verify countertop size and shape prior to fabrication by field measurements taken after base units are installed.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. 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. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch (16 mm).
- C. Attach wood countertops using screws with minimum penetration into substrate board of 5/8 inch (16 mm).
- D. 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 CLEANING

- A. Clean countertops surfaces thoroughly.

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 14202

ELEVATORS AND LIFTS

Display hidden notes to specifier. (Don't know how? [Click Here](#))
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PART 1. GENERAL

1.1 SECTION INCLUDES

- A. Commercial wheelchair lifts.

1.2 RELATED SECTIONS

- A. Division 16 Sections for electrical service for elevators to and including disconnect and fused switches at machine room.
- B. Division 16 Sections for standby power source, transfer switch, and connection from auxiliary contacts in transfer switch to controller.
- C. Division 16 Section "Voice and Data Communication Cabling" for telephone service to elevators.
- D. Section 03300 - Cast-in-Place Concrete: Concrete for elevator machine foundation, and pit.
- E. Section 06100 - Rough Carpentry: Hoistway framing, building-in hoistway door frames and overhead hoist beams.
- F. Section 08210 - Wood Doors: Hoistway doors.
- G. Section 08710 - Door Hardware.
- H. Section 09260 - Gypsum Board Assemblies: Gypsum shaft walls.
- I. Section 09650 - Resilient Flooring: Floor finish in cab.
- J. Section 09686 - Carpet: Floor finish in cab.
- K. Section 09900 - Paints and Coatings: Interior transparent wood finish in cab.
- L. Section 13850 - Detection and Alarm: Fire and smoke detectors and interconnecting devices.

1.3 REFERENCES

- A. American National Standards Institute (ANSI) B-29.2 - Chain Standards for Inverted Tooth (Silent) Chains and Sprockets.

- B. American Society of Mechanical Engineers (ASME) A17.1 - Safety Code for Elevators and Escalators.
- C. American Society of Mechanical Engineers (ASME) A18.1 - Safety Standard for Platform and Stairway Chair Lifts.
- D. CSA B44.1 - Elevator and Escalator Electrical Equipment.
- E. CSA B355 - Lifts for Persons with Physical Disabilities.
- F. CSA B613 - Private Residence Lifts for Persons with Physical Disabilities.
- G. U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)".
- H. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities.
- I. NFPA 70 - National Electric Code.
- J. CSA - National Electric Code.

1.4 REQUIREMENTS OF REGULATORY AGENCIES:

- A. Fabricate and install work in compliance with applicable jurisdictional authorities.
- B. File shop drawings and submissions with local authorities as the information is made available. Company pre-inspection and jurisdictional authority inspections and permits are to be made on timely basis as required.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01300.
- 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: Provide a complete layout of lift equipment detailing dimensions and clearances as required.
- D. Selection Samples: For each finish product specified requiring selection of color or finish, two complete sets of color charts representing manufacturer's full range of available colors and patterns.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Skilled tradesmen shall be employees of the installing contractor approved by the manufacturer, with demonstrated ability to perform the work on a timely basis.
 - 2. Execute work of this section only by a company that has adequate product liability insurance.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.

- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install systems under environmental conditions outside manufacturer's absolute limits.

1.9 WARRANTY

- A. Coverage - this warranty applies to the repair or replacement, at Manufacturer's option, of parts that fail due to defective material or workmanship. Manufacturer may, at its option, provide factory reconditioned parts. This warranty is provided to the Authorized Dealer on behalf of the final purchaser of the product and is not transferable. The Manufacturer's warranty does not cover labor charges for the removal, repair or replacement of warranty parts but such costs may be covered for a period of time by Authorized Dealer's warranty, which is provided to purchaser separately.

- 1. The manufacturer shall offer a 36-month limited warranty on parts from date of shipment.

PART 2. PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Savaria, which is located at: 2 Walker Drive, Brampton, ON, Canada, L6T 5E1; Toll Free Tel: 800-661-5112; Tel: 905-791-5555; Fax: 905-791-2222; Email: [request info](#); Web: www.savaria.com
- B. Substitutions: Not permitted.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 COMMERCIAL WHEELCHAIR LIFT

- A. Screw Vertical Platform Lifts: Savaria – Multilift Enclosure.
 - 1. Model:
 - a. Multilift – Aluminum Enclosure
 - b. Multilift – Plexiglass Enclosure
 - c. Multilift – Tempered Glass Enclosure
- B. Screw Vertical Platform Lift: The lift described here, manufactured by Savaria Lifts Inc., is a vertical platform lift consisting of a tower with a lifting platform. The platform is made to accommodate a wheelchair user or a person with impaired mobility. The lift can be used indoor or outdoor and in commercial and residential applications.
- C. Work described in this section includes providing equipment, incidental material and labor required for a complete, operable ACME screw drive wheelchair lift installation. Lifts shall be erected, installed, adjusted, tested and placed in operation by lift system manufacturer, or manufacturer's authorized installer.
 - 1. Lifts shall be in accordance:
 - a. ASME A18.1 and ADAAG compliant (USA)
 - b. ASME A18.1 and A117.1 compliant (USA)

- c. ASME 18.1 only (USA)
- D. The following preparatory work to receive the lifts specified in this section is part of the work of other sections:
 - 1. Permanent 120 VAC, 20 amp single phase power to operate lift to be provided from a lockable fused/cartridge type disconnect switch with auxiliary contacts for battery operation. Refer to drawings for permanent power specifications and location of disconnects. Temporary power may be provided to expedite installation of lift.
 - 2. Provide rough openings per lift contractor's shop drawings.
 - 3. Provide substantial, level pit floor slab as indicated on the lift contractor's shop drawings.
- E. Characteristics:
 - 1. Rated Load: 750 lb (340 kg).
 - 2. Rated Speed: 8 fpm (0.04 m/s).
 - 3. Car Dimensions:
 - a. 36 inches W by 48 inches D (914 mm by 1219 mm).
 - b. 36 inches W by 54 inches D (914 mm by 1372 mm)
 - c. 36 inches W by 60 inches D (914 mm by 1524 mm)
 - 4. Levels Served: 2.
 - 5. Car Configuration:
 - a. Front/rear exit
 - b. 90 degree exit
 - 6. Travel: _____ inches. (Maximum travel is 72" including pit depth)
 - 7. Pit Depth:
 - a. 3" – Standard
 - b. 0" – Fixed Ramp Required
 - 8. Powder Coat Finish
 - a. Almond beige – Standard
 - b. Optional Color – From manufactures color chart
 - c. Custom Color – Provide color sample to manufacturer
 - 9. Operation: Constant pressure.
 - 10. Power Supply: 120 volt, 20 amp, 1 phase, 60 Hz.
 - 11. Drive System: ACME screw and back-up nut.
 - 12. Manual Emergency Operation: A manual hand crank is provided to lower or raise the platform in case of emergency.
 - 13. Emergency Power:
 - a. No battery backup – Standard.
 - b. 24 VDC Battery raising and lowering
 - 14. Controller: Relay logic based controller
- F. Car Enclosure: Side Guards of platform shall have a steel frame with a powder coat finish and steel panel inserts to a minimum of 42 inches (1067 mm) high.
- G. Doors and Gates:
 - 1. First landing door:
 - a. Door type: 80" low profile aluminum door with a concealed electro/mechanical interlock.
 - b. Flush closing operation with enclosure side.
 - c. Operation
 - 1) Manual – with hydraulic closer
 - 2) Automatic - Surface 24 volt door opener with battery back-up for low profile aluminum door.
 - d. Door Width
 - 1) 36 inches (889 mm) clear opening.

- 2) 42 inches (1067 mm) clear opening
2. Upper landing door/gate:
 - a. Door/gate type:
 - 1) 80" low profile aluminum door with a concealed electro/mechanical interlock.
 - 2) 42" low profile aluminum gate with a concealed electro/mechanical interlock.
 - b. Flush closing operation with enclosure side.
 - c. Operation
 - 1) Manual – with hydraulic closer
 - 2) Automatic - Surface 24 volt door opener with battery back-up for low profile aluminum door.
 - 3) Automatic – Surface mounted gate opener for low profile aluminum gate.
 - d. Door/Gate Width
 - 1) 36 inches (889 mm) clear opening.
 - 2) 42 inches (1067 mm) clear opening
- H. Call Stations: Provide a surface, flush, or doorframe mounted call/send station.
 1. Call stations will be:
 - a. Keyless
 - b. Keyed (removable in off position)
 - c. Keyed (removable in on/off position)
- I. Lift Enclosure:
 1. The enclosure will be made entirely of aluminum for durability against corrosion.
 2. The enclosure frames and panels shall be fully assembled and screwed together from inside the enclosure for ease of assembling and quick installation time.
 3. All enclosure inserts shall be replaceable from the inside of the enclosure for ease of service.
 4. Fully enclosed unit
 - a. Yes – Lift will be fitted with ventilation & dome roof to protect from the outdoor elements.
 - b. No – Lift will be open at upper landing.
- J. Car Operation:
 1. Car operating panel shall consist of constant pressure buttons, an emergency stop button and an on/off key switch (when applicable).
 2. Auxiliary lighting: The car shall be equipped with a battery operated light fixture. The battery shall be the rechargeable type with an automatic recharging system.
- K. Acme Screw Drive: The screw should have a diameter of 1 inch (25 mm) and a back-up nut shall be installed.
- L. Stopping Device: All limit switches shall be located in a position to be inaccessible to unauthorized persons. They shall be located behind the mast wall and be accessible through removable panels.
- M. Terminal Stopping Device: Normal terminal stopping devices shall be provided at top and bottom of runway to stop the car positively and automatically.
- N. Guide Rails and Bracket: Guide rails and brackets shall be used to guide the platform and sling. Roller guide shoes shall be used for better ride quality and durability. Guide rails shall form part of the structural integrity of the unit and be

integral to the mast enclosure, ensuring stability and minimum platform deflection when loaded.

- O. Car Sling: Car sling shall be fabricated from steel tubing 42 inches high (1070 mm) with adequate bracing to support the platform and car enclosure. Roller guide shoes shall be mounted on the top and bottom of the car sling to engage the guide rails. Guide shoes to be roller type with 3 inches (76 mm) diameter wheels.
- P. Wiring: All wiring and electrical connections shall comply with applicable codes. Insulated wiring shall have flame-retardant and moisture proof outer covering and shall be run in conduit, or electrical wire ways.

PART 3. EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until hoistway and machine room has been properly prepared.
- B. Site dimensions shall be taken to verify that tolerances and clearances have been maintained and meet local regulations.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding. PREPARATION
- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 ELEVATOR INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install the components of the elevator system that are required and that are required by jurisdictional authorities to license the elevator.
- A. Trained employees of the elevator contractor shall perform installation work.
- B. Adjust elevator for proper operation and clean unit thoroughly.
- C. Instruct users in operating procedures and owner's maintenance person in trouble-shooting and maintenance procedures.

3.4 LIFT INSTALLATION

- A. Install all the components of the lift system that are specified in this section to be provided, and that are required by jurisdictional authorities to license the lift.
- B. Trained employees of the lift contractor shall perform all installation work of this section.
- C. Adjust lift for proper operation and clean unit thoroughly.
- D. Instruct users in operation procedures and Owner's maintenance person in trouble-shooting and maintenance procedures.

3.5 PROTECTION

- A. Protect installed products until completion of project.

- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 21 0553 - IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Stencils.
- D. Pipe markers.
- E. Ceiling tacks.

1.02 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems 2020.

1.03 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.
- E. Manufacturer's Installation Instructions: Indicate special procedures, and installation instructions.
- F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Control Panels: Nameplates.
- B. Instrumentation: Tags.
- C. Major Control Components: Nameplates.
- D. Piping (where exposed or accessible): Pipe markers.
- E. Pumps: Nameplates.
- F. Small-sized Equipment: Tags.
- G. Valves: Nameplates and ceiling tacks where above lay-in ceilings.

2.02 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.

2.03 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch (40 mm) diameter.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.
- C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 STENCILS

- A. Stencils: With clean cut symbols and letters of following size:
 - 1. 3/4 to 1-1/4 inch (20-30 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 1/2 inch (15 mm) high letters.
 - 2. 1-1/2 to 2 inch (40-50 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 3/4 inch (20 mm) high letters.
 - 3. 2-1/2 to 6 inch (65-150 mm) Outside Diameter of Insulation or Pipe: 12 inch (300 mm) long color field, 1-1/4 inch (30 mm) high letters.
- B. Paint for Stencils: As specified in Section 09 9123, semi-gloss enamel, colors complying with ASME A13.1.

2.05 PIPE MARKERS

- A. Color: Comply with ASME A13.1.
- B. 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.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches (150 mm) wide by 4 mil (0.10 mm) thick, manufactured for direct burial service.

2.06 CEILING TACKS

- A. Description: Steel with 3/4 inch (20 mm) diameter color coded head.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 09 9123 for stencil painting.

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 tags with corrosion resistant chain.
- C. Apply stencil painting in accordance with Section 09 9123.
- D. Install plastic pipe markers in accordance with manufacturer's instructions.
- E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- F. Install underground plastic pipe markers 6 to 8 inches (150 to 200 mm) below finished grade, directly above buried pipe.
- G. Locate ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 21 1100 - FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

PART 1 GENERAL

1.01 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of work with size, location and installation of service utilities.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.02 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Welders Certificate: Include welders certification of compliance with ASME BPVC-IX.
- C. Product Data:
 - 1. Include data on pipe materials, pipe fittings, valves, and accessories.
 - 2. Provide manufacturer's catalog information.
 - 3. Indicate valve data and ratings.
- D. Field Quality Control Submittals: Testing activities.
- E. Project Record Documents:
 - 1. Record actual locations of piping mains, valves, connections, fire hydrants, free-standing fire department connections, underground manholes and vaults, valve boxes, thrust restraints, and invert elevations.
 - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- F. Maintenance Data: Include installation instructions, spare parts lists, and exploded assembly views.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years documented experience.
- B. Provide grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.
- C. Perform Work in accordance with Local Authority Having Jurisdiction, local municipality, local water utility, and Owner's requirements.

1.04 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.

1.05 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.

1.06 WARRANTY

- A. Refer to Division 01 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide ten year warranty for manufacturer's defects and labor costs for replacement.

PART 2 PRODUCTS

2.01 WATER PIPE

- A. Steel Pipe and Fittings:
 - 1. Pipe: Standard weight, zinc-coated, listed, ASTM A53/A53M.
 - 2. Fittings: Comply with ASME B16.3, Class 150, zinc coated, threaded or ASME B16.4, Class 125, zinc-coated.
 - 3. Mechanically Factory Applied Protective Materials:
 - a. Clean by wire brushing and solvent cleaning.
 - b. Apply one coat of coal-tar primer and two coats of coal-tar enamel complying with AWWA C203.
 - c. Protect threaded pipe ends and fittings prior to coating.
- B. Ductile Iron Pipe: Listed, AWWA C104/A21.4:
 - 1. Fittings: Ductile iron, standard thickness.
 - 2. Joints: AWWA C111/A21.11, styrene-butadiene rubber (SBR) or vulcanized SBR gasket with rods.
 - 3. Jackets: AWWA C105/A21.5 polyethylene jacket.
- C. Ductile Iron Pipe: Listed, AWWA C151/A21.51.
 - 1. Fittings: AWWA C110/A21.10, ductile iron, standard thickness.
 - 2. Joints: AWWA C111/A21.11, styrene-butadiene rubber (SBR) or vulcanized SBR rubber gasket with 3/4 inch (19 mm) diameter rods.

2.02 VALVES

- A. General:
 - 1. Manufacturer's name and pressure rating marked on valve body.
 - 2. Minimum Compliance: UL (DIR) listed and labeled.
 - 3. Maximum Inlet Pressure: 400 psi (2,760 kPa).
 - 4. Maximum Service Temperature: 180 degrees F (82.2 degrees C).
 - 5. Valve Coatings:
 - a. Internally: 4 mils, 0.004 inch (0.10 mm) epoxy, minimum.
 - b. Externally: Epoxy base then fire red enamel paint or heat-fused red epoxy paint.
- B. Detector Check with Water Meter:
 - 1. Manufacturers:
 - a. Badger Meter, Inc: www.badgermeter.com.
 - b. FEBCO: www.febcoonline.com.
 - c. Watts Water Technologies, Inc: www.wattswater.com.
 - d. Substitutions: Refer to Division 01 - Product Requirements.
 - 2. 4 inch NPS (100 mm, DN) to 10 inch NPS (250 mm, DN):

- a. Description: Double check valve, water meter, by-pass piping, and isolation valves designed to measure both low flow and high water volume usage.
 - 1) Valve Body: Comprised of epoxy coated stainless steel, ductile iron, or cast iron.
 - 2) Valve Ends: Flanged.

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. Earthwork: Perform earthwork operations in accordance with Sections 31 2316, 31 2316.13, and 31 2323.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. 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 [4] sq feet thrust restraint bearing on subsoil.
- D. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.04 INSTALLATION

- A. General Requirements:
 1. Location of Water Lines:
 - a. Terminate the work covered by this Section at a point approximately 5 feet (1.5 m) from the building unless indicated otherwise.
 2. Sleeving:
 - a. Sleeve water piping where piping is required to be installed within 3 feet (900 mm) of existing structures.
 - b. Provide ductile iron or Schedule 40 steel sleeves.
 - c. Fill annular space between pipe and sleeves with mastic.
 - d. Install water pipe and sleeve without damaging structures or causing settlement or movement of foundations or footings.
 3. Pipe Laying and Jointing:
 - a. Remove fins and burrs from pipe and fittings.
 - b. Prior to placing in position, clean pipe, fittings, valves, and accessories, and maintain in clean condition.
 - c. Provide proper facilities for lowering pipe sections into trenches.
 - d. Dropping or dumping of piping, fittings, valves, or any other water line material into trenches is not permitted.
 - e. Cut pipe in a neat, workmanlike manner accurately to length established at the site and work into place without forcing or springing.
 - f. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material.
 - g. Wedging or blocking between bells and spigots will not be permitted.
 - h. Install bell-and-spigot pipe with the bell end pointing in the direction of laying.
 - i. Grade the pipeline in straight lines avoiding the formation of dips and low points.
 - j. Support piping at proper elevation and grade.
 - k. Secure firm, uniform support.
 - l. Wood support blocking will not be permitted.
 - m. Install pipe so that the full length of each pipe section and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings.
 - n. Provide anchors and supports where necessary for fastening work into place.
 - o. Provide proper provisions for expansion and contraction of pipelines.
 - p. Keep trenches free of water until joints have been properly made.
 - q. Close open ends of piping temporarily with wood blocks or bulkheads at the end of each workday.
 - r. Do not install pipe during unacceptable trench conditions or inclement weather.
 - s. Minimum Depth of Pipe Cover: Not less than 2-1/2 feet (760 mm).
 4. Connections to Existing Water Lines:
 - a. Ensure minimal interruption of service on the existing line.
 - b. Make connections to existing lines under pressure in accordance with the recommended procedures of the manufacturer of the pipe being tapped.
 5. Penetrations:
 - a. Provide ductile-iron or Schedule 40 steel for pipes passing through walls of valve pits and structures.
 - b. Fill annular space between sleeves and walls with rich cement mortar.
 - c. Fill annular space between pipe and sleeves with mastic.
- B. Special Requirements:
 1. Ductile Iron Piping:
 - a. Unless otherwise specified, install pipe and fittings in accordance with paragraph "General Requirements".
 - b. Jointing.
 - c. Allowable Deflection:
 - 1) Maximum Allowable Deflection: As stated in AWWA C600.
 - 2) If the alignment requires deflection in excess of the above limitations, furnish special blends or a sufficient number of shorter pipe lengths to provide angular deflections within the limit set forth.
 - d. Pipe Anchorage:

- 1) Provide concrete thrust blocks (reaction backing), for pipe anchorage except where metal harness is indicated.
 - 2) Thrust blocks to comply with the requirements of AWWA C600 for thrust restraint, except that size and positioning of thrust blocks to be as indicated.
 - 3) Use concrete, ASTM C94/C94M, having a minimum compressive strength of 2,500 psi (15 MPa) at 28 days; or use concrete of a mix not leaner than one part cement, 2-1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.
 - 4) Provide metal harness in accordance with the requirements of AWWA C600 for thrust restraint, using tie rods and clamps as indicated in NFPA 13, except as otherwise indicated.
 - e. Exterior Protection: Completely encase buried ductile iron pipelines with polyethylene tube or sheet, using Class A polyethylene film, in accordance with AWWA C105/A21.5.
 2. Steel Piping:
 - a. Jointing:
 - 1) Assemble grooved and shouldered type joints in accordance with the recommendations of the coupling manufacturer.
 - b. Allowable Offsets.
 - c. Pipe Anchorage:
 - 1) Provide concrete thrust blocks (reaction backing) for pipe anchorage, except where metal harness is indicated.
 - 2) Thrust blocks to be in accordance with the recommendations for thrust restraint in AWWA M11, except that size and positioning of thrust blocks are to be as indicated.
 - 3) Use ASTM C94/C94M concrete having a minimum compressive strength of 2500 psi (15 MPa) at 28 days; or use concrete of a mix not leaner than one part cement, 2-1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.
 - 4) Metal Harness:
 - (a) Provide in accordance with the recommendations for joint harnesses in AWWA M11, except as otherwise indicated.
 - (b) Fabricated by the pipe manufacturer and furnished with the pipe.
 - C. Valves:
 1. Set valves on solid bearing.
 2. Center and plumb valve box over valve.
 3. Set box cover flush with finished grade.
 - D. Water Meters:
 1. Install in accordance with the requirements of the Local Authority Having Jurisdiction and local water utility.
 - E. Free-Standing Fire Department Connections:
 1. Install in accordance with NFPA 13 and the Local Authority Having Jurisdiction.
 2. Fire Department Connection to Main: Install ball drip valves at each check valve.
 3. Protective Pipe Bollards:
 - a. Install on 3 sides of each fire department connection.
 - b. See Section 05 5000.
 - 3.05 SERVICE CONNECTIONS
 - A. Provide fire water service to Local Authority Having Jurisdiction requirements with reduced pressure backflow preventer and water meter with by-pass valves and sand strainer.
 - B. Anchor fire service main to interior surface of foundation wall.
 - 3.06 FIELD QUALITY CONTROL
 - A. Field Tests and Inspections:
 1. Refer to Division 01 - Quality Requirements, for additional requirements.
 2. Provide all labor, equipment, and incidentals required for field testing, except that water and electric power needed for field tests will be furnished as set forth in Division 01 - Temporary Utilities.
 3. Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently and at least 5 days after placing of concrete after concrete thrust blocks have hardened sufficiently and at least 5 days after placing of concrete.
 4. Fill pipeline 24 hours before testing and apply test pressure to stabilize system, using only potable water.
 5. Test water piping in accordance with NFPA 13, where the additional water added to the system must not exceed the limits given in NFPA 13.
 6. Pressure test piping to 100 psi (689.47 kPa).
 7. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
 8. Prepare reports of testing activities.
 - 3.07 CLOSEOUT ACTIVITIES
 - A. Refer to Division 01 - Closeout Submittals, for closeout submittals.
 - B. Refer to Division 01 - Demonstration and Training, for additional requirements.
 - C. Demonstrate proper operation of equipment to Owner's designated representative.
- END OF SECTION

SECTION 21 1300 - FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wet-pipe sprinkler system.
- B. System design, installation, and certification.
- C. Fire department connections.

1.02 REFERENCE STANDARDS

- A. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements 2015.
- B. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements 2015.
- C. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements 2015.
- D. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements 2016.
- E. ITS (DIR) - Directory of Listed Products current edition.
- F. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 405 - Standard for Safety Fire Department Connection Devices Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.04 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Shop Drawings:
 - 1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
 - 2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components, and accessories. Indicate system controls.
 - 3. Submit shop drawings to Authorities Having Jurisdiction for approval. Submit proof of approval to Architect.
- D. Samples: Submit two of each style of sprinkler specified.
- E. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.
- F. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Refer to Division 01 - Product Requirements, for additional provisions.
 - 2. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.
 - 3. Sprinkler Wrenches: For each sprinkler type.
- H. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of referenced design and installation standard on site.
- B. Comply with FM (AG) requirements.
- C. Designer Qualifications: Design system under direct supervision of a Professional Engineer and/or state licensed experienced in design of this type of work and licensed in the State in which the Project is located.
- D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- E. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years experience approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Sprinklers, Valves, and Equipment:
 - 1. Tyco Fire Protection Products: www.tyco-fire.com.
 - 2. Viking Corporation: www.vikinggroupinc.com.
 - 3. Reliable.
 - 4. Substitutions: Refer to Division 01 - Product Requirements.

2.02 SPRINKLER SYSTEM

- A. Sprinkler System: Provide coverage for entire building.
- B. Non-residential Occupancy: Comply with NFPA 13.
- C. Water Supply: Determine volume and pressure from water flow test data.
- D. Provide fire department connections where indicated.
- E. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

2.03 SPRINKLERS

- A. Suspended Ceiling Type: Concealed pendant type with matching push on escutcheon plate.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Finish: Enamel, color White .
 - 4. Escutcheon Plate Finish: Enamel, color as selected.

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5. Fusible Link: Glass bulb type temperature rated for specific area hazard.
 - B. Exposed Area Type: Upright type.
 1. Response Type: Quick.
 2. Coverage Type: Extended.
 3. Fusible Link: Glass bulb type temperature rated for specific area hazard.
 - C. Sidewall Type: Semi-recessed horizontal sidewall type with matching push on escutcheon plate.
 1. Response Type: Quick.
 2. Coverage Type: Extended.
 3. Finish: Enamel, color White .
 4. Escutcheon Plate Finish: Enamel, color as selected.
 5. Fusible Link: Glass bulb type temperature rated for specific area hazard.
 - D. Residential Sprinklers: Concealed upright type with matching push on escutcheon plate.
 1. Response Type: Quick.
 2. Finish: Enamel, color White .
 3. Cover Plate Finish: Enamel, color as selected.
 4. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- 2.04 PIPING SPECIALTIES
- A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber-faced clapper to automatically actuate water motor alarm, pressure retard chamber and variable pressure trim with the following additional capabilities and features:
 1. Activate electric alarm.
 2. Test and drain valve.
 3. Replaceable internal components without removing valve from installed position.
 4. Manufacturers:
 - a. Victaulic Company; Series 751 with Series 760 motor alarm: www.victaulic.com/#sle.
 - b. Substitutions: Refer to Division 01 - Product Requirements.
 - B. Antifreeze Systems: Include UL listed pre-mixed solution for areas subject to freezing with the following additional capabilities and features:
 1. Backflow preventer at connection point and expansion tank sized for temperature range.
 2. Fill valve, funnel, and test/air vent valve at top of system.
 3. Test and drain valves at lowest and most remote points of system.
 - C. Backflow Preventer: Reduced pressure principle valve assembly backflow preventer with drain and OS & Y gate valve on each end.
 - D. Test Connections:
 1. Backflow Preventer Test Connection:
 - a. Provide downstream of the backflow prevention assembly, listed hose valves with 2.5 inch (65 mm) National Standard male hose threads with cap and chain.
 - b. Furnish one valve for each 250 gpm (16 L/s) of system demand or fraction thereof.
 - c. Provide permanent sign reading "Test Valve" in accordance with Section 21 0553.
 - E. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.
 - F. Fire Department Connections:
 1. Type: Free standing made of corrosion resistant metal complying with UL 405.
 - a. Sleeve: Brass, 18 inches (460 mm) height.
 - b. Signage: Raised or engraved lettering 1 inch (25.4 mm) minimum indicating system type.
 - c. Manufacturers:
 - 1) Elkhart Brass Manufacturing Company, Inc: www.elkhartbrass.com.
 - 2) Substitutions: Refer to Division 01 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with referenced NFPA design and installation standard.
- B. Install equipment in accordance with manufacturer's instructions.
- C. Provide approved double check valve assembly at sprinkler system water source connection.
- D. Place pipe runs to minimize obstruction to other work.
- E. Place piping in concealed spaces above finished ceilings.
- F. Center sprinklers in two directions in ceiling tile and provide piping offsets.
- G. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- H. Flush entire piping system of foreign matter.
- I. Install guards on sprinklers where indicated.
- J. Hydrostatically test entire system.
- K. Require test be witnessed by Fire Marshal and Authority Having Jurisdiction.

3.02 INTERFACE WITH OTHER PRODUCTS

- A. Ensure required devices are installed and connected to fire alarm system.

END OF SECTION

SECTION 22 0050 - PLUMBING EXECUTION

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Definitions.
 - 2. Coordination.
 - 3. Piping materials and installation instructions common to most piping systems.
 - 4. Dielectric fittings.
 - 5. Mechanical sleeve seals.
 - 6. Sleeves.
 - 7. Escutcheons.
 - 8. Grout.
 - 9. Plumbing demolition.
 - 10. Equipment installation requirements common to equipment sections.
 - 11. Concrete bases.
 - 12. Supports and anchorages.

1.02 RELATED DOCUMENTS

- A. Drawings, General Provisions of the Contract, including General Conditions, Supplementary General Conditions, other Division 00 & 01 Specification Sections, shall apply to this division.
- B. These requirements apply to all Division 22 work.

1.03 DEFINITIONS

- A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.04 COORDINATION

- A. Coordination: Coordinate construction operations to ensure efficient and orderly installation of the Work.
 - 1. Coordinate construction operations, that depend on each other for proper installation, connection, and operation.
 - 2. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 3. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 4. Make adequate provisions to accommodate items scheduled for later installation.
 - 5. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Construction Schedule.
 - 2. Preparation of the Schedule of Values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Preinstallation conferences.
 - 7. Project closeout activities.
 - 8. Startup and adjustment of systems.
 - 9. Project closeout activities.

1.05 PROJECT MEETINGS

- A. General: Attend meetings and conferences at Project site, unless otherwise indicated.
 - 1. Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Engineer of scheduled meeting dates and times.
 - 2. Agenda: Request the meeting agenda if not furnished prior to meeting.
 - 3. Minutes: Record significant discussions and agreements achieved. Request the meeting minutes if not furnished. Note all discrepancies and notify Engineer of all changes to the Work or to the Contract Documents.
- B. Preconstruction Conference: Attend the preconstruction conference before starting construction, no later than 15 days after execution of the Agreement to review responsibilities and personnel assignments.
 - 1. Attendees: Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Discuss items of significance that could affect progress, including the following as applicable:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for requests for interpretations (RFIs).
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - j. Submittal procedures.
 - k. LEED requirements.
 - l. Preparation of Record Documents.
 - m. Use of the premises.
 - n. Work restrictions.
 - o. Owner's occupancy requirements.
 - p. Responsibility for temporary facilities and controls.
 - q. Construction waste management and recycling.
 - r. Parking availability.
 - s. Office, work, and storage areas.
 - t. Equipment deliveries and priorities.
 - u. First aid.
 - v. Security.
 - w. Progress cleaning.
 - x. Working hours.
 - C. Preinstallation Conferences: Attend a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following as applicable:
 - a. The Contract Documents.
 - b. Options.
 - c. Related requests for interpretations (RFIs).
 - d. Related Change Orders.
 - e. Purchases, deliveries, submittals.
 - f. Review of mockups.
 - g. Possible conflicts.
 - h. Compatibility problems.
 - i. Time schedules.
 - j. Weather limitations.
 - k. Manufacturer's written recommendations.
 - l. Warranty requirements.
 - m. Compatibility of materials.
 - n. Acceptability of substrates.
 - o. Space and access limitations.
 - p. Regulations of authorities having jurisdiction.
 - q. Testing and inspecting requirements.
 - r. Installation procedures.
 - s. Coordination with other work.
 - t. Required performance results.
 - u. Protection of adjacent work.
 - v. Protection of construction and personnel.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present, to parties who should have been present, and to the Engineer.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- 1.06 SUBMITTALS
- A. Alternate Products: Alternate manufacturers, equipment and/or products must be specified or approved prior to bid in writing via addendum to be accepted. All costs associated with deviations from the basis of design shall be borne by the contractor. Deviations shall include alternate manufacturer and/or alternate product and shall include all significant dimensional, performance, electrical, or installation differences from the basis of design products. Costs for reimbursement shall include the costs of other trades affected, and shall include all engineering costs to evaluate such deviations.
 - B. Substitutions: Unspecified manufacturers shall be considered substitutions and shall be submitted for consideration under the specified substitution procedures. Substitutions shall be submitted to the engineer for evaluation. If

approved by the engineer, substitution shall be offered to the owner for consideration. All costs associated with substitutions shall be borne by the contractor. Costs for reimbursement shall include the costs of other trades affected, and shall include all engineering costs to evaluate such deviations.

- C. Coordination Drawings: Prepare Coordination Drawings (coordinated shop drawings) to maximize utilization of space for efficient installation of different components and for installation of products and materials fabricated by separate entities. Submit to Engineer for review before starting work.
 - 1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
 - a. Indicate functional and spatial relationships of components of the work with all other systems and trades.
 - b. Indicate required installation sequences.
 - c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide sketches of proposed alternate construction to Engineer for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- D. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project. Submit to Engineer before starting work.
 - 1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.
- E. Make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.
- F. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.
- G. Prior to submitting shop drawings for review, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

1.07 Warranties

- A. All work shall include a parts and labor warranty on materials and workmanship for a period of 1 year.
- B. Refer to Division 01 for additional warranty requirements.

PART 2 PRODUCTS

2.01 SLEEVES

- A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- B. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.
- C. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include underdeck clamp, clamping ring with set screws, nuts, and bolts for membrane flashing.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.02 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.03 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: Carbon steel. Include two for each sealing element.
- D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.04 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.

2.05 PIPE, TUBE, AND FITTINGS

- A. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.06 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

- B. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.
- E. Welding Filler Metals: Comply with AWS D10.12.
- F. Solvent Cements for Joining Plastic Piping:
 - 1. CPVC Piping: ASTM F 493.
 - 2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.07 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

PART 3 EXECUTION

3.01 COMMON REQUIREMENTS

- A. Install according to manufacturer requirements and other Division specification sections.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas. Where located within walls and other concealed areas subject to damage, provide suitable protection.
- D. Piping indicated to be exposed and piping in equipment rooms and service areas shall be at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Materials exposed within plenums shall be noncombustible or have a flame spread index of 25 or less and a smoke-developed index of 50 or less.
- G. Install piping and equipment with clearances to permit servicing.
- H. Install piping at indicated slopes free of sags and bends and with fittings for branch connections and changes in direction.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Contact manufacturer's representative to visit site and observe installation in order to confirm installation requirements and warranty coverage. Document observation in writing and include in O&M manuals.
- L. Provide service and maintenance for not less than one year from the Date of Substantial Completion or for the warranty period specified in Division 01, whichever is longer. Refer to Division 01 for additional service and requirements.

3.02 PENETRATIONS

- A. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls. Sleeve ends shall be flush with both wall surfaces unless otherwise noted. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Concrete and masonry penetrations: seal space outside of sleeves with grout. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- B. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- C. Roof-Penetrations: Seal penetration of roof with flexible boot-type flashing units applied in coordination with roofing work.
- D. Aboveground, Exterior-Wall Pipe Penetrations: Position pipe in center of sleeve. Maintain 1% outward slope, unless otherwise indicated. Seal penetrations using non-expanding foam. After cured, trim flush with sleeve end and paint with color to match surrounding finish.
- E. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- F. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at. Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07. "Comply with requirements in Division 07."
- G. Apply firestopping to non-ducted penetrations of fire and/or smoke rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07.
- H. Penetrations of membranes of rated walls shall be protected by UL listed products. Coordinate exact installation conditions with selected fire sealants supplier. For penetrations which do not have a standard UL installation detail, arrange for engineering determination from damper manufacturer and/or sealant supplier and provide modifications required to match detail.

- I. Install escutcheons for penetrations of walls, ceilings, and floors.
- 3.03 PIPING JOINT CONSTRUCTION
 - A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 - B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 - C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
 - D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
 - E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
 - F. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
 - G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
 - H. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 4. PVC Nonpressure Piping: Join according to ASTM D 2855.
 - I. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
 - J. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
 - K. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
 - L. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.
- 3.04 PIPING CONNECTIONS
 - A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.
- 3.05 INSTALLATION - COMMON REQUIREMENTS
 - A. Install equipment, fixtures, valves and specialties according to manufacturer installation instructions and recommendations.
 - B. Refer to other Sections of these Specifications for additional requirements.
 - C. Install to allow maximum possible headroom unless specific mounting heights are indicated.
 - D. Install work level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
 - E. Install work to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
 - F. Install work to allow right of way for piping installed at required slope.
 - G. Contact equipment manufacturer's representative to visit site and observe installation in order to confirm installation requirements and warranty coverage. Document observation in writing and include in O&M manuals.
 - H. Provide service and maintenance for not less than one year from the Date of Substantial Completion or for the warranty period specified in Division 01, whichever is longer. Refer to Division 01 for additional service and requirements.
- 3.06 CONCRETE BASES
 - A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Provide concrete bases which are plumb, level and fully supported to prevent shifting over time.
 - 2. Provide concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 3. Place and secure anchorage devices. Install according to equipment manufacturer's recommendations, setting drawings, templates, diagrams, instructions, and directions for supported equipment. Provide anchor bolts according to anchor-bolt manufacturer's written instructions. Install anchor bolts to elevations required for proper attachment to supported equipment. Unless otherwise noted, install epoxy-coated anchor bolts to match equipment that extend through concrete base, and anchor into structural concrete.

4. Where located on structural floor, provide dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
5. Provide 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.07 SUPPORTS AND ANCHORAGES

- A. Provide supports to match construction type and adjacent assembly rating.
- B. For combustible construction, provide wood supports and anchorages. Cut, fit, and place nailers, blocking, and anchorages to support, and anchor materials and equipment. Select fasteners that will not penetrate members to opposite side. Tighten connections between members. Install fasteners without splitting wood members.
- C. For non-combustible building construction provide metal supports and anchorages. Refer to Division 05 Section "Metal Fabrications" for structural steel. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment. Field Welding shall comply with AWS D1.1.
- D. Attach to substrates to support applied loads.

3.08 GROUTING

- A. Clean surfaces that will come into contact with grout. Provide forms for placement of grout.
- B. Mix and install grout for HVAC equipment base bearing surfaces, and anchors.
- C. Place grout around anchors and completely filling equipment base and provide smooth bearing surface for equipment. Avoid air entrapment during placement of grout.
- D. Allow grout to cure before loading or applying forces.

3.09 SLEEVE-SEAL INSTALLATION

- A. Install to seal below-grade exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION 220500

SECTION 22 0516 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flexible pipe connectors.
- B. Pipe loops, offsets, and swing joints.

1.02 REFERENCE STANDARDS

- A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2015a (Reapproved 2019).
- B. EJMA (STDS) - EJMA Standards Tenth Edition.

1.03 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

PART 2 PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS

- A. Manufacturers:
 - 1. Mercer Rubber Company: www.mercer-rubber.com.
 - 2. The Metraflex Company: www.metraflex.com/#sle.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Inner Hose: Stainless steel.
- C. Exterior Sleeve: Single braided, stainless steel.
- D. Pressure Rating: 125 psi and 450 degrees F (862 kPa and 232 degrees C).
- E. Joint: As specified for pipe joints.
- F. Size: Use pipe sized units.
- G. Maximum offset: 3/4 inch (20 mm) on each side of installed center line.

2.02 FLEXIBLE JOINTS AND LOOPS - HOSE AND BRAID

- A. Provide flexible loops with two flexible sections of hose and braid, two 90 degree elbows, and 180 degree return with support bracket and air release or drain plug.
- B. Provide flexible loops capable of movement in the x, y, and z planes. Flexible loops to impart no thrust loads to the building structure.
- C. Flexible Connectors: Flanged, braided type with wetted components of stainless steel, sized to match piping.
 - 1. Maximum Allowable Working Pressure: 150 psig (1030 kPa) at 120 degrees F (49 degrees C).
 - 2. End Connections: Same as specified for pipe jointing.
 - 3. Provide necessary accessories including, but not limited to, swivel joints.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.
- C. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.
- D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.
- E. Provide support and pipe loops to control expansion and contraction of piping. Provide where straight run > 50' to allow 3" of expansion per 50' of length for DCW, .6" per 50' for DHW.
- F. Substitute grooved piping for vibration isolated equipment instead of flexible connectors. Grooved piping need not be anchored.

