INDIAN HEALTH SERVICE

Crow Hospital

Mold and Water Damage Repair

Bid Package 2 | Project Manual

Crow Agency, MT 59022
Bodwé Project No. 241532
IHS Contract No. 75H70125F30005
Issued for Bid – July 29, 2026

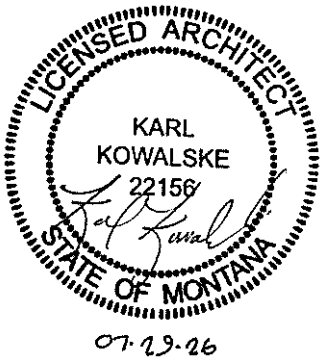
Steelhead
ENGINEERING co
Part of Bodwé Group

PROJECT MANUAL FOR:
INDIAN HEALTH SERVICE
CROW HOSPITAL WATER AND MOLD DAMAGE REPAIR
BID PACKAGE 2
CROW AGENCY, MT 59022

PREPARED FOR:
INDIAN HEALTH SERVICE
701 5TH AVENUE, SUITE 1650
SEATTLE, WA 98104

PREPARED BY:
STEELHEAD ENGINEERING, A BODWÉ COMPANY
259 E MICHIGAN AVE, SUITE 407
KALAMAZOO, MI 49007
W: BODWEGROUP.COM/COMPANIES/STEELHEAD-ENGINEERING

IN CONSULTATION WITH:
SEVEN GENERATIONS A+E, A BODWÉ COMPANY
NEHIL SIVAK



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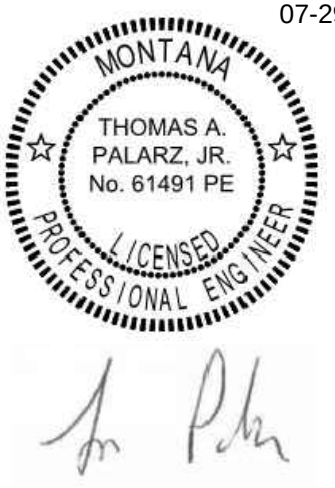

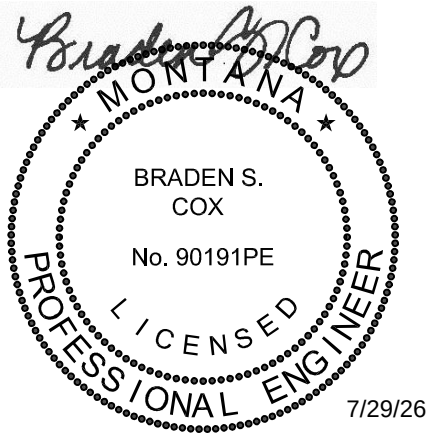

7/29/26

BODWÉ PROJECT NO. 241532-B
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JULY 29, 2026 - ISSUED FOR BID

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004325 SUBSTITUTION REQUEST FORM - DURING PROCUREMENT

PROJECT: IHS CROW HOSPITAL WATER AND MOLD DAMAGE REPAIR
PROJECT NO.: 241532-B

To: The Steelhead Engineering Company; Attention: Michelle Decker; email: mdecker@bodwegroup.com

Re: _____

From: _____ Date: _____

DESCRIPTION:

Specification Title: _____

Section No.: _____ Page: _____

Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____

Trade Name: _____

Model No.: _____

Website: _____

SUPPORTING DATA ATTACHED:

- Attached data to include product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are to be clearly identified.
- Attached data to also include a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

[ ] Drawings [ ] Product Data [ ] Samples [ ] Tests [ ] Reports [ ] _____

THE UNDERSIGNED CERTIFIES:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted by [Firm]: _____

Signed by:

Signature: _____

Print Name: _____

Address: _____

Email: _____

A/E'S REVIEW AND RECOMMENDATION:

[ ] Substitution approved - Make submittals in accordance with Specification Section 01 6000 Product Requirements, Substitution Procedures.

[ ] Substitution approved as noted - Make submittals in accordance with Specification Section 01 6000 Product Requirements, Substitution Procedures.

[ ] Substitution rejected - Use specified materials.

[ ] Substitution request received too late - Use specified materials.

Remarks _____

Signed by: _____ Date: _____

END OF SECTION

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SECTION 005433
DIGITAL/ELECTRONIC MEDIA DATA PROTOCOL - USE AGREEMENT

PART 1 GENERAL

1.01 FORM OF AGREEMENT

A. AIA Document C106 - 2013: Digital Data Licensing Agreement

1.02 AGREEMENT TO BE EXECUTED

A. Section 00 5433.01 - Digital/Electronic Media Data Protocol - EXHIBIT is attached following this page.

B. Use of agreement is to give license from the Architect/Engineer to the Receiving Party for the use of Digital Data on this project.

C. Sample AIA document is for showing content and expected agreement.

1.03 SUPPLEMENTAL INFORMATION TO THE LICENSING AGREEMENT

A. LICENSE CONDITIONS
   1. Receiving Party to use digital media to support this project's construction.
   2. Document is not to be returned as the required submittal requested in individual technical specification sections.

B. LICENSING FEE OR OTHER COMPENSATION
   1. No Cost.

C. DIGITAL DATA
   1. Electronic media copies of the documents are available upon written request.
      a. Architect will fill in AIA C106 after a formal request from Receiving Party and forward it for approval.
   2. Formal Request:
      a. List all documents requested.
      b. Indicate the format/version requested (.dwg, .rvt, .docx, etc.).
      c. Clearly identify the purpose for the request.
   3. After Requesting Party receives licensing agreement:
      a. Sign the form as indicated, including e-mail address and telephone number, and submit it accordingly to The Steelhead Engineering Company.

1.04 RELATED REQUIREMENTS

A. Section 00 7200 - General Conditions.

B. Section 00 7300 - Supplementary Conditions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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DRAFT

AIA® Document C106™ – 2022

Digital Data Licensing Agreement

AGREEMENT made as of the « » day of « » in the year « »
(In words, indicate day, month, and year.)

BETWEEN the Party transmitting Digital Data ("Transmitting Party"):
(Name, address, and contact information, including electronic addresses)

«The Steelhead Engineering Company, LLC»
«259 E. Michigan Avenue, Suite 407»
«Kalamazoo, MI 49007»
« »
« »

and the Party receiving the Digital Data ("Receiving Party"):
(Name, address, and contact information, including electronic addresses)

« »
« »
« »
« »
« »
« »
«»

for the following Project:
(Name and location or address of the Project)

« »
« »

for the following Digital Data ("Digital Data"):
(Identify below, in detail, the information created or stored in digital form that the Parties intend to be subject to this Agreement.)

«DRAFT CONTRACT »

The Transmitting Party and Receiving Party agree as follows.

TABLE OF ARTICLES

1 GENERAL PROVISIONS

2 TRANSMISSION OF DIGITAL DATA

3 LICENSE CONDITIONS

4 LICENSING FEE OR OTHER COMPENSATION

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 The purpose of this Agreement is to grant a license from the Transmitting Party to the Receiving Party for the Receiving Party's use of Digital Data and to set forth the license terms.

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

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User Notes: (1698065510)

§ 1.2 This Agreement is the entire and integrated agreement between the Parties. Except as specifically set forth herein, this Agreement does not create any other contractual relationship between the Parties.

§ 1.3 Confidential Digital Data is Digital Data containing confidential or business proprietary information that the Transmitting Party designates as "confidential."

ARTICLE 2 TRANSMISSION OF DIGITAL DATA

§ 2.1 The Transmitting Party grants to the Receiving Party a nonexclusive limited license to use the Digital Data solely and exclusively for the uses, and in accordance with the terms, set forth in Article 3.

§ 2.2 Only the Receiving Party is permitted to access and use the Digital Data. Unlicensed and unauthorized access or use by third parties is strictly prohibited except as set forth in Section 2.4.1.

§ 2.3 The transmission of Digital Data constitutes a warranty by the Transmitting Party to the Receiving Party that the Transmitting Party is the copyright owner of the Digital Data or otherwise has permission to transmit the Digital Data to the Receiving Party for its use on the Project in accordance with the terms and conditions of this Agreement.

§ 2.4 Where the Transmitting Party has designated information furnished pursuant to this Agreement as "confidential," the Receiving Party shall keep the information confidential and shall not disclose it to any other person or entity except as set forth in Section 2.4.1.

§ 2.4.1 The Receiving Party may disclose Confidential Digital Data after seven (7) days' notice to the Transmitting Party where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Receiving Party may also disclose Confidential Digital Data to its employees, consultants, sureties, subcontractors and their employees, sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.5 By transmitting Digital Data, the Transmitting Party does not convey any ownership right in the Digital Data or in the software used to generate the Digital Data. Unless otherwise granted in a separate license, the Receiving Party's right to use, modify, or further transmit Digital Data is specifically limited to those uses, and in accordance with the terms, set forth in Article 3, and nothing contained in this Agreement conveys any other right to use the Digital Data.

§ 2.6 To the fullest extent permitted by law, the Receiving Party shall indemnify and defend the Transmitting Party from and against all claims arising from or related to the Receiving Party's modification to, or unlicensed use of, the Digital Data.

§ 2.7 Transmission of the Digital Data does not abridge or extinguish the Transmitting Party's rights, including, to the extent applicable, exclusive ownership interest, in such information under all applicable state, federal, and international laws including, without limitation, laws governing the protection of copyrights and intellectual property.

§ 2.8 The provisions of this Article 2 shall survive the termination of this Agreement.

ARTICLE 3 LICENSE CONDITIONS

§ 3.1 The Receiving Party may use and rely upon the Digital Data to the extent set forth in this Article 3. *(Choose only one option below.)*

[**«X»**] **§ 3.1.1** The Digital Data is transmitted solely for the Receiving Party's information. Receiving Party acknowledges that any use of the Digital Data shall be at Receiving Party's sole risk. The Receiving Party accepts the Digital Data "as is" without any warranty or representations from the Transmitting Party as to whether the Digital Data is accurate, complete, or fit for use as intended by the Receiving Party. The Receiving Party is solely responsible for verifying whether the Digital Data is accurate, complete, or fit for the Receiving Party's intended use.

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User Notes: (1698065510)

[«X»] § 3.1.2 Other:
(Identify terms, permitted uses, or other conditions related to the Digital Data.)

«Shall not be substituted for preparation of submittal or shop drawings.»

§ 3.2 If no specific terms or uses are selected or set forth in Section 3.1, then the Receiving Party may use the Digital Data at its sole risk pursuant to the terms and conditions set forth in Section 3.1.1.

ARTICLE 4 LICENSING FEE OR OTHER COMPENSATION

The Receiving Party agrees to pay the Transmitting Party the following fee or other compensation for the Receiving Party's use of the Digital Data:
(State the fee, in dollars, or other method by which the Receiving Party will compensate the Transmitting Party for the Receiving Party's use of the Digital Data.)

«N/A »

This Agreement is entered into as of the day and year first written above and terminates one year from said date, except as set forth below.
(Indicate when this Agreement will terminate, if other than one year from the date it was entered into, and other conditions related to termination.)

« »

TRANSMITTING PARTY *(Signature)*	**RECEIVING PARTY** *(Signature)*
« »« »	« »« »
(Printed name and title)	*(Printed name and title)*

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User Notes: (1698065510)

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006325 SUBSTITUTION REQUEST FORM - DURING CONSTRUCTION

PROJECT: IHS CROW HOSPITAL WATER AND MOLD DAMAGE REPAIR
PROJECT NO.: 241532-B

To: The Steelhead Engineering Company; Attention: Michelle Decker; email: mdecker@bodwegroup.com

Re: _____

From: _____ Date: _____

DESCRIPTION:

Specification Title: _____

Section No.: _____ Page: _____

Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____

Trade Name: _____

Model No.: _____

Website: _____

Installer: _____

Address: _____

Telephone: _____

History: [ ] New Product [ ] 1-4 years old [ ] 5-10 years old [ ] More than 10 years old

Differences between proposed substitution and specified product:

_____

_____

_____

_____

Reason for not providing specified item:

_____

_____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

Date Installed: _____

Proposed Substitution affects other parts of the work: [ ] No [ ] Yes Explain:

_____

_____

_____

_____

Savings to Owner for accepting substitution: _____ [$ _____]

Proposed substitution changes contract time: [ ] No [ ] Yes [add] [deduct] _____ days

SUPPORTING DATA ATTACHED:

- Attached data to include product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are to be clearly identified.
- Attached data to also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

[ ] Drawings [ ] Product Data [ ] Samples [ ] Tests [ ] Reports [ ] _____

THE UNDERSIGNED CERTIFIES:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.

- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by [Firm]: _____

Signed by:

Signature: _____

Print Name: _____

Address: _____

Email: _____

Attachments: [ ]

A/E'S REVIEW AND RECOMMENDATION:

[ ] Substitution approved - Make submittals in accordance with Specification Section 01 3000 Submittal Procedures.

[ ] Substitution approved as noted - Make submittals in accordance with Specification Section 01 3000 Submittal Procedures.

[ ] Substitution rejected - Use specified materials.

Remarks _____

Signed by: _____ Date: _____

OWNERS REVIEW AND ACTION:

[ ] Substitution approved - Make submittals in accordance with Specification Section 01 3000 Submittal Procedures. Prepare Change Order.

[ ] Substitution approved as noted - Make submittals in accordance with Specification Section 01 3000 Submittal Procedures. Prepare Change Order.

[ ] Substitution rejected - Use specified materials.

Remarks _____

Signed by: _____ Date: _____

ADDITIONAL COMMENTS:

[ ] Contractor [ ] Subcontractor [ ] Supplier [ ] Manufacturer [ ] A/E

_____

_____

_____

_____

END OF SECTION

SECTION 011000
SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: IHS Crow Hospital Water and Mold Damage Repair BP2.

B. Project Location: Crow/ Northern Cheyenne Hospital at 1010 7650 East, Crow Agency, MT 59022.

C. Owner's Name: Indian Health Service.
   1. Project Identification/ Task Number: 75H70124D00014/75H70125F30005.
   2. Owner's Representative:
      a. Jerry Smith, P.E., IHS Contracting Officer Representative.
      b. Indian Health Service.
      c. Billings Area.
      d. Division of Facilities Management & Engineering.
      e. (406) 247-7091.

D. Architect's Name: The Steelhead Engineering Company, LLC (TSEC).
   1. David W. Martin, Senior Project Manager.
   2. 600 E. Michigan Ave, Ste. B, Kalamazoo, MI 49007.
   3. (269) 207-4634; dmartin@bodwegroup.com.

E. The Project consists of the alteration of departments, rooms and areas affected by mold and water damage.

1.02 CONTRACT DESCRIPTION

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

1.03 DESCRIPTION OF ALTERATIONS WORK

A. Scope of demolition and removal work is indicated on drawings and specified in Section 024100.

B. Renovate the following rooms and spaces, including demolition and/ or replacement of existing walls, doors, including frames and hardware, flooring, cabinetry, and ceiling tiles/ grid and other finishes or accessories as indicated on the drawings:
   1. Central Sterile Processing.
   2. Surgery.
   3. Supply and housekeeping rooms.
   4. Toilet and locker rooms.

C. Plumbing, Electrical, and Fire Suppression will be minimal, except for the complete reconfiguration of the Central Sterile Processing area. Replace existing fixtures as indicated in drawings.

D. HVAC: Replace existing system with new construction, keeping existing in operation until ready for changeover.

E. Contractor is required to remove, salvage, and store medical eqiupment prior to the start of work, for later installation by the Contractor as indicated in the equipment schedule.

F. Contractor is required to furnish and install medical equipment as indicated in the equipment schedule.

1.04 WORK BY OWNER

A. Cooperate fully with Owner, so work may be carried out smoothly, without interfering with or delaying Work under this Contract, or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

B. Items noted NIC (Not in Contract) will be supplied and installed by Owner after Date of Substantial Completion. Some items include:
   1. Procurement and installation of all movable furnishings.
   2. Minor relocation of existing equipment as indicated in the construction documents.

3. Movable cabinets.
4. Furnishings.

C. Owner will supply equipment for installation by Contractor as indicated in the equipment schedule.

1.05 OWNER OCCUPANCY

A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.

B. Owner intends to occupy the Project upon Substantial Completion.

C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations. Perform the Work so as not to interfere with Owner's day to day operations. Maintain existing exits unless otherwise indicated.

D. Schedule the Work to accommodate Owner occupancy.
1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without permission from the Owner and approval of authorities having jurisdiction.
2. Notify Owner not less than 72 hours in advance of activities that will affect Owner operations.

1.06 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.
1. Locate and conduct construction activities in ways that will limit disturbance to site.
2. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

B. Arrange use of site and premises to allow:
1. Owner occupancy.
2. Use of site and premises by the public.

C. 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.
3. Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees.
    a. Schedule deliveries to minimize use of driveways and entrances by construction operations; minimize space and time requirements for storage of materials and equipment on site;
    b. See Construction Documents for Contractor site access and staging areas to be developed and removed upon project completion.

D. Existing building spaces may be used for storage.

E. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

F. Time Restrictions:
1. Coordinate with Owner prior to start of construction.

G. Utility Outages and Shutdown:
1. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging for temporary utility services according to requirements indicated:
    a. Notify Owner not less than two days in advance of proposed utility interruptions.
    b. Obtain Owner's written permission before proceeding with utility interruptions.
2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
3. Prevent accidental disruption of utility services to other facilities.

H. Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, odors, or other disruption to Owner occupancy with Owner.
   1. Notify Owner not less than two days in advance of proposed disruptive operations.

I. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Owner's property is not permitted.

J. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 012500
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

A. Section 004325 - Substitution Request Form - During Procurement: Required form for substitution requests made prior to award of contract (During procurement).

B. Section 006325 - Substitution Request Form - During Construction: Required form for substitution requests made after award of contract (During construction).

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

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

E. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions: Restrictions on emissions of indoor substitute products.

1.03 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
   1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
      a. Unavailability.
      b. Regulatory changes.
   2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
      a. Substitution requests offering advantages solely to the Contractor will not be considered.

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

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

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

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

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Submittal Time Restrictions:

1. Owner will consider requests for substitutions only if submitted at least 10 days prior to the date for receipt of bids.

B. Submittal Form (before award of contract):
   1. Forms indicated in the Project Manual are adequate for this purpose, and must be used.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Submittal Form (after award of contract):
   1. Submit substitution requests by completing the form in Section 006325; see this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.

B. COR will consider requests for substitutions only within 15 days after date of Agreement.

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

D. Submit request for Substitution for Convenience within 14 days of discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by COR, 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.
      b. Other unanticipated project considerations.

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

3.04 RESOLUTION

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

B. COR will notify Contractor in writing of decision to accept or reject request.
   1. COR's decision following review of proposed substitution will be noted on the submitted form.

3.05 ACCEPTANCE

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

3.06 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

END OF SECTION

SECTION 013526
SAFETY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section contains infection control procedures for Work, performed within all areas of the facility.

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary.

B. Section 015000 - Temporary Facilities and Controls.

C. Section 017000 - Execution and Closeout Requirements.

D. Section 024100 - Demolition.

E. Section 061000 - Rough Carpentry.

F. Section 092116 - Gypsum Board Assemblies.

G. Section 099123 - Interior Painting.

H. Section 312200 - Grading.

1.03 REFERENCE STANDARDS

A. Latest publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

B. American Society of Safety Professionals (ASSP):
   1. Pre-Project and Pre-Task Safety and Health Planning.
   2. Protection of the Public on or Adjacent to Construction Sites.
   3. Basic Elements of an Employer's Program to Provide a Safe and Healthful Work Environment; American National Standards Institute Construction and Demolition Standards.
   4. Definitions and Nomenclature Used for Fall Protection and Fall Arrest.
   5. The Fall Protection Code.

C. American Society for Testing and Materials (ASTM):
   1. Surface Burning Characteristics of Building Materials.

D. The Facilities Guidelines Institute (FGI):
   1. FGI Guidelines - 2010 Guidelines for Design and Construction of Healthcare Facilities.

E. National Fire Protection Association (NFPA):
   1. Standard for Portable Fire Extinguishers.
   2. Flammable and Combustible Liquids Code.
   3. Standard for Fire Prevention During Welding, Cutting and Other Hot Work.
   4. National Electrical Code.
   5. Recommended Practice for Electrical Equipment Maintenance.
   6. Standard for Electrical Safety in the Workplace.
   7. Standard for Safeguarding Construction, Alteration, and Demolition Operations.
   8. Standard for Fire Retardant – Treated Wood and Fire-Retardant Coatings for Building Materials.

F. The Joint Commission (TJC):
   1. Comprehensive Accreditation and Certification Manual.

G. U.S. Occupational Safety and Health Administration (OSHA):
   1. Reporting and Recording Injuries and Illnesses.
   2. Safety and Health Regulations for General Industry.
   3. Safety and Health Regulations for Construction Industry.
   4. Multi-Employer Citation Policy.

1.04 DEFINITIONS

A. Critical Lift:

1. A lift with the hoisted load exceeding seventy-five (75) percent of the crane's maximum capacity; lifts made out of the view of the operator (blind picks); lifts involving two or more cranes; personnel being hoisted; and special hazards such as lifts over occupied facilities, loads lifted close to power-lines, and lifts in high winds or where other adverse environmental conditions exist; and any lift which the crane operator believes is critical.

B. OSHA "Competent Person" (CP):
   1. One who is capable of identifying existing and predictable hazards in the surroundings and working conditions which are unsanitary, hazardous or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them (see 29 CFR 1926.32(f)).

C. Competent Person, Confined Space:
   1. The CP, Confined Space, is a person meeting the competent person requirements as defined EM 385-1-1 Appendix Q, with thorough knowledge of OSHA's Confined Space Standard, 29 CFR 1910.146, and designated in writing to be responsible for the immediate supervision, implementation and monitoring of the confined space program, who through training, knowledge and experience in confined space entry is capable of identifying, evaluating and addressing existing and potential confined space hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

D. Competent Person, Cranes and Rigging:
   1. The CP, Cranes and Rigging, as defined in EM 385-1-1 Appendix Q, is a person meeting the competent person, who has been designated in writing to be responsible for the immediate supervision, implementation and monitoring of the Crane and Rigging Program, who through training, knowledge and experience in crane and rigging is capable of identifying, evaluating and addressing existing and potential hazards and, who has the authority to take prompt corrective measures regarding such hazards.

E. Competent Person, Excavation/Trenching:
   1. A CP, Excavation/Trenching, is a person meeting the competent person requirements as defined in EM 385-1-1 Appendix Q and 29 CFR 1926, who has been designated in writing to be responsible for the immediate supervision, implementation and monitoring of the excavation/trenching program, who through training, knowledge and experience in excavation/trenching is capable of identifying, evaluating and addressing existing and potential hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

F. Competent Person, Fall Protection:
   1. The CP, Fall Protection, is a person meeting the competent person requirements as defined in EM 385-1-1 Appendix Q and in accordance with ASSE/SAFE Z359.0, who has been designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the fall protection program, who through training, knowledge and experience in fall protection and rescue systems and equipment, is capable of identifying, evaluating and addressing existing and potential fall hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

G. Competent Person, Scaffolding:
   1. The CP, Scaffolding is a person meeting the competent person requirements in EM 385-1-1 Appendix Q and designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the scaffolding program. The CP for Scaffolding has enough training, knowledge and experience in scaffolding to correctly identify, evaluate and address existing and potential hazards and has the authority to take prompt corrective measures with regard to these hazards. CP qualifications must be documented and include experience on the specific scaffolding systems/types being used, assessment of the base material that the scaffold will be erected upon, load calculations for materials and personnel, and erection and dismantling. The CP for scaffolding must have a documented, minimum of 8-hours of scaffold training to include training on the specific type of scaffold being used (e.g. mast-climbing, adjustable, tubular frame), in accordance with EM 385-1-1 Section 22.B.02.

H. Competent Person (CP) Trainer:

1. A CP, Trainer as defined in EM 385-1-1 Appendix Q, who is qualified in the material presented, and who possesses a working knowledge of applicable technical regulations, standards, equipment and systems related to the subject matter on which they are training Competent Persons. A competent person trainer must be familiar with the typical hazards and the equipment used in the industry they are instructing. The training provided by the competent person trainer must be appropriate to that specific industry. The competent person trainer must evaluate the knowledge and skills of the competent persons as part of the training process.

I. High Risk Activities:
   1. High Risk Activities are activities that involve work at heights, crane and rigging, excavations and trenching, scaffolding, electrical work, and confined space entry.

J. Qualified Person (QP):
   1. Person who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.

K. Qualified Person, Fall Protection (QP for FP):
   1. A QP for FP is a person meeting the requirements of EM 385-1-1 Appendix Q, and ASSE/SAFE Z359.0, with a recognized degree or professional certificate and with extensive knowledge, training and experience in the fall protection and rescue field who is capable of designing, analyzing, and evaluating and specifying fall protection and rescue systems.

L. High Visibility Accident: Any mishap which may generate publicity or high visibility.

M. Mishap: Mishap in this specification is defined according to the EM 385-1-1. A mishap is any unplanned, undesired event that occurs during the course of work being performed. This includes accidents, incidents, and near misses.

N. Mishap Criticality Categories:
   1. No impact/Near-Miss – Near miss incidents that shall be investigated and reported to the COR within twenty-four (24) hours.
   2. Minor incident/impact – Incidents that require first aid or result in minor equipment damage (less than $5000). These incidents must be investigated and reported to the COR within twenty-four (24) hours.
   3. Moderate incident/impact – Any work-related injury or illness that results in:
      a. Days away from work (any time lost after day of injury/illness onset).
      b. Restricted work.
      c. Transfer to another job.
      d. Medical treatment beyond first aid.
      e. Loss of consciousness.
      f. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (a) through (e) above.
   4. Major incident/impact – Any mishap that leads to fatalities, hospitalizations, amputations, and losses of an eye as a result of contractors' activities. Or any incident which leads to major property damage (greater than $20,000) and/or may generate publicity or high visibility. These incidents must be investigated and are required to be reported as soon as practical, but not later than two (2) hours after the incident.

O. Load Handling Equipment (LHE):
   1. LHE is a term used to describe cranes, hoists and all other hoisting equipment (hoisting equipment means equipment, including crane, derricks, hoists and power operated equipment used with rigging to raise, lower or horizontally move a load).

P. Medical Treatment: Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by physician or registered personnel.

1.05 SUBMITTAL REQUIRMENTS

A. Preconstruction Submittals:
   1. Accident Prevention Plan (APP).

B. Reports:
   1. Monthly Contractor Health Safety and Environmental (HS and E) Performance Report.
   2. Notifications and Reports.
   3. Near-Miss Reports.

C. Load Handling Equipment (LHE) Inspection Reports.

D. Work Plans:
   1. Standard Lift Plan.
   2. Critical Lift Plan.
   3. Activity Hazard Analysis (AHA).
   4. Confined Space Entry Permit.
   5. Hot Work Permit.
   6. Portable Gauge Operations Planning Worksheet.

E. Certificates:
   1. Contractor Safety Self-Evaluation Checklist.
   2. Crane Operators/Riggers Certifications.
   3. Certificate of Compliance.
   4. Mobile Cranes Inspection Certificate.
   5. License Certificates.
   6. Machinery and Mechanized Equipment Certification Form.

1.06 ACCIDENT PREVENTION PLAN (APP)

A. The APP (aka Construction Safety and Health Plan) shall interface with the Contractor's overall safety and health program. Include any portions of the Contractor's overall safety and health program referenced in the APP in the applicable APP element and ensure it is site-specific. The Prime Contractor shall be the "controlling authority" for all worksite safety and health of each subcontractor(s). Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that Mishap prevention responsibilities are being carried out.

B. The APP shall be prepared as follows:
   1. Written in English by a qualified person who is employed by the Prime Contractor articulating the specific work and hazards pertaining to the contract. Specifically articulating the safety requirements found within these contract safety specifications.
   2. Address both the Prime Contractors and the subcontractors work operations.
   3. State measures to be taken to control hazards associated with materials, services, or equipment provided by suppliers.
   4. Address all the elements/sub-elements and in order as follows:
      a. SIGNATURE SHEET - Title, signature, and phone number of the following:
         1) Plan preparer (Qualified Person such as corporate safety staff person or contracted Certified Safety Professional with construction safety experience).
         2) Plan approver (company/corporate officers authorized to obligate the company).
         3) Plan concurrence (e.g., Chief of Operations, Corporate Chief of Safety, Corporate Industrial Hygienist, project manager or superintendent, project safety professional). Provide concurrence of other applicable corporate and project personnel (Contractor).
      b. BACKGROUND INFORMATION - List the following:
         1) Contractor.
         2) Contract number.
         3) Project name.
         4) Brief project description, description of work to be performed, and location; phases of work anticipated (these will require an AHA).
      c. STATEMENT OF SAFETY AND HEALTH POLICY - Provide a copy of current corporate/company Safety and Health Policy Statement, detailing commitment to providing a safe and healthful workplace for all employees. The Contractor’s written safety program goals, objectives, and accident experience goals for this contract

should be provided. The Statement of Safety and Health Policy must be signed by a company executive.

d. RESPONSIBILITIES AND LINES OF AUTHORITIES - Provide the following:
   1) A statement of the employer's ultimate responsibility for the implementation of its Safety and Occupational Health (SOH) program.
   2) Identification and accountability of personnel responsible for safety at both corporate and project level. Contracts specifically requiring safety or industrial hygiene personnel shall include a copy of their resumes.
   3) The names of Competent and/or Qualified Person(s) and proof of competency/qualification to meet specific OSHA Competent/Qualified Person(s) requirements must be attached.
   4) Requirements that no work shall be performed unless a designated competent person is present on the job site.
   5) Requirements for pre-task Activity Hazard Analysis (AHAs).
   6) Lines of authority.
   7) Policies and procedures regarding noncompliance with safety requirements (to include disciplinary actions for violation of safety requirements) should be identified;

e. SUBCONTRACTORS AND SUPPLIERS - If applicable, provide procedures for coordinating SOH activities with other employers on the job site:
   1) Identification of subcontractors and suppliers (if known).
   2) Safety responsibilities of subcontractors and suppliers.

f. TRAINING:
   1) Site-specific SOH orientation training at the time of initial hire or assignment to the project for every employee before working on the project site is required.
   2) Mandatory training and certifications that are applicable to this project (e.g., explosive actuated tools, crane operator, rigger, crane signal person, fall protection, electrical lockout/ NFPA 70E, machine/equipment lockout, confined space, etc.) and any requirements for periodic retraining/recertification are required.
   3) Procedures for ongoing safety and health training for supervisors and employees shall be established to address changes in site hazards/conditions.
   4) OSHA ten (10) hour Construction Outreach training within the past five years is required for all workers on site and the OSHA thirty (30) hour Construction Outreach training within the past five years is required for Trade Competent Persons (CPs).

g. SAFETY AND HEALTH INSPECTIONS:
   1) Specific assignment of responsibilities for a minimum daily job site safety and health inspection during periods of work activity: Who will conduct (e.g., "Site Safety and Health CP"), proof of inspector's training/qualifications, when inspections will be conducted, procedures for documentation, deficiency tracking system, and follow-up procedures.
   2) Any external inspections/certifications that may be required (e.g., contracted CSP or CSHT).

h. MISHAP INVESTIGATION AND REPORTING:
   1) The APP shall include identify person(s) responsible to provide the following to the Contracting Officer Representative:
      (a) Monthly HS and E Performance Report (Exposure Hours Data).
      (b) Mishap investigation reports.
      (c) Project site injury and illness logs.
      (d) Near-Miss reports.

5. PLANS (PROGRAMS, PROCEDURES) REQUIRED: Based on a risk assessment of contracted activities and on mandatory OSHA compliance programs, the Contractor shall address all applicable occupational, patient, and public safety risks in site-specific compliance and accident prevention plans. These Plans shall include but are not limited to procedures for addressing the risks associates with the following:
   a. Emergency response.
   b. Contingency for severe weather.

c. Fire Prevention.
d. Medical Support.
e. Posting of emergency telephone numbers.
f. Prevention of alcohol and drug abuse.
g. Site sanitation (housekeeping, drinking water, toilets).
h. Night operations and lighting.
i. Hazard communication program:
    1) Welding/Cutting “Hot” work.
    2) Electrical Safe Work Practices (Electrical LOTO/ NFPA 70E).
    3) General Electrical Safety.
        (a) Hazardous energy control (LOTO).
    4) Site-Specific Fall Protection and Prevention.
    5) Excavation/trenching.
    6) Asbestos abatement.
    7) Lead abatement.
    8) Crane Critical lift.
    9) Respiratory protection.
    10) Health hazard control program.
    11) Radiation Safety Program.
    12) Abrasive blasting.
    13) Heat/Cold Stress Monitoring.
    14) Crystalline Silica Monitoring (Assessment).
    15) Demolition plan (to include engineering survey).
    16) Formwork and shoring erection and removal.
    17) Pre-Cast Concrete.
    18) Public (Mandatory compliance with ANSI/ASSP A10.34-2012).

C. Submit the APP to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES fifteen (15) calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP.

D. Once accepted by the Contracting Officer Representative, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer in accordance with FAR Clause 52.236-13, Accident Prevention, until the matter has been rectified.

E. Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the Contracting Officer Representative. Should any severe hazard exposure, i.e. imminent danger, become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Contracting Officer Representative within two (2) hours of discovery. Eliminate/remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions to safeguard onsite personnel, visitors, the public and the environment.

1.07 ACTIVITY HAZARD ANALYSES (AHA)

A. AHAs are also known as Job Hazard Analyses, Job Safety Analyses, and Activity Safety Analyses. Before beginning each work activity involving a type of work presenting hazards not experienced in previous project operations or where a new work crew or sub-contractor is to perform the work, the Contractor(s) performing that work activity shall prepare an AHA.

B. AHAs shall define the activities being performed and identify the work sequences, the specific anticipated hazards, site conditions, equipment, materials, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level of risk.

C. Work shall not begin until the AHA for the work activity has been accepted by the Contracting Officer Representative and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and on-site representatives at preparatory and initial control phase meetings.
    1. The names of the Competent/Qualified Person(s) required for a particular activity (for example, excavations, scaffolding, fall protection, other activities as specified by OSHA or

other State and Local agencies) shall be identified and included in the AHA. Certification of their competency/qualification shall be submitted to the Contracting Officer Representative) for acceptance prior to the start of that work activity.

2. The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified person(s).
   a. If more than one Competent/Qualified Person is used on the AHA activity, a list of names shall be submitted as an attachment to the AHA. Those listed must be Competent/Qualified for the type of work involved in the AHA and familiar with current site safety issues.
   b. If a new Competent/Qualified Person (not on the original list) is added, the list shall be updated (an administrative action not requiring an updated AHA). The new person shall acknowledge in writing that he or she has reviewed the AHA and is familiar with current site safety issues.
3. Submit AHAs to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES for review at least fifteen (15) calendar days prior to the start of each phase. Subsequent AHAs as shall be formatted as amendments to the APP. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.
4. The AHA list will be reviewed periodically (at least weekly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.
5. Develop the activity hazard analyses using the project schedule as the basis for the activities performed. All activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier, or subcontractor and provided to the prime contractor for review and approval and then submitted to the Contracting Officer Representative for review for compliance.

1.08 PRECONSTRUCTION CONFERENCE

A. Contractor representatives who have a responsibility or significant role in implementation of the accident prevention program, as required by 29 CFR 1926.20(b)(1), on the project shall attend the pre-construction conference to gain a mutual understanding of its implementation. This includes the project superintendent, subcontractor superintendents, and any other assigned safety and health professionals.

B. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, review, and acceptance of AHAs to preclude project delays.

1.09 SAFETY MEETINGS

A. Conduct safety meetings to review past activities, plan for new or changed operations, review pertinent aspects of appropriate AHA (by trade), establish safe working procedures for anticipated hazards, and provide pertinent Safety and Occupational Health (SOH) training and motivation. Conduct meetings at least once a month for all supervisors on the project location. The SSHO, supervisors, foremen, or CDSOs must conduct meetings at least once a week for the trade workers. Document meeting minutes to include the date, persons in attendance, subjects discussed, and names of individual(s) who conducted the meeting. Maintain documentation on-site and furnish copies to the Contracting Officer on request. Notify the Contracting Officer Representative of all scheduled meetings seven (7) calendar days in advance.

1.10 “SITE SAFETY AND HEALTH OFFICER” (SSHO) AND “COMPETENT PERSON” (CP)

A. The Prime Contractor shall provide a Safety oversight team that includes a minimum of one (1) person at each project site, for each shift, to function as the Site Safety and Health Officer (SSHO), and an Alternate Safety Officer. The Prime Contractor shall provide a minimum of one “Full-Time” SSHO at each project site, for each shift (with no other duties) that holds as current, a professional safety certification with at least three (3) years of dedicated construction safety related experience. The SSHO shall ensure that the requirements of 29 CFR 1926.16 are met

for the project. The SSHO must be at the work site at all times, during construction activities, to implement and administer the Contractor's safety program and accepted Accident Prevention Plan. If the SSHO is off-site for a period longer than 8 hours, or one shift, and not exceeding forty (40) hours, or five (5) shifts, a qualified Alternate Safety Officer shall be provided and shall fulfill the same roles and responsibilities as the primary SSHO. The Alternate Safety Officer shall have the required training, experience, and qualifications. When the Primary SSHO is temporarily (not to exceed eight (8) hours) off-site, a Designated Representative (DR) from the Prime Contractors' staff, as identified in the AHA may be used in lieu of an Alternate Safety Officer and shall be on the project site, at all times, when work is being performed. Note that the DR is a collateral duty safety position, with safety duties in addition to their full-time occupation. Each subcontractor shall designate a minimum of one CP that will be identified as a CP to administer their individual safety programs.

B. Further, all specialized Competent Persons for the work crews will be supplied by the respective contractor (i.e. Asbestos, Electrical, Cranes, and Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).

C. These Competent Persons can have collateral duties as the subcontractor's superintendent and/or work crew lead persons as well as fill more than one specialized CP role (i.e. Asbestos, Electrical, Cranes, and Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations). However, the SSHO has be a separate qualified individual from the Prime Contractor's Superintendent and/or Quality Control Manager with duties only as the SSHO.

D. The SSHO or an equally qualified Designated Representative/alternate will maintain a presence on the site during construction operations. CPs will maintain presence during their construction activities. A listing of the designated SSHO and all known CPs shall be submitted prior to the start of work as part of the APP with the training documentation and/or AHA.

E. The repeated presence of uncontrolled hazards during a contractor's work operations will result in the designated CP as being deemed incompetent and result in the required removal of the employee.

1.11 TRAINING

A. The designated Prime Contractor SSHO must meet the requirements of all applicable OSHA standards and be capable (through training, experience, and qualifications) of ensuring that the appropriate Federal, State and local requirements are met for the project.

B. As a minimum the SSHO must have completed the OSHA thirty (30) hour Construction Safety Outreach class within the past five (5) years and:
   1. Seven (7) years of construction industry safety related experience.
   2. OR have a safety and health degree from an accredited university or college and five (5) years of construction industry safety related experience.
   3. OR hold as current, a Certified Safety Professional (CSP) or a Construction Health and Safety Technician (CHST) certification and five (5) years of construction industry safety related experience.

C. The Alternate Safety Officer shall have five (5) years of construction industry safety experience If the SSHO does not have a current certification, certification must be obtained within ninety (90) days, maximum, of contract award.

D. All designated CPs shall have completed the OSHA thirty (30) hour Construction Safety course training within the past five (5) years. In addition, all CPs with high hazard work operations (such as operations involving asbestos, electrical, cranes, demolition, work at heights/fall protection, fire safety/life safety, ladder, rigging, scaffolds, and trenches/excavations) shall have a specialized formal course in the hazard recognition and control associated with those high hazard work operations. Documented "repeat" deficiencies in the execution of safety requirements will require retaking the requisite formal course.

E. All other construction workers shall have the OSHA 10-hour Construction Safety Outreach course within the past five (5) years and any necessary safety training to be able to identify hazards within their work environment.

F. Submit training records associated with the above training requirements to Contracting Officer Representative for review for compliance with contract requirements in accordance with Section

01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES fifteen (15) calendar days prior to the date of the preconstruction conference for acceptance.

G. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the SSHO or his/her designated representative. As a minimum, this briefing shall include information on the site-specific hazards, construction limits, safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of equipment, emergency procedures, accident reporting etc. Documentation shall be provided to the COR that individuals have undergone contractor's safety briefing.

H. Ongoing safety training will be accomplished in the form of weekly documented safety meeting.

1.12 INSPECTIONS

A. The SSHO shall conduct frequent and regular safety inspections (daily) of the site and each of the subcontractors CPs shall conduct frequent and regular safety inspections (daily) of their work operations. Each week, the SSHO shall conduct a formal documented inspection with a written report of the entire construction areas with the subcontractors' "Trade Safety and Health CPs" present in their work areas. Coordinate with, and report findings and corrective actions weekly to Contracting Officer Representative.

B. A Certified Safety Professional (CSP) with specialized knowledge in construction safety or a certified Construction Safety and Health Technician (CSHT) shall randomly conduct a monthly site safety inspection. The CSP or CSHT shall be one that is not a part of the immediate site project team. The individual can be a corporate safety professional or independently contracted who is not an immediate member of the construction project site team. The CSP or CSHT will provide their certificate number on the required report for verification as necessary.
   1. Results of the inspection will be documented with tracking of the identified hazards to abatement.
   2. The Contracting Officer Representative will be notified immediately prior to start of the inspection and invited to accompany the inspection.
   3. Identified hazard and controls will be discussed to come to a mutual understanding to ensure abatement and prevent future reoccurrence.
      a. A report of the inspection findings with status of abatement will be provided to the Contracting Officer Representative within one week of the onsite inspection.

1.13 MISHAPS, OSHA 300 LOGS, AND MAN-HOURS

A. The prime contractor shall establish and maintain a Near-Miss and Mishap reporting, recordkeeping, and analysis system to track and analyze all injuries and illnesses, high visibility incidents, accidental property damage (both government and contractor) and Near-Misses that occur on site. Notify and provide an initial report to the Contracting Officer Representative as soon as practical, but no more than two hours after any Moderate or Major Mishap, High Visibility Incidents, or any weight handling and hoisting equipment mishap. No Impact/Near-Miss and Minor Mishaps shall be reported within twenty-four (24) hours or as soon as practical. Within the notification the sender shall include contractor name; contract title; type of contract; name of activity, installation or location where mishap occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of mishap (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the Mishap site until the Contracting Officer Representative determines whether a government investigation will be conducted.

B. Conduct a mishap investigation for all Mishaps including mishaps resulting in at least $20,000 in damages without injury, to establish the root cause(s) of the mishap. The Mishap investigation shall include images, five ()5 whys, the injured person's firsthand account, any witness accounts, methods of procedures, related AHA to the task, and corrective action plan signed by the president, vice president, or appropriate corporate-level leadership identified in the company's org chart for the project. Additionally, provide the report to the Contracting Officer Representative within seven (7) calendar days of the accident. The Contracting Officer Representative will provide copies of any required or special forms.

C. A summation of all man-hours worked by the contractor and associated sub-contractors for each month will be reported to the Contracting Officer Representative.

D. A summation of all Minor, Moderate, and Major incidents experienced on site by the contractor and associated sub-contractors for each month will be provided to the Contracting Officer

Representative monthly. The contractor and associated sub-contractors' OSHA 300 logs will be made available to the Contracting Officer Representative upon request.

1.14 PERSONAL PROTECTIVE EQUIPMENT (PPE)

A. PPE is governed in all areas by the nature of the work the employee is performing. For example, specific PPE required for performing work on electrical equipment is identified in NFPA 70E, Standard for Electrical Safety in the Workplace.

B. Any PPE above and beyond the Mandatory PPE identified below and determined by the Contracting Officer Representative to be necessary in the performance of the duties relative to this contract, shall be provided upon written notification by the Contracting Officer Representative. All PPE shall also be accompanied by any relevant or required training necessary to ensure its proper use.

C. Mandatory Minimum PPE includes:
   1. Hard Hats – unless written authorization is given by the Contracting Officer Representative in circumstances of work operations that have limited potential for falling object hazards such as during finishing work or minor remodeling. With authorization to relax the requirement of hard hats, if a worker becomes exposed to an overhead falling object hazard, then hard hats would be required in accordance with the OSHA regulations.
   2. Safety glasses - unless written authorization is given by the Contracting Officer Representative in circumstances of no eye hazards, appropriate safety glasses meeting the ANSI Z.87.1 standard must be worn by each person on site.
   3. Appropriate Safety Shoes – based on the hazards present, safety shoes shall be worn by each person on site unless written authorization is given by Contracting Officer Representative in circumstances of no foot hazards.
   4. Hearing protection - Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks.
   5. High-visibility Safety Apparel – appropriate brightly colored clothing that feature some type of reflective material on them, such as safety vests, shall be worn by personnel or visitors on construction sites.

1.15 PRE-CONSTRUCTION RISK ASSESSMENT

A. Control of all construction-associated hazards that affect medical facilities, their occupants, services and mission-essential functions and capabilities is critical in all medical center facilities. VHA Pre-Construction Risk Assessments (PCRAs) for construction, renovation and maintenance projects are included with this contract solicitation with required mitigations of identified hazards. VHA-PCRAs will be re-validated and updated as needed based on but not limited to changes from original designs, affected individuals, areas/locations, scope, contractor means and methods, safety requirements, phasing, contractor competencies and capabilities.

B. Infection Prevention and Control is critical in all medical center facilities. Interior construction activities causing disturbance of existing dust, or creating new dust, must be conducted within ventilation-controlled areas that minimize the flow of airborne particles into patient areas. A detailed analysis of potential risks for infectious disease transmission affecting the care, treatment or services of patients or residents has been conducted.

C. Products and Materials:
   1. Sheet Plastic: Fire retardant polyethylene, 6-mil thickness meeting local fire codes.
   2. Barrier Doors: Self Closing, one-hour fire-rated, solid core wood in steel frame, painted.
   3. Dust proof one-hour fire-rated drywall.
   4. High Efficiency Particulate Air-Equipped filtration machine rated at ninety-five (95) percent capture of 0.3 microns including pollen, mold spores and dust particles. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Maintenance of equipment and replacement of the HEPA filters and other filters will be in accordance with manufacturer's instructions.
   5. Exhaust Hoses: Heavy duty, flexible steel reinforced; Ventilation Blower Hose.
   6. Adhesive Walk-off Mats: Provide minimum size mats of twnety-four (24) inches x thirty-six (36) inches.
   7. Disinfectant: EPA-registered, hospital-approved disinfectant or equivalent product.
   8. Portable Ceiling Access Module.

1.16 INFECTION CONTROL

A. Infection Control is critical in all medical center facilities. Interior construction activities causing disturbance of existing dust, or creating new dust, must be conducted within ventilation-controlled areas that minimize the flow of airborne particles into patient areas. Exterior construction activities causing disturbance of soil or creates dust in some other manner must be controlled.

B. For work occurring at a medical facility, coordinate with the facility Safety Manager/Officer, as several aspects of this section directly relate to infection control risk assessments required in or adjacent to construction affecting occupied buildings accredited by The Joint Commission.

C. An AHA associated with infection control will be performed by personnel in accordance with FGI Guidelines (i.e. Infection Control Risk Assessment (ICRA)). The ICRA procedure found on the American Society for Healthcare Engineering (ASHE) website will be utilized. Risk classifications of Class II or lower will require approval by the Contracting Officer Representative before beginning any construction work. Risk classifications of Class III or higher will require a permit before beginning any construction work. Infection Control permits will be issued by the COR. The Infection Control Permits will be posted outside the appropriate construction area. More than one permit may be issued for a construction project if the work is located in separate areas requiring separate classes.
   1. Class I requirements:
      a. During Construction Work:
         1) Notify the Contracting Officer Representative.
         2) Execute work by methods to minimize raising dust from construction operations.
         3) Ceiling tiles: Immediately replace a ceiling tile displaced for visual inspection.
      b. Upon Completion:
         1) Clean work area upon completion of task.
         2) Notify the Contracting Officer Representative.
   2. Class II requirements:
      a. During Construction Work:
         1) Notify the Contracting Officer Representative.
         2) Provide active means to prevent airborne dust from dispersing into atmosphere such as wet methods or tool mounted dust collectors where possible.
         3) Water mist work surfaces to control dust while cutting.'Seal unused doors with duct tape.
         4) Block off and seal air vents.
         5) Remove or isolate HVAC system in areas where work is being performed.
      b. Upon Completion:
         1) Wipe work surfaces with cleaner/disinfectant.
         2) Contain construction waste before transport in tightly covered containers.
         3) Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area.
         4) Upon completion, restore HVAC system where work was performed.
         5) Notify the Contracting Officer Representative.
   3. Class III requirements:
      a. During Construction Work:
         1) Obtain permit from the Contracting Officer Representative.
         2) Remove or Isolate HVAC system in area where work is being done to prevent contamination of duct system.
         3) Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non-work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.
         4) Maintain negative air pressure, 0.01 inches of water gauge, within work site utilizing HEPA equipped air filtration units and continuously monitored with a digital display, recording and alarm instrument, which must be calibrated on installation, maintained with periodic calibration and monitored by the contractor.
         5) Contain construction waste before transport in tightly covered containers.
         6) Cover transport receptacles or carts. Tape covering unless solid lid.

b. Upon Completion:
   1) Do not remove barriers from work area until completed project is inspected by the Contracting Officer Representative and thoroughly cleaned.
   2) Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.
   3) Vacuum work area with HEPA filtered vacuums.
   4) Wet mop area with cleaner/disinfectant.
   5) Upon completion, restore HVAC system where work was performed.
   6) Return permit to the Contracting Officer Representative.

4. Class IV requirements:
   a. During Construction Work:
      1) Obtain permit from the Contracting Officer Representative.
      2) Isolate HVAC system in area where work is being done to prevent contamination of duct system.
      3) Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non-work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.
      4) Maintain negative air pressure, 0.01 inches of water gauge, within work site utilizing HEPA equipped air filtration units and continuously monitored with a digital display, recording and alarm instrument, which must be calibrated on installation, maintained with periodic calibration and monitored by the contractor.5) Seal holes, pipes, conduits, and punctures.
      5) Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave work site.
      6) All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area.
   b. Upon Completion:
      1) Do not remove barriers from work area until completed project is inspected by the Contracting Officer Representative with thorough cleaning.
      2) Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.
      3) Contain construction waste before transport in tightly covered containers.
      4) Cover transport receptacles or carts. Tape covering unless solid lid.
      5) Vacuum work area with HEPA filtered vacuums.
      6) Wet mop area with cleaner/disinfectant.
      7) Upon completion, restore HVAC system where work was performed.
      8) Return permit to the Contracting Officer Representative.

D. Barriers shall be erected as required based upon classification (Class III and IV requires barriers) and shall be constructed as follows:
   1. Class III and IV - Closed door with masking tape applied over the frame and door is acceptable for projects that can be contained in a single room.
   2. Construction, demolition or reconstruction not capable of containment within a single room must have the following barriers erected and made presentable on hospital occupied side:
      a. Class III and IV (where dust control is the only hazard, and an agreement is reached with the COR) - Airtight plastic barrier that extends from the floor to ceiling. Seams must be sealed with duct tape to prevent dust and debris from escaping.
      b. Class III and IV - Drywall barrier erected with joints covered or sealed to prevent dust and debris from escaping.
      c. Class III and IV - Seal all penetrations in existing barrier airtight.

E. Class III and IV - Barriers at penetration of ceiling envelopes, chases and ceiling spaces to stop movement air and debris.

a. Class IV only - Anteroom or double entrance openings that allow workers to remove protective clothing or vacuum off existing clothing.
b. Class III and IV - At elevators shafts or stairways within the field of construction, overlapping flap minimum of two feet wide of polyethylene enclosures for personnel access.

F. Products and Materials:
1. Sheet Plastic: Fire retardant polystyrene, 6-mil thickness meeting local fire codes.

G. Barrier Doors: Self Closing One-hour fire-rated solid core wood in steel frame, painted.
1. Dust proof one-hour fire-rated drywall.
2. High Efficiency Particulate Air-Equipped filtration machine rated at ninety-five (95) percent capture of 0.3 microns including pollen, mold spores and dust particles. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Maintenance of equipment and replacement of the HEPA filters and other filters will be in accordance with manufacturer's instructions.
3. Exhaust Hoses: Heavy duty, flexible steel reinforced; Ventilation Blower Hose.
4. Adhesive Walk-off Mats: Provide minimum size mats of twenty-four (24) inches x thirty-six (36) inches.
5. Disinfectant: Hospital-approved disinfectant or equivalent product.
6. Portable Ceiling Access Module.