END OF SECTION

SECTION 22 0519 - METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pressure gauges and pressure gauge taps.
- B. Thermometers and thermometer wells.

1.02 REFERENCE STANDARDS

- A. ASME B40.100 - Pressure Gauges and Gauge Attachments 2013.
- B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers 2014.
- C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers 2014 (Reapproved 2021).
- D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com.
 - 2. Moeller Instrument Company, Inc: www.moellerinstrument.com.
 - 3. Omega Engineering, Inc: www.omega.com.
 - 4. Substitutions: Refer to Division 01 - Product Requirements.
- B. 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 (115 mm) diameter.
 - 3. Mid-Scale Accuracy: One percent.
 - 4. Scale: Psi and kPa.

2.02 PRESSURE GAUGE TAPPINGS

- A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi (1034 kPa).
- B. Needle Valve: Brass, 1/4 inch (6 mm) NPT for minimum 150 psi (1034 kPa).
- C. Pulsation Damper: Pressure snubber, brass with 1/4 inch (6 mm) connections.
- D. Syphon: Steel, Schedule 40, 1/4 inch (6 mm) angle or straight pattern.

2.03 STEM TYPE THERMOMETERS

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com.
 - 2. Omega Engineering, Inc: www.omega.com.
 - 3. Weksler Glass Thermometer Corp: www.wekslerglass.com.
 - 4. Substitutions: Refer to Division 01 - Product Requirements.
- B. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
 - 1. Size: 9 inch (225 mm) scale.
 - 2. Window: Clear Lexan.
 - 3. Accuracy: 2 percent per ASTM E77.
 - 4. Calibration: Degrees F.

2.04 DIAL THERMOMETERS

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com.
 - 2. Omega Engineering, Inc: www.omega.com.
 - 3. Weksler Glass Thermometer Corp: www.wekslerglass.com.
 - 4. Substitutions: Refer to Division 01 - Product Requirements.
- B. Thermometers - Adjustable Angle: Dial type bimetallic actuated; ASTM E1; stainless steel case, adjustable angle with front recalibration, silicone fluid damping, white with black markings and black pointer, hermetically sealed lens, stainless steel stem.
 - 1. Size: 5 inch (125 mm) diameter dial.
 - 2. Accuracy: 1 percent.
 - 3. Calibration: Degrees F.

2.05 THERMOMETER SUPPORTS

- A. Socket: Brass separable sockets for thermometer stems with or without extensions, and with cap and chain.
- B. Flange: 3 inch (75 mm) outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.06 TEST PLUGS

- A. Test Plug: 1/4 inch (6 mm) or 1/2 inch (13 mm) brass fitting and cap for receiving 1/8 inch (3 mm) outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F (93 degrees C).

2.07 STATIC PRESSURE GAUGES

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com.
 - 2. Omega Engineering, Inc: www.omega.com.
 - 3. Weksler Glass Thermometer Corp: www.wekslerglass.com.
 - 4. Substitutions: Refer to Division 01 - Product Requirements.

- B. 3-1/2 inch (90 mm) diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.
- C. Accessories: Static pressure taps with compression fittings for bulkhead mounting, 1/4 inch (6 mm) diameter tubing.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install pressure gages with pulsation dampers. Provide gage cock to isolate each gage. Extend nipples and siphons to allow clearance from insulation.
- C. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch (60 mm) for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
- D. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- E. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- F. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.
- G. Locate test plugs adjacent thermometers and thermometer sockets.

3.02 SCHEDULES

- A. Pressure Gauges, Location and Scale Range:
 - 1. Pumps, 0 to 100 psi (0 to 689.47 kPa).
 - 2. Expansion tanks, 0 to 100 psi (0 to 689.47 kPa).
 - 3. Standpipe, highest points, 0 to 150 psi (0 to 1034.21 kPa).
 - 4. Standpipe and sprinkler water supply connection, 0 to 100 psi (0 to 1034.21 kPa).
 - 5. Sprinkler system, 0 to 100 psi (0 to 689.47 kPa).
 - 6. Pressure reducing valves, 0 to 100 psi (0 to 689.47 kPa).
 - 7. Backflow preventers, 0 to 100 psi (0 to 689.47 kPa).
- B. Pressure Gauge Tappings, Location:
 - 1. Boiler - inlets and outlets.
- C. Thermometers, Location and Scale Range:
 - 1. Headers to central equipment, 0 to 150 degrees F (0 to 65.55 Degrees C).
 - 2. Domestic hot water supply and recirculation, 0 to 150 degrees F (0 to 65.55 Degrees C).

END OF SECTION

SECTION 22 0523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Applications.
- B. Ball valves.
- C. Butterfly valves.
- D. Check valves.
- E. Gate valves.
- F. Plug valves.

1.02 REFERENCE STANDARDS

- A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2018.
- B. ASME B31.9 - Building Services Piping 2020.
- C. ASTM A48/A48M - Standard Specification for Gray Iron Castings 2003 (Reapproved 2021).
- D. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings 2004 (Reapproved 2019).
- E. ASTM B61 - Standard Specification for Steam or Valve Bronze Castings 2015 (Reapproved 2021).
- F. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings 2017.
- G. MSS SP-67 - Butterfly Valves 2017.
- H. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends 2011.
- I. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves 2013.
- J. NSF 61 - Drinking Water System Components - Health Effects 2020.
- K. NSF 372 - Drinking Water System Components - Lead Content 2020.

1.03 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

1.04 QUALITY ASSURANCE

- A. Manufacturer:
 - 1. Obtain valves for each valve type from single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
 - 2. Protect valve parts exposed to piped medium against rust and corrosion.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. See drawings for specific valve locations.
- B. Provide the following valves for the applications if not indicated on drawings:
 - 1. Shutoff: Ball, butterfly, gate or plug.
 - 2. Throttling: Provide ball type balancing valve with gauge taps and scale.
- C. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.
- D. Domestic, Hot and Cold Water Valves:
 - 1. 2 NPS (50 DN) and Smaller:
 - a. Bronze: Provide with solder-joint or threaded ends.
 - b. Ball: One piece, full port, bronze with brass trim.
 - c. Bronze Swing Check: Class 125, bronze disc.
 - d. Bronze Gate: Class 125, NRS.
 - 2. 2-1/2 NPS (65 DN) and Larger:
 - a. Iron, 2-1/2 NPS (65 DN) to 4 NPS (100 DN): Provide with threaded or flanged ends.
 - b. Iron Grooved-End Butterfly: 175 CWP.
 - c. Iron Gate: Class 125, NRS.

2.02 GENERAL REQUIREMENTS

- A. Valve Pressure and Temperature Ratings: No less than rating indicated; as r for system pressures and temperatures.
- B. Valve Sizes: Match upstream piping unless otherwise indicated.
- C. Valve Actuator Types.
- D. Valves in Insulated Piping: With 2 NPS (50 DN) stem extensions and the following features:
 - 1. Gate Valves: Rising stem.
 - 2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - 3. Butterfly Valves: Extended neck.
 - 4. Memory Stops: Fully adjustable after insulation is installed.
- E. Valve-End Connections.
- F. General ASME Compliance:
 - 1. Solder-joint Connections: ASME B16.18.
 - 2. Building Services Piping Valves: ASME B31.9.
- G. Potable Water Use:
 - 1. Certified: Approved for use in compliance with NSF 61 and NSF 372.
 - 2. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.
- H. Source Limitations: Obtain each valve type from a single manufacturer.

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2.03 IRON, GROOVED-END BUTTERFLY VALVES

- A. CWP Rating: 175 psig (1200 kPa).
 - 1. Comply with MSS SP-67, Type I.
 - 2. Body: Coated ductile iron.
 - 3. Stem: Two-piece stainless steel.
 - 4. Disc: Coated ductile iron.
 - 5. Disc Seal: EPDM.

2.04 BRONZE, LIFT CHECK VALVES

- A. General:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. Class 125:
 - 1. Comply with MSS SP-80, Type 1, Metal Disc to Metal Seat and Type 2, Nonmetallic Disc to Metal Seat.
 - 2. CWP Rating: 200 psig (1380 kPa).
 - 3. Design: Vertical flow.
 - 4. Body: Comply with ASTM B61 or ASTM B62, bronze.
 - 5. Ends: Threaded as indicated.
 - 6. Disc (Type 1): Bronze.

2.05 BRONZE, SWING CHECK VALVES

- A. General:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.

2.06 BRONZE, GATE VALVES

- A. General:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.

2.07 IRON, GATE VALVES

2.08 LUBRICATED PLUG VALVES

- A. Regular Gland with Flanged Ends:
 - 1. Comply with MSS SP-78, Type II.
 - 2. Class 125: CWP Rating: 200 psig (1380 kPa).
 - 3. Class 250: CWP Rating: 400 psig (2760 kPa).
 - 4. Body: ASTM A48/A48M or ASTM A126, cast iron with lubrication sealing system.
 - 5. Pattern: Regular or short.
 - 6. Plug: Cast iron or bronze with sealant groove.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.
- B. Verify valve parts to be fully operational in all positions from closed to fully open.
- C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.
- D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
- B. Provide separate valve support and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.
- C. Install check valves where necessary to maintain direction of flow as follows:
 - 1. Swing Check: Install horizontal maintaining hinge pin level.

END OF SECTION

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Stencils.
- D. Pipe markers.
- E. Ceiling tacks.

1.02 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems 2020.

1.03 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.
- E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Heat Transfer Equipment: Nameplates.
- B. Piping: Tags.
- C. Pumps: Nameplates.
- D. Tanks: Nameplates.
- E. Valves: Tags and ceiling tacks where located above lay-in ceiling.
- F. Water Treatment Devices: Nameplates.

2.02 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/4 inch (6 mm).
 - 3. Background Color: Black.
 - 4. Plastic: Comply with ASTM D709.

2.03 TAGS

- A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.

2.04 STENCILS

- A. Stencils: With clean cut symbols and letters of following size:
 - 1. 3/4 to 1-1/4 inch (20-30 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 1/2 inch (15 mm) high letters.
 - 2. 1-1/2 to 2 inch (40-50 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 3/4 inch (20 mm) high letters.
 - 3. 2-1/2 to 6 inch (65-150 mm) Outside Diameter of Insulation or Pipe: 12 inch (300 mm) long color field, 1-1/4 inch (30 mm) high letters.

2.05 PIPE MARKERS

- A. Comply with ASME A13.1.
- B. 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.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- D. Color code as follows:
 - 1. Potable, Cooling, Boiler, Feed, Other Water: Green with white letters.
 - 2. Flammable Fluids: Yellow with black letters.

2.06 CEILING TACKS

- A. Description: Steel with 3/4 inch (20 mm) diameter color coded head.
- B. Color code as follows:
 - 1. Plumbing Valves: Green.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 09 9123 for stencil painting.

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. Apply stencil painting in accordance with Section 09 9123.
- D. Install plastic pipe markers in accordance with manufacturer's instructions.
- E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- F. Use tags on piping 3/4 inch (20 mm) diameter and smaller.
 - 1. Identify service, flow direction, and pressure.
 - 2. Install in clear view and align with axis of piping.
 - 3. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

G. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 22 0719 - 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 C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.
- C. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2019.
- D. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber 2020.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- F. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

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 and approved by manufacturer.

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; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
 - 1. K (Ksi) Value: ASTM C177, 0.23 at 75 degrees F (0.034 at 24 degrees C).
 - 2. Maximum Service Temperature: 220 degrees F (104 degrees C).
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.

2.03 POLYETHYLENE

- A. Manufacturers:
 - 1. Armacell LLC: www.armacell.us.
 - 2. Substitutions: Refer to Division 01 - Product Requirements.
- B. Insulation: Flexible closed-cell polyethylene tubing, slit lengthwise for installation, complying with applicable requirements of ASTM D1056.
 - 1. K (Ksi) Value: ASTM C177; 0.25 at 75 degrees F (0.036 at 24 degrees C).
 - 2. Maximum Service Temperature: 200 degrees F (93 degrees C).
 - 3. Density: 2 lb/cu ft (32 kg/cu m).
 - 4. Maximum Moisture Absorption: 1.0 percent by volume.
 - 5. Moisture Vapor Permeability: 0.05 perm inch (0.073 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
 - 6. Connection: Contact adhesive.

2.04 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturers:
 - 1. Aeroflex USA, Inc: www.aeroflexusa.com.
 - 2. Armacell LLC: www.armacell.us.
 - 3. Substitutions: Refer to Division 01 - Product Requirements.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3; use molded tubular material.
 - 1. 'K' Value: ASTM C534; 0.25 at 75 degrees F.
 - 2. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
 - 3. Maximum Service Temperature: 220 degrees F (104 degrees C).
 - 4. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.05 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 (Minus 18 degrees C).
 - b. Maximum Service Temperature: 150 degrees F (66 degrees C).

- c. Moisture Vapor Permeability: 0.002 perm inch (0.0029 ng/Pa s m), maximum, when tested in accordance with ASTM E96/E96M.
- d. Thickness: 10 mil (0.25 mm).
- e. Connections: Brush on welding adhesive.
- B. Canvas Jacket: UL listed 6 oz/sq yd (220 g/sq m) plain weave cotton fabric treated with dilute fire retardant lagging 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 with 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. For hot piping conveying fluids 140 degrees F (60 degrees C) 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 (60 degrees C), insulate flanges and unions at equipment using preformed fitting covers.
- 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 (40 mm) diameter or larger.
 - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 - 3. Insert Location: Between support shield and piping and under the finish jacket.
 - 4. Insert Configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 - 5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 8400.
- J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet (3 meters) above finished floor): Finish with canvas jacket sized for finish painting.

3.03 SCHEDULES

- A. Plumbing Systems:
 - 1. Domestic Hot Water Supply:
 - a. Glass Fiber Insulation:
 - 1) Pipe Size Range: All sizes.
 - 2) Thickness: 1 inch (25 mm).
 - b. Hydrous Calcium Silicate Insulation: Pipe hanger saddles.
 - 2. Domestic Hot Water Recirculation:
 - a. Glass Fiber Insulation:
 - 1) Pipe Size Range: All sizes.
 - 2) Thickness: 1 inch (25 mm).
 - b. Polyethylene Insulation:
 - 1) Pipe Size Range: All sizes.
 - 2) Thickness: 1 inch (25 mm).
 - 3. Domestic Cold Water:
 - a. closed cell elastomeric or polyethylene.
 - b. 1/2" thick.
 - 4. Roof Drain Bodies.
 - 5. Roof Drainage Above Grade.
 - 6. Roof Drainage Within 10 Feet (3 Meters) of the Exterior:
 - a. closed cell elastomeric or polyethylene.
 - b. 1/2" thick.
 - 7. Roof Drainage Run Horizontal at Roof Level.

END OF SECTION

SECTION 22 1005 - 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. Natural Gas Piping
 - 4. Flanges, unions, and couplings.
 - 5. Pipe hangers and supports.
 - 6. Ball valves.
 - 7. Balancing valves.

1.02 REFERENCE STANDARDS

- A. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems 2015 (Reaffirmed 2020).
- B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 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 B31.1 - Power Piping 2020.
- F. ASME B31.9 - Building Services Piping 2020.
- G. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers 2021.
- H. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2021.
- I. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Potable Water Distribution Systems 2020.
- J. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.
- K. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- L. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.
- M. ASTM B32 - Standard Specification for Solder Metal 2020.
- N. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2020.
- O. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.
- P. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube 2016.
- Q. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings 2016.
- R. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120 2021a.
- S. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings 2004 (Reapproved 2016).
- T. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter 2021.
- U. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series) 2020.
- V. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40 2021.
- W. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems 2020.
- X. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe 2021.
- Y. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings 2014, with Editorial Revision (2018).
- Z. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings 2020.
- AA. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2017.
- BB. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems 2019a.
- CC. 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 2020.
- DD. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2016.
- EE. ASTM F437 - Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80 2021.
- FF. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40 2017.
- GG. ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80 2019.
- HH. ASTM F441/F441M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80 2020.
- II. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR) 2020.
- JJ. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings 2020.

- KK. ASTM F628 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core 2012, with Editorial Revision (2018).
- LL. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing 2020b.
- MM. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems 2020.
- NN. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing 2021.
- OO. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings 2017.
- PP. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast 2017, with Errata (2018).
- QQ. AWWA C651 - Disinfecting Water Mains 2014.
- RR. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018.
- SS. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010.
- TT. NSF 61 - Drinking Water System Components - Health Effects 2020.
- UU. NSF 372 - Drinking Water System Components - Lead Content 2020.
- VV. PPI TR-4 - PPI Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings For Thermoplastic Piping Materials or Pipe 2017.
- 1.03 SUBMITTALS
 - A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
 - B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
 - C. Project Record Documents: Record actual locations of valves.
- 1.04 QUALITY ASSURANCE
 - A. Perform work in accordance with applicable codes. Coordinate inspections to allow adequate time for review and approval before piping system concealment.
 - B. Valves: Manufacturer's name and pressure rating marked on valve body.
 - C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.
 - D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.
 - E. 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. 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.
- 1.06 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 (1500 mm) OF BUILDING
 - A. ABS Pipe: ASTM F628.
 - 1. Fittings: ABS.
 - 2. Joints: Solvent welded with ASTM D2235 cement.
 - B. ABS Pipe: ASTM D2661.
 - 1. Fittings: ABS.
 - 2. Joints: Solvent welded with ASTM D2235 cement.
 - C. PVC Pipe: ASTM D2665 or ASTM D3034.
 - 1. Fittings: PVC.
 - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.
 - D. PVC Pipe: ASTM D2729.
 - 1. Fittings: PVC.
 - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.
 - E. PVC Pipe: ASTM D2665.
 - 1. Fittings: PVC.
 - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.
 - F. PVC Pipe: ASTM D1785 and ASTM D2665 dual marked Schedule 40,
 - 1. or ASTM D2241 SDR 26 with not less than 150 psi (1 034 kPa) pressure rating.
 - 2. Fittings: ASTM D2466, PVC.
 - 3. Fittings: ASTM D2665, PVC.
 - 4. Joints: Solvent welded, with ASTM D2564 solvent cement.
- 2.03 SANITARY SEWER PIPING, ABOVE GRADE
 - A. ABS Pipe: ASTM F628.
 - 1. Fittings: ABS.
 - 2. Joints: Solvent welded with ASTM D2235 cement.
 - B. ABS Pipe: ASTM D2661.
 - 1. Fittings: ABS.

2. Joints: Solvent welded with ASTM D2235 cement.
- C. PVC Pipe: ASTM D2729.
 1. Fittings: PVC.
 2. Joints: Solvent welded, with ASTM D2564 solvent cement.
- D. PVC Pipe: ASTM D1785 and ASTM D2665 dual marked Schedule 40,
 1. Fittings: ASTM D2665, PVC.
 2. Joints: Solvent welded, with ASTM D2564 solvent cement.
- 2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET (1500 mm) OF BUILDING
 - A. Ductile Iron Pipe: AWWA C151/A21.51.
 1. Fittings: Ductile or gray iron, standard thickness.
 2. Joints: AWWA C111/A21.11, styrene butadiene rubber (SBR) or vulcanized SBR gasket with 3/4 inch (19 mm) diameter rods.
 - B. PE Pipe: ASTM D2239.
 1. Fittings: ASTM D2609, PE.
 2. Joints: Mechanical with stainless steel clamp.
- 2.05 DOMESTIC WATER PIPING, ABOVE GRADE
 - A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), Drawn (H).
 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 2. Joints: ASTM B32, alloy Sn95 solder.
 3. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.
 - a. Manufacturers:
 - 1) Apollo Valves: www.apollovalves.com/#sle.
 - 2) CopperPress
 - 3) Grinnell Products, a Tyco Business: www.grinnell.com.
 - 4) Nibco
 - 5) Viega LLC: www.viega.com.
 - 6) Substitutions: See Section 01 6000 - Product Requirements.
 - B. CPVC Pipe (if approved by Owner and Engineer): ASTM D2846/D2846M, ASTM F441/F441M, or ASTM F442/F442M.
 1. Fittings: CPVC; ASTM D2846/D2846M, ASTM F437, ASTM F438, or ASTM F439.
 2. Joints: ASTM D2846/D2846M, solvent weld with ASTM F493 solvent cement.
 - C. Cross-Linked Polyethylene (PEX) Pipe (if approved by Owner and Engineer): ASTM F876 or ASTM F877.
 1. Manufacturers:
 - a. SharkBite, a brand of Reliance Worldwide Corporation: www.sharkbite.com/#sle.
 - b. Uponor, Inc; Logic System: www.uponorengineering.com/sle.
 - c. Viega LLC: www.viega.com.
 - d. Substitutions: Refer to Division 01 - Product Requirements.
 2. PPI TR-4 Pressure Design Basis:
 - a. 80 psig (551 kPa) at maximum 200 degrees F (93 degrees C).
 3. Fittings: Brass and engineered polymer (EP) ASTM F1960.
 4. Joints: ASTM F1960 cold-expansion fittings (Crimp fittings are not permitted).
 - D. Polyethylene Raised Temp, PE-RT bimodal polyethylene (if approved by Owner and Engineer): ASTM 2769.
 1. Manufacturers:
 - a. Legend Hyperpure
 2. Rated Pressure and Temperature:
 - a. 200 psi at maximum 73°F
 - b. 100 psi at maximum 180°F
 3. Fittings: Brass and engineered polymer
 4. Joints: Crimp, cinch, clamp, push fit, and fused fittings, per manufacturer's instruction.
 5. Warranty:
 - a. 100-year limited warranty.
- 2.06 NATURAL GAS PIPING, ABOVE GRADE
 - A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
 1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
 2. Joints: Threaded or welded to ASME B31.1.
- 2.07 FLANGES, UNIONS, AND COUPLINGS
 - A. Unions for Pipe Sizes 3 inch (80 mm, DN) and Under:
 1. Ferrous Pipe: Class 150 malleable iron threaded unions.
 2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.
 - B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
- 2.08 PIPE HANGERS AND SUPPORTS
 - A. Provide hangers and supports that comply with MSS SP-58.
 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
 3. Trapeze Hangers: Welded steel channel frames attached to structure.
 4. Vertical Pipe Support: Steel riser clamp.
 5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.

6. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
 - a. Bases: High-density polypropylene.
 - b. Base Sizes: Large enough to distribute load sufficiently to prevent indentation of roofing assembly.
 - c. Steel Components: Stainless steel or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
 - d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion-resistant material.
 - e. Height: Provide minimum clearance of 6 inches (150 mm) under pipe to top of roofing.
 - B. Plumbing Piping - Drain, Waste, and Vent:
 1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (15 to 40 mm, DN): Malleable iron, adjustable swivel, split ring.
 2. Hangers for Pipe Sizes 2 inch (50 mm, DN) and Over: Carbon steel, adjustable, clevis.
 3. Wall Support for Pipe Sizes to 3 inch (80 mm, DN): Cast iron hook.
 4. Wall Support for Pipe Sizes 4 inch (100 mm, DN) and Over: Welded steel bracket and wrought steel clamp.
 5. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - C. Plumbing Piping - Water:
 1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (15 to 40 mm, DN): Malleable iron, adjustable swivel, split ring.
 2. Hangers for Cold Pipe Sizes 2 inch (50 mm, DN) and Over: Carbon steel, adjustable, clevis.
 3. Hangers for Hot Pipe Sizes 2 to 4 inch (50 to 100 mm, DN): Carbon steel, adjustable, clevis.
 4. Hangers for Hot Pipe Sizes 6 inch (150 mm, DN) and Larger: Adjustable steel yoke, cast iron pipe roll, double hanger.
 5. Wall Support for Pipe Sizes Up to 3 inch (80 mm, DN): Cast iron hook.
 6. Wall Support for Pipe Sizes 4 inch (100 mm, DN) and Larger: Welded steel bracket and wrought steel clamp.
 7. Wall Support for Hot Pipe Sizes 6 inch (150 mm, DN) and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron pipe roll.
 8. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 9. Floor Support for Hot Pipe Sizes to 4 inch (100 mm, DN): Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
 10. Floor Support for Hot Pipe Sizes 6 inch (150 mm, DN) and Larger: Adjustable cast iron pipe roll and stand, steel screws, and concrete pier or steel support.
 11. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
 - D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners.
- 2.09 BALL VALVES
- A. Construction, 4 Inches (100 mm) and Smaller: MSS SP-110, Class 150, 400 psi (2760 kPa) CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle, solder or threaded ends with union.
- 2.10 PRESSURE REDUCING VALVES
- A. Manufacturers:
 1. Caleffi
 2. Watts Regulator Company: www.wattsregulator.com.
 3. Zurn
 4. Substitutions: See Section 01 6000 - Product Requirements.
 - B. 2 inch (50 mm, DN) and Smaller:
 1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.
 2. Pressure Reducing Pilot-Operator:
 - a. Operating Range: 5 to 50 psi (0.35 to 35 Bar).
 - b. Connected into brass or bronze pilot piping and fittings.
 - c. Fixed flow restrictor, pressure gauges, and isolation valves.
 - C. Quality Assurance:
 1. Regulate pressures to remain between 40 psi and 80 psi at all points of delivery.
 2. Do not exceed 3-6 feet per second at full flow to prevent excessive wear.
 3. Do not exceed 15 psi pressure drop at rated flow.
- 2.11 RELIEF VALVES
- A. Temperature and Pressure Relief Valves:
 1. Manufacturers:
 - a. Watts Regulator Company: www.wattsregulator.com.
 - b. Substitutions: Refer to Division 01 - Product Requirements.
 2. ANSI Z21.22, AGA certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F (98.9 degrees C), capacity ASME BPVC-IV certified and labelled.
- 2.12 STRAINERS
- A. Manufacturers:
 1. Armstrong International, Inc: www.armstronginternational.com.
 2. Substitutions: Refer to Division 01 - Product Requirements.
 - B. Size 2 inch (50 mm, DN) and Smaller:

1. Threaded brass body for 175 psi (1200 kPa) CWP, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.
 2. Class 150, threaded bronze body 300 psi (2070 kPa) CWP, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.
 - C. Size 1-1/2 inch (40 mm, DN) to 4 inch (100 mm, DN):
 1. Class 125, flanged iron body, Y pattern with 1/16 inch (1.6 mm) stainless steel perforated screen.
- 2.13 TRAP-SEAL PRIMER VALVES
- A. Supply-Type, Trap-Seal Primer Valves:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MIFAB, Inc.
 - b. PPP Inc.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Watts Industries, Inc.; Water Products Div.
 2. Standard: ASSE 1018.
 3. Pressure Rating: 125 psig minimum.
 4. Body: Bronze.
 5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
 6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
 7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.
- 2.14 TRAP-SEAL PRIMER SYSTEMS
- A. Trap-Seal Primer Systems:
 1. Standard: ASSE 1044.
 2. Piping: NPS 3/4, ASTM B 88, Type L; copper, water tubing.
 3. Cabinet: Recessed-mounting steel box with stainless-steel cover.
 4. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
 5. Vacuum Breaker: ASSE 1001.
 6. Number Outlets: Match fixture quantity.
 7. Size Outlets: NPS 1/2.
- 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. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
 - D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
 - E. Group piping whenever practical at common elevations.
 - F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 22 0516.
 - G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
 - H. Provide access where valves and fittings are not exposed.
 1. Coordinate size and location of access doors with Section 08 3100.
 - I. Establish elevations of buried piping outside the building to ensure not less than 3 ft (0.91 m) of cover.
 - J. Install vent piping penetrating in roofed areas to maintain integrity of roof assembly; refer to roofing specification.
 - K. Where pipe supports are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
 - L. Provide support for utility meters in accordance with requirements of utility companies.
 - M. Prepare exposed, unfinished pipe, fittings, supports, and accessories for finish painting.
 - N. Excavate in accordance with Section 31 2316.
 - O. Install bell and spigot pipe with bell end upstream.
 - P. Install valves with stems upright or horizontal, not inverted. See Section 22 0523.
 - Q. Install water piping to ASME B31.9.
 - R. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
 - S. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
 - T. Sleeve pipes passing through partitions, walls, and floors.
 - U. 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 (100 mm, DN).
 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.
 - V. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9.
 2. Support horizontal piping as indicated.
 3. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
 4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
 5. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 8. Provide copper plated hangers and supports for copper piping.
 9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
 - a. Painting of interior plumbing systems and components is specified in Section 09 9123.
 - b. Painting of exterior plumbing systems and components is specified in Section 09 9113.
 10. Provide hangers adjacent to motor-driven equipment with vibration isolation; see Section 22 0548.
 11. Support cast iron drainage piping at every joint.
- 3.04 APPLICATION
- A. Use grooved mechanical couplings and fasteners only in accessible locations.
 - B. Install unions downstream of valves and at equipment or apparatus connections.
 - C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
 - D. Install ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
 - E. Install globe valves for throttling, bypass, or manual flow control services.
 - F. Provide flow controls in water recirculating systems where indicated.
 - G. Provide automatic flow control valve where domestic hot water system connects to domestic hot water return system. Locate where accessible for adjustment and servicing. Set thermostatic valves for 121 degree F return temperature.
 - H. Provide trap-seal primer valves for all floor drains which are not collecting condensate from HVAC equipment and where noted on plan. Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- 3.05 TOLERANCES
- A. Drainage Piping: Establish invert elevations within 1/2 inch (10 mm) vertically of location indicated and slope to drain at minimum of 1/4 inch per foot (1:50) slope.
 - B. Water Piping: Slope at minimum of 1/32 inch per foot (1:400) and arrange to drain at low points.
- 3.06 TESTING
- A. Pressure test piping installations according to code requirements and as follows (most stringent applies).
 - B. Pressure test all new, altered, extended and repaired supply, storm and sanitary drainage and vent piping.
 - C. Construct systems with fittings/isolation valves to allow testing of all new work.
 - D. Rough-in tests shall be performed with water unless manufacturer prescribes alternate method.
 - E. Notify building inspection official before testing to allow observation / witnessing.
 - F. Supply rough-in test: Cap all openings and attach pressure gauge near main isolation valve. Slowly open valve filling piping with water to system pressure and vent air from top of system so entire system is filled with water at full pressure. Close isolation valve trapping water in system at pressure without makeup. Videotape entire test procedure and record pressure gauge for an additional 15 minutes showing pressure is maintained.
 - G. Drain and vent rough-in test: cap all openings and insert a balloon plug within existing piping or main and fill entire system to overflow. If testing is performed in sections, all sections shall include at least a 10' water column except uppermost portion of system (including venting). Videotape top of stack for 15 minutes showing level is maintained.
 - H. Provide rough-in test report(s) to Engineer and Owner for review and comment before concealment.
 - I. After fixtures have been installed, operate fixtures with traps filled to confirm no visible leaks.
 - J. Perform final test: plug stack openings and insert manometer with at least 1" water column of air pressure. Videotape manometer showing level unchanged for at least 15 minutes and showing drop to zero upon removal of pressure.
 - K. Forward copies of final testing to Engineer and Owner. Maintain records and submit to building official upon request.
 - L. Include test reports in project closeout submittals provided to owner.
- 3.07 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM
- A. Disinfect water distribution system in accordance with Section 33 0110.58.
 - B. Prior to starting work, verify system is complete, flushed, and clean.
 - C. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
 - D. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.
 - E. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
 - F. Maintain disinfectant in system for 24 hours.
 - G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
 - H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
 - I. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.
- 3.08 SERVICE CONNECTIONS
- A. Provide new sanitary sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
 - B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer.

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1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.

3.09 **SUPPORT SCHEDULES**

A. **Pipe Hanger Spacing**

1. Spacing per International Plumbing Code Table 308.5 or manufacturer's instruction, whichever is more stringent.

END OF SECTION

SECTION 22 1006 - PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Drains.
- B. Cleanouts.
- C. Hose bibbs.
- D. Hydrants.
- E. Washing machine boxes and valves.
- F. Refrigerator valve and recessed box.
- G. Backflow preventers.
- H. Water hammer arrestors.
- I. Sanitary waste interceptors.
- J. Mixing valves.

1.02 REFERENCE STANDARDS

- A. ASME A112.6.3 - Floor and Trench Drains 2019.
- B. ASME A112.6.4 - Roof, Deck, and Balcony Drains 2003 (Reaffirmed 2012).
- C. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers 2017.
- D. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers 2021.
- E. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance 2011 (Reaffirmed 2016).
- F. NSF 61 - Drinking Water System Components - Health Effects 2020.
- G. NSF 372 - Drinking Water System Components - Lead Content 2020.
- H. PDI-WH 201 - Water Hammer Arresters 2017.

1.03 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- D. Certificates: Certify that all interceptors meet or exceed capacity and flow rate scheduled on plans.
- E. Sustainable Design Documentation: Submit appropriate evidence that materials used in potable water systems comply with the specified requirements.
- F. Operation Data: Indicate frequency of treatment required for interceptors.
- G. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
- H. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Refer to Division 01 - Product Requirements, for additional provisions.
 - 2. Extra Loose Keys for Outside Hose Bibbs: One.

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.

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.
- B. Unless otherwise noted on plans, provide fixtures as specified below.

2.02 DRAINS

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
 - 2. Josam Company: www.josam.com.
 - 3. Zurn Industries, LLC: www.zurn.com.
 - 4. Substitutions: Refer to Division 01 - Product Requirements.
- B. Roof Drains:
 - 1. Assembly: ASME A112.6.4.
 - 2. Body: Lacquered cast iron with sump.
 - 3. Strainer: Removable cast aluminum or cast iron dome with vandal proof screws.
 - 4. Accessories: Coordinate with roofing type, refer to Division 07:
 - a. Membrane flange and membrane clamp with integral gravel stop.
 - b. Adjustable under deck clamp.
 - c. Waterproofing flange.
 - d. Controlled flow weir.
 - e. Leveling frame.
 - f. Adjustable extension sleeve for roof insulation.
 - g. Perforated or slotted ballast guard extension for inverted roof.
 - h. Perforated stainless steel ballast guard extension.
- C. Roof Overflow Drains:
 - 1. Lacquered cast iron body and clamp collar and bottom clamp ring; pipe extended to 2 inches (50.8 mm) above flood elevation.

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- D. Downspout Nozzles:
 - 1. Bronze round with straight bottom section.
- E. Floor Drain (FD-1):
 - 1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.
- 2.03 CLEANOUTS
 - A. Manufacturers:
 - 1. Substitutions: Refer to Division 01 - Product Requirements.
 - B. Cleanouts at Exterior Surfaced Areas (CO-1):
 - 1. Round cast nickel bronze access frame and non-skid cover.
 - C. Cleanouts at Exterior Unsurfaced Areas (CO-2):
 - 1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.
 - D. Cleanouts at Interior Finished Floor Areas (CO-3):
 - 1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.
 - E. Cleanouts at Interior Finished Wall Areas (CO-4):
 - 1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.
 - F. Cleanouts at Interior Unfinished Accessible Areas (CO-5): Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.
- 2.04 HOSE BIBBS
 - A. Manufacturers:
 - 1. Woodford.
 - 2. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
 - 3. Watts Regulator Company: www.wattsregulator.com.
 - 4. Zurn Industries, Inc: www.zurn.com.
 - 5. Substitutions: Refer to Division 01 - Product Requirements.
 - B. Exterior Hose Bibbs:
 - 1. ASSE 1019; freeze resistant, self-draining type with chrome plated wall plate, hose thread spout, and integral vacuum breaker.
 - 2. Provide with key/removeable handle and furnish to owner at substantial completion.
 - C. Interior Hose Bibbs:
 - 1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with handwheel, integral vacuum breaker in compliance with ASSE 1011.
- 2.05 HYDRANTS
 - A. Manufacturers:
 - 1. Woodford.
 - 2. Arrowhead Brass & Plumbing, LLC: www.arrowheadbrass.com.
 - 3. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
 - 4. Zurn Industries, LLC: www.zurn.com.
 - 5. Watts Regulator Company: www.wattsregulator.com.
 - 6. Substitutions: Refer to Division 01 - Product Requirements.
 - B. Wall Hydrants:
 - 1. ASSE 1019; freeze resistant, self-draining type with chrome plated wall plate hose thread spout, lockshield and removable key, and integral vacuum breaker.
 - C. Roof Hydrants:
 - 1. ASSE 1019 freeze resistant, self draining type with chrome plated base plate, standpipe hose thread spout, lockshield and removable key, and integral vacuum breaker.
- 2.06 WASHING MACHINE BOXES AND VALVES
 - A. Box Manufacturers:
 - 1. IPS Corporation/Guy Grey: www.ipscorp.com.
 - 2. Oatey: www.oatey.com.
 - 3. Substitutions: Refer to Division 01 - Product Requirements.
 - B. Description: Preformed rough-in box with brass valves with single lever handle, socket for 2 inch (50 mm) waste, slip in finishing cover.
- 2.07 REFRIGERATOR VALVE AND RECESSED BOX
 - A. Box Manufacturers:
 - 1. IPS Corporation/Water-Tite: www.ipscorp.com.
 - 2. Oatey Supply Chain Services, Inc: www.oatey.com.
 - 3. Substitutions: Refer to Division 01 - Product Requirements.
 - B. Description: Plastic preformed rough-in box with brass valves with wheel handle, slip in finishing cover.
- 2.08 BACKFLOW PREVENTERS
 - A. Manufacturers:
 - 1. Watts Regulator Company: www.wattsregulator.com.
 - 2. Zurn Industries, Inc: www.zurn.com.
 - B. Reduced Pressure Backflow Preventer Assembly:
 - 1. ASSE 1013; cast bronze body and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure, and non-threaded vent outlet.

2. Size: assembly with threaded gate valves.
- 2.09 WATER HAMMER ARRESTORS
- A. Manufacturers:
 1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
 2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com.
 3. Zurn Industries, LLC: www.zurn.com.
 4. Substitutions: Refer to Division 01 - Product Requirements.
 - B. Water Hammer Arrestors:
 1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F (minus 73 to 149 degrees C) and maximum 250 psi (1700 kPa) working pressure.
- 2.10 SANITARY WASTE INTERCEPTORS
- A. Manufacturers:
 1. Zurn Industries, LLC: www.zurn.com.
 2. Substitutions: Refer to Division 01 - Product Requirements.
 - B. Grease Interceptors:
 1. Construction:
 - a. Material: Precast concrete.
 - b. Rough-in: Fully recessed below grade (deep rough-in), with grade rings and gravel base.
 - c. Accessories: Multi-weir baffle assembly, integral deep seal trap, removable integral flow control, sediment bucket.
 - d. Cover: Steel, epoxy coated, non-skid with gasket, securing handle, and enzyme injection port, recessed for floor finish.
 2. Unit Rating: gpm flow and lbs grease capacity per plans and local requirements (most stringent).
 - C. Lint/Sand/Sediment Interceptors:
 1. Epoxy coated cast iron body and secured cover with removable stainless steel sediment bucket.
- 2.11 MIXING VALVES
- A. Thermostatic Mixing Valves:
 1. Manufacturers:
 - a. Powers (Digital IntelliStation).
 - b. Armstrong (Brain Digital Mixing Station).
 - c. Caleffi (6000 Legiomix)
 - d. Substitutions: Refer to Division 01 - Product Requirements.
 2. Valve: lead free brass body, stainless steel or copper alloy bellows, integral temperature adjustment.
 3. Accessories:
 - a. Check valve on inlets.
 - b. Volume control shut-off valve on outlet.
 - c. Stem thermometer on outlet.
 - d. Strainer stop checks on inlets.
 - B. Thermostatic Tempering Valves:
 1. Manufacturers:
 - a. Watts.
 - b. Zurn
 - c. Caleffi
 - d. Substitutions: Refer to Division 01 - Product Requirements.
 2. Valve: lead free brass body, stainless steel or copper alloy bellows, integral temperature adjustment.
 3. Accessories:
 - a. Check valve with strainer on inlets.
 - b. Volume control shut-off valve on outlet.
 4. ASSE 1070
 - C. Thermostatic Balance Valves:
 1. Manufacturers:
 - a. Bell & Gossett Temp Setter
 - b. Caleffi Thermosetter 116 series.
 - c. Thermomegatech Circuit Solver
 2. Valve: Lead free brass body, stainless steel springs and cartridge, integral temperature adjustment from 95 to 140 degrees F with locking adjustment knob.
 - a. Capacity: 2 gpm (0.1262 L/s) flow at 1 psi pressure drop at full open.
 - b. Cv: 2.1 maximum, .23 minimum, .52 design.
 3. Accessories:
 - a. An integral dry-well holds a slide-in temperature gauge for local indication, or a sensor for remote temperature sensing.
 - b. Integral check valve to protect against circuit thermo-syphoning.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that walls and/or floors are prepared and ready for installation.
- B. Confirm that structure is constructed with adequate support.
- C. Confirm connecting pipe size exceeds minimum requirements.

3.02 PREPARATION

- A. Provide additional blocking to structure to prevent movement after construction.

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- B. Confirm location and size of openings before rough-in and installation.
- 3.03 INSTALLATION
- A. Install all work in accordance with manufacturer's instructions.
 - B. Install components level and plumb.
 - C. Install and secure work in place with flanges, screws, and bolts.
 - D. Seal to waterproofing membranes with sealant meeting membrane requirements.
 - E. 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.
 - F. Encase exterior cleanouts in concrete flush with grade.
 - G. Install floor cleanouts and floor drains at elevation to accommodate finished floor.
 - H. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.
 - I. Pipe relief from backflow preventer to nearest drain.
 - J. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to washing machine outlets.
- END OF SECTION

SECTION 22 3000 - PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water Heaters:
 - 1. Residential gas fired.
 - 2. Commercial gas fired.
 - 3. Residential electric.
- B. Diaphragm-type compression tanks.
- C. In-line circulator pumps.
- D. Submersible sump pumps.

1.02 REFERENCE STANDARDS

- A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels 2021.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.04 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittals procedures.
- B. Product Data:
 - 1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
 - 2. Indicate pump type, capacity, power requirements.
 - 3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
 - 4. Provide electrical characteristics and connection requirements.
- C. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.
- B. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.07 WARRANTY

- A. Refer to Division 01 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.01 WATER HEATERS

- A. Residential Gas Fired:
 - 1. Type: Automatic, natural gas-fired, vertical storage.
 - 2. Performance:
 - 3. Tank: Glass lined welded steel with single flue passage, flue baffle and draft hood; thermally insulated and encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.
 - 4. Controls: Automatic water thermostat and built-in gas pressure regulator; temperature range adjustable from 120 to 170 degrees F (49 to 77 degrees C), cast iron or sheet metal burner, safety pilot and thermocouple.
 - 5. Accessories:
 - a. Water Connections: Brass.
 - b. Dip Tube: Brass.
 - c. Drain valve.
 - d. Anode: Magnesium.
- B. Commercial Gas Fired:
 - 1. Type: Automatic, natural gas-fired, vertical storage.
 - 2. Performance:
 - 3. Tank: Glass lined welded steel ASME labeled; multiple flue passages, 4 inch (100 mm) diameter inspection port, thermally insulated with minimum 2 inches (50 mm) glass fiber, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.
 - 4. Accessories:
 - a. Water Connections: Brass.
 - b. Dip Tube: Brass.
 - c. Drain valve.
 - d. Anode: Magnesium.
 - e. Temperature and Pressure Relief Valve: ASME labeled.
 - 5. Certified For The Following Applications:
 - a. Automatic storage water heater.
 - b. Automatic circulating tank water heater.

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- c. For operation at 180 degrees F (82 degrees C).
 - d. For operation on combustible floors.
 - 6. Controls: Automatic water thermostat with temperature range adjustable from 120 to 180 degrees F (49 to 82 degrees C), automatic reset high temperature limiting thermostat factory set at 195 degrees F (90 degrees C), gas pressure regulator, multi-ribbon or tubular burner, 100 percent safety shut-off pilot and thermocouple, flue baffle and draft hood.
 - C. Residential Electric:
 - 1. Type: Automatic, electric, vertical storage.
 - 2. Performance:
 - a. As scheduled on plans.
 - 3. Electrical Characteristics:
 - a. As scheduled on plans.
 - 4. Tank: Glass lined welded steel, thermally insulated with one inch (25 mm) thick glass fiber; encased in corrosion-resistant steel jacket; baked-on enamel finish.
 - 5. Controls: Automatic water thermostat with externally adjustable temperature range from 120 to 170 degrees F (49 to 77 degrees C), flanged or screw-in nichrome elements, enclosed controls and electrical junction box and operating light. Wire double element units so elements do not operate simultaneously.
 - 6. Accessories:
 - a. Water Connections: Brass.
 - b. Dip Tube: Brass.
 - c. Drain valve.
 - d. Anode: Magnesium.
 - e. Temperature and Pressure Relief Valve: ASME labeled.
 - 2.02 WATER HEATER MANUFACTURERS
 - A. A.O. Smith Water Products Co: www.hotwater.com.
 - B. Bradford White Water Heaters
 - C. State Water Heaters
 - D. Lochinvar Water Heaters
 - 2.03 DIAPHRAGM-TYPE COMPRESSION TANKS
 - A. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig (860 kPa), with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.
 - B. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 12 psig (80 kPa).
 - 2.04 IN-LINE CIRCULATOR PUMPS
 - A. Manufacturers:
 - 1. Armstrong Pumps Inc: www.armstrongpumps.com.
 - 2. ITT Bell & Gossett: www.bellgossett.com.
 - 3. Grundfos
 - 4. Substitutions: Refer to Division 01 - Product Requirements.
 - B. Casing: Bronze, rated for 125 psig (860 kPa) working pressure, with stainless steel rotor assembly.
 - C. Impeller: Bronze.
 - D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.
 - E. Seal: Carbon rotating against a stationary ceramic seat.
 - F. Drive: Flexible coupling.
 - 2.05 SUBMERSIBLE SUMP PUMPS
 - A. Manufacturers:
 - 1. Armstrong Pumps Inc: www.armstrongpumps.com.
 - 2. Goulds Pumps: www.goulds.com.
 - 3. Zoeller Pump Company: www.zoeller.com.
 - 4. Substitutions: Refer to Division 01 - Product Requirements.
 - B. Type: Completely submersible, vertical, centrifugal.
 - C. Casing: Cast iron pump body and oil filled motor chamber.
 - D. Impeller: Cast iron; open non-clog, stainless steel shaft.
 - E. Bearings: Ball bearings.
 - F. Sump: Fiberglass basin with steel cover plate; 24 inches (609.6 mm) diameter, 48 inches (1219.2 mm) deep.
 - G. Accessories: Oil resistant 6 foot (2 m) cord and plug with three-prong connector for connection to electric wiring system including grounding connector.
 - H. Servicing: Slide-away coupling consisting of discharge elbow secure to sump floor, movable bracket, guide pipe system, lifting chain and chain hooks.
 - I. Controls: Integral diaphragm type level controls with separate liquid level control high level alarm.
- PART 3 EXECUTION**
- 3.01 INSTALLATION**
- A. Install plumbing equipment in accordance with manufacturer's instructions, by code, and complying with conditions of certification, if any.
 - B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.
 - C. Domestic Water Storage Tanks:
 - 1. Provide steel pipe support, independent of building structural framing members.
 - 2. Clean and flush prior to delivery to site. Seal until pipe connections are made.
 - D. Pumps:

1. Ensure shaft length allows sump pumps to be located minimum 24 inches (600 mm) below lowest invert into sump pit and minimum 6 inches (150 mm) clearance from bottom of sump pit.
2. Provide air cock and drain connection on horizontal pump casings.
3. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.
4. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches (100 mm) and over.
5. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
6. Align and verify alignment of base mounted pumps prior to start-up.
7. Provide electrical interlocking from cooling condensate pump safety switch to associated HVAC unit(s) furnished under other Sections.

END OF SECTION

SECTION 22 4000 - PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water closets.
- B. Lavatories.
- C. Sinks.
- D. Service sinks.
- E. Under-lavatory pipe supply covers.
- F. Electric water coolers.
- G. Bathtubs.
- H. Showers.

1.02 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment 2014.
- C. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration 2008 (Reaffirmed 2013).
- D. ASME A112.18.1 - Plumbing Supply Fittings 2018, with Errata.
- E. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures 2011 (Reaffirmed 2017).
- F. ASME A112.19.2 - Ceramic Plumbing Fixtures 2018, with Errata.
- G. ASSE 1014 - Performance Requirements for Backflow Prevention Devices for Hand-Held Showers 2005.
- H. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices 2020.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- J. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- K. ISFA 2-01 - Classification and Standards for Solid Surfacing Material 2013.
- L. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
- M. NSF 61 - Drinking Water System Components - Health Effects 2020.
- N. NSF 372 - Drinking Water System Components - Lead Content 2020.

1.03 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Samples: Submit two lavatory supply fittings.
- D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Refer to Division 01 - Product Requirements, for additional provisions.
 - 2. Extra Faucet Washers: One set of each type and size.
 - 3. Extra Shower Heads: 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.

1.05 MOCK-UP

- A. Provide mock-up of typical bathroom group.
- B. Mock-up may remain as part of the Work.

1.06 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.

1.07 WARRANTY

- A. Refer to Division 01 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for electric water cooler.

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.
- B. Water Efficiency: EPA WaterSense label is required for all water closets, urinals, lavatory faucets, and showerheads.

2.02 TANK TYPE WATER CLOSETS

- A. Tank Type Water Closet Manufacturers:
 - 1. American Standard, Inc: www.americanstandard-us.com.
 - 2. Kohler Company: www.kohler.com.
 - 3. Niagara Corp. www.niagaracorp.com.
 - 4. Substitutions: Refer to Division 01 - Product Requirements.
- B. Bowl: ASME A112.19.2; floor mounted, siphon jet, vitreous china, 16.5 inches (420 mm) high, close-coupled closet combination with elongated rim, insulated vitreous china closet tank with fittings and lever flushing valve, bolt caps, vandalproof cover locking device.
- C. Performance: MaP score >1000 gram solids capacity.
- D. Seat Manufacturers:
 - 1. American Standard, Inc: www.americanstandard-us.com.
 - 2. Bemis Manufacturing Company: www.bemismfg.com.

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3. Church Seat Company: www.churchseats.com.
 4. Olsonite: www.olsonite.com.
 5. Substitutions: Refer to Division 01 - Product Requirements.
 - E. Seat: Solid white plastic, open front, brass bolts, with cover.
 - F. Handle Height: 44 inches (1117 mm) or less.
- 2.03 LAVATORIES
- A. Manufacturers:
 1. American Standard, Inc: www.americanstandard-us.com.
 2. Kohler Company: www.kohler.com.
 3. Toto USA: www.totousa.com.
 4. Substitutions: Refer to Division 01 - Product Requirements.
 - B. Vitreous China Counter Top Basin: ASME A112.19.2; vitreous china self-rimming counter top lavatory, with drillings to match faucet, front overflow, soap depression, seal with concealed vinyl gasket and caulk.
 - C. Vitreous China Under-Mount Basin: ASME A112.19.2; vitreous china under-mount lavatory, front overflow, mounting kit and template by manufacturer.
 - D. Supply Faucet Manufacturers:
 1. American Standard, Inc: www.americanstandard-us.com.
 2. Kohler Company: www.kohler.com.
 3. Substitutions: Refer to Division 01 - Product Requirements.
- 2.04 SINKS
- A. Single Compartment Bowl: ASME A112.19.3;
 1. 20 gage, 0.0359 inch thick, Type 302 stainless steel, self rimming and undercoated, with ledge back drilled for trim.
 2. Drain: 3-1/2 inch (90 mm) crumb cup and tailpiece.
- 2.05 UNDER-LAVATORY PIPE SUPPLY COVERS
- A. General:
 1. Insulate exposed drainage piping including hot, cold and tempered water supplies under lavatories or sinks per ADA Standards.
 2. Construction: 1/8 inch (3.2 mm) PVC with antimicrobial, antifungal and UV resistant properties.
 - a. Comply with ASME A112.18.9 for covers on accessible lavatory piping.
 - b. Comply with ICC A117.1.
- 2.06 SHOWER RECEPTORS
- A. Solid Surfacing Shower Receptors: Solid plastic resin casting, self-supporting, for installation over conventional subfloor; complying with IAPMO Z124.
 1. Material: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, renewable material 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.
 2. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 450 or less, Class A, when tested in accordance with ASTM E84.
 3. Finish on Exposed Surfaces: Provide satin or matte, gloss rating of 3 to 20.
 - B. Drain Trim: Removable chrome plated strainer and tail piece.
- 2.07 SHOWERS
- A. Hand-Held Shower Head:
 1. ASME A112.18.1, adjustable spray hand-held shower head with swivel fitting, with ASSE 1014 backflow preventer.
 2. Provide pushbutton flow control.
 3. Include 60 inch (1525 mm) minimum flexible polished stainless steel hose and in-line vacuum breaker
 4. Provide 36" combination glide bar/grab bar with sliding spray holder that locks at any height, allowing use of unit as either a hand-held spray or a fixed shower head.
- 2.08 ELECTRIC WATER COOLERS
- A. Manufacturers:
 1. Sunroc Division of Oasis: <http://www.sunroccoolers.com>.
 2. Elkay Manufacturing Company: www.elkay.com.
 3. Haws Corporation: www.hawesco.com.
 4. Oasis, a Lynn Tilton Company: www.oasiscoolers.com.
 5. Substitutions: Refer to Division 01 - Product Requirements.
 - B. Water Cooler: Electric, mechanically refrigerated; surface mounted, ADA compliant; stainless steel top, vinyl on steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket; integral air cooled condenser and stainless steel grille.
 1. Capacity: 8 gallons per hour (30.3 liters per hour) of 50 degrees F (10 degrees C) water with inlet at 80 degrees F (27 degrees C) and room temperature of 90 degrees F (32 degrees C), when tested in accordance with ASHRAE Std 18.
 2. Electrical: 115 V, 60 Hertz compressor, 6 foot (2 m) cord and plug for connection to electric wiring system including grounding connector.
- 2.09 SERVICE SINKS
- A. Manufacturers:
 1. Elkay Manufacturing Company: www.elkay.com.
 2. Fiat: www.fiat.com.
 3. Substitutions: Refer to Division 01 - Product Requirements.

- B. Bowl: 36 by 24 by 10 inch (900 by 600 by 250 mm) high white molded stone, floor mounted, with one inch (25 mm) wide shoulders, vinyl bumper guard, stainless steel strainer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

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 loose key stops, reducers, and escutcheons.
- C. Install components level and plumb.
- D. Install and secure fixtures in place with wall supports and bolts.
- E. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07 9005, color to match fixture.
- F. Provide two (2) sinks, faucets, and water closets of each type provided for attic stock.

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 before substantial completion.

3.07 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Do not permit use of fixtures by construction personnel.
- C. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 23 0050 - HVAC EXECUTION

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes:
 - 1. Definitions.
 - 2. Coordination.
 - 3. Piping materials and installation instructions common to most piping systems.
 - 4. Dielectric fittings.
 - 5. Mechanical sleeve seals.
 - 6. Sleeves.
 - 7. Escutcheons.
 - 8. Grout.
 - 9. HVAC demolition.
 - 10. Equipment installation requirements common to equipment sections.
 - 11. Concrete bases.
 - 12. Supports and anchorages.

1.02 RELATED DOCUMENTS

- A. Drawings, General Provisions of the Contract, including General Conditions, Supplementary General Conditions, other Division 00 & 01 Specification Sections, shall apply to this division.
- B. These requirements apply to all Division 23 work.

1.03 DEFINITIONS

- A. "Approved" means approved by the Engineer and Owner.
- B. "Furnish" means to purchase, arrange for delivery to site, and to take delivery at the site.
- C. "Install" means to place in position for use.
- D. "Provide" means to furnish and install.
- E. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- F. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- G. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- H. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- I. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.

1.04 COORDINATION

- A. Coordination: Coordinate construction operations to ensure efficient and orderly installation of the Work.
 - 1. Coordinate construction operations, which depend on each other for proper installation, connection, and operation.
 - 2. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 3. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 4. Make adequate provisions to accommodate items scheduled for later installation.
 - 5. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items ~~as required~~ notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Construction Schedule.
 - 2. Preparation of the Schedule of Values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Pre-installation conferences.
 - 7. Project closeout activities.
 - 8. Startup and adjustment of systems.
 - 9. Project closeout activities.

1.05 PROJECT MEETINGS

- A. General: Attend meetings and conferences at Project site, unless otherwise indicated.
 - 1. Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Engineer of scheduled meeting dates and times.
 - 2. Agenda: Request the meeting agenda if not furnished prior to meeting.
 - 3. Minutes: Record significant discussions and agreements achieved. Request the meeting minutes if not furnished. Note all discrepancies and notify Engineer of all changes to the Work or to the Contract Documents.

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- B. Preconstruction Conference: Attend the preconstruction conference before starting construction, no later than 15 days after execution of the Agreement to review responsibilities and personnel assignments.
1. Attendees: Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following as applicable:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for requests for interpretations (RFIs).
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - j. Submittal procedures.
 - k. LEED requirements.
 - l. Preparation of Record Documents.
 - m. Use of the premises.
 - n. Work restrictions.
 - o. Owner's occupancy requirements.
 - p. Responsibility for temporary facilities and controls.
 - q. Construction waste management and recycling.
 - r. Parking availability.
 - s. Office, work, and storage areas.
 - t. Equipment deliveries and priorities.
 - u. First aid.
 - v. Security.
 - w. Progress cleaning.
 - x. Working hours.
- C. Pre-installation Conferences: Attend a pre-installation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following as applicable:
 - a. The Contract Documents.
 - b. Options.
 - c. Related requests for interpretations (RFIs).
 - d. Related Change Orders.
 - e. Purchases, deliveries, submittals.
 - f. Review of mockups.
 - g. Possible conflicts.
 - h. Compatibility problems.
 - i. Time schedules.
 - j. Weather limitations.
 - k. Manufacturer's written recommendations.
 - l. Warranty requirements.
 - m. Compatibility of materials.
 - n. Acceptability of substrates.
 - o. Space and access limitations.
 - p. Regulations of authorities having jurisdiction.
 - q. Testing and inspecting requirements.
 - r. Installation procedures.
 - s. Coordination with other work.
 - t. Required performance results.
 - u. Protection of adjacent work.
 - v. Protection of construction and personnel.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present, to parties who should have been present, and to the Engineer.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

1.06 SUBMITTALS

- A. Alternate Products: Alternate manufacturers, equipment and /or products must be specified or approved prior to bid in writing via addendum to be accepted. All costs associated with deviations from the basis of design shall be borne by the contractor. Deviations shall include alternate manufacturer and/or alternate product and shall include all

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significant dimensional, performance, electrical, or installation differences from the basis of design products. Costs for reimbursement shall include the costs of other trades affected, and shall include all engineering costs to evaluate such deviations.

- B. Substitutions: Unspecified manufacturers shall be considered substitutions and shall be submitted for consideration under the specified substitution procedures. Substitutions shall be submitted to the engineer for evaluation. If approved by the engineer, substitution shall be offered to the owner for consideration. All costs associated with substitutions shall be borne by the contractor. Costs for reimbursement shall include the costs of other trades affected, and shall include all engineering costs to evaluate such deviations.
- C. Coordination Drawings: Prepare Coordination Drawings (coordinated shop drawings), scaled at not less than 3/8"=1'-0", to coordinate and maximize utilization of space for efficient installation of different components and for installation of products and materials fabricated by separate entities. Submit to Engineer for review before starting work.
 - 1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
 - a. Indicate functional and spatial relationships of components of the work with all other systems and trades.
 - b. Indicate required installation sequences.
 - c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide sketches of proposed alternate construction to Engineer for resolution of such conflicts. Dimension changes and difficult installations will not be considered changes to the Contract.
- D. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project. Submit to Engineer before starting work.
 - 1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.
- E. Make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.
- F. Prior to submitting shop drawings for review, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.
- G. Welding certificates.

1.07 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified at contractor's cost. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.08 Warranties

- A. All work shall include a parts and labor warranty on materials and workmanship for a period of 1 year. In addition to standard manufacturer product warranties, all equipment shall include a warranty on compressors and heat exchangers for a period of 10 years.
- B. Refer to Division 01 for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURED CURBS

- A. Manufactured Curbs, Equipment Rails, and Other Roof Mounting Assemblies:
 - 1. The Pate Company: www.patecurbs.com.
 - 2. Substitutions: Refer to Division 01 - Product Requirements.
- B. General requirements: Factory-assembled hollow sheet metal construction with fully mitered and welded corners, integral counterflashing, internal reinforcing, and top side and edges formed to shed water.
 - 1. Sheet Metal: Hot-dip zinc coated steel sheet complying with ASTM A653/A653M, SS Grade 33 (230); G60 (Z180) coating designation; 18 gage, 0.048 inch (1.21 mm) thick.
 - 2. Roofing Cants: Provide integral sheet metal roofing cants dimensioned to begin slope at top of roofing insulation; 1:1 slope; minimum cant height 4 inches (200 mm).
 - 3. Manufacture curb bottom and mounting flanges for installation directly on roof deck, not on insulation; match slope and configuration of roof deck.
 - 4. Provide the layouts and configurations shown on the drawings.
- C. Roof Curbs: Provide curb on all sides of opening, with top of curb horizontal for equipment mounting.
 - 1. Provide preservative treated wood nailers along top of curb.
 - 2. Insulate inside curbs with 1-1/2 inch (38 mm) thick fiberglass insulation.
 - 3. Height Above Finished Roof Surface: 12 inches ([] mm), minimum.

4. Height Above Roof Deck: 14 inches (356 mm), minimum.
 - D. Equipment Rails: Two-sided curbs in straight lengths, with top horizontal for equipment mounting.
 1. Provide preservative treated wood nailers along top of rails.
 2. Height Above Finished Roof Surface: 6 inches (152 mm), minimum.
 3. Height Above Roof Deck: 14 inches (356 mm), minimum.
 - E. Pipe, Duct, and Conduit Mounting Pedestals: Vertical posts, minimum 8 inches (400 mm) square unless otherwise indicated.
 1. Provide preservative treated wood nailers over entire top surface, for supports to be provided **by others**.
 2. Height Above Finished Roof Surface: 12 inches ([] mm), minimum.
 3. Height Above Roof Deck: 14 inches (356 mm), minimum.
- 2.02 SLEEVES**
- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
 - B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.
 - C. Sleeves for Rectangular Openings: Galvanized sheet steel.
 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).
 - D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- 2.03 GROUT**
- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 2. Design Mix: 5000-psi, 28-day compressive strength.
 3. Packaging: Premixed and factory packaged.
- 2.04 MECHANICAL SLEEVE SEALS**
- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 2. Pressure Plates: Carbon steel.
 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements.
- 2.05 ESCUTCHEONS/TRIM RINGS**
- A. Description: Manufactured wall and ceiling escutcheons, floor plates, and duct trim rings, with an ID to closely fit around pipe/duct/insulation surface and with an OD that completely covers opening.
 - B. One-Piece, deep-drawn or cast metal with polished chrome plated finish and set screw.
 - C. Split, cast metal with concealed hinge polished chrome plated finish and set screw.
 - D. Rectangular trim rings shall be formed metal with mitered corners.
- 2.06 PIPE, TUBE, AND FITTINGS**
- A. For condensate drain piping, refer to Division 22 piping sections for pipe, tube, and fitting materials and joining methods.
 - B. For HVAC piping, refer to individual Division 23 piping sections for pipe, tube, and fitting materials and joining methods.
 - C. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.
- 2.07 DIELECTRIC FITTINGS**
- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
 - B. Insulating Material: Suitable for system fluid, pressure, and temperature.
 - C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
 - D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure **as required** to suit system pressures.
 - E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
 - F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
- PART 3 EXECUTION**
- 3.01 HVAC DEMOLITION**
- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
 - B. Contractor shall be responsible for all work and costs associated with demolition shown or noted on plans.
 - C. Verify exact requirements before bid and include direct and related indirect costs in estimate including permit application, fees, dust control, protection of existing, temporary HVAC, fuel usage, scaffolding, disconnection, disposal, cutting and patching.
 - D. Occupied Buildings: For occupied buildings, coordinate with local management for communication with building users, occupants, and/or residents regarding potential for disruption, and provide 72 hour advance notification for planned outages. Install new work to the fullest extent possible before interrupting existing services to minimize

disruption to residents. Provide temporary heat/cooling equipment for disruptions lasting over 4 hours.

E. In performing the work:

1. Coordinate with existing conditions and other trades before starting work.
2. Remove portions of walls, floors, ceilings, etc. required for access to demolished and new work.
3. Disconnect, demolish, and remove systems, equipment, and components indicated to be removed.
4. Piping to Be Removed: Remove portion indicated to be removed and cap or plug remaining with same or compatible piping material.
5. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
6. Ducts to Be Removed: Remove portion of ducts indicated to be removed and cap remaining ducts with same or compatible duct material.
7. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
8. Equipment to Be Removed: Arrange for disconnection of electrical power. Disconnect and cap services and remove equipment. Remove related supports, anchorages, and concrete bases.
9. Equipment to Be Removed and Reinstalled: Arrange for disconnection of electrical power. Disconnect and cap services and remove, clean, and store equipment. When appropriate, reinstall, reconnect, arrange for power connection and make equipment operational.
10. Equipment to Be Removed and Salvaged: Arrange for disconnection of electrical power. Disconnect and cap services, remove equipment and deliver to Owner.

F. If new or existing to remain products are damaged during demolition, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

G. Subcontract the General Contractor to perform patching, repair or replacement of walls floors, ceilings, etc. removed for access to the work. General contractor shall repair finishes to match surrounding finishes.

3.02 COMMON REQUIREMENTS

A. Install according to manufacturer requirements and other Division specification sections.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of systems. Indicated locations and arrangements were used to size and calculate friction loss, expansion, pump sizing, and other design considerations. Install as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install in concealed locations, unless otherwise indicated and except in equipment rooms and service areas. Where located within walls and other concealed areas subject to damage, provide suitable protection.

D. If exposed, install at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Where above accessible ceiling, install tight to structure with sufficient space for ceiling panel removal.

F. Materials exposed within plenums shall be noncombustible or have a flame spread index of 25 or less and a smoke-developed index of 50 or less.

G. Install to allow servicing.

H. Install piping at indicated slopes and free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install piping escutcheons/duct trim rings for exposed penetrations of walls, ceilings, and floors.

3.03 PENETRATIONS

A. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls. Sleeve ends shall be flush with both wall surfaces unless otherwise noted. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Concrete and masonry penetrations: seal space outside of sleeves with grout. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

B. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

C. Roof-Penetrations: Penetrations shall use premanufactured pipe curbs fastened to deck with insulation and roofing membrane applied by roofing contractor. Seal penetrations into curb with flexible boots, with sealant between pipe and boot with pipe clamp for compression around perimeter.

D. Aboveground, Exterior-Wall Penetrations: Position pipe in center of sleeve. Maintain 1% outward slope, unless otherwise indicated. Seal penetrations using non-expanding foam. After cured, trim flush with sleeve end and paint with color to match surrounding finish.

E. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

F. Rated Assembly Penetrations: Maintain indicated fire and smoke ratings of walls, partitions, ceilings, and floors. Coordinate selection and application of firestopping specified in Division 07. Comply with requirements in Division 07.

G. For ducted penetrations of fire and/or smoke rated assemblies, provide dampers to maintain fire and/or smoke rating. Provide dynamically rated fire dampers for penetrations of wall and noncombustible floor assemblies. Provide combination fire and smoke dampers for corridors and other fire/smoke rated assemblies. Provide ceiling radiation dampers for combustible floor/ceiling assemblies with interlock to shut down fan. Fire and smoke damper products and execution requirements are specified elsewhere in Division 23.

H. For non-ducted penetrations of fire and/or smoke rated floor and wall assemblies, apply firestopping to restore original fire-resistance rating of assembly. Firestopping shall comply with listing of rated assembly. Firestopping materials and installation requirements are specified in Division 07.

I. Penetrations of membranes shall be protected by UL listed products. Coordinate exact installation conditions with selected fire sealants supplier. For penetrations which do not have a standard UL installation detail, arrange for

engineering determination from manufacturer and/or sealant supplier, furnish details to inspecting authority and provide products and execution to match listing details.

3.04 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 4. PVC Non-pressure Piping: Join according to ASTM D 2855.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Non-pressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.05 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.06 INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment, devices, and specialties according to manufacturer installation instructions and recommendations.
- B. Refer to other Sections of these Specifications for additional requirements.
- C. Install to allow maximum possible headroom unless specific mounting heights are indicated. Provide warning markers for all work below 7'-6" above walking surface.
- D. Install work level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- E. Install work to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- F. Install work to allow right of way for piping with required slope.
- G. Contact equipment manufacturer's representative to visit site and observe installation in order to confirm installation requirements and warranty coverage. Document observation in writing and include in O&M manuals.
- H. Provide service and maintenance for not less than one year from the Date of Substantial Completion or for the warranty period specified in Division 01, whichever is longer. Refer to Division 01 for additional service and requirements.

3.07 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Provide concrete bases which are plumb, level and fully supported to prevent shifting over time.
 - 2. Provide concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 3. Place and secure anchorage devices. Install according to equipment manufacturer's recommendations, setting drawings, templates, diagrams, instructions, and directions for supported equipment. Provide anchor bolts according to anchor-bolt manufacturer's written instructions. Install anchor bolts to elevations required for proper attachment to supported equipment. Unless otherwise noted, install epoxy-coated anchor bolts to match

- equipment that extend through concrete base, and anchor into structural concrete.
4. Where located on structural floor, provide dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 5. Provide 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."
- 3.08 SUPPORTS AND ANCHORAGES
- A. Provide supports to match construction type and adjacent assembly rating.
 - B. For combustible construction, provide wood supports and anchorages. Cut, fit, and place nailers, blocking, and anchorages to support, and anchor materials and equipment. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
 - C. For non-combustible building construction provide metal supports and anchorages. Refer to Division 05 Section "Metal Fabrications" for structural steel. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment. Field Welding shall comply with AWS D1.1.
 - D. Attach to substrates ~~as required~~ to support applied loads.
- 3.09 GROUTING
- A. Clean surfaces that will come into contact with grout. Provide forms ~~as required~~ for placement of grout.
 - B. Mix and install grout for HVAC equipment base bearing surfaces, and anchors.
 - C. Place grout around anchors and completely filling equipment base and provide smooth bearing surface for equipment. Avoid air entrapment during placement of grout.
 - D. Allow grout to cure before loading or applying forces.
- 3.10 SLEEVE-SEAL INSTALLATION
- A. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- END OF SECTION 230500

SECTION 23 0548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vibration isolation requirements.
- B. Vibration isolators.

1.02 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
 - 1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
- B. Shop Drawings - Vibration Isolation Systems:
 - 1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.
- C. Manufacturer's detailed field testing and inspection procedures.
- D. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- E. Shop Drawings:
 - 1. Include delegated design calculations that indicate compliance with the applicable building code, and the vibration isolator manufacturer's recommendations.

1.05 QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Perform delegated design and installation in accordance with applicable codes.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

- A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.
- B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:
- C. General Requirements:
 - 1. Select vibration isolators to provide required static deflection.
 - 2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
 - 3. Select vibration isolators for outdoor equipment to comply with wind design requirements.
 - 4. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch (50 mm) operating clearance beneath base unless otherwise indicated.
- D. Equipment Isolation: As indicated on drawings and as scheduled in ASRAE Handbook (2015 Applications Chapt. 48) based on equipment, application and structure.

2.02 PERFORMANCE REQUIREMENTS

- A. General:
 - 1. All equipment mounted on vibration isolated bases to have minimum operating clearance of 2 inches (50 mm) between the base and floor or support beneath unless noted otherwise.

2.03 VIBRATION ISOLATORS

- A. Manufacturers:
 - 1. Vibration Isolators:
 - a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
 - b. Mason Industries: www.mason-ind.com/#sle.
 - c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
 - 2. Source Limitations: Furnish vibration-isolators and associated accessories produced by a single manufacturer and obtained from a single supplier.
- B. General Requirements:
 - 1. Spring Elements for Spring Isolators:

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- a. Color code or otherwise identify springs to indicate load capacity.
 - b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
 - c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
 - d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
 - e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
 - f. Selected to function without undue stress or overloading.
- C. Vibration Isolators for Nonseismic Applications:
- D. Non-Seismic Type:
- 1. Spring Hanger:
 - a. Housing: Steel construction containing stable steel spring and integral glass fiber or elastomeric element preventing metal to metal contact.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Coordinate proposed equipment locations with structural shop drawings and structure before ordering equipment.
- B. Verify structure with field measurements before placing equipment supports.
- C. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.
- 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. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Secure fasteners according to manufacturer's recommended torque settings.
- D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated.
- E. Vibration Isolation Systems:
 - 1. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
 - 2. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
 - 3. Adjust isolators to be free of isolation short circuits during normal operation.
 - 4. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

3.03 FIELD QUALITY CONTROL

- A. Provide services of a manufacturer's authorized representative for vibration isolation systems to observe installation and assist in inspection and testing. Include manufacturer's detailed testing and inspection procedures and field reports with submittals.
- B. Vibration Isolation Systems:
 - 1. Verify isolator static deflections.
 - 2. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.
- C. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.
- D. Refer to Division 01 - Quality Requirements, for additional requirements.

END OF SECTION

SECTION 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Adhesive-backed markers.
- D. Ceiling tacks.

1.02 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Schedule: Submit schedules of equipment and valves including tag, location, function, and manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.
- E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- F. Project Record Documents: Record locations of equipment, dampers and valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Air Handling Units: Nameplates.
- B. Condensing Units: Nameplates.
- C. Air Terminal Units: Tags.
- D. Clothes Dryer Exhaust Duct Length Identification: Tags.
- E. Control Panels: Nameplates.
- F. Dampers: Ceiling tacks, where located above lay-in ceiling.
- G. Ductwork: Adhesive backed markers or stencilled painting. Use only where not exposed to public.
- H. Piping: Adhesive backed markers or stencilled painting.
- I. Pumps: Nameplates.
- J. Thermostats: Nameplates.

2.02 NAMEPLATES

- A. Manufacturers:
 - 1. Letter Color: White.
 - 2. Letter Height: 1/4 inch (6 mm).
 - 3. Background Color: Black.
 - 4. Plastic: Comply with ASTM D709.

2.03 TAGS

- A. Manufacturers.
- B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch (40 mm) diameter.
- C. Metal Tags: Aluminum with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.

2.04 ADHESIVE-BACKED MARKERS

- A. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch (0.76 mm); printed with UV and chemical resistant inks.
- B. Style: Individual Label.
- C. Color: Varies by use. Match owner preference.

2.05 CEILING TACKS

- A. Description: Steel with 3/4 inch (20 mm) diameter color coded head.
- B. Color code as follows:
 - 1. HVAC Equipment: Yellow.
 - 2. Fire Dampers and Smoke Dampers: Red.
 - 3. Heating/Cooling Valves: Blue.

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. Clothes Dryer Exhaust Duct Length Identification: Where the exhaust duct is concealed within the building construction, the equivalent length of the exhaust duct shall be identified on a permanent tag. The tag shall be located within 6 feet of the exhaust duct connection.
- C. Install in accordance with manufacturer's instructions.
- D. Use tags on piping 3/4 inch (20 mm) diameter and smaller.
 - 1. Identify service, flow direction, and pressure.
- E. Install ductwork with markers or stencils visible from points of access (not on exposed ducts in public areas). Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- F. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.
- G. Provide "Low Clearance" warning labels for all equipment, ducts, piping and other work with headroom below 6'-6".
- H. Provide "Trip Hazard" warning labels for all work across or restricting a 30" path of travel.

END OF SECTION

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SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.
- B. Measurement of final operating condition of HVAC systems.
- C. Sound measurement of equipment operating conditions.

1.02 REFERENCE STANDARDS

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition 2016.
- B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems 2008, with Errata (2019).

1.03 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
- C. TAB Agency Required Qualifications:
 - 1. An independent, 3rd party agency specializing in the testing, adjusting, and balancing of systems specified in this section.
 - 2. Having minimum of three years documented experience.
 - 3. Certified by one of the following:
 - a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
- D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.
- E. Pre-Qualified TAB Agencies:
 - 1. Kahoe.
 - 2. Melink
- F. Final Report: Indicate measurements and note deficiencies that prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
 - 1. Submit under provisions of Division 01.
 - 2. Submit to the Engineer within two weeks after completion of testing, adjusting, and balancing.
 - 3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
 - 4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
 - 5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
 - 6. Units of Measure: Report data in I-P (inch-pound) units only.
 - 7. Include the following on the title page of each report:
 - a. Name of Testing, Adjusting, and Balancing Agency.
 - b. Address of Testing, Adjusting, and Balancing Agency.
 - c. Telephone number of Testing, Adjusting, and Balancing Agency.
 - d. Project name.
 - e. Project location.
 - f. Project Architect.
 - g. Project Engineer.
 - h. Project Contractor.
 - i. Report date.
- G. Project Record Documents: Record actual locations of all balancing devices.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 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. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

3.02 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. Zone dampers and zone damper system is fully installed and operating properly.
 - 9. Air coil fins are cleaned and combed.
 - 10. Access doors are closed and duct end caps are in place.

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11. Air outlets are installed and connected.
12. Duct system leakage is minimized.
- B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- C. Beginning of work means acceptance of existing conditions.
- 3.03 PREPARATION
 - A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
 - B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.
- 3.04 ADJUSTMENT TOLERANCES
 - A. Equipment: Adjust to within plus or minus 5 percent of design for supply systems.
 - B. Equipment: Adjust to within plus or minus 10 percent of design for return and exhaust systems.
 - C. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
- 3.05 RECORDING AND ADJUSTING
 - A. Field Logs: Maintain written logs including:
 1. Running log of events and issues.
 2. Discrepancies, deficient or uncompleted work.
 3. Contract interpretation requests.
 4. Lists of completed tests.
 - B. Ensure recorded data represents actual measured or observed conditions.
 - C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
 - D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.
 - E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
 - F. Mark final settings on balancing devices with permanent marker, and photograph.
 - G. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
 - H. At final inspection, recheck random selections of data recorded in report. Recheck devices, equipment or areas (up to 10%) selected for witnessing by the Owner, Architect and/or Engineer.
 - I. Check and adjust systems approximately six months after final acceptance and submit report.
- 3.06 AIR SYSTEM PROCEDURE
 - A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
 - B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
 - C. Measure air quantities at air inlets and outlets.
 - D. 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.
 - E. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
 - F. 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.
 - G. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
 - H. Check zone dampers for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.
- 3.07 SCOPE
 - A. Test, adjust, and balance all equipment and systems installed or modified under this contract.
- 3.08 MINIMUM DATA TO BE REPORTED
 - A. Electric Motors:
 1. Manufacturer.
 2. Model/Frame.
 3. HP/BHP.
 4. Phase, voltage, amperage; nameplate, actual, no load.
 5. RPM.
 - B. Air Moving Equipment:
 1. Location.
 2. Manufacturer.
 3. Model number.
 4. Arrangement/Class/Discharge.
 5. Air flow, specified and actual.
 6. Return air flow, specified and actual.
 7. Outside air flow, specified and actual.
 8. Total static pressure, specified and actual.
 9. Total external pressure, specified and actual.
 10. Inlet pressure.
 11. Discharge pressure.
 12. Fan RPM.
 - C. Heating/Cooling/Makeup Equipment:
 1. Identification/location.