H. Before any construction on site begins, all contractor personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.

I. A dust control program will be established and maintained as part of the contractor's infection preventive measures in accordance with the FGI Guidelines for Design and Construction of Healthcare Facilities. Prior to start of work, prepare a plan detailing project-specific dust protection measures with associated product data, including periodic status reports, and submit to COR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

J. Medical center Infection Control personnel will monitor for airborne disease (e.g. aspergillosis) during construction. A baseline of conditions will be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality with safe thresholds established.

K. In general, the following preventive measures shall be adopted during construction to keep down dust and prevent mold.
1. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents or building openings. HEPA filtration is required where the exhaust dust may reenter the medical center.
2. Exhaust hoses shall be exhausted so that dust is not reintroduced to the medical center.
3. Adhesive Walk-off/Carpet Walk-off Mats shall be used at all interior transitions from the construction area to any occupied medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.
4. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as it is created. Transport these outside the construction area in containers with tightly fitting lids.
5. The contractor shall not haul debris through patient-care areas without prior approval of the COR. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.
6. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills must be cleaned up and dried within twelve (12) hours. Remove and dispose of porous materials that remain damp for more than seventy-two (72) hours.

7. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.

L. Final Cleanup:
1. Upon completion of project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.
2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.

M. All new air ducts shall be cleaned prior to final inspection.

N. Exterior Construction:
1. Contractor shall verify that dust will not be introduced into the medical center through intake vents or building openings. HEPA filtration on intake vents is required where dust may be introduced.
2. Dust created from disturbance of soil such as from vehicle movement will be wetted with use of a water truck as necessary.
3. All cutting, drilling, grinding, sanding, or disturbance of materials shall be accomplished with tools equipped with either local exhaust ventilation (i.e. vacuum systems) or wet suppression controls.

1.17 TUBERCULOSIS SCREENING

A. Contractor shall provide written certification that all contract employees assigned to the work site have had a pre-placement tuberculin screening within ninety (90) days prior to assignment to the worksite and been found have negative TB screening reactions. Contractors shall be required to show documentation of negative TB screening reactions for any additional workers who are added after the ninety (90) day requirement before they will be allowed to work on the work site. NOTE: This can be the Center for Disease Control (CDC) and Prevention and two-step skin testing or a Food and Drug Administration (FDA)-approved blood test.
1. Contract employees manifesting positive screening reactions to the tuberculin shall be examined according to current CDC guidelines prior to working on VHA property.
2. Subsequently, if the employee is found without evidence of active (infectious) pulmonary TB, a statement documenting examination by a physician shall be on file with the employer (construction contractor), noting that the employee with a positive tuberculin screening test is without evidence of active (infectious) pulmonary TB.
3. If the employee is found with evidence of active (infectious) pulmonary TB, the employee shall require treatment with a subsequent statement to the fact on file with the employer before being allowed to return to work on VHA property.

1.18 FIRE SAFETY

A. Fire Safety Plan: Establish and maintain a site-specific fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. This plan may be an element of the Accident Prevention Plan.

B. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.

C. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 meters (20 feet) exposing overall length, separate by 3 meters (10 feet).

D. Temporary Construction Partitions:
1. Install and maintain temporary construction partitions to provide smoke-tight separations between construction areas and adjoining areas. Construct partitions of gypsum board or fire-retardant treated plywood (fire-retardant treated in accordance with NFPA 703) on both sides of fire-retardant treated wood framing or metal steel studs. Extend the partitions through suspended ceilings to floor slab deck or roof. Seal joints and penetrations. At door openings, install Class C, 3/4 hour fire/smoke rated doors with self-closing devices.

2. Install one-hour fire-rated temporary construction partitions to maintain integrity of existing exit stair enclosures, exit passageways, fire-rated enclosures of hazardous areas, horizontal exits, smoke barriers, vertical shafts and openings enclosures.
3. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING.

E. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.

F. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with Contracting Officer Representative.

G. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to Contracting Officer Representative.

H. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.

I. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.

J. Standpipes: Install and extend standpipes up with each floor in accordance with 29 CFR 1926 and NFPA 241. Do not charge wet standpipes subject to freezing until weather protected.

K. Sprinklers: Install, test and activate new automatic sprinklers prior to removing existing sprinklers.

L. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than four (4) hours in a twenty four (24) hour period. Request interruptions and coordinate with Contracting Officer Representative. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the Contracting Officer Representative. Parameters for the testing and results of any tests performed shall be recorded by the Contracting Officer Representative.

M. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with Contracting Officer Representative.

N. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with Contracting Officer Representative. Obtain permits from Contracting Officer Representative at least twenty-four (24) hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.

O. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to Contracting Officer Representative.

P. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.

Q. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.

R. If required, submit documentation to the COR that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.

1.19 ELECTRICAL

A. All electrical work shall comply with NFPA 70 (NEC), NFPA 70B, NFPA 70E, 29 CFR Part 1910 Subpart J – General Environmental Controls, 29 CFR Part 1910 Subpart S – Electrical, and 29 CFR 1926 Subpart K in addition to other references required by contract.

B. All qualified persons performing electrical work under this contract shall be licensed journeyman or master electricians. All apprentice electricians performing under this contract shall be deemed unqualified persons unless they are working under the immediate supervision of a licensed electrician or master electrician.

C. All electrical work will be accomplished de-energized and in the Electrically Safe Work Condition (refer to NFPA 70E for Work Involving Electrical Hazards, including Exemptions to

Work Permit). Any Contractor, subcontractor or temporary worker who fails to fully comply with this requirement is subject to immediate termination in accordance with FAR clause 52.236-5(c). Only in rare circumstance when achieving an electrically safe work condition prior to beginning work would increase or cause additional hazards, or is infeasible due to equipment design or operational limitations is energized work permitted. The Contracting Officer Representative will make the determination if the circumstances would meet the exception outlined above. An AHA and permit specific to energized work activities will be developed, reviewed, and accepted by the COR prior to the start of that activity.

1. Development of a Hazardous Electrical Energy Control Procedure is required prior to de-energization. A single Simple Lockout/Tagout Procedure for multiple work operations can only be used for work involving qualified person(s) de-energizing one set of conductors or circuit part source. Task specific Complex Lockout/Tagout Procedures are required at all other times.
2. Verification of the absence of voltage after de-energization and lockout/tagout is considered “energized electrical work” (live work) under NFPA 70E, and shall only be performed by qualified persons wearing appropriate shock protective (voltage rated) gloves and arc rate personal protective clothing and equipment, using Underwriters Laboratories (UL) tested and appropriately rated contact electrical testing instruments or equipment appropriate for the environment in which they will be used.
3. Personal Protective Equipment (PPE) and electrical testing instruments will be readily available for inspection by the Contracting Officer Representative.

D. Before beginning any electrical work, an Activity Hazard Analysis (AHA) will be conducted to include Shock Hazard and Arc Flash Hazard analyses (NFPA Tables can be used only as a last alterative and it is strongly suggested a full Arc Flash Hazard Analyses be conducted). Work shall not begin until the AHA for the work activity and permit for energized work has been reviewed and accepted by the Contracting Officer Representative and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and COR at preparatory and initial control phase meetings.

E. Ground-fault circuit interrupters. GFCI protection shall be provided where an employee is operating or using cord- and plug-connected tools related to construction activity supplied by 125-volt, 15-, 20-, or 30- ampere circuits. Where employees operate or use equipment supplied by greater than 125-volt, 15-, 20-, or 30- ampere circuits, GFCI protection or an assured equipment grounding conductor program shall be implemented in accordance with NFPA 70E - 2015, Chapter 1, Article 110.4(C)(2).

1.20 FALL PROTECTION

A. The fall protection (FP) threshold height requirement is 4 feet for ALL WORK, unless specified differently by the OSHA 29 CFR 1926 requirements are more stringent, to include steel erection activities, systems-engineered activities (prefabricated) metal buildings, residential (wood) construction and scaffolding work.

1. The use of a Safety Monitoring System (SMS) as a fall protection method is prohibited.
2. The use of Controlled Access Zone (CAZ) as a fall protection method is prohibited.
3. A Warning Line System (WLS) may ONLY be used on floors or flat or low-sloped roofs (between 0 - 18.4 degrees or 4:12 slope) and shall be erected around all sides of the work area (See 29 CFR 1926.502(f) for construction of WLS requirements). Working within the WLS does not require FP. No worker shall be allowed in the area between the roof or floor edge and the WLS without FP. FP is required when working outside the WLS.
4. Fall protection while using a ladder will be governed by OSHA requirements.

1.21 SCAFFOLDS AND OTHER WORK PLATFORMS

A. All scaffolds and other work platforms construction activities shall comply with 29 CFR 1926 Subpart L.

B. The fall protection (FP) threshold height requirement is four (4) feet as stated in Section 1.16.

C. The following hierarchy and prohibitions shall be followed in selecting appropriate work platforms.

1. Scaffolds, platforms, or temporary floors shall be provided for all work except that can be performed safely from the ground or similar footing.

2. Ladders less than twenty (20) feet may be used as work platforms only when use of small hand tools or handling of light material is involved.
3. Ladder jacks, lean-to, and prop-scaffolds are prohibited.
4. Emergency descent devices shall not be used as working platforms.

D. Contractors shall use a scaffold tagging system in which all scaffolds are tagged by the Competent Person. Tags shall be color-coded: green indicates the scaffold has been inspected and is safe to use; red indicates the scaffold is unsafe to use. Tags shall be readily visible, made of materials that will withstand the environment in which they are used, be legible and shall include:
1. The Competent Person's name and signature.
2. Dates of initial and last inspections.

E. Mast Climbing work platforms: When access ladders, including masts designed as ladders, exceed twentry (20) feet (six (6) meters) in height, positive fall protection shall be used.

1.22 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

A. All installation, maintenance, and servicing of equipment or machinery shall comply with 29 CFR 1910.147 except for specifically referenced operations in 29 CFR 1926 such as concrete and masonry equipment 1926.702(j), heavy machinery and equipment 1926.600(a)(3)(i), and process safety management of highly hazardous chemicals (1926.64). Control of hazardous electrical energy during the installation, maintenance, or servicing of electrical equipment shall comply with Section 1.15 to include NFPA 70E and other requirements discussed in the section.

1.23 CONFINED SPACE ENTRY

A. All confined space entry shall comply with 29 CFR 1926, Subpart AA except for specifically referenced operations in 29 CFR 1926 such as excavations/trenches [1926.651(g)].

B. A site-specific Confined Space Entry Plan (including permitting process) shall be developed and submitted to the Contracting Officer Representative.

1.24 WELDING AND CUTTING

A. As specified in section 1.14, Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with Contracting Officer Representative. Obtain permits from Contracting Officer Representative at least 24 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.

1.25 LADDERS

A. All Ladder use shall comply with 29 CFR 1926 Subpart X and EM 385-1-1.

B. All portable ladders shall be of sufficient length and shall be placed so that workers will not stretch or assume a hazardous position.

C. Manufacturer safety labels shall be in place on ladders.

D. Step Ladders shall not be used in the closed position.

E. Top steps or cap of step ladders shall not be used as a step.

F. Portable ladders, used as temporary access, shall extend at least three (3) feet (0.9 meters) above the upper landing surface.
1. When a three (3) feet (0.9 meters) extension is not possible, a grasping device (such as a grab rail) shall be provided to assist workers in mounting and dismounting the ladder.
2. In no case shall the length of the ladder be such that ladder deflection under a load would, by itself, cause the ladder to slip from its support.

G. Ladders shall be inspected for visible defects on a daily basis and after any occurrence that could affect their safe use. Broken or damaged ladders shall be immediately tagged "DO NOT USE," or with similar wording, and withdrawn from service until restored to a condition meeting their original design.

1.26 FLOOR AND WALL OPENINGS

A. All floor and wall openings shall comply with 29 CFR 1926 Subpart M.

B. Floor and roof holes/openings are any that measure over two (2) inches (fifty-one (51) mm) in any direction of a walking/working surface which persons may trip or fall into or where objects may fall to the level below. Skylights located in floors or roofs are considered floor or roof hole/openings.

C. All floor, roof openings or hole into which a person can accidentally walk or fall through shall be guarded either by a railing system with toe boards along all exposed sides or a load-bearing cover. When the cover is not in place, the opening or hole shall be protected by a removable guardrail system or shall be attended when the guarding system has been removed, or other fall protection system.
   1. Covers shall be capable of supporting, without failure, at least twice the weight of the worker, equipment and material combined.
   2. Covers shall be secured when installed, clearly marked with the word “HOLE”, “COVER” or “Danger, Roof Opening-Do Not Remove” or color-coded or equivalent methods (e.g., red or orange “X”). Workers must be made aware of the meaning for color coding and equivalent methods.
   3. Non-load-bearing skylights shall be guarded by a load-bearing skylight screen, cover, or railing system along all exposed sides.
   4. Workers are prohibited from standing/walking on skylights.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 014000
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. Contractor's design-related professional design services.

F. Control of installation.

G. Tolerances.

H. Manufacturers' field services.

I. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittal procedures.

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

1.03 REFERENCE STANDARDS

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

B. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2025b.

C. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2026.

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

E. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2021.

1.04 DEFINITIONS

A. Contractor's Quality Control Plan: Contractor's management plan for executing the Contract for Construction.

B. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.

1. Design Services Types Required:
    a. Construction-Related: Services Contractor needs to provide in order to carry out the Contractor’s sole responsibilities for construction means, methods, techniques, sequences, and procedures.
    b. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.

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

1.05 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

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

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

C. Scope of Contractor's Professional Design Services: Provide for the following items of work:

1. Sprinkler Layout: Coordinate with ceiling installation, detailed pipe layout, and hydraulic calculations as described in Section 211300 - Fire-Suppression Sprinkler Systems.
2. System Design: As described in Section 230913 - Instrumentation and Control Devices for HVAC.
3. System Design: As described in Section 230923 - Direct-Digital Control System for HVAC.
4. Piping System Design: As described in Section 232300 - Refrigerant Piping.

1.06 SUBMITTALS

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

B. Designer's Qualification Statement: Submit for COR's knowledge as contract administrator, or for Owner's information.
   1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
      a. Full name.
      b. Professional licensure information.
      c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.

C. Design Data: Submit for COR'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 COR 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 COR, provide interpretation of results.
   2. Test report submittals are for COR'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 COR, 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.

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 COR's benefit as contract administrator or for Owner.

1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.07 QUALITY ASSURANCE

A. 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.

B. 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.
      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.

C. 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.

1.08 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 COR before proceeding.

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

1.09 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Contractor shall employ and pay for services of an independent testing agency to perform specified testing.

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

C. Contractor Employed Agency:
   1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM E699, and ASTM C1021.
   2. Laboratory Qualifications: Accredited by IAS according to IAS AC89.
   3. Laboratory: Authorized to operate in the State in which the Project is located.

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 COR 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 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 COR before proceeding.

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

3.03 TESTING AND INSPECTION

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

B. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with COR 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 COR and Contractor of observed irregularities or non-compliance of Work or products.
   5. Perform additional tests and inspections required by COR.
   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 COR 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 COR.

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

3.04 MANUFACTURERS' FIELD SERVICES

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

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

3.05 DEFECT ASSESSMENT

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

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

END OF SECTION

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SECTION 015000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary telecommunications services.

B. Temporary sanitary facilities.

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

D. Security requirements.

E. Vehicular access and parking.

F. Waste removal facilities and services.

G. Field offices.

1.02 RELATED REQUIREMENTS

A. Section 013526 - Safety Requirements.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

1.04 TEMPORARY UTILITIES

A. Owner will provide the following:
   1. Electrical power and metering, consisting of connection to existing facilities.
   2. Water supply, consisting of connection to existing facilities.

B. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.05 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. Internet Connections: Minimum of one; DSL modem or faster.

1.06 TEMPORARY SANITARY FACILITIES

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

B. Maintain daily in clean and sanitary condition.

1.07 BARRIERS

A. See Section 013526 - Safety Requirements, for additional requirements.

B. 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.

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

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

1.08 FENCING

A. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.09 INTERIOR ENCLOSURES

A. See Section 013526 - Safety Requirements, for additional requirements.

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

C. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:
   1. STC rating of 35 in accordance with ASTM E90.
   2. Maximum flame spread rating of 75 in accordance with ASTM E84.

D. Paint surfaces exposed to view from Owner-occupied areas.

1.10 SECURITY

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

B. Coordinate with Owner's security program.

1.11 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.

F. Existing parking areas may be used for construction parking. Coordinate location with Owner.

1.12 WASTE REMOVAL

A. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.

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

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

D. 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.

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

1.13 FIELD OFFICES

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

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

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

1.14 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

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

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

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 015719
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction procedures to promote adequate indoor air quality after construction.

B. Building flush-out after construction and before occupancy.

C. Testing indoor air quality before commencement of construction; existing building areas only.

D. Testing indoor air quality after completion of construction.

1.02 PROJECT GOALS

A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
   1. Cleaning of ductwork is not contemplated under this Contract.
   2. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
   3. Establish condition of existing ducts and equipment prior to start of alterations.

B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
   1. Furnish products meeting the specifications.
   2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.03 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 230593 - Testing, Adjusting, and Balancing for HVAC: Testing HVAC systems for proper air flow rates, adjustment of dampers and registers, and settings for equipment.

1.04 REFERENCE STANDARDS

A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2017, with Addendum (2022).

B. ASTM D5197 - Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology); 2021.

C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.

D. EPA 600/4-90/010 - Compendium of Methods for the Determination of Air Pollutants in Indoor Air; 1990.

E. EPA 625/R-96/010b - Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air; 1999, with Addendum (2000).

F. SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction; 2007.

1.05 DEFINITIONS

A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.

B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.

C. Particulates: Dust, dirt, and other airborne solid matter.

D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

1.06 SUBMITTALS

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

B. Indoor Air Quality Management Plan: Describe, in detail, measures to be taken to promote adequate indoor air quality upon completion; use SMACNA (OCC) as a guide.
   1. Submit not less than 60 days before enclosure of building.

2. Identify potential sources of odor and dust.
3. Identify construction activities likely to produce odor or dust.
4. Identify areas of project potentially affected, especially occupied areas.
5. Evaluate potential problems by severity and describe methods of control.
6. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.
7. Describe cleaning and dust control procedures.
8. Describe measures specific for Healthcare projects, including, as applicable, plan for issues related to moisture, particulates, VOCs, outdoor emissions, tobacco, noise and vibration, and infection control.

C. Interior Finishes Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.

D. Duct and Terminal Unit Inspection Report.

E. Air Contaminant Test Plan: Identify:
1. Testing agency qualifications.
2. Locations and scheduling of air sampling.
3. Test procedures, in detail.
4. Test instruments and apparatus.
5. Sampling methods.

F. Air Contaminant Test Reports: Show:
1. Location where each sample was taken, and time.
2. Test values for each air sample; average the values of each set of 3.
3. HVAC operating conditions.
4. Certification of test equipment calibration.
5. Other conditions or discrepancies that might have influenced results.

1.07 QUALITY ASSURANCE

A. Testing and Inspection Agency Qualifications: Independent testing agency having minimum of 5 years experience in performing the types of testing specified.

PART 2 PRODUCTS

2.01 MATERIALS

A. Low VOC Materials: See Section 016116.

B. Low VOC Materials: See other sections for specific requirements for materials with low VOC content.

C. Auxiliary Air Filters: MERV of 8, minimum, when tested in accordance with ASHRAE Std 52.2.

PART 3 EXECUTION

3.01 CONSTRUCTION PROCEDURES

A. Prevent the absorption of moisture and humidity by adsorptive materials by:
1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
3. Provide sufficient ventilation for drying within reasonable time frame.

B. Begin construction ventilation when building is substantially enclosed.

C. When working in a portion of an occupied building, prevent movement of air from construction area to occupied area.

D. Use of HVAC equipment and ductwork for ventilation during construction is not permitted:
1. Provide temporary ventilation equivalent to 1.5 air changes per hour, minimum.
2. Exhaust directly to outside.
3. Seal HVAC air inlets and outlets immediately after duct installation.

E. Do not store construction materials or waste in mechanical or electrical rooms.

F. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
   1. Inspect duct intakes, return air grilles, and terminal units for dust.
   2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
   3. Clean tops of doors and frames.
   4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
   5. Clean return plenums of air handling units.
   6. Remove intake filters last, after cleaning is complete.

G. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.

H. Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures.

3.02 BUILDING FLUSH-OUT

A. Contractor's Option: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.

B. Perform building flush-out before occupancy.

C. Do not start flush-out until:
   1. All construction is complete.
   2. HVAC systems have been tested, adjusted, and balanced for proper operation.
   3. Inspection of inside of return air ducts and terminal units confirms that cleaning is not necessary.
   4. New HVAC filtration media have been installed.

D. Building Flush-Out: Operate all ventilation systems at normal flow rates with 100 percent outside air until a total air volume of 14,000 cubic feet per square foot of floor area has been supplied.
   1. Obtain Owner's concurrence that construction is complete enough before beginning flush-out.
   2. Maintain interior temperature of at least 60 degrees F and interior relative humidity no higher than 60 percent.
   3. If additional construction involving materials that produce particulates or any of the specified contaminants is conducted during flush-out, start flush-out over.
   4. If interior spaces must be occupied prior to completion of the flush-out, supply a minimum of 25 percent of the total air volume prior to occupancy, and:
      a. Begin ventilation at least three hours prior to daily occupancy.
      b. Continue ventilation during all occupied periods.
      c. Provide minimum outside air volume of 0.30 cfm per square foot or design minimum outside air rate, whichever is greater.

E. Install new HVAC filtration media after completion of flush-out and before occupancy or further testing.

3.03 AIR CONTAMINANT TESTING

A. Contractor's Option: Either full continuous flush-out, or satisfactory air contaminant testing is required, not both.

B. Perform air contaminant testing before starting construction, as base line for evaluation of post-construction testing.

C. Perform air contaminant testing before occupancy.

D. Do not start air contaminant testing until:
   1. All construction is complete, including interior finishes.
   2. HVAC systems have been tested, adjusted, and balanced for proper operation.
   3. New HVAC filtration media have been installed.

E. Indoor Air Samples: Collect from spaces representative of occupied areas:

1. Collect samples while operable windows and exterior doors are closed, HVAC system is running normally as if occupied, with design minimum outdoor air, but with the building unoccupied.
2. Collect samples from spaces in each contiguous floor area in each air handler zone, but not less than one sample per 25,000 square feet; take samples from areas having the least ventilation and those having the greatest presumed source strength.
3. Collect samples from height from 36 inches to 72 inches above floor.
4. Collect samples from same locations on 3 consecutive days during normal business hours; average the results of each set of 3 samples.
5. Exception: Areas with normal very high outside air ventilation rates, such as laboratories, do not need to be tested.
6. When retesting the same building areas, take samples from at least the same locations as in first test.

F. Outdoor Air Samples: Collect samples at outside air intake of each air handler at the same time as indoor samples are taken.

G. Analyze air samples and submit report.

H. Volatile Organic Compounds Limits:
1. Formaldehyde: Not more than 27 parts per billion.
2. Total Volatile Organic Compounds (TVOCs): Not more than 500 micrograms per cubic meter.
3. Chemicals Listed in CAL (CDPH SM) Table 4-1, other than Formaldehyde: Not more than allowable concentrations listed in Table 4-1.

I. Air Contaminant Concentration Test Methods:
1. Formaldehyde: ASTM D5197, EPA 625/R-96/010b Method TO-11A, or EPA 600/4-90/010 Method IP-6A.
2. Particulates: EPA 600/4-90/010 Method IP-10.
3. Total Volatile Organic Compounds (TVOC): EPA 625/R-96/010b Method TO-1, TO-15, or TO-17; or EPA 600/4-90/010 Method IP-1.
4. Chemicals Listed in CAL (CDPH SM) Table 4-1, except Formaldehyde: ASTM D5197, or EPA 625/R-96/010b Method TO-1, TO-15, or TO-17.
5. Carbon Monoxide: EPA 600/4-90/010 Method IP-3, plus measure outdoor air; measure in ppm; report both indoor and outdoor measurements.

END OF SECTION

SECTION 016000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations.

F. Procedures for Owner-supplied products.

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

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: Lists of products to be removed from existing building.

B. Section 011000 - Summary: Identification of Owner-supplied products.

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

D. Section 014000 - Quality Requirements: Product quality monitoring.

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

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

G. Section 230513 - Common Motor Requirements for HVAC Equipment: Motors for HVAC equipment.

1.03 REFERENCE STANDARDS

A. NEMA MG 00001 - Motors and Generators; 2024.

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.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

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

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

C. Specific Products to be Reused: The reuse of certain materials and equipment already existing on the project site is required.

1. See Section 011000 for list of items required to be salvaged for reuse and relocation.

2.02 NEW PRODUCTS

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

B. See Section 014000 - Quality Requirements, for additional source quality control requirements.

C. 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.
   4. Containing lead, cadmium, or asbestos.

D. Where other criteria are met, Contractor shall give preference to products that:
   1. If used on interior, have lower emissions, as defined in Section 016116.
   2. If wet-applied, have lower VOC content, as defined in Section 016116.
   3. Have longer documented life span under normal use.
   4. Result in less construction waste. See Section 017419
   5. Are made of vegetable materials that are rapidly renewable.
   6. Are made of recycled materials.
   7. If made of wood, are made of sustainably harvested wood, wood chips, or wood fiber.
   8. If bio-based, other than wood, are or are made of Sustainable Agriculture Network certified products.

E. Provide interchangeable components by the same manufacture for components being replaced.

F. Motors: Refer to Section 230513 - Common Motor Requirements for HVAC Equipment, NEMA MG 00001 Type. Specific motor type is specified in individual specification sections.

2.03 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 with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

C. Products Specified as Basis-of-Design: Submit substitution requests for unnamed products to COR for evaluation.

2.04 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 012500 - Substitution Procedures.

3.02 OWNER-SUPPLIED PRODUCTS

A. See Section 011000 - Summary for identification of Owner-supplied products.

3.03 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.

3.04 STORAGE AND PROTECTION

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

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

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

D. Store with seals and labels intact and legible.

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

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

G. Provide off-site storage and protection when site does not permit on-site storage or protection.
   1. Execute a formal supplemental agreement between Owner and Contractor allowing off-site storage, for each occurrence.

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

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

J. Do not store products directly on the ground.

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

L. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

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

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

O. 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

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SECTION 016116
VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for Indoor-Emissions-Restricted products.

B. Requirements for VOC-Content-Restricted products.

C. Requirement for installer certification that they did not use any non-compliant products.

1.02 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittal procedures.

B. Section 014000 - Quality Requirements: Procedures for testing and certifications.

C. Section 015719 - Temporary Environmental Controls: Procedures and testing.

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

E. Section 079200 - Joint Sealants: Emissions-compliant sealants.

1.03 DEFINITIONS

A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
   1. Interior paints and coatings applied on site.
   2. Interior adhesives and sealants applied on site, including flooring adhesives.
   3. Flooring.
   4. Composite wood.
   5. Products making up wall and ceiling assemblies.
   6. Thermal and acoustical insulation.
   7. Other products when specifically stated in the specifications.

B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
   1. Interior paints and coatings applied on site.
   2. Interior adhesives and sealants applied on site, including flooring adhesives.
   3. Other products when specifically stated in the specifications.

C. Interior of Building: Anywhere inside the exterior weather barrier.

D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.

E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
   1. Concrete.
   2. Clay brick.
   3. Metals that are plated, anodized, or powder-coated.
   4. Glass.
   5. Ceramics.
   6. Solid wood flooring that is unfinished and untreated.

1.04 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 D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005 (Reapproved 2018).

C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.

D. CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; Current Edition.

E. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2020.

F. CHPS (HPPD) - High Performance Products Database; Current Edition.

G. CRI (GLP) - Green Label Plus Testing Program - Certified Products; Current Edition.

H. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).

I. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

J. SCS (CPD) - SCS Certified Products; Current Edition.

K. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.05 SUBMITTALS

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

B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

C. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of installer's products, or 2) that such products used comply with these requirements.

1.06 QUALITY ASSURANCE

A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
   1. Wet-Applied Products: State amount applied in mass per surface area.
   2. Paints and Coatings: Test tinted products, not just tinting bases.
   3. Evidence of Compliance: Acceptable types of evidence are the following;
      a. Current UL (GGG) certification.
      b. Current SCS (CPD) Floorscore certification.
      c. Current SCS (CPD) Indoor Advantage Gold certification.
      d. Current listing in CHPS (HPPD) as a low-emitting product.
      e. Current CRI (GLP) certification.
      f. Test report showing compliance and stating exposure scenario used.
   4. Product data submittal showing VOC content is NOT acceptable evidence.
   5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.

B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Report of laboratory testing performed in accordance with requirements.
      b. Published product data showing compliance with requirements.
      c. Certification by manufacturer that product complies with requirements.

C. Composite Wood Emissions Standard: CARB (ATCM) for ultra-low emitting formaldehyde (ULEF) resins.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Current SCS "No Added Formaldehyde (NAF)" certification; www.scscertified.com.
      b. Report of laboratory testing performed in accordance with requirements.
      c. Published product data showing compliance with requirements.
      d. Certification by manufacturer that product complies with requirements.

D. 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 Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.

B. Indoor-Emissions-Restricted Products: Comply with Indoor Emissions Standard and Test Method, except for:
   1. Composite Wood, Wood Fiber, and Wood Chip Products: Comply with Composite Wood Emissions Standard or contain no added formaldehyde resins.
   2. Inherently Non-Emitting Materials.

C. VOC-Content-Restricted Products: VOC content not greater than required by the following:
   1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
   2. Joint Sealants: SCAQMD 1168 Rule.
   3. Paints and Coatings: Each color; most stringent of the following:
      a. 40 CFR 59, Subpart D.
      b. SCAQMD 1113 Rule.
      c. CARB (SCM).

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 017000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

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

C. Pre-installation meetings.

D. Cutting and patching.

E. Cleaning and protection.

F. Demonstration and instruction of Owner personnel.

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

H. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

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

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

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

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

E. Section 015100 - Temporary Utilities: Temporary heating, cooling, and ventilating facilities.

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

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

H. Section 024100 - Demolition: Demolition of whole structures and parts thereof.

I. Section 078400 - Firestopping.

J. Individual Product Specification Sections:
   1. Advance notification to other sections of openings required in work of those sections.

1.03 REFERENCE STANDARDS

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

1.04 SUBMITTALS

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

B. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
   2. Identify demolition firm and submit qualifications.
   3. Include a summary of safety procedures.

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.
   6. Include in request:

a. Identification of Project.
b. Location and description of affected work.
c. Necessity for cutting or alteration.
d. Description of proposed work and products to be used.
e. Alternatives to cutting and patching.
f. Effect on work of Owner or separate Contractor.
g. Written permission of affected separate Contractor.
h. Date and time work will be executed.

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

1.05 QUALIFICATIONS

A. For demolition work, employ a firm specializing in the type of work required.
1. Minimum of three years of documented experience.

B. 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.

1.06 PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Protect site from puddling or running water.

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

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

E. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
1. Indoors, adjacent to occupied hospital spaces: Limit conduct of especially noisy interior work to the hours of 6 pm to 7 am or as directed by the COR.

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

G. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

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

1.07 COORDINATION

A. See Section 011000 for occupancy-related requirements.

B. 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.

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

D. 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.

E. 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.

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

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

H. 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 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

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

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

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

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

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

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

3.02 PREPARATION

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

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

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

3.03 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 COR 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 COR, Owner, participants, and those affected by decisions made.

3.04 GENERAL INSTALLATION REQUIREMENTS

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

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

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

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

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

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

3.05 ALTERATIONS

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

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

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

D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. See Section 011000 for other limitations on outages and required notifications.
      c. Provide temporary connections as required to maintain existing systems in service.
   4. Verify that abandoned services serve only abandoned facilities.
   5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

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

F. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
   1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to COR.
   2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.

3. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for COR review and request instructions.

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

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

I. Clean existing systems and equipment.

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

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

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

3.06 CUTTING AND PATCHING

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

B. See Alterations article above for additional requirements.

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

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

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

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

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

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 078400, to full thickness of the penetrated element.

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

3.07 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.

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. Protect installed work from damage by construction operations.

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

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

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

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

F. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.

G. Prohibit traffic from landscaped areas.

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

3.09 DEMONSTRATION AND INSTRUCTION

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.

E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

G. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

3.10 ADJUSTING

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

B. Testing, adjusting, and balancing HVAC systems: See Section 230593 - Testing, Adjusting, and Balancing for HVAC.

3.11 FINAL CLEANING

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

B. Use cleaning materials that are nonhazardous.

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

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

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

F. Clean filters of operating equipment.

G. Clean 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.

3.12 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Owner.

B. Accompany COR 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 COR when work is considered ready for COR'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 COR's Substantial Completion inspection.

E. Owner will occupy all of the building as specified in Section 011000.

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

G. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

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

I. Complete items of work determined by COR listed in executed Certificate of Substantial Completion.

3.13 MAINTENANCE

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

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

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

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

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

END OF SECTION

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SECTION 017419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. Owner requires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
   1. Aluminum and plastic beverage containers.
   2. Corrugated cardboard.
   3. Wood pallets.
   4. Clean dimensional wood.
   5. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
   6. Glass.
   7. Windows, doors, and door hardware.
   8. Plumbing fixtures.
   9. Fluorescent lamps (light bulbs).
   10. Acoustical ceiling tile and panels.

E. Contractor Reporting Responsibilities: Submit periodic Waste Disposal Reports; report landfill disposal, recycling, salvage, and reuse regardless of to whom the cost or savings accrues; use the same units of measure on required reports.

F. Develop and follow a Waste Management Plan designed to implement these requirements.

G. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.

H. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: List of items to be salvaged from the existing building for relocation in project or for Owner.

B. Section 012500 - Substitution Procedures.

C. Section 013000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

D. Section 015000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

E. Section 016000 - Product Requirements: Waste prevention requirements related to product substitutions.

F. Section 016000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.

G. Section 017000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.03 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

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

B. Submit Waste Management Plan within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner; submit projection of all trash and waste that will require disposal and alternatives to landfilling.

C. Waste Management Plan: Include the following information:
   1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
   2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
   3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
      a. List each material proposed to be salvaged, reused, or recycled.
   4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
   5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
   6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.

D. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
   1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
   2. Submit Report on a form acceptable to Owner.
   3. Landfill Disposal: Include the following information:
      a. Identification of material.
      b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
      c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   4. Incinerator Disposal: Include the following information:
      a. Identification of material.
      b. Amount, in tons or cubic yards, of trash/waste material from the project delivered to incinerators.
      c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   5. Recycled and Salvaged Materials: Include the following information for each:
      a. Identification of material, including those retrieved by installer for use on other projects.
      b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
      c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
      e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
   6. Material Reused on Project: Include the following information for each:
      a. Identification of material and how it was used in the project.
      b. Amount, in tons or cubic yards.
      c. Include weight tickets as evidence of quantity.
   7. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

A. See Section 016000 and Section 012500.

B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 016000:
   1. Relative amount of waste produced, compared to specified product.
   2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Price.
   3. Proposed disposal method for waste product.
   4. Markets for recycled waste product.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

A. See Section 011000 for list of items to be salvaged from the existing building for relocation in project or for Owner.

B. See Section 013000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

C. See Section 015000 for additional requirements related to trash/waste collection and removal facilities and services.

D. See Section 016000 for waste prevention requirements related to delivery, storage, and handling.

E. See Section 017000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and COR.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.
   1. Prebid meeting.
   2. Preconstruction meeting.
   3. Regular job-site meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
   1. As a minimum, provide:
      a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
      b. Separate dumpsters for each category of recyclable.
      c. Recycling bins at worker lunch area.
   2. Provide containers as required.
   3. Locate enclosures out of the way of construction traffic.
   4. Provide adequate space for pick-up and delivery and convenience to subcontractors.
   5. If an enclosed area is not provided, clearly lay out and label a specific area on-site.
   6. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

SECTION 017800
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 013000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

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

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

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

1.03 SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's list of Incomplete items.

C. Project Record Documents: Submit documents to COR with claim for final Application for Payment.

D. Operation and Maintenance Data:
   1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with COR comments. Revise content of all document sets as required prior to final submission.
   3. Submit two sets of revised final documents in final form within 10 days after final inspection.

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

B. Ensure entries are complete and accurate, enabling future reference by Owner.

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

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
2. Field changes of dimension and detail.
3. Details not on original Contract drawings.

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

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

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

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

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

3.04 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.
1. Include HVAC outdoor and exhaust air damper calibration strategy.
    a. Include provisions which ensure that full closure of dampers can be achieved.

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

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

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

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

I. Provide list of original manufacturer's spare parts and recommended quantities to be maintained in storage.

J. Include test and balancing reports.

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

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

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

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

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

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

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

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

3.06 WARRANTIES AND BONDS

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

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

C. Co-execute submittals when required.

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

E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

F. 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.

G. 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.

H. 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 024100
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

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

B. Section 011000 - Summary: Description of items to be salvaged or removed for re-use by Contractor.

C. Section 015000 - Temporary Facilities and Controls: Security, protective barriers, and waste removal.

D. Section 016000 - Product Requirements: Handling and storage of items removed for salvage and relocation.

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

F. Section 017419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

1.03 DEFINITIONS

A. Demolish: Dismantle, raze, destroy, or wreck any building or structure or any part thereof.

B. Remove: Detach or dismantle items from existing construction and dispose of them off site, unless items are indicated to be salvaged or reinstalled.

C. Remove and Salvage: Detach or dismantle items from existing construction in a manner to prevent damage. Clean, package, label and deliver salvaged items to Owner in ready-for-reuse condition.

D. Remove and Reinstall: Detach or dismantle items from existing construction in a manner to prevent damage. Clean and prepare for reuse and reinstall where indicated.

E. Existing to Remain: Designation for existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.04 REFERENCE STANDARDS

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

1.05 SUBMITTALS

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

B. Demolition Plan: Submit demolition plan as required by OSHA and local AHJs.
   1. Indicate extent of demolition, removal sequencing, bracing and shoring, and location and construction of barricades and fences.
   2. Summary of safety procedures.
   3. Demolition firm qualifications.

C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.06 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.
   1. Minimum of three years of documented experience.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 DEMOLITION

A. Remove items indicated, for salvage, relocation, and recycling.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with requirements in Section 017000.

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 permits from authority having jurisdiction.
   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. Do not begin removal until built elements to be salvaged or relocated have been removed.

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

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

G. Hazardous Materials:
   1. If hazardous materials are discovered during removal operations, stop work and notify COR and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.

H. Perform demolition in a manner that maximizes salvage and recycling of materials.
   1. Comply with requirements of Section 017419 - Construction Waste Management and Disposal.
   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. Protect existing utilities to remain from damage.

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

C. 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.

D. 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.

E. 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.

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

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

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

B. Separate areas in which demolition is being conducted from areas that remain occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction indicated on drawings in locations indicated on drawings.

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

D. Services including, but not limited to, HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications: Remove and/ or replace existing fixtures as indicated.
   1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. See Section 011000 - Summary for limitations on outages and required notifications.
   4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification.

E. Protect existing work to remain.
   1. Prevent movement of structure. Provide shoring and bracing as required.
   2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch to match new work.

3.05 DEBRIS AND WASTE REMOVAL

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

B. Remove materials not to be reused on site; comply with requirements of Section 017419 - 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

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SECTION 051200
STRUCTURAL STEEL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work of this Section includes the fabrication, delivery and installation of structural steel items as shown and noted on the Drawings and as specified herein. Structural steel is that work defined in American Institute of Steel Construction (AISC) "Code of Standard Practice," and as otherwise shown on Drawing.

1.02 RELATED REQUIREMENTS

A. Section 099113 - Exterior Painting

1.03 REFERENCE STANDARDS

A. AISC "Manual of Steel Construction" including "Specification for Structural Steel Buildings", 9th Edition.

B. AISC "Code of Standard Practice for Steel Buildings and Bridges".

C. "Specifications for Structural Joints Using ASTM A325 or A490 Bolts", as approved by Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.

D. AWS "Structural Welding Code - Steel", D1.1.

E. American National Standards Institute (ANSI).

F. American Society for Testing and Materials (ASTM), as cited.

G. SSPC, Steel Structures Painting Council.

1.04 SUBMITTALS

A. Submit detailed checked shop drawings showing all information necessary for the fabrication and assembly of the component parts of the structure including, but not limited to the following:
   1. Size and weight of members.
   2. Type and location of shop and field connections.
   3. Type, size and extent of all welds.
   4. The welding sequence when required.
   5. Type, size and number of bolts.
   6. Notation of erection marks.

1.05 QUALITY CONTROL

A. Testing
   1. Testing in the mill, shop, and field of structural steel, welds, and bolts shall be performed by an independent testing agency approved by the Engineer and retained by the Owner. Weld inspectors shall be AWS Certified Welding Inspector (CWI) per AWS QCI. Inspectors performing nondestructive testing of welds other than visual shall be NDT Level II per American Society for Nondestructive Testing Recommended Practice No. SNT-TC-1A.

B. Welding
   1. Use welders with current AWS certifications for the required welding work.
   2. Quality - Welding processes and welding operators per the "Structural Welding Code-Steel," AWS D1.1.

C. Design, fabricate and erect work covered in this division using the latest edition of the following applicable standards:
   1. AISI "Specification for the Design of Cold-Formed Steel Structural Members".
   2. AWS "Structural Welding Code-Steel," AWS D1.1.
   3. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings".
   4. AISC "Manual of Steel Construction".
   5. AISC "Code of Standard Practice for Steel Buildings and Bridges".
   6. AISC "Specifications for Structural Joints Using ASTM A 325 or A 490 Bolts".

1.06 CONNECTIONS

A. All connections not shown on the Drawings shall be designed and detailed by the Fabricator. Connection design shall be by a qualified Professional Engineer registered in the State of Montana.

B. Detailing shall be performed using rational engineering design and standard practice in accordance with the Contract Documents.

C. Connections, unless otherwise shown on the Drawings, shall be simple shear connections utilizing high-strength bolts and bearing type connections with threads excluded from the shear plane.

D. Simple shear connections for wide flanges shall be designed for one-half the maximum allowed web shear for the Section in question unless specifically noted.

E. The minimum number of bolts per connection shall be two (2).

F. Minimum fillet weld size shall comply with AISC, but shall not be less than 1/4" unless specifically noted otherwise on the Drawings.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver all structural steel to the Project site and handle the store in such a manner as not to damage or distort material.

B. Store off the ground such that water will not pond on horizontal surfaces.

C. Replace damaged members at no additional expense to the Owner.

D. Clearly mark each piece with suitable erection marks, which corresponds to the Shop Drawings erection marks.

E. Handle so as not to damage (primer, paint system).

PART 2 PRODUCTS

2.01 STRUCTURAL STEEL MATERIALS SHALL BE AS FOLLOWS:

A. Rolled shapes - ASTM A572 Grade 50

B. Rolled steel plates and bars - ASTM A36, and, as indicated on the Drawings.

C. Coldformed steel tubing - ASTM A500, Grade B.

D. Hotformed steel tubing - ASTM A501.

2.02 ACCESSORIES

A. High-strength bolts and nuts - ASTM A325 or A490 as shown on the Drawings.

B. Welding electrodes per "Structural Welding Code - Steel", AWS D1.1.

2.03 MATERIAL SUBSTITUTION

A. Structural steel shapes other than those indicated may be substituted only upon prior approval of Engineer. All substitute material(s) must be of equivalent strength to that specified, and must not interfere with architectural, mechanical or electrical requirements in any way. Any additional cost above that of originally specified material must be borne by this Contractor.

2.04 PAINTING

A. Primer for those members not receiving galvanizing: See Section 099000 for painting. Approved primers include:
   1. "Guardsman 11-750" Structural Steel Primer
   2. "Durako K-797" Alkaline Primer
   3. "Rust-Oleum 1069" Heavy Duty Rust Inhibitive Red Primer
   4. "Tnemec 99" Red Metal Primer
   5. Sherwin Williams "Kromik Metal Primer #41N1"
   6. Substitutions: See Section 016000 - Product Requirements.

B. Final Coat: See Section 099000.

C. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint-20.

PART 3 EXECUTION

3.01 INSPECTION

A. Inspect area to receive the work and report immediately in writing to the Engineer, as required in the General Conditions, any unacceptable conditions. Do not proceed with work until unsatisfactory conditions have been corrected in an acceptable manner. Commencement of erection implies acceptance of related work.

3.02 FABRICATION

A. Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final Shop Drawings. Provide camber in structural members where indicated.

B. Properly mark and match-mark materials for field assembly.

C. Where finishing is required, complete assembly including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.

D. Weld or bolt shop connection, as indicated. Bolt field connections, except where welded or other connections are shown on the Drawings.

E. Bolted connections, use high-strength threaded fasteners, bearing type with no threads in shear planes.

F. Perform shop welding by either shielded metal - arc process or submerged-arc process.

G. Make all fillet welds 1/4" minimum unless noted otherwise on Drawings.

H. Make all butt welds full-penetration welds, using back-up of chip and back weld.

I. Column Bearing Surfaces
   1. Where bearing plates are integral with column sheet, provide at least saw cut bearing surfaces to give full bearing over the cross sections.
   2. Where butt splices and ends rest on separate bearing plates, provide milled bearing surfaces.
   3. Provide structural steel members noted on the drawings with integral bearing plates.

J. Provide holes and openings in proper location for attachment of work by other trades. No field burning will be permitted. Mislocated holes or misfabricated connection material shall be reported to Engineer without delay.

K. After fabrication, all steel shall be cleaned of all rust, loose mill scale and other foreign materials.

L. Verify all dimensions in the field prior to fabrication.

M. Provide accurately fitted, tight joints; sharp lines and angles at intersections; and smooth surfaces.

N. Fabricate work to be square, plumb, straight and true when erected in the completed project.

O. Construct exposed joints to exclude water.

P. Break all sharp edges and corners.

Q. Provide slotted connection at firewall as shown in drawing details.

3.03 PAINTING

A. Clean all miscellaneous metal surfaces of all loose mill scale, loose rust, spatter, slag or flux deposits, and other foreign material per Steel Structures Painting Council Specifications SSPC-SP-3. For those members to receive galvanizing, follow guidelines for SSPC-6.

B. Shop apply paint to all steel surfaces.

C. Shop coat: Structural steel shall be given one shop coat of heavy-duty, rust-inhibiting, metal protecting prime paint. Minimum dry film thickness must be not less than two mils (0.002 inch). Primer shall be applied in strict compliance with manufacturer's specifications and recommendations.

D. Where field touch-up painting is required, prepare surfaces and apply coat per paint manufacturer's recommendations.

E. Paint all exposed bolts, nuts, washers, and miscellaneous hardware with same paint system used on structural steel.

F. See Section 099000 for additional information.

G. Galvanizing: For those items indicated for galvanizing, apply zinc-coating by the hot-dip process compliance with the following requirements:
   1. ASTM A 153 for galvanizing iron and steel hardware.
   2. ASTM A 123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick and heavier.

H. After erection of all miscellaneous metal items required herein, clean and touch-up all welds and abrasions with the same type of paint system as used for the shop coat. Touch-up all damaged galvanized surfaces with galvanizing repair paint.

3.04 GENERAL

A. Prior to steel erection examine the site conditions and the work of others insofar as it affects structural steel work and report immediately in writing to the Engineer as required by the General Conditions any conditions which interfere with the erection of structural steel.

B. Begin steel erection only after deficiencies have been corrected in an acceptable manner.

C. Commencement of erection of structural steel implies acceptance of related work performed by others.

D. Prior to application of sprayed-on fireproofing, the Contractor shall remove in the field all loose mill scale or rust.

E. Furnish anchor bolts, leveling plates, nuts and washers for installation and grouting as specified in Division 3, Concrete. All such, as well as other items required to be built into concrete or masonry, shall be furnished to General Contractor at proper time, and shall include instructions and templates for their installation.

3.05 ERECTION

A. Carry the framing up true and plumb using temporary bracing as necessary to take care of all loads to which the structure may be subjected, including erection equipment and its operation.

B. As steel erection progresses, securely connect the work to take care of all dead load, wind and erection stresses.

C. All welding to meet AISC and AWS criteria - see Part 1.

D. All bolting shall use high-strength bolts, hardened washers, and nuts.

E. All mud, tags and other foreign materials must be removed from steel members.

F. Splicing of members will not be permitted except where shown on the Drawings.

G. The Contractor shall be responsible for the control of all erection procedures and sequences with relation to temperature differentials, especially with respect to structural steel framing into concrete walls.

3.06 CONNECTIONS

A. Shop Connection
   1. Welded: Use E70 electrodes in accordance with procedures and recommendations of AWS.

B. Field Connection
   1. Epoxy adhesive anchors as shown on the Drawings, and installed and tested as per manufacturer's recommendations.

3.07 TESTING

A. Testing for all welds and bolted connections will be as specified below.
   1. All welds shall be visually inspected. Twenty-five (25) percent at random shall be measured.
   2. Ultrasonically test 100 percent of all full-penetration welds.
   3. Ultrasonically test 100 percent of all partial penetration column splice welds.
   4. Check 50 percent of stiffener plate fillet welds by magnetic particle for final pass.

5. Ultrasonically test for lamination in column flanges for rigid frame beam to column moment connection. Such zones extend nine (9) inches on either side of the top beam flange for the full width of the column flange. The fabricator shall mark out areas on the column flanges where field weld for the top beam flange connection will be made. Test the column flange only at the top beam flange location.
6. The Owner's testing agency shall perform all shop and field inspection and testing as outlined above.
7. The structural steel fabricator and erector shall schedule all work to allow the above testing requirements to be completed.

END OF SECTION

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SECTION 061000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preservative treated wood materials.

B. Fire retardant treated wood materials.

C. Concealed wood blocking, nailers, and supports.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 077200 - Roof Accessories: Prefabricated roof curbs.

1.03 REFERENCE STANDARDS

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

B. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2017).

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

D. AWPA U1 - Use Category System: User Specification for Treated Wood; 2025.

E. PS 20 - American Softwood Lumber Standard; 2025.

1.04 SUBMITTALS

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

B. Product Data: Provide technical data on fire-retardant treatment, wood preservative materials and application instructions.

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.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

1.06 WARRANTY

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

B. Manufacturer Warranty: Provide 2-year manufacturer warranty for materials and workmanship commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Douglas Fir-Larch, unless otherwise indicated.
   2. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
   3. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.

2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Roof Sheathing: Oriented strand board wood structural panel; PS 2.
   1. Grade: Sheathing.
   2. Bond Classification: Exposure 1.
   3. Performance Category: 5/8 PERF CAT.
   4. Edges: Square.
   5. Warranty: Manufacturer's standard lifetime limited warranty against manufacturing defects and that panels will not delaminate or require sanding due to moisture absorption damage from exposure to weather for up to the stated period.

2.04 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.

B. Liquid Flashing: One-part, fast-curing, nonsag, elastomeric, gun grade, trowelable liquid flashing.

C. General Purpose Construction Adhesives: Comply with ASTM C557.

2.05 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. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
   2. 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. Fire Retardant Treatment:
   1. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Interior rough carpentry items are to be fire retardant treated where indicated on drawings.
      c. Treat rough carpentry items as indicated .
      d. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. 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 other locations as indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

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.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

C. 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.

D. Provide the following specific nonstructural 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.

3.04 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with framing of roof openings, and roofing assembly installation.

B. Provide wood curb at each roof opening except where prefabricated curbs are specified and where specifically indicated otherwise; form corners by alternating lapping side members.

3.05 INSTALLATION OF CONSTRUCTION PANELS

A. Roof Sheathing for curbs: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
   1. At long edges use sheathing clips where joints occur between roof framing members.
   2. Nail panels to framing; staples are not permitted.

3.06 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

END OF SECTION

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SECTION 064100
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Plastic-laminate-faced architectural cabinets.
   2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets that are not concealed within other construction.

B. Related Sections:
   1. 123600 – Countertops

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.03 SUBMITTALS

A. Product Data: For each type of product.
   1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: For plastic-laminate-faced architectural cabinets.
   1. Include plans, elevations, sections, and attachment details.
   2. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples: For each exposed product and for each color and texture specified.

D. Certificates demonstrating compliance with Federal Acquisition Regulations Buy American Act requirements.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
   1. Shop Certification: AWI's Quality Certification Program accredited participant.

B. Installer Qualifications: Fabricator of products.

PART 2 PRODUCTS

2.01 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of cabinets indicated for construction, finishes, installation, and other requirements.
   1. Provide inspections of fabrication and installation together with labels and certificates from AWI certification program indicating that woodwork complies with requirements of grades specified.

B. Grade: Custom.

C. Type of Construction: Frameless.

D. Door and Drawer-Front Style: Flush overlay.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard. Refer to Interior Finish Key.

F. Laminate Cladding for Exposed Surfaces:
   1. Horizontal Surfaces: Grade HGS.
   2. Postformed Surfaces: Grade HGP.
   3. Vertical Surfaces: Grade HGS.
   4. Edges: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.
   5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.

G. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

H. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
   1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

I. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   1. Refer to interior finish key on drawings.