2. Design and Actual air flow.
 3. Design and actual return air flow.
 4. Design and actual outside air flow.
 5. Design and actual supply air temperature (after coil during heating/cooling)
 6. Return air temperature.
 7. Outside air temperature.
 8. Mixed air temperature.
 9. Design and actual outside/return air ratio.
 - D. Exhaust Fans:
 1. Location.
 2. Manufacturer.
 3. Model number.
 4. Air flow, specified and actual.
 5. Total static pressure (total external), specified and actual.
 6. Inlet pressure.
 7. Discharge pressure.
 8. Fan RPM.
 - E. Duct Traverses:
 1. System equipment/zone/main ducts.
 2. Duct size.
 3. Area.
 4. Design/actual velocity.
 5. Design/actual air flow.
 6. Duct design/actual static pressure.
 7. Take airflow measurements no more than 6" apart at a minimum of 25 points, regardless of duct size.
 8. Advise if return duct has no more than 0.5 duct equivalent straight diameters upstream of the fan.
 9. Advise if supply duct mains have no more than 2.5 duct equivalent straight diameters downstream of the fan.
 10. Although preferred in a straight section of duct, lack of a straight section of duct is not an excuse for omitting the duct traverse altogether. Call the Engineer before omitting the duct traverse.
 11. If supply or return duct main traverse readings cannot be performed in order to perform duct leakage calculations, provide duct leakage testing (further below).
 - F. Duct Leak Calculation:
 1. Description of equipment/ductwork tested.
 2. Equipment/duct design/actual total pressure.
 3. Equipment/duct design/actual static pressure.
 4. Equipment/duct main air flow.
 5. Sum of inlet/outlet air flows.
 6. Calculated leakage (equipment flow less sum of inlets/outlets).
 - G. Duct Leak Tests (if duct traverse total flow not performed):
 1. Description of equipment/ductwork tested.
 2. Duct design/actual total pressure.
 3. Duct design/actual static pressure.
 4. Equipment/duct main air flow.
 5. Sum of outlet air flows.
 6. Maximum allowable leakage duct capacity times leak factor.
 7. Test static pressure.
 8. Test orifice differential pressure.
 9. Leakage.
 - H. Air Distribution Tests:
 1. Room number/location.
 2. Design velocity.
 3. Design air flow.
 4. Test (final) velocity.
 5. Test (final) air flow.
 6. Percent of design air flow.
 7. Supply air temperature at end of run(during heating/cooling)
 - I. Sound Level:
 1. Location and dB level.
 2. Octave bands - equipment off.
 3. Octave bands - equipment on.
 4. Normally acceptable readings.
 5. Unusual conditions at time of test.
- END OF SECTION

SECTION 23 0913 - INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Input/Output Sensors:
 - 1. Temperature sensors.
 - 2. Humidity sensors.
 - 3. Static pressure (air pressure) sensors.
 - 4. Damper position indicators.
 - 5. Carbon dioxide sensors.
- B. Thermostats:
 - 1. Electric room thermostats.
 - 2. Line voltage thermostats.
 - 3. Room thermostat accessories.

1.02 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. 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.
- C. 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.
- D. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.
- E. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
- F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Refer to Division 01 - Product Requirements, for additional provisions.
 - 2. Extra Thermostats and Other Exposed Sensors: One of each type.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years experience approved by manufacturer.
- C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.
- D. All sensing devices and transmitters must be compatible with project DDC controllers.

1.04 WARRANTY

- A. Refer to Division 01 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Substantial Completion.
- C. Provide five year manufacturer's warranty for control air compressors.

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 INPUT/OUTPUT SENSORS

- A. Temperature Sensors:
 - 1. Use thermistor type temperature sensing elements with characteristics resistant to moisture, vibration, and other conditions consistent with the application without affecting accuracy and life expectancy.
- B. Humidity Sensors:
 - 1. Duct Mounted Sensor: Voltage type encased in a plastic housing.
 - a. Humidity:
 - 1) HS Element: Digitally profiled thin-film capacitive.
 - 2) Accuracy 1 percent at 10 to 80 percent relative humidity at 77 degrees F (25 degrees C), multi-point calibration, NIST traceable.
 - 2. Wall Mounted Sensor: Voltage type encased in a plastic housing.
- C. Static Pressure (Air Pressure) Sensors:
 - 1. Unidirectional with ranges not exceeding 150 percent of maximum expected input.
 - 2. Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 40 to 100 degrees F (5 to 40 degrees C).
 - 3. Accuracy: One percent of full scale with repeatability 0.3 percent.
 - 4. Output: 0 to 5 vdc with power at 12 to 28 vdc.
- D. Damper Position Indicators: Potentiometer mounted in enclosure with adjustable crank arm assembly connected to damper to transmit 0 to 100 percent damper travel.
- E. Carbon Dioxide Sensors, Duct and Wall:
 - 1. General: Provide non-dispersive infrared (NDIR), diffusion sampling CO2 sensors with integral transducers and linear output.
- F. Static Pressure Sensors:
 - 1. Unidirectional with ranges not exceeding 150 percent of maximum expected input.
- G. Equipment Operation Sensors:

1. Status Inputs for Fans: Differential pressure switch with adjustable range of 0 to 5 inches wg (0 to 1250 Pa).
 2. Status Inputs for Electric Motors: Current sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.
- H. Damper Position Indication: Potentiometer mounted in enclosure with adjustable crank arm assembly connected to damper to transmit 0 - 100 percent damper travel.
- 2.03 THERMOSTATS
- A. Electric Room Thermostats:
 1. Type: NEMA DC 3, 24 volts, with setback/setup temperature control.
 2. Service: Two step cooling and two step heating.
 3. Covers: Locking with set point adjustment, without thermometer.
 4. Smart capabilities:
 - a. Connect to the internet using wi-fi for remote control from a smart phone.
 - b. Self adjust using learning technologies, resident patterns and ambient conditions.
 - c. Provide resident access to energy consumption reports.
 - B. Line Voltage Thermostats:
 1. Integral manual On/Off/Auto selector switch, single or two pole.
 2. Dead Band: Maximum 2 degrees F (one degree C).
 3. Cover: Locking with set point adjustment, with thermometer.
 4. Rating: Motor load.
 - C. Room Thermostat Accessories:
 1. Thermostat Covers: Brushed aluminum.
 2. Insulating Bases: For thermostats located on exterior walls.
 3. Thermostat Guards: Metal mounted on separate base.
 4. Adjusting Key: As required for device.
- 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.
 - H. Verify controls compatibility with mechanical equipment manufacturers.
- 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 60 inches (1500 mm) above floor. Align with lighting switches and humidistats. Refer to Section 26 2726.
 - C. Provide guards on thermostats in entrances.
 - D. Provide valves with position indicators and with pilot positioners where sequenced with other controls.
 - E. Provide mixing dampers of opposed blade construction arranged to mix streams. Provide pilot positioners on mixed air damper motors.
 - F. Provide isolation (two position) dampers of parallel blade construction.
 - G. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.
 - H. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.
 - I. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.
 - J. Provide conduit and electrical wiring in accordance with Section 26 0583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.
 - K. Provide conduit and electrical wiring in accordance with Division 26.
 - L. Provide communications conduit and wiring in accordance with Division 27.
- 3.03 MAINTENANCE
- A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
 - B. Provide service and maintenance of control system for one year from Date of Substantial Completion.
 - C. Provide complete service of controls systems, including call backs, and submit written report of each service call.
 - D. In addition to normal service calls, make minimum of 4 complete normal inspections (one at the beginning of each season) of approximately 4 hours duration to inspect, calibrate, and adjust controls.
 - E. Provide a separate maintenance contract for additional or extended maintenance service.
- END OF SECTION

SECTION 23 2113 - HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hydronic system requirements.
- B. Heating water and glycol piping, above grade.
- C. Condenser water piping, above grade.
- D. Valves:
 - 1. Ball valves.
 - 2. Butterfly valves.
 - 3. Check valves.
- E. Flow controls.

1.02 REFERENCE STANDARDS

- A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2021.
- 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 2020.
- F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.
- 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 A536 - Standard Specification for Ductile Iron Castings 1984 (Reapproved 2019)e1.
- I. ASTM B32 - Standard Specification for Solder Metal 2020.
- J. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2020.
- K. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.
- L. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120 2021a.
- M. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series) 2020.
- N. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40 2021.
- O. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80 2020.
- P. 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 2020.
- Q. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers 1992, with Editorial Revision (2018).
- R. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications 2007 (Reapproved 2019).
- S. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2011 (Amended 2012).
- T. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020.
- U. AWWA C606 - Grooved and Shouldered Joints 2015.
- V. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of piping with size, location and installation of service utilities.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Welders Certificate: Include welders certification of compliance with ASME BPVC-IX.
- C. Product Data:
 - 1. Include data on pipe materials, pipe fittings, valves, and accessories.
 - 2. Provide manufacturers catalogue information.
 - 3. Indicate valve data and ratings.
 - 4. Show grooved joint couplings, fittings, valves, and specialties on drawings and product submittals, specifically identified with the manufacturer's style or series designation.
- D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
- E. Project Record Documents: Record actual locations of valves.
- F. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Valve Repacking Kits: One for each type and size of valve.

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 3 years of experience. For all proprietary piping systems, installer shall provide proof/verification of manufacturer training and certification.
- C. Provide all grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.

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1.06 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.

1.07 WARRANTY

- A. Manufacturer shall warrant piping and fittings for a 25-year period.
 - 1. Warranty covers the repair or replacement of any piping or fittings proven defective.
 - 2. Warranty may transfer to subsequent owners.
 - 3. The most recent limited warranty published by the manufacturer takes precedence at the time of installation.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

- A. Comply with ASME B31.9 and applicable federal, state, and local regulations.
- B. Piping: Provide piping, fittings, hangers and supports, as indicated, and as follows:
 - 1. Where more than one piping system material is specified, provide joining fittings that are compatible with both piping materials and ensure that the integrity of the system is not jeopardized.
 - 2. Use non-conducting dielectric connections whenever joining dissimilar metals.
 - 3. Grooved mechanical joints may be used in accessible locations only.
 - a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Architect.
 - b. Use rigid joints unless otherwise indicated.
 - c. Use flexible joints at motorized equipment.
- C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.
 - 1. Where grooved joints are used in piping, provide grooved valve/equipment connections if available; if not available, provide flanged ends and grooved flange adapters.
- D. Valves: Provide valves where indicated:
 - 1. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch (20 mm) gate valves with cap; pipe to nearest floor drain.
 - 2. Provide isolation valve and automatic air vent at all high points of piping system. Provide in owner approved location where occasional water discharge will not be a nuisance.
 - 3. On discharge of all pumps, use spring loaded check valve or triple duty valve.
 - 4. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.
 - 5. For throttling, bypass, or manual flow control services, use globe or ball valves with integral pressure measurement ports.
 - 6. Provide combination manual balance / shut-off valve at system main at every split, branch or vertical riser.

2.02 HEATING WATER AND GLYCOL PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:
 - 1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
 - 2. Threaded Joints: ASME B16.3, malleable iron fittings.
 - 3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.
- B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn, using one of the following joint types:
 - 1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
 - a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
 - b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.
 - 2. Grooved Joints: AWWA C606 grooved tube, fittings of same material, and copper-tube-dimension mechanical couplings.
 - 3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
 - 4. Mechanical Press Sealed Fittings: Double pressed type complying with ASME B16.22, utilizing EPDM, nontoxic synthetic rubber sealing elements.
 - a. Manufacturers:
 - 1) Apollo Valves: www.apollovalves.com/#sle.
 - 2) CopperPress
 - 3) Grinnell Products, a Tyco Business: www.grinnell.com.
 - 4) Viega LLC: www.viega.com.
 - 5) Substitutions: See Section 01 6000 - Product Requirements.

2.03 CONDENSER WATER PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M, Schedule 40, black.
 - 1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings with finish matching piping; AWS D1.1/D1.1M welded.
 - 2. Threaded Joints: ASME B16.3, malleable iron fittings with finish matching piping.
 - 3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.
- B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn; using one of the following joint types:
 - 1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
 - a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
 - b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.
 - 2. Grooved Joints: AWWA C606 grooved tube, fittings of same material, and copper-tube-dimension mechanical couplings.

3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
 4. Mechanical Press Sealed Fittings: Double pressed type complying with ASME B16.22, utilizing EPDM, nontoxic synthetic rubber sealing elements.
 - a. Manufacturers:
 - 1) Apollo Valves;: www.apollovalves.com/#sle.
 - 2) CopperPress
 - 3) Grinnell Products, a Tyco Business: www.grinnell.com.
 - 4) Shurjoint Piping Products, Inc., www.shurjoint.com.
 - 5) Viega LLC: www.viega.com.
 - 6) Substitutions: See Section 01 6000 - Product Requirements.
- 2.04 EQUIPMENT DRAINS AND OVERFLOWS
- A. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26.
 1. Fittings: ASTM D2466 or D2467, PVC.
 2. Joints: Solvent welded in accordance with ASTM D2855.
- 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. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Malleable iron, adjustable swivel, split ring.
 - C. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Greater: Carbon steel, adjustable, clevis.
 - D. Hangers for Hot Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.
 - E. Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Greater: Adjustable steel yoke, cast iron roll, double hanger.
 - F. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - G. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Greater: Steel channels with welded spacers and hanger rods, cast iron roll.
 - H. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
 - I. Wall Support for Pipe Sizes 4 Inches (100 mm) and Greater: Welded steel bracket and wrought steel clamp.
 - J. Wall Support for Hot Pipe Sizes 6 Inches (150 mm) and Greater: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
 - K. Vertical Support: Steel riser clamp.
 - L. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - M. Floor Support for Hot Pipe Sizes to 4 Inches (100 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - N. Floor Support for Hot Pipe Sizes 6 Inches (150 mm) and Greater: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
 - O. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
 - P. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.
- 2.06 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS
- A. Unions for Pipe 2 Inches (50 mm) and Less:
 1. Ferrous Piping: 150 psig (1034 kPa) malleable iron, threaded.
 - B. Flanges for Pipe 2 Inches (50 mm) and Greater:
 1. Ferrous Piping: 150 psig (1034 kPa) forged steel, slip-on.
 2. Gaskets: 1/16 inch (1.6 mm) 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. Housing Material: Ductile iron, galvanized complying with ASTM A536.
 4. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F (minus 34 degrees C) to 230 degrees F (110 degrees C).
 5. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
 6. When pipe is field grooved, provide coupling manufacturer's grooving tools.
 7. Manufacturers:
 - a. Grinnell Products, a Tyco Business: www.grinnell.com.
 - b. Shurjoint Piping Products, Inc., www.shurjoint.com.
 - c. Victaulic Company: www.victaulic.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
 - D. Dielectric Connections:
 1. Flanges:
 - a. Dielectric flanges with same pressure ratings as standard flanges.
 - b. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
 - c. Construct of galvanized steel with threaded end connections to match connecting piping.
 - d. Suitable for the required operating pressures and temperatures.
- 2.07 BUTTERFLY VALVES
- A. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck.
 - B. Disc: Construct of aluminum bronze, chrome plated ductile iron, stainless steel, ductile iron with EPDM encapsulation, or Buna-N encapsulation.

- C. Operator: 10 position lever handle.
- 2.08 SPRING LOADED CHECK VALVES
- 2.09 **FLOW CONTROLS**
 - A. Manufacturers:
 - 1. Caleffi: [142 Flo-Set Combination Balance / Shutoff Valve] www.caleffi.com/usa/en-us
 - 2. Substitutions: See Section 01 6000 - Product Requirements.
 - B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.
 - C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi (24 kPa).
- PART 3 EXECUTION**
- 3.01 PREPARATION
 - A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
 - B. Prepare pipe for grooved mechanical joints by coupling manufacturer.
 - C. Remove scale and dirt on inside and outside before assembly.
 - D. Prepare piping connections to equipment using jointing system specified.
 - E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- 3.02 INSTALLATION
 - A. Install in accordance with manufacturer's instructions.
 - B. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
 - C. Route piping in orderly manner, parallel to building structure, and maintain gradient.
 - D. Group piping whenever practical at common elevations.
 - E. Sleeve pipe passing through partitions, walls and floors.
 - F. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified.
 - G. Slope piping and arrange to drain at low points.
 - H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 0516.
 - 1. Flexible couplings may be used in header piping to accommodate thermal growth, thermal contraction in lieu of expansion loops.
 - 2. Use flexible couplings in expansion loops.
 - I. Grooved Joints:
 - 1. Install in accordance with the manufacturer's latest published installation instructions.
 - 2. Gaskets to be suitable for the intended service, molded, and produced by the coupling manufacturer.
 - J. 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 (100 mm).
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
 - K. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
 - 2. Support horizontal piping as scheduled.
 - 3. Install hangers to provide minimum 1/2 inch (13 mm) space between finished covering and adjacent work.
 - 4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
 - 5. Use hangers with 1-1/2 inch (38 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
 - 7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - 8. Prime coat exposed steel hangers and supports. Refer to Section 09 9123. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
 - L. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 0719.
 - M. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 23 0719.
 - N. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 3100.
 - O. Use eccentric reducers to maintain top of pipe level.
 - P. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
 - Q. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. Refer to Section 09 9123.
 - R. Install valves with stems upright or horizontal, not inverted.
- 3.03 SCHEDULES
 - A. Hanger Spacing for Plastic Piping.
 - 1. 1/2 inch (15 mm): Maximum span, 42 inches (1000 mm); minimum rod size, 1/4 inch (6 mm).
 - 2. 3/4 inch (20 mm): Maximum span, 45 inches (1100 mm); minimum rod size, 1/4 inch (6 mm).
 - 3. 1 inch (25 mm): Maximum span, 51 inches (1300 mm); minimum rod size, 1/4 inch (6 mm).
 - 4. 1-1/4 inches (32 mm): Maximum span, 57 inches (1400 mm); minimum rod size, 3/8 inch (9 mm).
 - 5. 1-1/2 inches (40 mm): Maximum span, 63 inches (1600 mm); minimum rod size, 3/8 inch (9 mm).

6. 2 inches (50 mm): Maximum span, 69 inches (1700 mm); minimum rod size, 3/8 inch (9 mm).
7. 3 inches (80 mm): Maximum span, 7 feet (2100 mm); minimum rod size, 3/8 inch (9 mm).
8. 4 inches (100 mm): Maximum span, 8 feet (2400 mm); minimum rod size, 1/2 inch (13 mm).
9. 6 inches (150 mm): Maximum span, 10 feet (3.0 m); minimum rod size, 1/2 inch (13 mm).
10. 8 inches (200 mm): Maximum span, 11 feet (3.3 m); minimum rod size, 5/8 inch (16 mm).

END OF SECTION

SECTION 23 2300 - REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping.
- B. Refrigerant.
- C. Moisture and liquid indicators.
- D. Valves.
- E. Filter-driers.
- F. Engineered wall seals and insulation protection.

1.02 REFERENCE STANDARDS

- A. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2018.
- B. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes 2018.
- C. ASME B31.5 - Refrigeration Piping and Heat Transfer Components 2020.
- D. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service 2020.
- E. ASTM B1003 - Standard Specification for Seamless Copper Tube for Linesets (2016).
- F. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.
- G. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2016).
- H. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).
- I. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials 2021a.
- J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- K. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- L. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials 2013 (Reapproved 2021).
- M. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015 (Reapproved 2021)e1.
- N. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2011 (Amended 2012).

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. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.
- C. Liquid Indicators.
- D. Valves.
 - 1. Use service valves on suction and discharge of compressors.
 - 2. Use gauge taps at compressor inlet and outlet.
- E. Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.
- F. Filter-Driers:
 - 1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.
 - 2. Use sealed filter-driers in systems utilizing hermetic compressors.

1.04 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.
- C. Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.
- D. Maintenance Data: Include instructions for changing cartridges, assembly views, spare parts lists.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store piping and specialties in shipping containers with labeling in place.
- B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.
- C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.01 PIPING

- A. Copper Tube: ASTM B280, 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.
- B. Copper Tube to 7/8 inch (22 mm) OD: ASTM B88 (ASTM B88M), Type K (A), annealed.
 - 1. Fittings: ASME B16.26 cast copper.
 - 2. Joints: Flared.
- C. Pipe Supports and Anchors:
 - 1. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Malleable iron adjustable swivel, split ring.

2.02 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 (93 degrees C) and maximum working pressure of 500 psi (3450 kPa).

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2.03 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 (3450 kPa).

2.04 FILTER-DRIERS

- A. 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.
- B. Construction: UL listed.
 1. Sealed Type: Copper shell.
 2. Connections: As specified for applicable pipe type.

2.05 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturer:
 1. Standard products furnished by tubing manufacturer.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
 1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
 2. Maximum Service Temperature: 180 degrees F (82 degrees C).
 3. Connection: Waterproof vapor barrier adhesive.
 4. R Value: > R-3 h-SF-deg.F/BTU minimum.
 5. Thickness: >.75" minimum.
 6. K value: < .245 BTU-in./(h-SF-deg.F) per ASTM C177.
 7. Permeability: < .01 perm-in.

2.06 ENGINEERED WALL SEALS AND INSULATION PROTECTION

- A. Manufacturers:
 1. Airex Manufacturing, Inc: www.airexmfg.com/#sle.
 2. Substitutions: Refer to Division 01 - Product Requirements.
- B. Pipe Penetration Wall Seal: Seals HVAC piping wall penetrations with compression gasket wall mounted rigid plastic outlet cover.
 1. Outlet Cover Color: Selected by architect.
 2. Water Penetration: Comply with ASTM E331.
 3. Air Leakage: Comply with ASTM E283.
 4. Air Permeance: Comply with ASTM E2178.
- C. Insulation Protection System: Mechanical line insulation and PVC cover.
 1. PVC Insulation Cover Color: Black with full-length velcro fastener.
 2. Weatherization and Ultraviolet Exposure Protection: Comply with ASTM G153.
 3. Water/Vapor Permeability: Comply with ASTM E96/E96M.
 4. Anti-Fungal and Anti-Microbial Resistance: Comply with ASTM G21.
 5. Flame Spread and Smoke Development Rating of 25/450: Comply with ASTM E84.
 6. Adhesive free.

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. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- E. Pipe Hangers and Supports.
- F. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers. Slope horizontal piping 0.40 percent in direction of flow.
- G. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Section 08 3100.
- H. Flood piping system with nitrogen when brazing.
- I. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.
- J. Insulate piping; refer to Section and Section 22 0716.
- K. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.
- L. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

3.03 FIELD QUALITY CONTROL

- A. Refer to Division 01 - Quality Requirements, for additional requirements.
- B. Test refrigeration system in accordance with ASME B31.5.
- C. Pressure test system with dry nitrogen to 200 psi (1380 kPa). Perform final tests at 27 inches (92 kPa) vacuum and 200 psi (1380 kPa) using halide torch. Test to no leakage.

3.04 SCHEDULES

- A. Hanger Spacing for Copper Tubing.
 1. 1/2 inch (13 mm), 5/8 inch (16 mm), and 7/8 inch (22 mm) OD: Maximum span, 5 feet (1500 mm); minimum rod size, 1/4 inch (6.3 mm).

2. 1-1/8 inch (29 mm) OD: Maximum span, 6 feet (1800 mm); minimum rod size, 1/4 inch (6.3 mm).
END OF SECTION

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SECTION 23 8126.13 - SMALL-CAPACITY SPLIT-SYSTEM AIR CONDITIONERS

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. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams. Include equipment served by condensing units in submittal, or submit at same time, to ensure capacities are complementary.
- C. Shop Drawings: Provide plans with routing coordinated through walls and structure. Indicate assembly, required clearances, and location and size of field connections.
- D. Design Data: Indicate refrigerant pipe sizing.
- E. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions. Provide manufacturer's approved refrigerant piping schematics indicating refrigerant pipe sizes for lengths to be installed; riser isometric diagrams; double risers or traps for oil management if required.
- F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- G. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
- H. Project Record Documents: Record actual locations of components and connections.

1.04 QUALITY ASSURANCE

- A. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- C. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.05 WARRANTY

- A. Refer to Division 01 - Closeout Submittals, for additional warranty requirements.
- B. Special Warranty: Manufacturer's standard form on all parts for a period of 1 year from date of installation. The compressor shall have a warranty of 6 years from the date of the original installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on equipment schedule or comparable product by one of the following.
 - 1. Bryant: www.bryant.com.
 - 2. Mitsubishi.
 - 3. Fujitsu.
 - 4. Panasonic.

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; auxiliary electric heat.
 - 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.

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, condensate pump and controls; wired for single power connection with control transformer.
 - 1. Location: High-wall.
 - 2. Cabinet: Galvanized steel.
 - a. Finish: White.
 - 3. Fan: Line-flow fan direct driven by a single motor.
- 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.

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- C. Remote Actuators.
 - D. Condensate pump.
 - 1. Furnished with equipment by manufacturer capable of pumping maximum condensate flow up to 10' elevation head.
- 2.04 OUTDOOR UNITS
- A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
 - 1. Comply with AHRI 210/240.
 - 2. Refrigerant: R-410A.
 - 3. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23.1 and UL 207.
 - B. Compressor: AHRI 520; hermetic, variable speed inverter type, 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.
 - 1. Condenser Fans: Direct-drive propeller type.
 - 2. Condenser Fan Motor: Enclosed, 1-phase type, permanently lubricated.
 - D. Coil: Air-cooled, aluminum fins bonded to copper tubes.
 - E. 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.
 - 2. Provide heat pump reversing valves.
 - F. Operating Controls:
 - 1. Control by room thermostat to maintain room temperature setting.
 - 2. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig (1965 kPa) and off when pressure drops below 140 psig (965 kPa) for operation to 0 degrees F (-18 degrees C).
 - G. Mounting Pad: Poured concrete pad, minimum 4 inches (100 mm) thick and extend at least 4 inches beyond unit.
- 2.05 ACCESSORY EQUIPMENT
- A. Room Thermostat: Wall-mounted, large easy to read digital display, electric solid state microcomputer based room thermostat with remote sensor to maintain temperature setting; low-voltage; with following features:
 - 1. System selector switch (heat-off-cool) and fan control switch (auto-on).
 - 2. Automatic switching from heating to cooling.
 - 3. Preferential rate control to minimize overshoot and deviation from setpoint.
 - 4. Programming based on weekdays, Saturday and Sunday.
 - 5. Thermostat Display:
 - a. Time of day.
 - b. Actual room temperature.
 - c. Programmed temperature.
 - d. Day of week.
 - e. System Mode Indication: Heating, Cooling, Fan Auto, Off, and On, Auto or On, Off.
 - 6. Smart capabilities:
 - a. Connect to the internet using wi-fi for remote control from a smart phone.
 - b. Self adjust using learning technologies, resident patterns and ambient conditions.
 - c. Provide resident access to energy consumption reports.
 - 7. Manufacturers:
 - a. Mitsubishi.
 - b. Fujitsu.
 - c. Panasonic.
- 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 refrigeration systems in accordance with ASHRAE Std 15 and manufacturer installation instructions and recommendations.
 - C. Have manufacturer's local representative verify installation and accessories are correct and match manufacturer requirements. Document the inspection and signoff and include in Owner and Maintenance manual.
 - D. Pipe drain from condensate outlet to nearest floor drain. Provide with check valve to prevent drainback, and code compliant (plenum rated in return ceiling) drainage tubing to approved receptor.
- END OF SECTION

SECTION 23 3423 - HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cabinet and ceiling exhaust fans.
- B. Ceiling exhaust fans (Energy Star).

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 2020.
- D. AMCA Compliance: Products shall comply with air and sound performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- E. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating 2016.
- F. AMCA 300 - Reverberant Room Method for Sound Testing of Fans 2014.
- G. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data 2014.
- H. NEMA MG 1 - Motors and Generators 2018.
- I. UL 705 - Power Ventilators 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. Manufacturer's Instructions: Indicate installation instructions.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project and attic stock.
 - 1. Refer to Division 01 - Product Requirements, for additional provisions.
 - 2. Dwelling Unit Bathroom Exhaust Fans: Provide two extra bathroom exhaust fans.

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 FIELD CONDITIONS

- A. Permanent ventilators may not be used for ventilation during construction.

PART 2 PRODUCTS

2.01 POWER VENTILATORS - GENERAL

- A. Static and Dynamically Balanced: Comply with AMCA 204.
- B. Performance Ratings: Comply with AMCA 210, bearing certified rating seal.
- C. Sound Ratings: Comply with AMCA 301, tested to AMCA 300, bearing certified sound ratings seal.
- D. Fabrication: Comply with AMCA 99.
- E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.02 CABINET AND CEILING EXHAUST FANS

- A. Manufacturers:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on the equipment schedule or a comparable product by one of the following:
 - 1. Greenheck Fan Corporation: www.greenheck.com.
 - 2. Loren Cook.
 - 3. PennBarry, Division of Air System Components: www.pennbarry.com.
 - 4. Substitutions: Refer to Division 01 - Product Requirements.
- C. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
- D. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.

2.03 CEILING EXHAUST FANS (Energy Star Labeled)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on equipment schedule or a comparable product by one of the following:
 - 1. Broan.
 - 2. Greenheck Fan Corporation.
 - 3. Loren Cook.
 - 4. Nutone.
 - 5. Panasonic.
- B. Description: Energy Star Rated, centrifugal fans designed for installing in ceiling or wall for concealed applications.
- C. Housing: Steel lined with acoustical insulation.
- D. Fan Wheel: Centrifugal wheel directly mounted on motor shaft. Fan shrouds, motor and fan wheel shall be removable for service.
- E. Grille: Painted aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.
- F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- G. Accessories:
 - 1. Ceiling Radiation Damper: Where located in rated assembly, provide with UL-555C rated damper.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide backdraft dampers on outlet from cabinet and ceiling exhaust fans and as indicated.

END OF SECTION

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SECTION 26 0050 - ELECTRICAL EXECUTION

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Definitions.
 - 2. Coordination.
 - 3. Common electrical installation requirements.

1.02 RELATED DOCUMENTS

- A. Drawings, General Provisions of the Contract, including General Conditions, Supplementary General Conditions, other Division 00 & 01 Specification Sections, shall apply to this division.
- B. These requirements apply to all work in Divisions 26, 27 and 28.

1.03 DEFINITIONS

- A. "Approved" means approved by the Engineer and Owner.
- B. "Furnish" means to purchase, arrange for delivery to site, and to take delivery at the site.
- C. "Install" means to place in position for use.
- D. "Provide" means to furnish and install.
- E. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- F. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters, overhangs and attics.
- G. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- H. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- I. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.

1.04 COORDINATION

- A. Coordination: Coordinate construction operations to ensure efficient and orderly installation of the Work.
 - 1. Coordinate construction operations, that depend on each other for proper installation, connection, and operation.
 - 2. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 3. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 4. Make adequate provisions to accommodate items scheduled for later installation.
 - 5. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Construction Schedule.
 - 2. Preparation of the Schedule of Values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Preinstallation conferences.
 - 7. Project closeout activities.
 - 8. Startup and adjustment of systems.
 - 9. Project closeout activities.

1.05 PROJECT MEETINGS

- A. General: Attend meetings and conferences at Project site, unless otherwise indicated.
 - 1. Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Engineer of scheduled meeting dates and times.
 - 2. Agenda: Request the meeting agenda if not furnished prior to meeting.
 - 3. Minutes: Record significant discussions and agreements achieved. Request the meeting minutes if not furnished. Note all discrepancies and notify Engineer of all changes to the Work or to the Contract Documents.
- B. Preconstruction Conference: Attend the preconstruction conference before starting construction, no later than 15 days after execution of the Agreement to review responsibilities and personnel assignments.
 - 1. Attendees: Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Discuss items of significance that could affect progress, including the following as applicable:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.

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- d. Designation of key personnel and their duties.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for requests for interpretations (RFIs).
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - j. Submittal procedures.
 - k. LEED requirements.
 - l. Preparation of Record Documents.
 - m. Use of the premises.
 - n. Work restrictions.
 - o. Owner's occupancy requirements.
 - p. Responsibility for temporary facilities and controls.
 - q. Construction waste management and recycling.
 - r. Parking availability.
 - s. Office, work, and storage areas.
 - t. Equipment deliveries and priorities.
 - u. First aid.
 - v. Security.
 - w. Progress cleaning.
 - x. Working hours.
- C. Preinstallation Conferences: Attend a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following as applicable:
 - a. The Contract Documents.
 - b. Options.
 - c. Related requests for interpretations (RFIs).
 - d. Related Change Orders.
 - e. Purchases, deliveries, submittals.
 - f. Review of mockups.
 - g. Possible conflicts.
 - h. Compatibility problems.
 - i. Time schedules.
 - j. Weather limitations.
 - k. Manufacturer's written recommendations.
 - l. Warranty requirements.
 - m. Compatibility of materials.
 - n. Acceptability of substrates.
 - o. Space and access limitations.
 - p. Regulations of authorities having jurisdiction.
 - q. Testing and inspecting requirements.
 - r. Installation procedures.
 - s. Coordination with other work.
 - t. Required performance results.
 - u. Protection of adjacent work.
 - v. Protection of construction and personnel.
 - 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 - 4. Reporting: Distribute minutes of the meeting to each party present, to parties who should have been present, and to the Engineer.
 - 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

1.06 SUBMITTALS

- A. Alternate Products: Alternate manufacturers, equipment and/or products must be specified or approved prior to bid in writing via addendum to be accepted. All costs associated with deviations from the basis of design shall be borne by the contractor. Deviations shall include alternate manufacturer and/or alternate product and shall include all significant dimensional, performance, electrical, or installation differences from the basis of design products. Costs for reimbursement shall include the costs of other trades affected, and shall include all engineering costs to evaluate such deviations.
- B. Substitutions: Unspecified manufacturers shall be considered substitutions and shall be submitted for consideration under the specified substitution procedures. Substitutions shall be submitted to the engineer for evaluation. If approved by the engineer, substitution shall be offered to the owner for consideration. All costs associated with substitutions shall be borne by the contractor. Costs for reimbursement shall include the costs of other trades affected, and shall include all engineering costs to evaluate such deviations.

- C. Coordination Drawings: Prepare Coordination Drawings (coordinated shop drawings) to maximize utilization of space for efficient installation of different components and for installation of products and materials fabricated by separate entities. Submit to Engineer for review before starting work.
 - 1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
 - a. Indicate functional and spatial relationships of components of the work with all other systems and trades.
 - b. Indicate required installation sequences.
 - c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide sketches of proposed alternate construction to Engineer for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
 - D. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project. Submit to Engineer before starting work.
 - 1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.
 - E. Make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.
 - F. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.
 - G. Prior to submitting shop drawings for review, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.
- 1.07 Warranties
- A. All work shall include a parts and labor warranty on materials and workmanship for a period of 1 year.
 - B. Refer to Division 01 for additional warranty requirements.
- PART 2 PRODUCTS**
- 2.01 MANUFACTURED CURBS
- A. Manufactured Curbs, Equipment Rails, and Other Roof Mounting Assemblies:
 - 1. The Pate Company: www.patecurbs.com.
 - 2. Substitutions: Refer to Division 01 - Product Requirements.
 - B. General requirements: Factory-assembled hollow sheet metal construction with fully mitered and welded corners, integral counterflashing, internal reinforcing, and top side and edges formed to shed water.
 - 1. Sheet Metal: Hot-dip zinc coated steel sheet complying with ASTM A653/A653M, SS Grade 33 (230); G60 (Z180) coating designation; 18 gage, 0.048 inch (1.21 mm) thick.
 - 2. Roofing Cants: Provide integral sheet metal roofing cants dimensioned to begin slope at top of roofing insulation; 1:1 slope; minimum cant height 4 inches (200 mm).
 - 3. Manufacture curb bottom and mounting flanges for installation directly on roof deck, not on insulation; match slope and configuration of roof deck.
 - 4. Provide the layouts and configurations shown on the drawings.
 - C. Equipment Rails: Two-sided curbs in straight lengths, with top horizontal for equipment mounting.
 - 1. Provide preservative treated wood nailers along top of rails.
 - 2. Height Above Finished Roof Surface: 6 inches (152 mm), minimum.
 - 3. Height Above Roof Deck: 14 inches (356 mm), minimum.
 - D. Pipe, Duct, and Conduit Mounting Pedestals: Vertical posts, minimum 8 inches (400 mm) square unless otherwise indicated.
 - 1. Provide preservative treated wood nailers over entire top surface, for supports to be provided by others.
 - 2. Height Above Finished Roof Surface: 12 inches (305 mm), minimum.
 - 3. Height Above Roof Deck: 14 inches (356 mm), minimum.
- 2.02 SLEEVES
- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
 - B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop and 1% outward slope, unless otherwise indicated.
 - C. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).
 - D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- 2.03 GROUT
- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

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3. Packaging: Premixed and factory packaged.
- 2.04 MECHANICAL SLEEVE SEALS
- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - B. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - C. Pressure Plates: Steel. Include two for each sealing element.
 - D. Connecting Bolts and Nuts: Steel with corrosion-resistant coating or stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.
- 2.05 ESCUTCHEONS
- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
 - B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
 - C. One-Piece, Cast-Brass Type: With set screw.
 1. Finish: Polished chrome-plated.
 - D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 1. Finish: Polished chrome-plated.
- PART 3 EXECUTION
- 3.01 ELECTRICAL DEMOLITION
- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
 - B. Contractor shall be responsible for all work and costs associated with demolition shown or noted on plans.
 - C. Verify exact requirements before bid and include direct and related indirect costs in estimate including permit application, fees, dust control, protection of existing, temporary power, fuel usage, scaffolding, disconnection, disposal, cutting and patching.
 - D. Occupied Buildings: For occupied buildings, coordinate with local management for communication with building users, occupants, and/or residents regarding potential for disruption, and provide 72 hour advance notification for planned outages. Install new work to the fullest extent possible before interrupting existing services to minimize disruption to residents. Provide temporary power for disruptions lasting over 15 minutes. Assume (midnight to 4am) premium labor rates for power shutdown, changeover and reconnection.
 - E. In performing the work:
 1. Coordinate with existing conditions and other trades before starting work.
 2. Remove portions of walls, floors, ceilings, etc. required for access to demolished and new work.
 3. Disconnect, demolish, and remove systems, equipment, and components indicated to be removed.
 4. Conduit/Wire to Be Removed: Remove portion indicated to be removed and cap or plug remaining with same or compatible material.
 5. Conduit/Wire Abandoned in Place: Cap or plug with compatible material.
 6. Equipment to Be Removed: Disconnect electrical power. Disconnect and cap services and remove equipment. Remove related supports, anchorages, and concrete bases.
 7. Equipment to Be Removed and Reinstalled: Arrange for disconnection of electrical power. Disconnect and cap services and remove, clean, and store equipment. When appropriate, reinstall, reconnect, arrange for power connection and make equipment operational.
 8. Equipment to Be Removed and Salvaged: Arrange for disconnection of electrical power. Disconnect and cap services, remove equipment and deliver to Owner.
 - F. If new or existing to remain products are damaged during demolition, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.
 - G. Subcontract the General Contractor to perform patching, repair or replacement of walls floors, ceilings, etc. removed for access to the work. General contractor shall repair finishes to match surrounding finishes.
- 3.02 COMMON REQUIREMENTS
- A. Install according to requirements and other Division specification sections.
 - B. Drawing plans, schematics, and diagrams indicate general location and arrangement of systems. Indicated locations and arrangements were used for sizing, calculations and other design considerations. Install as indicated unless deviations to layout are approved on Coordination Drawings.
 - C. Install circuits in concealed locations, unless otherwise indicated and except in equipment rooms and service areas. Where located within walls and other concealed areas subject to damage, provide suitable protection.
 - D. Conduits indicated to be exposed and piping in equipment rooms and service areas shall be at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
 - E. Install conduits through (preferred) or tight to structure (if approved by architect). If above accessible ceiling, allow sufficient space for ceiling panel removal.
 - F. Materials exposed within plenums shall be noncombustible or have a flame spread index of 25 or less and a smoke-developed index of 50 or less.
 - G. Install circuits and disconnects to permit servicing.
 - H. Install conduits free of sags and bends.
 - I. Install boxes for changes in direction and branch connections.
 - J. Install circuits to allow application of insulation.
 - K. Select system components with voltage rating equal to or greater than system operating voltage.
 - L. Install escutcheons for penetrations of walls, ceilings, and floors.
 - M. Comply with NECA 1 and NECA 100. Provide all work plumb, level, and in workmanlike manner.
 - N. Provide corrosion protection for all work (equipment, conduits, supports, and fasteners) located in exterior, underground, or damp environments.