2.02 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
   1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

2.03 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction as determined by testing performed on identical products by a qualified testing agency.
   1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
   2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
   3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

2.04 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087100 "Door Hardware."

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, self-closing.

C. Back-Mounted Arch Pulls: BHMA A156.9, B02011, Steel bar handles as selected by Architect.
   1. Basis of Design: Amerock Extensity Arch Cabinet Pull
   2. Pull Size: 3-3/4" Center to center.
   3. Pull Finish: Satin Nickel

D. Catches: Magnetic catches, BHMA A156.9, B03141.

E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

F. Shelf Rests: BHMA A156.9, B04013; metal.

G. Drawer Slides: BHMA A156.9.
   1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer.
      a. Type: Full extension.
      b. Material: Zinc-plated steel with polymer rollers.
   2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
   3. For drawers more than 3 inches (75 mm) high, but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1HD-100.
   4. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide Grade 1HD-100.

H. Door Locks: BHMA A156.11, E07121.

I. Drawer Locks: BHMA A156.11, E07041.

J. Door and Drawer Silencers: BHMA A156.16, L03011.

K. Grommets for Cable Passage: 2-inch (51-mm) OD, molded-plastic grommets and matching plastic caps with slot for wire passage.
   1. Color: As selected by COR from manufacturer's full range.

L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
   1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
   2. Satin Stainless Steel: BHMA 630.

M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

N. Aluminum Millwork Trim and Reveals: Fry Reglet Architectural Metals. Provide aluminum trim and reveals as indicated on drawings. Install as part of the millwork according to manufacturer.

O. ADA-compliant vanity support bracket: Surface mounted bracket for supporting sloping counter or shelf.
   1. Basis of Design: Rakks EH-LV-80
   2. Fabricate components from extruded aluminum sections complying with ASTM B221, 6063-T5 alloy and temper.

2.05 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
   1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.06 FABRICATION

A. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

B. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 EXECUTION

3.01 INSTALLATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

B. Grade: Install cabinets to comply with quality standard grade of item to be installed.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) using concealed shims.
   1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
   2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

END OF SECTION

SECTION 066100
SOLID SURFACE SHOWER SYSTEM

PART 1 – GENERAL

1.01 1.1 SUMMARY

A. Shower Receptors

B. Solid Surface Wall Panels

1.2 SECTION INCLUDES

A. Solid Surface Shower Receptors.

1.3 REFERENCES

A. American National Standards Institute (ANSI)

1.4 SYSTEM DESCRIPTION

A. Performance Requirements: Provide shower receptors that conform to the following requirements of regulatory agencies.
   1. Provide shower receptors that conform to ANSI124.1.2-2005 when tested for workmanship and finish, structural integrity and material characteristics.
   2. Provide Shower receptors that conform to ANSI Z457/CSA B45.5-11 when tested for load bearing.

1.5 SUBMITTALS

A. Product Data: Manufacturer's printed product data for each type of shower receptor specified.

B. Samples: Verification samples minimum of 1 ½” x 3" samples indicating color.

C. Shop Drawings

D. Manufacturer's Installation Instruction: Printed installation instructions for shower receptors.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in unopened factory packaging to the jobsite

B. Inspect materials at delivery to assure that specified products have been received.

C. Store in original packaging in an interior climate-controlled location away from direct sunlight.

1.7 PROJECT CONDITIONS

A. Environmental Requirements: Products must be installed in an interior climate-controlled environment.

1.8 WARRANTY

A. Manufacturer’s standard Solid Surface Limited 10-Year Warranty against material and manufacturing defects.

PART 2 – PRODUCTS

9.01 2.1 MANUFACTURER

A. Provide all shower receptors from a single source.

2.2 MANUFACTURED UNITS

A. Solid Surface Standard ADA Shower Receptors
   1. Width of receptor shall be based off of field measurements.
   2. Depth of Trench Receptor shall be 30 7/8”, 36 ¾”, and 48 7/8” outside dimension, standard; custom depths up to 48 7/8” available.
   3. Drain Location shall be 5 5/8” on center from the back, outside edge of the receptor. Minimum drain offset from either edge varies by size.
   4. Water Barrier shall be double water barrier (w/flange), ½” thick x 4 ½” high water barrier with ¼” thick x 5 ½” high flange.
      a. Receptor Cap (Optional), fabricated solid surface channel for joining 2 or more receptors together side by side.

1) Water Barrier Extension, fabricated double water barrier extension, 18” long, used to extend the water barrier of a receptor to match the depth of an adjacent receptor.

5. Threshold:
   a. ADA Threshold (1/4” max beveled edge with 2:1 slope, height varies by size)

B. Shower Drain:
   1. Provide solid surface round drain showers with tamper resistant round drain cover, ADA compliant threshold, Oatey 42150 brass, no caulk drain, and integral non-skid surface on the floor of the shower base.

2.3 SOLID SURFACE WALL PANELS

A. Manufacturer’s standard solid surface 96-inch-tall wall panel system matched to the receptor size with inside wedge corner trim and seamless up to 60-inch back wall shall be included where indicated.

2.4 MATERIALS

A. Solid Surface: ADA shower receptor shall be manufactured from an acrylic-modified polyester resin.

B. Finish: Refer to interior finish key on drawings.

PART 3 – EXECUTION

13.01 3.1 EXAMINATION

A. Examine areas and conditions in which shower receptors will be installed.

B. Framing template shall be provided by the manufacturer and used to make certain wall framing in shower areas fits the shower base per manufacturer’s instructions.

3.2 PREPARATION

A. General: Prior to installation, clean area to remove dust, debris and loose particles.

3.3 INSTALLATION

A. General: Install components plumb and level, scribe adjacent finishes, in accordance with approved shop drawings and recommended installation instructions.

B. Install all shower components on a fully-supported solid, moisture resistant substrate.

C. All solid surface accessories shall be hard-seamed in place with the manufacturer’s color-matched acrylic glue.

3.4 CLEANING

A. At completion of the installation, clean surfaces in accordance with the Solid Surface manufacturer’s clean-up and maintenance instructions.

- - - E N D - - -

END OF SECTION

SECTION 070150.19
PREPARATION FOR RE-ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roofing membrane and selective roofing system component removal and replacement for installation of new roof mounted mechanical unit as indicated on drawings.

B. Temporary roofing protection.

1.02 RELATED REQUIREMENTS

A. Section 075400 - Thermoplastic Membrane Roofing.

B. Section 076200 - Sheet Metal Flashing and Trim: Replacement of flashing and counterflashings.

C. Section 237413 - Packaged Outdoor Central-Station Air-Handling Units.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with affected mechanical and electrical work associated with roof penetrations.

B. Preinstallation Meeting: Convene one week before starting work of this section.
   1. Attendees:
      a. COR.
      b. Contractor.
      c. Owner.
      d. Installer.
      e. Other installers responsible for adjacent and intersecting work.
   2. Meeting Agenda: Provide agenda to participants prior to meeting in preparation for discussions on the following:
      a. Removal and installation schedule and sequence.
      b. Necessary preparatory work.
      c. Protection before, during, and after roofing system installation.
      d. Partial removal of existing roofing system.
      e. Temporary roofing and daily terminations.
      f. Transitions and connection to and with other work.

1.04 SUBMITTALS

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

B. Product Data: Submit for each type of material.

C. Shop Drawings: Indicate size, configuration, and installation details.

D. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Materials Removal Company Qualifications: Company specializing in performing work of type specified with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

1.07 FIELD CONDITIONS

A. Existing Roofing System: Polyvinyl Chloride (PVC) roofing.

B. Do not remove existing roofing membrane when weather conditions threaten the integrity of building contents or intended continued occupancy.

C. Maintain continuous temporary protection prior to and during installation of new roofing system.

D. Provide notice at least three days before starting activities that will affect normal building operations.

E. Owner will occupy building areas directly below re-roofing area.
   1. Provide Owner with at least 48 hours written notice of roofing activities that may affect their operations and to allow them to prepare for upcoming activities as necessary.
   2. Do not disrupt Owner's operations or activities.
   3. Maintain access of Owner's personnel to corridors, existing walkways, and adjacent buildings.

1.08 WARRANTY

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

B. Existing Warranties: Perform this work using methods and materials that will maintain existing roof system warranties.
   1. Notify existing roof system warrantor prior to starting this work and obtain written instructions for procedures necessary to maintain this existing warranty.
   2. Upon completion of this work, notify warrantor of reroofing completion and obtain documentation to verify that existing roofing system has been inspected and warranty is still in effect.
      a. Submit documentation upon project closeout.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Flex MF/R 60 mil PVC Roof Membrane to match existing.
   1. Roofing Membrane to meet or exceed Factory Mutual's 1-90 wind uplift requirements.
   2. Color: White.

B. Substitutions are not allowed.

2.02 COMPONENTS

A. Existing Roofing System: Polyvinyl Chloride (PVC) roofing. System components may include the following and should be replaced to match existing:
   1. Roofing membrane.
   2. Cover board.
   3. Flat and Tapered Roof Insulation.
   4. Vapor retarder.
   5. Substrate board.

B. Perform this work using methods and materials that will maintain existing roof system warranties.

C. See the following sections for additional information on components relating to this work:
   1. Partial removal of existing roofing system in preparation for new roof top mechanical unit as indicated on drawings.

2.03 MATERIALS

A. Patching Materials: Provide necessary materials in accordance with requirements of existing roofing system.

B. Temporary Roofing Protection Materials:
   1. Contractor's responsibility to select appropriate materials for temporary protection of roofing areas as determined necessary for this work. Use methods and materials that will maintain existing roof system warranty.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing roof surface has been cleared of materials being removed from existing roofing system and ready for next phase of work as required.

3.02 PREPARATION

A. Sweep roof surface clean of loose matter.

B. Remove loose refuse and dispose of properly off-site.

3.03 MATERIAL REMOVAL

A. Remove only existing roofing materials that can be replaced with new materials the same day.

B. Remove roofing membrane, perimeter base flashings, flashings around roof protrusions as required to accept new Packaged Outdoor Central-Station Air-Handling Units.

C. Remove and replace existing insulation, cant strips, and blocking as necessary.

D. Remove and replace existing cover board, insulation, vapor retarder, sheathing paper, and underlay as required.

E. Ensure roof drainage remains functional.
   1. Keep drainage systems clear of debris.
   2. Prevent water from entering building and existing roofing system.

F. Coordinate rooftop utilities remaining active during roofing work with COR.

3.04 INSTALLATION

A. Coordinate scope of this work with requirements for installation of new roofing system, see Section 075400 for additional requirements.

3.05 PROTECTION

A. Provide protection of existing roofing system that is not having work performed on it.

B. Provide temporary protective sheeting over uncovered deck surfaces.

C. Provide for surface drainage from sheeting to existing drainage facilities.

D. Do not permit traffic over unprotected or repaired deck surface.

END OF SECTION

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SECTION 072100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Batt insulation at interior wall construction.

1.02 RELATED REQUIREMENTS

A. Section 092216 - Non-Structural Metal Framing.

1.03 DEFINITIONS

A. Mineral Fiber Material Composition: Insulation referred to as mineral fiber block, board, and blanket insulation is composed of fibers from mineral based substances such as rock, slag, or glass and processed from the molten state into fibrous form.
   1. Based on type of insulation substance, the material will be referred to as a mineral fiber when having a rock or slag base, and glass fiber with a glass or silica sand base, also considered a mineral.
   2. Insulation blankets are flexible units consisting of felted, bonded, or unbonded fibers formed into rolls or flat cut pieces referred to as batts; rolls are simply longer versions of batts.
   3. For additional information about mineral fiber and the various classification types, refer to the following reference standards; ASTM C553, ASTM C612, ASTM C665, and ASTM C726.

1.04 REFERENCE STANDARDS

A. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2024.

B. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.

D. ASTM C726 - Standard Specification for Mineral Wool Roof Insulation Board; 2017.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

1.05 SUBMITTALS

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

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Shop Drawings: Submit drawings that indicate insulation type, locations and extent of insulation applications at interior walls.
   1. Include details for penetrations, terminations, and tie-ins with adjoining construction.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation in Interior Metal Framed Walls: Acoustic Batt insulation with no vapor retarder.

2.02 MINERAL FIBER BLANKET INSULATION MATERIALS

A. Mineral Wool Blanket Thermal Insulation: Flexible preformed interior insulation, complying with ASTM C665.
   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. Thickness: As indicated on drawings.
   4. Products:
      a. Basis of Design, or approved equal: ROCKWOOL; Safe'n'Sound: www.rockwool.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

2.03 ACCESSORIES

A. Tape: As recommended by insulation manufacturer for application.
   1. Application: Sealing of interior circular penetrations, such as pipes or cables in walls.
   2. Width: As required for application.
   3. Temperature Resistance: Range of minus 40 to 212 degrees F.

B. Mineral Wool Insulation Attachment: As recommended by manufacturer.

C. Adhesive: Type recommended by insulation manufacturer for application.

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 irregularities or materials or substances that may impede adhesive bond.

3.02 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in interior wall 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. Retain insulation batts in place as recommended by manufacturer.

3.03 FIELD QUALITY CONTROL

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

3.04 PROTECTION

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

END OF SECTION

SECTION 075400
THERMOPLASTIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Adhered system with thermoplastic roofing membrane.

B. Insulation, tapered.

C. Vapor retarder.

D. Cover boards.

E. Flashings.

1.02 REFERENCE STANDARDS

A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.

B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.

C. ASTM D4434/D4434M - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing; 2021.

D. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces; 2011 (Reapproved 2019).

E. FM (AG) - FM Approval Guide; Current Edition.

F. NRCA (RM) - The NRCA Roofing Manual; 2025.

G. NRCA (WM) - The NRCA Waterproofing Manual; 2021.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.
   1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.04 SUBMITTALS

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

B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, and fasteners.

C. Shop Drawings: Submit drawings that indicate joint or termination detail conditions, conditions of interface with other materials, and setting plan for tapered insulation.

D. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.

E. Installer's qualification statement.

F. Warranty Documentation:
   1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
   2. Submit installer's written verification that installation complies with warranty conditions for waterproof membrane.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of this section with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact, unless otherwise indicated.

C. Store materials in weather protected environment, clear of ground and moisture.

D. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

E. Protect foam insulation from direct exposure to sunlight.

1.07 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.

B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above 180 degrees F.

C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

E. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.08 WARRANTY

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

B. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
   1. Warranty Term: 20 years.
   2. For repair and replacement include costs of both material and labor in warranty.

C. Existing Warranties: Perform this work using methods and materials that will maintain existing roof system warranties.
   1. Notify existing roof system warrantor prior to starting this work and obtain written instructions for procedures necessary to maintain this existing warranty.
   2. Upon completion of this work, notify warrantor of reroofing completion and obtain documentation to verify that existing roofing system has been inspected and warranty is still in effect.
      a. Submit documentation upon project closeout.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Thermoplastic Polyvinyl Chloride (PVC) Membrane Roofing Materials:
   1. Flex Membrane International Corporation; Flex MF/R PVC: www.flexroofingsystems.com/#sle, to match existing.
   2. Substitutions: Not permitted.

2.02 ROOFING - UNBALLASTED APPLICATIONS

A. Thermoplastic Membrane Roofing: One ply membrane, fully adhered, over insulation.

B. Roofing Assembly Requirements:
   1. Solar Reflectance Index (SRI): 109, minimum, calculated in accordance with ASTM E1980.
      a. Field applied coating may not be used to achieve specified SRI.
   2. Insulation Thermal Resistance (R-Value): 3 per inch, minimum; provide insulation of thickness required.

C. Acceptable Insulation Types:
   1. Tapered polyisocyanurate board to match existing.

2.03 MEMBRANE ROOFING AND ASSOCIATED MATERIALS

A. Membrane Roofing Materials:
   1. PVC: Polyvinyl chloride (PVC) complying with ASTM D4434/D4434M, sheet contains reinforcing fibers or reinforcing fabrics to match existing.
      a. Thickness: 60 mil, 0.060 inch, minimum to match existing.
   2. Sheet Width:

a. Adhered Application: Limit width to 120 inches, maximum, when ambient temperatures are less than 40 degrees F for extended period of time during installation.

3. Color: White.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Vapor Retarder: Material approved by roof manufacturer; compatible with roofing and insulation materials.

D. Flexible Flashing Material: Same material as membrane.

E. Through-Wall Flashing: Cold-applied, self-adhering, styrene-butadiene-styrene (SBS) modified rubberized asphalt sheet membrane bonded with high density cross-woven polyethylene film.

1. Thickness: 47 mil, 0.047 inch, minimum.
2. Width: 12 inches, minimum.

2.04 COVER BOARDS

A. Cover Boards: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.

1. Thickness: 1/2 inch, fire-resistant.
2. Products:
   a. Georgia-Pacific; DensDeck Prime: www.densdeck.com/#sle to match existing.
   b. Substitutions: Not permitted.

2.05 INSULATION

A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.

1. Classifications:
   a. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.
      1) Class 1 - Faced with glass fiber reinforced cellulosic facers on both major surfaces of the core foam.
      2) Compressive Strength: Classes 1-2-3, Grade 2, 20 psi (138 kPa), minimum.
      3) Thermal Resistance, R-value: At 1-1/2 inches thick; Class 1, Grades 1-2-3, 8.4 (1.48), minimum, at 75 degrees F to match existing.
2. Board Size: 48 by 96 inches.
3. Board Thickness: 1.5 inches.
4. Board Edges: Square.
5. Products:
   a. Flex ISO II Tapered Roof Insulation.
   b. Substitutions: Not permitted.

2.06 ACCESSORIES

A. Split Pipe Boots: Prefabricated pipe flashing through membrane; same material as membrane.

B. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches wide; self adhering.

C. Membrane Adhesive: As recommended by membrane manufacturer.

D. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.

E. Insulation Adhesive: As recommended by insulation manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 INSTALLATION, GENERAL

A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.

B. Do not apply roofing membrane during cold or wet weather conditions.

C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.

D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

F. Coordinate this work with installation of associated counterflashings installed by other sections as the work of this section proceeds.

G. Use methods and materials that will maintain existing roof system warranty.

3.03 INSTALLATION - VAPOR RETARDER AND INSULATION, UNDER MEMBRANE

A. Install vapor retarder to deck surface with adhesive in accordance with manufacturer's instructions.
   1. Extend vapor retarder under cant strips and blocking to deck edge.
   2. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane.

B. Attachment of Insulation: Embed insulation in adhesive in full contact, in accordance with roofing and insulation manufacturers' instructions.

C. Cover Boards: Mechanically fasten cover boards in accordance with roofing manufacturer's instructions and FM (AG) Factory Mutual requirements.

D. Lay subsequent layers of insulation with joints staggered minimum 6 inches from joints of preceding layer.

E. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.

F. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.

G. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

H. Tape joints of insulation in accordance with roofing and insulation manufacturers' instructions.

I. Do not install more insulation than can be covered with membrane in same day.

J. Use methods and materials that will maintain existing roof system warranty.

3.04 INSTALLATION - MEMBRANE

A. Use methods and materials that will maintain existing roof system warranty.

B. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

C. Shingle joints on sloped substrate in direction of drainage.

D. Fully Adhered Application: Apply adhesive to substrate at rate recommended by manufacturer. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.

E. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

F. At intersections with vertical surfaces:
   1. Extend membrane over cant strips and up a minimum of 4 inches onto vertical surfaces.
   2. Fully adhere flexible flashing over membrane and up to nailing strips.

G. Around roof penetrations, seal flanges and flashings with flexible flashing.

H. Coordinate installation of roof drains and sumps and related flashings.

3.05 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Remove bituminous markings from finished surfaces.

C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

D. Repair or replace defaced or damaged finishes caused by work of this section.

3.06 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

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SECTION 076200
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, exterior penetrations, and other items as indicated on drawings.

B. Sealants for joints within sheet metal fabrications.

1.02 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2026.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

D. ASTM B32 - Standard Specification for Solder Metal; 2020.

E. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

F. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

G. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.04 SUBMITTALS

A. See Section 013000 - 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 two samples illustrating metal finish color.

D. Fabricator's Qualifications Statement.

E. Installer's Qualifications Statement.

1.05 QUALITY ASSURANCE

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

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 GENERAL

A. Use methods and materials that will maintain existing roof system warranty.

2.02 MANUFACTURERS

A. Sheet Metal Flashing and Trim:
   1. ALUCOBOND by 3A Composites USA: www.alucobondusa.com/#sle.
   2. Hickman Edge Systems: www.hickmanedgesystems.com/#sle.

3. Petersen Aluminum Corporation: www.pac-clad.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

2.03 SHEET MATERIALS

A. Galvanized Steel, for Wall Cavity Head Closure: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 12-gauge, 0.105-inch thick base metal.

B. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch thick base metal, shop pre-coated with PVDF coating.
   1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
   2. Color: As selected by COR from manufacturer's full colors.

C. Pre-Finished Aluminum: ASTM B209/B209M, 3005 alloy, H12 or H14 temper; 20 gauge, 0.032 inch thick; plain finish shop pre-coated with PVDF coating.
   1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; pretreated metal with two-coat system including primer and color coat with at least 70 percent PVDF coating.
   2. Color: As selected by COR from manufacturer's full colors.

D. Stainless Steel: ASTM A666/A666M, Type 304 alloy, soft temper, 28 gauge, 0.0156 inch thick; smooth No. 4 - Brushed finish.

2.04 PREFINISHED ALUMINUM SHEETS

A. Aluminum Sheet Substrates: ASTM B209/B209M, alloy and temper as recommended by manufacturer for application.

B. Superior Performance Organic Coating System: Comply with AAMA 2605 for aluminum preparation, pretreatment, primer and finish coat system; provide thermally cured 70-percent PVDF fluoropolymer systems; tested for weathering for 10 years with 5 delta units color change maximum.

2.05 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; 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 long legs; seam for rigidity, seal with sealant.

F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

2.06 FLASHING

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

2.07 ACCESSORIES

A. Fasteners: Blind fasteners or self-drilling hex-washer head screws, gasketed with soft neoprene washer.
   1. Exposed: Heads matching color of sheet metal using plastic caps or factory-applied coating.
   2. Blind: High-strength aluminum or stainless-steel rivets, suitable for metal being fastened.
   3. Through Aluminum: Aluminum or series 300 stainless steel.
   4. Through Stainless Steel: Series 300 stainless steel.

B. Underlayment: Polyethylene, 6 mil, 0.006 inch thick.

C. Primer Type: Zinc chromate.

D. Concealed Sealants: Non-curing butyl sealant.

E. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

F. Solder: ASTM B32, Alloy Grade - Sn50 (50/50).

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, 0.015 inch.

3.03 INSTALLATION

A. Use methods and materials that will maintain existing roof system warranty.

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.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for field inspection requirements.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

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SECTION 077200
ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof curbs.

B. Equipment rails.

C. Roof penetrations mounting curbs.

1.02 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

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

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

D. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

1.03 SUBMITTALS

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

B. Product Data: Manufacturer's data sheets on each product to be used.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance requirements.

C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.
   1. Non-penetrating Rooftop Supports: Submit design calculations for loadings and spacings.

D. Warranty Documentation:
   1. Submit manufacturer warranty.
   2. Ensure that forms have been completed in Owner's name and registered with manufacturer.
   3. Submit documentation that roof accessories are acceptable to roofing manufacturer, and do not limit the roofing warranty.

1.04 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store products under cover and elevated above grade.

1.05 WARRANTY

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

PART 2 PRODUCTS

2.01 ROOF CURBS

A. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
   1. Applications: Roof curbs used for roof penetrations/openings as indicated on drawings.
   2. Roof Curb Mounting Substrate: Curb substrate consists of corrugated metal roof deck with insulation.
   3. Sheet Metal Material:

a. Galvanized Steel: Hot-dip zinc coated steel sheet complying with ASTM A653/A653M, SS Grade 33; G60 coating designation; 18 gauge, 0.048 inch thick.
   1) Finish: Factory primed.

B. Roof Curb Caps: Square-type aluminum cap with weathertight seal when vent or equipment is not installed.

C. Curbs Adjacent to Roof Openings: Provide curb on each side 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 thick fiberglass insulation.
   3. Height Above Finished Roof Surface: 8 inches, minimum.

D. Equipment Rail Curbs: Straight curbs on each side of equipment, with top of curbs horizontal and level with each other for equipment mounting.
   1. Provide preservative treated wood nailers along top of rails.
   2. Height Above Finished Roof Surface: 8 inches, minimum or as required by manufacturer to not void existing roof membrane warranty.

E. Equipment Support: Straight curbs on each side of equipment, with top of curbs parallel with metal roofing system and each other for equipment mounting.

F. Pipe, Duct, or Conduit Mounting Curbs: Vertical posts, minimum 8 inches square unless otherwise indicated.
   1. Provide preservative treated wood nailers over entire top surface, for supports that are provided by others.
   2. Height Above Finished Roof Surface: 8 inches, minimum.

2.02 NON-PENETRATING ROOFTOP SUPPORTS/ASSEMBLIES

A. Non-Penetrating Rooftop Support/Assemblies: Manufacturer-engineered and factory-fabricated, with pedestal bases that rest on top of roofing membrane, and not requiring any attachment to roof structure and not penetrating roofing assembly.
   1. Design Loadings and Configurations: As required by applicable codes.
   2. Height: Provide minimum clearance of 8 inches under supported items to top of roofing.
   3. Support Spacing and Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
   4. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
   5. Hardware, Bolts, Nuts, and Washers: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A153/A153M.

B. Pipe Supports: Provide attachment fixtures complying with MSS SP-58 and as indicated.
   1. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify COR of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.04 CLEANING

A. Clean installed work to like-new condition.

3.05 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

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SECTION 078100
APPLIED FIRE PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Applied fire protection of interior structural steel not exposed to damage or moisture.

B. Applied fire protection of structural steel exposed to damage or moisture.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 092116 - Gypsum Board Assemblies: Gypsum board fireproofing.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

B. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2019 (Reapproved 2023).

C. ASTM E759/E759M - Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2023).

D. ASTM E760/E760M - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2023).

E. ASTM E859/E859M - Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members; 2023.

F. ASTM E937/E937M - Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993 (Reapproved 2023).

G. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

1.04 ADMINISTRATIVE REQUIREMENTS

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

B. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

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

B. Product Data: Provide data indicating product characteristics, performance criteria, and limitations of use.

C. Manufacturer's Certificate: Certify that applied fireproofing products meet or exceed requirements of Contract Documents.

D. 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.

E. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

F. Field Quality Control Submittals: Submit field test report.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

1.06 QUALITY ASSURANCE

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

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

1.07 FIELD CONDITIONS

A. Do not apply fireproofing when temperature of substrate material and surrounding air is below 40 degrees F 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.

D. Do not allow roof traffic during installation of roof fireproofing and drying period.

1.08 WARRANTY

A. See Section 017800 - 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 APPLIED FIRE PROTECTION ASSEMBLIES

A. Provide assemblies as indicated on drawings.

B. UL listings with a Load Restriction are not allowed.

C. Patch and repair existing applied fire protection as required. Provide fire rated assembly rating to match existing for roof and floor assemblies to meet UL Design standards.

2.02 MATERIALS

A. Applied Fire Protection 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. Bond Strength: 150 pounds per square foot, minimum, when tested in accordance with ASTM E736/E736M when set and dry.
   2. Dry Density: As required by fire resistance design.
   3. Compressive Strength: 8.33 pounds per square inch, minimum.
   4. Effect of Impact on Bonding: No cracking, spalling or delamination, when tested in accordance with ASTM E760/E760M.
   5. Corrosivity: No evidence of corrosion, when tested in accordance with ASTM E937/E937M.
   6. 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.
   7. Effect of Deflection: No cracking, spalling, or delamination, when tested in accordance with ASTM E759/E759M.
   8. Fungal Resistance: No growth after 28 days when tested according to ASTM G21.

B. Applied Fire Protection Material Exposed to Damage or Moisture: 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: Portland cement-based; not mineral fiber-based.
   2. Bond Strength: 1,000 psf, minimum, when tested in accordance with ASTM E736/E736M when set and dry.
   3. Dry Density: As required by fire resistance design.
   4. Effect of Impact on Bonding: No cracking, spalling or delamination, when tested in accordance with ASTM E760/E760M.

5. Corrosivity: No evidence of corrosion, when tested in accordance with ASTM E937/E937M.
6. Air Erosion Resistance: Weight loss of 0.025 g/sq ft, maximum, when tested in accordance with ASTM E859/E859M after 24 hours.
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.
8. Fungal Resistance: No growth after 28 days when tested according to ASTM G21.

2.03 ACCESSORIES

A. Primer Adhesive: Of type recommended by applied fire protection manufacturer.

B. Overcoat: As recommended by manufacturer of applied fire protection material.

C. Metal Lath: Expanded metal lath; minimum weight of 1.7 psf, galvanized finish.

D. Water: Clean, potable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive fireproofing. Repair existing fireproofing using same method as original installation or trowel installation techniques recommended by manufacturer.

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. Install metal lath over structural members as indicated or as required by UL Assembly Design Numbers.

B. Apply primer adhesive, primer coating, fireproofing, overcoat, and sealer in accordance with manufacturer's instructions.

C. Apply fireproofing in uniform thickness and density as necessary to achieve required ratings.

D. Apply overcoat at the rate recommended by fireproofing manufacturer.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 014000 - Quality Requirements

B. Inspect installed fireproofing after application and curing for integrity, prior to its concealment.
   1. Submit field test reports promptly to Contractor and COR.

C. Ensure that actual thicknesses, densities, and bond strengths meet requirements for specified ratings and requirements of authorities having jurisdiction (AHJ).

D. Repair or replace applied fireproofing at locations where test results indicate fireproofing does not meet specified requirements.

E. Re-inspect installed fireproofing for integrity of fire protection, after installation of subsequent Work.

3.05 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 078400
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of 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 016116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 017000 - Execution and Closeout Requirements: Cutting and patching.

C. Section 078100 - Applied Fire Protection.

D. Section 092116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

C. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems; 2024.

D. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2024.

E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

F. FM (AG) - FM Approval Guide; Current Edition.

G. FM 4991 - Approval Standard of Firestop Contractors; 2013.

H. ITS (DIR) - Directory of Listed Products; Current Edition.

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

J. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

1.04 PERFORMANCE REQUIREMENTS

A. Wall Penetrations: For penetrations into or through fire-resistance-rated walls, provide approved penetration firestop systems installed as tested in accordance with ASTM E814 or UL 1479 having an F-rating not less than the fire-resistance rating of the wall penetrated.

B. Floor Penetrations: For through penetrations of horizontal assemblies, provide approved through-penetration firestop systems installed as tested in accordance with ASTM E814 or UL 1479 having an F-rating and T-rating of not less than 1 hour but not less than the required rating of the assembly penetrated. The following exceptions do not require a T-rating:
   1. Floor penetrations within the cavity of a wall.
   2. Floor penetrations by floor, tub or shower drains contained within the concealed space of a horizontal assembly.
   3. Floor penetrations of maximum 4 inch nominal diameter penetrating directly into metal-enclosed electrical power switchgear.

C. Linear Openings (Joints): For joints in or between fire-resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies, provide approved fire-resistant joint systems installed as tested in accordance with ASTM E1966 or UL 2079 having an F-rating not less than the fire-resistance rating of the floor or roof in or between which the system is installed.
   1. Provide fire-resistant joint systems designed to accommodate the required movement and tested for this purpose in accordance with ASTM E1966 or UL 2079.

D. Perimeter Fire Barrier (Curtain Wall) System: For voids created at the intersection of exterior curtain walls and floor or floor/ceiling assemblies, provide approved systems installed as tested

in accordance with ASTM E2307 having an F-rating not less than the fire-resistance rating of the floor or floor/ceiling assembly.

E. Smoke Barriers:
   1. For penetrations in Smoke Barriers, provide systems subjected to an air leakage test in accordance with UL1479 with L-ratings not to exceed 5 cfm/sf of penetration opening or a total of 50 cfm in any 100 square feet of wall or floor area at both ambient and elevated temperatures.
   2. For fire-resistant joints in Smoke Barriers, provide systems subjected to an air leakage test in accordance with UL 2079 with L-ratings not to exceed 5 cfm per linear foot of joint at both ambient and elevated temperatures.

F. W-rating: Provide products with a Class 1 W-rating in accordance with UL 1479. W-ratings determine the capability of the firestop system to maintain water tightness of the penetration through a floor or wall construction at ambient air conditions under 3 feet of water pressure head (1.3 psi) for a period of 72 hours. The W-rating may be applicable for building structures whose floors are subjected to incidental standing water.

G. Provide products that upon curing do not re-emulsify, dissolve, leach, breakdown, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water, or other forms of moisture characteristic during and after construction.

H. When intumescent products are used, provide products that do not contain sodium silicate or any other water-soluble intumescent ingredient in the formulation.

I. Provide firestop sealants sufficiently flexible to accommodate motion such as pipe vibration, water hammer, thermal expansion, and other normal building movement without damage to the seal.

J. Pipe insulation shall not be removed, cut away or otherwise interrupted through wall or floor openings. Provide products appropriately tested for the thickness and type of insulation utilized.

K. For penetration of data, video, and communications cables in all locations where frequent cable moves, adds and changes will occur, fire rated pathway devices shall be the preferred product. Such devices shall be:
   1. Capable of retrofitting around existing cables.
   2. Designed such that two or more devices can be ganged together.
   3. UL Certified as maintenance free such that no action is required to activate the smoke and fire sealing mechanism.

L. When cable pathways are not practical, openings within walls and floors designed to accommodate voice, data and video cabling shall be provided with re-enterable products specifically designed for retrofit.

M. Provide fire-resistive joint sealants sufficiently flexible to accommodate movement such as thermal expansion and other normal building movement without damage to the seal.

N. Provide fire-resistive joint sealants designed to accommodate a specific range of movement and tested for this purpose in accordance with a cyclic movement test criteria as outlined in Standards, ASTM E1966, or ANSI/ UL 2079.

O. Provide penetration firestop systems, fire-resistive joint systems, or perimeter fire barrier systems subjected to an air leakage test conducted in accordance with Standard, ANSI/ UL1479 for penetrations and ANSI/UL2079 for joint systems with published L-ratings for ambient and elevated temperatures as evidence of the ability of firestop system to restrict the movement of smoke.

P. Provide a fire-rated grommet for all individual or small grouped cable applications up to 0.53 inch (14 mm).

Q. Provide moisture-curing products where inclement weather or greater than transient water exposure is expected.

1.05 SUBMITTALS

A. See Section 013000 - 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 each type of firestopping product indicated including product characteristics, performance ratings, and limitations. For sealants, indicate VOC content.

D. System Drawings: Submit documentation from a qualified third-party testing agency that is applicable to each firestopping system configuration for construction, joint opening width and/or penetrating items.

E. Product Certificates: Certificate of conformance signed by manufacturers of firestopping products certifying that products comply with requirements.

F. Listed Firestop Systems: For each penetration, joint or perimeter containment firestopping system. Include location, types of construction conditions, fire-resistance ratings, and design designation of qualified and tested firestop systems in accordance with a third party testing agency.

G. Unlisted Firestop Systems: Where Project conditions require a modification to a qualified testing agency's illustration for a particular penetration or joint firestopping system; submit illustration and written description to manufacturer's qualified personnel as an engineering judgment (also known as Technical Evaluation) or equivalent fire-resistance-rated assembly developed in accordance with current International Firestop Council (IFC) guidelines by a manufacturer certified according to the UL Technical Evaluation Developer Program (UL TEDP). Obtain approval of authorities having jurisdiction prior to submittal.

H. Sustainable Design Submittal: Submit VOC content documentation for nonpreformed materials.

I. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

J. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

K. Manufacturer's Qualification Statement.

L. Installer's Qualification Statement.

1.06 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Firestopping tests are performed by a qualified testing and inspection agency. A qualified testing and inspection agency is UL, Intertek, FM or other organization performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
   2. Firestopping products bear classification marking of qualified testing and inspection agency.
   3. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
   4. 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.
   5. 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. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:
      a. Verification of minimum three years documented experience installing work of this type.
      b. Verification of at least five satisfactorily completed projects of comparable size and type.
      c. Licensed by local authorities having jurisdiction (AHJ).

D. Obtain firestop systems for each type of penetration or joint opening and construction condition indicated from a single manufacturer.

E. Conduct conference at Project site to comply with requirements in Division 01 Section “Project Meetings”.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver firestopping products to Project site in original, unopened containers or packages with intact and legible manufacturer’s labels identifying product and manufacturer, date of manufacture; lot number; shelf life, if applicable; qualified testing and inspection agency’s classification marking; and mixing instructions for multi-component materials.

B. Store and handle materials for firestopping products to prevent their deterioration or damage due to moisture, temperature changes, contaminants or other causes

1.08 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.

C. Do not use materials that contain flammable solvents.

1.09 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes or cut openings to accommodate through-penetration firestop systems.

C. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Firestopping Manufacturers:
   1. 3M Fire Protection Products: www.3m.com/firestop/#sle.
   2. Basis of Design, or approved equal: Specified Technologies Inc. (STI), 210 Evans Way, Somerville, NJ 08876. Tel: (800) 992-1180, Fax: (908) 526-9623, Email: specseal@stifirestop.com, Website: www.stifirestop.com.
   3. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

2.02 FIRESTOPPING - GENERAL

A. Provide firestopping products that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by firestopping products manufacturer based on testing and field experience.

B. Provide components for each firestopping system that are needed to install fill materials. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems

2.03 MATERIALS

A. General: Use only firestopping products that have been tested for specific fire-resistance-rated construction conditions conforming to construction assembly type, penetrating item type or joint opening width and movement capabilities, annular space requirements, and fire-rating involved for each separate instance.

B. Intumescent Sealant: one-part, two-stage intumescent, latex compound which, when exposed to high heat or flame, capable of expanding a minimum of 8 times, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal Series SSS Intumescent Sealant.

C. Intumescent Sealant: Single Stage intumescent latex formulations capable of expanding a minimum 8 times, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal Series LCI Intumescent Sealant.

D. Endothermic Sealants: Single component latex formulations which absorb heat and release water vapor, resisting the progress of smoke and flame, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal Series LC Endothermic Sealant

E. Elastomeric Spray/Sealant: Single component latex formulations that upon cure do not re-emulsify during exposure to moisture and accommodate minimum ± 25 percent movement, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal Series AS Elastomeric Spray
   2. Specified Technologies, Inc. (STI) SpecSeal Series ES Elastomeric Sealant

F. Firestop Devices: Factory-assembled steel collars lined with intumescent material capable of expanding a minimum 30 times sized to fit specific outside diameter of penetrating item, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal Series SSC Firestop Collars
   2. Specified Technologies, Inc. (STI) SpecSeal Series LCC Firestop Collars

G. Fire Rated Cable Pathways: Gangable device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill, requiring no additional action in the form of plugs, twisting closure, putty, pillow, or sealant to achieve fire and leakage ratings and capable of being retrofitted around existing cables, the following products are acceptable:
   1. Specified Technologies Inc. (STI) EZ-Path Fire Rated Pathway

H. Cable Retrofit Device: Retrofit device modules capable of being retrofitted around existing cables and cable sleeves flush with wall surface or extended sleeves. Clam shell design with Intumescent pads restores non-compliant overfilled cable applications allowing 50 to 100 percent cable fill requiring no additional action in the form of plugs, twisting closure, putty, pillow, or sealant to achieve fire and leakage ratings, the following products are acceptable:
   1. Specified Technologies Inc. (STI) EZ-Path Retrofit Devices

I. Cable Tray Retrofit Device: Two-piece device capable of being retrofitted around existing wire basket cable trays restoring non-compliant overfilled cable trays. Device contains intumescent materials allowing 25 to 100 percent fill achieving fire and leakage ratings, the following products are acceptable:
   1. Specified Technologies Inc. (STI) EZ-Path Cable Tray Retrofit Devices

J. Wall Opening Protective Materials: Intumescent, non-curing pads or inserts for protection of electrical switch and receptacle boxes when the horizontal separation is less than 24 inches (610 mm), the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal Series SSP Firestop Putty Pads
   2. Specified Technologies, Inc. (STI) SpecSeal Series EP PowerShield Insert Pads

K. Firestop Putty: Intumescent, 100% solids, non-hardening, water resistant, butyl rubber-based putties containing no solvents or silicone compounds, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal Series SSP Firestop Putty

L. Wrap Strips: Single component intumescent elastomeric strips for use around combustible penetrations, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal Series RED2 Wrap Strip
   2. Specified Technologies, Inc. (STI) SpecSeal Series BLU2 Wrap Strip

M. Firestop Pillows: Re-enterable, non-curing, mineral fiber core encapsulated with an intumescent coating on all six sides contained in a flame-retardant poly bag, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal Series SSB Firestop Pillows

N. Mortar: Portland cement based dry-mix product formulated for mixing with water at Project site to form a non-shrinking, water-resistant, homogenous mortar, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal Series SSM Firestop Mortar

O. Silicone Sealants: Moisture curing, single component, silicone elastomeric sealant for horizontal surfaces (pourable or nonsag) or vertical surface (nonsag), the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal SIL300 Silicone Firestop Sealant

2. Specified Technologies, Inc. (STI) SpecSeal SIL300 SL Self-Leveling Silicone Firestop Sealant'

P. All-Weather Coatings: Moisture curing, single component hybrid copolymer elastomeric spray coatings for horizontal surfaces where greater water resistance is required or inclement weather is anticipated, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal Fast Tack Firestop Spray

Q. Silicone Foam: Multicomponent, silicone-based liquid elastomers, that when mixed, expand and cure in place to produce a flexible, non-shrinking foam, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) Pensil 200 Silicone Foam

R. Composite Sheet: Intumescent material sandwiched between a galvanized steel sheet and steel wire mesh protected with aluminum foil the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal CS Composite Sheet

S. Cast-In-Place Firestop Device: Single component molded firestop device installed on forms prior to concrete placement with totally encapsulated, tamper-proof integral firestop system and smoke sealing gasket, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal CD Cast-In Firestop Device

T. Fire-Rated HVAC Retaining Angles: Steel angle system with integral intumescent firestop gasket for use on steel HVAC ducts without fire or smoke dampers, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal FyreFlange Firestop Angles

U. Firestop Plugs: Re-enterable, foam rubber plug impregnated with intumescent material capable of expanding minimum 10 times for use in blank openings and round cable sleeves, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal Series FP Firestop Plug

V. Fire-Rated Cable Grommet: Molded two-piece grommet made from plenum grade polymer with a foam inner core for sealing cable penetrations in gypsum walls, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) EZ-Firestop Grommet (RFG1 or RFG2)

W. Fire-Rated Closet Flange Gasket: Molded, single-component, intumescent gasket for use beneath a closet flange (Toilet) in floor applications, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal Series CF34 Closet Flange Firestop Gasket

X. Thermal Wrap: flexible, fire-resistive, endothermic wrap for protection of: Membrane penetrations of utility boxes (electrical panels, medical gas boxes, elevator call boxes) per UL 1479 (ASTM E814); Through-penetrations of steel electrical conduits per UL 1479 (ASTM E814); Electrical circuits (cables, conduits, cable trays) per UL 1709 (ASTM E1725); Single or multi-containment liquid fuel lines per UL 1489.

Y. Weight of Wrap not to exceed 1.4 lbs/ft². Installation of Wrap to allow use of steel tie wire when installed around piping, conduits, and cable trays. The following products are acceptable:
   1. Specified Technologies, Inc. (STI) E-Wrap™ Endothermic Wrap.

Z. Joint Gasketing: Intumescent gasketing with pressure sensitive adhesive capable of +/- 100 percent movement and suitable for use in head-of-wall, wall-to-wall, bottom-of-wall, and perimeter fire barrier joints, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpeedFlex TTG Track Top Gasket.

AA. Clinician Patient Access Device: Maintenance-free, self-sealing pass-through device for carrying patient service lines through corridor walls to limit healthcare staff exposure to infectious disease, the following products are acceptable:
   1. Specified Technologies, Inc. (STI) Clinician Patient Access Device (CPAD Device).

BB. Firestop Spray: water-based, non-halogenated elastomeric coating containing no solvents, inorganic fibers, or asbestos. Coating shall dry to form a flexible, water-resistant film and adhere to all common construction surfaces. Min. Shore A hardness of dried coating shall be 62-68. The following products are acceptable:
   1. Specified Technologies, Inc. (STI) SpecSeal Safing Spray

CC. Curtainwall Fire Containment System: Steel clip system designed to accelerate installation of curtainwall insulation for perimeter fire barrier systems, the following products are acceptable:
1. Specified Technologies, Inc. (STI) Quick Clip Field Installation System.
2. Specified Technologies, Inc. (STI) Quick Clip Factory Installation System.

DD. Window Wall Gasket: Intumescent gasket system designed for edge of slab firestopping in window wall construction and is installed between the floor and aluminum framing, the following products are acceptable.
1. Specified Technologies, Inc. (STI) Window Wall Gasket (WWG)

EE. Firestopping Materials: Any materials meeting requirements.

FF. Prohibited Materials: Do not use ethylene glycol.

GG. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.

HH. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
1. Permanent forming/damming/backing materials, including the following:
a. Slag wool fiber insulation.
b. Foams or sealants used to prevent leakage of fill materials in liquid state.
c. Fire-rated form board.
d. Polyethylene/polyurethane backer rod.
e. Rigid polystyrene board.
2. Temporary forming materials.
3. Substrate primers.
4. Steel sleeves

II. Fire Ratings: Refer to drawings for required systems and ratings.

2.04 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
1. Fire Ratings: Use system that is listed by 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. Examine substrates and conditions for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.

B. Verify that all pipes, conduits, cables, and/or other items which penetrate fire-rated construction have been permanently installed prior to installation of firestops.

C. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellents, and any other substances that may inhibit optimum adhesion.

D. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

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

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

3.02 PREPARATION

A. Clean out openings immediately before installing firestop systems to comply with written recommendations of firestopping manufacturer and the following requirements:
1. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestop systems. Remove loose particles remaining from cleaning operation.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

A. General Requirements: Install through-penetration firestop systems and fire-resistive joint systems in accordance with “Performance Criteria” Article and in accordance with the conditions of testing and classification as specified in the published design.

B. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
   1. Seal all openings or voids made by penetrations to ensure an air and water resistant seal.
   2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of through-penetration firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
   3. Protect materials from damage on surfaces subjected to traffic.
   4. Apply a suitable bond-breaker to prevent three-sided adhesion in applications where this condition might occur such as the intersection of a gypsum wallboard/steel stud wall to floor or roof assembly where the joint is backed by a steel ceiling runner or track.

C. Do not cover installed firestopping until inspected by Owner's Independent Testing Agency.

D. Install forming/damming/backing materials and other accessories required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire resistance ratings required.

E. Install joint forming/damming materials and other accessories required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths of installed firestopping material relative to joint widths that allow optimum movement capability and achieve fire resistance ratings required.

F. Install fill materials for firestop systems by proven techniques to produce the following results:
   1. Fill voids, joints and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
   2. Apply materials so they fully contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
   4. Tool non-sag firestop materials after their application and prior to the time skinning begins. Use tooling agents approved by the firestopping manufacturer.

G. On vertical pipe penetrations, lift riser clamps to permit the installation of firestopping around the entire pipe penetration. For penetrations involving fire or fire/smoke dampers, only firestop products approved by the damper manufacturer shall be installed in accordance with the damper installation instructions.

H. Do not cover installed firestopping until inspected by authorities having jurisdiction.

I. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

A. Inspecting Agency: Authorities Having Jurisdiction, the Owner, or Owner’s Representative shall be allowed to perform random destructive testing during inspection of firestop systems to verify compliance per listings or manufacturer’s installation instructions. All areas of work must be accessible until inspection by the applicable Authorities Having Jurisdiction and inspection agencies. The contractor shall be responsible to repair all tested assemblies with no cost to the owner.

B. Proceed with enclosing firestop systems with other construction only after inspections are complete.

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

3.05 MARKING AND IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375 inch (9.5 mm) strokes.
   1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).

3.06 CLEANING

A. Clean off excess fill materials adjacent to openings, as Work progresses by methods and with cleaning materials that are approved in writing by firestopping manufacturer(s) and that do not damage materials in which openings occur. Leave finished work in neat, clean condition with no evidence of spillovers or damage to adjacent surfaces.

B. Clean adjacent surfaces of firestopping materials.

3.07 PROTECTION

A. Provide final protection and maintain conditions during and after installation that ensure firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestop systems immediately and install new materials to produce firestop systems complying with specified requirements.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

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SECTION 079200
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Self-leveling pourable joint sealants.

C. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.

B. Section 092116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

C. Section 093000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.03 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).

B. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).

C. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).

D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

F. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).

H. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.

I. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2020).

J. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

K. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Backing material recommended by sealant manufacturer.
   4. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   5. Substrates the product should not be used on.
   6. Substrates for which use of primer is required.
   7. Substrates for which laboratory adhesion and/or compatibility testing is required.
   8. Installation instructions, including precautions, limitations, and recommended backing materials and tools.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

E. For sealants and primers, submit VOC content and emissions documentation; see Section 016116.

F. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

G. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.

H. Field Quality Control Plan: Submit at least two weeks prior to start of installation.

I. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.

J. Field Quality Control Log: Submit filled-out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

K. Installer's qualification statement.

L. Executed warranty.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

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

C. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
   1. Adhesion Testing: In accordance with ASTM C794.
   2. Compatibility Testing: In accordance with ASTM C1087.
   3. Allow sufficient time for testing to avoid delaying the work.
   4. Deliver sufficient samples to manufacturer for testing.
   5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
   6. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

D. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
   1. Identification of testing agency.
   2. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
      a. Substrate; if more than one type of substrate is involved in a single joint, provide two entries on form, for testing each sealant substrate side separately.
      b. Test date.
      c. Location on project.
      d. Sealant used.
      e. Stated movement capability of sealant.
      f. Test method used.
      g. Date of installation of field sample to be tested.
      h. Date of test.
      i. Copy of test method documents.
      j. Age of sealant upon date of testing.
      k. Test results, modeled after the sample form in the test method document.
      l. Indicate use of photographic record of test.

E. Field Quality Control Plan:
   1. Visual inspection of entire length of sealant joints.

2. Nondestructive field adhesion testing of sealant joints, except interior acrylic latex sealants.
    a. For each different sealant and substrate combination, allow for one test every 12 inches in the first 10 linear feet of joint and one test every 24 inches thereafter.
    b. If any failures occur in the first 10 linear feet, continue testing at 12 inches intervals at no extra cost to Owner.
3. Destructive field adhesion testing of sealant joints, except interior acrylic latex sealant.
    a. For each different sealant and substrate combination, allow for one test every 100 feet in the first 1,000 linear feet, and one test per 1,000 linear feet thereafter, or once per floor on each elevation.
    b. If any failures occur in the first 1,000 linear feet, continue testing at frequency of one test per 500 linear feet at no extra cost to Owner.
4. Field testing agency's qualifications.
5. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.

F. Field Adhesion Test Procedures:
1. Allow sealants to fully cure as recommended by manufacturer before testing.
2. Have a copy of the test method document available during tests.
3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
4. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
5. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
6. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to COR.

G. Nondestructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Nondestructive Spot Method.
1. Record results on Field Quality Control Log.
2. Repair failed portions of joints.

H. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
1. Sample: At least 18 inches long.
2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch by that percentage; if adhesion failure occurs before the 1-inch mark is that distance from the substrate, the test has failed.
3. If either adhesive or cohesive failure occurs before minimum elongation, take necessary measures to correct conditions and retest; record each modification to products or installation procedures.
4. Record results on Field Quality Control Log.
5. Repair failed portions of joints.

I. Field Adhesion Tests of Joints: Test for adhesion using most appropriate method in accordance with ASTM C1521, or another applicable method as recommended by manufacturer.

1.06 WARRANTY

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

B. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Nonsag Sealants:

1. Pecora Corporation: www.pecora.com/#sle.
2. Sika Corporation: usa.sika.com/#sle.
3. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Self-Leveling Sealants:
1. Pecora Corporation: www.pecora.com/#sle.
2. Sika Corporation: usa.sika.com/#sle.
3. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:
1. Interior Joints:
a. Do not seal through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
b. Seal the following joints:
1) Joints between door frames and window frames and adjacent construction.
2) In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, and piping penetrations.
3) In sound-rated wall and ceiling assemblies, seal joints between wall assemblies and ceiling assemblies; between wall assemblies and other construction; between ceiling assemblies and other construction.
2. Do Not Seal:
a. Joints indicated to be covered with expansion joint cover assemblies.
b. Joints where sealant is specified to be furnished and installed by manufacturer of product to be sealed.
c. Joints where sealant installation is specified in other sections.

B. Interior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.
1. Wall and Ceiling Joints in Nonwet Areas: Acrylic emulsion latex sealant.
2. Wall and Ceiling Joints in Wet Areas: Nonsag polyurethane sealant for continuous liquid immersion.
3. Floor Joints in Wet Areas: Nonsag polyurethane non-traffic-grade sealant suitable for continuous liquid immersion.
4. Joints between Tile in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
a. See Section 093000 for sealing between tile and plumbing fixtures.
5. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
6. Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant.
7. Other Floor Joints: Self-leveling polyurethane traffic-grade sealant.

C. Interior Wet Areas: Bathrooms and restrooms; fixtures in wet areas include plumbing fixtures, countertops, and cabinets.

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 acceptable levels of volatile organic compound (VOC) content; see Section 016116.

2.04 NONSAG JOINT SEALANTS

A. Nonstaining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
4. Color: To be selected by COR from manufacturer's standard range.

B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
   1. Color: To be selected by COR from manufacturer's standard range.

C. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 50 percent, minimum.
   2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by COR from manufacturer's standard range.

D. Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multicomponent; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface.
   1. Movement Capability: Plus and minus 35 percent, minimum.
   2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by COR from manufacturer's standard range.

E. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.
   1. Color: To be selected by COR from manufacturer's standard range.

F. Noncuring Butyl Sealant: Solvent-based, single component, nonsag, nonskinning, nonhardening, nonbleeding; nonvapor permeable; intended for fully concealed applications.

2.05 SELF-LEVELING JOINT SEALANTS

A. Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single component; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Color: To be selected by COR from manufacturer's standard range.

B. High Quality Latex-Based Sound Sealant: ASTM C834, Type OP an opaque sealant, and Grade 0, 32 degrees F, meets requirements for low-temperature flexibility.
   1. Color: To be selected by COR from manufacturer's standard colors.

C. Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
   1. Composition: Multicomponent, 100 percent solids by weight.
   2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.
   3. Color: To be selected by COR from manufacturer's standard colors.
   4. Joint Width, Minimum: 1/8 inch.

2.06 ACCESSORIES

A. Sealant Backing Materials, General: Materials placed in joint before applying sealants; assists sealant performance and service life by developing optimum sealant profile and preventing three-sided adhesion; type and size recommended by sealant manufacturer for compatibility with sealant, substrate, and application.

B. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

C. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.

D. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

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.

D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
   1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
   2. Notify COR of date and time that tests will be performed, at least seven days in advance.
   3. Record each test on Preinstallation Adhesion Test Log as indicated.
   4. If any sample fails, review products and installation procedures, consult manufacturer, or take other measures that are necessary to ensure adhesion; retest in a different location; if unable to obtain satisfactory adhesion, report to COR.
   5. After completion of tests, remove remaining sample material and prepare joints for new sealant installation.

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.

E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Provide joint sealant installations complying with ASTM C1193.

C. Install acoustical sealant application work in accordance with ASTM C919.

D. 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.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. 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.

H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 FIELD QUALITY CONTROL

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

B. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

C. Non-Destructive Adhesion Testing: If there are any failures in first 100 linear feet, notify COR immediately.

D. Destructive Adhesion Testing: If there are any failures in first 1,000 linear feet, notify COR immediately.

E. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

F. Repair destructive test location damage immediately after evaluation and recording of results.

END OF SECTION

SECTION 079513
EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Expansion joint cover assemblies for floor and wall surfaces.

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealing expansion and control joints using gunnable and pourable sealants.

B. Section 092116 - Gypsum Board Assemblies: Placement of expansion joint assemblies in gypsum board walls and ceilings.

1.03 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

C. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2020.

D. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2024.

E. ITS (DIR) - Directory of Listed Products; Current Edition.

F. UL (DIR) - Online Certifications Directory; Current Edition.

G. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices and available colors and finish.

C. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, affected adjacent construction and anchorage locations.

D. Samples: Submit two samples 4 inch long, illustrating profile, dimension, color, and finish selected.

E. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.

PART 2 PRODUCTS

2.01 EXPANSION JOINT COVER ASSEMBLY APPLICATIONS

A. Interior Fire-Rated Floor Joints:
   1. Manufacturers:
      a. Basis of Design, or approved equal: Inpro Corporation; 105 Series Surface Mount Expansion Joint Covers: www.inprocorp.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

B. Interior Fire-Rated and Non-Fire-Rated Wall and Ceiling Joints:
   1. Manufacturers:
      a. Basis of Design, or approved equal: Inpro Corporation; 118 Series Wall Expansion Joint Covers: www.inprocorp.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

2.02 EXPANSION JOINT COVER ASSEMBLIES

A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
   1. Joint Dimensions and Configurations: As indicated on drawings.

2. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
3. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
4. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.

B. Floor Joint Covers: Coordinate with indicated floor coverings.

C. Resilient Seal Type Covers: Having flat exposed surface without crevices that could collect dirt; designed to withstand expected movement without extrusion of seal from joint assembly; for floors, provide style that is flush with top of floor covering; for exterior joints, weathertight.

D. Covers in Fire Rated Assemblies: Provide cover assembly having fire rating equivalent to that of assembly into which it is installed.
1. Acceptable Evaluation Agencies: UL (DIR) and ITS (DIR).

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.
1. Exposed Finish: To be selected by COR from manufacturer's full range.

B. Resilient Seals:
1. Color: As selected by COR from manufacturer's full range.

C. Anchors and Fasteners: As recommended by cover manufacturer.

D. Ferrous Metal Anchors: Galvanized where embedded in concrete or in contact with cementitious materials.

E. Threaded Fasteners: Aluminum.

F. Backing Paint for Aluminum Components in Contact with Cementitious Materials: Asphaltic type.

2.04 ACCESSORIES

A. Resilient Fire Barrier: For use with metal expansion joint covers and elastomeric seals, with fire rating in accordance with surrounding construction performance capabilities.
1. Application: Floor and wall.
2. Fire Resistance Rating: 2-hour or to match existing fire resistance rating, in accordance with ASTM E1966 and UL 2079.
3. Joint Opening: Verify existing joint opening in the field.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.

3.02 INSTALLATION

A. Install components and accessories in accordance with manufacturer's instructions.

B. Align work plumb and level, flush with adjacent surfaces.

C. Rigidly anchor to substrate to prevent misalignment.

3.03 PROTECTION

A. Do not permit traffic over unprotected floor joint surfaces.

END OF SECTION

SECTION 081213
HOLLOW METAL FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal frames for non-hollow metal doors.

B. Fire-rated hollow metal frames for non-hollow metal doors.

1.02 RELATED REQUIREMENTS

A. Section 081423 - Clad Wood Doors: Non-hollow metal door for hollow metal frames.

B. Section 087100 - Door Hardware: Hardware, silencers, and weatherstripping.

C. Section 099123 - Interior Painting: Field painting.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2024.

C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2024.

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2025.

F. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

H. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

J. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.

K. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

L. ITS (DIR) - Directory of Listed Products; Current Edition.

M. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

N. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2024.

O. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.

P. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.

Q. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.

R. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2023.

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.

1.04 SUBMITTALS

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

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

E. Manufacturer's qualification statement.

F. Installer'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 of documented experience.

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

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with applicable requirements and in compliance with standards and/or custom guidelines as indicated.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Frames with Integral Casings:
   1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   2. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
   3. DCI Hollow Metal: www.dcihollowmetal.com.
   4. Substitutions: See Section 016000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Hollow Metal Frames: Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of side hinged doors.

B. Design Pressure (DP): In accordance with ASCE 7.

C. Refer to Door and Frame Schedule on drawings for frame sizes, fire ratings, sound ratings, finishing, door hardware to be installed, and other variations, if any.

D. Door Frame Type: Provide hollow metal door frames with integral casings.
   1. Interior Doors: Use frames with integral casings.

E. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.

F. Accessibility: Comply with ICC A117.1 and ADA Standards.

G. 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 frame that is also indicated as being sound-rated must comply with the requirements specified for exterior frames and for sound-rated frames; where two requirements conflict, comply with the most stringent.

H. Hardware Preparations, Selections and Locations: Comply with BHMA A156.115, NAAMM HMMA 830, NAAMM HMMA 831 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

I. Frames Wider than 48 Inches: Reinforce with steel channel fitted tightly into head of frame, and flush with top.

2.03 HOLLOW METAL DOOR FRAMES WITH INTEGRAL CASINGS

A. Frame Finish: Factory primed and field finished.

B. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).

a. Level 3 - Extra Heavy-duty.
b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
c. Frame Metal Thickness: 16 gauge, 0.053 inch 16 gauge, 0.053 inch, minimum.

C. Fire-Rated Door Frames: Full profile/continuously welded type.
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 3 - Extra Heavy-duty.
b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
c. Frame Metal Thickness: 14 gauge, 0.067 inch, minimum.
2. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C or NFPA 252 ("positive pressure fire tests").
3. Provide units listed and labeled by ITS (DIR) or UL (DIR).
a. Attach fire rating label to each fire rated unit.

2.04 FINISHES

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

2.05 ACCESSORIES

A. 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.

B. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

A. Install frames in accordance with manufacturer's instructions and related requirements of specified 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 087100.
1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.

E. Coordinate installation of electrical connections to electrical hardware items.

3.03 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edges, crossed corner to corner.

3.04 SCHEDULE

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

END OF SECTION

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SECTION 081423
CLAD WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High Impact Resistant Vinyl Clad Flush Doors.

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealing joints between frames and adjacent construction.

B. Section 087100 - Door Hardware.

1.03 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights; 2022, with Errata (2023).

B. ASTM C1036 - Standard Specification for Flat Glass; 2021.

C. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

D. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

E. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2021, with Errata (2022).

F. WDMA I.S. 4 - Industry Specification for Preservative Treatment for Millwork; 2025.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section; require attendance by each affected installer.

1.05 SUBMITTALS

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

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

D. Samples: Submit two samples of door construction, 4 by 4 inch in size cut from top corner of door.

E. Selection Samples: Submit two complete sets of color chips, illustrating manufacturer's available finishes, colors, and textures.

F. Performance Validation: Submit certified label or test report on products as indicated under performance requirements to validate product compliance.

G. Manufacturer's Installation Instructions: Indicate special installation instructions.

H. Manufacturer's qualification statement.

I. Installer's qualification statement.

J. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

K. Specimen warranty.

1.06 QUALITY ASSURANCE

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

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

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Accept doors on site in manufacturer's standard packaging. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges if stored more than one week. Break seal on site to permit ventilation.

1.08 WARRANTY

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

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. High Impact Resistant Vinyl Clad Flush Doors:
   1. Basis of Design, or approved equal: VT Industries, Inc.; InPro Palladium: www.vtindustries.com/#sle.
   2. Substitutions: See Section 016000 - Product Requirements.

2.02 COMPONENTS

A. Clad Wood Doors: See drawings for locations and additional requirements.

B. Comply with WDMA workmanship for faces, vertical edges, crossbands, horizontal edges and dimensional tolerances. Heavy Duty Performance Level.

C. Except as may be otherwise shown on the drawings fabricate the work of this section to WDMA "Custom Grade" for PC 5 pressed doors

D. Core: Structural Composite Lumber Core (SCLC).

E. Configuration: As indicated on drawings.
   1. Door Style: As indicated on drawings.

F. Glazing: Double glazed, clear, uncoated, fully tempered, with glass thicknesses as recommended by manufacturer for specified wind conditions.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3 (architectural).
   2. Fully Tempered Glass: ASTM C1048, Kind FT - Fully Tempered.

G. Glazing Stops: Aluminum channel shape, mitered corners; prepared for countersink style screws.
   1. Adjust top rail on full glass doors to accept hardware so that no hardware is visible in daylight opening.
   2. STC doors with light kits shall be factory glazed to maintain rating & warranty.
   3. Labeled fire rated doors to be factory glazed to comply with NFPA 80.

H. Door Hardware: Manufacturer's standard.
   1. See Section 087100 for balance of hardware not provided by door manufacturer.

I. Meeting Edges for Pairs of Fire Rated Doors.
   1. On fire rated pairs, no metal meeting edges allowed.
   2. Manufacture doors whereby the opening will not require either an overlapping metal edge and astragal or metal meeting edges. (Special hardware requirements apply).

2.03 DOOR INTERIOR WOOD FACINGS

A. Vinyl Clad: InPro Palladium® (Rigid PVC), 0.040 face thickness, pattern, and color.

B. Door Edging: Replaceable Edges.
   1. Snap-on vinyl cladding.

C. Wood Finish: Woodgrain Finish - American Teak 0553.

D. Facing Adhesive: Hot melt (Polyurethane Reactive).

2.04 PERFORMANCE REQUIREMENTS

A. Clad Wood Doors: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific door type:
   1. Performance Class (PC): Meet or exceed WDMA I.S.1-A-13 Performance Standards (Heavy Duty) .

B. Performance Validation: Side hinged doors (SHD) in compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance requirements as indicated, or an independent test report for indicated products itemizing compliance and acceptable by authorities having jurisdiction.

C. Acoustical Performance: Sound Transmission Class (STC) rating as indicated on drawings, when tested in accordance with ASTM E90.

2.05 FABRICATION

A. Fabricate doors in accordance with door quality standard specified.

B. All constructions to include:
   1. Bond stiles and rails to core without the use of mechanical fasteners, abrasive sand core assembly to achieve uniform thickness.
   2. Crossband to be minimum 1/11 th high density fiberboard.

C. Cores constructed with stiles and rails:
   1. Provide solid blocks at lock edge for hardware reinforcement.
   2. Provide solid blocking for other thru-bolted hardware.

D. Vertical Edges (Stiles):
   1. Matching Edges to match face material; edges applied after face.
   2. Removable edge:
      a. Removable replaceable edge on hinge and lock stiles to be concealed by the frame stop on the push side of the door.

E. Horizontal Edges (Rails):
   1. Mill option structural composite lumber.

F. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.

G. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.

H. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

I. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

J. Cut and configure exterior door edge to receive recessed weatherstripping devices.

K. Provide edge clearances in accordance with the quality standard specified.

2.06 ACCESSORIES

A. Door Astragals: Thickness, wood species, and interior and exterior finishes to match door; provide with weatherseals.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.

B. Assemble multiple units before installation in accordance with manufacturer's installation guidelines.

C. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

D. Use machine tools to cut or drill for hardware.

E. Coordinate installation of doors with installation of integral frames and hardware.

F. Coordinate installation of glazing.

3.03 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.

B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 CLEANING

A. Remove protective material from factory finished surfaces.

B. Clean units using cleaning material and methods in accordance with door manufacturer's written recommendations.

C. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

3.06 PROTECTION

A. Protect installed work from damage due to subsequent construction activity on the site.

END OF SECTION

SECTION 081473
SLIDING WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior sliding wood door systems.

1.02 RELATED REQUIREMENTS

A. Section 081423 - Clad Wood Doors.

B. Section 087100 - Door Hardware.

C. Section 088000 - Glazing: Product and execution requirements for glass.

1.03 REFERENCE STANDARDS

A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2026.

1.04 SUBMITTALS

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

B. Product Data: Provide component dimensions and descriptions of hardware and accessories.

C. Shop Drawings: Indicate opening dimensions, elevations of different types, framed opening tolerances, and installation requirements.

D. Samples: Two, 12 inches long, indicating typical sliding door frame construction, accessories, and finishes.

E. Manufacturer's Instructions: Indicate installation.

F. Executed warranty.

1.05 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Deliver products to project site and store in manufacturer's protective cartons until openings ready for door installation.

1.06 WARRANTY

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

B. Manufacturer Warranty: Provide 5-year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting and misting. Include provision for replacement of failed units. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 INTERIOR SLIDING WOOD DOOR SYSTEMS

A. Track Systems for Top-Hung Doors: Aluminum-cased frame with trim wrapping head of opening and wall at jambs; soft close; includes face frame, face trim, concealed receiving channel, adjustable top track, factory-installed locks, and brush seals.
   1. Configuration: Surface-mounted on wall.
   2. Carriage Assembly: Weight rating of 220 lb, minimum.
   3. Operation: Manual.
   4. Gaskets: Full gasketing, integral, double seal.
   5. Finish: Class II natural anodized.

2.02 COMPONENTS

A. Glazing: See Section 088000.

B. Hardware: See Section 087100.

2.03 ASSEMBLY

A. Factory assemble frame as one unit, including head jambs and sill. Factory assemble operating panels, fixed panels, and sidelites.

B. Sizes: Allow for tolerances of rough framed openings, clearances, and shims around perimeter of assemblies.

C. Joints and Connections: Flush, hairline width, and waterproof, with rigidly joined corners.

2.04 FINISHES

A. Aluminum Finish:
   1. Pigmented Organic Coating: AAMA 2603; polyester or acrylic baked enamel finish.
   2. Color: Selected by COR from manufacturer's standard range.

2.05 ACCESSORIES

A. Sliding Panel Bottom Rollers: Stainless steel, adjustable from interior.

B. Limit Stops: Resilient rubber.

C. Anchors: Hot-dip galvanized steel.

D. Blocking: Provide support wall blocking as required for sliding door locations in accordance with sliding door manufacturer's requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings ready to receive work. Verify opening dimensions and clearances as indicated on approved shop drawings.

3.02 PREPARATION

A. Prepare opening to permit indicated installation of door unit.

3.03 INSTALLATION

A. Install sliding door units in accordance with manufacturer's instructions.

B. Attach frame and shims to perimeter opening, accommodating construction tolerances and other irregularities.

C. Use anchorage devices to securely fasten sliding door assembly to wall construction without distortion or imposed stresses.

D. Install operating hardware in accordance with manufacturer's instructions.

E. Install perimeter trim and interior closures.

3.04 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation from Plumb: 1/16 inch.

C. Maximum Variation from Level: 1/16 inch.

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 foot straight edge.

3.05 ADJUSTING

A. Adjust hardware for smooth operation.

3.06 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Remove protective material from factory-finished surfaces.

C. Remove labels and visible markings.

D. Wash surfaces by method acceptable to sealant and sliding door manufacturer. Rinse and wipe surfaces clean.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 085659
SERVICE AND TELLER WINDOW UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Service and teller window units.

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealing joints between frames and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Specification for Anodized Architectural Aluminum; 2026.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

1.04 SUBMITTALS

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

B. Product Data: Submit manufacturer's product data for specified products indicating materials, operation, glazing, finishes, and installation instructions.

C. Shop Drawings: Indicate configuration, sizes, rough-in, mounting, anchors and fasteners, and installation clearances.

D. Samples for Selection of Finishes:
   1. Anodized Finish: Submit two samples, 4 inch by 4 inch in size illustrating metal finishes for each finish specified.

E. Manufacturer Qualification Statement.

F. Warranty: 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 at least ten years documented experience, and with ability to provide test reports showing that their standard manufactured products meet the specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver units in manufacturer's original packaging and unopened containers with identification labels intact.

B. Store units in area protected from exposure to weather and vandalism.

1.07 WARRANTY

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

B. Provide manufacturer's warranty agreeing to repair or replace units and their components that fail in materials or workmanship within five years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Service and Teller Window Units:
   1. Basis of Design, or approved equal: Frameworks; Slim Slider: www.frameworks.com.
   2. Substitutions: See Section 016000 - Product Requirements.

2.02 SERVICE AND TELLER WINDOW UNITS

A. Location: Built within interior wall, as indicated on drawings.

B. Type of Use: Walk-up.

C. Window Type: Sliding, single horizontal.
   1. Operation: Manual.

2. Mounting: Flush with wall surface.
3. Window Size: As indicated on drawings.
4. Material: Aluminum.
5. Header: Manufacturer's standard type.

D. Glazing: Single (monolithic), clear.
1. Tempered safety glazing.

2.03 ASSEMBLY COMPONENTS

A. Windows: Factory-fabricated, finished, and glazed, with extruded aluminum frame and glazing stops; complete with hardware and anchors.
1. Provide window units that are re-glazable from the secure side without dismantling the non-secure side of framing.
2. Rigidly fit and secure joints and corners with internal reinforcement. Make joints and connections flush, hairline, and weatherproof. Fully weld corners.
3. Apply factory finish to exposed surfaces.
4. Horizontal Sliding Windows: Top-hung operable sash; with thumb-turn release.

2.04 MATERIALS

A. Aluminum Extrusions: Minimum 1/8 inch thick frame and sash material complying with ASTM B221 and ASTM B221M.

B. Monolithic Glass: Fully tempered float glass; minimum 1/4 inch thickness.

2.05 FINISHES

A. Class II Natural Anodized Finish: AAMA 611 AA-M12C22A31 Clear anodic coating not less than 0.4 mils thick.

2.06 ACCESSORIES

A. Hardware and Security Devices for Sliding Windows:
1. Night Security Lock Bar: Sliding aluminum lock bar.
2. Handles: Stainless steel, manufacturer's standard profile and finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that window openings are ready for installation of windows.

B. Verify that correct embedded anchors are in place and in proper location; repair or replace anchors as required to achieve satisfactory installation.

C. Notify COR if conditions are not suitable for installation of units; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install units in correct orientation (inside/outside or secure/non-secure).

C. Anchor units securely in manner so as to achieve performance specified.

3.03 ADJUSTING

A. Adjust operating components for smooth operation while also maintaining a secure enclosure and a tight fit at the contact points; lubricate operating hardware.

3.04 CLEANING

A. Remove protective material from factory finished surfaces.

B. Clean exposed surfaces promptly after installation without damaging finishes.

3.05 PROTECTION

A. Provide temporary protection to ensure that service and teller windows are without damage upon Date of Substantial Completion.

END OF SECTION

SECTION 087100
DOOR HARDWARE

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 commercial door hardware for the following:
   1. Swinging doors.
   2. Sliding doors.
   3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:
   1. Mechanical door hardware.
   2. Electromechanical door hardware.
   3. Automatic operators.
   4. Cylinders specified for doors in other sections.

C. Related Sections:
   1. Division 01 Section "General Conditions”.
   2. Division 06 Section “Rough Carpentry”.
   3. Division 06 Section “Finish Carpentry”.
   4. Division 08 Section “Operations and Maintenance”.
   5. Division 08 Section “Hollow Metal Doors and Frames”.
   6. Division 08 Section “Flush Wood Doors”.
   7. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.
   8. Division 26 Section "Electrical”

D. Codes and References: Comply with the version adopted by the Authority Having Jurisdiction.
   1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   2. ICC/IBC - International Building Code.
   3. NFPA 70 - National Electrical Code.
   4. NFPA 80 - Fire Doors and Windows.
   5. NFPA 101 - Life Safety Code.
   6. NFPA 105 - Installation of Smoke Door Assemblies.
   7. UL/ULC and CSA C22.2 - Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
   8. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
   1. ANSI/BHMA Certified Product Standards - A156 Series.
   2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
   3. ANSI/UL 294 - Access Control System Units.
   4. UL 305 - Panic Hardware.
   5. ANSI/UL 437- Key Locks.

1.03 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
   1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:
    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.
    h. Warranty information for each product.
4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:
1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
    a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
    b. Complete (risers, point-to-point) access control system block wiring diagrams.
    c. Wiring instructions for each electronic component scheduled herein.
2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:
1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.04 CLOSEOUT SUBMITTALS

A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.05 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
   1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
   2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
   1. Function of building, purpose of each area and degree of security required.
   2. Plans for existing and future key system expansion.
   3. Requirements for key control storage and software.
   4. Installation of permanent keys, cylinder cores and software.
   5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
   1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
   2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
   3. Review sequence of operation narratives for each unique access controlled opening.
   4. Review and finalize construction schedule and verify availability of materials.
   5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.06 DELIVERY, STORAGE AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.07 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.08 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
   1. Structural failures including excessive deflection, cracking, or breakage.
   2. Faulty operation of the hardware.
   3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   4. Electrical component defects and failures within the systems operation.

C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MATERIALS

A. Hardware shall not have any visible manufacturer names on exposed materials, except cylinders, when the door is in a closed position.

2.02 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
   1. Quantity: Provide the following hinge quantity:
      a. Two Hinges: For doors with heights up to 60 inches.
      b. Three Hinges: For doors with heights 61 to 90 inches.
      c. Four Hinges: For doors with heights 91 to 120 inches.
      d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
   2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
      a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
      b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.
   3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
      a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
      b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
   4. Hinge Options: Comply with the following:
      a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.
   5. Manufacturers:
      a. McKinney (MK) - TA/T4A Series, 5-knuckle.

2.03 CONTINUOUS HINGES

A. Pin and Barrel Continuous Hinges: ANSI/BHMA A156.26 Grade 1-600 pin and barrel continuous hinges with minimum 14 gauge Type 304 stainless steel hinge leaves, concealed

stainless pin, and twin self-lubricated nylon bearings at each knuckle separation. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:
    a. Markar Products; ASSA ABLOY Architectural Door Accessories (MR).
    b. Pemko (PE).

2.04 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets with a 1-year warranty. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
    1. Manufacturers:
        a. McKinney (MK) - QC (# wires) Option.

B. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
    1. Manufacturers:
        a. Adams Rite (AD) - 4612 Series.
        b. Securitron (SU) - EL-EPT Series.

C. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.
    1. Provide one each of the following tools as part of the base bid contract:
        a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
        b. McKinney (MK) - Connector Hand Tool: QC-R003.
    2. Manufacturers:
        a. McKinney (MK) - QC-C Series.

2.05 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.
    1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
    2. Furnish dust proof strikes for bottom bolts.
    3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
    4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
    5. Manufacturers:
        a. Rockwood (RO).

B. Coordinators: ANSI/BHMA A156.3 door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.
    1. Manufacturers:
        a. Rockwood (RO).

C. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Pulls shall be provided with a 10” clearance from the finished floor on the push side to accommodate wheelchair accessibility.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
6. Manufacturers:
   a. Rockwood (RO).

2.06 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
   1. Threaded mortise cylinders with rings and cams to suit hardware application.
   2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
   3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
   4. Tubular deadlocks and other auxiliary locks.
   5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
   6. Keyway: Match Facility Standard.

C. Keying System: Each type of lock and cylinders to be factory keyed.
   1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
   2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
   3. Existing System: Field verify and key cylinders to match Owner's existing system.

D. Key Quantity: Provide the following minimum number of keys:
   1. Change Keys per Cylinder: Two (2)
   2. Master Keys (per Master Key Level/Group): Five (5).
   3. Construction Keys (where required): Ten (10).

E. Construction Keying: Provide construction master keyed cylinders.

2.07 MORTISE LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.
   1. Manufacturers:
      a. Corbin Russwin Hardware (RU) - ML2000 Series.

2.08 CYLINDRICAL LOCKS AND LATCHING DEVICES

A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed cylindrical locksets. Listed manufacturers shall meet all functions and features as specified herein.
   1. Manufacturers:
      a. Corbin Russwin Hardware (RU) - CLX3300 Series.

2.09 STAND ALONE ACCESS CONTROL LOCKING DEVICES

A. Stand Alone Electronic Keypad Locksets: Internal, battery-powered, self-contained ANSI Grade 1 mortise or cylindrical lock consisting of electronically motor driven locking mechanism and integrated keypad without requirements for separate electronic programming devices. Locks to accept standard, interchangeable (removable) core, security and high security override

cylinders. Provide keypad locks with a minimum 100 user codes furnished standard with 6 "AA" batteries and non-volatile memory.

1. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
2. Manufacturers:
   a. Sargent Manufacturing (SA) - KP Series.

2.10 HOSPITAL AND BEHAVIORAL HEALTH PRODUCTS

A. Push-Pull Latches, Paddle Type, Cylindrical: ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed latches. Listed manufacturers shall meet all functions and features as specified herein.
   1. Provide latches with functions and features as follows:
      a. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
      b. Ligature-resistant paddle trim capable of being mounted vertically, horizontally, or in mixed combinations.
      c. Ten-year limited warranty.
   2. Manufacturers:
      a. Corbin Russwin (RU) - HP3000 Series.

2.11 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
   1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
   2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
   3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
   4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:
   1. Strikes for Mortise Locks and Latches: BHMA A156.13.
   2. Strikes for Bored Locks and Latches: BHMA A156.2.
   3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
   4. Dustproof Strikes: BHMA A156.16.

2.12 ELECTROMAGNETIC LOCKING DEVICES

A. Surface Electromagnetic Locks (Heavy Duty): Electromagnetic locks to be surface mounted type conforming to ANSI A156.23, Grade 2 with minimum holding force strength of 1,200 pounds. Locks to be capable of either 12 or 24 voltage and be UL listed for use on fire rated door assemblies. Electronics are to be fully sealed against tampering and allow exterior weatherproof applications. As indicated in Hardware Sets, provide specified mounting brackets and housings. Power supply to be by the same manufacturer as the lock with combined products having a lifetime replacement warranty.
   1. Manufacturers:
      a. Securitron (SU) - M62 Series.
      b. Securitron (SU) - M82 Series.

2.13 ELECTRIC STRIKES

A. Standard Electric Strikes: Electric strikes conforming to ANSI/BHMA A156.31, Grade 1, for use on non-rated or fire rated openings. Strikes shall be of stainless steel construction tested to a minimum of 1500 pounds of static strength and 70 foot-pounds of dynamic strength with a minimum endurance of 1 million operating cycles. Provide strikes with 12 or 24 VDC capability, fail-secure unless otherwise specified. Where specified provide latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike.
   1. Manufacturers:
      a. HES (HS) - 1500/1600 Series.

B. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five year warranty.

2.14 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
   1. Exit devices shall have a five-year warranty.
   2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
   3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.
   4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
   5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
   6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
      a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
      b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
   7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
   8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.
   9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
   10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
   11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.
   1. Provide exit devices with functions and features as follows:
      a. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
      b. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
      c. No catch points: addition of applied deflectors or other added components are not allowed.
      d. No visible plastic.
      e. Heavy duty end caps with flush and overlapping options made of stainless steel, brass, or bronze with architectural finishes.
      f. Constructed of all stainless steel.
      g. Stainless steel pullman type latch with deadlock feature.
      h. Narrow or wide style exterior trim as specified in the hardware sets.
      i. Center case adjustability on concealed vertical rod exit devices; single operation with hex key individually adjusts top or bottom latches. No retainer screws or clips required to maintain adjustment.
      j. Ten-year limited warranty for mechanical features.
   2. Manufacturers:
      a. Corbin Russwin Hardware (RU) - PED4000 / PED5000 Series.

2.15 SURFACE DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:
   1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
   2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
   3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
   4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
   5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
   6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
   1. Heavy duty surface mounted door closers shall have a 30-year warranty.
   2. Manufacturers:
      a. Corbin Russwin Hardware (RU) - DC6000 Series.
      b. Norton Rixson (NO) - 7500 Series.

2.16 ELECTROHYDRAULIC DOOR OPERATORS

A. Electrohydraulic Door Operators (High Traffic): Provide ANSI/BHMA A156.19 Certified Products Directory (CPD) listed low energy operators that meet ANSI/BHMA A156.4 requirements and are UL listed for use on fire rated doors and UL10C certified that comply with requirements for the Americans with Disabilities Act (ADA). Operators shall be verified by GreenCircle to offer energy savings of 19% when compared to similar products to accommodate openings up 250 pounds and 48” wide. Provide accessories such as custom templates, special mounting brackets, spacers and drop plates as needed for proper installation. Operators shall accommodate openings up to 200 pounds and 48” wide. Listed manufacturers shall meet all functions and features as specified herein.
   1. Provide operators with features as follows:
      a. Non-handed with push and pull side mounting.
      b. Operates as mechanical surface closer during close cycles, when door is opened manually or if power is off.
      c. Activation by push button, hands-free or radio frequency devices.
      d. On board electronics to collect usage and cycle count data to facilitate preventative maintenance/diagnostics.
      e. Two-year limited warranty.
      f. Wi-Fi interface where the operator is a secure, password protected WiFi hot spot with no connection to building’s IT required.
         1) Simple setup with no app required.
         2) View status and make adjustments without removing the cover.
         3) Built-in logic to support single use restroom applications with no external relay boards, logic modules, position switches required.
      g. Mounting backplate to simplify and speed up installation.
   2. Operators shall have the following functionality:
      a. Adjustable Hold Open: Amount of time a door will stay in the full open position after an activation.

b. Blow Open for Smoke Ventilation: Door opens when signal is received from alarm system allowing air or smoke to flow through opening. Door will stay open until signal from alarm system is stopped.
c. Infinite Hold Open: Door will hold open at set position until power is turned off.
d. Obstruction Detection: Door closes if it hits an obstruction while opening; door will reverse to open position if it hits an obstruction while closing. Door will stop once it hits an obstruction and will rest against the obstruction until removed.
e. Open Delay: Delays operator opening for locking hardware.
f. Overload Safety Shut-Off: After two minutes of receiving a door activation signal, inverter times out and door closes to prevent motor/inverter damage.
g. Presence Detector Input: Input for external sensor to detect presence at door open or close position only.
h. Push & Go: As the door is manually opened, the operator "senses" movement and opens door to the full-open position.
i. Selector Mode Switch: Off disables the signal inputs unless Blow Open is activated, on activates the signal inputs, hold open activates the unit (unless Blow Closed is activated) to the hold open position.
j. Vestibule Delay: When the wall switch is pressed, first door in vestibule will open. Second door will open once vestibule door delay has expired. Delay is adjustable.

3. Manufacturers:
   a. Norton Rixson (NO) - 6000 Series.

2.17 DOOR STOPS AND HOLDERS

A. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
   1. Manufacturers:
      a. Rockwood (RO).

B. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
   1. Manufacturers:
      a. Norton Rixson (NO).
      b. Rockwood (RO).
      c. Sargent Manufacturing (SA).

2.18 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
   1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
   1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:
   1. Pemko (PE).

2.19 ELECTRONIC ACCESSORIES

A. Switching Power Supplies: Provide the least number of power supplies at the appropriate amperage level sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
   1. Power supplies shall meet all functions and features as specified herein.
      a. UL listed dual voltage 12 or 24 VDC field selectable continuous output.
      b. Tolerates brownout or overvoltage input ± 15% of nominal voltage.
      c. Thermal shutdown protection with auto restart.
      d. Circuit breaker protection against overcurrent and reverse battery faults.
      e. Integrated battery charging circuit to prevent overvoltage on locking devices.
      f. Available with a single relay fire trigger or individually triggered relayed outputs.
      g. Monitoring options as specified.
   2. Manufacturers:
      a. Securitron (SU) - AQD Series.

2.20 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.21 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

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

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.02 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.03 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
   1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
   1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.04 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
   1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.05 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.06 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.07 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.08 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
   1. Quantities listed are for each pair of doors, or for each single door.
   2. The supplier is responsible for handing and sizing all products.

3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Manufacturer's Abbreviations:
1. MK - McKinney
2. MR - Markar
3. RS - RITE Slide
4. RO - Rockwood
5. RU - Corbin Russwin
6. SA - SARGENT
7. SU - Securitron
8. OT - Other
9. HS - HES
10. NO - Norton Rixson

Hardware Sets

Set: 1.0

Doors: B236, B237A

2	Continuous Hinge	HG326 EL-EPT-SC AS	630	MR	
1	Concealed Vert Rod Exit	PED5849 MELR N9CV49PT M55	630	RU	
1	Concealed Vert Rod Exit	PED5840 MELR N9CV40PT M55	630	RU	
1	Cylinder	Match Facility Standard		OT	
1	Automatic Operator, pair, push side	D6031	689	NO	
2	Armor Plate	K1050 34" High x CSK	US32D	RO	
2	Door Stop	409 / 441H	US32D	RO	
2	Silencer	608		RO	
2	Frame Harness	QC-C__x (length as required)		MK	
2	Door Harness	QC-C__x (length as required)		MK	
2	Auto Door Push Plate	639		NO	
1	Power Supply	AQDx (size as reqd)		SU	
1	Card Reader	By Security Contractor			

Notes: Presenting authorized credential to reader on wall retracts latchbolts on both panics allowing doors to be pulled open.
Authorized card swipe also allows auto operator switches to be used on exterior side. Interior switches always activated.
REX switch in panic rails signals access control system of authorized egress.
Free egress at all times via exit device.
During loss of power, door remains locked.
Card reader / actuator switch integration required – by Security Contractor.

Set: 2.0

Doors: B233A, B247A, B271

2	Continuous Hinge	HG326 EL-EPT-SC AS	630	MR
1	Magnetic Lock	M62BD		SU
2	Concealed Vert Rod Exit, Exit Only	PED5801 MELR EO M55	630	RU
1	Automatic Opener	D6001DE	689	NO
2	Armor Plate	K1050 34" High x CSK	US32D	RO
2	Door Stop	409 / 441H	US32D	RO
2	Silencer	608		RO
2	Frame Harness	QC-C__x (length as required)		MK
2	Door Harness	QC-C__x (length as required)		MK
2	Auto Door Push Plate	639		NO
1	Power Supply	AQDx (size as reqd)		SU
1	Card Reader	By Security Contractor		

Notes: Function to be verified. In path of egress?
From Stretcher B237 Side:
Presenting authorized credential to reader on wall releases maglock allowing door to be pushed open, and/or use auto operator to open doors.
From Corridor B247 Side:
Free egress at all times via exit device on right hand leaf. Auto operator button always active.

Set: 3.0

Doors: B263

5	Hinge (heavy weight)	T4A3786	US26D	MK	
1	Electric Hinge	T4A3786 QCxx	US26D	MK	⚡
1	Auto Flush Bolt, top x aux bolt	2848 / 2948	US32D	RO	
1	Storeroom Lock	CLX3357 NZD	626	RU	
1	Cylinder	Match Facility Standard		OT	
1	ElectroLynx Adaptor	2004M		HS	⚡
1	Electric Strike, cylindrical lock	1500C	630	HS	⚡
1	SMART Pac Bridge Rectifier	2005M3		HS	⚡
1	Automatic Operator, pair, push side	D6031	689	NO	⚡
2	Kickplate	K1050 10" High x CSK	US32D	RO	
2	Door Stop	409 / 441H	US32D	RO	
2	Silencer	608		RO	
1	Frame Harness	QC-C__x (length as required)		MK	⚡
1	Door Harness	QC-C__x (length as required)		MK	⚡
2	Auto Door Push Plate	639		NO	⚡
1	Power Supply	AQDx (size as reqd)		SU	⚡
1	Card Reader	By Security Contractor			

Notes: Presenting authorized credential to reader on wall releases electric strike allowing door to be opened.
Free egress at all times via inside lever.
During loss of power, door remains locked.

Set: 4.0

Doors: B248A

2	Continuous Hinge, swing clear, hinge guard	HG326 AS	630	MR	
2	Push Pull	111x73C/73CL	US32D	RO	
1	Automatic Operator, pair, pull side	D6011	689	NO	⚡
2	Armor Plate	K1050 34" High x CSK	US32D	RO	
2	Door Stop	409 / 441H	US32D	RO	
2	Meeting Stile Astragal	29324CNB		PE	
1	Gasketing	S88BL		PE	
2	Auto Door Push Plate	639		NO	⚡

Set: 5.0

Doors: B251A, B255

2	Continuous Hinge, swing clear, hinge guard	HG326 AS	630	MR	
2	Push Pull	111x73C/73CL	US32D	RO	
2	Concealed Overhead Stop, HD ADJ	1ADJ-x36	630	NO	
1	Automatic Operator, pair, pull side	D6011	689	NO	⚡
2	Armor Plate	K1050 34" High x CSK	US32D	RO	
2	Meeting Stile Astragal	29324CNB		PE	
1	Gasketing	S88BL		PE	
2	Auto Door Push Plate	639		NO	⚡

Set: 6.0

Doors: B247B, B260, B272, B275

3	Hinge, Full Mortise	TA2714	US26D	MK	
1	Storeroom Lock	CLX3357 NZD	626	RU	
1	Cylinder	Match Facility Standard		OT	
1	ElectroLynx Adaptor	2004M		HS	⚡
1	Electric Strike, cylindrical lock	1500C	630	HS	⚡
1	SMART Pac Bridge Rectifier	2005M3		HS	⚡
1	Door Closer	7500	689	NO	
1	Kickplate	K1050 10" High x CSK	US32D	RO	
1	Door Stop	409 / 441H	US32D	RO	
3	Silencer	608		RO	
1	Frame Harness	QC-C__x (length as required)		MK	⚡
1	Power Supply	AQDx (size as reqd)		SU	⚡
1	Card Reader	By Security Contractor			

Notes: Presenting authorized credential to reader on wall releases electric strike allowing door to be opened.
Free egress at all times via inside lever.
During loss of power, door remains locked.

Set: 9.0

Doors: B229, B230

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Passage Latch	HP3010 HPSK	630	RU
1	Door Closer	7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Door Stop	409 / 441H	US32D	RO
1	Gasketing	S88BL		PE
1	Auto Door Bottom	STC411APK		PE

Set: 10.0

Doors: B244, B246C, B267, B269

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Keypad Cylindrical Lock	KP10XG77 LL	US26D	SA
1	Cylinder	Match Facility Standard		OT
1	Door Closer	7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Door Stop	409 / 441H	US32D	RO
3	Silencer	608		RO

Set: 11.0

Doors: B245A, B245C, B246A

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Keypad Cylindrical Lock	KP10XG77 LL	US26D	SA
1	Cylinder	Match Facility Standard		OT
1	Concealed Overhead Stop, HD ADJ	1ADJ-x36	630	NO
1	Door Closer	7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
3	Silencer	608		RO

Set: 12.0

Doors: B233B, B259

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom Lock	CLX3357 NZD	626	RU
1	Cylinder	Match Facility Standard		OT
1	Door Closer	7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Door Stop	409 / 441H	US32D	RO
1	Gasketing	S44BL		PE

Set: 13.0

Doors: B231, B234, B258, B265, B274, B283

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom Lock	CLX3357 NZD	626	RU
1	Cylinder	Match Facility Standard		OT
1	Door Closer	7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Door Stop	409 / 441H	US32D	RO
3	Silencer	608		RO

Set: 14.0

Doors: B240, B262, B268, B276

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Office Lock	CLX3361 NZD	626	RU
1	Cylinder	Match Facility Standard		OT
1	Door Stop	409 / 441H	US32D	RO
1	Gasketing	S88BL		PE

Set: 15.0

Doors: B235

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Passage Latch	CLX3310 NZD	626	RU
1	Door Closer	7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Door Stop	409 / 441H	US32D	RO
3	Silencer	608		RO

Set: 16.0

Doors: B238, B239, B273, B282

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Privacy Lock	ML2060 NSA V21	626	RU
1	Door Closer	7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Mop Plate	K1050 4" High x CSK	US32D	RO
1	Door Stop	409 / 441H	US32D	RO
3	Silencer	608		RO

Set: 17.0

Doors: B237B, B242A, B242B, B248B, B252A, B266

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Passage Latch	HP3010 HPSK	630	RU
1	Door Closer	7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Door Stop	409 / 441H	US32D	RO
3	Silencer	608		RO

Set: 18.0

Doors: B227

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Passage Latch	HP3010 HPSK	630	RU
1	Door Closer	CPS7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
3	Silencer	608		RO

Set: 19.0

Doors: B242C, B249, B251B, B252B

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Passage Latch	HP3010 HPSK	630	RU
1	Concealed Overhead Stop, HD ADJ	1ADJ-x36	630	NO
1	Door Closer	7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Gasketing	S44BL		PE

Set: 20.0

Doors: B243

1	Sliding Door System	Rite Slide System		RS
1	Pull, back to back	S3110-B-12.75-0.75	630	RS

Set: 21.0

Doors: B245B, B246B

1	Sliding Door System	By Others		OT

Set: 23.0

Doors: B277, B281

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Classroom Lock	CLX3355 NZD	626	RU
1	Cylinder	Match Facility Standard		OT
1	Door Closer	7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Door Stop	409 / 441H	US32D	RO
3	Silencer	608		RO

Set: 24.0

Doors: B261

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Passage Latch	HP3010 HPSK	630	RU
1	Door Closer	7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Door Stop	409 / 441H	US32D	RO
1	Gasketing	S44BL		PE

Set: 25.0

Doors: B278

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Rim Exit Device, Exit Only	PED5201 EO	630	RU
1	Door Closer	7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Door Stop	409 / 441H	US32D	RO
1	Gasketing	S88BL		PE

END OF SECTION

SECTION 088000
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glazing units.

B. Glazing compounds.

1.02 RELATED REQUIREMENTS

A. Section 081423 - Clad Wood Doors: Glazed lites in doors.

B. Section 085659 - Service and Teller Window Units: Glazing provided as part of assembly.

C. Section 102800 - Toilet, Bath, and Laundry Accessories: Mirrors.

1.03 REFERENCE STANDARDS

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

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).

C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2026).

D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

E. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.

F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).

G. GANA (GM) - GANA Glazing Manual; 2022.

H. GANA (SM) - GANA Sealant Manual; 2008.

I. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (Reaffirmed 2016).

J. NGA (LGRM) - Laminated Glazing Reference Manual; 2019.

1.04 SUBMITTALS

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

B. Product Data on Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Manufacturer's qualification statement.

E. 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. Perform work in accordance with GANA (GM), GANA (SM), IGMA TM-3000, and NGA (LGRM) for glazing installation methods. Maintain one copy on site.

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

1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
    a. Safety Glazing Certification Council (SGCC).

1.06 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

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

B. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Float Glass Manufacturers:
   1. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
   2. Guardian Glass, LLC: www.guardianglass.com/#sle.
   3. Pilkington North America Inc: www.pilkington.com/na/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

2.02 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
   2. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
   1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.

2.03 GLAZING UNITS

A. Monolithic Safety Glazing: Non-fire-rated.
   1. Applications:
      a. Glazed lites in doors, except fire doors.
      b. Sliding glass doors in service and teller window units..
      c. Other locations required by applicable federal, state, and local codes and regulations.
      d. Other locations indicated on drawings.
   2. Glass Type: Fully tempered safety glass as specified.
   3. Tint: Clear.
   4. Thickness: 1/4 inch, nominal.

2.04 GLAZING COMPOUNDS

A. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; nonbleeding, nonstaining with cured Shore A hardness range of 15 to 25; color as selected.

2.05 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

B. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that the minimum required face and edge clearances are being provided.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 CLEANING

A. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.

B. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

C. Remove nonpermanent labels immediately after glazing installation is complete.

D. Clean glass and adjacent surfaces after sealants are fully cured.

E. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.06 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

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SECTION 090561
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. Thin-set porcelain tile.
   3. Resinous flooring system.

B. Removal of existing floor coverings.

C. Preparation of existing concrete floor slabs for installation of floor coverings.

D. Testing of concrete floor slabs for moisture and alkalinity (pH).

E. 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.

F. Patching compound.

G. Remedial floor coatings.

H. Remedial floor treatment.

I. Remedial floor sheet membrane.

1.02 RELATED REQUIREMENTS

A. Section 017419 - Construction Waste Management and Disposal: Handling of existing floor coverings removed.

B. Section 093000: Tiling.

C. Section 096500: Resilient Flooring.

D. Section 096700: Fluid-Applied Flooring.

1.03 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens); 2023.

B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete; 2020.

C. ASTM D4259 - Standard Practice for Preparation of Concrete by Abrasion Prior to Coating Application; 2024.

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

F. ASTM F3010 - Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings;2018.

G. ASTM F3513 - Standard Practice for Single Component, Fluid-Applied Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings; 2024.

H. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; 2018.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.05 SUBMITTALS

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

B. Visual Observation Report: For existing floor coverings to be removed.

C. 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.

D. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
   1. Manufacturer's qualification statement.
   2. Certificate: Manufacturer's certification of compatibility with types of flooring applied over remedial product.
   3. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
   4. Manufacturer's installation instructions.
   5. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.

E. 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. Product data for recommended remedial coating.
   7. Certificate: Include certification of accuracy by authorized official of testing agency.
   8. Submit report to COR.
   9. Submit report not more than two business days after conclusion of testing.

F. Adhesive Bond and Compatibility Test Report.

G. Copy of RFCI (RWP).

1.06 QUALITY ASSURANCE

A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.

B. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.

C. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
   1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.

D. Contractor's Responsibility Relating to Independent Agency Testing:
   1. Provide access for and cooperate with testing agency.
   2. Confirm date of start of testing at least 10 days prior to actual start.
   3. Allow at least 4 business days on site for testing agency activities.
   4. Achieve and maintain specified ambient conditions.
   5. Notify Owner when specified ambient conditions have been achieved and when testing will start.

1.07 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.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 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.

B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.

C. Remedial Floor Coating, Two-Component: Single-layer coating resistant to water vapor transmission meeting flooring manufacturer's emission limits, resistant to alkalinity (pH) level found, and suitable for flooring adhesion without further treatment.
   1. Material: Comply with ASTM F3010.
   2. Thickness: As required for application and in accordance with manufacturer's installation instructions.
   3. Use product recommended by testing agency.

D. Remedial Floor Coating, Single Component: Resistant to water vapor transmission meeting flooring manufacturer's emission limits; single or double layer; resistant to alkalinity (pH) level found, and suitable for flooring adhesion without further treatment.
   1. Material: Comply with ASTM F3513.
   2. Thickness: As required for application and in accordance with manufacturer's installation instructions.
   3. Use product recommended by testing agency.

E. Remedial Floor Treatment: Penetrating, spray-applied, silicate-based product resistant to water vapor transmission meeting flooring manufacturer's emission limits, resistant to alkalinity (pH) level found, and suitable for flooring adhesion without further treatment.
   1. Use product recommended by testing agency.

F. Remedial Floor Sheet Membrane: Pre-formed multi-ply sheet membrane installed over concrete subfloor, resistant to water vapor transmission meeting flooring manufacturer's emission limits, resistant to alkalinity (pH) level found, and suitable for flooring adhesion without further treatment.
   1. Thickness: 28 mil (0.028 inch).
   2. Tape: Types recommended by underlayment manufacturer to install membrane and cover seams.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Follow recommendations of testing agency.

B. Perform following operations in the order indicated:
   1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
      a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
      b. Removal of existing floor covering.
   2. Existing concrete slabs with coatings or penetrating sealers/hardeners/dustproofers:
      a. Prepare surface according to recommendations of remedial coating manufacturer and according to ASTM D4259.
   3. Preliminary cleaning.

4. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
5. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
6. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
7. Specified remediation, if required.
8. Patching, smoothing, and leveling, as required.
9. Other preparation specified.
10. Adhesive bond and compatibility test.
11. Protection.

C. Remediations:
1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 REMOVAL OF EXISTING FLOOR COVERINGS

A. Comply with local, State, and federal regulations and recommendations of RFCI (RWP), as applicable to floor covering being removed.

B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.03 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.

3.04 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F1869 and as follows.

D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.

F. Report: Report the information required by the test method.

3.05 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.

3.06 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. 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.

3.07 PREPARATION

A. See individual floor covering section(s) for additional requirements.

B. Comply with recommendations of testing agency.

C. Comply with requirements and recommendations of floor covering manufacturer.

D. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

E. Do not fill expansion joints, isolation joints, or other moving joints.

3.08 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.09 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

3.10 APPLICATION OF REMEDIAL FLOOR TREATMENT

A. Comply with requirements and recommendations of treatment manufacturer.

3.11 INSTALLATION OF REMEDIAL FLOOR SHEET MEMBRANE

A. Install in accordance with sheet membrane manufacturer's instructions.

3.12 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

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SECTION 092116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Gypsum wallboard.

C. Joint treatment and accessories.

D. Acoustic (sound-dampening) wall and ceiling board.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 061063 Miscellaneos Rough Carpentry: Wood blocking product and execution requirements.

C. Section 072100 - Thermal Insulation: Acoustic insulation.

D. Section 079200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

E. Section 092216 - Non-Structural Metal Framing.

F. Section 093000 - Tiling: Tile backing board.

1.03 REFERENCE STANDARDS

A. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.

B. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).

C. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

D. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.

E. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

F. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

G. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

H. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

J. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

K. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.

L. ASTM E413 - Classification for Rating Sound Insulation; 2022.

M. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2024.

N. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

O. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

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

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of gypsum board assemblies with size, location, and installation of service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Install service utilities in an orderly and expeditious manner.

1.05 SUBMITTALS

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

B. Product Data:
   1. Provide data on gypsum board, accessories, and joint finishing system.
   2. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

C. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

D. Test Reports: For stud framing products that do not comply with AISI S220 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

E. Installer's Qualification Statement.

1.06 QUALITY ASSURANCE

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

1.07 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.

C. Store metal products to prevent corrosion.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.
   1. See PART 3 for finishing requirements.

B. Interior Partitions, Indicated as Sound-Rated: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC as indicated on drawings calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Fire-Resistance-Rated Assemblies: Provide completed assemblies as indicated on drawings.
   1. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 BOARD MATERIALS

A. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Type X board is required at all locations.
   3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
      a. Mold resistant board is required in wet rooms including toilet rooms, locker and shower rooms, housekeeping, decontamination, OR/OB, and OR.
   4. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   5. Thickness:
      a. Vertical Surfaces: 5/8 inch or as indicated on drawings.
      b. Ceilings: 5/8 inch or as indicated on drawings.
      c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.