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- O. Headroom Maintenance: Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items. If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
 - P. Right of Way: Give to piping systems installed at a required slope.
- 3.03 PENETRATIONS**
- A. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.
 - B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls. Sleeve ends shall be flush with both wall surfaces unless otherwise noted. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Concrete and masonry penetrations: seal space outside of sleeves with grout. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
 - C. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
 - D. Roof-Penetrations: Penetrations shall use premanufactured pipe curbs fastened to deck with insulation and roofing membrane applied by roofing contractor. Seal penetrations into curb with flexible boots, with sealant between pipe and boot with pipe clamp for compression around perimeter.
 - E. Aboveground, Exterior-Wall Pipe Penetrations: Position pipe in center of sleeve. Maintain 1% outward slope, unless otherwise indicated. Seal penetrations using non-expanding foam. After cured, trim flush with sleeve end and paint with color to match surrounding finish.
 - F. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.
 - G. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors. Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07. "Comply with requirements in Division 07."
 - H. Apply firestopping to penetrations of fire and/or smoke rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07.
 - I. Penetrations of membranes of rated walls shall be protected by UL listed products. Coordinate exact installation conditions with selected fire sealants supplier. For penetrations which do not have a standard UL installation detail, arrange for engineering determination from sealant supplier and/or manufacturer and provide modifications required to match detail.
- 3.04 INSTALLATION - COMMON REQUIREMENTS**
- A. Install equipment, fixtures, devices, wiring and specialties according to manufacturer installation instructions and recommendations.
 - B. Refer to other Sections of these Specifications for additional requirements.
 - C. Install to allow maximum possible headroom unless specific mounting heights are indicated.
 - D. Install work level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
 - E. Install work to facilitate service, maintenance, and repair or replacement of components. Connect work for ease of disconnecting, with minimum interference to other installations. Install work to allow maximum possible headroom unless specific mounting heights are not indicated.
 - F. Install work to allow right of way for piping installed at required slope.
 - G. Contact equipment manufacturer's representative to visit site and observe installation in order to confirm installation requirements and warranty coverage. Document observation in writing and include in O&M manuals.
 - H. Provide service and maintenance for not less than one year from the Date of Substantial Completion or for the warranty period specified in Division 01, whichever is longer. Refer to Division 01 for additional service and requirements.
- 3.05 CONCRETE BASES**
- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Provide concrete bases which are plumb, level and fully supported to prevent shifting over time.
 - 2. Provide concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 3. Place and secure anchorage devices. Install according to equipment manufacturer's recommendations, setting drawings, templates, diagrams, instructions, and directions for supported equipment. Provide anchor bolts according to anchor-bolt manufacturer's written instructions. Install anchor bolts to elevations required for proper attachment to supported equipment. Unless otherwise noted, install epoxy-coated anchor bolts to match equipment that extend through concrete base, and anchor into structural concrete.
 - 4. Where located on structural floor, provide dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - 5. Provide 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."
- 3.06 SUPPORTS AND ANCHORAGES**
- A. Provide supports to match construction type and adjacent assembly rating.
 - B. For combustible construction, provide wood supports and anchorages. Cut, fit, and place nailers, blocking, and anchorages to support, and anchor materials and equipment. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

- C. For non-combustible building construction provide metal supports and anchorages. Refer to Division 05 Section "Metal Fabrications" for structural steel. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment. Field Welding shall comply with AWS D1.1.
 - D. Attach to substrates to support applied loads.
- 3.07 GROUTING
- A. Clean surfaces that will come into contact with grout. Provide forms for placement of grout.
 - B. Mix and install grout for equipment base bearing surfaces, and anchors.
 - C. Place grout around anchors and completely filling equipment base and provide smooth bearing surface for equipment. Avoid air entrapment during placement of grout.
 - D. Allow grout to cure before loading or applying forces.
- 3.08 SLEEVE-SEAL INSTALLATION
- A. Install to seal below-grade exterior wall penetrations.
 - B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- END OF SECTION 260500

SECTION 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single conductor building wire.
- B. Nonmetallic-sheathed cable.
- C. Underground feeder and branch-circuit cable.
- D. Service entrance cable.
- E. Armored cable.
- F. Metal-clad cable.
- G. Manufactured wiring systems.
- H. Wiring connectors.
- I. Electrical tape.
- J. Heat shrink tubing.
- K. Oxide inhibiting compound.
- L. Wire pulling lubricant.

1.02 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 2011 (Reapproved 2017).
- 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 B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers 2005 (Reapproved 2021).
- F. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy Wire for Subsequent Covering of Insulation 2018.
- G. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape 2017.
- H. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes 2013.
- I. FS A-A-59544 - Cable and Wire, Electrical (Power, Fixed Installation); Federal Specification 2008a (Validated 2019).
- J. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- K. NECA 104 - Recommended Practice for Installing Aluminum Building Wire and Cable 2012.
- L. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC) 2012.
- M. NECA 121 - Standard for Installing Nonmetallic-Sheathed Cable (Type NM-B) and Underground Feeder and Branch-Circuit Cable (Type UF) 2007.
- N. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy 2021.
- O. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- P. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- Q. UL 4 - Armored Cable Current Edition, Including All Revisions.
- R. UL 44 - Thermoset-Insulated Wires and Cables Current Edition, Including All Revisions.
- S. UL 83 - Thermoplastic-Insulated Wires and Cables Current Edition, Including All Revisions.
- T. UL 183 - Manufactured Wiring Systems Current Edition, Including All Revisions.
- U. UL 486A-486B - Wire Connectors Current Edition, Including All Revisions.
- V. UL 486C - Splicing Wire Connectors Current Edition, Including All Revisions.
- W. UL 486D - Sealed Wire Connector Systems Current Edition, Including All Revisions.
- X. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables Current Edition, Including All Revisions.
- Y. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape Current Edition, Including All Revisions.
- Z. UL 719 - Nonmetallic-Sheathed Cables Current Edition, Including All Revisions.
- AA. UL 854 - Service-Entrance Cables Current Edition, Including All Revisions.
- BB. UL 1569 - Metal-Clad Cables Current Edition, Including All Revisions.

1.03 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 the installation of direct burial cable with other trades to avoid conflicts with piping or other potential conflicts.
 - 3. Coordinate with electrical equipment installed under other sections to provide terminations 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.

1.04 SUBMITTALS

- A. Refer to Division 01 - 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. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate

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- substituted conductors.
 - D. Field Quality Control Test Reports.
 - 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, and installation of product.
 - F. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.
- 1.05 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.
 - C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- 1.06 DELIVERY, STORAGE, AND HANDLING
- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.
- 1.07 FIELD CONDITIONS
- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F (-10 degrees C), unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.
- 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 permitted only as follows:
 - 1. Where not otherwise restricted, may be used:
 - a. For branch circuit wiring in dry locations within one- and two-family dwellings and their attached or detached garages, and their storage buildings.
 - b. For branch circuit wiring in dry locations within multifamily dwellings permitted to be of Types III, IV, and V construction.
 - 2. In addition to other applicable restrictions, may not be used:
 - a. Where exposed to view.
 - b. Above suspended ceilings.
 - c. Where exposed to damage.
 - d. For damp, wet, or corrosive locations.
 - D. Underground feeder and branch-circuit cable is permitted only as follows:
 - 1. Where not otherwise restricted, may be used:
 - a. For damp, wet, or corrosive locations as a substitute for NFPA 70, Type NMC nonmetallic-sheathed cable, when nonmetallic-sheathed cable is permitted.
 - 2. In addition to other applicable restrictions, may not be used:
 - a. Where exposed to view.
 - b. Where exposed to damage.
 - E. Service entrance cable is permitted only as follows:
 - 1. Where not otherwise restricted, may be used:
 - a. For overhead service drop, installed in raceway from service head.
 - b. For underground service entrance, installed in raceway only if USE rated.
 - 2. In addition to other applicable restrictions, may not be used:
 - a. Where exposed to damage.
 - F. Armored 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 (1.8 m).
 - b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
 - 1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.
 - c. For general purpose, non-essential electrical systems in non-hazardous patient care areas of health care facilities, when provided with additional insulated grounding conductor for redundant grounding.
 - 2. In addition to other applicable restrictions, may not be used:
 - a. Unless approved by Owner.
 - b. Where not approved for use by the authority having jurisdiction.
 - c. Where exposed to view.
 - d. Where exposed to damage.
 - e. For damp, wet, or corrosive locations.
 - f. For isolated ground circuits.
 - 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 (1.8 m).
 - b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.

- 1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.
 2. In addition to other applicable restrictions, may not be used:
 - a. Unless approved by Owner.
 - b. Where not approved for use by the authority having jurisdiction.
 - c. Where exposed to view.
 - d. Where exposed to damage.
 - e. For damp, wet, or corrosive locations, unless provided with a PVC jacket listed as suitable for those locations.
 - f. For isolated ground circuits, unless provided with an additional isolated/insulated grounding conductor.
 - g. For patient care areas of health care facilities requiring redundant grounding.
 - H. Emergency systems shall include the following restrictions:
 1. Wiring shall remain entirely separate from other wiring and shall use entirely separate equipment, raceways and junction boxes.
 2. Feeder wiring shall use fire resistive cables:
 - a. Products shall be listed under category FHJR and installed according to the listing.
 - b. Other means and methods may be used if permitted by code as determined by the AHJ.
 - I. Manufactured wiring systems are permitted only as follows:
 1. Where not otherwise restricted, may be used:
 - a. For branch circuits where concealed above accessible ceilings for lighting.
 - b. For general purpose, non-essential electrical systems in non-hazardous patient care areas of health care facilities, when provided with additional insulated grounding conductor for redundant grounding.
 2. In addition to other applicable restrictions, may not be used:
 - a. Unless approved by Owner.
 - b. Where not approved for use by the authority having jurisdiction.
 - c. Where exposed to view.
 - d. Where exposed to damage.
 - e. For damp, wet, or corrosive locations.
 - f. For isolated ground circuits, unless provided with an additional isolated/insulated grounding conductor.
- 2.02 CONDUCTOR AND CABLE MANUFACTURERS
- A. Cerro Wire LLC: www.cerrowire.com.
 - B. Encore Wire Corporation: www.encorewire.com.
 - C. Southwire Company: www.southwire.com.
 - D. Substitutions: Refer to Division 01 - Product Requirements.
- 2.03 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 new conductors and cables manufactured not more than one year prior to installation.
 - D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. for a complete operating system.
 - E. Comply with NEMA WC 70.
 - F. Comply with FS A-A-59544 where applicable.
 - G. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
 - H. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
 - I. Conductors for Grounding and Bonding: Also comply with Section 26 0526.
 - J. Conductors and Cables Installed Where Exposed to Direct Rays of Sun: Listed and labeled as sunlight resistant.
 - K. 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.
 - L. Conductor Material:
 1. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
 - a. Substitution of aluminum conductors for copper is permitted, when approved by Owner and authority having jurisdiction, only for the following:
 - 1) Services: Copper conductors size 6 AWG and larger.
 - 2) Feeders: Copper conductors size 6 AWG and larger.
 - b. Where aluminum conductors are substituted for copper, comply with the following:
 - 1) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and equivalent or less voltage drop.
 - 2) Increase size of raceways, boxes, wiring gutters, enclosures, etc. to accommodate aluminum conductors.
 - 3) Provide aluminum equipment grounding conductor sized according to NFPA 70.
 - 4) Equip electrical distribution equipment with compression lugs for terminating aluminum conductors.
 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.
 4. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.
 - M. Minimum Conductor Size:

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1. Branch Circuits: 14 AWG permitted only for 15 Amp branch circuits less than 50 feet in length. Otherwise, 12 AWG conductors shall be used.
 - a. Exceptions:
 - 1) 20 A, 120 V circuits longer than 75 feet (23 m): 10 AWG, for voltage drop.
 - 2) 20 A, 120 V circuits longer than 150 feet (46 m): 8 AWG, for voltage drop.
 - 3) 20 A, 277 V circuits longer than 150 feet (46 m): 10 AWG, for voltage drop.
 2. Control Circuits: 14 AWG.
 - N. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
 - O. 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. 240/120 V, 1 Phase, 3 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Neutral/Grounded: White.
 - c. Equipment Ground, All Systems: Green.
 - d. Travelers for 3-Way and 4-Way Switching: Pink.
 - e. For control circuits, comply with manufacturer's recommended color code.
- 2.04 SINGLE CONDUCTOR BUILDING WIRE
- A. Description: Single conductor insulated wire.
 - B. 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.
 - C. Insulation Voltage Rating: 600 V.
 - D. Insulation:
 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
 2. Aluminum Building Wire (only where specifically indicated or permitted for substitution): Type XHHW-2.
- 2.05 NONMETALLIC-SHEATHED CABLE
- A. Description: NFPA 70, Type NM multiple-conductor cable listed and labeled as complying with UL 719, Type NM-B.
 - B. Conductor Stranding:
 1. Size 10 AWG and Smaller: Solid.
 2. Size 8 AWG and Larger: Stranded.
 - C. Insulation Voltage Rating: 600 V.
- 2.06 UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE
- A. Description: NFPA 70, Type UF multiple-conductor cable listed and labeled as complying with UL 493, Type UF-B.
 - B. Provide equipment grounding conductor unless otherwise indicated.
 - C. Conductor Stranding:
 1. Size 10 AWG and Smaller: Solid.
 2. Size 8 AWG and Larger: Stranded.
 - D. Insulation Voltage Rating: 600 V.
 - E. Cable Jacket: Listed and labeled as sunlight resistant.
- 2.07 SERVICE ENTRANCE CABLE
- A. Service Entrance Cable for Above-Ground Use: NFPA 70, Type SE multiple-conductor cable listed and labeled as complying with UL 854, Style R.
 - B. Service Entrance Cable for Underground Use: NFPA 70, Type USE single-conductor cable listed and labeled as complying with UL 854, Type USE-2 and with UL 44 Type RHH/RHW-2.
 - C. Conductor Stranding: Stranded.
 - D. Insulation Voltage Rating: 600 V.
- 2.08 ARMORED CABLE
- A. Description: NFPA 70, Type AC cable listed and labeled as complying with UL 4, and listed for use in classified firestop systems to be used.
 - B. Conductor Stranding:
 1. Size 10 AWG and Smaller: Solid.
 2. Size 8 AWG and Larger: Stranded.
 - C. Insulation Voltage Rating: 600 V.
 - D. Insulation: Type THHN.
 - E. Grounding: Combination of interlocking armor and integral bonding wire.
 - F. Armor: Steel, interlocked tape.

2.09 METAL-CLAD CABLE

- A. 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.
- B. Conductor Stranding:
 - 1. Size 10 AWG and Smaller: Solid.
 - 2. Size 8 AWG and Larger: Stranded.
- C. Insulation Voltage Rating: 600 V.
- D. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
- E. Grounding: Full-size integral equipment grounding conductor.
- F. Armor: Steel, interlocked tape.
- G. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

2.10 MANUFACTURED WIRING SYSTEMS

- A. Description: Manufactured wiring assemblies complying with NFPA 70 Article 604, and listed and labeled as complying with UL 183.
- B. Provide components necessary to transition between manufactured wiring system and other wiring methods.
- C. Branch Circuit Cables:
 - 1. Conductor Stranding (Size 10 AWG and Smaller): Solid.
 - 2. Insulation Voltage Rating: 600 V.
 - 3. Insulation: Type THHN.
 - 4. Grounding: Full-size integral equipment grounding conductor.
 - 5. Armor: Steel, interlocked tape.
- D. Connectors: Keyed and color-coded to prevent interconnection of different voltages.
- E. Fixture Leads: Type TFN insulation.

2.11 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 26 0526.
- 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.
 - 3. Connectors for Aluminum Conductors: Use 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. Aluminum Conductors: Use compression connectors for all connections.
 - 7. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
 - 8. 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 (105 degrees C) for standard applications and 302 degrees F (150 degrees C) for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
- H. Mechanical Connectors: Provide bolted type or set-screw type.
- I. Compression Connectors: Provide circumferential type or hex type crimp configuration.
- J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

2.12 ACCESSORIES

- A. Electrical Tape:
 - 1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
 - a. Substitutions: See Section 01 6000 - Product Requirements.
 - 2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
 - 3. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil (0.76 mm); suitable for continuous temperature environment up to 194 degrees F (90 degrees C) and short-term 266 degrees F (130 degrees C) overload service.
 - 4. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil (3.2 mm); suitable for continuous temperature environment up to 176 degrees F (80 degrees C).

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5. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil (2.3 mm).
- 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.
- C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
- D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

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. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
 5. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
 - 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 to account for ampacity derating.
 - c. Size raceways, boxes, etc. to accommodate conductors.
 6. 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.
 - a. Branch circuits fed from ground fault circuit interrupter (GFCI) circuit breakers.
 - b. Branch circuits fed from feed-through protection of GFI receptacles.
 - c. Branch circuits with dimming controls.
 - d. Branch circuits with isolated grounding conductor.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install aluminum conductors in accordance with NECA 104.
- E. Install nonmetallic-sheathed cable (Type NM-B) in accordance with NECA 121.
- F. Install underground feeder and branch-circuit cable (Type UF-B) in accordance with NECA 121.
- G. Install armored cable (Type AC) in accordance with NECA 120.
- H. Install metal-clad cable (Type MC) in accordance with NECA 120.
- I. 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.
- J. Exposed Cable Installation (only where specifically permitted):
 1. Route cables parallel or perpendicular to building structural members and surfaces.
 2. Protect cables from physical damage.
- K. Direct Burial Cable Installation:
 1. Provide trenching and backfilling in accordance with Sections 31 2316 and 31 2323.
 2. Install cable with minimum cover of 36 inches (914 mm) unless otherwise indicated or required.
 3. Protect cables from damage in accordance with NFPA 70.
 4. Provide underground warning tape in accordance with Section 26 0553 along entire cable length.
- L. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- M. 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.
- N. Terminate cables using suitable fittings.
 1. Armored Cable (Type AC):
 - a. Use listed fittings and anti-short, insulating bushings.
 - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

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- c. Do not use direct-bearing set-screw type fittings for cables with aluminum armor.
- 2. 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.
- O. Install conductors with a minimum of 12 inches (300 mm) of slack at each outlet.
- P. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- Q. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- R. 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. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
 - 6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - 7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- S. 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, electrical tape, or heat shrink tubing.
 - a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
 - 2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
 - a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
 - b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
 - 3. Wet Locations: Use heat shrink tubing.
- T. Insulate ends of spare conductors using vinyl insulating electrical tape.
- U. 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.
- V. Identify conductors and cables in accordance with Section 26 0553.
- W. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- X. Life safety wiring/raceways shall be run within separate fire rated assemblies, protected by listed thermal barrier systems (FHIT), or other approved means and methods.
- Y. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished, for a complete operating system.
- 3.04 FIELD QUALITY CONTROL
 - A. Refer to Division 01 - Quality Requirements, for additional requirements.
 - B. Inspect and test in accordance with NETA ATS, except Section 4.
 - C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
 - 1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
 - D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

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. Ground enhancement material.

1.02 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings 2017.
- C. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 780 - Standard for the Installation of Lightning Protection Systems 2020.
- F. UL 467 - Grounding and Bonding Equipment Current Edition, Including All Revisions.

1.03 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 Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.04 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
- C. Field quality control test reports.
- D. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.
- B. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- E. Grounding System Resistance:
 - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- F. Grounding Electrode System:
 - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
 - a. Provide continuous grounding electrode conductors without splice or joint.
 - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
 - 2. 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 (3.0 m) at an accessible location not more than 5 feet (1.5 m) from the point of entrance to the building.
 - b. Provide bonding jumper(s) around insulating joints/pipes 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 In-Ground Support Structure:
 - a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
 - 4. Concrete-Encased Electrode:
 - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet (6.0 m) of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
 - 5. Ground Ring:

- a. If a lightning protection system is installed, provide a ground ring encircling the building or structure consisting of bare copper conductor not less than 2 AWG in direct contact with earth, installed at a depth of not less than 30 inches (750 mm).
 - b. Where location is not indicated, locate ground ring conductor at least 24 inches (600 mm) outside building perimeter foundation.
 - c. Provide ground enhancement material around conductor.
 - d. Provide connection from ground ring conductor to:
 - 1) Perimeter columns of metal building frame.
 - 2) Ground rod electrodes located at each corner of the building/structure.
 6. Ground Rod Electrode(s):
 - a. Where less than two other grounding electrodes are not present, provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
 - b. Space electrodes not less than 10 feet (3.0 m) from each other and any other ground electrode.
 - c. Where location is not indicated, locate electrode(s) at least 5 feet (1.5 m) outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
 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 (6 by 50 by 300 mm) unless otherwise indicated or required.
 - b. Ground Bar Mounting Height: 18 inches (450 mm) above finished floor unless otherwise indicated.
 - 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.
 8. Provide bonding and equipment grounding for pools and fountains and associated equipment in accordance with NFPA 70.
 - 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 in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
 - a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
 - b. Raceway Size: 3/4 inch (21 mm) trade size unless otherwise indicated or required.
 - c. Ground Bar Size: 1/4 by 2 by 12 inches (6 by 50 by 300 mm) unless otherwise indicated or required.
 - d. Ground Bar Mounting Height: 18 inches (450 mm) above finished floor unless otherwise indicated.
 - I. Lightning Protection Systems:
 1. Do not use grounding electrode dedicated for lightning protection system for component of building grounding electrode system provided under this section.
 2. Provide bonding of building grounding electrode system provided under this section and lightning protection grounding electrode system in accordance with NFPA 70 and NFPA 780.
- 2.02 GROUNDING AND BONDING COMPONENTS
- A. General Requirements:
 1. Provide products listed, classified, and labeled as suitable for the purpose intended.
 2. Provide products listed and labeled as complying with UL 467 where applicable.
 - B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
 1. Use insulated copper conductors unless otherwise indicated.
 - a. Exceptions:
 - 1) Use bare copper conductors where installed underground in direct contact with earth.
 - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
 - C. Connectors for Grounding and Bonding:
 1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.

3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
- D. Ground Bars:
 1. Description: Copper rectangular ground bars with mounting brackets and insulators.
 2. Size: As indicated.
 3. Holes for Connections: As indicated 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 (19 mm) diameter by 10 feet (3.0 m) length, unless otherwise indicated.
- F. Ground Enhancement Material:
 1. Description: Factory-mixed conductive material designed for permanent and maintenance-free improvement of grounding effectiveness by lowering resistivity.

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 indicated.
- 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. Perform work in accordance with NECA 1 (general workmanship).
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70.
 1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches (150 mm) below finished grade.
 2. Indoor Installations: Unless otherwise indicated, install with 4 inches (100 mm) of top of rod exposed.
- D. Make grounding and bonding connections using specified connectors.
 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- E. Identify grounding and bonding system components in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

- A. Refer to Division 01 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.13.
- D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION

SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

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 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 2016a.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.
- D. MFMA-4 - Metal Framing Standards Publication 2004.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.04 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

1.05 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with applicable building code.

1.06 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. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
 - 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 - 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
 - 5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
 - 1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
 - 2. Conduit Clamps: Bolted type unless otherwise indicated.
- C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
- D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
 - 1. Comply with MFMA-4.
- E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
- F. Anchors and Fasteners:
 - 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

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. Perform work in accordance with NECA 1 (general workmanship).

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- C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
 - D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
 - E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
 - F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
 - G. Equipment Support and Attachment:
 - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment.
 - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
 - H. Conduit Support and Attachment: Also comply with Section 26 0533.13.
 - I. Box Support and Attachment: Also comply with Section 26 0533.16.
 - J. Interior Luminaire Support and Attachment: Also comply with Section 26 5100.
 - K. Exterior Luminaire Support and Attachment: Also comply with Section 26 5600.
 - L. Secure fasteners according to manufacturer's recommended torque settings.
 - M. Remove temporary supports.
- 3.03 FIELD QUALITY CONTROL
- A. Refer to Division 01 - Quality Requirements, for additional requirements.
 - B. Inspect support and attachment components for damage and defects.
 - C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
 - D. Correct deficiencies and replace damaged or defective support and attachment components.
- END OF SECTION

SECTION 26 0533.13 - CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Intermediate metal conduit (IMC).
- C. PVC-coated galvanized steel rigid metal conduit (RMC).
- D. Flexible metal conduit (FMC).
- E. Liquidtight flexible metal conduit (LFMC).
- F. Electrical metallic tubing (EMT).
- G. Rigid polyvinyl chloride (PVC) conduit.
- H. Electrical nonmetallic tubing (ENT).
- I. Liquidtight flexible nonmetallic conduit (LFNC).
- J. Reinforced thermosetting resin conduit (RTRC).
- K. Conduit fittings.
- L. Accessories.

1.02 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. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit 2018.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2013.
- F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2017.
- G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- H. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit 2018.
- 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. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT) 2014 (Reaffirmed 2019).
- L. NEMA TC 14 (SERIES) - Reinforced Thermosetting Resin Conduit and Fittings Series 2015.
- M. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- N. UL 1 - Flexible Metal Conduit Current Edition, Including All Revisions.
- O. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.
- P. UL 360 - Liquid-Tight Flexible Metal Conduit Current Edition, Including All Revisions.
- Q. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.
- R. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.
- S. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.
- T. UL 1242 - Electrical Intermediate Metal Conduit-Steel Current Edition, Including All Revisions.
- U. UL 1653 - Electrical Nonmetallic Tubing Current Edition, Including All Revisions.
- V. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections.
 - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections.
 - 4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
 - 5. Notify Architect of any 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 is complete between outlet, junction and splicing points.

1.04 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
- C. Shop Drawings:
 - 1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
 - 2. Include proposed locations of roof penetrations and proposed methods for sealing.
- D. 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.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

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- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
 - C. Underground:
 - 1. Under Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
 - 2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
 - 3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
 - 4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
 - 5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
 - 6. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
 - D. Exposed, Exterior: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit.
 - E. Connections to Vibrating Equipment:
 - 1. Dry Locations: Use flexible metal conduit.
 - 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
 - 3. Maximum Length: 6 feet (1.8 m) unless otherwise indicated.
- 2.02 CONDUIT REQUIREMENTS
- A. Electrical Service Conduits: Also comply with Section 26 2100.
 - B. Communications Systems Conduits: Also comply with Section 27 1000.
 - C. Fittings for Grounding and Bonding: Also comply with Section 26 0526.
 - D. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
 - E. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - F. 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. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
 - B. Fittings:
 - 1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.
 - 3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.
- 2.04 INTERMEDIATE METAL CONDUIT (IMC)
- A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
 - B. Fittings:
 - 1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.
 - 3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.
- 2.05 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)
- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
 - B. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil (1.02 mm).
 - C. PVC-Coated Fittings:
 - 1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
 - 2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
 - 3. Material: Use steel or malleable iron.
 - 4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil (1.02 mm).
 - D. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil (0.38 mm).
- 2.06 FLEXIBLE METAL CONDUIT (FMC)
- A. 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 to be used.
 - B. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.

- 2.07 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)
- A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
 - B. Fittings:
 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel or malleable iron.
- 2.08 ELECTRICAL METALLIC TUBING (EMT)
- A. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
 - B. Fittings:
 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel or malleable iron.
 3. Connectors and Couplings: Use compression (gland) type.
 - a. Do not use indenter type connectors and couplings.
 - b. Do not use set-screw type connectors and couplings.
- 2.09 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT
- A. 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.
 - B. 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.
- 2.10 ELECTRICAL NONMETALLIC TUBING (ENT)
- A. Description: NFPA 70, Type ENT electrical nonmetallic tubing complying with NEMA TC 13 and listed and labeled as complying with UL 1653.
 - B. Fittings:
 1. Manufacturer: Same as manufacturer of ENT to be connected.
 2. Use solvent-welded type fittings.
 3. Solvent-Welded Fittings: Rigid PVC fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; suitable for use with ENT.
- 2.11 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)
- A. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.
 - B. Fittings:
 1. Manufacturer: Same as manufacturer of conduit to be connected.
 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for the type of conduit to be connected.
- 2.12 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC)
- A. Description: NFPA 70, Type RTRC reinforced thermosetting resin conduit complying with NEMA TC 14 (SERIES).
 - B. Supports: Per manufacturer's recommendations.
 - C. Fittings: Same type and manufacturer as conduit to be connected.
- 2.13 ACCESSORIES
- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil (0.51 mm).
 - B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.
 - C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
 - D. Epoxy Adhesive for RTRC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
 - E. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force (890 N).
 - F. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.
 - G. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.
- 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.
- 3.02 INSTALLATION
- A. Install products in accordance with manufacturer's instructions.
 - B. Perform work in accordance with NECA 1 (general workmanship).
 - C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
 - D. Install intermediate metal conduit (IMC) in accordance with NECA 101.
 - E. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.
 - F. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
 - G. Install electrical nonmetallic tubing (ENT) in accordance with NECA 111.
 - H. Install liquidtight flexible nonmetallic conduit (LFNC) in accordance with NECA 111.
 - I. Conduit Routing:
 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 2. Conceal all conduits unless specifically indicated to be exposed.

3. 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.
4. Unless otherwise approved, do not route conduits exposed:
 - a. Across floors.
 - b. Across roofs.
 - c. Across top of parapet walls.
 - d. Across building exterior surfaces.
5. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
6. Arrange conduit to maintain adequate headroom, clearances, and access.
7. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
8. Arrange conduit to provide no more than 150 feet (46 m) between pull points.
9. Route conduits above water and drain piping where possible.
- J. Conduit Support:
 1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
 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.
- K. Connections and Terminations:
 1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
 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. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
 7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
- L. 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 to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
 4. Conceal bends for conduit risers emerging above ground.
 5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
 6. Where conduits penetrate waterproof membrane, seal 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 to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
 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, using materials and methods specified in Section 07 8400.
- M. Underground Installation:
 1. Provide trenching and backfilling in accordance with Section 31 2316.13.
 2. Provide trenching and backfilling in accordance with Sections 31 2316 and 31 2323.
 3. Minimum Cover, Unless Otherwise Indicated or Required:
 - a. as required by NFPA 70 (NEC).
 4. Provide underground warning tape in accordance with Section 26 0553 along entire conduit length for service entrance where not concrete-encased.
- N. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 03 3000 with minimum concrete cover of 3 inches (76 mm) on all sides unless otherwise indicated.
- O. 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 calculated in accordance with NFPA 70 for reinforced thermosetting resin conduit (RTRC) conduit installed above ground to compensate for thermal expansion and contraction.
 4. Where conduits are subject to earth movement by settlement or frost.

- P. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
 - 1. Where conduits pass from outdoors into conditioned interior spaces.
 - 2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
 - 3. Where conduits penetrate coolers or freezers.
 - Q. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed. Leave minimum slack of 12 inches (300 mm) at each end.
 - R. Provide grounding and bonding in accordance with Section 26 0526.
 - S. Identify conduits in accordance with Section 26 0553.
 - 3.03 FIELD QUALITY CONTROL
 - A. Refer to Division 01 - Quality Requirements, for additional requirements.
 - B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
 - C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
 - D. 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.
- END OF SECTION

SECTION 26 0533.16 - BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2010.
- 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.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- I. UL 508A - Industrial Control Panels Current Edition, Including All Revisions.
- J. UL 514A - Metallic Outlet Boxes Current Edition, Including All Revisions.

1.02 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.
 - 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.

1.03 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.
- C. Samples:
 - 1. Floor Boxes: Provide one sample(s) of each floor box proposed for substitution upon request.
- 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 locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

1.04 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.05 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 (1,650 cu cm), Including Those Used as Junction and Pull Boxes:
 - 1. Use sheet-steel boxes, fire rated boxes, or fire rated boxes for dry locations unless otherwise indicated or required.
 - 2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
 - 3. Use suitable concrete type boxes where flush-mounted in concrete.
 - 4. Use suitable masonry type boxes where flush-mounted in masonry walls.
 - 5. Use raised covers suitable for the type of wall construction and device configuration where required.
 - 6. Use shallow boxes where required by the type of wall construction.
 - 7. Do not use "through-wall" boxes designed for access from both sides of wall.
 - 8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.

9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
12. 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: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
 - c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
13. Wall Plates: Comply with Section 26 2726.
14. 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/#sle.
 - e. Thomas & Betts Corporation: www.tnb.com/#sle.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
 1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
 2. NEMA 250 Environment Type, Unless Otherwise Indicated.
 3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
 4. Finish for Painted Steel Enclosures: Primed and field painted with color selected by architect unless otherwise indicated.
- D. Floor Boxes:
 1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 2726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
 2. Use cast iron floor boxes within slab on grade.
 3. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
 4. Manufacturer: Same as manufacturer of floor box service fittings.

PART 3 EXECUTION

3.01 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. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- E. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- F. Box Locations:
 1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 where approved by the Architect.
 2. Unless dimensioned, box locations indicated are approximate.
 3. Locate boxes for devices installed under other sections.
 - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.
 - b. Communications Systems Outlets: Comply with Section 27 1000.
 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 24 inch horizontal separation unless otherwise listed and/or approved by the AHJ.
 8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) 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 (610 mm) separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads, and/or use other listed and approved means or methods to maintain fire rating.
 - b. Do not install flush-mounted boxes with area larger than 16 square inches (0.0103 sq m) or such that the total aggregate area of openings exceeds 100 square inches (0.0645 sq m) for any 100 square feet (9.29 sq m) of wall area unless using other listed and approved means or methods to maintain fire rating.
 10. 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.

- G. Box Supports:
 - 1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 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.
 - H. Install boxes plumb and level.
 - I. Flush-Mounted Boxes:
 - 1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.
 - 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 - 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.
 - J. Install boxes to preserve insulation integrity.
 - K. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.
 - L. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
 - M. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
 - 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 26 0526.
- 3.02 CLEANING
- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.
- 3.03 PROTECTION
- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.
- END OF SECTION

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Underground warning tape.
- F. Warning signs and labels.

1.02 REFERENCE STANDARDS

- A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs 2011 (Reaffirmed 2017).
- B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels 2011 (Reaffirmed 2017).
- 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 2021.
- E. UL 969 - Marking and Labeling Systems Current Edition, Including All Revisions.

1.03 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.

1.04 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

- A. Identification for Equipment:
 - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Switchgear:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
 - b. Switchboards:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
 - c. Panelboards:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Use typewritten circuit directory (1/8" font minimum) to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
 - d. Transformers:
 - 1) Identify kVA rating.
 - 2) Identify voltage and phase for primary and secondary.
 - 3) Identify load(s) served. Include location.
 - e. Enclosed switches, circuit breakers, and motor controllers:
 - 1) Identify voltage and phase.
 - 2) Identify power source and circuit number. Include location when not within sight of equipment.
 - 3) Identify load(s) served. Include location when not within sight of equipment.
 - f. Time Switches:
 - 1) Identify load(s) served and associated circuits controlled. Include location.
 - g. Enclosed Contactors:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify configuration, e.g., E.O.E.H. (electrically operated, electrically held) or E.O.M.H. (electrically operated, mechanically held).
 - 4) Identify coil voltage.
 - 5) Identify load(s) and associated circuits controlled. Include location.
 - h. Transfer Switches:
 - 1) Identify voltage and phase.

- 2) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.
 - 3) Identify load(s) served. Include location when not within sight of equipment.
 - 4) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.
2. Service Equipment:
 - a. Use identification nameplate to identify each service disconnecting means.
 - 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.
 3. Emergency System Equipment:
 - a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
 - b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
 4. 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. Industrial control panels.
 - c. Motor control centers.
 - d. Elevator control panels.
 - e. Industrial machinery.
 5. 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 (89 mm by 127 mm).
 - b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.
 6. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.
 7. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" or approved equivalent.
- B. Identification for Conductors and Cables:
 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
 2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
 3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
 - a. At each source and load connection.
 - b. Within boxes when more than one circuit is present.
 - c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
 4. Use underground warning tape to identify direct buried cables.
 - C. Identification for Devices:
 1. 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.
 2. Use identification label to identify serving branch circuit for all receptacles.
 - a. For receptacles in all locations, provide identification on inside surface of wallplate.
- ## 2.02 IDENTIFICATION NAMEPLATES AND LABELS
- A. Identification Nameplates:
 1. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.
 - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
 2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch (1.6 mm); engraved text.
 3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
 4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
 5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.
 - B. Identification Labels:
 1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.

2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
 - C. Format for Equipment Identification:
 1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
 2. Legend:
 - a. Equipment designation or other approved description.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height:
 - a. Equipment Designation: 1/2 inch (13 mm).
 5. Color:
 - a. Normal Power System: White text on black background.
 - b. Emergency Power System: White text on red background.
 - c. Fire Alarm System: White text on red background.
 - D. Format for Receptacle Identification:
 1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
 2. Legend: Power source and circuit number or other designation indicated.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 3/16 inch (5 mm).
 5. Color: Black text on clear background.
- 2.03 WIRE AND CABLE MARKERS
- A. 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.
 - B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
 - C. Legend: Power source and circuit number or other designation indicated.
 - D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
 - E. Minimum Text Height: 1/8 inch (3 mm).
 - F. Color: Black text on white background unless otherwise indicated.
- 2.04 VOLTAGE MARKERS
- A. Minimum Size:
 - B. Legend:
 - C. Color: Black text on orange background unless otherwise indicated.
- 2.05 UNDERGROUND WARNING TAPE
- A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
 - B. Non-detectable Type Tape: 6 inches (152 mm) wide, with minimum thickness of 4 mil (0.1 mm).
 - C. Legend: Type of service, continuously repeated over full length of tape.
 - D. Color.
- 2.06 WARNING SIGNS AND LABELS
- A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
 - B. Warning Signs:
 1. Materials.
 2. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.
 - C. Warning Labels:
 1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
 2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
 3. Minimum Size: 2 by 4 inches (51 mm by 102 mm) unless otherwise indicated.
- PART 3 EXECUTION
- 3.01 PREPARATION
- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.
- 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. Interior Components: Legible from the point of access.
 6. Conductors and Cables: Legible from the point of access.
 7. Devices: Inside 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.
 1. Do not use adhesives on exterior surfaces except where substrate cannot be penetrated.
 - E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
 - F. Install underground warning tape above buried lines with one tape per trench at 3 inches (75 mm) below finished grade.
 - G. Secure rigid signs using stainless steel screws.

- H. Mark all handwritten text, where permitted, to be neat and legible.
 - 3.03 FIELD QUALITY CONTROL
 - A. Refer to Division 01 - Quality Requirements, for additional requirements.
 - B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.
- END OF SECTION

SECTION 26 0583 - WIRING CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical connections to equipment.

1.02 REFERENCE STANDARDS

- A. NEMA WD 1 - General Color Requirements for Wiring Devices 1999 (Reaffirmed 2015).
- B. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2016.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 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.

1.04 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
 - 1. Colors: Comply with NEMA WD 1.
 - 2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
 - 3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
- B. Disconnect Switches: As specified in Section 26 2816.16 and in individual equipment sections.
- C. Wiring Devices: As specified in Section 26 2726.
- D. Flexible Conduit: As specified in Section 26 0533.13.
- E. Wire and Cable: As specified in Section 26 0519.
- F. Boxes: As specified in Section 26 0533.16.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

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.
- 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. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

END OF SECTION

SECTION 26 0923 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Occupancy sensors.
- B. Time switches.
- C. In-wall interval timers.
- D. Outdoor photo controls.
- E. Lighting contactors.

1.02 REFERENCE STANDARDS

- A. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing 2017.
- B. ANSI C136.24 - American National Standard for Roadway and Area Lighting Equipment - Nonlocking (Button) Type Photocontrols 2020.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2010.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- F. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2000, with Errata (2008).
- G. NEMA ICS 6 - Industrial Control and Systems: Enclosures 1993 (Reaffirmed 2016).
- H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 773 - Plug-in, Locking Type Photocontrols for Use with Area Lighting Current Edition, Including All Revisions.
- J. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control Current Edition, Including All Revisions.
- K. UL 916 - Energy Management Equipment Current Edition, Including All Revisions.
- L. UL 917 - Clock-Operated Switches Current Edition, Including All Revisions.
- M. UL 1472 - Solid-State Dimming Controls Current Edition, Including All Revisions.
- N. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules Current Edition, Including All Revisions.
- O. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections.
 - 2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
 - 3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections.
 - 4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.04 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
- C. Field Quality Control Reports.
- D. 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.
- E. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.05 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. for a complete operating system.

2.02 OCCUPANCY SENSORS

- A. Manufacturers:
 - 1. Hubbell Incorporated: www.hubbell.com/#sle.
 - 2. Lutron Electronics Company, Inc: www.lutron.com/#sle.
 - 3. Sensor Switch Inc: www.sensorswitch.com/#sle.
 - 4. WattStopper: www.wattstopper.com/#sle.
 - 5. Substitutions: Refer to Division 01 - Product Requirements.
- B. 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/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.

3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
 4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
 5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
 6. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
 7. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
- C. Wall Switch Occupancy Sensors:
1. 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. 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.
 2. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet (83.6 sq m).
- D. Wall Dimmer Occupancy Sensors:
1. General Requirements:
 - 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 dimming control capability, and no leakage current to load in off mode.
 - b. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.
- E. Ceiling Mounted Occupancy Sensors:
1. All Ceiling Mounted Occupancy Sensors:
 - a. Description: Low profile occupancy sensors designed for ceiling installation.
 2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet (41.8 sq m) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.
 - b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet (111.5 sq m) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.
- F. 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 to control the load indicated on drawings.
 3. Input Supply Voltage: 120 V ac unless otherwise indicated.
- 2.03 TIME SWITCHES
- A. Manufacturers:
1. Intermatic, Inc: www.intermatic.com/#sle.
 2. Paragon, a brand of Invensys Controls: www.invensyscontrols.com.
 3. Tork, a division of NSI Industries LLC: www.tork.com/#sle.
 4. Substitutions: Refer to Division 01 - Product Requirements.
- B. Digital Electronic Time Switches:
1. Description: Factory-assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
 2. Program Capability:
 - a. Astronomic Time Switches (outdoor circuits): Single channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.
 3. Schedule Capacity: Not less than 16 programmable on/off operations.
 4. Provide automatic daylight savings time and leap year compensation.
 5. Provide power outage backup to retain programming and maintain clock.
 6. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
 7. Provide remote photocell input with light level adjustment.
 8. Input Supply Voltage: As indicated on the drawings.
- C. Electromechanical Time Switches:
1. Description: Factory-assembled controller with motor-operated timing dial mechanism and adjustable trippers for setting on/off operations, listed and labeled as complying with UL 917.
 2. Program Capability:
 - a. 24-Hour Time Switches (indoor circuits): With same schedule for each day of the week and skip-a-day feature to omit selected days.
 3. Schedule Capacity:
 - a. 24-Hour Time Switches: Accommodating not less than 12 pairs of selected on/off operations per day.

4. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
 5. Input Supply Voltage: As indicated on the drawings.
 6. Provide lockable enclosure; environmental type per NEMA 250 as specified for the following installation locations:
- 2.04 IN-WALL INTERVAL TIMERS
- A. Manufacturers:
 1. Intermatic, Inc: www.intermatic.com/#sle.
 2. Tork, a division of NSI Industries LLC: www.tork.com/#sle.
 - B. Digital Electronic In-Wall Interval Timers:
 1. Description: Factory-assembled solid state programmable controller with LCD display, suitable for mounting in standard wall box, and listed and labeled as complying with UL 916 or UL 917.
 2. Program Capability: Designed to turn load off at end of preset time interval.
 3. Time Interval: Field selectable range of presets available up to 12 hours.
 4. Provide field selectable audible and visual indication to warn that end of interval operation is about to turn off load.
 5. Provide power outage backup to retain programming and maintain clock.
 6. Manual override: Capable of both turning load off and resetting timer to original preset time interval.
 7. Switch Configuration: Suitable for use in either SPST or 3-way application.
- 2.05 OUTDOOR PHOTO CONTROLS
- A. Stem-Mounted Outdoor Photo Controls:
 1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
 2. Housing: Weatherproof, impact resistant polycarbonate.
 3. Photo Sensor: Cadmium sulfide.
 4. Provide external sliding shield for field adjustment of light level activation.
 5. Light Level Activation: 1 to 5 footcandles (10.8 to 53.8 lux) turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
 6. Voltage: As required to control the load indicated on the drawings.
 7. Failure Mode: Fails to the on position.
 8. Load Rating: As required to control the load indicated on the drawings.
 - B. Locking Receptacle-Mounted Outdoor Photo Controls
 1. Description: Plug-in locking type photo control unit complying with ANSI C136.10 for mounting on a compatible receptacle, listed and labeled as complying with UL 773.
 2. Housing: Weatherproof, impact resistant UV stabilized polypropylene, color to be selected.
 3. Photo Sensor: Cadmium sulfide.
 4. Light Level Activation: 1 to 3 footcandles (10.8 to 32.3 lux) turn-on and 1.5 to 1 turn-off to turn-on ratio with instant turn-on and delayed turn-off.
 5. Voltage: As required to control the load indicated on the drawings.
 6. Failure Mode: Fails to the on position.
 7. Load Rating: As required to control the load indicated on the drawings.
 8. Surge Protection: 160 joule metal oxide varistor.
 - C. Button Type Outdoor Photo Controls
 1. Description: Direct-wired photo control unit complying with ANSI C136.24 with weatherproof gasketed wall plate where required or indicated, listed and labeled as complying with UL 773A.
 2. Housing: Weather resistant polycarbonate.
 3. Photo Sensor: Cadmium sulfide.
 4. Light Level Activation: 1 to 3 footcandles (10.8 to 32.3 lux) turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
 5. Voltage: As required to control the load indicated on the drawings.
 6. Failure Mode: Fails to the on position.
 7. Load Rating: As required to control the load indicated on the drawings.
- 2.06 LIGHTING CONTACTORS
- A. Manufacturers:
 1. ABB/GE: www.geindustrial.com/#sle.
 2. Eaton Corporation: www.eaton.com/#sle.
 3. Rockwell Automation Inc; Allen-Bradley Products: ab.rockwellautomation.com/#sle.
 4. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
 5. Siemens Industry, Inc: www.usa.siemens.com/#sle.
 6. Substitutions: See Section 01 6000 - Product Requirements.
 - B. Description: Magnetic lighting contactors complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; noncombination type unless otherwise indicated; ratings, configurations and features as indicated on the drawings.
 - C. Short Circuit Current Rating:
 - D. Enclosures:
 1. Comply with NEMA ICS 6.
 2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 3. Finish: Manufacturer's standard unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.
- F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.
- G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 0533.16 for installation of lighting control devices provided under this section.
- C. Install lighting control devices in accordance with manufacturer's instructions.
- D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- E. Install lighting control devices plumb and level, and held securely in place.
- F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 2726.
- G. Provide required supports in accordance with Section 26 0529.
- H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- I. Identify lighting control devices in accordance with Section 26 0553.
- J. Occupancy Sensor Locations:
 - 1. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet (1.2 m) from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.
- K. Outdoor Photo Control Locations:
 - 1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
 - 2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.
- L. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.

3.03 FIELD QUALITY CONTROL

- A. Refer to Division 01 - Quality Requirements, for additional requirements.
- B. Inspect each lighting control device for damage and defects.
- C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
- D. Test time switches to verify proper operation.
- E. Test outdoor photo controls to verify proper operation, including time delays where applicable.
- F. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.04 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.
- C. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.
- D. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings in written report to be included with submittals.
- E. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect.

3.05 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

- 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.
 - 2. Location: At project site.

END OF SECTION

SECTION 26 2100 - LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical service requirements.

1.02 PRICE AND PAYMENT PROCEDURES

- A. Allowances:
 - 1. Refer to Division 01 - Allowances, for allowances affecting this section.
 - 2. Include cash allowance for Utility Company charges associated with providing service.

1.03 REFERENCE STANDARDS

- A. IEEE C2 - National Electrical Safety Code 2017.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- 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. 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. Coordinate the work with other installers to provide communication lines required for Utility Company meters.
 - 5. 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 Owner.
- 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.

1.05 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Utility Company letter of availability for providing electrical service to project.
- C. 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.
- D. Shop Drawings: Include dimensioned plan views and sections indicating locations and arrangement of Utility Company and service entrance equipment, metering provisions, required clearances, and proposed service routing.
 - 1. Obtain Utility company approval of shop drawings prior to submittal.
- E. Drawings prepared by Utility Company.
- F. Project Record Documents: Record actual locations of equipment and installed service routing.

1.06 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.

1.07 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: As indicated on drawings.
- C. Utility Company: To be determined by Contractor. Coordinate with Owner and confirm with Engineer.
- D. Division of Responsibility (before bid, confirm below with plans and utility standards and advise if discrepancy):

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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 contractor per utility company requirements.
 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 Compartments in Service Entrance Equipment: Furnished and installed by Contractor per Utility Company requirements.
 - 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.
 - f. Communications Conduits for Meters: Furnished and installed by Contractor per Utility Company requirements.
 - E. Products Furnished by Contractor: Comply with Utility Company requirements.
- 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 required trenching and backfilling in accordance with Section 31 2316 and Section 31 2323.
 - E. Construct cast-in-place concrete pads for utility equipment in accordance with Utility Company requirements and Section 03 3000.
 - F. Provide required protective bollards in accordance with Utility Company requirements.
 - G. Provide required support and attachment components in accordance with Section 26 0529.
 - H. Provide grounding and bonding for service entrance equipment in accordance with Section 26 0526.
 - I. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 26 0553.
- 3.04 PROTECTION**
- A. Protect installed equipment from subsequent construction operations.
- END OF SECTION**

SECTION 26 2413 - SWITCHBOARDS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e (Amended 2017).
- B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers 2016.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA 400 - Standard for Installing and Maintaining Switchboards 2007.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- F. NEMA PB 2 - Deadfront Distribution Switchboards 2011.
- G. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less 2013.
- H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- K. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.
- L. UL 891 - Switchboards Current Edition, Including All Revisions.
- M. UL 1053 - Ground-Fault Sensing and Relaying Equipment Current Edition, Including All Revisions.

1.02 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 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. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Service Entrance Switchboards:
 - 1. Coordinate with Utility Company to provide switchboards with suitable provisions for electrical service and utility metering, where applicable.
 - 2. Coordinate with Owner to arrange for Utility Company required access to equipment for installation and maintenance.
 - 3. See Section 26 2100 for Utility Company contact information and additional requirements.
 - 4. Obtain Utility Company approval of switchboard prior to fabrication.
 - 5. Preinstallation Meeting: Convene one week prior to commencing work of this section to review requirements with Utility Company representative.
 - 6. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.03 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, 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 dimensions, voltage, bus ampacities, 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 switchboards 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 upon request.
 - 5. Include documentation demonstrating selective coordination upon request.
- D. Service Entrance Switchboards: Include documentation of Utility Company approval of switchboard.
- E. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 2 as production (routine) tests.
- F. 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.
- G. Field Quality Control Test Reports.
- H. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.
- I. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Refer to Division 01 - Product Requirements, for additional provisions.
 - 2. Enclosure Keys: Two of each different key.
 - 3. Electronic Trip Circuit Breakers: Provide one portable test set.
 - 4. Drawout Devices:

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- a. Handles Necessary for Racking of Devices: One for each electrical room containing switchgear with drawout devices.
 - b. Lifting Yokes: One of each different yoke required, for each electrical room containing drawout devices.
 - c. Removable Covers: One for blocking each different opening size when device is temporarily removed from its compartment.
- 5. See Section 26 2813 for requirements for spare fuses and spare fuse cabinets.
- 1.04 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.
 - C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
 - D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- 1.05 DELIVERY, STORAGE, AND HANDLING
 - A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.
 - B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.
 - C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
 - D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.
- 1.06 FIELD CONDITIONS
 - A. Maintain field conditions within required service conditions during and after installation.
- PART 2 PRODUCTS
- 2.01 MANUFACTURERS
 - A. Switchboards - Basis of Design: Eaton.
 - B. Switchboards- Other Acceptable Manufacturers:
 - 1. ABB/GE: www.geindustrial.com/#sle.
 - 2. Eaton Corporation: www.eaton.com.
 - 3. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
 - 4. Siemens Industry, Inc: www.usa.siemens.com/#sle.
 - 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 switchboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.
- 2.02 SWITCHBOARDS
 - A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
 - B. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.
 - D. Front-Connected Switchboards:
 - 1. Main Device(s): Individually-mounted.
 - 2. Feeder Devices: Panel/group-mounted.
 - 3. Arrangement: Front accessible only (not rear accessible), rear aligned.
 - 4. Gutter Access: Bolted covers.
 - E. Service Entrance Switchboards:
 - 1. Listed and labeled as suitable for use as service equipment according to UL 869A.
 - 2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
 - 3. Comply with Utility Company requirements for electrical service.
 - 4. Utility Metering Provisions: Provide separate barriered compartment complying with Utility Company requirements where indicated or where required by Utility Company. Include hinged sealable door and provisions for Utility Company current transformers (CTs), potential transformers (PTs), or potential taps.
 - 5. See Section 26 2100 for additional requirements.
 - F. Service Conditions:
 - 1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
 - a. Altitude: Less than 6,600 feet (2,000 m).
 - b. Ambient Temperature:
 - 1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
 - 2) Switchboards Containing Fusible Switches: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).
 - 2. Provide switchboards and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
 - G. Short Circuit Current Rating:

1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
2. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
3. Label equipment utilizing series ratings by NFPA 70.
- H. Main Devices: Configure for top or bottom incoming feed as indicated for the installation. Provide separate pull section and/or top-mounted pullbox as indicated to facilitate installation of incoming feed.
- I. Bussing: Sized in accordance with UL 891 temperature rise requirements.
 1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
 2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
 3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
 4. Phase and Neutral Bus Material: Copper.
 5. Ground Bus Material: Copper.
- J. Conductor Terminations: Suitable for use with the conductors to be installed.
 1. Line Conductor Terminations:
 - a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - b. Main and Neutral Lug Type: Mechanical.
 2. Load Conductor Terminations:
 - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - b. Lug Type:
 - 1) Provide mechanical lugs unless otherwise indicated.
- K. Enclosures:
 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
 - b. Outdoor Locations: Type 3R.
 2. Finish: Manufacturer's standard unless otherwise indicated.
 3. Outdoor Enclosures:
 - a. Color: Manufacturer's standard.
 - b. Access Doors: Lockable, with all locks keyed alike.
- L. Future Provisions:
 1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
 2. Equip distribution sections with full height vertical bussing to accommodate maximum utilization of space for devices.
 3. Where designated spaces for future device provisions are not indicated, include provisions for minimum of 10% device(s) rated at 10% percent of rating of switchboard main or incoming feed.
 4. Arrange and equip through bus and ground bus to accommodate future installation of additional switchboard sections.
- M. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 4300, list switchboards as a complete assembly including surge protective device.
- N. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
- O. Arc Flash Energy-Reducing Maintenance Switching: For circuit breakers rated 1200 A or higher, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.
- P. Owner Metering:
 1. Provide microprocessor-based digital electrical metering system including all instrument transformers, wiring, and connections necessary for measurements specified.
 2. Measured Parameters:
 - a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
 - b. Current (Amps): For each phase and neutral.
 - c. Frequency (Hz).
 - d. Real power (kW): For each phase, 3-phase total.
 - e. Reactive power (kVAR): For each phase, 3-phase total.
 - f. Apparent power (kVA): For each phase, 3-phase total.
 - g. Power factor.
 - h. Power demand: Real, reactive, and apparent. As measured during peak 15 minute period over previous 12 months.
 3. Meter Accuracy: Plus/minus 1.0 percent.
 4. Features:
 - a. Remote monitoring capability via PC.
- Q. Instrument Transformers:
 1. Comply with IEEE C57.13.
 2. Select suitable ratio, burden, and accuracy for connected devices.
 3. Current Transformers: Connect secondaries to shorting terminal blocks.
 4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

2.03 OVERCURRENT PROTECTIVE DEVICES

A. Circuit Breakers:

1. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity to provide the short circuit current rating indicated, but not less than specified minimum requirements.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - c. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.
2. Molded Case Circuit Breakers:
 - a. 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.
 - 1) Provide thermal magnetic circuit breakers unless otherwise indicated.
 - 2) Provide electronic trip circuit breakers where indicated.
 - b. 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.
 - 1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
 - 2) Provide interchangeable trip units where indicated.
 - c. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
 - 1) Provide the following field-adjustable trip response settings:
 - (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
 - (b) Long time delay.
 - (c) Short time pickup and delay.
 - (d) Instantaneous pickup.
 - (e) Ground fault pickup and delay where ground fault protection is indicated.
 - 2) Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
 - 3) Provide communication capability where indicated: Compatible with system indicated.
 - d. Provide the following circuit breaker types where indicated:
 - 1) 100 Percent Rated Circuit Breakers: Listed for application within the switchboard where installed at 100 percent of the continuous current rating.
 - 2) Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
 - e. Provide the following features and accessories where indicated or where required to complete installation:
 - 1) Shunt Trip: Provide coil voltage for connection to indicated trip actuator.
 - 2) Pad-Lock Provision: For locking circuit breaker handle in OFF position.

2.04 SOURCE QUALITY CONTROL

- A. Refer to Division 01 - Quality Requirements, for additional requirements.
- B. Factory test switchboards according to NEMA PB 2, including the following production (routine) tests on each switchboard assembly or component:
 1. Dielectric tests.
 2. Mechanical operation tests.
 3. Grounding of instrument transformer cases test.
 4. Electrical operation and control wiring tests, including polarity and sequence tests.
 5. Ground-fault sensing equipment test.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive switchboards.
- 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. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.
- C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.
- D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch (10 mm) between switchboard and wall.
- E. Provide required support and attachment in accordance with Section 26 0529.
- F. Install switchboards plumb and level.
- G. Unless otherwise indicated, mount switchboards on properly sized 4 inch (100 mm) high concrete pad constructed in accordance with Section 03 3000.
- H. Provide grounding and bonding in accordance with Section 26 0526.
- I. Install all field-installed devices, components, and accessories.
- J. Where accessories are not self-powered, provide control power source as indicated to complete installation.

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- K. Set field-adjustable circuit breaker tripping function settings as indicated.
 - L. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
 - M. Provide filler plates to cover unused spaces in switchboards.
 - N. Identify switchboards in accordance with Section 26 0553.
- 3.03 FIELD QUALITY CONTROL
- A. Refer to Division 01 - Quality Requirements, for additional requirements.
 - B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's reports with submittals.
 - C. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
 - D. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.
 - E. Inspect and test in accordance with NETA ATS, except Section 4.
 - F. Perform inspections and tests listed in NETA ATS, Section 7.1.
 - G. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers. Tests listed as optional are not required.
 - H. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions by NFPA 70.
 - 1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.
 - I. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.
 - J. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.
 - K. Test shunt trips to verify proper operation.
 - L. Correct deficiencies and replace damaged or defective switchboards or associated components.
- 3.04 ADJUSTING
- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
 - B. Adjust alignment of switchboard covers and doors.
- 3.05 CLEANING
- A. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.
 - B. Repair scratched or marred surfaces to match original factory finish.
- 3.06 CLOSEOUT ACTIVITIES
- A. Refer to Division 01 - Closeout Submittals, for closeout submittals.
 - B. Refer to Division 01 - Demonstration and Training, for additional requirements.
 - C. Training: Train Owner's personnel on operation, adjustment, and maintenance of switchboard and associated devices.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials.
 - 2. Provide minimum of two hours of training.
 - 3. Instructor: Manufacturer's authorized representative.
 - 4. Location: At project site.
- 3.07 PROTECTION
- A. Protect installed switchboards from subsequent construction operations.
- END OF SECTION

SECTION 26 2416 - PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Load centers.
- D. Overcurrent protective devices for panelboards.

1.02 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e (Amended 2017).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards 2015.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- E. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2000, with Errata (2008).
- F. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.
- G. NEMA PB 1 - Panelboards 2011.
- H. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less 2013.
- I. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- J. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- L. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- M. UL 67 - Panelboards Current Edition, Including All Revisions.
- N. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.
- O. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- P. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.
- Q. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- R. UL 1053 - Ground-Fault Sensing and Relaying Equipment Current Edition, Including All Revisions.
- S. UL 1699 - Arc-Fault Circuit-Interrupters Current Edition, Including All Revisions.

1.03 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.

1.04 SUBMITTALS

- A. Refer to Division 01 - 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. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB/GE: www.geindustrial.com/#sle.
- B. Eaton Corporation: www.eaton.com.
- C. General Electric Company: www.geindustrial.com.
- D. Schneider Electric; Square D Products: www.schneider-electric.us.

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- E. Siemens Industry, Inc: www.usa.siemens.com.
 - F. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this 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 (2,000 m).
 - 2. Ambient Temperature:
 - a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
 - 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 26 0573.
 - 2. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
 - 3. Label equipment utilizing series ratings 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 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 solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
 - 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: Type 3R.
 - 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 - 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.
 - 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 26 4300, list and label panelboards as a complete assembly including surge protective device.
 - L. Panelboard Contactors: Where panelboard contactors are indicated, provide electrically operated, mechanically held magnetic contactor complying with NEMA ICS 2.
 - 1. Ampere Rating: Not less than ampere rating of panelboard bus.
 - 2. Short Circuit Current Rating: Not less than the panelboard short circuit current rating.
 - 3. Coil Voltage: As required for connection to control system indicated.
 - M. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
 - N. Provide the following features and accessories where indicated or where required to complete installation:
 - 1. Feed-through lugs.
 - 2. Sub-feed lugs.
- 2.03 POWER DISTRIBUTION PANELBOARDS
- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution 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 and Neutral Bus Material: Aluminum.
 - 2. Ground Bus Material: Aluminum.
 - D. Circuit Breakers:
 - 1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.
 - E. Enclosures:
 - 1. Provide surface-mounted enclosures unless otherwise indicated.
- 2.04 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.

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- C. Bussing:
 - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
 - 2. Phase and Neutral Bus Material: Aluminum.
 - 3. Ground Bus Material: Aluminum.
 - D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
 - E. Enclosures:
 - 1. Provide surface-mounted or flush-mounted enclosures as indicated.
 - 2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 - 3. Provide clear plastic circuit directory holder mounted on inside of door.
- 2.05 LOAD CENTERS
- A. Description: Circuit breaker type load centers listed and labeled as complying with UL 67; ratings, configurations, and features as indicated on the drawings.
 - B. Bussing:
 - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
 - 2. Bus Material: Aluminum or copper.
 - C. Circuit Breakers: Thermal magnetic plug-in type.
 - D. Enclosures:
 - 1. Provide flush-mounted enclosures unless otherwise indicated.
 - 2. Fronts: Provide hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 - 3. Provide circuit directory label on inside of door or individual circuit labels adjacent to circuit breakers.
- 2.06 OVERCURRENT PROTECTIVE DEVICES
- A. Fusible Switches:
 - 1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
 - 2. Fuse Clips: As required to accept indicated fuses.
 - a. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
 - 3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
 - 4. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - B. 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 to provide the short circuit current rating indicated, but not less than:
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - c. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.
 - 3. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. 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.
 - 5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
 - a. Provide the following field-adjustable trip response settings:
 - 1) Long time pickup, adjustable by setting dial.
 - 2) Long time delay.
 - 3) Short time pickup and delay.
 - 4) Instantaneous pickup.
 - 6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
 - 7. 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.
 - b. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
 - c. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
 - d. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
 - 8. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.
 - 9. Do not use handle ties in lieu of multi-pole circuit breakers.

10. Provide multi-pole circuit breakers for multi-wire branch circuits by NFPA 70.
11. Provide the following features and accessories where indicated or where required to complete installation:
 - a. Shunt Trip: Provide coil voltage for connection to indicated trip actuator
 - b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.

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 26 0529.
- 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 floor-mounted power distribution panelboards on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 03 3000.
- I. Provide minimum of six spare 1 inch (27 mm) trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.
- J. Provide grounding and bonding in accordance with Section 26 0526.
 1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
- K. Install all field-installed branch devices, components, and accessories.
- L. Provide fuses complying with Section 26 2813 for fusible switches as indicated.
- M. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard by NFPA 70.
- N. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 0573.
- O. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- P. Provide filler plates to cover unused spaces in panelboards.
- Q. 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. Video surveillance system circuits.
- R. Identify panelboards in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

- A. Refer to Division 01 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- D. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 50 amperes. Tests listed as optional are not required.
- E. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions by NFPA 70.
- F. Test GFCI circuit breakers to verify proper operation.
- G. Test AFCI circuit breakers to verify proper operation.
- H. Test shunt trips to verify proper operation.
- I. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.
- J. 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 26 2726 - WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Wall dimmers.
- C. Receptacles.
- D. Wall plates.
- E. Floor box service fittings.

1.02 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for 2017h.
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification) 2017g.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2010.
- E. NEMA WD 1 - General Color Requirements for Wiring Devices 1999 (Reaffirmed 2015).
- F. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2016.
- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 20 - General-Use Snap Switches Current Edition, Including All Revisions.
- I. UL 498 - Attachment Plugs and Receptacles Current Edition, Including All Revisions.
- J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices Current Edition, Including All Revisions.
- K. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- L. UL 1472 - Solid-State Dimming Controls Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.04 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.05 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 WIRING DEVICE 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 GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide tamper resistant receptacles for receptacles installed in dwelling units.
- E. Provide GFCI protection for receptacles installed within 6 feet (1.8 m) of sinks.
- F. Provide GFI protection for all receptacles installed in kitchens.
- G. Provide GFCI protection for receptacles serving electric drinking fountains.

2.02 WIRING DEVICE FINISHES

- A. Finish selected by owner and architectural representative.

2.03 WALL SWITCHES

- A. Manufacturers:
 - 1. Hubbell Incorporated: www.hubbell.com/#sle.
 - 2. Hubbell Incorporated: www.hubbell-wiring.com.
 - 3. Leviton Manufacturing Company, Inc: www.leviton.com.
 - 4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us.
 - 5. Substitutions: Refer to Division 01 - Product Requirements.
- B. General Use Switches (only where specifically noted): AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- C. Accessible Wall Switches (all public and private exposed locations): Industrial specification grade, 20 A, 120/277 V with decorator style rocker type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
- D. Lighted Wall Switches: (Concealed locations and mechanical/electrical spaces); and Industrial specification grade, 20 A, 120 V with illuminated decorator style rocker type switch actuator and maintained contacts; illuminated with load off; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
- E. Pilot Light Wall Switches: (for use with contactors) Industrial specification grade, 20 A, 120/277 V with red illuminated standard toggle type switch actuator and maintained contacts and illuminated with load on. Provide single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
- F. Locking Wall Switches: Industrial specification grade, 20 A, 120 V with lever type keyed switch actuator and maintained contacts; switches keyed alike; single pole single throw or double pole single throw as indicated on the drawings.
- G. Momentary Contact Wall Switches (for use with mechanically held contactors, door controllers, and where shown on plan): Industrial specification grade, 20 A, 120 V with toggle type three position switch actuator and momentary contacts; single pole double throw, off with switch actuator in center position.

2.04 WALL DIMMERS

- A. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.
- B. Control: Decorator rocker control type with preset slide adjustment.

2.05 RECEPTACLES

- A. Manufacturers:
 - 1. Hubbell Incorporated: www.hubbell.com/#sle.
 - 2. Hubbell Incorporated: www.hubbell-wiring.com.
 - 3. Leviton Manufacturing Company, Inc: www.leviton.com.
 - 4. Lutron Electronics Company, Inc; Designer Style: www.lutron.com/#sle.
 - 5. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
 - 6. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.
- B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498 and where applicable FS W-C-596; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 - 2. NEMA configurations specified are according to NEMA WD 6.
 - 3. Hospital Grade Receptacles (healthcare locations): Listed as complying with UL 498 Supplement SD, with green dot hospital grade mark on device face.
- C. Convenience Receptacles:
 - 1. Standard Convenience Receptacles (common areas): Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
 - 2. Tamper Resistant Convenience Receptacles (dwelling units): Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
- D. GFCI Receptacles:
 - 1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
 - 2. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
 - 3. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.

2.06 COMMUNICATIONS OUTLETS

- A. Telephone Outlet:
 - 1. Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1 complying with Category 5e. Comply with UL 1863.
 - 2. Outlet color to be verified with owners IT personnel.
- B. Data Outlet:
 - 1. Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1 complying with Category 5e. Comply with UL 1863.
 - 2. Outlet color to be verified with owners IT personnel.
- C. TV Outlet:
 - 1. Type F coaxial cable connector.
- D. Combination Outlet:
 - 1. Any combination of telephone, data, or television outlets as noted on plans. Provide in a common box with a common faceplate.

2.07 WALL PLATES

- A. Manufacturers:
 - 1. Hubbell Incorporated: www.hubbell-wiring.com.
 - 2. Leviton Manufacturing Company, Inc: www.leviton.com.
 - 3. Lutron Electronics Company, Inc: www.lutron.com/sle.
 - 4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us.
 - 5. Substitutions: Refer to Division 01 - Product Requirements.
- B. Wall Plates: Comply with UL 514D.
 - 1. Configuration: One piece cover for quantity and types of corresponding wiring devices.
 - 2. Size: Standard; do not use oversized plates without architect approval.
 - 3. Screws: Metal with slotted heads finished to match wall plate finish.
- C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.
- 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 and identified as extra-duty type.
- E. Wall plates shall be uniform in color, style and material within an area for all receptacle, switch and communications devices.
- F. For wall mounted telephones (above 36" AFF), wall plate shall have telephone mounting studs.

2.08 FLOOR BOX SERVICE FITTINGS

- A. Description: Service fittings compatible with floor boxes provided under Section 26 0533.16 with components, adapters, and trims required for complete installation.

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- B. Flush Floor Service Fittings:
- PART 3 EXECUTION**
- 3.01 EXAMINATION**
- A. Verify that field measurements are as indicated.
 - B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
 - C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
 - D. Verify that final surface finishes are complete, including painting.
 - E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
 - F. Verify that conditions are satisfactory for installation prior to starting work.
- 3.02 INSTALLATION**
- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
 - B. Coordinate locations of outlet boxes provided under Section 26 0533.16 for installation of wiring devices provided under this section.
 - 1. Mounting Heights: As indicated on the drawings. If not indicated, install as follows:
 - a. Wall Switches: box top 48 inches (1.2 m) above finished floor.
 - b. Wall Dimmers: box top 48 inches (1.2 m) above finished floor.
 - c. Receptacles: box bottom 18 inches (450 mm) above finished floor or 6 inches (150 mm) above counter.
 - 2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
 - 3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
 - 4. Locate wall switches on strike side of door with edge of wall plate 3 inches (80 mm) from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
 - 5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
 - C. Install wiring devices in accordance with manufacturer's instructions.
 - D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
 - E. Where required, connect wiring devices using pigtails not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.
 - F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
 - G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
 - H. Provide GFI receptacles with integral GFI protection at each location indicated (exterior, isolated or remote locations). Do not use feed-through wiring to protect downstream devices.
 - I. Unless otherwise indicated, GFI receptacles may be connected to provide feed-through protection to downstream devices in immediate vicinity (same room). Label such devices to indicate they are protected by upstream GFI protection.
 - J. Install wiring devices plumb and level with mounting yoke held rigidly in place.
 - K. Install wall switches with OFF position down.
 - L. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
 - M. Do not share neutral conductor on branch circuits utilizing wall dimmers.
 - N. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
 - O. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
 - P. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- 3.03 FIELD QUALITY CONTROL**
- A. Refer to Division 01 - Quality Requirements, for additional requirements.
 - B. Inspect each wiring device for damage and defects.
 - C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
 - 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.
- 3.04 ADJUSTING**
- A. Adjust devices and wall plates to be flush and level.
 - B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect.
- 3.05 CLEANING**
- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.
- END OF SECTION**

SECTION 26 2813 - FUSES

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. NEMA FU 1 - Low Voltage Cartridge Fuses 2012.
- B. NFPA 70 - National Electrical Code 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 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses Current Edition, Including All Revisions.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
 - 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 Contract Documents. Obtain direction before proceeding with work.

1.03 SUBMITTALS

- A. Refer to Division 01 - 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. Spare Fuse Cabinet: Include dimensions.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Refer to Division 01 - Product Requirements, for additional provisions.
 - 2. Extra Fuses: One set(s) of three for each type and size installed.
 - 3. Fuse Pullers: One set(s) compatible with each type and size installed.
 - 4. Spare Fuse Cabinet Keys: Two.

1.04 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com.
- B. Littelfuse, Inc: www.littelfuse.com.
- C. Substitutions: Refer to Division 01 - Product Requirements.

2.02 FUSES

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment 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.
 - 2. Class RK5, Time-Delay Fuses.
- H. 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.

2.03 SPARE FUSE CABINET

- A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.
- B. Finish: Manufacturer's standard, factory applied grey finish unless otherwise indicated.

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 mounting surfaces are ready to receive spare fuse cabinet.
- C. 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.
- C. Install spare fuse cabinet where indicated.
- D. Identify spare fuse cabinet in accordance with Section 26 0553.

END OF SECTION

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SECTION 26 2816.13 - ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e (Amended 2017).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- 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 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- I. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.
- J. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- K. UL 1053 - Ground-Fault Sensing and Relaying Equipment Current Edition, Including All Revisions.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within 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. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted enclosed circuit breakers 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.

1.03 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.
 - 1. Include characteristic trip curves for each type and rating of circuit breaker upon request.
- 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.
 - 1. Include dimensioned plan and elevation views of enclosed circuit breakers 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.
- 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, installation, and starting of product.
- E. Project Record Documents: Record actual installed locations of enclosed circuit breakers.
- F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.04 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.05 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 circuit breaker internal components, enclosure, and finish.

1.06 FIELD CONDITIONS

- A. Maintain ambient temperature between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C) during and after installation of enclosed circuit breakers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB/GE: www.geindustrial.com/#sle.
- B. Eaton Corporation: www.eaton.com.
- C. General Electric Company: www.geindustrial.com.
- D. Schneider Electric; Square D Products: www.schneider-electric.us.
- E. Siemens Industry, Inc: www.usa.siemens.com/#sle.
- F. Substitutions: Refer to Division 01 - Product Requirements.
- G. Source Limitations: Furnish enclosed circuit breakers and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED CIRCUIT BREAKERS

- A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.

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- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet (2,000 m).
 - 2. Ambient Temperature: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
 - D. Short Circuit Current Rating:
 - 1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location indicated on the drawings.
 - 2. Listed series ratings are acceptable except where not permitted by motor contribution according to NFPA 70.
 - 3. Label equipment utilizing series ratings by NFPA 70.
 - E. Enclosed Circuit Breakers Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
 - F. Conductor Terminations: Suitable for use with the conductors to be installed.
 - G. Provide thermal magnetic circuit breakers unless otherwise indicated.
 - H. Provide electronic trip circuit breakers for circuit breaker frame sizes 225 amperes and above.
 - I. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.
 - J. 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.
 - K. Provide externally operable handle with means for locking in the OFF position.
 - L. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
 - 1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
 - 2. Where accessory ground fault sensing and relaying equipment is used, equip companion circuit breakers with ground-fault shunt trips.
 - a. Use zero sequence ground fault detection method unless otherwise indicated.
 - b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
 - c. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.
 - M. Selectivity: Where the requirement for selectivity is indicated, furnish products to achieve selective coordination.
- 2.03 MOLDED CASE CIRCUIT BREAKERS
- A. 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.
 - B. Interrupting Capacity:
 - 1. Provide circuit breakers with interrupting capacity to provide the short circuit current rating indicated, but not less than:
 - a. 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
 - 2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - 3. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.
 - C. Conductor Terminations:
 - 1. Provide mechanical lugs unless otherwise indicated.
 - 2. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - D. 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.
 - 1. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
 - 2. Provide interchangeable trip units where indicated.
 - E. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
 - 1. Provide the following field-adjustable trip response settings:
 - a. Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
 - b. Long time delay.
 - c. Short time pickup and delay.
 - d. Instantaneous pickup.
 - e. Ground fault pickup and delay where ground fault protection is indicated.
 - 2. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
 - 3. Provide communication capability where indicated: Compatible with system indicated.
 - F. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
 - G. Provide the following circuit breaker types where indicated:
 - 1. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
 - 2. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.

- H. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.
- I. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.
- J. Provide the following features and accessories where indicated or where required to complete installation:
 - 1. Shunt Trip: Provide coil voltage for connection to indicated trip actuator.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings of the enclosed circuit breakers are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed circuit breakers.
- 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 26 0529.
- E. Install enclosed circuit breakers plumb.
- F. Install flush-mounted enclosed circuit breakers so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- G. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.
- H. Provide grounding and bonding in accordance with Section 26 0526.
- I. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

3.03 FIELD QUALITY CONTROL

- A. Refer to Division 01 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with manufacturer's instructions and NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers used for service entrance and for circuit breakers larger than 400 amperes. Tests listed as optional are not required.
 - 1. Perform insulation-resistance tests on all control wiring with respect to ground.
 - 2. Test functions of the trip unit by means of secondary injection.
- D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions by NFPA 70.
- E. Test GFCI circuit breakers to verify proper operation.
- F. Test shunt trips to verify proper operation.
- G. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

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 circuit breaker enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 2816.16 - ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Enclosed safety switches.

1.02 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- 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. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- H. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.
- I. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.

1.03 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 the contract documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

- A. Refer to Division 01 - 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.
 - 1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
- 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, installation, and starting of product.
- E. Project Record Documents: Record actual locations of enclosed switches.
- F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Refer to Division 01 - Product Requirements, for additional provisions.
 - 2. See Section 26 2813 for requirements for spare fuses and spare fuse cabinets.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB/GE: www.geindustrial.com/#sle.
- B. Eaton Corporation: www.eaton.com.
- C. General Electric Company: www.geindustrial.com.
- D. Schneider Electric; Square D Products: www.schneider-electric.us.
- E. Siemens Industry, Inc: www.usa.siemens.com.
- F. Substitutions: Refer to Division 01 - Product Requirements.
- G. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a 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 (2,000 m).
 - 2. Ambient Temperature: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).
- D. Horsepower Rating: Suitable for connected load.

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- 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.
- 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: Where exposed, color as selected by architect 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. 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. Integral fuse pullers.

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 26 0529.
- E. Install enclosed switches plumb.
- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.
- G. Provide grounding and bonding in accordance with Section 26 0526.
- H. Provide fuses complying with Section 26 2813 for fusible switches **as** indicated by equipment manufacturer's recommendations.
- I. Identify enclosed switches in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

- A. Refer to Division 01 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- D. 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. Where exposed to view, subcontract GC to paint (before mounting) to match adjacent finish.

END OF SECTION

SECTION 26 4113 - LIGHTNING PROTECTION FOR STRUCTURES

NOTICE: LIGHTNING PROTECTION HAS BEEN RELOCATED TO SECTION 13 4613 - LIGHTNING PROTECTION FOR STRUCTURES PER MASTERFORMAT 2020 UPDATES. THIS SECTION IS OBSOLETE AND WILL BE REMOVED AFTER DECEMBER 2021.

PART 1 GENERAL

3.01 SECTION INCLUDES

- A. Strike (air) terminals and interconnecting conductors.
- B. Grounding and bonding for lightning protection.