B. Backing Board For Wet Areas:
   1. See Section 093000 - Tiling for tile backing board.

C. 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: 5/8" inch.
   3. Edges: Tapered.

D. Acoustical Sound Dampening Wall and Ceiling Board: Two layers of heavy paper-faced, high-density gypsum board separated by a viscoelastic polymer layer and capable of achieving STC rating, as indicated on drawings, in typical stud wall assemblies as calculated in accordance with ASTM E413 and when tested in accordance with ASTM E90.
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered.
   3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

2.03 GYPSUM BOARD ACCESSORIES

A. Acoustic Insulation: See Section 072100.

B. Acoustic Sealant: See Section 079200.

C. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
   1. Corner Beads: Low profile, for 90 degree outside corners.
   2. L-Trim: Sized to fit 5/8-inch thick gypsum wallboard.
   3. J-Trim: Sized to fit 5/8 inch thick gypsum wallboard. Exposed short flange does not receive joint compound.

D. Moisture Guard Trim: ASTM C1047, rigid plastic, 48 inch length, applied to bottom edge of gypsum board throughout building.
   1. Height: 1/2 inch.
   2. Depth: 5/8 inch.
   3. Provide on all wet walls and rooms including toilet rooms, locker and shower rooms, housekeeping, decontamination, OR/OB, and OR.

E. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
   2. Paper Tape: 2 inch wide, creased paper tape for joints and corners.
      a. Interior Gypsum Board: Paper.
      b. Tile Backing Panels: As recommended by panel manufacturer.
   3. Joint Compound: Setting type, field-mixed. For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

F. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.

G. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

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. Sound Isolation Tape: Apply to vertical studs and top and bottom tracks/runners in accordance with manufacturer's instructions.

C. 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 Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

D. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as follows:
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

D. Moisture Guard Trim: Install on bottom edge of gypsum board throughout building.

3.05 JOINT TREATMENT

A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.

B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
   2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   3. Level 3: Walls to receive textured wall finish.
   4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
   5. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
   6. Level 0: Temporary partitions.

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.
   2. Taping, filling, and sanding are not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
   3. Taping, filling, and sanding are not required at base layer of double-layer applications.

D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

E. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.06 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.07 PROTECTION

A. Protect installed gypsum board assemblies from subsequent construction operations.

END OF SECTION

SECTION 092216
NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal partition, ceiling, and soffit framing.

B. Framing accessories.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Wood blocking within stud framing.

B. Section 072100 - Thermal Insulation: Acoustic insulation.

C. Section 078400 - Firestopping: Sealing top-of-wall assemblies at fire-resistance-rated walls.

D. Section 079200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

E. Section 092116 - Gypsum Board Assemblies: Execution requirements for anchors for attaching work of this section.

1.03 REFERENCE STANDARDS

A. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

D. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.

E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.

F. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

G. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

H. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.

I. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

J. ASTM E413 - Classification for Rating Sound Insulation; 2022.

1.04 SUBMITTALS

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

B. Shop Drawings:
   1. Indicate prefabricated work, component details, stud layout, framed openings, anchorage to structure, acoustic details, type and location of fasteners, accessories, and items of other related work.
   2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement of framing connections.

C. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories:
   1. ClarkDietrich: www.clarkdietrich.com/#sle.
   2. Jaimes Industries: www.jaimesind.com/#sle.
   3. MarinoWARE: www.marinoware.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

2.02 FRAMING MATERIALS

A. Fire-Resistance-Rated Assemblies: Comply with applicable code and as indicated on drawings.

B. Non-Loadbearing Framing System Components: AISI S220; sheet steel, of size and properties necessary for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
   1. Studs: C-shaped with knurled or embossed faces.
   2. Runners: U-shaped, sized to match studs.
   3. Ceiling Channels: C-shaped.
   4. Furring: Hat-shaped sections, minimum depth of 7/8 inch.
   5. Resilient Furring Channels: Single leg configuration; 1/2 inch channel depth.
      a. Products:
         1) Same manufacturer as other metal framing.
         2) Substitutions: See Section 016000 - Product Requirements.

C. Partition Head to Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and screwed to secondary deflection channel set inside but unattached to top track.

D. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.

E. Preformed Top Track Firestop Seal:
   1. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.

F. Non-Loadbearing Framing Accessories:
   1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
   2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
      a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
      b. Height: As indicated on drawings.
   3. Bracing and Bridging: ASTM A653/A653M G90 galvanized steel; for lateral bracing of wall studs with slots for engaging on-module studs.
   4. Fasteners: ASTM C1002 self-piercing self-tapping screws.
   5. Anchorage Devices: Powder actuated.
   6. Acoustic Insulation: See Section 072100.

2.03 FABRICATION

A. Fabricate assemblies of framed sections to sizes and profiles required.

B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that rough-in utilities are in proper location.

3.02 INSTALLATION OF STUD FRAMING

A. Comply with requirements of ASTM C1007.

B. Extend partition framing to structure where indicated and to ceiling in other locations.

C. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

D. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs as indicated.

E. Align and secure top and bottom runners at 24 inches on center or as indicated on drawings.

F. At partitions indicated with an acoustic rating:
   1. Provide components and install as required to produce STC ratings as indicated on drawings, based on published tests by manufacturer conducted in accordance with ASTM E90 with STC rating calculated in accordance with ASTM E413.

G. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

H. Install studs vertically at spacing indicated on drawings.

I. Align stud web openings horizontally.

J. Secure studs to tracks using crimping method. Do not weld.

K. Fabricate corners using a minimum of three studs.

L. Install double studs at wall openings, door and window jambs, not more than 2 inches from each side of openings.

M. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

N. Blocking: Use wood blocking secured to studs. Provide blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and opening frames.

O. Furring: Coordinate with sound isolation clip spacing and locations. Lap splices a minimum of 6 inches.

3.03 CEILING FRAMING

A. Comply with requirements of ASTM C754.

B. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

C. Install furring independent of walls, columns, and above-ceiling work.

D. Securely anchor hangers to structural members or embed them in structural slab. Space hangers as required to limit deflection to criteria indicated.

E. Space main carrying channels at maximum 72 inches on center, and not more than 6 inches from wall surfaces. Lap splice securely.

F. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

G. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.

H. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.

I. Laterally brace suspension system.

3.04 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet.

B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

END OF SECTION

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SECTION 093000
TILING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Porcelain floor and wall tile.
   2. Tile backing panels.
   3. Waterproof membranes.
   4. Crack isolation membranes.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product including all required installation materials.

B. Samples:
   1. Each type and composition of tile and for each color and finish required.
   2. Solid Surface thresholds.
   3. Grout for color selection and verification.
   4. Metal tile profiles.

C. Shop Drawings demonstrating tile patterns and installation accessories.

D. Certificates demonstrating compliance with Federal Acquisition Regulations Buy American Act requirements.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.04 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tile: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.05 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Installer is a Five-Star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
   2. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.
   3. Installer employs only Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers for Project.

PART 2 PRODUCTS

2.01 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide Standard-grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.02 TILE PRODUCTS

A. Ceramic Wall Tile Type: CWT
   1. Basis of Design Manufacturer: Wow
   2. Composition: Ceramic.
   3. Module Size: 2 by 5 inches.
   4. Thickness: 8.5 mm.
   5. Finish: Gloss.
   6. Tile Color and Pattern: Refer to interior finish key on drawings.

7. Grout Color: as indicated on drawings.

B. Porcelain Tile Type: PFT-1 & PTB-1
1. Basis of Design Manufacturer: Crossville
2. Certification: Tile certified by the Porcelain Tile Certification Agency.
3. Face Size: 6 by 24 inches and 12 by 24 inches; refer to interior finish key on drawings.
4. Face Size Variation: Rectified.
5. Thickness: 8.5 mm.
6. Edge: Rectified.
7. Dynamic Coefficient of Friction: Not less than 0.42.
8. Tile Color, Glaze, and Pattern: Refer to interior finish key on drawings.
9. Grout Color: Refer to interior finish key on drawings.

C. Porcelain Tile Type: PWT-1
1. Basis of Design Manufacturer: Crossville
2. Certification: Tile certified by the Porcelain Tile Certification Agency.
3. Face Size: 12 by 24 inches; refer to interior finish key on drawings.
4. Face Size Variation: Rectified.
5. Thickness: 8.5 mm.
6. Tile Color, Glaze, and Pattern: Refer to interior finish key on drawings.
7. Grout Color: as indicated on drawings.

2.03 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 or ASTM C1325, Type A.
1. Thickness: 1/4 inch (6.4 mm).

2.04 WATERPROOF MEMBRANES

A. General: Manufacturer's standard product that complies with ANSI A118.10 S and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Waterproof Membrane, Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch (0.2-mm) nominal thickness.
1. Basis of design: Schluter Systems; Kerdi System

2.05 CRACK ISOLATION MEMBRANES

A. General: Manufacturer's standard product that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Corrugated Polyethylene: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on the underside; 3/16-inch (4-mm) nominal thickness.
1. Basis of design: Schluter Systems; Ditra Uncoupling System

2.06 SETTING MATERIALS

A. Polymer Modified Large and Heavy Tile Dry-Set Mortar (Thinset): ANSI A118.4.
1. Provide prepackaged, dry-mortar mix to which only water must be added at Project site.
2. For wall applications, provide nonsagging mortar.

B. Improved Modified Dry-Set Mortar (Thinset): **ANSI A118.15**.
1. Provide prepackaged, dry-mortar mix to which only water must be added at Project site.
2. For wall applications, provide nonsagging mortar.

2.07 GROUT MATERIALS

A. High-Performance Tile Grout: ANSI A118.7.
1. Basis of design: Tec Power Grout
2. Polymer Type:
a. Dry, redispersible form, prepackaged with other dry ingredients.
b. Liquid-latex form for addition to prepackaged dry-grout mix.

B. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less.
1. Basis of design: Laticrete Spectralock Pro

2.08 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring and wall applications.
   1. Basis of Design: Schluter Systems

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
   2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

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

3.02 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped **1/4 inch per foot** (1:50) toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.03 INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
   1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
      a. Tile floors in wet areas.
      b. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Where accent tile differs in thickness from field tile, vary setting bed thickness so that tiles are flush.

E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the

use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

F. Joint Widths: As directed by the manufacturer’s installation instructions.

G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

I. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

J. Install tile backing panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use modified dry-set mortar for bonding material unless otherwise directed in manufacturer's written instructions.

K. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

L. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

3.04 INTERIOR CERAMIC & PORCELAIN TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:
   1. TCNA F115/F122: Thinset mortar on waterproof membrane and epoxy grout.
      a. Thinset Mortar: Improved modified dry-set mortar.
      b. Grout: Water-cleanable epoxy grout.

B. Interior Wall Installations, Wood or Metal Studs or Furring:
   1. TCNA W244C or TCNA W244F: Thinset mortar on cementitious backer units.
      a. Thinset Mortar: Improved modified dry-set mortar.
      b. Grout: High-performance unsanded or Water-cleanable epoxy grout. Refer to interior finish key.

C. Wet Wall Installations with Plumbing fixtures:
   1. TCNA B415: Thinset mortar on waterproof membrane over cementitious backer units.
      a. Thinset Mortar: Improved modified dry-set mortar.
      b. Grout: Water-cleanable epoxy grout.

END OF SECTION

SECTION 095100
ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

C. Certificates demonstrating compliance with Federal Acquisition Regulations Buy American Act requirements.

D. Delegated-Design Submittal: For seismic restraints for ceiling systems.
   1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.

B. Product test reports.

C. Research reports.

D. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic restraints for ceiling systems.

B. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

C. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: Class A according to ASTM E 1264.
   2. Smoke-Developed Index: 50 or less.

2.02 ACOUSTICAL PANELS - ACP-1

A. Basis of Design: Armstrong ULTIMA Beveled Tegular 1895 with Fire Guard.

B. Acoustical Panel Standard: Manufacturer's standard panels according to ASTM E 1264.

C. Color: White.

D. Light Reflectance (LR): 0.88.

E. Ceiling Attenuation Class (CAC): 40.

F. Noise Reduction Coefficient (NRC): 0.60.

G. Articulation Class (AC): N/A

H. Edge/Joint Detail: Reveal sized to fit flange of exposed suspension-system members.

I. Thickness: 3/4 inch (22 mm).

J. Modular Size: 24 by 24 inches (610 by 610 mm).

K. Fire Performance: Fire Guard to be installed with coordinating Fire Guard suspension system to maintain fire rated ceiling assembly.

2.03 METAL SUSPENSION SYSTEM

A. Basis of Design: Armstrong Suprafine Ceiling Grid with Fire Guard

B. Metal Suspension-System Standard: Manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M.

C. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 (Z90) coating designation; with prefinished 9/16-inch- (15-mm-) wide metal caps on flanges.
   1. Structural Classification: Heavy-duty system.
   2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
   3. Face Design: Flat, flush.
   4. Cap Material: Cold-rolled steel or aluminum.
   5. Cap Finish: Painted white.

D. Fire Performance: Fire Guard to be installed with coordinating Fire Guard acoustic panels to maintain fire rated ceiling assembly.

2.04 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Hold-Down Clips: Manufacturer's standard hold-down.

C. Impact Clips: Manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

PART 3 EXECUTION

3.01 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated.

B. Layout openings for penetrations centered on the penetrating items.

3.02 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C 636/C 636M, seismic design requirements, and manufacturer's written instructions.

B. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
   1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
   2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
   3. Arrange directionally patterned acoustical panels as follows:
      a. As indicated on reflected ceiling plans.
      b. Install panels with pattern running in one direction parallel to long axis of space.
      c. Install panels in a basket-weave pattern.
   4. Install hold-down and seismic clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.

3.03 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform inspections.
   1. Periodic inspection during the installation of suspended ceiling grids according to ASCE/SEI 7.

END OF SECTION

SECTION 096500
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient sheet flooring.

B. Resilient tile flooring.

C. Resilient base.

D. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 033000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.

C. Section 090561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

D. Section 090561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.03 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2023.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

C. ASTM F1303 - Standard Specification for Sheet Vinyl Floor Covering with Backing; 2004 (Reapproved 2021).

D. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile; 2020.

E. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.

F. ASTM F1913 - Standard Specification for Vinyl Sheet Floor Covering Without Backing; 2019.

G. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

H. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

I. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; 2018.

1.04 SUBMITTALS

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

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Shop Drawings: Indicate seaming plans and floor patterns.

D. Verification Samples: Submit two samples, minimum ox 8 x 10 inch in size illustrating color and pattern for each resilient flooring product specified.

E. Certificates demonstrating compliance with Federal Acquisition Regulations Buy American Act requirements.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

D. Protect roll materials from damage by storing on end.

1.07 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 SHEET FLOORING

A. Vinyl Sheet Flooring - Type RSF-1 : Transparent or translucent vinyl wear layer over interlayer and backing.
   1. Basis of Design Manufacturers:
      a. Mannington Commercial
   2. Minimum Requirements: Comply with ASTM F1303, Type I, with Class A fibrous backing.
   3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
   4. VOC Content Limits: As specified in Section 016116.
   5. Wear Layer Thickness: 0.020 inch minimum.
   6. Total Thickness: 0.080 inch minimum.
   7. Sheet Width: 144 inch minimum.
   8. Seams: Heat welded.
   9. Color: As indicated on drawings.

B. Welding Rod: Solid bead in material compatible with flooring, produced by flooring manufacturer for heat welding seams, and in color matching field color.

2.02 TILE FLOORING

A. Luxury Vinyl Tile - Type RTF-1: Printed film type, with transparent or translucent wear layer; acoustic interlayer or backing.
   1. Basis of Design Manufacturers:
      a. Mannington Commercial
   2. Minimum Requirements: Comply with ASTM F1700, Class III.
   3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648.
   4. VOC Content Limits: As specified in Section 016116.
   5. Square Tile Size: Refer to interior finish key.
   6. Wear Layer Thickness: 40 mil.
   7. Total Thickness: 0.098 inch.
   8. Tile Edge: Straight.
   9. Color and Pattern: As indicated on drawings.

2.03 RESILIENT BASE

A. Resilient Base - Type RB-1: ASTM F1861, Type TS, rubber, vulcanized thermoset; style as scheduled.
   1. Basis of Design Manufacturers:
      a. Roppe Corporation: www.roppe.com
   2. Height: 4 inches.
   3. Thickness: 0.125 inch.
   4. Finish: Matte.
   5. Length: Roll.
   6. Color: As indicated on drawings.

B. Resilient Base - Type[RB-2]: ASTM F1861, Type TP, thermoplastic rubber; style as scheduled.

1. Basis of Design Manufacturers:
   a. Mannington Commercial; Ideal Base.
2. Height: 6.25 inches.
3. Thickness: 0.08 inch.
4. Finish: Matte.
5. Length: Roll.
6. Color: As indicated on drawings.
7. Weld Rod: Weld rod at toe of sanitary cove base to coordinate with adjacent flooring. Color to be selected by interior designer.

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.
   1. VOC Content Limits: As specified in Section 016116.

C. Adhesive for Vinyl Flooring:
   1. Manufacturers:
      a. As recommended by flooring manufacturer.

D. Adhesive for Static Control Flooring:
   1. Product as recommended by static control flooring manufacturer.

E. Moldings, Transition and Edge Strips: as indicated on drawings.

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 Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Test in accordance with Section 090561.
   2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
   3. Follow moisture and alkalinity remediation procedures in Section 090561.

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 subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

D. Prohibit traffic until filler is fully cured.

E. Clean substrate.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:
   1. Spread only enough adhesive to permit installation of materials before initial set.
   2. Fit joints and butt seams tightly.
   3. Set flooring in place, press with heavy roller to attain full adhesion.

D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
   1. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.
   2. Resilient Strips: Attach to substrate using adhesive.

F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

G. Install flooring in recessed floor access covers, maintaining floor pattern.

H. At movable partitions, install flooring under partitions without interrupting floor pattern.

3.04 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. Cut sheet at seams in accordance with manufacturer's instructions.

C. Seal seams by heat welding where indicated.

3.05 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 from adjacent rows.

3.06 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Install base on solid backing. Bond tightly to wall and floor surfaces.

C. Scribe and fit to door frames and other interruptions.

3.07 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.08 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 096700
FLUID-APPLIED FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fluid-applied flooring and base.

1.02 RELATED REQUIREMENTS

A. Section 090561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

B. Section 090561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.03 REFERENCE STANDARDS

A. ANSI/ESD STM7.1 - The Protection of Electrostatic Discharge Susceptible Items Flooring Systems Resistive Characterization; 2021.

1.04 SUBMITTALS

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

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available; and texture.

C. Samples: Submit two samples, 4 by 4 inch in size illustrating color and pattern for each floor material for each color specified.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and application rate for each coat.

E. Manufacturer's Qualification Statement.

F. Applicator's Qualification Statement.

G. Certificates demonstrating compliance with Federal Acquisition Regulations Buy American Act requirements.

H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section.
   1. Minimum 3 years of documented experience.

1.06 MOCK-UPS

A. Construct mock-up(s) of fluid applied flooring to serve as basis for evaluation of texture and workmanship. Mockup shall include integral cove base, inside corner, outside corner, floor-to-drain transition if applicable, and full vinyl-flake broadcast finish.
   1. Number of Mock-Ups to be Prepared: One.
   2. Use same materials and methods for use in the work.
   3. Locate where directed.
   4. Minimum Size: 48 inches by 48 inches.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store resin materials in a dry, secure area.

B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.08 FIELD CONDITIONS

A. Maintain minimum temperature in storage area of 55 degrees F.

B. Store materials in area of installation for minimum period of 24 hours prior to installation.

C. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fluid-Applied Flooring:
   1. Sherwin-Williams High-Performance Flooring: www.sherwin-williams.com/resin-flooring/#sle.
   2. Substitutions: See Section 016000 - Product Requirements.

2.02 FLUID-APPLIED FLOORING SYSTEMS

A. Fluid-Applied Flooring Type RES-1: Epoxy base coat(s), with troweled aggregate.
   1. Primer: Sherwin-Williams, Resuflor Glaze Resin or manufacturer approved primer as required for the substrate conditions.
   2. Aggregate: Vinyl flakes. Full broadcast, color blend as selected from manufacturer's standard range.
   3. Body Coat: Sherwin-Williams, SofTop RX resilient polyurethane.
   4. Grout Coat: Sherwin-Williams, Accelera EXT polyaspartic grout coat.
   5. Top Coat: Sherwin-Williams, Accelera EXT polyaspartic wear coat.
   6. System Thickness: 3/16 inch, nominal, dry film thickness (DFT).
   7. Texture: Slip resistant.
   8. Sheen: Satin to Gloss, as selected by COR from manufacturer's standard finish options..
   9. Color: Refer to interior finish key.
   10. Performance Requirements:
      a. Critical Radiant Flux: Class I, minimum 0.45 W/cm² when tested in accordance with ASTM E648.
      b. VOC Content: Comply with Section 016116 and applicable federal, state, and local regulations.
      c. Flooring System Components: furnish complete system from a single manufacturer.
      d. Flooring shall provide a seamless, resilient, monolithic surface suitable for healthcare occupancies.
      e. Installer shall be approved by the flooring manufacturer for installation of specified system.

2.03 ACCESSORIES

A. Base Caps: Zinc with projecting base of 1/8 inch; color as selected.

B. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.

C. Primer: Type recommended by fluid-applied flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive flooring.

C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.

D. Verify that wood subfloors have 12 percent maximum moisture content.

E. Cementitious Subfloor Surfaces: Verify that substrates are ready for fluid-applied flooring installation by testing for moisture and alkalinity (pH).
   1. Test in accordance with Section 090561.
   2. Obtain instructions if test results are not within limits recommended by fluid-applied flooring manufacturer.
   3. Follow moisture and alkalinity remediation procedures in Section 090561.

3.02 PREPARATION

A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.

B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.

C. Vacuum clean substrate.

3.03 INSTALLATION - ACCESSORIES

A. Install terminating cap strip at top of base; attach securely to wall substrate.

3.04 INSTALLATION - FLOORING

A. Apply in accordance with manufacturer's instructions.

B. Apply each coat to minimum thickness required by manufacturer.

C. Finish to smooth level surface.

D. Install integral cove base where indicated on drawings.

E. Maintain required environmental conditions throughout installation and cure period.

3.05 FIELD QUALITY CONTROL

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

B. Test installed floor surface in accordance with ANSI/ESD STM7.1 .

3.06 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

END OF SECTION

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SECTION 099123
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
   6. Marble, granite, slate, and other natural stones.
   7. Floors, unless specifically indicated.
   8. Ceramic and other tiles.
   9. Glass.
   10. Acoustical materials, unless specifically indicated.
   11. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 055000 - Metal Fabrications: Shop-primed items.

C. Section 099113 - Exterior Painting.

1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

D. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

E. SSPC-SP 2 - Hand Tool Cleaning; 2024.

F. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

G. SSPC-SP 13 - Surface Preparation of Concrete; 2018.

1.05 SUBMITTALS

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

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
   2. MPI product number (e.g., MPI #47).
   3. Cross-reference to specified paint system products to be used in project; include description of each system.

C. Samples: Submit two paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

D. Certificates demonstrating compliance with Federal Acquisition Regulations Buy American Act requirements.

E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 fc measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Provide paints and finishes from the same manufacturer to the greatest extent possible.

C. Paints:
   1. PPG Paints.
   2. Sherwin-Williams Company.
   3. Benjamin Moore.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Supply each paint material in quantity required to complete entire project's work from a single production run.
   3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content: See Section 016116.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified on drawings.

E. Colors: As indicated on drawings.

2.03 PAINT SYSTEMS - INTERIOR

A. Interior Latex Zero V.O.C.: Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board.
   1. Two top coats and one coat primer.
   2. Top Coat(s): Interior Latex; MPI #43, 44, 52, 53, 54, or 114.
      a. Products:
         1) Pittsburgh Paints Speedhide Interior Latex, 6-411 Series, Eggshell. (MPI #44)
         2) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Eg-Shel. (MPI #52)
   3. Top Coat Sheen:
      a. Eggshell: MPI gloss level 3; use this sheen at all locations.

B. Waterbased Alkyd Urethane: Hollow Metal Doors/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
   1. Two top coats and one coat primer.
   2. Top Coat(s): Interior Alkyd, Water Based; MPI #157, 167, 168, or 169.
      a. Products:
         1) Sherwin-Williams Pro Industrial Waterbased Alkyd Urethane.
   3. Top Coat Sheen:
      a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.

C. Precatalyzed Waterbased Epoxy: Medium Duty Vertical and Overhead: Including gypsum board.
   1. Two top coats and one coat primer.
   2. Top Coat(s): Interior Light Industrial Coating, Water Based; MPI #151, 153, or 154.
      a. Products:
         1) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Eg-Shel. (MPI #151)
   3. Top Coat Sheen:
      a. Eggshell: MPI gloss level 3; use this sheen at all locations.

D. Interior Waterborne Dry Fall: Metals; exposed structure and overhead-mounted services in utilitarian spaces, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, galvanized conduit, and galvanized piping.
   1. Shop primer by others.
   2. Top Coat: Latex Dry Fall; MPI #118, 155, or 226.
      a. Products:
         1) Sherwin-Williams Waterborne Acrylic Dryfall, Flat. (MPI #118)
   3. Top Coat Sheen:
      a. Flat: MPI gloss level 1; use this sheen at all locations.

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
   1. Interior Institutional Low Odor/VOC Primer Sealer; MPI #149.
   2. Interior Latex Primer Sealer; MPI #50.
   3. Interior Drywall Primer Sealer.
   4. Anti-Corrosive Alkyd Primer for Metal; MPI #79.
   5. Interior Water Based Primer for Galvanized Metal; MPI #134 or #134 X-Green.
      a. Products:
         1) Sherwin-Williams Pro-Cryl Universal Primer. (MPI #134)

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or 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. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

F. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
   2. Prepare surface according to SSPC-SP 2.

G. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
   3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 Commercial Blast Cleaning. Protect from corrosion until coated.

H. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

F. Sand wood and metal 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. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

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SECTION 101423
PANEL SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Panel signage including room identification, directories, and directionals.

1.02 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM A555/A555M - Standard Specification for General Requirements for Stainless Steel Wire and Wire Rods; 2023.

C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

D. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.03 SUBMITTALS

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

B. Product Data: Manufacturer's product literature for each type of panel sign, indicating styles, font, foreground and background colors, locations, and overall dimensions of each sign.

C. Shop Drawings:
   1. Include dimensions, locations, elevations, materials, text and graphic layout, attachment details, and schedules.
   2. Schedule: Provide information sufficient to completely define each panel sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
      a. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
      b. When content of signs is indicated to be determined later, request such information from Owner through COR at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
      c. Submit for approval by Owner through COR prior to fabrication.

D. Samples: Submit two samples of each type of sign, of size similar to that required for project, indicating sign style, font, and method of attachment.

E. Verification Samples: Submit samples showing colors, materials, and finishes specified.

F. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

H. Certificates demonstrating compliance with Federal Acquisition Regulations Buy American Act requirements.

1.04 QUALITY ASSURANCE

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

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. 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 minimum ambient temperature during and after installation.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN MANUFACTURER

A. Panel Signage:
   1. Takeform; Vivid.
   2. Substitutions: See Section 016000 - Product Requirements.

2.02 REGULATORY REQUIREMENTS

A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

2.03 PANEL SIGNAGE

A. Panel Signage:
   1. Application: Room and door, directories, and directional signs.
   2. Description: Flat signs with applied character panel media, tactile characters.
   3. Sign Size: As indicated on drawings.
   4. Total Thickness: 0.375 inch.
   5. Sign Edges: Squared.
   6. Letter Edges: Squared.
   7. Corners: Squared.
   8. Color and Font, unless otherwise indicated:
      a. Character Font: As indicated on drawings.
      b. Character Case: Upper and lower case (title case).
      c. Background Color: As scheduled.
      d. Character Color: Contrasting color as indicated on drawings.
   9. Material: Acrylic, comprised of two layers. Edges shall be smooth without chips, burrs, sharp edges, or marks. The direct print shall be second surface to prevent scratching, fading, or other damage.
      a. Acrylic shall be non-glare optically clear with P99 finish assuring no loss of clarity or composition of print.
   10. Profile: Flat panel without frame.
   11. Tactile Letters: Raised 1/32 inch minimum, PETG and subsurface colored for scratch resistance.
   12. Braille: Grade II, ADA-compliant.
   13. One-Sided Wall Mounting: Tape adhesive.
   14. Glass Mounting: provide blank backer, matching the sign in shape and size, on opposite side of the glass to cover tape and adhesive.
   15. Printed Inserts:
      a. The signage shall be capable of accepting paper inserts to allow changing and updating as required. Insert components shall have a 0.040" thickness non-glare acrylic window and shall be flush to sign face for a smooth seamless appearance.
      b. The signage contractor shall provide and install all signage inserts.
      c. Manufacturer shall provide a template containing layout, font, color, artwork and trim lines to allow owner to produce inserts on laser or ink jet printer. The template shall be in Acrobat or Word format.

2.04 SIGNAGE APPLICATIONS

A. Basis of Design Manufacturer:
   1. Takeform; Fusion.

B. Room and Door Signs:
   1. Office Doors: Identify with the room names and numbers indicated on drawings; provide "window" section for replaceable occupant name.
   2. Conference and Meeting Rooms: Identify with the room names and numbers indicated on drawings; provide "window" section with sliding "In Use/Vacant" indicator.
   3. Service Rooms: Identify with room names and numbers indicated on drawings.
   4. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers indicated on the drawings, and braille.

C. Interior Directional and Informational Panel Signs:
   1. Directories: For customer-produced media; provide divider strips.
   2. Where suspended, ceiling mounted, or projecting from wall signs are indicated, provide two-sided signs with same information on both sides.

D. Emergency Evacuation Map Panel Signs:
   1. Allow for one map per elevator lobby.
   2. Map content to be provided by Owner.

2.05 ACCESSORIES

A. Cable Display Systems: Sizes and configurations indicated on drawings.
   1. Description:
      a. Tensioned cable display system used to support panels from ceilings with the following components:
         1) Suspended Fittings: Top tracks.
            (a) Top Fitting Mounting: Ceiling.
         2) Wire Cable: 7x7 construction.
            (a) Stainless Steel: ASTM A555/A555M; ASTM A666/A666M, Type 304 or Type 316.
         3) Cable Gripper Fittings: Provide stainless steel top panel supports.

B. Tape Adhesive: Double-sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify that power and data service is correctly sized and located to accommodate panel signs.

C. Notify COR if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install with horizontal edges level.

C. Locate panel signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

D. Protect from damage until substantial completion; repair or replace damaged items.

END OF SECTION

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SECTION 102123
CUBICLE CURTAINS AND TRACK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface mounted overhead curtain track and guides.

B. Cubicle curtains.

1.02 RELATED REQUIREMENTS

A. Section 055000 - Metal Fabrications: Track supports above ceiling.

B. Section 095100 - Acoustical Ceilings: Suspended ceiling system to support track.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.

1.04 SUBMITTALS

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

B. Product Data: Provide data for curtain fabric characteristics.

C. Shop Drawings: Indicate a reflected ceiling plan view of curtain track, hangers and suspension points, attachment details, schedule of curtain sizes.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention .

E. Maintenance Data: Include recommended cleaning methods and materials and stain removal methods.

F. Certificates demonstrating compliance with Federal Acquisition Regulations Buy American Act requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept curtain materials on site and inspect for damage.

B. Store curtain materials on site and deliver to Owner for installation when requested.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN MANUFACTURER

A. Cubicle Curtain: Refer to interior finish key on drawings.

B. Cubicle Track:
   1. Inpro; FormaTrac: www.inprocorp.com/#sle.
   2. Substitutions: See Section 016000 - Product Requirements.

2.02 TRACKS AND TRACK COMPONENTS

A. Tracks: PVC with metal spline sections; one piece per track run.
   1. Profile: I-beam.
   2. Mounting: Surface.
   3. Track End Stop: To fit track section.
   4. Track Bends: Minimum 12 inch radius; fabricated without deformation of track section or impeding movement of carriers.
   5. Finish on Exposed Surfaces: Clear anodized.

B. Curtain Carriers: Nylon rollers, size and type compatible with track; designed to eliminate bind when curtain is pulled; fitted to curtain to prevent accidental curtain removal.

C. Installation Accessories: Types required for specified mounting method and substrate conditions.

2.03 CURTAINS

A. Cubicle Curtains:
   1. Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
   2. Inherently flame resistant or flameproofed; capable of passing NFPA 701 test.
   3. Material: Close weave polyester; anti-bacterial, self deodorizing, sanitized, and preshrunk.
   4. Color/Pattern: Refer to interior finish key on drawings.
   5. Open Mesh Cloth: Open weave to permit air circulation; flameproof material, mesh color as selected by architect.

B. Curtain Fabrication:
   1. Width of curtain to be 10 percent wider than track length.
   2. Length of curtain to end 15 inches above finished floor.
   3. Pattern match fabric with vertical seams.
   4. Include open mesh cloth at top that extends a minimum of 22 inches down from the ceiling to comply with NFPA 13. Mesh top panel shall have a minimum of 70% openness.
   5. Seams and Hems: Manufacturer's standard fabrication method for securely sewn and finished seams and hems.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and supports above ceiling are ready to receive work of this Section.

B. Verify that field measurements are as indicated.

3.02 INSTALLATION

A. Install curtain track to be secure, rigid, and true to ceiling line.

B. Secure track to ceiling system.

C. Install end cap and stop device.

D. Install curtains on carriers ensuring smooth operation.

END OF SECTION

SECTION 102513
PATIENT BED SERVICE WALLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Patient bed service walls (headwalls).

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealing joints between service walls and adjacent wall construction.

B. Section 260505 - Selective Demolition for Electrical: Alterations of existing electrical services.

C. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Cables and wiring.

D. Section 260533.13 - Conduit for Electrical Systems.

E. Section 260533.16 - Boxes for Electrical Systems.

F. Section 262726 - Wiring Devices.

1.03 DEFINITIONS

A. Patient Bed Service Wall (headwall): Configurable medical gas and electric service assembly or unit employing multiple service rows or columns to conveniently locate medical gas, electrical, and communication devices.
   1. Where indicated on drawings as "Headwall", meaning is same as patient bed service wall.

1.04 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. ANSI A208.1 - American National Standard for Particleboard; 2022.

C. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

E. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

F. NFPA 99 - Health Care Facilities Code; 2024, with Errata.

G. UL (DIR) - Online Certifications Directory; Current Edition.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of units with wall framing, including stud spacing, and size, location, and installation of service utilities.

B. Preinstallation Meeting: Conduct preinstallation meeting one week prior to start of work of this section; require attendance by all affected installers.

C. Sequencing: Ensure that facility services connections are achieved in an orderly and expeditious manner.

1.06 SUBMITTALS

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

B. Product Data: Provide descriptive literature that includes dimensions, construction, capacities, utility and service requirements, clearances, locations, required accessories, optional features, test reports, certifications.

C. Shop Drawings: Indicate locations in facility using large-scale plans, elevations, and cross sections.
   1. Include electrical ratings, overall and detailed dimensions, mounting details, rough-in and anchor placement dimensions and tolerances, installation and servicing clearances required, wiring diagrams, materials, and connection diagrams.
   2. Include configuration drawings showing arrangement of devices, including nurse call, medical gases, electrical receptacles, switches, and lights.

D. Certificate: Certify that products of this section meet or exceed specified requirements.

1. Certify that equipment has been properly installed, adjusted, and tested in accordance with manufacturer's recommendations.

E. Certificate demonstrating compliance with Federal Acquisition Regulations Buy American Act requirements.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

H. Operation and Maintenance Manuals: Include wiring diagrams, technical data sheets, and information for ordering replacement parts.
   1. Identify terminals on wiring diagrams to facilitate installation, maintenance and operation.

I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

J. Project Record Documents: Record actual locations of concealed facility services connections.

1.07 QUALITY ASSURANCE

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

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

C. Preconstruction Testing: Factory-test components of service walls.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Package each system component to ensure protection from damage during shipment and delivery. Legibly indicate on exterior of each container or crate, shipping address and brief description of contents. Outside of container, fasten waterproof envelope containing packing list and complete instructions for uncrating and handling contents.

B. Coordinate maximum size of each shipment with opening sizes along access routes to places of storage and installation, including sizes of elevator doors and cabs.

C. Store products clear of floor in manner to prevent damage.

D. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.

1.09 WARRANTY

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

B. Manufacturer Warranty: Provide 10-year manufacturer warranty for service wall system installation. Complete forms in Owner's name and register with manufacturer.

PART 2 - PRODUCTS

2.01 BASIS OF DESIGN MANUFACTURER

A. Amico Corporation; NuLook Serenity Surface Mounted Headwall System.

2.02 PATIENT BED SERVICE WALL (PBSW) ASSEMBLIES (HEADWALL)

A. UL (DIR) Listings: Provide assemblies, units, and components listed in following categories:

B. Construction: Assemblies or units consisting of structural framework, removable panels, and removable equipment console units that are factory assembled to house bedside medical services.
   1. Include provisions for medical gas fittings, power receptacles and switches, light fixtures, grounding jacks, data jacks, nurses call patient station, and accessory rails. Refer to requirements on drawings.
   2. VOC Limits for Adhesives: Where used in manufacture of PBSW assemblies limit VOC content to 2.1 lb/gal or less when calculated according to 40 CFR 59, Subpart D.

C. Medical Gas Outlets: See Section 226000.

D. Electrical Receptacles and Switches: See Section 262726.

E. Nurse Call Patient Station: See Section 275223 for nurse call equipment space provisions.

F. Grounding Jack: Solid brass receptacle enclosed in nonconductive housing; spring loaded, with twist-to-lock action.

G. Data Cart Jack: Manufacturer's standard.

2.03 PBSW CONFIGURATIONS

A. Type HW1 : Two bed PBSW assembly with vertical configuration.
   1. Vertical wall-mounted assemblies.
      a. Configuration and dimensions as indicated on drawings.
   2. Electrical Services: Wire devices in accordance with schematic diagram indicated on drawings.
   3. Piped Services:
      a. Medical Oxygen Fittings: As indicated on drawings.
      b. Medical Air Fittings: As indicated on drawings.
      c. Vacuum Fittings: As indicated on drawings.

2.04 PATIENT BED SERVICE WALLS FABRICATION

A. Construct basic structural framework of 14 gauge, 0.067 inch cold-rolled steel sheet.

B. Aluminum Extrusions: ASTM B221 Alloy 6063-T5.

C. Construct unit to be self-supporting for above-the-floor, surface-mounted installation.

D. Removable Front Panels: Construct panels of one of following materials, as standard with manufacturer for unit types specified:
   1. 3D Thermofoil Laminate: 0.012 inch thick rigid thermofoil 3D laminate material applied over substrate without any visible seams, moldings, or edge banding.
      a. Basis of Design: Riken USA.
      b. Color as indicated on drawings.
      c. Substrate: Fire-retardant-treated particleboard complying with ANSI A208.1. Composed of wood chips, sawdust, or flakes of medium density, made with waterproof resin binders; of grade to suit application; sanded faces.
   2. Secure panels with hidden screws or other means to offer an overall finished appearance.
   3. Exposed metal surfaces or trims greater than 1/8 inch wide to be of anodized aluminum, finished to resist abrasion and effects from harsh cleaning compounds.

E. Back Panels: Attach side and back panels made of minimum 0.060 inch thick galvanized sheet steel, or equivalent strength aluminum side and back panels, with flush screws to permit close wall mounting. Finish side panels to match or compliment front panels. Match back panel for freestanding units with finish of front and side panels.

F. Provide panel wall system consisting of removable vertical, central and decorative sections installed on extruded aluminum frames via steel spring clip system. Design individual sections such that they can be removed without the need for special tools.

G. Use hardware in assembling components and connecting panels that allows for repeated assembly, disassembly and reconfiguration.

H. Provide units complete with structural frames, access panels, electrical outlets, electrical back boxes, wiring and services.

I. Fascia: 3/8 inch thick fire-retardant MDF with rigid thermofoil wrap as specified in this Section.
   1. Medical Gas Piping: Factory-installed and manifolded for single-point connection at top of unit to facility services.
      a. Type "L" copper pipe, cleaned, capped, protected from contact with dissimilar metals, and properly identified.
      b. As indicated on drawings.
   2. Electrical Wiring: Factory installed.
      a. Wiring: Wire for standard and critical branch power circuits: #10 or #12 (as specified) type THHN stranded copper wire, 600 volt, with heat resistant thermoplastic insulation for hot (black) and neutral (white).
      b. Grounds: #10 THHN stranded copper wire (green).
      c. Grounding and Bonding: All ground conductors to be installed in conduit or raceway. Each power receptacle to have a ground conductor connected to a grounding screw.

Where electrical terminations are located inside patient bed panel walls, install grounding bus for each type of power, to ensure grounding of complete power system.

d. Low Voltage Data Provisions: connected to device junction box via conduit or raceway. Provide pull cord extending from junction box to service provision. Refer to Division 26 for additional wiring requirements.
e. Telephone nurse call patient station device: In accordance with requirements of Division 27.
f. Electrical Receptacles: Hubbell 15 or 20 amp, 120 or 277 volt, UL listed and marked "Hospital Grade". Quantity and type as shown on reviewed Shop Drawings. Ensure compatibility of plug on accessory equipment to be used with these devices.
g. Duplex and Simplex receptacles: NEMA style 5-15R or 5-20R. Ivory color for use on normal power circuits and red color for use on critical branch power circuits.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall framing, facility services connections, rough-in frames, anchors and supports are accurately placed and deliver services at specified characteristics and within acceptable functional ranges.

B. Examine areas, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of service walls.

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

3.02 INSTALLATION

A. Installation of patient bed service walls noted as OFCI or CFCI is by Contractor. Coordinate with items furnished and or installed by Owner.

B. Install service wall assembly components securely, square, level, and plumb.

C. Comply with applicable requirements of NFPA 99.

D. Install and make facility services connections as required for complete and operational PBSW system for each unit or assembly.
1. Coordinate work of affected trades.
2. Electrical Components: Install and test components, wiring, and grounding in accordance with NECA 130.
3. Perform required existing electrical services alterations in compliance with requirements of Section 260505.
4. Compressed Air, Oxygen and Vacuum System Components: Install and test components and piping system in accordance with requirements of Section 226000.

E. Seal along perimeter of service wall system installation using sealant specified in Section 079200.
1. Sealant VOC Content Limits: As specified in Section 016116.

3.03 TOLERANCES

A. Maximum Variation From True Position in Any Direction: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 SYSTEM STARTUP

A. Prepare and start systems in accordance with manufacturers' instructions and recommendations.

3.05 ADJUSTING

A. Adjust components for proper operation within manufacturer's published tolerances.

B. Adjust controls and moving parts for smooth operation.

3.06 CLEANING

A. Clean surfaces as recommended by manufacturer.

B. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

3.07 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals for closeout submittals.

3.08 PROTECTION

A. Protect installed patient bed service walls from subsequent construction operations.

END OF SECTION

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SECTION 102600
WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Corner guards.

B. Protective wall covering.

C. Hygienic wall paneling.

1.02 RELATED REQUIREMENTS

A. Section 055000 - Metal Fabrications: Corner guards fabricated from rolled metal sections or bent plate.

B. Section 061000 - Rough Carpentry: Blocking for wall and corner guard anchors.

C. Section 092116 - Gypsum Board Assemblies: Placement of supports in stud wall construction.

D. Section 092216 - Non-Structural Metal Framing: Placement of supports in stud wall construction.

1.03 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2024.

B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents; 2021.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

D. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2023.

E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

1.04 SUBMITTALS

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

B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

C. Shop Drawings: Include plans, elevation, sections, and attachment details. Show design and spacing of supports for protective corridor handrails, required to withstand structural loads.

D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
   1. Submit two sections of corner guards and protective corridor handrails, 24 inches long.
   2. Submit two samples of protective wall covering, 6 by 6 inches square.

E. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

F. Certificates demonstrating compliance with Federal Acquisition Regulations Buy American Act requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.

B. Protect work from moisture damage.

C. Protect work from UV light damage.

D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

1.06 WARRANTY

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

PART 2 PRODUCTS

2.01 BASIS OF DESIGN MANUFACTURERS

A. Protective Corridor Handrails and Corner Guards:
   1. Inpro Corp.

B. Protective Wall Covering:
   1. Inpro Corp.

C. Protective Wall Panels: PVC-free Hygienic Wall Panels:
   1. Altro USA, Inc..

2.02 PERFORMANCE CRITERIA

A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.

B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.

C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

2.03 PRODUCT TYPES

A. Corner Guards - Surface Mounted:
   1. Corner guards fabricated from rolled section or bent plate are specified in Section 055000.
   2. Material: Polyethylene terephthalate (PET or PETG); PVC-free with full height extruded aluminum retainer.
   3. Performance: Resist lateral impact force of 100 lbs at any point without damage or permanent set.
   4. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
   5. Width of Wings: 2 inches.
   6. Corner: Square.
   7. Color: As indicated on drawings.
   8. Length: One piece.

B. Protective Wall Covering (WP-1):
   1. Material: Polyethylene terephthalate (PET or PETG); PVC and PBTs-free.
   2. Thickness: 0.040 inch.
   3. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
   4. Color: As indicated on drawings.
   5. Accessories: Provide manufacturer's standard color-matched trim and moldings.
      a. Inside Corner Trim: Standard angle
      b. Outside Corner Trim: Standard angle.
   6. Mounting: Adhesive.

C. Hygienic Wall Panels:
   1. Material: 100% pure vinyl, extruded, semi-rigid PVCu homogeneous sheet. Free of plasticizers and fillers.
   2. Thickness: 0.10 inch (2.5 mm).
   3. Panel Size: 4 feet by 10 feet.
   4. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 55 or less, when tested in accordance with ASTM E84.
   5. Color and Pattern: As indicated on drawings.
   6. Accessories: Provide manufacturer's standard PVC color-matched trim and moldings.
   7. Mounting: Adhesive.

2.04 FABRICATION

A. Fabricate components with tight joints, corners and seams.

B. Pre-drill holes for attachment.

C. Form end trim closure by capping and finishing smooth.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

B. Verify that field measurements are as indicated on drawings.

C. Verify that substrate surfaces for adhered items are clean and smooth.
   1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations and/or application conditions where adhesion test's results are unsatisfactory.

D. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

B. Position top of corridor hand rail 36 inches from finished floor.

C. Position full-height corner guard 4 inches above finished floor.

D. Terminate rails 2 inch short of door openings and intersecting walls.

E. Position protective wall covering no less than 1 inch above finished floor to allow for floor level variation.
   1. Wainscot Installation: Establish a level line at the specified height for entire length of run. Install by aligning top of edge of covering with this line.
   2. Apply adhesive with 1/8 inch V-notch trowel to an area of wall surface that can be completed within cure time of the adhesive.
   3. Install trim pieces as required for a complete installation. Allow tolerance for thermal movement.
   4. At joints indicated to be caulked, allow for a minimum 1/16 inch wide gap between edges of sheets. Gaps are required to be of consistent width throughout the project.
   5. Use a roller to ensure maximum contact with adhesive.
   6. At inside and outside corners cut covering sheets to facilitate installation of trim pieces or corner guards.

3.03 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch.

B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

3.04 CLEANING

A. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.

B. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

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SECTION 102800
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Commercial shower and bath accessories.

C. Healthcare accessories.

D. Under-lavatory pipe supply covers.

E. Diaper changing stations.

F. Utility room accessories.

1.02 RELATED REQUIREMENTS

A. Section 061053 Misc. Rough Carpentry: Placement of concealed anchor devices.

B. Section 093000 - Tiling: Ceramic washroom accessories.

C. Section 102113.19 - Plastic Toilet Compartments.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

C. ASTM C1036 - Standard Specification for Flat Glass; 2021.

D. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2024.

E. ASTM D5047 - Standard Specification for Polyethylene Terephthalate Film and Sheeting; 2017.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

G. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2022.

H. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

I. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

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 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

D. Certificates demonstrating compliance with Federal Acquisition Regulations Buy American Act requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Commercial Toilet, Shower, and Bath Accessories:
   1. American Specialties, Inc
   2. Bradley Corporation
   3. Bobrick Washroom Equipment Inc..
   4. Substitutions: Section 016000 - Product Requirements.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

B. PETG Plastic Sheet: ASTM D5047.

C. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Powder-Coated Steel: Clean, degrease, and neutralize. Follow immediately with a phosphatizing treatment, prime coat, and two finish coats of powder coat enamel.

C. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

D. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

E. Back paint components where contact is made with building finishes to prevent electrolysis.

F. Selected from manufacturer's standard range by AE's Interior Designer.

2.04 COMMERCIAL TOILET ACCESSORIES

A. Toilet Paper Dispenser [TPD1]: Double roll, surface mounted bracket type, stainless steel, spindleless type for tension spring delivery designed to prevent theft of tissue roll.
   1. Attached Purse Shelf: 0.03 inch satin finished stainless steel, with rolled or formed edge at front.
   2. Basis of Design Products:
      a. Bobrick B4288 Surface-Mounted Toilet Tissue Dispenser..
      b. Substitutions: Section 016000 - Product Requirements.

B. Paper Towel Dispenser [PT1]: Folded paper type, stainless steel, surface-mounted, with viewing slots on sides as refill indicator.
   1. Capacity: 400 multifold minimum.
   2. Basis of Design Products:
      a. Bobrick B-4262 Surface-Mounted Paper Towel Dispenser..
      b. Substitutions: Section 016000 - Product Requirements.

C. Soap Dispenser [SD1]: Liquid soap dispenser, wall-mounted, surface, with stainless steel cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gauge refill indicator.
   1. Minimum Capacity: 48 ounces.
   2. Basis of Design Products:
      a. Bobrick B-4112 Surface-Mounted Manual Liquid Soap Dispenser..
      b. Substitutions: Section 016000 - Product Requirements.

D. Mirrors [MIR1, MIR2, MIR3]: Stainless steel channel framed, 1/4 inch thick annealed float glass; ASTM C1036.
   1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
   2. Size: As indicated on drawings.
   3. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
   4. Basis of Design Products:
      a. Bobrick; B-165 Channel-Frame Mirror.
      b. Substitutions: Section 016000 - Product Requirements.

E. Grab Bars [GB1, GB2, GB3]: Stainless steel, peened surface.
   1. Heavy Duty Grab Bars: Floor supports are not acceptable.
      a. Push/Pull Point Load: Minimum 1000 pound-force, minimum.
      b. Dimensions: 1-1/2 inch outside diameter, minimum 0.125 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
      c. Length and Configuration: As indicated on drawings.

d. Basis of Design Products:
1) Substitutions: Section 016000 - Product Requirements.

F. Sanitary Napkin Disposal Unit [SND1]: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
1. Basis of Design Products:
a. Bobrick B-270 Surface-Mounted Sanitary Napkin Disposal..
b. Substitutions: Section 016000 - Product Requirements.

2.05 COMMERCIAL SHOWER AND BATH ACCESSORIES

A. Shower Curtain Rod [SCR1]: Stainless steel tube, 1-1/4 inch outside diameter, 0.04 inch wall thickness, satin-finished, with 3 inch outside diameter, minimum 0.04 inch thick satin-finished stainless steel flanges, for installation with exposed fasteners.
1. Basis of Design Products:
a. Bobrick B-6047 Series Extra-Heavy Duty Shower Curtain Rod..
b. Substitutions: Section 016000 - Product Requirements.

B. Shower Curtain [SHC-1]:
1. Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
2. Inherently flame resistant or flameproofed; capable of passing NFPA 701 test.
3. Material: Close weave polyester; anti-bacterial, self deodorizing, sanitized, and preshrunk.
4. Size: Varies, hemmed edges. Refer to shower stall sizes in drawings.
5. Open Mesh Cloth: Open weave to permit air circulation; flameproof material, manufacturer's standard color.
6. Attachment of Curtain Fabric to Open Mesh Cloth: Snap fasteners.
7. Color: As indicated on drawings.
8. Basis of Design Products:
a. As indicated on drawings in interior finish key.
b. Substitutions: Section 016000 - Product Requirements.

C. Robe Hook [RH1]: Heavy-duty stainless steel, double-prong, rectangular-shaped bracket and backplate for concealed attachment, satin finish.
1. Basis of Design Products:
a. Bobrick; B-6727 Surface-Mounted Double Robe Hook.
b. Substitutions: Section 016000 - Product Requirements.

2.06 HEALTHCARE ACCESSORIES

A. PPE Dispensers
1. Hand Sanitizer Dispenser [HS1]: Surface Mounted, PETG construction.

2.07 UNDER-LAVATORY PIPE AND SUPPLY COVERS

A. Under-Lavatory Pipe and Supply Covers:
1. Insulate exposed drainage piping, including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.
2. Exterior Surfaces: Smooth non-absorbent, non-abrasive surfaces.
3. Construction: 1/8 inch flexible PVC.
a. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
b. Microbial and Fungal Resistance: Comply with ASTM G21.
4. Color: White.

2.08 DIAPER CHANGING STATIONS

A. Diaper Changing Station [DCS1]: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
1. Material: Stainless steel.
2. Mounting: Surface.
3. Color: Gray.
4. Basis of Design Products:
a. Bobrick KB300-SS Horizontal Surface-Mounted Diaper Changing Station..

b. Substitutions: 016000 - Product Requirements.

2.09 UTILITY ROOM ACCESSORIES

A. Combination Utility Shelf/Mop and Broom Holder [MOP1]: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
   1. Drying rod: Stainless steel, 1/4 inch diameter.
   2. Hooks: Three, 0.06 inch stainless steel rag hooks at shelf front.
   3. Mop/broom holders: Four spring-loaded rubber cam holders at shelf front.
   4. Length: 36 inches.
   5. Basis of Design Products:
      a. Bobrick B-224 Surface-Mounted Utility Shelf..
      b. Substitutions: 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

D. Verify that field measurements are as indicated on drawings.

E. See Section 061053 Miscellaneous Rough Carpentry. for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
   1. Grab Bars: As indicated on drawings.
   2. Mirrors: 40 inch maximum, measured from floor to bottom of reflective surface unless otherwise indicated.
   3. Other Accessories: As indicated on drawings.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

SECTION 105129
PHENOLIC LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Phenolic lockers.

B. Locker benches.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry Wood base construction.

B. Section 061000 - Rough Carpentry Wood blocking and nailers.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.04 SUBMITTALS

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

B. Product Data: Manufacturer's published data for each type of product indicated. Include fabrication details, description of materials and finishes

C. Shop Drawings: Include overall product dimensions, floor plan, elevations, and attachments to other work.

D. Samples: Submit two samples 2 by 2 inches in size of color selected.

E. Manufacturer's Installation Instructions: Indicate component installation assembly.

F. Certificates demonstrating compliance with Federal Acquisition Regulations Buy American Act requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect locker finish and adjacent surfaces from damage.

B. Ship lockers fully assembled. Top, end panel, and base shipped separately to be assembled at the job site.

C. Lift and handle lockers from the base, not the sides.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Phenolic Lockers & Pedestal Benches:
   1. Basis of Design: Bradley Corporation
   2. Substitutions: See Section 016000 - Product Requirements.

2.02 MATERIALS

A. Phenolic Core: Black. Compressed cellulose impregnated with phenolic resins. Provide smooth material, without creases or ripples.
   1. The surface laminate shall be fused to the resin-impregnated core. All edges are machine finished smooth with a 15-degree beveled edge.
   2. Surface Burning Characteristics: As determined by testing identical products according to ASTM E 84 by qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      a. Flame Spread Index: 55-60.
      b. Smoke-Developed Index: 165-250.
   3. Laminate: Melamine plastic laminate. NEMA LD 3, grade VGS.
   4. Stainless-Steel Sheet: ASTM A 666, Type 304.
   5. Zinc Aluminum Magnesium and Copper Alloy (Zamac): ASTM B 86.
   6. Stainless Steel Castings: ASTM A 743/A 743-M.

7. Aluminum: ASTM B 221.
8. Tamper-Resistant Fasteners: Stainless steel torx-head screws.
    a. Locker Connectors: No. 10 x 24 sex bolts
    b. Anchors: Type and size required for secure anchorage.
    c. Drilled-in-place Masonry Anchors: Minimum 1/4 by 1-3/4 inch screws.

2.03 TIERED PHENOLIC LOCKERS

A. Wardrobe Lockers: Phenolic lockers, free-standing with matching closed base.
    1. Accessibility: Comply with ICC A117.1 and ADA Standards.
    2. Width: 12 inches.
    3. Depth: 15 inches.
    4. Height: 72 inches.
    5. Locker Configuration: Two tier.
    6. Fittings: Size and configuration as indicated on drawings.
        a. Hooks: Two single prong.
    7. Ventilation: By open space between the back of the door and locker body.
    8. Locking: Built-in digital keypad locks.
    9. Provide sloped top.

B. Locker Benches: Free standing type; bench top of phenolic material; painted aluminum pedestals.
    1. Accessibility: Comply with ICC A117.1 and ADA Standards.
    2. Depth: 12 inches
    3. Height: 17 inches.
    4. Length: 48 inches.
    5. Color/Finish: As selected by interior design to match adjacent lockers.
    6. Manufacturers:
        a. Basis of Design: Bradey Corporation

2.04 LOCKER CONSTRUCTION

A. Sides, Bottoms, Top, and Dividers: Locker bodies constructed of 3/8 inch thick solid phenolic core panels. White color on interior facing and concealed panel faces. Tops and bottoms for lockers are constructed of 1/2 inch thick panels.
    1. Continuous Locker Tops: Sloped tops 1/2 inch thick. Provide top lengths in longest dimensions to avoid butt joints.
    2. Finished End Panels: 1/2 inch thick material, with color and finish matching locker body.
    3. Filler Panels: 1/2 inch thick material, with color and finish matching locker.
    4. Doors: Full overlay, covering full width and height of locker body. Fabricate from a single piece 1/2 inch finished phenolic panel. Doors shall have radiused corners and polished edges. 1/2 inch material with 3/8 inch ventilation slots.
    5. Handle: Constructed of cast satin stainless steel. Handle is secured to door with stainless steel screws.
    6. Built-In Digital Keypad Lock: Battery-powered lock with alphanumeric keypad for 4-digit access code; optional access with programming, manager bypass, or user key.
        a. Latch: Deadbolt.
        b. Temporary or shared access with user-defined code.
    7. Exterior Exposed Color: As indicated in the interior finish key on drawings.
    8. Pedestal Legs: Constructed of ABS plastic. Adjustable from 4 inches to 6 inches, four provided per locker.
    9. Toe Kick: 1 inch solid phenolic material, with finish matching locker door.
    10. Fasteners for Accessories and Locking Mechanisms: Tamperproof type.

B. Hinges: Concealed heavy-duty, 13-gauge hinge construction of type 304 stainless steel. Two hinges are provided for two-tier doors. Fastened with 1/4 inch x 20 stainless machine screws into the prepared door that is drilled, tapped and reinforced with a stainless steel heil-coil. 90 degree stainless steel limit arm is secured under the top shelf to prevent the door from intruding on the adjacent user space.

C. Wall Hooks: Gray nylon. Two hooks per locker. Mounted at 6 inches to the bottom of the hook from the top locker panel.

D. Number Plates: Manufacturer's standard, minimum 4-digit, permanently attached with adhesive; may be field installed.

2.05 PHENOLIC PEDESTAL BENCHES

A. Locker Benches: Free standing type; bench top of phenolic material; painted aluminum pedestals.
   1. Accessibility: Comply with ICC A117.1 and ADA Standards.

B. Pedestal Bench Dimensions:
   1. Height: 17 inches.
   2. Depth: 12 inches.
   3. Length: 48 inches.

C. Materials:
   1. Bench Top: Decorative laminate with solid black phenolic core. 3/4 inch thick phenolic material.
   2. Pedestal: 16-gauge, black powder-coated steel, 2-3/8 inch diameter. Anchored to bench top with hardware.
      a. Pedestal Height: 16-1/4 inches.

D. Laminate Color: As indicated in the interior finish key on drawings.

2.06 LOCKER FABRICATION

A. Lockers shall be shipped assembled; top, end panel, and base assembled at the job site.

B. Locker bodies constructed of 3/8 inch thick solid phenolic panels. Lockers are fixed together with a minimum of six 316 grade stainless steel fasteners through pre-drilled. No aluminum or metal profiles or reinforcements are used. Toe clearance 3 inches from locker front.

C. Hardware Attachments: All hinges, handles, hasps, hooks, and locks attached with stainless steel screws.

D. Filler Panels: Constructed of 1/2 inch thick solid phenolic core panels. Finished to match lockers.
   1. Height: 72 inches.
   2. Width: 4 inches.

E. Continuous Tops: Fabricated in lengths indicated, without visible fasteners at splice location; and finished to match lockers.

F. Finished End Panels: Constructed of 1/2 inch thick solid phenolic core panels to match lockers. Fabrication configured to conceal fasteners and holes at exposed ends of lockers.
   1. Height: 72 inches.
   2. Depth: 15 inches.
   3. End Type: Double.
   4. Top Style: Sloped.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. General: Install lockers plumb and square on floor. Lockers shall be secured to a wall.

C. Locker Feet: Install the adjustable leg with the lag screw. Adjust the locker leg to 4-1/16 inches from the bottom of the locker. Install screw caps.

D. Lockers Installation:
   1. Starting in the corner or wall where the run of lockers begin, stand two tier lockers up and bolt the side panels together using the locker connecting bolts and barrel nuts provided. There will be six fasteners for each side-to-side locker connection. Adjust the height as installation proceeds. Drill a 1/4 inch hole through the back of the lockers 6 inches down from the locker top, in lines with a wall stud. Install a locker-to-wall screw to hold the lockers in place.
   2. Filler Panels: Pre fit the filler panel and scribe as necessary to wall.
   3. Toe Kick: Install the toe kick mounting plates aligned with the legs on the toe kick. Install toe kick by snapping the toe kick mounting plates into each leg.

4. Top: Slope top panel is secured using a ledger board on the back wall with aluminum angle brackets secured from the underside of the locker.

3.02 CLEANING

A. Clean locker interiors and exterior surfaces.

B. Remove packaging and construction debris and legally dispose of off-site.

3.03 MAINTENANCE

A. Stubborn dirt and grease shall be removed with a mild cleaning solution and a sloth or soft-bristled brush.

B. Graffiti can usually be removed with industrial "Graffiti Remover". Make sure to test in an inconspicuous area to avoid damage to the plastic surface or causing haze.

C. Do not use abrasive pads or abrasive cleaners to avoid scratch marks in the plastic.

END OF SECTION

SECTION 115300
LABORATORY EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Installation of Contractor-furnished (CFCI) equipment.

B. Installation of Owner-furnished (OFCI) equipment.

1.02 ABBREVIATIONS AND ACRONYMS

A. OFCI - Owner Furnishes and Contractor Installs.

B. CFCI - Contractor Furnishes and Contractor Installs.

1.03 REFERENCE STANDARDS

A. ASME BPVC - Boiler and Pressure Vessel Code; 2025.

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

C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

D. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.

E. NEMA MG 00001 - Motors and Generators; 2024.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2024.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of laboratory equipment with laboratory casework.

B. Preinstallation Meeting: Convene one week before starting work of this section.

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

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

B. Product Data: Provide equipment dimensions and construction; equipment capacities; physical dimensions; utility and service requirements, clearances, and locations; required accessories and optional features; point loads.

C. Shop Drawings: Indicate equipment locations, large scale plans, elevations, cross sections, rough-in and anchor placement dimensions and tolerances, installation and servicing clearances required.

D. Samples: Submit two samples of exposed finish surfaces, 4 x 4 inch in size illustrating color and finish.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Test Reports: Factory tests for each type of equipment.

G. Manufacturer's Installation Instructions: Indicate special installation requirements.

H. Manufacturer's Qualification Statement.

I. Installer's Qualification Statement.

J. Operation Data: Include description of equipment operation and required adjusting and testing.

K. Maintenance Data: Identify system maintenance requirements, servicing cycles, lubrication types required and local spare part sources.

L. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

M. Project Record Documents: Record actual locations of concealed utility connections.

1.06 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the types of products specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package each piece of equipment to ensure protection from damage during shipment and delivery. Legibly indicate on the exterior of each container or crate, the shipping address and a brief description of its contents. Outside of the container, fasten a waterproof envelope containing a packing list and complete instructions for uncrating and setting the equipment in place.

B. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.

1.08 WARRANTY

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

B. Provide ten year manufacturer warranty for materials, parts, and labor for sterilizer chamber.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sterilizers:
   1. Basis of Design, or approved equal: Steris AMSCO 400 Small Steam Sterilizer: www.steris.com.
   2. Substitutions: See Section 016000 - Product Requirements.

B. Single-Chamber Washer/ Disinfector:
   1. Basis of Design, or approved equal: Steris AMSCO 5052 Single-Chamber Washer/ Disinfector: www.steris.com.
   2. Substitutions: See Section 016000 - Product Requirements.

C. Instrument Washer:
   1. Basis of Design, or approved equal: SciCAN HYDRIM C61W G4: www.scican.com.
   2. Substitutions: See Section 016000 - Product Requirements.

D. Instrument Drying Cabinet:
   1. Basis of Design, or approved equal: Steris ENDODRY Drying and Storage System: www.steris.com.
   2. Substitutions: See Section 016000 - Product Requirements.

E. Pass-thru Automated Enodscope Reprossessor:
   1. Basis of Design, or approved equal: Steris Medivators Advantage Plus: www.steris.com.
   2. Substitutions: See Section 016000 - Product Requirements.

F. Flex Ultrasonic Washer Disinfector:
   1. Basis of Design, or approved equal: Skytron Flex Ultrasonic Washer Disinfector: www.skytron.com.
   2. Substitutions: See Section 016000 - Product Requirements.

2.02 REGULATORY REQUIREMENTS

A. Comply with applicable codes for equipment.

B. Comply with UL requirements for fabrication and installation of equipment.

2.03 EQUIPMENT

A. Equipment: Scheduled on drawings.

B. Owner furnishes and Contractor installs equipment noted as OFCI.

C. Contractor furnishes and installs equipment noted as CFCI.

D. Each item energized by a single switch.

E. Prewire and prepipe each unit of equipment complete with trim and fittings. Include reduced pressure or atmospheric type backflow preventer fitting to prevent backflow of polluted water or waste into water supply system or equipment. Comply with applicable code requirements.

F. Affix a securely attached plate which includes the manufacturer's name, address, and catalog or serial number to each equipment item. If applicable, include pressure vessels bearing the ASME stamp and pressure rating, indicating compliance with applicable code requirements.

G. Installation Accessories: Provide all rough-in frames, anchors, supports, accessories and closure trim required for complete installation.

H. Use corrosion-resistant materials for all rivets, bolts, nuts, studs, spacers, and welding metal.

I. Fully assemble equipment in factory, except for those items which cannot be moved to their final locations as single item due to existing construction space restrictions and new construction space restrictions.

2.04 STERILIZERS

A. Type STS , Sterilizer: (CFCI) Small scientific sterilizer.
   1. General: High-performance sterilizer (autoclave) specifically designed for sterilizing or decontaminating laboratory items of many sizes and types, with programmable treatment options.
      a. UL listed and/or approved electrical devices and components, bearing NEMA MG 00001, IEC or other recognized International ratings, as appropriate for the use intended. Low-voltage DC outputs external to the electrical box.
   2. Cabinet Enclosure: Yes.
   3. Mounting: On floor, free-standing.
   4. Chamber Interior Dimensions: 20 inches wide by 20 inches high by 38 inches front to back.
   5. Operating Weight: 1230 pounds.
   6. Doors: Number, type, and construction indicated.
      a. Number of Doors: Two.
      b. Sliding, Vertical, manual-type.
      c. Gaskets: Manufacturer's standard for type door specified, manufactured to withstand temperatures and pressures generated.
   7. Operator Controls: Digital type, with touch screen controls and multi-level menus.
      a. Reprogrammable cycle configurations.
      b. Continuous cycle monitoring and control.
      c. Touch-screen: Allowing operator to easily control all programmable equipment functions, access all equipment monitoring functions, and operate the equipment. At a minimum, allowing the following functionality:
         1) Selecting a Program.
         2) Presetting main parameters, including sterilization temperature and time, dry time, and set real time clock.
         3) Starting a cycle.
         4) Stopping a cycle.
      d. Status Indication: Showing status of critical equipment operation. At a minimum, provide indicators for:
         1) Start: Indicating required temperature is available for unit operation.
         2) Heat: Indicating unit is in the heating stage.
         3) Steam: Indicating unit is in the timed sterilization stage.
         4) Exhaust: Indicating unit is in the exhaust stage.
         5) Drying: Indicating unit is in the drying stage.
         6) Fail: Indicating system has failed as a result of protective cut-off or because Stop button has been pressed. Failure message appearing on display.
         7) Door Closed: Indicating door is properly closed.
      e. Printer: 24 character (minimum) per line printer integrated into control panel.
         1) Functionality: Hard-copy printout of all relevant information concerning operation during each cycle including temperature, pressure, vacuum, sterilization and drying time, number of cycles, etc. For uncompleted cycle(s), a printout indicating cycle failure and cause of cycle failure.

f. Non-operating end (NOE) control panel.
   1) Double-door Sterilizers Only: A touch-sensitive screen similar to the operating end screen. Ability to start preprogrammed cycles. Display concurrently showing the same information as the operating end screen display.

8. Control and Monitoring System: Controller, gauges, and wiring.
   a. Controller: Microcomputer based controller monitoring and controlling all aspects of equipment cycle and process operations. Provide battery backup of microprocessor memory. Controller to ensure fully automatic operation through all equipment cycles.
9. Operations Programming: Sterilizer designed to operate a minimum of 12 sterilization programs and 2 test programs as follows:
   a. Unwrapped Instruments: 4 programs.
   b. Wrapped Instruments: 4 programs.
   c. Liquids: 4 programs.
   d. Vacuum Test: For testing integrity of pressure vessel and piping system.
   e. "Bowie-Dick Test": For testing efficacy of sterilization process.
10. Cycle Descriptions: Type included, as indicated.
   a. Vacuum Cycle: Air and condensate removed from the chamber and load by pulling vacuum during load conditioning and again during drying. Temperature range 230 to 280 degrees F. Required.
   b. Gravity Cycle: Chamber air purged with flowing steam. Air drawn into chamber through bacteria retentive filter during drying phase. Temperature range 230 to 280 degrees F. Required.
   c. Liquid Cycle: Designed to sterilize liquids in open flasks or containers with positive self-venting closures. Similar to gravity cycle except dry phase cannot be selected, and slow exhaust provided after sterilizing phase. Temperature range 230 to 280 degrees F. Required.
   d. Flash Cycle: Designed to flash sterilize instruments in an Operating Room setting for 3 to 10 minutes at 275 degrees F. Required.
11. Personnel Safety: Design units to integrate personnel safety features typical to the industry including, but not limited to:
   a. Door operation limiters preventing operator from opening door(s) when unsafe conditions are present.
   b. Effective design, insulation and fabrication preventing hot surfaces on the exterior of the unit.
12. Pressure Vessel: Rectangular design, horizontally mounted with internal corners longitudinally radiused and polished, with welds ground smooth and polished, and comply with ASME BPVC.
   a. Material: Type 316L stainless steel.
   b. Pressure Rating: 50 psig.
   c. Vessel Identification: One permanently fixed plate stamped in accordance with ASME codes.
13. Pressure Vessel Jacket: Enclosing pressure vessel.
   a. Material: Type 304L stainless steel.
   b. Pressure Rating: 50 psig.
   c. Monitoring: Provide pressure transducer and gauge to monitor jacket pressure.
   d. Cooling: Jacket isolation and dumping of jacket steam occurring at the end of all liquid cycles to facilitate optimal solution cooling.
14. Chamber and Door Insulation: Manufacturer's standard, fully enclosed.
15. Sterilization Chamber Mounting Frame: Type 304L stainless steel frame with height adjustable leveling bolts for support of sterilizing chamber, piping and cabinet.
16. Type of Piping: Materials and configurations indicated.
17. Piping Configuration: Piping and components mounted off stands both on top of and below chamber in configuration designed for ease of servicing, including unions before and after individual components.
18. Sensors and Gauges: As appropriate to units specified. Installed to be easily removable for calibration except where required to be calibrated in place.
19. Drain RTD: Single RTD in the drain to monitor sterilization temperature throughout the cycle. Process temperature recorded on printout.

20. Drainage: Sloped piping to reduce condensate collection areas connected to the chamber. Stainless steel basket screens on chamber drains.
21. High Water Dump and Alarm: Drain line piping system and alarm.
    a. Functionality: Removal of excess condensate from chamber drain line before the condensate can impede the operation of the controlling RTD in the drain line, or contact the lowest product container in the autoclave chamber. Non-clogging type automatic drain valve located in the chamber opening if condensate exceeds pre-determined water level. Activation of visual and audible alarm.
22. Utility Requirements:
    a. Electrical: 480V, 3 phase, 36A.
    b. Steam: 1 inch NPS FPT; 50-80 psi; 255 pounds per hour maximum flow ,and 148 pounds per hour average flow. Condensate free, and 97 percent to 100 percent vapor quality.
    c. Condensate: 1 inch NPS FPT.
    d. Hot Water: 1 1/2 inch NPS FPT; 35 psi; 120-180 degrees F; 200 gallons per load maximum.
    e. Drain Outlet: 2 inch NPS FPT; 140 degrees F maximum; 120 GPM maximum.
    f. Exhaust: 12 inches diameter; 600 CFM; 180 degrees F, saturated.
    g. Compressed Air: 1/2 inch NPS FPT; 80 psi; 4 CFM.

2.05 SINGLE-CHAMBER WASHER/ DISINFECTOR

A. Type WD , Washer: (CFCI).
1. General: High-performance commercial-quality washer specifically designed for cleaning laboratory glassware of many sizes and types, with programmable treatment options and controlled intake of chemicals.
    a. UL listed and/or approved electrical devices and components, bearing NEMA MG 00001, IEC or other recognized International ratings, as appropriate for the use intended. Low-voltage DC outputs external to the electrical box.
2. Cabinet Enclosure: Yes.
3. Mounting: On floor, free-standing.
4. Chamber Interior Dimensions: 26 1/2 inches wide by 26 1/4 inches high by 26 inches front to back.
5. Heating: Electric.
6. Operating Weight: 1050 pounds.
7. Doors: Number, type, and construction indicated.
    a. Number of Doors: Two.
    b. Operation: Vertical-sliding, power-operated, dynamically pressing door against gasketing and ensuring complete air and water tightness of wash chamber.
    c. Interlock feature on double-doors unit.
    d. Double-pane tempered glass viewing panel.
    e. Gaskets: Manufacturer's standard for type door specified, manufactured to withstand temperatures and pressures generated.
8. Interior Illumination: Manufacturer’s standard luminaire(s) located on top of the Washer, complete with electronic ballast, gasketed tempered safety glass diffuser, and using fluorescent lamps.
9. Washing System: Manufacturer's standard, configured for two-level loading and washing, and rinse-water source options.
    a. Materials: Type 304 stainless steel.
10. Operator Controls: Digital type, with touch screen controls and multi-level menus.
    a. Reprogrammable cycle configurations.
    b. Continuous cycle monitoring and control.
    c. Continuous service diagnostics.
    d. Touch screen: Allowing operator to easily control all programmable equipment functions, access all equipment monitoring functions, and operate the equipment. At a minimum, allowing the following functionality:
        1) Selecting a program.
        2) Presetting main parameters, including sterilization temperature and time, dry time, and set real time clock.

3) Starting a cycle.
4) Stopping a cycle.

e. Status Indication: Showing status of critical equipment operation. At a minimum, provide indicators for:
1) Start: Indicating required temperature is available for unit operation.
2) Heat: Indicating unit is in the heating stage.
3) Steam: Indicates unit is in the timed sterilization stage.
4) Exhaust: Indicates unit is in the exhaust stage.
5) Drying: Indicates unit is in the drying stage.
6) Fail: Indicates system has failed as a result of protective cut-off or because Stop button has been pressed. Failure message appears on display.
7) Door Closed: Indicates door is properly closed.

f. Impact Printer: Provide 24 character (minimum) per line printer integrated into control panel to provide hard copy of all relevant information concerning operation during each cycle including temperature, pressure, vacuum, sterilization and drying time, number of cycles, etc. In case of uncompleted cycle, include printout indicating cycle failure and cause of cycle failure.

g. Non-operating end (NOE) control panel, equipped on double-door washers only: A touch-sensitive screen similar to the operating end screen. Preprogrammed cycles can be started from the NOE control panel. The display concurrently shows the same information as the operating end screen display.

11. Control and Monitoring System: Controller, gauges, sensors and wiring.
a. Controller: Microcomputer based controller monitoring and controlling all aspects of equipment cycle and process operations. Provide battery backup of microprocessor memory. Controller to ensure fully automatic operation through all equipment cycles.
12. Operations Programming: Washer designed to operate a minimum 8 of washing cycles, each including up to 18 treatments.
13. Personnel Safety: Integrated personnel safety features typical to the industry.
a. Safety Door Switch(es): Preventing cycle operation if door(s) not fully-closed.
b. Safety Sensor: Retracting door if obstruction is detected in the doorway.
c. Effective design, insulation and fabrication preventing hot surfaces on the exterior of the unit.
14. Wash Chamber: Rectangular design, with internal corners longitudinally radiused and polished. All welds ground smooth and polished.
a. Material: Type 304L stainless steel, No.4 finish.
15. Spray System: Manufacturer's standard.
16. Insulation: Manufacturers standard type, with vapor-retarder, covering the outer top, sides and bottom of washer chamber.
17. Sensors and Gauges: Provide as appropriate to units specified. Install to be easily removable for calibration except where required to be calibrated in place.
18. Utility Requirements:
a. Electrical: 480V, 3 phase, 60HZ, 36A.
b. Steam: 1/2 inch NPS FPT; 50-80 psi; Condensate free, and 97 percent to 100 percent vapor quality.
c. Condensate: 1/2 inch NPS FPT.
d. Cold Water: 1/2 inch NPS FPT; 35 psi minimum.
e. Hot Water: 1/2 inch NPS FPT; 35 psi minimum; 120-180 degrees F.
f. Drain Outlet: 1 1/2 inch NPS FPT; 140 degrees F maximum.
g. Compressed Air: 1/8 inch NPS FPT.
h. Ventilation: A dedicated 3 inch flexible, corrosion-resistant, watertight duct to exterior of building, sloped towards washer.

2.06 INSTRUMENT WASHER

A. Type DCW, Instrument Washer: (CFCI).
1. General: High-performance commercial-quality washer specifically designed for cleaning instruments, with programmable treatment options and controlled intake of chemicals.

a. UL listed and/or approved electrical devices and components, bearing NEMA MG 00001, IEC or other recognized International ratings, as appropriate for the use intended. Low-voltage DC outputs external to the electrical box.

2. Cabinet Enclosure: Yes.
3. Mounting: On floor, free-standing.
4. Dimensions: 23.5 inches wide by 20.5 inches high by 20.7 inches front to back.
5. Heating: Electric.
6. Weight: 97 lbs.
7. Washing System: Manufacturer's standard, configured for two-level loading and washing, and rinse-water source options.
   a. Materials: Type 304 stainless steel.
8. Operator Controls: WiFi enabled G4 technology.
   a. Touch screen: Allowing operator to easily control all programmable equipment functions, access all equipment monitoring functions, and operate the equipment.
9. Control and Monitoring System: Controller, gauges, sensors and wiring.
   a. Controller: Microcomputer based controller monitoring and controlling all aspects of equipment cycle and process operations. Provide battery backup of microprocessor memory. Controller to ensure fully automatic operation through all equipment cycles.
10. Utility Requirements:
    a. Electrical: 208-240 V, 3 phase, 12 A, 60 HZ.
    b. Condensate: 1/2 inch NPS FPT.
    c. Cold Water: 3/4 inch NPS FPT; 35 psi minimum.
    d. Hot Water: 3/4 inch NPS FPT; 35 psi minimum; 120-180 degrees F.
    e. Drain Outlet: 1 1/2 inch NPS FPT; 140 degrees F maximum.
    f. Compressed Air: 1/8 inch NPS FPT.
    g. Ventilation: A dedicated 3 inch flexible, corrosion-resistant, watertight duct to exterior of building, sloped towards washer.

2.07 INSTRUMENT DRYING CABINET

A. Type DC, Instrument Drying Cabinet (CFCI).
   1. General: High-performance commercial-quality dryer specifically designed for clean medical devices, with programmable treatment options.
      a. UL listed and/or approved electrical devices and components, bearing NEMA MG 00001, IEC or other recognized International ratings, as appropriate for the use intended. Low-voltage DC outputs external to the electrical box.
   2. Cabinet Enclosure: Yes. Pass-through.
   3. Mounting: On floor, free-standing.
   4. Dimensions: 24 inches wide by 75 inches high by 22 inches front to back.
   5. Heating: Electric.
   6. Doors:
      a. Number of Doors: Two.
      b. Hinged, manual type.
      c. Tempered glazing.
   7. Drying System: Compressed air drying cabinet.
   8. Filtration System.
   9. Materials: Type 304 stainless steel.
   10. Operator Controls: Digital type, with touch screen controls and multi-level menus.
      a. Touch screen: Allowing operator to easily control all programmable equipment functions, access all equipment monitoring functions, and operate the equipment.
      b. Timer countdown.
      c. Temperature control.
   11. Utility Requirements:
      a. Electrical: 100-240 VAC, 3 phase, 60 HZ.

2.08 PASS-THRU AUTOMATED ENDOSCOPE REPROSSESSOR

A. Type MEDV, Pass-Thru Reprocessor (CFCI).
   1. General: High-performance commercial-quality for disinfection of heat sensitive, semi-critical endoscopes and related accessories.

a. UL listed and/or approved electrical devices and components, bearing NEMA MG 00001, IEC or other recognized International ratings, as appropriate for the use intended. Low-voltage DC outputs external to the electrical box.

2. Mounting: On floor, free-standing.
3. Dimensions: 51 1/2 inches wide by 31 1/4 inches deep by 78 3/4 inches high.
4. Weight: 882 lbs.
5. Doors: Two per module. Dirty and Clean.
6. Pass-Thru window with intercom.
7. Barcode Scanner.
8. Spray arms.
9. Overhead compartment on contaminated side.
10. Operator Controls: Digital type, with touch screen controls and multi-level menus.
    a. Touch screen: Allowing operator to easily control all programmable equipment functions, access all equipment monitoring functions, and operate the equipment.
    b. Sensors for channel connectivity and blockage monitoring.
    c. Remote diagnostic capabilities.
11. Utility Requirements:
    a. Electrical: 480V, 3 phase, 36A.

2.09 ULTRASONIC WASHER DISINFECTOR

A. Type UCC, Flex Ultrasonic Washer Disinfector (CFCI).
1. General: High-performance commercial-quality for disinfection of heat sensitive, semi-critical endoscopes and related accessories.
    a. UL listed and/or approved electrical devices and components, bearing NEMA MG 00001, IEC or other recognized International ratings, as appropriate for the use intended. Low-voltage DC outputs external to the electrical box.
2. Mounting: On floor, free-standing.
3. Dimensions: 51.5 inches wide by 41.4 inches deep by 42.9 inches high.
4. Weight: 800 lbs.
5. Door: One with viewing window, automated.
6. Single loading shelf.
7. Operator Controls: Digital type, with touch screen controls and multi-level menus.
    a. Touch screen: Allowing operator to easily control all programmable equipment functions, access all equipment monitoring functions, and operate the equipment.
    b. Solution flow monitoring.
    c. Remote diagnostic capabilities.
8. Sub micron water filters meeting critical water as defined by ANSI/AAMI ST79:2017 and AAMI TIR 34.
9. Cycles: Two pre-programmed cycles; cannulated and non-cannulated surgical instruments.
10. Emergency shut off.
11. Utility Requirements:
    a. Electrical: 480V, 3 phase, 50A, 60 HZ.
    b. Cold Water: 3/4 inch NPT; 60-80 psi, 80 degrees F; 40 gallons per load; 8-10 GPM.
    c. Hot Water: 3/4 inch NPT; 60-80 psi, 128 degrees F; 8-10 GPM.
    d. Drain: 2 inch floor drain; 1 1/2 inch NPT wall drain.
    e. Compressed Air: 1/2 inch NPT with shut off; 90-120 psi.

2.10 MATERIALS

A. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666/A666M, Type 304 and 316, stretcher-leveled standard of flatness.

B. Laminated Safety Glass: ASTM C1172

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Fasteners: Stainless-steel, or other corrosion-resistant materials, standard with the manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that utility connections, rough-in frames, anchors and supports are accurately placed and deliver building services at specified characteristics and/or within acceptable functional ranges.

B. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

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

3.02 INSTALLATION

A. Installation of equipment noted as OFCI or CFCI is by Contractor. Coordinate with equipment furnished by Owner.

B. Install in accordance with manufacturer's instructions.

C. Large Components: Ensure that large components can be moved into final position without damage to other construction.

D. Mounting: Anchor equipment securely in place.
   1. Mount equipment in compliance with SMACNA (SRM) requirements.

E. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner, and their locations are coordinated with equipment rough-in requirements.
   1. Require manufacturer's installer to supervise connection to utilities being performed by mechanical and electrical trades.
   2. Make connections between ferrous and nonferrous metallic pipe with dielectric waterways and flanges having temperature and pressure rating equal to or greater than that specified for the connecting piping. Use dielectric waterways internally lined with an insulator specifically designed to prevent current flow between dissimilar metals.
   3. Connect steam lines on equipment to building source only after building steam lines have been cleaned of preservatives and materials that may be harmful to the equipment.

F. Touch-up minor damaged surfaces caused during installation. Replace damaged components as directed by COR.

3.03 FIELD QUALITY CONTROL

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

B. Perform functional testing in accordance with referenced specification requirements. Test one item or similar model, as necessary or appropriate, to ensure that it is operational and installation complies with specification requirements.

3.04 ADJUSTING

A. Adjust operating equipment to efficient operation.

3.05 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. Demonstrate proper operation of equipment to Owner's designated representative.

C. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Briefly describe function, operation, and maintenance of each component.

D. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's training personnel.
   4. Location: At project site.

E. Final Acceptance: Remove labels, fingerprints, and clean all surfaces both inside and out. Repair any marred or damaged surfaces that affect appearance, such as both interior and exterior of cabinets in a manner acceptable to Owner. Replace any parts that cannot be repaired in such a manner.

3.06 MAINTENANCE

A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

END OF SECTION

SECTION 122400
WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior manual roller shades.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.03 REFERENCE STANDARDS

A. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.

C. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

D. WCMA A100.1 - Standard for Safety of Window Covering Products; 2022.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.

B. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.

C. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.

D. Certificates demonstrating compliance with Federal Acquisition Regulations Buy American Act requirements.

E. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.

1.05 QUALITY ASSURANCE

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

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.07 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 WARRANTY

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

PART 2 PRODUCTS

2.01 BASIS OF DESIGN MANUFACTURERS

A. Interior Manually Operated Roller Shades:
   1. Draper, Inc; Clutch Operated FlexShade: www.draperinc.com.
   2. MechoShade Systems LLC; Mecho/7 System: www.mechoshade.com.
   3. SWFcontract, a division of Springs Window Fashions, LLC.; Pro Series Manual Solar Shade System: www.swfcontract.com.

2.02 ROLLER SHADES

A. General:

1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
2. Provide shade system that operates smoothly when shades are raised or lowered.

B. Interior Roller Shades RWS - Basis of Design: Draper, Inc; Clutch Operated FlexShade.
1. Description: Single roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and other components necessary for complete installation.
   a. Mounting: Wall mounted.
2. Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
3. Roller Tubes: As required for type of shade operation; designed for removal without removing mounting hardware.
   a. Material: Extruded aluminum or steel, with wall thickness and material selected by manufacturer.
   b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
4. Hembars: Designed to maintain bottom of shade straight and flat, selected from manufacturer's standard options.
5. Manual Operation:
   a. Clutch Operator: Manufacturer's standard material and design, permanently lubricated.
   b. Drive Chain: Continuous loop stainless steel beaded ball chain, 95 lb minimum breaking strength. Provide upper and lower limit stops.
6. Accessories:
   a. Light Gap Reduction Channels: Provide extruded aluminum channels to reduce light leakage at sides of shades.
   b. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to mounting end caps, without exposed fasteners; clear anodized finish.
   c. Fasteners: Noncorrosive, and as recommended by shade manufacturer.

2.03 SHADE FABRIC

A. Fabric - Type RWS-1: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
1. Basis of Design Manufacturers:
   a. Draper; Refer to interior finish key on drawings.
2. Material: 36% Fiberglass, 64% Vinyl.
3. Performance Requirements:
   a. Flammability: Pass NFPA 701 large and small tests.
4. Material Certifications and Product Disclosures:
   a. Low-Emitting Material Certification: Greenguard Gold certified and listed in UL (GGG).
   b. Restriction of Hazardous Substances (RoHS) Compliant.
5. Openness Factor: as indicated on drawings.
6. Color: as indicated on drawings.

2.04 ROLLER SHADE FABRICATION

A. Field measure finished openings prior to ordering or fabrication.

B. Dimensional Tolerances: As recommended in writing by manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

C. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

3.05 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

3.06 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

3.07 MAINTENANCE

A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

END OF SECTION

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SECTION 123600
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.

D. Sinks molded into countertops.

1.02 RELATED REQUIREMENTS

A. Section 064100 - Architectural Wood Casework.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2022.

B. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2022.

C. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

E. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

F. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

G. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

H. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

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

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.

C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.

D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

E. Certificates demonstrating compliance with Federal Acquisition Regulations Buy American Act requirements.

F. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

G. Installer's qualification statement.

H. Installation Instructions: Manufacturer's installation instructions and recommendations.

I. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. 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. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
   1. Flat Sheet Thickness: 1/2 inch, minimum.
   2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
      a. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
      b. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
      c. Color and Pattern: As indicated on drawings.
   3. Other Components Thickness: 1/2 inch, minimum.
   4. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
   5. Skirts: As indicated on drawings.

2.02 MATERIALS

A. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

B. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.03 ACCESSORIES

A. Fixed Top-Mounted Countertop Support Brackets:
   1. Material: Steel.
   2. Finish: Manufacturer's standard, factory-applied, textured powder coat.
   3. Color: As selected by Architect.
   4. Products:
      a. Rakks Brackets: www.rakks.com.
      b. Substitutions: See Section 016000 - Product Requirements.

2.04 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
   2. Height: 4 inches, unless otherwise indicated.

C. Solid Surfacing: Fabricate tops up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
   1. Integral sinks: Shop-mount securely to countertop with adhesives, using flush configuration, as per manufacturer's instructions, and as detailed on drawings.

D. Wall-Mounted Counters: Provide 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. If substrate preparation is the responsibility of another installer, notify COR of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install vanities in accordance with manufacturer's instructions and approved shop drawings

B. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

C. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/8 inch 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

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SECTION 210500
COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Above ground piping.
B. Escutcheons.
C. Fire rated enclosures.
D. Mechanical couplings.
E. Pipe hangers and supports.
F. Pipe sleeves.
G. Pipe sleeve-seal systems.
H. Piping specialties.
I. Pressure gauges.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.
B. Section 099113 - Exterior Painting: Preparation and painting of exterior fire protection piping systems.
C. Section 099123 - Interior Painting: Preparation and painting of interior fire protection piping systems.
D. Section 211300 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

1.03 REFERENCE STANDARDS

A. ASME A112.18.1 - Plumbing Supply Fittings; 2024.
B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2026.
C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
D. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2021.
E. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard; 2025.
F. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded; 2021.
G. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.
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; 2025, with Errata.
I. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).
J. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.
K. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2021.
L. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2025.
M. ASTM A536 - Standard Specification for Ductile Iron Castings; 2024.
N. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2021.
O. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2024.
P. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.
Q. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2021.

R. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2023.

S. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2023.

T. AWWA C606 - Grooved and Shouldered Joints; 2022.

U. FM (AG) - FM Approval Guide; Current Edition.

V. ITS (DIR) - Directory of Listed Products; Current Edition.

W. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

X. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; 2024.

Y. NFPA 1963 - Standard for Fire Hose Connections; 2019.

Z. UL (DIR) - Online Certifications Directory; Current Edition.

AA. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

BB. UL 405 - Standard for Safety Fire Department Connection Devices; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

B. Product Data: Provide manufacturer's catalog information. Indicate valve data and ratings.

C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, and floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

D. Manufacturer's qualification statement.

E. Installer's qualification statement.

F. Project Record Documents: Record actual locations of components and tag numbering.

G. Operation and Maintenance Data: Include installation instructions and spare parts lists.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.

1.05 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 work of the type specified in this section.
   1. Minimum three years experience.
   2. Approved by manufacturer.

C. Comply with FM (AG), UL (DIR), and ITS (DIR) or Warnock Hersey requirements.

D. Valves: Bear FM (AG), UL (DIR), and ITS (DIR) or Warnock Hersey product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.

E. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

F. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers, with labeling in place.

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.

1.07 WARRANTY

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

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Sprinkler-based System:
   1. Comply with NFPA 13.
   2. See Section 211300.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

C. Provide system pipes, fittings, sleeves, escutcheons, seals, and other related accessories.

2.02 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A795 Schedule 10, ASTM A53 Schedule 40, ASTM A135/A135M Schedule 10, ASTM A135/A135M UL listed light wall type, or ASTM A795 Schedule 40, black.
   1. Steel Fittings: ASTM A234/A234M wrought carbon steel or alloy steel, ASME B16.5 steel flanges and fittings, or ASME B16.11 forged steel socket welded and threaded.
   2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
   3. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.
   4. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.

B. Ductile Iron Pipe: AWWA C151/A21.51.
   1. Fittings: AWWA C110/A21.10, standard thickness.
   2. Joints: AWWA C111/A21.11, SBR or vulcanized styrene-butadiene rubber gasket.
   3. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped composition sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

2.03 PIPE SLEEVES

A. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.
   3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
   4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

B. Plastic, Sheet Metal, or Moisture-Resistant Fiber: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. Pipe Passing Through Below Grade Exterior Walls:
   1. Zinc-coated or cast-iron pipe.
   2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

D. Pipe Passing Through Mechanical and Laundry Floors above Basement:
   1. Galvanized steel pipe or black iron pipe with asphalt coating.
   2. Connect sleeve with floor plate except in mechanical rooms.

E. Not required for wall hydrants for fire department connections or in drywall construction.

F. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Floor, Partitions, and Beam Flanges: 2 inch greater than external; pipe diameter.
   3. Rated Openings: Caulked tight with firestopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.04 PIPE SLEEVE-SEAL SYSTEMS

A. Manufacturers:
   1. Advance Products & Systems, Inc: www.apsonline.com/#sle.
   2. GPT, a company of Enpro Industries, Inc: www.gptindustries.com/#sle.

3. Substitutions will be allowed: See Section 016000 - Product Requirements.

B. Modular Mechanical Seals:
1. Elastomer-based interlocking links to continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
3. Size and select seal component materials in accordance with service requirements.
4. Service Requirements:
a. Corrosion resistant.
b. Oil, fuel, gas, and solvent resistant.
c. Underground, buried, and wet conditions.
d. Fire Resistance: 1 hour, UL (DIR) approved.
e. High temperature, up to 400 deg F.
f. Low temperature, down to minus 67 deg F.
5. Glass-reinforced plastic pressure end plates.

C. Wall Sleeve: PVC material with waterstop collar, and nailer end caps.

D. Sleeve-Forming Disk: Nonconductive plastic-based material, 3 inch thick.

E. Pipeline-Casing Seals:
1. Coated-metallic boltless casing-spacer for 4 inch carrier pipe.
2. Coated-metallic boltless modular seal for 6 inch carrier pipe.
3. Carbon steel band with riser for 12 inch carrier pipe.
4. End Seals: 1/8 inch, pull-on type, rubber or synthetic rubber based.

2.05 FIRE-RATED ENCLOSURES

A. Provide as required to preserve fire resistance rating of building elements.

2.06 ESCUTCHEONS

A. Manufacturers:
1. Fire Protection Products, Inc: www.fppi.com/#sle.com/#sle.
2. Tyco Fire Protection Products: www.tyco-fire.com/#sle.
3. Viking Group Inc: www.vikinggroupinc.com/#sle.
4. Substitutions will be allowed: See Section 016000 - Product Requirements.

B. Material:
1. Chrome-plated.
2. Metals and Finish: Comply with ASME A112.18.1.

C. Construction:
1. One-piece for mounting on chrome-plated tubing or pipe and one-piece type elsewhere.
2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.07 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
1. Manufacturers:
a. AFCON, a brand of Anvil International: www.anvilintl.com/#sle.
b. FNW: www.fnw.com/#sle.
c. Substitutions will be allowed: See Section 016000 - Product Requirements.

B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.
1. Manufacturers:
a. AFCON, a brand of Anvil International: www.anvilintl.com/#sle.
b. FNW: www.fnw.com/#sle.
c. Substitutions will be allowed: See Section 016000 - Product Requirements.

C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

D. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

E. Wall Support for Pipe Sizes 1-1/2 inches and Over: Welded steel bracket and wrought steel clamp.

F. Vertical Support: Steel riser clamp.

G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.08 MECHANICAL COUPLINGS

A. Manufacturers:
   1. Anvil International: www.anvilintl.com/#sle.
   2. Shurjoint Piping Products, Inc: www.shurjoint.com/#sle.
   3. Tyco Fire Protection Products: www.tyco-fire.com/#sle.
   4. Victaulic Company; FireLock Style 009H: www.victaulic.com/#sle.
   5. Substitutions will be allowed: See Section 016000 - Product Requirements.

B. Rigid Mechanical Couplings for Grooved Joints:
   1. Dimensions and Testing: Comply with AWWA C606.
   2. Minimum Working Pressure: 300 psig.
   3. Housing Material: Fabricate of ductile iron complying with ASTM A536.
   4. Housing Coating: Factory applied orange enamel.
   5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
   6. Bolts and Nuts: Hot-dipped-galvanized or zinc-electroplated steel.
   7. Provide stops for direct stab installation without field assembly.

2.09 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 will be allowed: See Section 016000 - Product Requirements.

B. Auxiliary Drains: Condensate collection drain for each section of trapped pipe in preaction or dry fire protection system.

C. Test Connections:
   1. Backflow Preventer Test Connection:
      a. Provide downstream of the backflow prevention assembly, listed hose valves with 2.5-inch National Standard male hose threads with cap and chain.
      b. Provide one valve for each 250 gpm of system demand or fraction thereof.
      c. Provide permanent sign reading "Test Valve." See Section 210553.

D. Electric Alarm: Electrically operated chrome-plated gong with pressure alarm switch.

E. Water Flow Switch: Vane-type switch for mounting horizontally or vertically, with two contacts; rated 10 A at 125 VAC and 2.5 A at 24 VDC.

F. Fire Department Connections:
   1. Type: Flush, wall mount made of corrosion-resistant metal complying with UL 405.
      a. Inlets: Two-way, 2-1/2 inch swivel fittings, internal threaded. Thread size and inlets according to NFPA 1963 or authority having jurisdiction. Brass caps with gaskets, chains, and lugs.
      b. Configuration: Horizontal.
      c. Outlet: Bottom with pipe threads, 4 NPS.
         1) Location: Back.
      d. Rated Working Pressure: 175 psi.
      e. Finish: Chrome.
      f. Signage: Raised or engraved lettering 1 inch, minimum, indicating system type.
      g. Manufacturers:
         1) Elkhart Brass Manufacturing Company, Inc: www.elkhartbrass.com/#sle.
         2) Fire End & Croker Corporation: www.croker.com/#sle.
         3) Substitutions will be allowed: See Section 016000 - Product Requirements.

2.10 PRESSURE GAUGES

A. Manufacturers:
   1. AGF Manufacturing: www.agfmfg.com/#sle.
   2. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
   3. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.
   4. Omega Engineering, Inc: www.omega.com/#sle.
   5. Winters Instruments: www.winters.com/#sle.
   6. Substitutions will be allowed: See Section 016000 - 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. Diameter: 4-1/2 inch.
   3. Mid-Scale Accuracy: One percent.
   4. Scale: Display in psi and kPa.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.

B. Install standpipe piping, hangers, and supports in accordance with NFPA 14.

C. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

D. Install piping to conserve building space, to not interfere with use of space and other work.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

H. Pipe Hangers and Supports:
   1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   2. Place hangers within 12 inches of each horizontal elbow.
   3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   6. 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 fire suppression systems is specified in Section 099123.
      b. Painting of exterior fire suppression systems is specified in Section 099113.

I. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

J. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.
   1. Painting of interior fire suppression systems is specified in Section 099123.
   2. Painting of exterior fire suppression systems is specified in Section 099113.

K. Structural Considerations:
   1. Do not penetrate building structural members unless indicated.

L. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
   1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
   2. Aboveground Piping:
      a. Pack solid using mineral fiber complying with ASTM C592.
      b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
   3. All Rated Openings: Caulk tight with firestopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.
   4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

M. Manufactured Sleeve-Seal Systems:
   1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
   2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
   3. Locate piping in center of sleeve or penetration.
   4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
   5. Tighten bolting for a watertight seal.
   6. Install in accordance with manufacturer's recommendations.

N. Escutcheons:
   1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
   2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
   3. Attach plates at the underside only of suspended ceilings.
   4. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.

O. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

P. Die-cut threaded joints with full-cut, standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.

3.03 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

C. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

END OF SECTION

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SECTION 210523
GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Two-piece ball valves with indicators.

B. Bronze butterfly valves with indicators.

C. Iron butterfly valves with indicators.

D. Bronze OS&Y gate valves.

E. Iron OS&Y gate valves.

F. NRS gate valves.

G. Trim and drain valves.

1.02 RELATED REQUIREMENTS

A. Section 210553 - Identification for Fire Suppression Piping and Equipment.

1.03 ABBREVIATIONS AND ACRONYMS

A. EPDM: Ethylene-propylene diene monomer.

B. NRS: Non-rising stem.

C. OS&Y: Outside screw and yoke.

D. PTFE: Polytetrafluoroethylene.

1.04 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2026.

C. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300; 2021.

D. AWWA C606 - Grooved and Shouldered Joints; 2022.

E. FM (AG) - FM Approval Guide; Current Edition.

F. FM 1112 - Examination Standard for Indicating Valves (Butterfly or Ball Type); 2020.

G. FM 1120/1130 - Examination Standard for Fire Service Water Control Valves (OS&Y and NRS Type Gate Valves); 2025.

H. FM 1140 - Examination Standard for Quick Opening Valves 1/4 Inch Through 2 Inch Nominal Size; 2024.

I. UL (DIR) - Online Certifications Directory; Current Edition.

J. UL 258 - Shutoff Valves for Trim and Drain Purposes for Fire Protection Service; Current Edition, Including All Revisions.

K. UL 262 - Gate Valves for Fire-Protection Service; Current Edition, Including All Revisions.

L. UL 1091 - Standard for Butterfly Valves for Fire-Protection Service; Current Edition, Including All Revisions.

1.05 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.

1.06 SUBMITTALS

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

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

1.07 QUALITY ASSURANCE

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

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

C. Where listed products are specified, provide products listed, certified, and labeled by FM (AG), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for purpose indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect valve ends and flange faces.
   3. Set valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:
   1. Maintain valve end protection and protect flanges and specialties from dirt.
      a. Provide temporary inlet and outlet caps.
      b. Maintain caps in place until installation.
   2. Store valves in shipping containers and maintain in place until installation.
      a. Store valves indoors and maintain at higher than ambient dew point temperature.
      b. If outdoor storage is unavoidable, store valves off the ground in watertight enclosures.

C. Use the following precautions for handling:
   1. Use sling to handle large valves, rig to avoid damage to exposed parts.
   2. Do not use operating handles or stems as lifting or rigging points.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Source Limitations: Furnish valves of same kind by same manufacturer.

B. Valve-End Connections:
   1. Flanges on Iron Valves: ASME B16.1 or ASME B16.42.
   2. Threaded Ends: ASME B1.20.1.
   3. Grooved Ends: AWWA C606.

C. Valve Pressure Ratings: Not less than minimum pressure rating indicated or higher as required.

D. Valve Sizes: Same as upstream piping unless otherwise indicated.

E. Valve Actuator Types:
   1. Worm-gear actuator with handwheel for quarter-turn valves, except trim and drain valves.
   2. Handwheel: For other than quarter-turn trim and drain valves.
   3. Hand-lever: For quarter-turn trim and drain valves 2 NPS and smaller.

2.02 TWO PIECE BALL VALVES WITH INDICATORS

A. Manufacturers:

B. UL 1091 and FM 1112 listed.

C. Description:
   1. Minimum Pressure Rating: 175 psig.
   2. Body Design: Two piece.
   3. Body Material: Forged brass or bronze.
   4. Port Size: Full or standard.
   5. Seat: PTFE.
   6. Stem: Bronze or stainless steel.
   7. Ball: Chrome-plated brass.
   8. Actuator: Worm gear or traveling nut.
   9. End Connections: Threaded or grooved.

2.03 BRONZE BUTTERFLY VALVES WITH INDICATORS

A. UL 1091 and FM 1112 listed.
B. Minimum Pressure Rating: 175 psig.
C. Body Material: Bronze.
D. Seat: EPDM.
E. Stem: Bronze or stainless steel.
F. Disc: Bronze with EPDM coating or stainless steel.
G. Actuator: Worm gear or traveling nut.
H. End Connections: Threaded or grooved.