3.02 REFERENCE STANDARDS

- A. NFPA 780 - Standard for the Installation of Lightning Protection Systems 2020.
- B. UL 96 - Lightning Protection Components Current Edition, Including All Revisions.
- C. LPI (Lightning Protection Institute) Standard 175; 2014.

3.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a meeting at least at least two weeks prior to commencement of any work affected by lightning protection system requirements to discuss prerequisites and coordination required by other installers; require attendance by representatives of installers whose work will be affected.

3.04 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate location and layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details.
 - 1. Include data on actual ground resistance determined by field measurement in accordance with NFPA 780.
 - 2. Include engineering analysis of equalization of potential to metal bodies within the structure.
 - 3. Include access panels, test holes, and disconnecting means for maintenance.
- C. Product Data: Provide dimensions and materials of each component, indication of testing agency listing, and installation instructions.
- D. Installation Certification: Submit copy of certification agency's approval.
- E. Operation and Maintenance Data: Provide recommended inspection and testing plan, including recommended intervals, to achieve periodic maintenance as recommended in NFPA 780; provide customized plan reflecting actual installation configuration with specific installed components identified.
- F. Project Record Documents: Record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors in project record documents.

3.05 QUALITY ASSURANCE

- A. Maintain one copy of each referenced system design standard on site.
- B. Manufacturer Qualifications: Company specializing in lightning protection equipment with minimum five years documented experience.
- C. Designer Qualifications: Person or entity, employed by installer, who specializes in lightning protection system design with minimum three years documented experience.
- D. Installer Qualifications: Capable of providing the specified certification of the installed system.
- E. Products: Listed, classified, and labeled as suitable for the purpose intended.
- F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

4.01 MANUFACTURERS

- A. Lightning Protection Components:
 - 1. East Coast Lightning Equipment: ECLE.biz.
 - 2. Advanced Lightning Technology (ALT): www.altfab.com.
 - 3. Harger Lightning and Grounding: www.harger.com.
 - 4. National Lightning Protection Corporation: www.theprotectionsource.com.
 - 5. Robbins Lightning, Inc: www.robbsnlightning.com.
 - 6. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#sle.
 - 7. Substitutions: Refer to Division 01 - Product Requirements.

4.02 LIGHTNING PROTECTION SYSTEM

- A. Lightning Protection System: Provide complete system complying with NFPA 780, including air terminals, bonding, interconnecting conductors and grounding electrodes.
 - 1. Provide system that protects:
 - a. The entire structure.
 - b. Open air areas within 100 feet (30 meters) of exterior walls at grade level.
 - c. Open air areas within building footprint.
 - 2. Coordinate with other grounding and bonding systems specified.
 - 3. Determine ground resistance by field measurement.
 - 4. Provide copper, bronze, or stainless steel components, except where aluminum is allowed by NFPA 780.
 - 5. Provide disconnecting means and access panels or similar devices to allow complete periodic inspection and testing as described by NFPA 780 Annex D.
 - 6. Provide system certified by Underwriters Laboratories or the Lightning Protection Institute.
- B. Strike Terminals: Provide strike (air) terminals for all corners adjacent to a 150' radius rolling sphere including but not limited to.
 - 1. Roofs.
 - 2. Penthouse roofs.

- 3. Roof mounted equipment.
- 4. Chimneys.
- 4.03 COMPONENTS
 - A. All Components: Complying with applicable requirements of UL 96.
 - B. Strike (Air) Terminals: Copper, solid, with adhesive bases for single-ply roof installations.
 - C. Grounding Rods: Solid copper.
 - D. Ground Plate: Copper.
 - E. Conductors: Copper cable.
 - F. Connectors and Splicers: Bronze.
- PART 3 EXECUTION
- 5.01 EXAMINATION
 - A. Verify that field measurements are as indicated on shop drawings.
 - B. Coordinate work with installation of roofing and exterior and interior finishes.
- 5.02 INSTALLATION
 - A. Install in accordance with referenced system standards and for specified certification.
- 5.03 FIELD QUALITY CONTROL
 - A. Refer to Division 01 - Quality Requirements, for additional requirements.
 - B. Perform visual inspection as specified in NFPA 780 as if this were a periodic follow-up inspection.
 - C. Perform continuity testing as specified in NFPA 780 as if this were testing for periodic maintenance.
 - D. Obtain the services of the specified certification agency to provide inspection and UL96A or LPI certification of the lightning protection system, including performance of any other testing required by that agency.
- END OF SECTION

SECTION 26 4300 - SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surge protective devices for service entrance locations.

1.02 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- 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 1449 - Standard for Surge Protective Devices Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. Refer to Division 01 - 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.

1.04 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. 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.

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 field-installed, externally-mounted or 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. Protected Modes:
- E. UL 1449 Voltage Protection Ratings (VPRs).
- F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.
- G. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations.
- H. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.

2.03 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

- A. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.
- B. 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.
- C. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.
- D. Surge Current Rating: Not less than 120 kA per mode/240 kA per phase.
- E. UL 1449 Nominal Discharge Current (I-n): 20 kA.
- F. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
- G. Diagnostics:
 - 1. Protection Status Monitoring: Provide indicator lights to report the protection for each phase.
 - 2. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

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 that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.
- D. Verify system grounding and bonding is in accordance with Section 26 0526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.
- E. 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. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.

- F. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.
- G. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 0526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.
- H. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

END OF SECTION

SECTION 26 5100 - INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires.
- B. Emergency lighting units.
- C. Exit signs.
- D. Ballasts and drivers.
- E. Lamps.
- F. Accessories.

1.02 REFERENCE STANDARDS

- A. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products 2008.
- B. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules 2015, with Errata (2017).
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems 2006.
- E. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems 2006.
- F. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility 2012.
- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 924 - Emergency Lighting and Power Equipment Current Edition, Including All Revisions.
- J. UL 935 - Fluorescent-Lamp Ballasts Current Edition, Including All Revisions.
- K. UL 1598 - Luminaires Current Edition, Including All Revisions.
- L. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections. 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.
 - 3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections.
 - 4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.04 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1.05 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.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 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.

1.07 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.08 WARRANTY

- A. Refer to Division 01 - Closeout Submittals, for additional warranty requirements.
- B. Provide three year manufacturer warranty for LED luminaires, including drivers.
- C. Provide two year manufacturer warranty for linear fluorescent ballasts.
- D. Provide five year pro-rata warranty for batteries for emergency lighting units.
- E. Provide ten year pro-rata warranty for batteries for self-powered exit signs.
- F. Provide three year full warranty for fluorescent emergency power supply units.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. Substitutions: Refer to Division 01 - Product Requirements except where individual luminaire types are designated with substitutions not permitted.

2.02 LUMINAIRES

- A. Manufacturers:
 - 1. Acuity Brands, Inc: www.acuitybrands.com/#sle.
 - 2. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com/#sle.

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3. Hubbell Lighting, Inc: www.hubbellighting.com/#sle.
 4. Lutron Electronics Company, Inc; www.lutron.com/#sle.
 5. Philips Lighting North America Corporation; www.lightingproducts.philips.com/#sle.
 6. Progress.
 7. Substitutions: Refer to Division 01 - Product Requirements.
 - B. Provide products that comply with requirements of NFPA 70.
 - C. Provide products that are listed and labeled as complying with UL 1598, where applicable.
 - D. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
 - F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
 - G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
 - H. Provide (1) extra of each type Common area and resident fixtures.
 - I. Recessed Luminaires:
 1. Ceiling Compatibility: Comply with NEMA LE 4.
 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
 3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
 - J. Fluorescent Luminaires:
 1. Provide ballast disconnecting means complying with NFPA 70 where required.
 2. Fluorescent Luminaires Controlled by Occupancy Sensors: Provide programmed start ballasts.
 3. Fluorescent Luminaires Controlled by Dual-Level Switching: Provide with two ballasts.
 - K. LED Luminaires:
 1. Components: UL 8750 recognized or listed as applicable.
 2. Tested in accordance with IES LM-79 and IES LM-80.
 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
 - L. LED Luminaire Components: UL 8750 recognized or listed as applicable.
 - M. Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.
 - N. 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. Manufacturers:
 1. Acuity Brands, Inc: www.acuitybrands.com.
 2. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com.
 3. Hubbell Lighting, Inc: www.hubbellighting.com.
 4. Substitutions: Refer to Division 01 - Product Requirements.
 - B. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
 - C. 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.
 - D. Battery:
 1. Size battery to supply all connected lamps, including emergency remote heads where indicated.
 - E. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
 - F. Provide low-voltage disconnect to prevent battery damage from deep discharge.
- 2.04 EXIT SIGNS
- A. Description: Exit signs and similar signs for special purpose applications such as area of refuge/rescue assistance.
 - B. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
 1. Number of Faces: Single- or double-face as indicated for installed location.
 2. Directional Arrows: As indicated for installed location.
- 2.05 BALLASTS AND DRIVERS
- A. Ballasts/Drivers - General Requirements:
 1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
 2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
- 2.06 LAMPS
- A. Manufacturers:
 1. General Electric Company/GE Lighting: www.gelighting.com.
 2. Osram Sylvania: www.sylvania.com.
 3. Philips Lighting North America Corporation: www.usa.lighting.philips.com/#sle.
 4. Philips Lighting Company: www.lighting.philips.com.
 5. Substitutions: Refer to Division 01 - Product Requirements.
 - B. Lamps - General Requirements:

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1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
 2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
 3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
 4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.
 5. Provide (1) box (6) lamps/bulbs of each type.
- C. Lamps - Sustainable Design Requirements:
1. Maximum Mercury Content:
 - a. T8 Linear Fluorescent, 96 Inch: 10 mg.
 - b. T8 Linear Fluorescent, 48 Inch: 3.5 mg.
 - c. T8 Linear Fluorescent, 36 Inch and 24 Inch: 3.5 mg.
 - d. T8 Linear Fluorescent, U-Bent: 6 mg.
 - e. T5 Linear Fluorescent: 2.5 mg.
 - f. T5 Circular Fluorescent: 9 mg.
 - g. Compact Fluorescent, Nonintegral Ballast: 3.5 mg.
 - h. Compact Fluorescent, Integral Ballast: 3.5 mg (ENERGY STAR qualified).
 - i. High Pressure Sodium, Up to 400 W: 10 mg.
 - j. High Pressure Sodium, Greater Than 400 W: 32 mg.
 2. Minimum Rated Lamp Life:
 - a. T8 Linear Fluorescent, 96 Inch: 24,000 hours for standard output lamps on instant start ballasts; 18,000 hours for high output lamps on instant start or programmed start ballasts; based on three hours per start.
 - b. T8 Linear Fluorescent, 48 Inch: 30,000 hours for standard and high output lamps on instant start ballasts; 36,000 hours on programmed start ballasts; based on three hours per start.
 - c. T8 Linear Fluorescent, 36 Inch and 24 Inch: 24,000 hours on instant start or programmed start ballasts; based on three hours per start.
 - d. T8 Linear Fluorescent, U-Bent: 18,000 hours on instant start ballasts; 24,000 hours on programmed start ballasts; based on three hours per start.
 - e. T5 Linear Fluorescent: 25,000 hours for standard and high output lamps on programmed start ballasts.
 - f. T5 Circular Fluorescent: 25,000 hours for standard and high output lamps on programmed start ballasts.
 - g. Compact Fluorescent, Nonintegral Ballast: 12,000 hours.
 - h. Compact Fluorescent, Integral Ballast: 10,000 hours for bare bulbs; 8,000 hours for covered models such as globes, reflectors, and A-19 lamps.
 - i. High Pressure Sodium: Use only non-cycling type lamps.
- D. Linear Fluorescent Lamps: Wattage and bulb type as indicated, with base type for luminaire.
1. Low Mercury Content: Provide lamps that pass the EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
 2. T8 Linear Fluorescent Lamps:
 - a. Correlated Color Temperature (CCT): 3,500 K unless otherwise indicated.
 - b. Color Rendering Index (CRI): Not less than 80.
 - c. Average Rated Life: Not less than 20,000 hours for an operating cycle of three hours per start.
 3. T5 Linear Fluorescent Lamps:
 - a. Correlated Color Temperature (CCT): 3,500 K unless otherwise indicated.
 - b. Color Rendering Index (CRI): Not less than 80.
 - c. Average Rated Life: Not less than 20,000 hours for an operating cycle of three hours per start.
- E. LED (Light Emitting Diode) Lamps
1. Correlated Color Temperature (CCT): 3,000 K unless otherwise indicated.
 2. Color Rendering Index (CRI): Not less than 80.
 3. Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 0533.16 for installation of luminaires provided under this section.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install products in accordance with manufacturer's instructions.
- D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

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- E. Provide required support and attachment in accordance with Section 26 0529.
- F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- G. 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 surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
 - 4. Secure pendant-mounted luminaires to building structure.
 - 5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
 - 6. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.
- H. 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.
 - 3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
- I. 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 for specified mounting height.
 - 3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet (1.2 m) between supports.
 - 4. Install canopies tight to mounting surface.
 - 5. Unless otherwise indicated, support pendants from swivel hangers.
- J. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- K. Install accessories furnished with each luminaire.
- L. Bond products and metal accessories to branch circuit equipment grounding conductor.
- M. Fluorescent Luminaires Controlled by Dual-Level Switching: Connect such that each switch controls the same corresponding lamps in each luminaire.
- N. 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.
 - 2. For every 10 fixtures installed, include 1 spare fixture with wiring and installation labor.
 - 3. Install lock-on device on branch circuit breaker serving units.
- O. 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.
 - 2. For every 10 fixtures installed, include 1 spare fixture with wiring and installation labor.
 - 3. Install lock-on device on branch circuit breaker serving units.
- P. Install lamps in each luminaire.
- 3.04 FIELD QUALITY CONTROL
 - A. Refer to Division 01 - Quality Requirements, for additional requirements.
 - B. Inspect each product for damage and defects.
 - C. Operate each luminaire after installation and connection to verify proper operation.
 - D. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.
 - E. 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 position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as directed by Architect or authority having jurisdiction.
 - C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated to properly designate egress path as directed by Architect or authority having jurisdiction.
- 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.
- 3.07 CLOSEOUT ACTIVITIES
 - A. Refer to Division 01 - Closeout Submittals, for closeout submittals.
 - B. Refer to Division 01 - Demonstration and Training, for additional requirements.
 - C. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.
 - D. Just prior to Substantial Completion, replace all lamps that have failed.
- 3.08 PROTECTION
 - A. Protect installed luminaires from subsequent construction operations.
- END OF SECTION

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SECTION 26 5600 - EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior luminaires.
- B. Ballasts.
- C. Lamps.
- D. Poles and accessories.
- E. Luminaire accessories.

1.02 REFERENCE STANDARDS

- A. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signal 2013 (Revised 2019).
- B. IEEE C2 - National Electrical Safety Code 2017.
- C. IES LM-63 - IESNA Standard File Format for Electronic Transfer of Photometric Data and Related Information 2002 (Reaffirmed 2008).
- D. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products 2008.
- E. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules 2015, with Errata (2017).
- F. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- G. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems 2006.
- H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 1598 - Luminaires Current Edition, Including All Revisions.
- J. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections. Coordinate elevation to obtain specified foundation height.
 - 2. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.04 SUBMITTALS

- A. Refer to Division 01 - 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.
 - 3. Provide structural calculations for each pole proposed for substitution.
- 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. LED Luminaires:
 - a. Include estimated useful life, calculated based on IES LM-80 test data.
 - b. Include IES LM-79 test report upon request.
 - 2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.
 - 3. Lamps: Include rated life and initial and mean lumen output.
 - 4. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.
- D. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.
- E. Samples:
 - 1. Provide one sample(s) of each luminaire proposed for substitution upon request.
 - 2. Provide one sample of each product finish illustrating color and texture upon request.
- F. 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.
- G. Field Quality Control Reports.
 - 1. Include test report indicating measured illumination levels.
- H. 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.
- I. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Refer to Division 01 - Product Requirements, for additional provisions.
 - 2. Extra Lamps: Ten percent of total quantity installed for each type, but not less than two of each type.
 - 3. Extra Ballasts: Two percent of total quantity installed for each type, but not less than one of each type.
 - 4. Extra Fuses: Five percent of total quantity installed for each type, but not less than two of each type.
 - 5. Touch-Up Paint: 2 gallons (8 liters), to match color of pole finish.
- K. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

- 1.05 QUALITY ASSURANCE
 - A. Comply with requirements of NFPA 70.
- 1.06 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.
- 1.07 WARRANTY
 - A. Refer to Division 01 - Closeout Submittals, for additional warranty requirements.
 - B. Provide three year manufacturer warranty for all LED luminaires, including drivers.
- PART 2 PRODUCTS
- 2.01 MANUFACTURERS
 - A. Acuity Brands, Inc: www.acuitybrands.com.
 - B. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com.
 - C. Hubbell Lighting, Inc: www.hubbelllighting.com.
 - D. Progress Lighting.
- 2.02 LUMINAIRE TYPES
 - A. Furnish products as indicated in luminaire schedule included on the drawings.
 - B. Substitutions: Refer to Division 01 - Product Requirements.
- 2.03 LUMINAIRES
 - A. Provide products that comply with requirements of NFPA 70.
 - B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
 - C. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
 - E. 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.
 - F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
 - G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.
 - H. LED Luminaires:
 - 1. Components: UL 8750 recognized or listed as applicable.
 - 2. Tested in accordance with IES LM-79 and IES LM-80.
 - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
 - I. LED Luminaire Components: UL 8750 recognized or listed as applicable.
 - J. Exposed Hardware: Stainless steel.
- 2.04 LAMPS
 - A. Manufacturers:
 - 1. General Electric Company/GE Lighting: www.gelighting.com.
 - 2. Osram Sylvania: www.sylvania.com.
 - 3. Philips Lighting Company: www.lighting.philips.com.
 - 4. Substitutions: Refer to Division 01 - Product Requirements.
 - 5. Manufacturer Limitations: Where possible, provide lamps produced by a single manufacturer.
 - 6. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.
 - B. Lamps - General Requirements:
 - 1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
 - 2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
 - 3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
 - 4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.
- 2.05 POLES
 - A. All Poles:
 - 1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
 - 2. Structural Design Criteria:
 - a. Comply with AASHTO LTS.
 - b. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
 - 1) Design Wind Speed: 110 miles per hour (177 kph), with gust factor of 1.3.
 - c. Dead Load: Include weight of proposed luminaire(s) and associated supports and accessories.
 - d. Include structural calculations demonstrating compliance with submittals.
 - 3. Material: Steel, unless otherwise indicated.
 - 4. Shape: Square straight, unless otherwise indicated.
 - 5. Finish: Match luminaire finish, unless otherwise indicated.
 - 6. Mounting Height: 20', unless otherwise indicated.
 - 7. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.
 - 8. Unless otherwise indicated, provide with the following features/accessories:

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- a. Top cap.
- b. Handhole, 2"w x 6"h size.
- c. Anchor bolts with leveling nuts or leveling shims.
- d. Anchor base cover.
- e. Provision for pole-mounted weatherproof GFI receptacle where indicated.
- f. Hinged base.
- g. Pole-top tenon, size for installed luminaire or bracket.

2.06 ACCESSORIES

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 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 26 0533.16 for installation of luminaires provided under this section.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install products in accordance with manufacturer's instructions.
- D. Install luminaires in accordance with NECA/IESNA 501.
- E. Provide required support and attachment in accordance with Section 26 0529.
- F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- G. Recessed Luminaires:
 - 1. Install trims tight to mounting surface with no visible light leakage.
- H. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- I. Pole-Mounted Luminaires:
 - 1. Maintain the following minimum clearances:
 - a. Comply with IEEE C2.
 - b. Comply with utility company requirements.
 - 2. Foundation-Mounted Poles:
 - a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 03 3000.
 - 1) Install anchor bolts plumb per template furnished by pole manufacturer.
 - 2) Position conduits to enter pole shaft.
 - b. Install foundations plumb.
 - c. Install poles plumb, using leveling nuts or shims to adjust to plumb.
 - d. Tighten anchor bolt nuts to manufacturer's recommended torque.
 - e. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.
 - f. Install anchor base covers or anchor bolt covers as indicated.
 - 3. Embedded Poles: Install poles plumb as indicated.
 - 4. Grounding:
 - a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
 - b. Provide supplementary ground rod electrode as specified in Section 26 0526 at each pole bonded to grounding system as indicated.
 - 5. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.
 - 6. Install breakaway in-line fuse holders and fuses complying with Section 26 2813 in pole handhole or transformer base for each ungrounded conductor.
 - 7. Install weather resistant GFI duplex receptacle with weatherproof cover as specified in Section 26 2726 in designated poles.
- J. Install accessories furnished with each luminaire.
- K. Bond products and metal accessories to branch circuit equipment grounding conductor.
- L. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

- A. Refer to Division 01 - Quality Requirements, for additional requirements.
- B. Inspect each product for damage and defects.
- C. Operate each luminaire after installation and connection to verify proper operation.
- D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.
- E. Measure illumination levels at night with calibrated meters to verify compliance with performance requirements. Record test results in written report to be included with submittals.

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.

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- B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Architect.
- 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.
- 3.07 CLOSEOUT ACTIVITIES
 - A. Refer to Division 01 - Closeout Submittals, for closeout submittals.
 - B. Refer to Division 01 - Demonstration and Training, for additional requirements.
 - C. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.
 - D. Just prior to Substantial Completion, replace all lamps that have failed.
- 3.08 PROTECTION
 - A. Protect installed luminaires from subsequent construction operations.
- END OF SECTION

SECTION 27 1000 - STRUCTURED CABLING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Communications system design requirements.
- B. Communications pathways.
- C. Communications equipment room fittings.
- D. Communications outlets.
- E. Communications identification.

1.02 REFERENCE STANDARDS

- A. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition 2019.
- B. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment Revision E, 2005.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set 2019.
- E. TIA-568.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards 2009c, with Addendum (2016).
- F. TIA-569 - Telecommunications Pathways and Spaces 2019e.
- G. TIA-606 - Administration Standard for Telecommunications Infrastructure 2017c.
- H. TIA-607 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises 2019d.
- I. UL 444 - Communications Cables Current Edition, Including All Revisions.
- J. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers Current Edition, Including All Revisions.
- K. UL 1863 - Communications-Circuit Accessories Current Edition, Including All Revisions.

1.03 COMMON WORK RESULTS

- A. Provide common work results and execution according to Division 26 requirements.

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 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. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
- 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).
- D. Evidence of qualifications for installer.
- E. Field Test Reports.
- F. 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 drawings.
- G. 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

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. Refer to Division 01 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a 2 year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cabling and Equipment:

2.02 SYSTEM DESIGN

- A. Provide a complete permanent system of cabling and pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.
 - 1. Provide fixed cables and pathways that comply with NFPA 70 and TIA-607 and are UL listed or third party independent testing laboratory certified.
 - 2. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F (0 to 60 degrees C) at relative humidity of 0 to 95 percent, noncondensing.

3. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.
 - B. System Description:
 1. Building Entrance Cable: Copper, 100 -pair.
 2. Offices and Work Areas: Provide one voice outlet and one data outlet in each work area minimum. Refer to plans for locations and additional requirements.
 - C. 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.
 - D. Intermediate Distribution Frames (IDF): Support structures for terminating horizontal cables that extend to telecommunications outlets.
 1. Locate intermediate distribution frames as indicated on the drawings.
 - E. Backbone Cabling: Cabling, pathways, and terminal hardware connecting intermediate distribution frames (IDF's) with main distribution frame (MDF), wired in star topology with main distribution frame at center hub of star.
 - F. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".
- 2.03 PATHWAYS
- A. Conduit: As specified in Section 26 0533.13; provide pull cords in all conduit.
- 2.04 COPPER CABLE AND TERMINATIONS
- A. Copper Horizontal Cable:
1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568.2 and listed and labeled as complying with UL 444.
 2. Cable Type - Voice and Data: TIA-568-C.2 Category 5e UTP (unshielded twisted pair); 24 AWG.
 3. Cable Capacity: 4-pair.
 4. Cable Applications:
 - a. Riser Applications: Use listed NFPA 70 Type CMR riser cable or Type CMP plenum cable.
 - b. General Purpose Applications: Use listed NFPA 70 Type CM/CMG general purpose cable, Type CMR riser cable, or Type CMP plenum cable.
 5. Cable Jacket Color - Data Cable: Blue.
 6. Cable Jacket Color - Voice Cable: White.
- B. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.
- C. Jacks and Connectors: Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.
 1. Performance: 500 mating cycles.
 2. Voice and Data Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.
- 2.05 COMMUNICATIONS EQUIPMENT ROOM FITTINGS
- A. Copper Cross-Connection Equipment:
1. Connector Blocks for Category 5e and Up Cabling: Type 110 insulation displacement connectors; capacity sufficient for cables to be terminated plus 25 percent spare.
 2. Patch Panels for Copper Cabling: Sized to fit EIA/ECA-310 standard 19 inch (482.6 mm) wide equipment racks; 0.09 inch (2.2 mm) thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface.
 - a. Jacks: Non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel.
 - b. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.
 - c. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.
 - d. Provide incoming cable strain relief and routing guides on back of panel.
- B. Backboards: Interior grade plywood without voids, 3/4 inch (19 mm) thick; UL-labeled fire-retardant.
 1. Do not paint over UL label.
- C. Equipment Frames, Racks and Cabinets:
1. Component Racks: EIA/ECA-310 standard 19 inch (482.6 mm) wide.
 2. Wall Mounted Racks: Steel construction, hinged to allow access to back of installed components.
 3. Wall Mounted Cabinets: Front doors with locks, louvered side panels, top and bottom cable access, and ground lug.
 4. Cabinets: Steel construction with corrosion resistant finish.
 5. Locks: Keyed alike.
- 2.06 COMMUNICATIONS OUTLETS
- A. Outlet Boxes: Comply with Section 26 0533.16.
 1. Provide depth to accommodate cable manufacturer's recommended minimum conductor bend radius.
- B. Wall Plates:
1. Comply with system design standards and UL 514C.
 2. Accepts modular jacks/inserts.
 3. Capacity:
 - a. Voice Only Outlets: 2 ports.
 - b. Data or Combination Voice/Data Outlets: 4 ports.

4. Wall Plate Material/Finish - Flush-Mounted Outlets: Match wiring device and wall plate finishes specified in Section 26 2726. All line and low voltage device and wall plate color and finish shall match within each area.
- 2.07 IDENTIFICATION PRODUCTS
- A. Comply with TIA-606.
- 2.08 SOURCE QUALITY CONTROL
- A. Refer to Division 01 - Quality Requirements, for additional requirements.
 - B. Factory test cables according to TIA-568 (SET).
- PART 3 EXECUTION
- 3.01 INSTALLATION - GENERAL
- A. Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569 (pathways), TIA-607 (grounding and bonding), BICSI N1, NFPA 70, and SYSTEM DESIGN as specified in PART 2.
 - B. Comply with Communication Service Provider requirements.
 - C. Grounding and Bonding: Perform in accordance with TIA-607 and NFPA 70.
 - D. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- 3.02 INSTALLATION OF PATHWAYS
- A. Install pathways with the following minimum clearances:
 1. 48 inches (1220 mm) from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
 2. 12 inches (300 mm) from power conduits and cables and panelboards.
 3. 5 inches (125 mm) from fluorescent and high frequency lighting fixtures.
 4. 6 inches (150 mm) from flues, hot water pipes, and steam pipes.
 - B. Conduit, in Addition to Requirements of Section 26 0533.13:
 - C. Outlet Boxes:
 1. Coordinate locations of outlet boxes provided under Section 26 0533.16 for installation of telecommunications outlets provided under this section.
 - a. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
 - b. Provide minimum of 24 inches (600 mm) horizontal separation between flush mounted outlet boxes installed on opposite sides of fire rated walls.
 - c. Unless otherwise indicated, provide separate outlet boxes for line voltage and low voltage devices.
- 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.
 - B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
 1. At Distribution Frames: 120 inches (3000 mm).
 2. At Outlets - Copper: 12 inches (305 mm).
 3. At Outlets - Optical Fiber: 39 inches (1000 mm).
 - C. Copper Cabling:
 1. Category 5e and Above: Maintain cable geometry; do not untwist more than 1/2 inch (12 mm) from point of termination.
 2. For 4-pair cables in conduit, do not exceed 25 pounds (110 N) pull tension.
 3. Use T568B wiring configuration.
 - D. Wall-Mounted Racks and Enclosures:
 1. Install to plywood backboards only, unless otherwise indicated.
 2. Mount so height of topmost panel does not exceed 78 inches (1980 mm) above floor.
 - E. Floor-Mounted Racks and Enclosures: Permanently anchor to floor in accordance with manufacturer's recommendations.
 - F. Identification:
 1. Use wire and cable markers to identify cables at each end.
 2. Use manufacturer-furnished label inserts, identification labels, or engraved wallplate to identify each jack at communications outlets with unique identifier.
 3. Use identification nameplate to identify cross-connection equipment, equipment racks, and cabinets.
- 3.04 FIELD QUALITY CONTROL
- A. Refer to Division 01 - Quality Requirements, for additional requirements.
 - B. Comply with inspection and testing requirements of specified installation standards.
 - C. 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.
 - D. Testing - Copper Cabling and Associated Equipment:
 1. Test operation of shorting bars in connection blocks.
 2. Category 5e and Above Backbone: Perform near end cross talk (NEXT) and attenuation tests.
 3. Category 5e and Above Links: Perform tests for wire map, length, attenuation, NEXT, and propagation delay.

E. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

END OF SECTION

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SECTION 27 5129.13 - RESCUE ASSISTANCE SIGNAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Area of refuge/rescue assistance emergency communication system and associated call stations, control stations, and accessories.

1.02 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- C. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. NFPA 72 - National Fire Alarm and Signaling Code Most Recent Edition Cited by Referring Code or Reference Standard.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for area of refuge/rescue assistance system components.
 - 2. Coordinate the work with other installers to provide communication lines required for control station timed automatic connection to designated constantly attended monitoring location.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install call stations and control station(s) until final surface finishes and painting are complete.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.
- C. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include system interconnection schematic diagrams.
- D. Design Data: Include standby battery calculations.
- E. Evidence of qualifications for installer.
- F. Specimen Warranty: Submit sample of manufacturer's warranty.
- G. 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 operation of product.
- H. Manufacturer's certification that products meet or exceed specified requirements.
- I. Operation and Maintenance Data: Include detailed information on system operation, equipment setup, replacement parts, and recommended maintenance procedures and intervals.
 - 1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.
- J. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- K. Maintenance contracts.
- L. Project Record Documents: Record actual locations of system components and installed wiring arrangements and routing.

1.05 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. ADA Standards.
 - 2. ICC (IBC) (International Building Code).
 - 3. NFPA 70 (National Electrical Code).
 - 4. NFPA 72 (National Fire Alarm and Signaling Code).
 - 5. The requirements of the State Fire Marshal.
 - 6. The requirements of the local authorities having jurisdiction.
 - 7. Applicable TIA/EIA standards.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Installer Qualifications: Company with minimum three years documented experience with similar area of refuge/rescue assistance systems and providing contract maintenance service as a regular part of their business; manufacturer's authorized installer.
- D. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.07 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

- B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Area of Refuge/Rescue Assistance Communication System:
 - 1. Alpha Communications
 - 2. Cornell Communications: www.cornell.com.
 - 3. Jeron
 - 4. Rath Microtech: www.area-of-refuge.com/#sle.
 - 5. Talk-A-Phone
- B. Substitutions: See Section 01 6000 - Product Requirements.
- 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 system components and accessories produced by a single manufacturer and obtained from a single supplier.

2.02 AREA OF REFUGE/RESCUE ASSISTANCE COMMUNICATION SYSTEM

- A. Provide new area of refuge/rescue assistance communication system consisting of all required equipment, conduit, boxes, wiring, connectors, hardware, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. System Description:
 - 1. Call Stations: Located at each designated area of refuge/rescue assistance as indicated on drawings, unless otherwise directed by authorities having jurisdiction.
 - 2. Master Control Station: New, located as indicated on drawings, unless otherwise directed by authorities having jurisdiction.
 - 3. Provide secondary control station(s) located as indicated on drawings.
 - 4. System battery backup is required.
 - 5. Timed automatic connection to designated constantly attended monitoring location is required.
 - 6. Minimum Number of Zones Supported: As required for call stations/zones indicated with minimum 20 percent spare capacity.
 - 7. Interface with Other Equipment:
 - a. phone system.
- C. System Operation:
 - 1. When a call for assistance is initiated at call station:
 - a. Provide audible and visual notification at call station to confirm that call has been placed.
 - b. Provide audible and visual notification at control station(s) that call has been placed and annunciate the location of the call station/zone that initiated a call.
 - c. Maintain visual notification of each call location at control station(s) until manually reset by control station operator.
 - d. Maintain audible notification at control station(s) that call(s) have been placed until call is acknowledged by control station operator.
 - e. Maintain visual notification at call station until manually reset by control station operator.
 - 2. When a call for assistance is acknowledged at control station:
 - a. Provide visual notification at control station that call has been acknowledged.
 - b. Provide visual notification at call station that call has been received.
 - c. Establish two-way voice communication between call station and control station.
 - 3. When a call has not been acknowledged during a programmed time delay to allow for local response, automatically initiate call to listed remote monitoring station under contract with facility, send signal identifying specific building, and establish two-way voice communication.
- D. Call Station(s):
 - 1. Suitable for the environment where installed.
 - 2. Finish: Painted steel or stainless steel.
 - 3. Mounting: As indicated on drawings.
 - 4. Provides means to initiate call for assistance.
 - 5. Provides for distinct audible and visual notification to confirm that call has been placed and for distinct visual notification that call has been acknowledged.
 - 6. Following initial call for assistance, provides for hands-free two-way communication with control station(s).
- E. Control Station(s):
 - 1. Suitable for the environment where installed.
 - 2. Mounting: As indicated on drawings.
 - 3. Provides visual notification that system is operational.
 - 4. Provides for distinct audible and visual notification of calls with annunciation of call station/zone locations.
 - 5. Provides for two-way communication with selected call stations.
 - 6. Provides for supervision of system wiring and provides distinct audible and visual notification of faults.
 - 7. Audible Notification Sound Level: Not less than 90 dB.
 - 8. Finish: Stainless Steel
 - 9. Provide Speaker phone system
- F. Accessories:
 - 1. Provide components as indicated for a complete operating system.

2. Wiring: Provide manufacturer's recommended cables as indicated for connections between system components, and in accordance with wiring methods indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that characteristics of system components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive system components.
- 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. Mounting Heights:
 1. Call Stations: As indicated on drawings.
 2. Control Stations: As indicated on drawings.
- D. Wiring: Comply with NFPA 70, Article 800 and manufacturer recommendations for routing, locations, conduits, and conductor types. Unless otherwise indicated, use cables (not in conduit).
 1. Use 2-hour fire-rated circuit integrity (CI) cable or 2-hour fire-rated mineral-insulated, metal-sheathed (MI) cable in accordance with NFPA 72 Level 2/Level 3 pathway survivability requirements.
 2. Use listed plenum rated cables in spaces used for environmental air.
 3. Install wiring in conduit where required for rough-in, where required by authorities having jurisdiction, and where exposed to damage.
 4. Conduit: Comply with Section 26 0533.13.
 5. Conceal all cables unless specifically indicated to be exposed.
 6. Cables in the following areas may be exposed, unless otherwise indicated:
 - a. Equipment closets.
 7. Route exposed cables parallel or perpendicular to building structural members and surfaces.
- E. Provide grounding and bonding in accordance with Section 26 0526.
- F. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- G. Identify system wiring and components in accordance with Section 26 0553.
- H. Identify zones at control station(s) to indicate call station locations.
- I. Provide required instructional signage at each call station.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Test to verify wiring is free of shorts and grounds.
- C. Prepare and start system in accordance with manufacturer's instructions.
- D. Test system for proper operation.
- E. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.
- F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.
- D. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
 1. Use operation and maintenance manual as training reference, supplemented with additional training materials.
 2. Provide minimum of 1 hour of training.
 3. Instructor: Manufacturer's authorized representative.
 4. Location: At project site.

3.06 PROTECTION

- A. Protect installed system components from subsequent construction operations.

3.07 MAINTENANCE

- A. See Section 01 7900 - Demonstration and Training, for additional requirements relating to maintenance service.
- B. Provide to Owner, a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of area of refuge/rescue assistance system for one year from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.
- C. Conduct site visit at least once every three months to perform inspection, testing, and preventive maintenance. Submit report to Owner indicating maintenance performed along with evaluations and recommendations.
- D. Provide trouble call-back service upon notification by Owner:
 1. Include allowance for call-back service during normal working hours at no extra cost to Owner.
 2. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.
- E. Maintain an on-site log listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced.

END OF SECTION

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SECTION 28 1000 - ACCESS CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Access control system requirements.
- B. Access control units and software.
- C. Access control point peripherals, including readers and keypads.
- D. Accessories.
- E. Access control devices.
- F. Access control panel.
- G. Access control software.

1.02 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 294 - Access Control System Units Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other installers to provide suitable door hardware for both access control functionality and code compliance.
 - 2. Coordinate the placement of readers with millwork, furniture, equipment, etc. installed under other sections.
 - 3. Coordinate the work with other installers to provide power for equipment at required locations.
 - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include elevations and details of proposed equipment arrangements. Include system interconnection schematic diagrams. Include requirements for interface with other systems.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed 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, installation, and operation of product.
- E. Maintenance contracts.
- F. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
 - 1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.
- G. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. NFPA 70.
 - 2. The requirements of the local authorities having jurisdiction.
 - 3. Applicable TIA/EIA standards.

1.06 WARRANTY

- A. Refer to Division 01 - Closeout Submittals, for additional warranty requirements.
- B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Access Control Units:
 - 1. Bosch Security Systems: www.boschsecurity.us/#sle.
 - 2. DoorKing, Inc: www.doorking.com/#sle.
 - 3. Honeywell International, Inc: www.honeywellaccess.com/#sle.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Readers and Keypads:
 - 1. Bosch Security Systems: www.boschsecurity.us/#sle.
 - 2. DoorKing, Inc: www.doorking.com/#sle.
 - 3. Honeywell International, Inc: www.honeywellaccess.com/#sle.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- C. Access Control System:
 - 1. Bosch Security Systems: www.boschsecurity.us/#sle.
 - 2. Honeywell International, Inc: www.honeywellaccess.com/#sle.
- D. 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.
- E. Source Limitations: Where possible, furnish system components and accessories produced by a single manufacturer and obtained from a single supplier.

2.02 ACCESS CONTROL SYSTEM REQUIREMENTS

- A. Provide new access control system consisting of required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. System Battery Backup: Provide batteries/uninterruptible power supplies (UPS) for 60 minutes full operation.
- C. Access Control Points:
 - 1. Refer to drawings for peripheral device locations.
 - 2. See article "ACCESS CONTROL POINT PERIPHERALS" below for device descriptions.
- D. Interface with Other Systems:
 - 1. Provide products compatible with other systems requiring interface with access control system.
 - 2. Interface with electrically operated door hardware as specified in Section 08 7100.
 - a. Capable of locking/unlocking/releasing controlled doors.
 - 3. Interface with video surveillance system as specified in Section 28 2000.
- E. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - 1. Access Control Units and Readers: Listed and labeled as complying with UL 294.
 - 2. Exterior Doors: Control access into building.

2.03 ACCESS CONTROL UNITS AND SOFTWARE

- A. Provide access control units and software compatible with readers to be connected.
- B. Unless otherwise indicated, provide software and licenses required for fully operational system.
- C. Access Control Unit:
 - 1. Features:
 - a. Dedicated power loss alarm input.
 - b. Supports database and event exporting.
 - c. Supports database backup.
 - d. Integral backup battery system.
- D. Computers:
 - 1. Workstation Computers: Unless otherwise indicated, workstation computer hardware and associated peripherals not furnished by access control system manufacturer to be provided by Contractor as part of work of this section, meeting access control system equipment manufacturer's recommended requirements.
- E. Software:
 - 1. Unless otherwise indicated, provide all software and licenses required for fully operational system.