2.04 IRON BUTTERFLY VALVES WITH INDICATORS

A. UL 1091 and FM 1112 listed.
B. Minimum Pressure Rating: 175 psig.
C. Body Material: Cast or ductile iron.
D. Seat: EPDM.
E. Stem: Stainless steel.
F. Disc: Ductile iron with EPDM coating.
G. Actuator: Worm gear or traveling nut.
H. Body Design: Grooved-end or wafer style.

2.05 BRONZE OS&Y GATE VALVES

A. UL 262 and FM 1120/1130 listed.
B. Minimum Pressure Rating: 175 psig.
C. Body and Bonnet Material: Bronze or brass.
D. Wedge: One-piece bronze or brass.
E. Wedge Seat: Bronze.
F. Stem: Bronze or brass.
G. Packing: Non-asbestos PTFE.
H. End Connections: Threaded.

2.06 IRON OS&Y GATE VALVES

A. UL 262 and FM 1120/1130 listed.
B. Minimum Pressure Rating: 175 psig.
C. Body and Bonnet Material: Cast or ductile iron.
D. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
E. Stem: Brass, bronze, or stainless steel.
F. Packing: Non-asbestos PTFE.
G. Supervisory Switch: External.
H. End Connections: Flanged.

2.07 IRON NRS GATE VALVES

A. UL 262 and FM 1120/1130 listed.
B. Minimum Pressure Rating: 175 psig.
C. Body and Bonnet Material: Cast or ductile iron.
D. Wedge: Cast or ductile iron with elastomeric coating.
E. Stem: Brass or bronze.
F. Packing: Non-asbestos PTFE.

G. Operation:
   1. Operating nut for post-indicating valves.
   2. Handwheel for non-post-indicating valves.

H. Post Plate: Provide for post-indicating valves.

I. Supervisory Switch: External.

J. End Connections: Flanged.

2.08 TRIM AND DRAIN VALVES

A. Ball Valves:
   1. Description:
      a. UL 258 or FM 1140 listed.
      b. Pressure Rating: 175 psig.
      c. Body Design: Two piece.
      d. Body Material: Forged brass or bronze.
      e. Port Size: Full or standard.
      f. Seat: PTFE.
      g. Stem: Bronze or stainless steel.
      h. Ball: Chrome-plated brass.
      i. Actuator: Hand-lever.
      j. End Connections: Threaded or grooved.

PART 3 EXECUTION

3.01 EXAMINATION

A. Confirm valve interior to be free of foreign matter and corrosion.

B. Remove packing materials.

C. Examine guides and seats by operating valves from the fully open position to the fully closed position.

D. Examine valve threads and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage.
   1. Check bolting for proper size, length, and material.
   2. Verify gasket for size, defects, damage, and suitable material composition for service.
   3. Replace defective valves with new valves.

3.02 INSTALLATION

A. Install valves in accessible locations to allow for operation, inspections, tests, and maintenance.

B. Install listed valves in accordance with their listing.

C. Install valves in accordance with manufacturer's instructions.

D. Support valves independently of adjacent piping.

E. Install valves in horizontal piping with stem at or above pipe center.

F. Position valves to allow full actuator movement.

G. Install OS&Y valves with full clearance for rising stem. Install surrounding components so they do not interfere with nor are they impacted by full extension of rising stem.

H. Install supervised shutoff valves in supervised-open position.
   1. Install permanent identification signs indicating portion of system controlled by each shutoff valve.
   2. Install threaded-end valves with unions upstream and downstream.

I. Install valve tags. See Section 210553. Label valves in accordance with NFPA standard applying to the piping system in which valves are installed.

END OF SECTION

SECTION 210553
IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tags.

B. Stencils.

C. Pipe markers.

D. Ceiling tacks.

1.02 SUBMITTALS

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

B. Product Data: Provide manufacturers catalog literature for each product required.

C. Manufacturer's Installation Instructions: Indicate special procedures, and installation instructions.

PART 2 PRODUCTS

2.01 TAGS

A. Manufacturers:
   1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com/#sle.
   2. Brady Corporation: www.bradycorp.com/#sle.
   3. Brimar Industries, Inc: www.pipemarker.com/#sle.
   4. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
   5. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   6. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.
   7. Substitutions: See Section 016000 - Product Requirements.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

2.02 STENCILS

A. Manufacturers:
   1. Brady Corporation: www.bradycorp.com/#sle.
   2. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
   3. Insite Solutions, LLC: www.stop-painting.com/#sle.
   4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   5. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.
   6. Substitutions: See Section 016000 - Product Requirements.

B. Stencils: With clean cut symbols and letters of following size:
   1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
   2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
   3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.

2.03 PIPE MARKERS

A. Manufacturers:
   1. Brady Corporation: www.bradycorp.com/#sle.
   2. Brimar Industries, Inc: www.pipemarker.com/#sle.
   3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
   4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   5. Seton Identification Products, a Tricor Company: www.seton.com/#sle.
   6. Substitutions: See Section 016000 - Product Requirements.

B. 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.

2.04 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install tags with corrosion resistant chain.

B. Install plastic pipe markers in accordance with manufacturer's instructions.

C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

D. Use tags on piping 3/4 inch diameter and smaller.
   1. Install in clear view and align with axis of piping.
   2. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

SECTION 211300
FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wet-pipe sprinkler system.

B. Dry-pipe sprinkler system.

C. Preaction sprinkler system.

D. System design, installation, and certification.

1.02 RELATED REQUIREMENTS

A. Section 210553 - Identification for Fire Suppression Piping and Equipment.

1.03 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide; Current Edition.

B. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2018, with Editorial Revision (2020).

C. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2017, with Editorial Revision (2020).

D. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2023.

E. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 013000 - 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 COR.

D. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.

E. Designer's qualification statement.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

H. 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.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - 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.

J. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

1.06 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 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 3 years experience and approved by manufacturer.

F. Equipment and Components: Provide products that bear FM (AG) label or marking.

G. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

1.07 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. Anvil International: www.anvilintl.com/#sle.
   2. Tyco Fire Protection Products: www.tyco-fire.com/#sle.
   3. Viking Corporation: www.vikinggroupinc.com/#sle.
   4. Substitutions will be allowed: See Section 016000 - Product Requirements.

2.02 SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for entire building.

B. Occupancy: Light hazard; comply with NFPA 13.

C. Water Supply: Determine volume and pressure from water flow test data.

D. Interface system with building fire and smoke alarm system.

E. Provide fire department connections where indicated.

F. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

G. Pipe Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
   1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
   2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
   3. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
   4. Other Types: As required.

2.03 SPRINKLERS

A. Suspended Ceiling Type: Semi-recessed pendant type with matching push on escutcheon plate.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Finish: Chrome plated.
   4. Escutcheon Plate Finish: Chrome plated.
   5. Fusible Link: Glass bulb type temperature rated for specific area hazard.

B. Exposed Area Type: Pendant type with guard.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Finish: Brass.

4. 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: Standard.
   3. Finish: Chrome plated.
   4. Escutcheon Plate Finish: Chrome plated.
   5. Fusible Link: Glass bulb type temperature rated for specific area hazard.

D. Dry Sprinklers: Concealed pendant type with matching push on escutcheon plate.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Finish: Chrome plated.
   4. Cover Plate Finish: Enamel, color white .
   5. Fusible Link: Glass bulb type temperature rated for specific area hazard.

E. Storage Sprinklers: Pendant type with guard.
   1. Response Type: Standard.
   2. Coverage Type: Standard.
   3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

F. Flexible Drop System: Stainless steel, multiple use, open gate type.
   1. Application: Use to properly locate sprinkler heads.
   2. Include all supports and bracing.
   3. Provide braided type tube as required for the application.
   4. Manufacturers:
      a. FlexHead Industries, a brand of Anvil International: www.anvilintl.com/#sle.
      b. Victaulic Company; Vic-Flex: www.victaulic.com/#sle.
      c. Substitutions will be allowed: See Section 016000 - Product Requirements.

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.

B. Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm, accelerator, and with the following additional capabilities and features:
   1. Activate electric alarm.
   2. Test and drain valve.
   3. Externally resettable.
   4. Replaceable internal components without removing valve from installed position.

C. Preaction Valve:
   1. Operated by detection system listed for releasing service and independent of building fire alarm system with provisions for local, manual, and indicated remote releases.
   2. Incorporate mechanical latching mechanism incorporating valve clappers independent of system water pressure fluctuations.
   3. Provide test detection device for each actuation circuit adjacent to each controlled valve in accordance with NFPA 13.

D. Backflow Preventer: Reduced pressure principle valve assembly backflow preventer with drain and OS & Y gate valve on each end.

E. Test Connections:
   1. Inspector's Test Connection for Preaction Systems:
      a. Provide test connections approximately 6 ft above floor for each or portion of each sprinkler system equipped with an alarm device, located at the most remote part of each system.

b. Route test connection to an open-site drain location, excluding janitor sinks, accepting full flow without negative consequences.
c. Supply discharge orifice with same size as corresponding sprinkler orifice.
d. Limit vertical height of exterior wall penetration to 2 ft above finished grade.

2. Backflow Preventer Test Connection:
a. Provide downstream of the backflow prevention assembly, listed hose valves with 2.5 inch National Standard male hose threads with cap and chain.
b. Furnish one valve for each 250 gpm of system demand or fraction thereof.
c. Provide permanent sign reading "Test Valve" in accordance with Section 210553.

F. Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.

G. 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.

H. Supervisory Switches:
1. Manufacturers:
a. Potter Electric Signal Company, LLC; CoilKeeper Solenoid Supervisory Switch: www.pottersignal.com/#sle.
b. Substitutions will be allowed: See Section 016000 - Product Requirements.

2.05 PREACTION VALVE CONTROL PANEL

A. Provide a modular type control panel for electrically operated detection and extinguishing systems for each preaction valve.

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 backflow preventer assembly at sprinkler system water source connection.

D. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.

E. Locate outside alarm gong on building wall as indicated.

F. Place pipe runs to minimize obstruction to other work.

G. Place piping in concealed spaces above finished ceilings.

H. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.

I. 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.

J. Flush entire piping system of foreign matter.

K. Install guards on sprinklers where indicated.

L. Hydrostatically test entire system.

M. Require test be witnessed by Fire Marshal.

3.02 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION

SECTION 220517
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.

B. Pipe sleeve-seals.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

1.03 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2024.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

C. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

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

B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.

1.05 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 work of the type specified this section.
   1. Minimum three years experience.
   2. Approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.07 WARRANTY

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

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Manufacturers:
   1. American Polywater Corporation; PZVR Watertight Wall Sleeves for Pipes: www.polywater-haufftechnik.com/#sle.
   2. Flexicraft Industries; Pipe Wall Sleeve: www.flexicraft.com/#sle.
   3. Substitutions: See Section 016000 - Product Requirements.

B. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.
   3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
   4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

C. Plastic or Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

D. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:
   1. Galvanized steel pipe or black iron pipe with asphalt coating.
   2. Connect sleeve with floor plate except in mechanical rooms.

E. Penetrations in concrete beam flanges are permitted but are prohibited through ribs or beams without prior approval from the COR.

F. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Partitions, and Beam Flanges: 1 inch greater than external pipe diameter.
   3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.02 PIPE-SLEEVE SEALS

A. Manufacturers:
   1. Advance Products & Systems, LLC; Innerlynx: www.apsonline.com/#sle.
   2. American Polywater Corporation; PGKD Modular Seals: www.polywater-haufftechnik.com/#sle.
   3. Flexicraft Industries; PipeSeal: www.flexicraft.com/#sle.
   4. The Metraflex Company; MetraSeal: www.metraflex.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

B. Modular Mechanical Sleeve-Seal:
   1. Elastomer-based interlocking links continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
   2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
   3. Size and select seal component materials in accordance with service requirements.
   4. Service Requirements:
      a. Corrosion resistant.
      b. Oil, fuel, gas, and solvent resistant.
      c. Underground, buried, and wet conditions.
      d. Fire Resistant: 1 hour, UL (DIR) approved.
      e. High Temperature, up to 400 degrees F.
      f. Low temperature, down to minus 67 degrees F.
   5. Glass-reinforced plastic pressure end plates.

C. Sealing Compounds:
   1. Provide packing and sealing compound to fill pipe to sleeve thickness.
   2. Combined packing and sealing compounding to match partition fire-resistance hourly rating.

D. Pipe Sleeve Material:
   1. Bearing Walls: Steel, cast iron, or terra-cotta pipe.
   2. Masonry Structures: Sheet metal or fiber.

E. Wall Sleeve: PVC material with waterstop collar, and nailer end-caps.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Structural Considerations: Do not penetrate building structural members unless indicated.

F. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

1. Aboveground Piping:
   a. Pack solid using mineral fiber complying with ASTM C592.
   b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
2. All Rated Openings: Caulk tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

G. Manufactured Sleeve-Seal Systems:
1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a water-tight seal.
6. Install in accordance with manufacturer's recommendations.

H. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.03 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

C. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

END OF SECTION

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SECTION 220523
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ball valves.

B. Check valves.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 220553 - Identification for Plumbing Piping and Equipment.

C. Section 220719 - Plumbing Piping Insulation.

D. Section 221005 - Plumbing Piping.

1.03 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Non-rising stem.

E. OS&Y: Outside screw and yoke.

F. PTFE: Polytetrafluoroethylene.

G. RS: Rising stem.

H. TFE: Tetrafluoroethylene.

I. WOG: Water, oil, and gas.

1.04 REFERENCE STANDARDS

A. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2022, with Errata (2023).

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

C. ASME B16.34 - Valves — Flanged, Threaded, and Welding End; 2025.

D. ASME B31.9 - Building Services Piping; 2025.

E. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.

F. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

G. NSF 61 - Drinking Water System Components - Health Effects; 2024.

H. NSF 372 - Drinking Water System Components - Lead Content; 2024.

1.05 SUBMITTALS

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

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

E. Maintenance Materials: Furnish Owner with one wrench for every five plug valves, in each size of square plug valve head.

1. See Section 016000 - Product Requirements for additional provisions.

1.06 QUALITY ASSURANCE

A. Manufacturer:

1. Obtain valves for each valve type from single manufacturer.

2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

1.07 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.
   3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
   4. Secure check valves in either the closed position or open position.

B. Use the following precautions during storage:
   1. Maintain valve end protection and protect flanges and specialties from dirt.
      a. Provide temporary inlet and outlet caps.
      b. Maintain caps in place until installation.
   2. Store valves in shipping containers and maintain in place until installation.
      a. Store valves indoors in dry environment.
      b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

1.08 EXERCISE THE FOLLOWING PRECAUTIONS FOR HANDLING:

A. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. See drawings for specific valve locations.

B. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).

C. Provide the following valves for the applications if not indicated on drawings:
   1. Shutoff: Ball, butterfly, gate or plug.
   2. Dead-End: Single-flange butterfly (lug) type.
   3. Throttling: Provide globe, angle, ball, or butterfly.

D. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.

E. Required Valve End Connections for Non-Wafer Types:
   1. Copper Tube:
      a. 2 inch and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
      b. 2-1/2 inch to 4 inch: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.

F. Low Pressure, Compressed Air Valves 150 psi or Less:
   1. 2 inch and Smaller:
      a. Bronze: Provide with solder-joint ends.
      b. Ball: One piece, full port, brass with brass trim.

G. Domestic, Hot and Cold Water Valves:
   1. 2 inch and Smaller:
      a. Ball: Two piece, full port, brass with brass trim.
      b. Bronze Swing Check: Class 125, bronze disc.

H. Sanitary Waste Water Valves:
   1. 2 inch and Smaller:
      a. Ball: One piece, full port, brass with brass trim.

2.02 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:
   1. Hand Lever: Quarter-turn valves 6 inch and smaller except plug valves.

2. Wrench: Plug valves with square heads.

D. Insulated Piping Valves: With 2 inch stem extensions and the following features:
1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

E. Valve-End Connections:
1. Solder Joint Connections: ASME B16.18.

F. General ASME Compliance:
1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
2. Solder-joint Connections: ASME B16.18.
3. 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.

2.03 BRASS, BALL VALVES

A. Two Piece, Full Port with Brass Trim and Female Thread, Male thread, or Solder Connections:
1. Comply with MSS SP-110.
2. WSP Rating: 150 psi.
3. WOG Rating: 600 psi.
4. Body: Forged brass.
5. Seats: PTFE.
6. Ball: Chrome-plated brass.
7. Operator: Lockable handle and memory stop.
8. Manufacturers:
a. Apollo Valves: www.apollovalves.com/#sle.
b. Bonomi North America, Inc: www.bonominorthamerica.com/#sle.
c. Effebi; Gladiator: www.effebi.com/#sle.
d. FNW; 410A: www.fnw.com/#sle.
e. Kitz Corporation of America; #868: www.kitzus-kca.com/#sle.
f. Mueller Streamline, Co; Series 7700: www.muellerstreamline.com/#sle.
g. Substitutions: See Section 016000 - Product Requirements.

2.04 BRONZE, BALL VALVES

A. General:
1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. One Piece, Reduced Port with Bronze Trim:
1. Comply with MSS SP-110.
2. WSP Rating: 400 psi.
3. CWP Rating: 600 psi.
4. Body: Bronze.
5. End Connections: Pipe press.
6. Seats: PTFE.

C. Two Piece, Full Port with Bronze Trim:
1. Comply with MSS SP-110.
2. WSP Rating: 150 psi.
3. WOG Rating: 600 psi.
4. Body: Forged bronze or dezincified-brass alloy.
5. Ends Connections: Pipe thread or solder.
6. Seats: PTFE.
7. Manufacturers:
a. Apollo Valves: www.apollovalves.com/#sle.

b. Bonomi North America, Inc: www.bonominorthamerica.com/#sle.
c. FNW: www.fnw.com/#sle.
d. Substitutions: See Section 016000 - Product Requirements.

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.

B. Class 125:
1. Pressure and Temperature Rating: MSS SP-80, Type 3.
2. Design: Y-pattern, horizontal or vertical flow.
3. WOG Rating: 200 psi.
4. Body: Bronze.
5. End Connections: Threaded.
6. Disc: Bronze.
7. Manufacturers:
a. Apollo Valves: www.apollovalves.com/#sle.
b. NIBCO INC: www.nibco.com/#sle.
c. Substitutions: See Section 016000 - Product Requirements.

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 as required 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 220529
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prefabricated trapeze-framed systems.

B. Strut systems for pipe or equipment support.

C. Beam clamps.

D. Pipe hangers.

E. Pipe supports, guides, shields, and saddles.

F. Anchors and fasteners.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 055000 - Metal Fabrications.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

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

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2025.

D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.

E. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

H. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

J. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

K. FM (AG) - FM Approval Guide; Current Edition.

L. MFMA-4 - Metal Framing Standards Publication; 2004.

M. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

N. UL (DIR) - Online Certifications Directory; Current Edition.

O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify COR of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.05 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

1.06 QUALITY ASSURANCE

A. Comply with applicable building code.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of plumbing work.

B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.

C. Materials for Metal Fabricated Supports: Comply with Section 055000.
1. Zinc-Plated Steel: Electroplated in accordance with ASTM B633 unless stated otherwise.
2. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.

D. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.
1. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
2. Outdoor, Damp, or Wet-Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.

2.02 PREFABRICATED TRAPEZE-FRAMED SYSTEMS

A. Prefabricated Trapeze-Framed Metal Strut Systems:
1. Manufacturers:
a. Anvil International, LLC: www.asc-es.com/#sle.
b. Custom Strut and Roll Forming, LLC: www.customstrut.com/#sle.
c. Gripple, Inc; Fast Track - Standard: www.gripple.com/#sle.
d. Unistrut, a brand of Atkore International, Inc: www.unistrut.com/#sle.
e. Substitutions: See Section 016000 - Product Requirements.
f. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
2. MFMA-4 compliant, prefabricated, side-loading continuous-slot metal strut channel bracket with associated tracks, fittings, and related accessories.
3. Strut Channel or Bracket Material:
a. Indoor Dry Locations: Use zinc-plated steel or galvanized steel.
4. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
5. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
6. Accessories: Provide bracket covers, cable basket clips, cable tray clips, clamps, conduit clamps, fire-retarding brackets, j-hooks, protectors, and vibration dampeners.

2.03 STRUT SYSTEMS FOR PIPE OR EQUIPMENT SUPPORT

A. Strut Channels:
   1. Manufacturers:
      a. ABB Installation Products: electrification.us.abb.com/#sle.
      b. Gripple, Inc; Universal Bracket: www.gripple.com/#sle.
      c. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
      d. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
   2. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
   3. Channel or Bracket Kits: Include rods, brackets, end-fixed fittings, covers, clips, and other related hardware required to complete sectional trapeze section for piping or other support.

B. Hanger Rods:
   1. Threaded zinc-plated steel unless otherwise indicated.
   2. Minimum Size, Unless Otherwise Indicated or Required:
      a. Equipment Supports: 1/2 inch diameter.
      b. Piping up to 1 inch: 1/4 inch diameter.
      c. Piping larger than 1 inch: 3/8 inch diameter.
      d. Trapeze Support for Multiple Pipes: 3/8 inch in length.

C. Channel Nuts:
   1. Manufacturers:
      a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
      b. FNW; 7821: www.fnw.com/#sle.
      c. Unistrut, a brand of Atkore International, Inc: www.unistrut.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.
      e. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
   2. Provide carbon steel channel nut with epoxy copper or zinc finish and long, regular, or short spring as indicated on drawings.

D. Cable Hanging System Kits:
   1. Manufacturers:
      a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
      b. Ductmate Industries, Inc: ductmate.com/#sle.
      c. Gripple, Inc: www.gripple.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.
      e. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
   2. Provide cable-wire in bulk or pre-cut lengths with respective cable hangers as required to hold minimum weight of 120 lb.
   3. Accessories: Provide brackets, clip or c-clip hangers, covers, and y-hook hangers.

2.04 BEAM CLAMPS

A. Manufacturers:
   1. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
   2. FNW; 7201: www.fnw.com/#sle.
   3. Unistrut, a brand of Atkore International, Inc: www.unistrut.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.
   5. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

B. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.

C. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

D. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

2.05 PIPE HANGERS

A. Band Hangers, Adjustable:
   1. Manufacturers:
      a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
      b. Gripple, Inc; Universal Clamp (Threaded): www.gripple.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.
      d. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
   2. MSS SP-58 type 7 or 9, zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.

B. J-Hangers, Adjustable:
   1. Manufacturers:
      a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.
      c. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
   2. MSS SP-58 type 5, zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.

C. Swivel Ring Hangers, Adjustable:
   1. Manufacturers:
      a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
      b. FNW; 7010: www.fnw.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.
      d. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
   2. MSS SP-58 type 10, epoxy-painted, zinc-colored.
   3. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
   4. FM (AG) and UL (DIR) listed for specific pipe size runs and loads.

D. Clevis Hangers, Adjustable:
   1. Manufacturers:
      a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
      b. FNW; 7005: www.fnw.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.
      d. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
   2. Copper Tube: MSS SP-58 type 1, epoxy-plated copper.
   3. Felt-Lined: MSS SP-58 type 1, zinc-plated, silicone-free carbon steel.
   4. Light-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.
   5. Standard-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.

2.06 PIPE CLAMPS

A. Riser Clamps:
   1. Manufacturers:
      a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
      b. FNW; 7020: www.fnw.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.
      d. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
   2. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
   3. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
   4. UL (DIR) listed: Pipe sizes 1/2 to 8 inch.

B. Extension Split Pipe Clamp:
   1. Manufacturers:

a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
b. Substitutions: See Section 016000 - Product Requirements.
c. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

2. MSS SP-58 type 12, hinged split ring and yoke roller hanger with epoxy copper or plain finish.
3. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
4. Provide hanger rod and nuts of the same type and material for a given pipe run.
5. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

C. Strut Clamps:
1. Manufacturers:
a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
b. FNW; 7815: www.fnw.com/#sle.
c. Unistrut, a brand of Atkore International, Inc: www.unistrut.com/#sle.
d. Substitutions: See Section 016000 - Product Requirements.
e. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
2. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.
3. Service Temperature Range: Minus 65 to 275 degrees F.

D. Insulation Coupling:
1. Manufacturers:
a. FNW; 7897: www.fnw.com/#sle.
b. Unistrut, a brand of Atkore International, Inc: www.unistrut.com/#sle.
c. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
2. Two bolt-type clamps designed for installation under insulation.
3. Material: Carbon steel with epoxy copper or zinc finish.

2.07 PIPE SUPPORTS, GUIDES, SHIELDS, AND SADDLES

A. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.

B. Stanchions:
1. Manufacturers:
a. Anvil International: www.anvilintl.com/#sle.
b. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
c. Substitutions: See Section 016000 - Product Requirements.
2. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
3. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.

C. Pipe Shields for Insulated Piping:
1. Manufacturers:
a. Anvil International: www.anvilintl.com/#sle.
b. FNW; 7753: www.fnw.com/#sle.
c. Substitutions: See Section 016000 - Product Requirements.
d. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
2. MSS SP-58 type 40, ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
3. General Construction and Requirements:
a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
b. Shields Material: UV-resistant polypropylene with glass fill.
c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
d. Service Temperature: Minus 40 to 178 degrees F.

e. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

D. Pipe Supports:
1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
2. Liquid Temperatures Up to 122 degrees F:
a. Overhead Support: MSS SP-58 types 1, 3 through 12 clamps.
b. Support From Below: MSS SP-58 types 35 through 38.

E. Pipe Supports, Thermal Insulated:
1. General Requirements:
a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
c. Provide pipe supports for 1/2 to 30 inch iron pipes.
d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by 360 degree, PVC jacketing.
2. PVC Jacket:
a. Pipe insulation protection shields to be provided with ball bearing hinge and locking seam.
b. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
c. Minimum Thickness: 60 mil, 0.06 inch.

F. Copper Pipe Supports:
1. Manufacturers:
a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
b. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
c. Substitutions: See Section 016000 - Product Requirements.
d. Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by single manufacturer.

G. Overhead Pipe Supports:
1. Manufacturers:
a. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
b. Substitutions: See Section 016000 - Product Requirements.
c. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

2.08 ANCHORS AND FASTENERS

A. Manufacturers - Mechanical Anchors:
1. FNW; 7502: www.fnw.com/#sle.
2. Hilti, Inc: www.us.hilti.com/#sle.
3. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.
4. MKT Fastening: www.mktfasteningusa.com/#sle.
5. Powers Fasteners, Inc: www.powers.com/#sle.
6. Substitutions: See Section 016000 - Product Requirements.

B. Manufacturers - Powder-Actuated Fastening Systems:
1. Hilti, Inc: www.us.hilti.com/#sle.
2. ITW Ramset, a division of Illinois Tool Works, Inc: www.ramset.com/#sle.
3. Powers Fasteners, Inc: www.powers.com/#sle.
4. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
5. Substitutions: See Section 016000 - Product Requirements.

C. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

D. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.

E. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.

F. Hollow Masonry: Use toggle bolts.

G. Hollow Stud Walls: Use toggle bolts.

H. Steel: Use beam ceiling clamps, beam clamps, machine bolts, or welded threaded studs.

I. Beam Ceiling Flanges: ASTM A47/A47M Grade 32510, malleable iron or stainless steel with copper, plain, stainless steel, or zinc finish.

J. Sheet Metal: Use sheet metal screws.

K. Plastic and lead anchors are not permitted.

L. Preset Concrete Inserts: Continuous metal strut channel and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
   1. Channel Material: Use galvanized steel.
   2. Manufacturer: Same as manufacturer of metal strut channel framing system.

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. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

C. Unless specifically indicated or approved by COR, do not provide support from suspended ceiling support system or ceiling grid.

D. Unless specifically indicated or approved by COR, do not provide support from roof deck.

E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

F. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

G. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

I. Secure fasteners according to manufacturer's recommended torque settings.

J. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

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

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

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SECTION 220553
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe markers.

1.02 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting: Identification painting.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

1.04 SUBMITTALS

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

B. Schedules:
   1. Submit plumbing component identification schedule listing equipment, piping, and valves.
   2. Detail proposed component identification data in terms of of wording, symbols, letter size, and color coding to be applied to corresponding product.
   3. Valve Data Format: Include id-number, location, function, and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

E. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

A. Tags:
   1. Piping: 3/4 inch diameter and smaller.
   2. Manual operated and automated control valves.
   3. Instrumentation, relays, gauges, and other related control equipment products.
   4. Ceiling tacks placed on lay-in ceiling surface to reference plumbing components.

B. Pipe Markers: 3/4 inch diameter and higher.

2.02 NAMEPLATES

A. Manufacturers:
   1. Brimar Industries, Inc: www.pipemarker.com/#sle.
   2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   3. Seton Identification Products: www.seton.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Description: Laminated piece with up to three lines of text.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.

2.03 TAGS

A. Manufacturers:
   1. Advanced Graphic Engraving: www.advancedgraphicengraving.com/#sle.
   2. Brady Corporation: www.bradycorp.com/#sle.
   3. Brimar Industries, Inc: www.pipemarker.com/#sle.
   4. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
   5. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   6. Seton Identification Products: www.seton.com/#sle.
   7. Substitutions: See Section 016000 - Product Requirements.

B. Flexible: Vinyl with engraved black letters on light contrasting background color with up to three lines of text. Minimum tag size 1-1/2 inch in diameter.

C. Metal: Brass, 19 gauge 1-1/2 inch in diameter with smooth edges, blank, smooth edges, and corrosion-resistant ball chain. Up to three lines of text.

2.04 STENCILS

A. Manufacturers:
1. Brady Corporation: www.bradycorp.com/#sle.
2. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
3. Insite Solutions, LLC: www.stop-painting.com/#sle.
4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
5. Seton Identification Products: www.seton.com/#sle.
6. Substitutions: See Section 016000 - Product Requirements.

B. Pipe: Stencil size required per external insulated or uninsulated pipe diameter.
1. 3/4 to 1-1/4 inch Range: 1/2 inch text over 8 inch long background.
2. 1-1/2 to 2 inch Range: 3/4 inch text over 8 inch long background.
3. 2-1/2 to 6 inch Range: 1-1/4 inch text over 12 inch long background.

2.05 PIPE MARKERS

A. Manufacturers:
1. Brady Corporation: www.bradycorp.com/#sle.
2. Brimar Industries, Inc: www.pipemarker.com/#sle.
3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
5. Seton Identification Products: www.seton.com/#sle.
6. Substitutions: See Section 016000 - Product Requirements.

B. Comply with ASME A13.1.

C. Flexible Marker: Factory fabricated, semi-rigid, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid conveyed.

D. Identification Scheme, ASME A13.1:
1. Primary: External Pipe Diameter, Uninsulated or Insulated.
a. 3/4 to 1-1/4 inches: Use 8 inch field-length with 1/2 inch text height.
b. 1-1/2 to 2 inches: Use 8 inch field-length with 3/4 inch text height.
c. 2-1/2 to 6 inches: Use 12 inch field-length with 1-1/4 inch text height.
2. Secondary: Color scheme per fluid service.
a. Compressed Air: White text on blue background.
b. Water; Potable, Cooling, Boiler Feed, and Other: White text on green background.
3. Tertiary: Other Details.
a. Directional flow arrow.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive identification products.

3.02 INSTALLATION

A. Install flexible nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags in clear view and align with axis of piping

C. Apply ASME A13.1 Pipe Marking Rules:
1. Place pipe marker adjacent to changes in direction.
2. Place pipe marker adjacent each valve port and flange end.
3. Place pipe marker at both sides of floor and wall penetrations.
4. Place pipe marker every 25 to 50 feet interval of straight run.

END OF SECTION

SECTION 220716
PLUMBING EQUIPMENT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cellular glass insulation.

B. Cellular melamine insulation.

C. Flexible elastomeric cellular insulation.

D. Flexible glass fiber insulation.

E. Rigid glass fiber insulation.

F. Jacketing and accessories.

1.02 REFERENCE STANDARDS

A. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2025.

E. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2022.

F. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2024.

G. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2024.

H. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

I. ASTM C1393 - Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks; 2025.

J. ASTM C1410 - Standard Specification for Cellular Melamine Thermal and Sound-Absorbing Insulation; 2017 (Reapproved 2023).

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

M. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

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

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.04 QUALITY ASSURANCE

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

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section and approved by manufacturer.

220716 PLUMBING EQUIPMENT INSULATION

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 CELLULAR MELAMINE INSULATION

A. Insulation: Flexible preformed open-cell polymeric foam tubing, slit lengthwise for installation, complying with applicable requirements of ASTM C1410.
   1. K Value: ASTM C177; 0.25 at 75 degrees F.
   2. Minimum Service Temperature: Minus 40 degrees F.
   3. Maximum Service Temperature: 350 degrees F.

2.03 FLEXIBLE GLASS FIBER INSULATION

A. Manufacturers:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Knauf Insulation: www.knaufinsulation.com/#sle.
   4. Manson Insulation, a company of Knauf Insulation: www.imanson.com/#sle.
   5. Owens Corning Corporation; FIBERGLAS FLEXWRAP: www.owenscorning.com/en-us/#sle.

B. Insulation: ASTM C553; flexible, noncombustible.
   1. K Value: 0.36 at 75 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
   2. Maximum Service Temperature: 450 degrees F.
   3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Insulation: ASTM C1393; pipe and tank, end grain adhered to jacket.
   1. K Value: ASTM C177, 0.27 at 75 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

2.04 RIGID GLASS FIBER INSULATION

A. Manufacturers:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Owens Corning Corporation: www.owenscorning.com/en-us/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: ASTM C612 or ASTM C592; rigid, noncombustible.
   1. K Value: 0.25 at 75 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Water Vapor Absorption: 5.0 percent by weight.
   4. Maximum Density: 8.0 pcf.

2.05 CELLULAR GLASS INSULATION

A. Pipe and Tube Insulation: ASTM C552, Type II, Grade 6.

1. K Value: 0.35 at 100 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
2. Service Temperature Range: From 250 degrees F to 800 degrees F.
3. Water Vapor Permeability: 0.005 perm inch maximum per inch.
4. Water Absorption: 0.5 percent by volume, maximum.
5. Density: 6.12 pcf, minimum.

2.06 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
1. Aeroflex USA; AEROFLEX EPDM Sheet/Roll: www.aeroflexusa.com/#sle.
2. Armacell LLC; AP ArmaFlex: www.armacell.us/#sle.
3. Jones Stephens; Rubber Pipe Insulation: www.jonesstephens.com/#sle.
4. K-Flex USA LLC; Insul-Sheet: www.kflexusa.com/#sle.
5. Substitutions: See Section 016000 - Product Requirements

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 220 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

2.07 JACKETING AND ACCESSORIES

A. PVC Plastic:
1. Jacket: Sheet material, off-white color.
a. Minimum Service Temperature: Minus 40 degrees F.
b. Maximum Service Temperature: 150 degrees F.
c. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
d. Thickness: 10 mil, 0.010 inch.
e. Connections: Brush on welding adhesive.

B. Stainless Steel Jacket: ASTM A666/A666M, Type 304 stainless steel.
1. Thickness: 0.010 inch.
2. Finish: Smooth.
3. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Exposed Equipment: Locate insulation and cover seams in least visible locations.

C. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

D. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

E. Install cellular melamine with factory-applied jackets with a manufacturer-approved adhesive along seams, both straight lap joints and circumferential lap joints.
1. Install seal over seams with factory-approved room temperature vulcanization (RTV) silicone sealant to ensure a positive vapor barrier seal in outdoor and sanitary wash down environments.

F. For hot equipment containing fluids 140 degrees F or less, do not insulate flanges and unions, but bevel and seal ends of insulation.

G. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.

H. Cover glass fiber insulation with metal mesh and finish with heavy coat of insulating cement.

END OF SECTION

SECTION 220719
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible elastomeric cellular insulation.

B. Glass fiber insulation.

C. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

1.03 REFERENCE STANDARDS

A. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

C. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2024).

D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2025.

E. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2025.

F. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

G. ASTM C1393 - Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks; 2025.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 3 years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 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 or UL 723.

2.02 GLASS FIBER INSULATION

A. Manufacturers:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Knauf Insulation: www.knaufinsulation.com/#sle.
   4. Manson Insulation, a company of Knauf Insulation: www.imanson.com/#sle.
   5. Owens Corning Corporation: www.owenscorning.com/en-us/#sle.
   6. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: ASTM C547 and ASTM C795; rigid, preformed pipe insulation, noncombustible.
   1. K Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Insulation: ASTM C1393; pipe and tank, end grain adhered to jacket.
   1. K Value: ASTM C177, 0.27 at 75 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

D. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm.

E. Vapor Barrier Lap Adhesive: Compatible with insulation.

F. Insulating Cement: ASTM C449.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
   1. Aeroflex USA; AEROFLEX Self-Seal: www.aeroflexusa.com/#sle.
   2. Armacell LLC; AP ArmaFlex: www.armacell.us/#sle.
   3. Jones Stephens; Rubber Pipe Insulation: www.jonesstephens.com/#sle.
   4. K-Flex USA LLC; Insul-Tube: www.kflexusa.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

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.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.04 JACKETING AND ACCESSORIES

A. PVC Plastic Jacket:
   1. Manufacturers:
      a. Johns Manville Corporation: www.jm.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.
   2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil, 0.010 inch.
      e. Connections: Brush on welding adhesive.
   3. Covering Adhesive Mastic: Compatible with insulation.

B. Stainless Steel Jacket: ASTM A666/A666M, Type 304 stainless steel.
   1. Thickness: 0.010 inch.

2. Finish: Smooth.
3. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

H. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

I. Inserts and Shields:
   1. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   2. Insert Location: Between support shield and piping and under the finish jacket.
   3. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   4. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 078400.

K. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet 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: 2 inch.
      b. Cellular Foam Insulation:
         1) Pipe Size Range: 2 inch.
         2) Thickness: 1/2 inch.

END OF SECTION

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SECTION 221005
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary waste piping, above grade.
B. Chemical-resistant sanitary waste piping.
C. Domestic water piping, above grade.
D. Vacuum piping, above grade.
E. Pipe flanges, unions, and couplings.
F. Pipe hangers and supports.
G. Ball valves.

1.02 RELATED REQUIREMENTS

A. Section 220529 - Hangers and Supports for Plumbing Piping and Equipment.
B. Section 330110.58 - Disinfection of Water Utility Piping Systems.

1.03 REFERENCE STANDARDS

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
C. ASME B16.51 - Copper and Copper Alloy Press-Connect Pressure Fittings; 2021.
D. ASME B31.1 - Power Piping; 2024.
E. ASME B31.3 - Process Piping; 2024.
F. ASME B31.9 - Building Services Piping; 2025.
G. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2026.
H. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2022.
I. ASTM B32 - Standard Specification for Solder Metal; 2020.
J. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
K. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.
L. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube; 2022.
M. ASTM B813 - Standard Specification for Water Flushable Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2024.
N. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2023.
O. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2026.
P. ASTM C1277 - Standard Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings; 2020.
Q. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020 (Reapproved 2024).
R. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2025.
S. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems; 2024.
T. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2020 (Reapproved 2024).

U. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

V. ASTM F437 - Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2024.

W. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40; 2023.

X. ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2024.

Y. ASTM F441/F441M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80; 2023.

Z. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR); 2023.

AA. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings; 2022 (Reapproved 2026).

BB. ASTM F3226/F3226M - Standard Specification for Metallic Press-Connect Fittings for Piping and Tubing Systems; 2019 (Reapproved 2024).

CC. AWWA C651 - Disinfecting Water Mains; 2023.

DD. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2020.

EE. IAPMO (UPC) - Uniform Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

FF. IAPMO/ANSI/CAN Z1117 - Standard for Press Connections; 2022.

GG. ICC (IPC) - International Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

HH. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2018, with Editorial Revision (2020).

II. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2017, with Editorial Revision (2020).

JJ. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

KK. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

LL. NSF 61 - Drinking Water System Components - Health Effects; 2024.

MM. NSF 372 - Drinking Water System Components - Lead Content; 2024.

NN. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 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, solder, and flux (if used), complying with NSF 61 and NSF 372; label pipe and fittings.

B. Plenum-Installed Piping: Provide piping with flame spread index of 25 or less and smoke developed index of 50 or less when tested in accordance with ASTM E84 or UL 723.

2.02 SANITARY WASTE PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74, service weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. PVC Pipe: ASTM D2665.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 CHEMICAL-RESISTANT SANITARY WASTE PIPING

A. CPVC Pipe: 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.

2.04 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Pipe: ASTM B88 (ASTM B88M), Type L, drawn temper.
   1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
   2. Joints: ASTM B32 solder.
   3. Joints: Grooved mechanical couplings.
   4. Mechanical Press Sealed Fittings: ASME B16.51 or IAPMO/ANSI/CAN Z1117, ICC (IPC), and IAPMO (UPC) approved, NSF 61 and NSF 372 certified, with EPDM seals.
      a. Manufacturers:
         1) Anvil International: www.anvilintl.com/#sle.
         2) Apollo Valves: www.apollovalves.com/#sle.
         3) Bonomi North America, Inc; BONOMI PRESS: www.bonominorthamerica.com/#sle.
         4) FNW; Copper Press: www.fnw.com/#sle.
         5) NIBCO INC; Press System: www.nibco.com/#sle.
         6) Substitutions: See Section 016000 - Product Requirements.

B. Stainless Steel Pipe: ASTM A269/A269M, Grade TP304 alloy.
   1. Mechanical Press Sealed Fittings: ASTM F3226/F3226M, ICC (IPC), and IAPMO (UPC) approved, NSF 61 and NSF 372 certified, with EPDM seals.

2.05 VACUUM PIPING, ABOVE GRADE

A. Aluminum Tube:
   1. Manufacturers:
      a. Applied System Technologies: appliedsystemtech.com/#sle.
      b. Prevost Corporation; PPS: www.prevostusa.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.
      d. Source Limitations: Furnish tubing, fittings, and joints produced by single manufacturer, produced by same manufacturer as tubing, and obtained from single supplier.
   2. Tube: ASTM B241/B241M, ASME B31.1, ASME B31.3.
   3. Alloy: 6063-T5, 6063-T6, or 6060-T51.
   4. Maximum Vacuum Pressure: 98 percent vacuum, minus 29.33 in-HG.
   5. Finish: Powder coated or electrostatically painted in gray.
   6. Fittings and Joints:
      a. Material: Provide fittings in aluminum, thermoplastic polymer, or stainless steel.

b. Joints: Removeable and reusable, gasketed, mechanical, push-connect type with bite ring, clamshell type, or bolted compression type.
c. Gaskets and Seals:

2.06 PIPE FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 inch and Under:
1. Ferrous Pipe: Class 150 malleable iron threaded unions.
2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Sizes Over 1 inch:
1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. No-Hub Couplings:
1. Testing: In accordance with ASTM C1277 and CISPI 310.
2. Gasket Material: Neoprene complying with ASTM C564.
3. Band Material: Stainless steel.
4. Eyelet Material: Stainless steel.
5. Manufacturers:
a. Ideal Clamp Products, Inc; Standard: www.idealtridon.com//#sle.
b. MIFAB, Inc; MI-QHUB: www.mifab.com/#sle.
c. PROFLO: www.ferguson.com/#sle.
d. Substitutions: See Section 016000 - Product Requirements.

2.07 PIPE HANGERS AND SUPPORTS

A. See Section 220529 for additional requirements.

B. Provide hangers and supports that comply with MSS SP-58.
1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
3. Trapeze Hangers: Welded steel channel frames attached to structure.
4. Vertical Pipe Support: Steel riser clamp.

C. Plumbing Piping - Drain, Waste, and Vent:
1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
2. Hangers for Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
3. Wall Support for Pipe Sizes to 3 inch: Cast iron hook.
4. Wall Support for Pipe Sizes 4 inch 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.
6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

D. Plumbing Piping - Water:
1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
2. Hangers for Cold Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
3. Hangers for Hot Pipe Sizes 2 to 4 inch: Carbon steel, adjustable, clevis.
4. Wall Support for Pipe Sizes Up to 3 inch: Cast iron hook.
5. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
6. Floor Support for Hot Pipe Sizes to 4 inch: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.

E. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
1. Concrete Wedge Expansion Anchors: Comply with ICC-ES AC193.
2. Masonry Wedge Expansion Anchors: Comply with ICC-ES AC01.
3. Concrete Screw Type Anchors: Comply with ICC-ES AC193.

2.08 BALL VALVES

A. Manufacturers:
   1. Anvil International: www.anvilintl.com/#sle.
   2. Apollo Valves: www.apollovalves.com/#sle.
   3. Uponor, Inc: www.uponorengineering.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Construction, 4 inch and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 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. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

G. Provide access where valves and fittings are not exposed.

H. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.

I. 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.

J. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

K. Sleeve pipes passing through partitions, walls, and floors.

L. Inserts:
   1. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

M. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Support horizontal piping as indicated.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   7. Provide copper plated hangers and supports for copper piping.
   8. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

N. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.03 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 gate 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.

3.04 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.

B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.05 FIELD TESTS AND INSPECTIONS

A. Verify and inspect systems according to requirements by the Authority Having Jurisdiction. In the absence of specific test and inspection procedures proceed as indicated below.

B. Domestic Water Systems:
   1. Perform hydrostatic testing for leakage prior to system disinfection.
   2. Test Preparation: Close each fixture valve or disconnect and cap each connected fixture.
   3. General:
      a. Fill the system with water and raise static head to 10 psi above service pressure. Minimum static head of 50 to 150 psi. As an exception, certain codes allow a maximum static pressure of 80 psi.

C. Gas Distribution Systems:
   1. Test Preparation: Close each appliance valve or disconnect and cap each connected appliance.
   2. General Systems:
      a. Inject a minimum of 10 psi of compressed air into the piping system for a duration of 15 minutes and verify with a gauge that no perceptible pressure drop is measured.
      b. Ensure test pressure gauge has a range of twice the specific pressure rate selected with an accuracy of 1/10 of 1 pound.

D. Test Results: Document and certify successful results, otherwise repair, document, and retest.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system in accordance with Section 330110.58.

B. Prior to starting work, verify system is complete, flushed, and clean.

C. 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. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe Size: 1/2 inch to 1-1/4 inch:
         1) Maximum Hanger Spacing: 6.5 ft.
         2) Hanger Rod Diameter: 3/8 inches.

b. Pipe Size: 1-1/2 inch to 2 inch:
   1) Maximum Hanger Spacing: 10 ft.
   2) Hanger Rod Diameter: 3/8 inch.
c. Pipe Size: 2-1/2 inch to 3 inch:
   1) Maximum Hanger Spacing: 10 ft.
   2) Hanger Rod Diameter: 1/2 inch.
d. Pipe Size: 4 inch to 6 inch:
   1) Maximum Hanger Spacing: 10 ft.
   2) Hanger Rod Diameter: 5/8 inch.

END OF SECTION

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SECTION 221119
DOMESTIC WATER PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Backflow preventers.

B. Vacuum breakers.

C. Mixing valves.

D. Balancing valves.

E. Strainers.

F. Outlet boxes.

G. Drain valves.

H. Water-hammer arrestors.

I. Trap primers.

1.02 REFERENCE STANDARDS

A. ASSE 1001 - Performance Requirements for Atmospheric Type Vacuum Breakers; 2021.

B. ASSE 1010 - Performance Requirements for Water Hammer Arresters; 2025.

C. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent; 2021.

D. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies; 2021.

E. ASSE 1017 - Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems; 2023.

F. ASSE 1018 - Performance Requirements for Trap Seal Primer Valves - Potable Water Supplied; 2023.

G. ASSE 1044 - Performance Requirements for Trap Seal Primer - Drainage Types and Electric Design Types; 2023.

H. ASSE 1069 - Performance Requirements for Automatic Temperature Control Mixing Valves; 2020 (Reaffirmed 2025).

I. AWWA C511 - Reduced-Pressure Principle Backflow Prevention Assembly; 2017 (Reaffirmed 2021).

J. AWWA C550 - Protective Interior Coatings for Valves and Hydrants; 2024.

K. NSF 61 - Drinking Water System Components - Health Effects; 2024.

L. NSF 372 - Drinking Water System Components - Lead Content; 2024.

M. PDI-WH 201 - Water Hammer Arresters; 2017.

1.03 SUBMITTALS

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

B. Product Data: Provide manufacturer's literature and data sheets for each product. Include information on materials of fabrication, assembly of components, dimensions, ratings, finishes, rough-in requirements, and installed accessories.

C. Project Record Documents:

D. Maintenance Materials: Furnish the following for Owner's use in project maintenance:
   1. See Section 016000 - Product Requirements for additional provisions.

1.04 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

C. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

D. Store products under cover and protected from weather and dirt. Elevate above grade.

E. Protect end connections, flanges, threads, and grooves from dirt and damage.

F. Protect product interiors against rust and corrosion.

G. Do not use operating handles or stems as lifting or rigging points.

H. Handle large products using slings.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products complying with NSF 61 and NSF 372.

B. Source Limitations: Furnish domestic water piping specialties of same kind by same manufacturer.

C. Provide brass-bodied domestic water piping specialties in DZR brass.

2.02 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:
   1. Manufacturers:
      a. BEECO by MIFAB, Inc: www.mifab.com/#sle.
      b. Wilkins by Zurn Water, LLC: www.zurn.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.
   2. NPS 2 and Smaller:
      a. Assembly: ASSE 1013 and AWWA C511.
      b. Backflow Valve: Manufactured from bronze, copper silicon alloy, or stainless steel.
      c. Isolation Valves: Ball valves on inlet and outlet.
      d. Maximum Working Pressure: 175 psi.
      e. Working Temperature Range: 33 to 180 degrees F.
      f. Accessories:
         1) Air gap fitting.
      g. Products:
         1) MIFAB, Inc; BEECO FRP Series: www.mifab.com/#sle.
         2) Wilkins by Zurn Water, LLC; 375XL: www.zurn.com/#sle.
         3) Wilkins by Zurn Water, LLC; 975XL3: www.zurn.com/#sle.
         4) Substitutions: See Section 016000 - Product Requirements.
   3. NPS 2-1/2 and Larger:
      a. Assembly: ASSE 1013 and AWWA C511.
      b. Backflow Valve: Manufactured from epoxy-coated cast iron, epoxy-coated ductile iron, or stainless steel.
      c. Isolation Valves: Epoxy-coated OS&Y valves on inlet and outlet.
      d. Epoxy Coatings: AWWA C550.
      e. Maximum Working Pressure: 175 psi.
      f. Working Temperature Range: 33 to 140 degrees F.
      g. Accessories:
         1) Air gap fitting.
      h. Products:
         1) MIFAB, Inc; BEECO Baracuda Series 40: www.mifab.com/#sle.
         2) Wilkins by Zurn Water, LLC; 375AST: www.zurn.com/#sle.
         3) Substitutions: See Section 016000 - Product Requirements.

B. Intermediate Atmospheric-Vent Backflow Preventers:
   1. Valve: ASSE 1012, brass or bronze, with union ends.
      a. Provide with polished chrome finish.
   2. Maximum Working Pressure: 175 psi.
   3. Working Temperature Range: 33 to 210 degrees F.

2.03 VACUUM BREAKERS

A. Atmospheric Vacuum Breakers:
   1. Manufacturers:
      a. Cash Acme, a brand of Reliance Worldwide Corporation: www.cashacme.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.
   2. Valve: ASSE 1001, brass, bronze, or copper silicon alloy.
      a. Provide with polished chrome finish.
   3. Provide with upstream wye-pattern strainer.
   4. Maximum Working Pressure: 125 psi.
   5. Working Temperature Range: 33 to 180 degrees F.

2.04 MIXING VALVES

A. Thermostatic Master Mixing Valves:
   1. Manufacturers:
      a. Cash Acme, a brand of Reliance Worldwide Corporation: www.cashacme.com/#sle.
      b. Holby Valve, Inc: www.holby.com/#sle.
   2. Valve: ASSE 1017, brass or bronze body; thermostatic element; corrosion- and lime-resistant internal components; integral locking temperature adjustment.
   3. Accessories:
      a. Shut-off valve on inlets and outlet.
   4. Products:
      a. Cash Acme, a brand of Reliance Worldwide Corporation; HG110-D: www.cashacme.com/#sle.
      b. Cash Acme, a brand of Reliance Worldwide Corporation; Masterguard 600 Series: www.cashacme.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.

B. Automatic Temperature Control Mixing Valves:
   1. Valve: ASSE 1069, brass or bronze body; thermostatic element; corrosion- and lime-resistant internal components; integral locking temperature adjustment; integral check valves with strainer screens on inlets.

2.05 BALANCING VALVES

A. Manual Balancing Valves:
   1. Valve: Brass, ball or globe valve design, with metering ports, position indicator, and memory stop.
   2. Maximum Working Pressure: 150 psi.
   3. Working Temperature Range: 33 to 200 degrees F.

B. Automatic Balancing Valves:
   1. Valve: Brass, pressure independent, with removable cartridge.
   2. Maximum Working Pressure: 200 psi.
   3. Working Temperature Range: 33 to 200 degrees F.