2.04 ACCESS CONTROL POINT PERIPHERALS

- A. Provide devices compatible with control units and software.
- B. Provide devices suitable for operation under the service conditions at the installed location.
- C. Readers and Keypads:
 - 1. General Requirements:
 - a. Provide readers compatible with credentials to be used.
 - b. Color: To be selected by Architect from manufacturer's available standard colors.
 - 2. Contactless Smart Card Reader:
 - 3. Proximity Reader:
- D. Provide readers compatible with credentials to be used.
- E. Reader Color: To be selected by Architect from manufacturer's available standard colors.
- F. Proximity Readers:
 - 1. Utilizes 125 kHz RF communication with compatible credentials.
- G. Door Position Switches:
 - 1. Magnetic Contacts: Encapsulated reed switch(es) and separate magnet; designed to monitor opened/closed position of doors.
 - 2. Contact Color: To be selected by Architect from manufacturer's available standard colors.
- H. Request to Exit Devices:
 - 1. Pushbuttons:
 - 2. Motion Sensors: Passive infrared.
 - 3. Door Hardware with Integral Request to Exit Switches: Comply with Section 08 7100.
- I. Door Locking Devices (Electric Strikes and Magnetic Locks): Comply with Section 08 7100.

2.05 ACCESSORIES

- A. Provide components as indicated for connection of access control system to devices and other systems indicated.
- B. Unless otherwise indicated, credentials to be provided by Contractor.
 - 1. Provide credentials compatible with readers and control units/software to be used.
- C. Provide cables as indicated for connections between system components.
- D. Provide accessory racks/cabinets as indicated for equipment mounting.
- E. Security Access Control Panel.
- F. Encoded Card Readers.
- G. Encoded Cards/Fobs.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install access control system in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Wiring Method: Unless otherwise indicated, use cables (not in conduit).
 - 1. Use suitable listed cables in wet locations, including underground raceways.
 - 2. Use suitable listed cables for vertical riser applications.
 - 3. Use listed plenum rated cables in spaces used for environmental air.

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4. Install wiring in conduit for the following:
 - a. Where required for rough-in.
 - b. Where required by authorities having jurisdiction.
 - c. Where exposed to damage.
 - d. Where installed outside the building.
 - e. For exposed connections from outlet boxes to devices.
 5. Conduit: Comply with Section 26 0533.13.
 6. Conceal cables unless specifically indicated to be exposed.
 7. Use power transfer hinges complying with Section 08 7100 for concealed connections to door hardware.
 8. Cables in the following areas may be exposed, unless otherwise indicated:
 - a. Equipment closets.
 9. Route exposed cables parallel or perpendicular to building structural members and surfaces.
 10. Do not exceed manufacturer's recommended maximum cable length between components.
 - D. Provide grounding and bonding in accordance with Section 26 0526.
 - E. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
 - F. Identify system wiring and components in accordance with Section 26 0553.
- 3.02 CLOSEOUT ACTIVITIES
- A. Refer to Division 01 - Closeout Submittals, for closeout submittals.
 - B. Refer to Division 01 - Demonstration and Training, for additional requirements.
 - C. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.
 - D. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
 1. Use operation and maintenance manual as training reference, supplemented with additional training materials.
- 3.03 PROTECTION
- A. Protect installed system components from subsequent construction operations.
- 3.04 MAINTENANCE
- A. Refer to Division 01 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
 - B. Provide to Owner, at no extra cost, a separate maintenance contract for the service and maintenance of access control system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.
 - C. Provide trouble call-back service upon notification by Owner:
 1. Include allowance for call-back service during normal working hours at no extra cost to Owner.
 2. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.
- END OF SECTION

SECTION 28 2000 - VIDEO SURVEILLANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Video surveillance system requirements.
- B. Video recording and viewing equipment.
- C. Cameras.
- D. Accessories.
- E. Video management software.

1.02 REFERENCE STANDARDS

- A. 47 CFR 15 - Radio Frequency Devices current edition.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NECA 303 - Standard for Installing Closed-Circuit Television (CCTV) Systems 2005.
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of cameras with structural members, ductwork, piping, equipment, luminaires, diffusers, fire suppression system components, and other potential conflicts installed under other sections.
 - 2. Coordinate the work with other installers to provide power for cameras and equipment at required locations.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include elevations and details of proposed equipment arrangements. Include system interconnection schematic diagrams. Include requirements for interface with other systems.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.
- D. Design Data:
 - 1. Standby battery/UPS calculations.
 - 2. Video storage capacity calculations.
- 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 operation of product.
- F. Manufacturer's detailed field testing procedures.
- G. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
 - 1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.
- H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- I. Maintenance contracts.

1.05 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. NFPA 70.
 - 2. Applicable TIA/EIA standards.
- 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 three years documented experience with video surveillance systems of similar size, type, and complexity and providing contract maintenance service as a regular part of their business; authorized manufacturer's representative.
- D. Products: Furnish products listed and classified by testing firm acceptable to authority having jurisdiction as suitable for purpose specified and indicated.

1.06 WARRANTY

- A. Refer to Division 01 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Video Recording and Viewing Equipment - Basis of Design: Sony.
- B. Video Recording and Viewing Equipment- Other Acceptable Manufacturers:
 - 1. Bosch Security Systems: www.boschsecurity.us.
 - 2. Honeywell International, Inc: www.honeywellvideo.com.
 - 3. Pelco, a brand of Schneider Electric: www.pelco.com.
 - 4. S2.
 - 5. HANWHA
- C. Cameras - Basis of Design: Sony.
- D. Cameras:
 - 1. Bosch Security Systems: www.boschsecurity.us.
 - 2. Honeywell International, Inc: www.honeywellvideo.com.
 - 3. Pelco, a brand of Schneider Electric: www.pelco.com.
 - 4. S2.

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5. HANWHA
 - E. Substitutions: Refer to Division 01 - Product Requirements.
 - F. 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.
 - G. Video Management System:
 1. Bosch Security Systems: www.boschsecurity.us.
 2. S2.
- 2.02 VIDEO SURVEILLANCE SYSTEM
- A. Provide new video surveillance system consisting of all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
 - B. System Description: IP system with connection to network (IP) cameras.
 1. Video Storage Capacity: Suitable for storing video from all cameras for 30 days.
 2. System Battery Backup: Provide batteries/uninterruptible power supplies (UPS) for 120 minutes full operation.
 - C. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - D. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B, consumer application.
- 2.03 VIDEO RECORDING AND VIEWING EQUIPMENT
- A. Provide video recording and viewing equipment compatible with cameras to be connected.
 - B. Network Video Recorders (NVRs):
 1. Supports connection of network (IP) cameras.
 2. Supports continuous and event-based recording.
 3. Network Video Recorder Type [____]:
 - a. Storage Capacity: 2 TB.
 - b. Network: Single 1 Gigabit Ethernet.
 - C. Computers:
 1. Workstation Computers: Unless otherwise indicated, workstation computer hardware not furnished by video surveillance system manufacturer to be provided by Contractor as part of work of this section, meeting video surveillance system equipment manufacturer's minimum requirements.
 - D. Software:
 1. Unless otherwise indicated, provide all software and licenses required for fully operational system.
- 2.04 CAMERAS
- A. Provide cameras and associated accessories suitable for operation under the service conditions at the installed location. Provide additional components (e.g. enclosures, heaters, blowers, etc.).
 - B. Where not factory-installed, provide additional components (e.g. lenses, mounting accessories, etc.) as necessary for complete installation.
 - C. Network (IP) Cameras:
 1. Signal-to-Noise Ratio: Not less than 50 dB.
 2. Provide the following standard features:
 - a. Automatic electronic shutter.
 - b. Automatic gain control.
 - c. Automatic white balance.
 - d. Web-based interface for remote viewing and setup.
 - e. Password protected security access.
 3. Network (IP) Indoor Fixed Dome Camera:
 - a. Camera Type: True day/night with IR cut filter.
 - b. Image Sensor: 1/4 inch CMOS.
 - c. Resolution: Up to 1080p (1920 x 1080).
 - d. Frame Rate: Up to 30 frames per second (fps) at all available resolutions.
 - e. Minimum Illumination: 3 lux color, .1 lux black and white.
 - D. Camera Enclosures and Mounting Brackets:
 1. Where not factory-installed, provide accessory camera enclosures suitable for operation under the service conditions at the installed location.
 2. Where not factory-installed, provide accessory camera mounting brackets necessary for installation.
- 2.05 ACCESSORIES
- A. Provide components as indicated for connection of video surveillance system to devices and other systems indicated.
 - B. Provide components as indicated for system power and network connections.
 - C. Provide cables as indicated for connections between system components.
 1. Data Cables for IP Network Connections: Unshielded twisted pair (UTP), minimum Category 5e, complying with Section 27 1000.
 2. Analog Video Connections:
 - a. Coaxial Cables: Copper center conductor and 95 percent bare copper braid shield, minimum RG59/U.
 - b. Coaxial Connectors: BNC crimp-on type.
 - D. Provide accessory racks/cabinets as indicated for equipment mounting.
- PART 3 EXECUTION
- 3.01 INSTALLATION
- A. Install video surveillance system in accordance with NECA 1 (general workmanship) and NECA 303.
 - B. Install products in accordance with manufacturer's instructions.

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- C. Provide required support and attachment in accordance with Section 26 0529.
 - D. Wiring Method: Unless otherwise indicated, use cables (not in conduit).
 - 1. Use suitable listed cables in wet locations, including underground raceways.
 - 2. Use suitable listed cables for vertical riser applications.
 - 3. Use listed plenum rated cables in spaces used for environmental air.
 - 4. Install wiring in conduit for the following:
 - a. Where required for rough-in.
 - b. Where required by authorities having jurisdiction.
 - c. Where exposed to damage.
 - d. Where installed outside the building.
 - e. For exposed connections from outlet boxes to cameras.
 - 5. Conduit: Comply with Section 26 0533.13.
 - 6. Conceal all cables unless specifically indicated to be exposed.
 - 7. Cables in the following areas may be exposed, unless otherwise indicated:
 - a. Equipment closets.
 - 8. Route exposed cables parallel or perpendicular to building structural members and surfaces.
 - E. Provide grounding and bonding in accordance with Section 26 0526.
 - F. Identify system wiring and components in accordance with Section 26 0553.
- 3.02 FIELD QUALITY CONTROL
- A. Refer to Division 01 - Quality Requirements, for additional requirements.
 - B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.
 - C. Prepare and start system in accordance with manufacturer's instructions.
 - D. Adjust cameras to provide desired field of view and produce suitable images under all service lighting conditions.
 - E. Program system parameters according to requirements of Owner.
 - F. Test for proper interface with other systems.
 - G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.
- 3.03 CLOSEOUT ACTIVITIES
- A. Refer to Division 01 - Closeout Submittals, for closeout submittals.
 - B. Refer to Division 01 - Demonstration and Training, for additional requirements.
 - C. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.
 - D. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials.
- 3.04 MAINTENANCE
- A. Refer to Division 01 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
 - B. Provide to Owner, at no extra cost, a separate maintenance contract for the service and maintenance of video surveillance system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.
 - C. Provide trouble call-back service upon notification by Owner:
 - 1. Include allowance for call-back service during normal working hours at no extra cost to Owner.
 - 2. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

END OF SECTION

SECTION 28 4600 - FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire alarm system design and installation, including all components, wiring, and conduit.
- B. Transmitters for communication with supervising station.
- C. Maintenance of fire alarm system under contract for specified warranty period.

1.02 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits 2002 (Corrigendum 2012).
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 72 - National Fire Alarm and Signaling Code Most Recent Edition Cited by Referring Code or Reference Standard.
- F. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 864 - Standard for Control Units and Accessories for Fire Alarm Systems.
- H. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. Refer to Division 01 - Administrative Requirements, for submittal procedures.
- B. Evidence of designer qualifications.
- C. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
 - 1. Copy (if any) of list of data required by authority having jurisdiction.
 - 2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
 - 3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
 - 4. System zone boundaries and interfaces to fire safety systems.
 - 5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
 - 6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
 - 7. List of all devices on each signaling line circuit, with spare capacity indicated.
 - 8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
 - 9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
 - 10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
 - 11. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
- D. Evidence of installer qualifications.
- E. Evidence of instructor qualifications; training lesson plan outline.
- F. Evidence of maintenance contractor qualifications, if different from installer.
- G. Inspection and Test Reports:
 - 1. Submit inspection and test plan prior to closeout demonstration.
 - 2. Submit documentation of satisfactory inspections and tests.
 - 3. Submit NFPA 72 "Inspection and Test Form," filled out.
- H. Operating and Maintenance Data: Refer to Division 01 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
 - 1. Complete set of specified design documents, as approved by authority having jurisdiction.
 - 2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
 - 3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
 - 4. List of recommended spare parts, tools, and instruments for testing.
 - 5. Replacement parts list with current prices, and source of supply.
 - 6. Detailed troubleshooting guide and large scale input/output matrix.
 - 7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
 - 8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.
 - 9. Video recorded copy of training sessions.
- I. Project Record Documents: Refer to Division 01 for additional requirements; have one set available during closeout demonstration:
 - 1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
 - 2. "As installed" wiring and schematic diagrams, with final terminal identifications.
 - 3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.
- J. Closeout Documents:

1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
 2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
 3. Certificate of Occupancy.
 4. Maintenance contract.
- K. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
1. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.
 2. In addition to the items in quantities indicated in PART 2, furnish the following:
 - a. All tools, software, and documentation necessary to modify the fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes to system description, operation, and evacuation and instructional messages.
 - b. One copy, on CD-ROM, of all software not resident in read-only-memory.
- 1.04 QUALITY ASSURANCE
- A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.
 - B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
 1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
 2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
 3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
 - C. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
 - D. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.
- 1.05 WARRANTY
- A. Refer to Division 01 - Closeout Submittals, for additional warranty requirements.
 - B. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.
 - C. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.
- PART 2 PRODUCTS
- 2.01 MANUFACTURERS
- A. Fire Alarm Control Units: Provided their products meet or exceed the performance of the basis of design product, products of the following are acceptable:
 1. Honeywell Security & Fire Solutions/Notifier: www.notifier.com.
 2. Honeywell Security & Fire Solutions/Silent Knight: www.silentknight.com.
 3. Siemens Building Technologies, Inc: www.usa.siemens.com.
 4. Simplex, a Tyco Business: www.simplex-fire.com.
 5. Edwards Division of United Technologies: www.edwardsfiresafety.com
 6. Provide all control units made by the same manufacturer.
 - B. Initiating Devices and Notification Appliances:
 1. Provide initiating devices and notification appliances from same manufacturer as the control unit(s).
 - C. Substitutions: Refer to Division 01 - Product Requirements.
 1. For substitution of products by manufacturers not listed, submit product data showing features and certification by Contractor that the design will comply with Contract Documents.
- 2.02 FIRE ALARM SYSTEM
- A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
 1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
 2. Protected Premises: Entire building shown on drawings.
 3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
 - a. ADA Standards.
 - b. The requirements of the State Fire Marshal.
 - c. The requirements of the local authority having jurisdiction.
 - d. Applicable local codes.
 - e. Contract Documents (drawings and specifications).
 - f. NFPA 101.
 - g. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
 4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
 5. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
 6. Hearing Impaired Occupants: Provide visible notification devices in all public areas and in dwelling units.
 7. Master Control Unit (Panel): New, located at supervising station.
 - B. Supervising Stations and Fire Department Connections:
 1. Public Fire Department Notification: By remote supervising station.
 2. Remote Supervising Station: UL-listed central station under contract to facility.

3. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 telephone lines.
 - C. Circuits:
 1. Initiating Device Circuits (IDC): Class B, Style A.
 2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
 3. Notification Appliance Circuits (NAC): Class B, Style W.
 - D. Spare Capacity:
 1. Initiating Device Circuits: Minimum 25 percent spare capacity.
 2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
 3. Speaker Amplifiers: Minimum 25 percent spare capacity.
 4. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.
 - E. Power Sources:
 1. Primary: Dedicated branch circuits of the facility power distribution system.
 2. Secondary: Storage batteries.
 3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
 4. Each Computer System: Provide uninterruptible power supply (UPS).
- 2.03 FIRE SAFETY SYSTEMS INTERFACES
- A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
 1. Sprinkler water control valves.
 2. Dry-pipe sprinkler system pressure.
 3. Dry-pipe sprinkler valve room low temperature.
 4. Elevator shut-down control circuits.
 - B. Alarm: Provide alarm initiation in accordance with NFPA 72 and fire AHJ for the following:
 1. Sprinkler water flow.
 2. Kitchen hood suppression activation; also disconnect fuel source from cooking equipment.
 3. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.
 - C. Elevators:
 1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
 2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.
 3. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.
 - D. HVAC:
 1. Duct Smoke Detectors: Furnish with auxiliary contacts. Close dampers indicated; shut down air handlers indicated. Provide with smoke test port (Life Safety Test DSDS or approved equivalent).
 2. DDC Building Automation System: provide logical interface for communication of alarm system status with device type and location activated during alarm event. In the event an area smoke detector is activated, the respective area air handling system shall shut down to prevent spread of smoke.
 3. Combination fire smoke dampers: provide wiring from damper position switches and programming to indicate damper position during remote testing.
 4. Smoke dampers: provide wiring from damper position switches and programming to indicate damper position during remote testing.
 - E. Doors:
 1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 7100.
 2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from. Refer to Section 08 7100.
- 2.04 COMPONENTS
- A. General:
 1. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted unit are acceptable.
 2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.
 - B. Fire Alarm Control Units, Initiating Devices, and Notification Appliances: Digital, addressable type; listed, classified, and labeled as suitable for the purpose intended.
 - C. Master Control Unit: As specified for Basis of Design above, or equivalent.
 - D. Initiating Devices:
 1. Manual Pull Stations: Provide 10% extra
 2. Smoke Detectors: Provide 10% extra
 3. Duct Smoke Detectors: Provide 10% extra
 4. Heat Detectors: Provide 10% extra
 5. Addressable Interface Devices: Provide [10%] extra.
 6. Carbon Monoxide Detectors: Provide 10% extra.
 - E. Notification Appliances:
 1. Speakers: 520hz.
 - a. Provide 10% extra.
 2. Strobes: 177cd.
 - a. Provide 10% extra.
 3. Sounder Bases:
 - a. Provide 10% extra.

- F. Circuit Conductors: Copper or optical fiber; provide 200 feet (60 m) extra; color code and label.
- G. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
- H. Locks and Keys: Deliver keys to Owner.
- I. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
 - 1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
 - 2. Provide one for each control unit where operations are to be performed.
 - 3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
 - 4. Provide extra copy with operation and maintenance data submittal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide in accordance with applicable codes, NFPA 72, NFPA 70, and the contract documents.
- B. Provide final connections and interface units for associated devices. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
- C. Obtain AHJ and Owner approval of locations of devices, before installation.
- D. Install instruction cards and labels.

3.02 INSPECTION AND TESTING FOR COMPLETION

- A. Notify Owner 7 days prior to beginning completion inspections and tests.
- B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests.
- E. Provide all tools, software, and supplies required to accomplish inspection and testing.
- F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.
- H. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least 14 days without any system or equipment malfunctions.
 - 1. Record all system operations and malfunctions.
 - 2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
 - 3. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

3.03 Owner PERSONNEL INSTRUCTION

- A. Provide the following instruction to designated Owner personnel:
 - 1. Hands-On Instruction: On-site, using operational system.
- B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
 - 1. Initial Training: 1 session pre-closeout.
- C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
 - 1. Initial Training: 1 session pre-closeout.
- D. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.
- E. Video record all training sessions and provide copy to owner with owner closeout submittals.

3.04 CLOSEOUT

- A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
 - 1. Be prepared to conduct any of the required tests.
 - 2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
 - 3. Have authorized technical representative of control unit manufacturer present during demonstration.
 - 4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
 - 5. Repeat demonstration until successful.
- B. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
 - 1. Specified diagnostic period without malfunction has been completed.
 - 2. Approved operating and maintenance data has been delivered.
 - 3. Spare parts, extra materials, and tools have been delivered.
 - 4. All aspects of operation have been demonstrated to Owner.
 - 5. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
 - 6. Occupancy permit has been granted.
 - 7. Specified pre-closeout instruction is complete.

3.05 MAINTENANCE

- A. Refer to Division 01 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
- B. Provide to Owner, at no extra cost, a written maintenance contract for entire manufacturer's warranty period, to include the work described below.
- C. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
 - 1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
 - 2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.

3. Record keeping required by NFPA 72 and authorities having jurisdiction.
 - D. Provide trouble call-back service upon notification by Owner:
 1. Provide on-site response within 2 hours of notification.
 2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
 3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.
 - E. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.
 - F. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.
 - G. Comply with Owner's requirements for access to facility and security.
- END OF SECTION

SECTION 32 1720 - REPLACEABLE ADA TACTILE WARNING SURFACES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division 1 Specifications Section, apply to this Section.

1.02 DESCRIPTION

- A. This Section specifies furnishing and installing Replaceable Cast In Place Detectable/Tactile Warning Surface Tiles where indicated. Not recommended for asphalt applications.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's literature describing products, installation procedures and routine maintenance.
- B. Samples for Verification Purposes: Submit two (2) tile samples minimum 6"x6" of the kind proposed for use.
- C. Shop drawings are required for products specified showing fabrication details, composite structural system, tile surface profile, fastener and anchor locations, plans of tile placement including joints, and material to be used as well as outlining installation materials and procedure.
- D. Material Test Reports: Submit complete test reports from qualified accredited independent testing laboratories to qualify that materials proposed for use are in compliance with requirements and meet or exceed the properties indicated on the specifications. All tests shall be conducted on a Replaceable Cast In Place Detectable Tactile Warning Surface Tile system as certified by a qualified independent testing laboratory and be current within a 24 month period.
- E. Maintenance Instructions: Submit copies of manufacturer's specified installation and maintenance practices for each type of Detectable Warning Surface Tile and accessory.

1.04 QUALITY ASSURANCE

- A. Provide Replaceable Cast In Place Detectable/Tactile Warning Surface Tiles and accessories as produced by a single manufacturer with a minimum of three (3) years experience in the manufacturing of Cast In Place Detectable/Tactile Warning Surface Tiles.
- B. Installer's Qualifications: Engage an experienced installer certified in writing by Replaceable Cast In Place Detectable/Tactile Warning Surface Tile manufacturer as qualified for installation, who has successfully completed installations similar in material, design, and extent to that indicated for Project.
- C. Americans with Disabilities Act (ADA): Provide Replaceable Detectable/Tactile Warning Surface Tiles which comply with the detectable warnings on walking surfaces section of the Americans with Disabilities Act (Title III Regulations, 28 CFR Part 36 ADA STANDARDS FOR ACCESSIBLE DESIGN, Appendix A, Section 4.29.2 DETECTABLE WARNINGS ON WALKING SURFACES).
- D. California Code of Regulations (CCR): Provide only approved DSAAC detectable warning products as provided in the California Code of Regulations (CCR) Title 24, Section 1112A.9 and 1127B.5 for "Curb Ramps" and Section 1133B.8.5 for "Detectable Warnings at Hazardous Vehicular Areas".
- E. Vitrified Polymer Composite (VPC) Replaceable Cast In Place Detectable/Tactile Warning Surface Tiles shall be an epoxy polymer composition with an ultra violet stabilization coating employing aluminum oxide particles in the truncated domes. The tile shall incorporate an in-line pattern of truncated domes measuring nominal 0.2" height, 0.9" base diameter, and 0.45" top diameter, spaced center-to-center 3.4" as measured on a diagonal and 2.35" as measured side by side. For wheelchair safety the field area shall consist of a non-slip surface with a minimum of 40 - 90° raised points 0.045" high, per square inch; "Armor-Tile" as manufactured by Engineered Plastics Inc., Tel: 800-682-2525, or approved equal.
 - 1. Dimensions: Replaceable Cast In Place Detectable/Tactile Warning Surface Tiles shall be held within the following dimensions and tolerances:
 - a. Length and Width: as indicated on drawings.
 - b. Depth: .50 (1/2") (+/-) 5% max.
 - c. Face Thickness: 0.1875 (3/16") (+/-) 5% max.
 - d. Warpage of Edge: 0.5% max.
 - e. Fasteners/Anchors: 11 min.
 - 2. Water Absorption of Tile when tested by ASTM D 570-98 not to exceed 0.05%.
 - 3. Slip Resistance of Tile when tested by ASTM C 1028-96 the combined Wet and Dry Static Co-Efficient of Friction not to be less than 0.80 on top of domes and field area.
 - 4. Compressive Strength of Tile when tested by ASTM D 695-02a not to be less than 28,000 PSI.
 - 5. Tensile Strength of Tile when tested by ASTM D 638-03 not to be less than 19,000 PSI.
 - 6. Flexural Strength of Tile when tested by ASTM D 790-03 not to be less than 25,000 PSI.
 - 7. Chemical Stain Resistance of Tile when tested by ASTM D 543-95 (re approved 2001) to withstand without discoloration or staining - 10% hydrochloric acid, urine, saturated calcium chloride, black stamp pad ink, chewing gum, red aerosol paint, 10% ammonium hydroxide, 1% soap solution, turpentine, Urea 5%, diesel fuel and motor oil.
 - 8. Abrasive Wear of Tile when tested by BYK - Gardner Tester ASTM D 2486-00 with reciprocating linear motion of 37± cycles per minute over a 10" travel. The abrasive medium, a 40 grit Norton Metallite sand paper, to be fixed and leveled to a holder. The combined mass of the sled, weight and wood block is to be 3.2 lb. Average wear depth shall not exceed 0.060 after 1000 abrasion cycles when measured on the top surface of the dome representing the average of three measurement locations per sample.
 - 9. Resistance to Wear of Unglazed Ceramic Tile by Taber Abrasion per ASTM C501-84 (re approved 2002) shall not be less than 500.
 - 10. Fire Resistance of Tile when tested to ASTM E 84-05 flame spread shall be less than 15.
 - 11. Gardner Impact to Geometry "GE" of the standard when tested by ASTM D 5420-04 to have a mean failure energy expressed as a function of specimen thickness of not less than 550 in. lb f/in. A failure is noted when a crack is visible on either surface or when any brittle splitting is observed on the bottom plaque in the specimen.

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12. Accelerated Weathering of Tile when tested by ASTM G 155-05a for 3000 hours shall exhibit the following result – $\Delta E < 4.5$, as well as no deterioration, fading or chalking of surface of tile color No 33538.
 13. Accelerated Aging and Freeze Thaw Test of Tile and Adhesive System when tested to ASTM D 1026 shall show no evidence of cracking, delaminating, warpage, checking, blistering, color change, loosening of tiles or other detrimental defects.
 14. Salt and Spray Performance of Tile when tested to ASTM B 117-03 not to show any deterioration or other defects after 200 hours of exposure.
 15. AASHTO HB-17 single wheel HS20-44 loading "Standard Specifications for Highways and Bridges". The Replaceable Cast In Place Tile shall be mounted on a concrete platform with 1/32" airspace at the underside of the tile top plate then subjected to the specified maximum load of 10,400 lbs., corresponding to an 8000 lb individual wheel load and a 30% impact factor. The tile shall exhibit no visible damage at the maximum load of 10,400 lbs.
- 1.05 DELIVERY, STORAGE AND HANDLING**
- A. Replaceable Cast In Place Detectable/Tactile Warning Surface Tiles shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy plastic wrappings to protect tile from concrete residue during installation and tile type shall be identified by part number.
 - B. Replaceable Cast In Place Detectable/Tactile Warning Surface Tiles shall be delivered to location at building site for storage prior to installation.
- 1.06 SITE CONDITIONS**
- A. Environmental Conditions and Protection: Maintain minimum temperature of 40°F in spaces to receive Replaceable Cast In Place Detectable/Tactile Warning Surface Tiles for at least 24 hours prior to installation, during installation, and for not less than 24 hours after installation.
 - B. The use of water for work, cleaning or dust control, etc. shall be contained and controlled and shall not be allowed to come into contact with the general public. Provide barricades or screens to protect the general public.
- 1.07 GUARANTEE**
- A. A Replaceable Cast In Place Detectable/Tactile Warning Surface Tiles shall be guaranteed in writing for a period of five (5) years from date of final completion. The guarantee includes defective work, breakage, deformation, fading and loosening of tiles.
- PART 2 PRODUCTS**
- 2.01 MANUFACTURERS**
- A. The Vitrified Polymer Composite (VPC) Replaceable Cast In Place Detectable/Tactile Warning Surface Tile specified is based on Armor-Tile manufactured by Engineered Plastics Inc. (800-682-525) existing engineered and field tested products, which have been in successful service for a period of three (3) years are subject to compliance with requirements, may be incorporated in the work and shall meet or exceed the specified test criteria and characteristics.
 - B. Color: Yellow conforming to Federal Color No. 33538. Color shall be homogeneous throughout the tile. Tiles are also available in Light Grey (Federal Color No. 26280), Dark Grey (Federal Color No. 36118), Onyx Black (Federal Color No. 17038), Pearl White (Federal Color No. 37875), Brick Red (Federal Color No. 22144), Ocean Blue (Federal Color No. 15187), Ochre Yellow (Federal Color No. 23594), and Colonial Red (Federal Color No. 20109).
- PART 3 EXECUTION**
- 3.01 INSTALLATION**
- A. During Replaceable Cast In Place Detectable/Tactile Warning Surface Tile installation procedures, and shall meet or exceed the specified test criteria and characteristics. ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.
 - B. Prior to placement of the Replaceable Cast In Place Detectable/Tactile Warning Surface Tile system, review manufacturer's instructions and contract drawings with the Contractor prior to the construction and refer any and all discrepancies to Project Engineer.
 - C. The specifications and related materials shall be in strict accordance with the contract documents and the guidelines set by their respective manufacturers. Not recommended for asphalt applications.
 - D. The physical characteristics of the concrete shall be consistent with the contract specifications while maintaining a slump range of 4 - 7 to permit solid placement of the Replaceable Cast In Place Detectable/Tactile Warning Surface Tile system. An overly wet mix will cause the tile to float. Under these conditions, suitable weights such as sandbags shall be placed on tile.
 - E. The concrete pouring and finishing operations require typical mason's tools, however, a 4' long level with electronic slope readout, and 10 lb. sandbags are specific to the installation of the Replaceable Cast In Place Detectable/Tactile Warning Surface Tile system.
 - F. The factory-installed plastic sheeting must remain in place during the entire installation process to prevent the splashing of concrete onto the finished surface of the tile.
 - G. When preparing to set the tile, it is important that no concrete be removed in the area to accept the tile. It is imperative that the installation technique eliminates any air voids under the tile. Gaps in the tile perimeter allow air to escape during the installation process.
 - H. The concrete shall be poured and finished true and smooth to the required dimensions and slope prior to the tile placement. Immediately after finishing concrete, the electronic level should be used to check that the required slope is achieved. The tile shall be placed true and square to the curb edge in accordance with the contract drawings. The Replaceable Cast In Place Detectable/Tactile Warning Surface Tiles shall be tamped (or vibrated) into the fresh concrete to ensure that the field level of the tile is flush to the adjacent concrete surface. The embedment process should not be accomplished by stepping on the tile as this may cause uneven setting which can result in air voids under the tile surface. The contract drawings indicate that the tile field level (base of truncated dome) is flush to adjacent surfaces to permit proper water drainage and eliminate tripping hazards between adjacent finishes.

- I. In cold weather climates it is recommended that the Replaceable Cast In Place Detectable/Tactile Warning Surface Tiles be set deeper such that the top of domes are level to the adjacent concrete on the top and sides of ramp. This installation will reduce the possibility of damage due to snow clearing operations. Care should be taken to finish the concrete on the side of the tile with the lower elevation, adding channels to allow water to drain from the field surface of the tile.
 - J. Immediately after placement, the tile elevation is to be checked to adjacent concrete. The elevation and slope should be set consistent with contract drawings to permit water drainage to curb as the design dictates. Ensure that the field surface of the tile is flush with the surrounding concrete and back of curb so that no ponding is possible on the tile at the back side of curb.
 - K. While concrete is workable, a 1/8" radius edging tool shall be used to create a finished edge of concrete, then a steel trowel shall be used to finish the concrete around the tile's perimeter, flush to the field level of the tile.
 - L. During and after the tile installation and the concrete curing stage, it is imperative that there is no walking, leaning or external force placed on the tile that may rock the tile causing a void between the underside of tile and concrete.
 - M. Following tile placement, review installation tolerances to contract drawings and adjust tile before the concrete sets. Suitable weights of 10 to 25 lb each may be required to be placed on each tile as necessary to ensure solid contact of the underside of tile to concrete.
 - N. Following the concrete curing stage, protective plastic wrap is to be removed from the tile surface by cutting the plastic with a sharp knife, tight to the concrete/tile interface. If concrete bled under the plastic, a soft brass wire brush will clean the residue without damage to the tile surface.
 - O. Tiles can be cut to custom sizes, or to make a radius, using a continuous rim diamond blade in a circular saw or mini-grinder. Use of a straightedge to guide the cut is advisable where appropriate.
- 3.02 **REPLACING TILES, PROTECTING AND MAINTENANCE**
- A. Protect tiles against damage during construction period to comply with Tactile Tile manufacturer's specification.
 - B. Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.
 - C. Replace tiles by method specified by Tactile Tile manufacturer.
 - D. Comply with manufacturer's maintenance manual for cleaning and maintaining tile surface. It is recommended to perform annual inspections for safety and tile integrity.

END OF SECTION

SECTION 32 3134 - PARKING ACCESS CONTROL AND TICKETING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Security gates and barriers.
- B. Parking ticket dispenser
- C. Parking ticket receiving / payment device
- D. Parking Automatic Pay Station
- E. Controls and related wiring.
- F. Parking Management Software and Web Validation Software System

1.02 RELATED REQUIREMENTS

- A. Section 26 0533.13 - Conduit for Electrical Systems: Empty conduit between system components.
- B. Section 26 0583 - Wiring Connections: Electrical power connections to the hydraulic power unit and controls.
- C. Section 31 2316 - Excavation: Excavating for footings, and utility trenching.
- D. Section 32 1216 - Asphalt Paving: Installation of adjacent paved surfaces.
- E. Section 32 1313 - Concrete Paving: Installation of adjacent paved surfaces.

1.03 REFERENCE STANDARDS

- A. ASTM F2200 - Standard Specification for Automated Vehicular Gate Construction 2020.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate installation of units with size, location and installation of service utilities.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of work of this section; require attendance by affected installers.
- C. Sequencing: Ensure that utility connections are completed in an orderly and expeditious manner.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Provide detailed drawings showing:
 - 1. Layout and overall dimensions of each major element of the parking ticketing and control access equipment, including the hydraulic power unit and operator control panels, if applicable.
 - 2. Foundation and anchoring requirements of the barrier equipment.
 - 3. Hydraulic schematic drawing showing size and number of hoses required to run between the barrier device and the hydraulic power unit.
 - 4. Electrical schematic including associated wiring, showing electrically connected components, including interface points for connection to equipment; indicate minimum conduit size and number of wires required to run between each component of the barrier equipment.
 - 5. Schematic drawings of the entire parking access and ticketing system, with manufacturer supplied equipment connected and integrated.
- C. Maintenance Contracts.
- D. Project Record Documents: After completion of field tests, provide updated drawings, showing exactly where equipment and controls are installed.
- E. Operation and Maintenance Data.
- F. Software: Copy of software required for operation of products specified under this section.

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's Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.
- C. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Store materials in a manner to ensure proper ventilation and drainage. Protect against damage, weather, vandalism and theft.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.
- C. Provide one year manufacturer warranty for materials and workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Parking garage access and security control equipment system: Basis-of-Design Product: Subject to compliance with requirements, provide equipment by TIBA Parking Systems as appended to this section or comparable product another approved manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions:
 - 1. Verify location of existing utilities, grades and conditions of substrate.
 - 2. Verify existing vehicle detector loops, including their size, geometry and wiring.
 - 3. Verify integration requirements with other site security equipment including but not limited to card readers, tire puncture devices, gates and other automated barrier systems.

3.02 PREPARATION

- A. Protect existing work from damage due to installation of this work.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

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- 3.04 FIELD QUALITY CONTROL
 - A. See Section 01 4000 - Quality Requirements, for additional requirements.
 - 3.05 SYSTEM STARTUP
 - A. Provide manufacturer's field representative to observe systems startup.
 - B. Prepare and start equipment in accordance with manufacturers' instructions and recommendations.
 - C. Adjust for proper operation within manufacturer's published tolerances.
 - 3.06 CLEANING
 - A. Touch up scratched surfaces using materials recommended by manufacturer. Match touchup paint color with barrier finish.
 - 3.07 CLOSEOUT ACTIVITIES
 - A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
 - B. See Section 01 7900 - Demonstration and Training, for additional requirements.
 - C. Demonstrate proper operation of equipment to Owner's designated representative.
 - D. Demonstration: Demonstrate operation of the barrier to Owner's personnel.
 - 1. Use operation and maintenance data as reference during demonstration.
 - 2. Briefly describe function, operation, and maintenance of each component.
 - E. Training: Train Owner's personnel on operation and maintenance of the barrier.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials.
 - 2. Provide minimum of two hours of training.
 - 3. Location: At project site.
 - 3.08 PROTECTION
 - A. Protect installed units from subsequent construction operations.
 - 3.09 MAINTENANCE
 - A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
 - B. Provide a separate maintenance contract for specified maintenance service.
- END OF SECTION

SECTION 33 4100 - SUBDRAINAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Building Perimeter, Retaining Wall, and Under-Slab Drainage Systems.

1.02 REFERENCE STANDARDS

- A. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2017.

PART 2 PRODUCTS

2.01 PIPE MATERIALS

- A. Polyvinyl Chloride Pipe: ASTM D2729; plain end, 4 inch (100 mm) inside diameter; with required fittings.
- B. Corrugated Plastic Tubing: Flexible type; 4 inch (100 mm) diameter, with required fittings.
- C. Use perforated pipe at subdrainage system; unperforated through sleeved walls.

2.02 AGGREGATE AND BEDDING

- A. Filter Aggregate and Bedding Material: Granular fill as specified in Section 31 2323.
- B. Filter Sand and Bedding Material: Sand as specified in Section 31 2323.

2.03 ACCESSORIES

- A. Pipe Couplings: Solid plastic.
- B. Joint Covers: No. 15 asphalt saturated roofing felt.
- C. Filter Fabric: Water pervious type, black fiberglass.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

3.02 PREPARATION

- A. Hand trim excavations to required elevations. Correct over-excavation with [_____].
- B. Remove large stones or other hard matter that could damage drainage piping or impede consistent backfilling or compaction.

3.03 INSTALLATION

- A. Install and join pipe and pipe fittings in accordance with pipe manufacturer's instructions.
- B. Place drainage pipe on clean cut subsoil.
- C. Lay pipe to slope gradients noted on drawings; with maximum variation from true slope of 1/8 inch (3 mm) in 10 feet (3 m).
- D. Place pipe with perforations facing down. Mechanically join pipe ends.
- E. Install pipe couplings.
- F. Install filter aggregate at sides, over joint covers and top of pipe. Provide top cover compacted thickness of 12 inches (300 mm).
- G. Place filter fabric over levelled top surface of aggregate cover prior to subsequent backfilling operations.
- H. Place aggregate in maximum 4 inch (100 mm) lifts, consolidating each lift.
- I. Refer to Section 31 2323 for compaction requirements. Do not displace or damage pipe when compacting.
- J. Connect to storm sewer system with unperforated pipe, through installed sleeves.
- K. Coordinate the Work with connection to municipal sewer utility service, and trenching.

3.04 FIELD QUALITY CONTROL

- A. Section 01 4000 - Quality Requirements: Field inspection and testing.
- B. Request inspection prior to and immediately after placing aggregate cover over pipe.

3.05 PROTECTION

- A. Protect pipe and aggregate cover from damage or displacement until backfilling operation begins.

END OF SECTION