C. Thermostatic Balancing Valves:
   1. Valve: Brass, with thermostatic element to maintain constant temperature in domestic hot water recirculating system; provide with tamper-resistant temperature adjustment knob.
   2. Maximum Working Pressure: 150 psi.
   3. Working Temperature Range: 33 to 200 degrees F.

2.06 STRAINERS

A. Manufacturers:
   1. NIBCO INC: www.nibco.com/#sle.
   2. Substitutions: See Section 016000 - Product Requirements.

B. NPS 2 and Smaller:
   1. Body: Wye-pattern in brass, bronze, or copper silicon alloy.
   2. Screen: Stainless steel mesh.
   3. Pressure Rating: 200 psi.

C. NPS 2-1/2 and Larger:

1. Body: Wye-pattern ductile iron, epoxy-coated cast iron, or epoxy-coated ductile iron,
   a. Epoxy Coatings: AWWA C550 or FDA approved.
2. Screen: Perforated stainless steel.
3. Pressure Rating: 200 psi.

2.07 OUTLET BOXES

A. Single-Fixture and Appliance Outlet Boxes:
1. Manufacturers:
   a. HoldRite, a brand of Reliance Worldwide Corporation; HR-F Series Fixture Outlet Box: www.holdrite.com/#sle.
   b. Substitutions: See Section 016000 - Product Requirements.
2. Description: Preformed plastic rough-in box or rough-in mini-box with backer plate and single chrome-plated brass quarter-turn ball valve.
   a. Provide mini-boxes with escutcheon in white primer or polished chrome finish.
3. Provide fire-rated assembly for installation in 1- and 2-hour-rated walls.
4. Accessories:
   a. Support brackets for installation between framing studs.
   b. Water-supply piping tailpiece.

2.08 DRAIN VALVES

A. Manufacturers:
1. Jones Stephens: www.jonesstephens.com/#sle.
2. Mueller Streamline, Co; Series 7700: www.muellerstreamline.com/#sle.
3. Substitutions: See Section 016000 - Product Requirements.

2.09 WATER-HAMMER ARRESTORS

A. Piston Type:
1. Description: ASSE 1010 or PDI-WH 201, copper body with plastic piston and EPDM O-rings.
2. Air Preload Pressure: 60 psi.
3. Maximum Working Pressure: 150 psi.
4. Working Temperature Range: 33 to 180 degrees F.

2.10 TRAP PRIMERS

A. Water-Supplied Trap Primers:
1. Description: ASSE 1018, bronze or brass body, water-supplied, pressure-drop activated trap primer with internal filter screen and integral vacuum breaker.
2. Operating Pressure Range: 20 to 80 psi.

B. Electronic Trap Primer Systems:
1. Manufacturers:
   a. MIFAB, Inc: www.mifab.com/#sle.
   b. Zurn Water, LLC: www.zurn.com/#sle.
   c. Substitutions: See Section 016000 - Product Requirements.
2. Description: ASSE 1044, packaged electronic trap primer system; factory piped and wired, with timer-controller, slow-acting solenoid, strainer, isolation valve, vacuum breaker, and distribution manifold.
3. Operating Pressure Range: 20 to 100 psi.
4. Controller Settings:
   a. Discharge Frequency: Once every 24 hours.
   b. Discharge Duration: 6 seconds.
   c. Discharge Volume to Each Port: Minimum 2 ounces of water.

PART 3 EXECUTION

3.01 EXAMINATION

A. Discard packing materials and verify product interiors are free from debris, damage, and corrosion.

B. Verify end connections, flanges, threads, and grooves are completely clean without signs of damage or degradation that could result in leakage.

C. For products containing isolation or shutoff valves, verify isolation and shutoff valves operate smoothly from fully closed to fully open.

3.02 INSTALLATION

A. Prior to installation of domestic water piping specialties, flush domestic water piping of foreign material.

B. Install products in accordance with manufacturer's instructions.

C. Install products level and plumb.

D. Install products with clearance for access and maintenance.

E. Support products NPS 2-1/2 and larger independently of surrounding pipe.

F. Support products with flanged or grooved ends independently of surrounding pipe.

G. For products containing isolation or shutoff valves, locate valves in horizontal piping with stems at or above center of piping, maintaining unimpeded stem movement.

H. Backflow Preventers:
   1. Install backflow preventers in accordance with requirements of local authorities having jurisdiction, including requirements of local water utility.
   2. Pipe relief from reduced-pressure-principle backflow preventers to nearest drain.

I. Thermostatic Master Mixing Valves: Unless noted otherwise on drawings, install with centerline at 48 inches above finish floor.

J. Balancing Valves: Install in accessible locations. Install shutoff valves on inlet and outlet.

K. Water Hammer Arrestors: Install in accordance with PDI-WH 201.

L. Trap Primers:
   1. Install trap primers minimum of 12 inches above flood level of highest drain being served.
   2. Unless noted otherwise on drawings, install electronic trap primer systems with manifold centerline at 48 inches above finish floor.
   3. Check that water flows through piping and that there are no leaks before pouring slabs or closing in walls.
   4. Cap unused ports on distribution manifold.

3.03 FIELD QUALITY CONTROL

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

B. Inspect each product for damage and defects.

C. Repair or replace damaged products.

D. Replace defective products.

E. For products containing isolation or shutoff valves, exercise isolation and shutoff valves from fully closed to fully open. Confirm smooth operation.

F. Backflow Preventers:
   1. Test in accordance with manufacturer's instructions.
   2. Test in accordance with requirements of authorities having jurisdiction.
   3. Test in accordance with ASSE listing of backflow preventer.
   4. Replace backflow preventers that fail testing.

G. Vacuum Breakers:
   1. Test in accordance with manufacturer's instructions.
   2. Test in accordance with requirements of authorities having jurisdiction.
   3. Test in accordance with ASSE listing of vacuum breaker.
   4. Replace vacuum breakers that fail testing.

H. Mixing Valves: Confirm outlet temperature remains steady without fluctuation.

I. Electronic Trap Primer Systems:
   1. Clean strainer.
   2. Test system following manufacturer's instructions.
   3. Visually confirm that water has reached each drain and that traps are full of water.
   4. Operate system until each trap is full.

J. Coordination of Other Tests and Inspections: Provide access to accommodate tests and inspections by independent testing agencies employed by Owner.

3.04 ADJUSTING

A. Adjust mixing valves to design temperature set point.

B. Adjust balancing valves to design flow.

C. Adjust thermostatic balancing valves to design temperature setpoint.

D. Adjust electronic trap primers to design flow.

3.05 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean products to remove dirt, paint, and other foreign materials.

C. Clean surfaces of products exposed to view in finished spaces to remove dirt, fingerprints, paint, and other foreign materials. Restore finishes to match original factory finish.

D. Clean surfaces of products exposed to view on building exterior to remove dirt, fingerprints, paint, and other foreign materials. Restore finishes to match original factory finish.

E. Clean strainers, including those internal to other products, prior to mm-dd-yyyy.

3.06 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

END OF SECTION

SECTION 221319
SANITARY WASTE PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Floor drains.

B. Floor sinks.

C. Cleanouts.

1.02 SUBMITTALS

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

B. Product Data: Provide manufacturer's literature and data sheets for each product. Include information on fabrication materials, assembly of components, dimensions, ratings, finishes, rough-in requirements, and installed accessories.

C. Manufacturer's Instructions: Provide for products listed below. Include instructions for handling, protection, examination, preparation, and installation.

1.03 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

C. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

D. Store products under cover and protected from weather and dirt. Elevate above grade.

E. Store plastic products protected from direct sunlight.

PART 2 PRODUCTS

2.01 FLOOR DRAINS

A. Cast Iron Floor Drains:
   1. Manufacturers:
      a. Jones Stephens: www.jonesstephens.com/#sle.
      b. MIFAB, Inc: www.mifab.com/#sle.
      c. Zurn Water, LLC: www.zurn.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.
   2. Assembly: ASME A112.6.3.
   3. Body: Lacquered cast iron with anchor flange and membrane clamping collar with weepholes.
   4. Strainer: Adjustable, removable, with vandal-proof screws.
      a. Round:
         1) Material: Nickel bronze.
         2) Diameter: 6 inches.
      b. Square:
         1) Material: Nickel bronze.
         2) Size: 6 by 6 inches.
   5. Accessories:
      a. Trap seal insert.
   6. Products:
      a. MIFAB, Inc; F1100 Series: www.mifab.com/#sle.
      b. Zurn Water, LLC; Z415-BZ1: www.zurn.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.

2.02 FLOOR SINKS

A. Cast Iron Floor Sinks:
   1. Manufacturers:
      a. MIFAB, Inc: www.mifab.com/#sle.

b. Zurn Water, LLC: www.zurn.com/#sle.
c. Substitutions: See Section 016000 - Product Requirements.

2. Assembly: ASME A112.6.7.
3. Body: Cast iron with white acid-resistant enameled interior and interior anti-splash dome strainer.
   a. Round:
      1) Diameter: 8 inches.
      2) Sump Depth: 6 inches.
   b. Square:
      1) Size: 8 by 8 inches.
      2) Sump Depth: 6 inches.
4. Clamping Flange: Provide anchor flange with membrane clamping collar.
5. Accessories:
   a. Trap primer plug.
   b. Trap seal insert.
6. Products:
   a. MIFAB, Inc; FS1720-FL Series: www.mifab.com/#sle.
   b. Substitutions: See Section 016000 - Product Requirements.

B. Stainless Steel Floor Sinks:
1. Manufacturers:
   a. FoodSafe Drains, a Division of Global Drain Technologies: www.foodsafedrains.com/#sle.
   b. Zurn Water, LLC: www.zurn.com/#sle.
   c. Substitutions: See Section 016000 - Product Requirements.
2. Assembly: ASME A112.6.7.
3. Body: Fabricated, Type 304 stainless steel with interior anti-splash dome strainer.
4. Clamping Flange: Provide anchor flange with membrane clamping collar.
5. Accessories:
   a. Trap primer plug.
   b. Trap seal insert.

2.03 CLEANOUTS

A. Manufacturers:
1. Jones Stephens: www.jonesstephens.com/#sle.
2. MIFAB, Inc: www.mifab.com/#sle.
3. PROFLO: www.ferguson.com/#sle.
4. Zurn Water, LLC: www.zurn.com/#sle.
5. Substitutions: See Section 016000 - Product Requirements.

B. Floor Cleanouts:
1. Assembly: ASME A112.36.2.
2. Body: Lacquered cast iron.
3. Closure Plug: PVC or ABS, threaded, gastight and watertight.
4. Top: Adjustable, with vandal-proof screws.
   a. Shape and Finish:
      1) All Locations, Unless Noted Otherwise: Round; nickel bronze.
5. Accessories:
   a. Clamp ring and flange for floors with waterproofing membrane.
6. Products:
   a. Jones Stephens; LevelBest: www.jonesstephens.com/#sle.
   b. MIFAB, Inc; C1100 Series: www.mifab.com/#sle.
   c. Substitutions: See Section 016000 - Product Requirements.

C. Wall Cleanouts:
1. Assembly: ASME A112.36.2.
2. Body: Tee type; body material to match surrounding pipe.
3. Plug: PVC or ABS, threaded, gastight.
4. Access Cover: Round, stainless steel wall access cover with vandal-proof screw.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Maintain continuity of waterproofing membranes. Secure waterproofing membranes to drain clamping collars and bonding flanges.

C. Install drains so strainers and grates are level and are at design elevation.

D. Install floor sinks so grates are flush with finished floor unless noted otherwise or unless directed otherwise by adopted code.

E. Extend cleanouts to finished floor or wall surface. Ensure clearance at cleanout for rodding or jetting of drainage system.

F. Install floor cleanouts to allow for floor finishes.

G. Locate, provide, and install cleanouts in piping in accordance with adopted code.

3.03 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean debris from drains.

C. Clean grates and strainers prior to mm-dd-yyyy.

3.04 PROTECTION

A. Protect installed drains from accumulating dirt and debris through remainder of construction.

B. Protect installed products from damage due to subsequent construction operations.

END OF SECTION

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SECTION 221500
GENERAL-SERVICE COMPRESSED-AIR SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rotary-screw air compressors.

B. Reciprocating air compressors.

C. System filters.

D. Aftercoolers.

E. Air receivers.

F. Pipe and fittings.

G. Unions and couplings.

H. Pressure reducing stations.

I. Air outlets.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete.

B. Section 220523 - General-Duty Valves for Plumbing Piping.

1.03 REFERENCE STANDARDS

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

C. ASME B31.1 - Power Piping; 2024.

D. ASTM B32 - Standard Specification for Solder Metal; 2020.

E. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

F. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

1.04 SUBMITTALS

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

B. Product Data: Provide manufacturers catalog literature with capacity, weight, and electrical characteristics and connection requirements.

C. Certificates: Provide certificate of compliance from Authority Having Jurisdiction indicating approval of air receiver.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions, hoisting and setting requirements, starting procedures.

E. Operation Data: Submit for air compressor, air receiver, and accessories, aftercooler, refrigerated air dryer, and pressure reducing station.

F. Maintenance Data: Submit for air compressor, air receiver, and accessories, aftercooler, refrigerated air dryer, and pressure reducing station.

G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

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

B. Pressure Vessels: Comply with applicable code for installation of pressure vessels.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept air compressors, refrigerated air dryer on site in factory-fabricated containers with shipping skids and plastic pipe end protectors in place. Inspect for damage.

B. Protect piping and equipment from weather and construction traffic.

1.07 WARRANTY

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

B. Provide five year manufacturer warranty for reciprocating air compressors.

PART 2 PRODUCTS

2.01 ROTARY SCREW AIR COMPRESSORS

A. Electrically driven, air-cooled compressor unit; factory-assembled with air intake, intake filters, after-cooler, oil separator, oil cooler, moisture separator with drain trap, oil charging valve, gauges, sight glasses, vibration isolators, controls, and safeties.

2.02 RECIPROCATING AIR COMPRESSORS

A. Electrically driven, air-cooled compressor unit; factory-assembled with air intake, intake filters, after-cooler, oil separator, oil cooler, moisture separator with drain trap, oil charging valve, gauges, sight glasses, vibration isolators, controls, and safeties.

2.03 SYSTEM FILTERS

A. Cartridge Number 1: Coalescing.

B. Location: Downstream of air compressor.

C. Flow Capacity: Match compressor rate.

2.04 AFTERCOOLERS

A. Construction: Removable tube nests of non-ferrous metal tubes and corrosion-resistant tube plates, safety valves, pressure gauge, moisture separator, moisture drain valve, water inlet piping with automatic water valve, automatic condensate trap and overflow piping with open funnel.

2.05 AIR RECEIVERS

2.06 PIPE AND FITTINGS

A. Copper Tube: ASTM B88 (ASTM B88M), Type K, drawn temper.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, solder, Grade Sn95.

2.07 UNIONS AND COUPLINGS

A. Unions:
   1. Ferrous Pipe: 150 psi malleable iron threaded unions.
   2. Copper Tube and Pipe: 150 psi bronze unions with soldered joints.

2.08 PRESSURE REDUCING STATIONS

A. Pressure Reducing Station: Consisting of automatic reducing valve and bypass and low pressure side relief valve and gauge. Provide oil separator where indicated.

B. Valve Capacity: Reduce pressure from 200 psi to 30 psi, adjustable upwards from reduced pressure.

2.09 AIR OUTLETS

A. Quick Connector: 3/8 inch brass, snap-on connector with self closing valve, Style A.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.

B. Install compressor unit on concrete housekeeping pad. See Section 033000.

C. Make air cock and drain connection on horizontal casing.

D. Connect condensate drains to nearest floor drain.

E. Install valved drip connections at low points of piping system. See Section 220523.

3.02 FIELD QUALITY CONTROL

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

B. Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ASME B31.1.

C. Repair or replace compressed air piping as required to eliminate leaks, and retest to demonstrate compliance.

D. Cap and seal ends of piping when not connected to mechanical equipment.

END OF SECTION

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SECTION 224000
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush valve water closets.

B. Lavatories.

C. Sinks.

D. Under-lavatory pipe supply covers.

E. Bathtubs and showers.

F. Shower receptors.

G. Showers.

H. Mop sinks.

I. Service sinks.

J. Emergency eye and face wash.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).

C. ASME A112.18.1 - Plumbing Supply Fittings; 2024.

D. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011 (Reaffirmed 2022).

E. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2024.

F. ASME A112.19.3 - Stainless Steel Plumbing Fixtures; 2022.

G. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2022.

H. ASSE 1014 - Performance Requirements for Backflow Prevention Devices for Hand-Held Showers; 2020.

I. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2020.

J. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

K. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

L. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2021.

M. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

N. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

O. IAPMO Z124 - Plastic Plumbing Fixtures; 2022, with Editorial Revision.

P. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

Q. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

R. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

S. NSF 61 - Drinking Water System Components - Health Effects; 2024.

T. NSF 372 - Drinking Water System Components - Lead Content; 2024.

U. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

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

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Manufacturer's Instructions: Indicate installation methods and procedures.

D. Sustainable Design Documentation: Submit appropriate evidence that materials used in potable water systems comply with the specified requirements.

E. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements for additional provisions.
   2. Extra Faucet Washers: One set of each type and size.
   3. Extra Lavatory Supply Fittings: One set of each type and size.
   4. Extra Shower Heads: One of each type and size.
   5. Extra Toilet Seats: One of each type and size.
   6. Flush Valve Service Kits: One for each type and size.

1.05 QUALITY ASSURANCE

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

1.06 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. See Section 017800 - 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.

C. Maximum Fixture or Faucet Supply Pressure: 60 psi unless stated otherwise.

2.02 REGULATORY REQUIREMENTS

A. Comply with applicable codes for installation of plumbing systems.

B. Comply with UL (DIR) requirements.

C. Perform work in accordance with local health department regulations.

D. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of installation.

2.03 FLUSH VALVE WATER CLOSETS

A. Water Closets:
   1. Vitreous china, ASME A112.19.2, floor mounted, siphon jet flush action, china bolt caps.
   2. Bowl: ASME A112.19.2; with rim height as indicated on the plans high with elongated rim.
   3. Flush Valve: Exposed (top spud).
   4. Flush Operation: Sensor operated.
   5. Handle Height: 44 inches or less.
   6. Inlet Size: 1-1/2 inches.
   7. Trapway Outlet: 4 inch.

8. Color: White.
9. Manufacturers:
    a. Advanced Modern Technologies Corporation: www.amtcorporation.com/#sle.
    b. American Standard, Inc: www.americanstandard-us.com/#sle.
    c. Gerber Plumbing Fixtures LLC: www.gerberonline.com/#sle.
    d. Kohler Company: www.kohler.com/#sle.
    e. Zurn Industries, LLC: www.zurn.com/#sle.
    f. Substitutions will be allowed: See Section 016000 - Product Requirements.

B. Flush Valves:
1. Valve Supply Size: 1 inch.
2. Valve Outlet Size: 1-1/2 inches.
3. Manufacturers:
    a. American Standard, Inc: www.americanstandard-us.com/#sle.
    b. Sloan Valve Company: www.sloanvalve.com/#sle.
    c. Zurn Industries, LLC; ZEMS Series: www.zurn.com/#sle.
    d. Substitutions will be allowed: See Section 016000 - Product Requirements.
4. Sensor-Operated:
    a. Type: ASME A112.19.5; chloramine-resistant clog-resistant dual-seat diaphragm valve complete with vacuum breaker, stops and accessories.
    b. Mechanism: Solenoid-operated piston or electronic motor-actuated operator with low-voltage powered infrared sensor, and mechanical override or override push button.
    c. Supplied Volume Capacity: 1.2 gal per flush.
5. Exposed Type: Chrome-plated, escutcheon, integral screwdriver stop.

C. Toilet Seats:
1. Manufacturers:
    a. American Standard, Inc: www.americanstandard-us.com/#sle.
    b. Bemis Manufacturing Company: www.bemismfg.com/#sle.
    c. Church Seat Company: www.churchseats.com/#sle.
    d. Olsonite: www.olsonite.com/#sle.
    e. Zurn Industries, LLC: www.zurn.com/#sle.
    f. Substitutions will be allowed: See Section 016000 - Product Requirements.

D. Water Closet Carriers:
1. Manufacturers:
    a. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
    b. JOSAM Company: www.josam.com/#sle.
    c. Zurn Industries, LLC; Z1201-N: www.zurn.com/#sle.
    d. Substitutions will be allowed: See Section 016000 - Product Requirements.
2. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.04 LAVATORIES

A. Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com/#sle.
2. Kohler Company: www.kohler.com/#sle.
3. Zurn Industries, LLC: www.zurn.com/#sle.
4. Substitutions will be allowed: See Section 016000 - Product Requirements.

B. Wall-Hung Basin:
1. Vitreous China: ASME A112.19.2; white, rectangular basin with splash lip, front overflow, soap depression, and hanger. Size as indicated on drawings with 4-inch centerset spacing.
2. Carrier:
    a. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.
    b. Manufacturers:
        1) Jay R. Smith MFG. Co: www.jrsmith.com/#sle.

2) JOSAM Company: www.josam.com/#sle.
3) Zurn Industries, LLC; Z1231: www.zurn.com/#sle.
4) Substitutions will be allowed: See Section 016000 - Product Requirements.

C. Under-Mount Sink:
1. Vitreous China: ASME A112.19.2; white interior, rectangular shape, front overflow, seal of putty, caulking, or concealed vinyl gasket, and white exterior finish. Size as indicated on drawings.

D. Supply Faucet:
1. Deck Mounted Faucet Manufacturers:
a. American Standard, Inc: www.americanstandard-us.com/#sle.
b. Kohler Company: www.kohler.com/#sle.
c. Stern Engineering; Classic Series: www.sternfaucets.com/#sle.
d. Zurn Industries, LLC; Aqua Sense Series: www.zurn.com/#sle.
e. Substitutions will be allowed: See Section 016000 - Product Requirements.
2. Single Lever Handle, Supply Faucet: ASME A112.18.1; deck-mount, ceramic cartridge disc valve, and maximum flow of 0.5 gpm, low-flow.
3. Two Handle, Supply Faucet: ASME A112.18.1; deck-mount, ceramic cartridge disc valve, and maximum flow of 0.5 gpm, low-flow.

E. Sensor Operated Faucet:
1. Cast brass, chrome plated, deck mounted with sensor located on neck of spout.
2. Spout Style: Standard.
3. Power Supply:
a. Wired: As indicated on drawings.
b. Wireless:
1) Battery: Replaceable alkaline or lithium type with 200,000 cycles, minimum.
2) Light Cell: Photovoltaic or infra-red cell that transforms both sunlight and artificial light into electrical energy for use and battery charging.
3) Low Battery Warning: Provide red or yellow colored indicator to light periodically at 30 days of remaining capacity and continuously 2 weeks prior to get fully discharged.
4. Mixing Valve: External lever operated.
5. Water Supply: 3/8 inch compression connections.
6. Aerator: Vandal resistant, 0.5 gpm, laminar flow device.
7. Automatic Shut-off: 30 seconds.
8. Sensor Range: Automatically adjusts.
9. Finish: Polished chrome.
10. Accessory: 4 inch deck plate.
11. Manufacturers:
a. American Standard, Inc: www.americanstandard-us.com/#sle.
b. Chicago Faucet Company: www.chicagofaucets.com/#sle.
c. Moen Incorporated: www.moen.com/#sle.
d. Powers Controls: www.powerscontrols.com/#sle.
e. Toto USA: www.totousa.com/#sle.
f. Watts: www.watts.com/#sle.
g. Zurn Industries, LLC: www.zurn.com/#sle.
h. Substitutions will be allowed: See Section 016000 - Product Requirements.

F. Thermostatic Mixing Valve:
1. ASSE 1070 listed with combination stop, strainer, and check valves, and flexible stainless steel connectors.
2. Manufacturers:
a. Cash Acme, a brand of Reliance Worldwide Corporation: www.cashacme.com/#sle.
b. Powers..
c. Watts.
d. Substitutions will be allowed: See Section 016000 - Product Requirements.
3. Braided hot and cold water supply lines.

4. Chrome plated 17 gauge, 0.0538 inch brass P-trap with clean-out plug and arm with escutcheon.

G. Accessories:
1. Chrome-plated 17 gauge, 0.0538 inch brass P-trap with clean-out plug and arm with escutcheon.

H. Accessories:
1. Offset waste with perforated open strainer.
2. Screwdriver stops.
3. Rigid supplies.

2.05 SINKS

A. Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com/#sle.
2. Kohler Company: www.kohler.com/#sle.
3. Elkay..
4. Substitutions will be allowed: See Section 016000 - Product Requirements.

B. Single Compartment Bowl
1. ASME A112.19.3; Dimensions as indicated, 20 gauge, 0.0359 inch thick, Type 302 stainless steel, self rimming and undercoated, with ledge back drilled for trim.
2. Drain: 1-1/2 inch chromed brass.
3. Drain: 3-1/2 inch crumb cup and tailpiece.

C. Double Compartment Bowl:
1. Drain: 1-1/2 inch chromed brass.
2. Drain: 3-1/2 inch crumb cup and tailpiece.

D. Undermount-Installed Single Compartment Bowl:
1. ASME A112.19.3, stainless steel, 18 gauge, 0.050 inch, type 304 stainless steel.
2. Drain: 3-1/2 inch, stainless steel with strainer, crumb cup, and tailpiece.

E. Undermount-Installed Double Compartment Bowl:
1. ASME A112.19.3, stainless steel, 18 gauge, 0.050 inch, type 304 stainless steel.
2. Bowl Proportion: Equally sized.
3. Drain: 3-1/2 inch, stainless steel with strainer, crumb cup, and tailpiece.

2.06 UNDER-LAVATORY PIPE SUPPLY COVERS

A. Manufacturers:
1. Plumberex Specialty Products, Inc: www.plumberex.com/#sle.
2. Truebro IPS Corp..
3. Substitutions will be allowed: See Section 016000 - Product Requirements.

B. General:
1. Insulate exposed drainage piping including hot, cold and tempered water supplies under lavatories or sinks per ADA Standards.
2. Exterior Surfaces: Smooth nonabsorbent for easy cleaning.
3. Construction: 1/8 inch PVC with antimicrobial, antifungal and UV resistant properties.
   a. Provide one piece injected molded design with internal bridge at top of J-bend to prevent separating.
   b. Comply with ASTM E84 for flame and smoke development.
   c. Comply with ASTM C1822 Type III for covers on accessible lavatory piping.
   d. Comply with ASME A112.18.9 for covers on accessible lavatory piping.
   e. Comply with ICC A117.1.
   f. Thermal Resistance: R value of 0.504 or lower when tested by ASTM C177.
   g. Thermal Conductivity: K value of 0.358 or density of 21.61 pcf per ASTM C518.
   h. Microbial and Fungal Resistance for Interior and Exterior: Comply with ASTM G21.
4. Color: High gloss white.
5. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces. No cable ties allowed.

2.07 BATHTUBS AND SHOWERS

A. Manufacturers:
   1. American Standard, Inc: www.americanstandard-us.com/#sle.
   2. Kohler Company: www.kohler.com/#sle.
   3. Substitutions will be allowed: See Section 016000 - Product Requirements.

B. Bath and Shower Trim: ASME A112.18.1; concealed shower and over rim supply with diverter spout, thermostatic mixing valve, bent shower arm with adjustable spray ball joint showerhead with maximum 2.5 gpm flow and escutcheon, lever operated pop-up waste and overflow.

C. Thermostatic Mixing Valve:
   1. ASSE 1070 listed with combination stop, strainer, and check valves, and flexible stainless steel connectors.
   2. Manufacturers:
      a. Cash Acme, a brand of Reliance Worldwide Corporation: www.cashacme.com/#sle.
      b. Leonard..
      c. Substitutions will be allowed: See Section 016000 - Product Requirements.

2.08 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 resin, renewable material filler, and pigments; homogenous, nonporous 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.
   4. Color and Pattern: As indicated.
   5. Manufacturers:
      a. American Bath Group: www.americanbathgroup.com/#sle.
      b. American Standard, Inc: www.americanstandard-us.com/#sle.
      c. Substitutions will be allowed: See Section 016000 - Product Requirements.

B. Drain Trim: Removable chrome-plated strainer and tail piece.

C. ADA 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 resin, renewable material filler, and pigments; homogenous, nonporous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
   2. Shower base to be recessed flush with finished floor and comply with ADA Standards and approved by the authorities having jurisdictions (AHJ).
   3. 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.
   4. Finish on Exposed Surfaces: Provide satin or matte, gloss rating of 3 to 20.
   5. Color and Pattern: As indicated.
   6. Manufacturers:
      a. American Bath Group: www.americanbathgroup.com/#sle.
      b. Substitutions will be allowed: See Section 016000 - Product Requirements.

D. Drain Trim: Removable chrome-plated strainer and tail piece.

2.09 SHOWERS

A. Manufacturers:
   1. American Bath Group: www.americanbathgroup.com/#sle.
   2. American Standard, Inc: www.americanstandard-us.com/#sle.
   3. Kohler Company: www.kohler.com/#sle.
   4. Substitutions will be allowed: See Section 016000 - Product Requirements.

B. Shower Valve:

1. Comply with ASME A112.18.1.
2. Provide two-handle, in-wall diverter valve body with integral thermostatic mixing valve to supply 1.5 gpm.

C. Wall Mounted Shower Valve:
1. Comply with ASME A112.18.1.

D. Shower Head:
1. ASME A112.18.1; chrome-plated vandal-proof institutional head with integral wall bracket, built-in 2.5 gpm flow control.

E. Hand-Held Shower Head:
1. ASME A112.18.1, adjustable spray hand-held shower head with swivel fitting with ASSE 1014 backflow preventer.
2. Include 60 inch minimum flexible polished stainless steel hose and in-line vacuum breaker
3. Provide 25 inch 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.

F. Thermostatic Mixing Valve:
1. Manufacturers:
   a. Cash Acme, a brand of Reliance Worldwide Corporation: www.cashacme.com/#sle.
   b. PROFLO; PFMVTD38: www.ferguson.com/#sle.
   c. Substitutions will be allowed: See Section 016000 - Product Requirements.
2. ASSE 1070 listed with combination stop, strainer, and check valves, and flexible stainless steel connectors.

2.10 MOP SINKS

A. Manufacturers:
1. Acorn Engineering Company: www.acorneng.com/#sle.
2. Just Manufacturing Company: www.justmfg.com/#sle.
3. Metcraft Industries, Inc: metcraftindustries.com/#sle.
4. Zurn Industries, LLC: www.zurn.com/#sle.
5. Substitutions will be allowed: See Section 016000 - Product Requirements.

B. Terrazzo Mop Sink Manufacturers:
1. Acorn Engineering Company: www.acorneng.com/#sle.
2. Just Manufacturing Company: www.justmfg.com/#sle.
3. Substitutions will be allowed: See Section 016000 - Product Requirements.

C. Material: Precast terrazzo composed of marble chips cast in Portland cement.

D. Type: Rectilinear, standard height.

E. Tiling Flange Construction: Galvanized steel.

F. Grid strainer: Stainless steel; integral; removable.

G. Dimensions: As indicated on drawings.

H. Accessories:
1. 5 feet of 1/2 inch diameter plain end reinforced plastic hose.
2. Hose clamp hanger.
3. Mop hanger.

2.11 SERVICE SINKS

A. Manufacturers:
1. Elkay Manufacturing Company: www.elkay.com/#sle.
2. Just Manufacturing Company: www.justmfg.com/#sle.
3. PROFLO; Double Bowl Sink with Legs: www.ferguson.com/#sle.
4. Substitutions will be allowed: See Section 016000 - Product Requirements.

2.12 EMERGENCY EYE AND FACE WASH

A. Manufacturers:
1. Haws Corporation: www.hawsco.com/#sle.
2. Substitutions will be allowed: See Section 016000 - Product Requirements.

B. Emergency Wash: ANSI Z358.1; wall-mounted, self-cleaning, nonclogging eye and face wash with quick opening, full-flow valves, stainless steel eye and face wash receptor, twin eye wash heads and face spray ring, stainless steel dust cover, copper alloy control valve and fittings.

C. Thermostatic Mixing Valve: Thermostatic mixing valve, ASSE 1070 listed, with combination stop, strainer, and check valves, and flexible stainless steel connectors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 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. Solidly attach water closets to floor with lag screws. Lead flashing is not intended to hold fixture in place.

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.

B. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

3.07 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 224500
EMERGENCY PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Eye/face wash equipment.

B. Safety stations (combination emergency fixture units).

C. Emergency-fixture water-tempering system.

1.02 REFERENCE STANDARDS

A. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2014, with Editorial Revision (2020).

B. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2023.

C. ASSE 1071 - Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment; 2012 (Reaffirmed 2021).

1.03 SUBMITTALS

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

PART 2 PRODUCTS

2.01 EYE/FACE WASH EQUIPMENT

A. Manufacturers:
   1. Encon Safety Products, Inc: www.enconsafety.com/#sle.
   2. Guardian Equipment: www.gesafety.com/#sle.
   3. Haws Corporation: www.hawsco.com/#sle.
   4. Hughes a company of Justrite Group: www.hughers-safety-showers.com/#sle.
   5. Justrite Manufacturing Company, LLC: www.justrite.com/#sle.
   6. Speakman Company: www.speakman.com/#sle.
   7. Sysbel: www.sysbelmfg.com/#sle.
   8. Substitutions: See Section 016000 - Product Requirements.

B. ANSI Z358.1, wall-mounted bowl with dual eye-spray head assembly.

C. Tepid Supply Water Temperature: Set to 85 degrees F.

D. Pipe and Fittings Material: PVC.

E. Valve: Full flow, self closing, quick to open thru wide-handle manual hand operator.

F. Drain: Built-into the bowl assembly with 1-1/4 inch female outlet.

G. Accessories:
   1. Signage: ANSI Z535.2, emergency eye/face wash safety equipment.
   2. Shut Off Valve: Provide upstream full flow ball valve with detached operating handle.

2.02 SAFETY STATIONS (COMBINATION EMERGENCY FIXTURE UNITS)

A. Manufacturers:
   1. Encon Safety Products, Inc: www.enconsafety.com/#sle.
   2. Guardian Equipment: www.gesafety.com/#sle.
   3. Haws Corporation: www.hawsco.com/#sle.
   4. Hughes a company of Justrite Group: www.hughers-safety-showers.com/#sle.
   5. Justrite Manufacturing Company, LLC: www.justrite.com/#sle.
   6. Speakman Company: www.speakman.com/#sle.
   7. Sysbel: www.sysbelmfg.com/#sle.
   8. Substitutions: See Section 016000 - Product Requirements.

B. Thermostatic Mixing Valve: ASSE 1071, manufacturer furnished, sized for maximum flow rate of safety station.

C. Tepid Supply Water Temperature: Set to 85 degrees F.

D. Pipe and Fittings Material: Powder coated galvanized steel.

E. Shower Head:
   1. Self-cleaning, non-clogging, 10 inches in diameter with escutcheon.
   2. Flow Pattern: Minimum, 20 inches at 60 inches above floor end.

F. Valves: Full flow, self closing, quick to open within one second using dedicated manual panic bar operator for shower and dedicated manual panic bar handle for eye wash.

2.03 EMERGENCY-FIXTURE WATER-TEMPERING SYSTEM

A. Manufacturers:
   1. ESBE: www.esbe.eu/global/en/#sle.
   2. Haws Corporation: www.hawsco.com/#sle.
   3. Speakman Company: www.speakman.com/#sle.
   4. Therm-Omega-Tech, Inc: www.thermomegatech.com/#sle.

B. Tepid Water Temperature: Set to 85 degrees F.

C. Above-freezing, Chemical-resistant System:

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that fixtures and accessories are of the correct type and size prior to installation.

B. Verify that deck, wall and floor finishes are prepared and ready for fixture installation.

3.02 INSTALLATION

A. Install fixtures and fittings in accordance with the manufacturer's instructions.

B. Adjust water flow rates to comply with manufacturer's rating of the fixture.

3.03 CLEANING

A. Thoroughly clean plumbing fixtures and equipment.

3.04 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Repair or replace products damaged before Date of Substantial Completion.

3.05 SCHEDULES

A. Fixture Heights: Install fixtures to heights above finished floor as indicated.
   1. Emergency Eye and Face Wash:
      a. Standard: 38 inches to receptor rim.
   2. Emergency Shower:
      a. Standard: 84 inches to bottom of head.

END OF SECTION

SECTION 226000
GAS AND VACUUM SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, tube, and fittings.

B. Valves.

C. Regulators and flowmeters.

D. Outlets.

E. Air compressors.

F. Alarm systems.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete.

B. Section 220517 - Sleeves and Sleeve Seals for Plumbing Piping.

C. Section 220529 - Hangers and Supports for Plumbing Piping and Equipment.

D. Section 220548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

E. Section 220553 - Identification for Plumbing Piping and Equipment.

1.03 ABBREVIATIONS AND ACRONYMS

A. CGA: Compressed Gas Association.

B. WAGD: Waste anesthesia gas disposal.

1.04 REFERENCE STANDARDS

A. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

B. ASME B16.50 - Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings; 2021.

C. ASSE/IAPMO/ANSI 6010 - Medical Gas System Installers; 2024.

D. ASSE/IAPMO/ANSI 6020 - Medical Gas Systems Inspectors; 2024.

E. ASSE/IAPMO/ANSI 6030 - Medical Gas Systems Verifiers; 2024.

F. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2023.

G. ASTM B819 - Standard Specification for Seamless Copper Tube for Medical Gas Systems; 2019.

H. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

I. CGA G-4.1 - Cleaning of Equipment for Oxygen Service; 2018.

J. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

K. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

L. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

M. NFPA 55 - Compressed Gases and Cryogenic Fluids Code; 2023, with Amendment .

N. NFPA 99 - Health Care Facilities Code; 2024, with Errata.

1.05 SUBMITTALS

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

B. Product Data: Provide manufacturer's literature and data sheets for each product. Include capacities, configurations, dimensions, finishes, weights, service condition requirements, and installed features.

1. Include sound level data for the following:
    a. Compressors.

C. Shop Drawings: Provide for products listed below. Indicate general assembly of components, mounting and installation details, unit dimensions, required clearances, construction details, field piping connection details, and electrical characteristics and connection requirements.
   1. Manifolds: Include dimensioned plans and elevations showing manifold, header assemblies, and cylinder arrangements.
   2. Outlets: Include elevation drawings showing arrangements of medical outlet wall assemblies.

D. Independent Inspection, Testing, and Verification Agency Reports: Documentation of inspection, testing, and verification results showing system compliance with NFPA 99.
   1. Submit copies to Owner.

E. Manufacturer's Instructions: Provide for products listed below. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.
   1. Outlets.
   2. Alarm systems.

F. Manufacturer's qualifications statement.

G. Installer's qualifications statement.

H. Inspector's qualification statement.

I. Testing and verification company's qualification statement.

J. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Medical Gas Systems: Select products and execute work in compliance with NFPA 99.

B. Laboratory Gas Systems: Select products and execute work in compliance with NFPA 55.

C. Bulk Oxygen Systems: Select products and execute work in compliance with NFPA 55.

D. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least three years of documented experience.

E. Installer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.
   1. Medical Gas and Medical Vacuum Systems: Certified in accordance with ASSE/IAPMO/ANSI 6010.

F. Inspector Qualifications: Company specializing in performing testing of type specified in this section, with minimum five years of documented experience.
   1. Medical Gas and Medical Vacuum System Inspectors: Certified in accordance with ASSE/IAPMO/ANSI 6020 or ASSE/IAPMO/ANSI 6030.

G. Testing and Verification Qualifications: Company specializing in performing testing of type specified in this section, with minimum five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept material on-site in factory containers and packing. Inspect for damage.

B. Protect from damage and contamination by maintaining factory packaging and caps in place until installation.

1.08 WARRANTY

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

PART 2 PRODUCTS

2.01 PERFORMANCE CRITERIA

A. Medical:
   1. Medical Air: 50 to 55 psig operating pressure.
   2. Medical Nitrogen: 160 to 185 psig operating pressure.
   3. Medical Nitrous Oxide: 50 to 55 psig operating pressure.
   4. Medical Oxygen: 50 to 55 psig operating pressure.
   5. Medical Vacuum: 15 in-Hg.

6. Medical Waste Anesthesia Gas Disposal: 15 in-Hg.

B. Laboratory:
   1. Laboratory Air: 50 to 55 psig operating pressure.

2.02 PIPE, TUBE, AND FITTINGS

A. Medical Gases:
   1. General Requirements:
      a. Pipe, tube, and fittings cleaned by manufacturer in accordance with CGA G-4.1.
      b. Pipe ends and tube ends factory capped or plugged by manufacturer prior to shipping and kept sealed until time of installation.
      c. Fittings sealed and labeled prior to shipping and kept sealed until time of installation.
   2. Copper Pipe:
      a. ASTM B819, seamless, drawn, Type L, factory labeled with nomenclature and colors complying with NFPA 99
         1) For nitrogen and instrument air systems with operating pressures in excess of 185 psig and with pipe sizes NPS 3 and larger, use Type K.
      b. Fittings: Wrought copper, ASME B16.22 or ASME B16.50.
      c. Joints: Brazed, AWS A5.8M/A5.8, copper-phosphorus or copper-phosphorus-silver brazing filler.

B. Laboratory Gases:
   1. General Requirements:
      a. Piping cleaned by manufacturer with pipe ends and tube ends factory capped or plugged by manufacturer prior to shipping and kept sealed until time of installation.
   2. Copper Pipe:
      a. ASTM B819, seamless, drawn, Type L.
      b. ASTM B280, seamless, drawn, Type ACR.
      c. Brazed Fittings and Joints:
         1) Fittings: Wrought copper, ASME B16.22 or ASME B16.50.
         2) Joints: Brazed, AWS A5.8M/A5.8, copper-phosphorus or copper-phosphorus-silver brazing filler.

C. Medical Vacuum and Waste Anesthesia Gas Disposal (WAGD) Systems:
   1. Copper Pipe:
      a. ASTM B819, seamless, drawn, Type L.
      b. Joints: Brazed, AWS A5.8M/A5.8, copper-phosphorus or copper-phosphorus-silver brazing filler.

2.03 VALVES

A. Manufacturers:
   1. Amico Corporation: www.amico.com/#sle.
   2. BeaconMedaes: www.beaconmedaes.com/#sle.
   3. Pattons Medical: www.pattonsmedical.com/#sle.
   4. Tri-Tech Medical: www.tri-techmedical.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

B. General Requirements for Valves for Medical and Laboratory Gas Systems:
   1. Manufacturer cleaned in accordance with CGA G-4.1.
   2. Sealed, bagged, and labeled prior to shipping in accordance with CGA G-4.1 and kept bagged and sealed until the time of installation.

C. Ball Valves:
   1. Three-piece, bronze body, MSS SP-110, double-seal, with quarter-turn handle and replaceable neoprene or teflon seat and stem seals, 600 psi cold working pressure.
   2. Ball Valves for Medical Gas Systems: Provide manufacturer-installed ASTM B819 Type K copper extensions with threaded purge ports on upstream and downstream sides of valve.

D. Zone Valve Boxes:
   1. Box: Galvanized steel with white powder-coat finish, flush-mounted and rigidly assembled to accommodate isolation valves and accompanying pressure gauges, punched or drilled sides to receive tubing, anchors to secure to wall construction.

2. Access: Cover plate or door. Cover plates and doors cannot close when valve handles are in closed position.
   a. Cover Plate: Anodized aluminum frame with replaceable plastic window with pull ring to remove window.
   b. Access Door: Steel, hinged, with white powder-coat finish, with magnetic seals and acrylic viewing window.
3. Valve Labels: Label and color code valves; indicate intended gas service and area served.
4. Pressure Gauges: Locate in valve box downstream of each isolation valve.

E. Emergency Oxygen Supply Connection:
1. Housing: Powder-coated steel enclosure, weathertight, with provisions for padlock or with keyed lock.
   a. Label: Permanently labeled: EMERGENCY OXYGEN SUPPLY CONNECTION.
2. Piping Assembly: Three-piece ball valve, pressure gauge, and female NPT inlet connection with threaded plug.

2.04 REGULATORS AND FLOWMETERS

A. General Requirements for Pressure Regulators and Flowmeters for Medical and Laboratory Gas Systems:
1. Manufacturer cleaned in accordance with CGA G-4.1.
2. Sealed, bagged, and labeled prior to shipping in accordance with CGA G-4.1 and kept bagged and sealed until the time of installation.

2.05 OUTLETS

A. Outlet Units:
1. Manufacturers:
   a. Allied Healthcare Products, Inc: www.alliedmedicalllc.com/#sle.
   b. Amico Corporation: www.amico.com/#sle.
   c. BeaconMedaes: www.beaconmedaes.com/#sle.
   d. NOVAIR USA: www.novair-usa.com/#sle.
   e. Pattons Medical: www.pattonsmedical.com/#sle.
   f. Tri-Tech Medical: www.tri-techmedical.com/#sle.
   g. Substitutions: See Section 016000 - Product Requirements.
2. NFPA 99 non-interchangeable connectors, automatic valves, secondary check valves (except vacuum and evacuation outlets), and capped 3/8 inch tubing stubs for supply connections, color coded and labeled for intended service.

B. Faceplates:
1. Flush Outlets: Mount in galvanized steel boxes with stainless steel faceplate with polycarbonate cover, color coded with embossed labeling.
2. Surface Outlets: Surface mount with color coded plastic cover and stainless steel faceplate with polycarbonate cover, color coded with embossed labeling.

2.06 AIR COMPRESSORS

A. Manufacturers:
1. Amico Corporation: www.amico.com/#sle.
2. BeaconMedaes: www.beaconmedaes.com/#sle.
3. FS-Curtis: us.fscurtis.com/#sle.
4. Kaeser Compressors, Inc: us.kaeser.com/#sle.
5. NOVAIR USA: www.novair-usa.com/#sle.
6. Pattons Medical: www.pattonsmedical.com/#sle.
7. Tri-Tech Medical: www.tri-techmedical.com/#sle.
8. Substitutions: See Section 016000 - Product Requirements.

B. Duplex Air Compressors:
1. Type: Oil-less scroll.
2. Compressors for Medical Use: Comply with NFPA 99.

3. Description: Packaged assembly; factory wired, piped, and tested; consisting of electrically driven air-cooled air compressors, air receiver, water-air separators, air dryers, accessories, and controls.
4. Compressors: Factory equip each compressor with motor, vibration isolators, intake filters, discharge check valve, inlet and outlet flexible connectors, isolation valve, aftercooler, moisture separator, safety relief valve, and temperature and pressure safety switches.
5. Receiver: Vertical, welded steel ASME receiver, prime coated with vinyl lining, with gauge, safety relief valve, and automatic tank drain.
6. Air Dryers: Integral, refrigerant or dessicant type, automatically draining, with pre-filters and post-filters.
7. Duplex Controller: Prewired in NEMA EN 10250 Type 12 enclosure with fusible disconnects, magnetic motor starters with overload protection, control circuit transformers, clock timer, pressure switches, visual and audible alarms, hand-off-automatic selector switches, and safety disconnect door.

2.07 ALARM SYSTEMS

A. High-Low Pressure Alarm Panel:
   1. Closed circuit, self-monitoring type to monitor single gas such as oxygen, vacuum, compressed air, nitrous oxide, or nitrogen.

B. Multi-Signal High-Low Pressure Alarm Panel:
   1. Closed circuit, self-monitoring type to monitor multiple gases such as oxygen, vacuum, compressed air, nitrous oxide, and nitrogen piping systems pressure or liquid level.
   2. Green light for systems normal.
   3. High-Low Pressure Switch: Dual circuit with two single pole, double throw, snap action switches, tested at 180 psi with adjustable range of 4 psi, preset at 40 psi and 60 psi.

C. Zone Pressure Annunciator:
   1. Panel with pressure gauge per gas line.
   2. Gas Line:
      a. Medical air.
      b. Nitrogen.
      c. Nitrous oxide.
      d. Oxygen.
      e. Vacuum.
      f. Waste anesthetic gas disposal.
   3. Accessories: Backbox, front cover, and customizable color-coded gas labels.

D. Digital Gas Pressure Monitor:
   1. Type: Display-module with hardwired pressure sensor.
   2. Base Module Interface:
      a. Numeric display with alarm buzzer.
      b. Self-test, silence, and programming controls.
      c. Up to six digital numeric-display modules.
   3. LED-based alarm level indicator, low to normal, and high.
   4. Pressure Modules with Externally Wired Sensors:
      a. Medical air.
      b. Nitrogen.
      c. Nitrous oxide.
      d. Oxygen.
      e. Vacuum.
      f. Waste anesthetic gas disposal.
   5. Accessories: Backbox, power supply, and color-coded labels per gas type with units.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install medical gas systems in accordance with NFPA 99.

B. Install laboratory gas systems in accordance with NFPA 55.

C. Install products and equipment in accordance with manufacturer's instructions.

D. Pipe, Tube, and Fittings:
   1. Install piping parallel and perpendicular to walls. Install without springing or forcing.
   2. Provide pipe sleeves where pipes and tubing pass through walls, floors, roofs, and partitions. Extend 2 inches above finished floors. See Section 220517.
   3. Make changes in size with reducing fittings.
   4. Make changes in direction or required turns or offsets with fittings.
   5. Cut pipe and tubing accurately and squarely.
   6. Ream pipe and tube ends. Remove burrs.
   7. Remove scale and dirt from outside of piping before assembly.

E. Pipe Hangers and Supports:
   1. See Section 220529. Install in accordance with MSS SP-58.
   2. Medical Gases: Space hangers and support vertical piping in accordance with NFPA 99.

F. Piping Identification:
   1. Identify piping with tape and decals. See Section 220553.
   2. Install labeling on pipe at intervals of not more than 20 feet and at least once in each room and each story traversed by pipeline.
   3. Medical Gas Systems: Label and color code piping in accordance with NFPA 99.

G. Valves:
   1. Install zone valves in valve boxes.
   2. Except where indicated or in flush wall mounted cabinets, install manual shut off valves with stem vertical and accessible for operation and maintenance.

H. Compressors, Vacuum Pumps, WAGD Vacuum Pumps, and Oral Evacuation Pumps:
   1. Vibration and Noise Isolation: See Section 220548.
   2. Install compressors and vacuum pumps on concrete housekeeping pad. See Section 033000.
   3. Install isolation valves at connections to equipment.
   4. Isolate systems including receivers, dryers, and filters until after completion and approval of purity tests for compressed air system. Tie-in at flange or union joint.

3.02 FIELD QUALITY CONTROL

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

B. Medical Gas Systems: Inspect, test and verify systems and equipment in accordance with NFPA 99. Submit documentation of inspection, testing, and verification results.

C. Laboratory Gas Systems: Engage independent agency to perform tests and inspections. Submit documentation of inspection and testing results.

D. After erection of pipe and tubing but prior to installation of service outlet valves, blow systems clear of free moisture and foreign matter with nitrogen gas.

E. Disconnect test gas and connect proper gas to each system. Purge entire system to remove test gas. Check with analyzer suitable for gas installed.

3.03 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals for closeout submittals.

END OF SECTION

SECTION 230513
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General construction and requirements.

B. Applications.

C. Single phase electric motors.

D. Three phase electric motors.

E. Electronically Commutated Motors (ECM).

1.02 REFERENCE STANDARDS

A. NEMA MG 00001 - Motors and Generators; 2024.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

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

B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

D. Operation Data: Include instructions for safe operating procedures.

E. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.04 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.06 WARRANTY

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Baldor Electric Company/ABB Group: www.baldor.com/#sle.

B. Leeson Electric Corporation: www.leeson.com/#sle.

C. Regal-Beloit Corporation (Century): www.centuryelectricmotor.com/#sle.

D. Substitutions: See Section 016000 - Product Requirements.

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service:
   1. Motors 3/4 HP and Smaller: 115 volts, single phase, 60 Hz.
   2. Motors Larger than 3/4 Horsepower: 480 volts, three phase, 60 Hz.

B. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 104 degrees F environment.
   3. Design for temperature rise in accordance with NEMA MG 00001 limits for insulation class, service factor, and motor enclosure type.

C. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

D. Wiring Terminations:
   1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
   2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.03 APPLICATIONS

A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not comply with these specifications.

B. Motors located in exterior locations, wet air streams downstream of sprayed coil dehumidifiers, draw through cooling towers, air cooled condensers, humidifiers, direct drive axial fans, roll filters, explosion proof environments, and dust collection systems: Totally enclosed type.

C. Motors located in outdoors, in wet air streams downstream of sprayed coil dehumidifiers, in draw through cooling towers, and in humidifiers: Totally enclosed weatherproof epoxy-treated type.

2.04 SINGLE PHASE POWER - SPLIT PHASE MOTORS

A. Starting Torque: Less than 150 percent of full load torque.

B. Starting Current: Up to seven times full load current.

2.05 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Starting Torque: Exceeding one fourth of full load torque.

B. Starting Current: Up to six times full load current.

2.06 SINGLE PHASE POWER - CAPACITOR START MOTORS

A. Starting Torque: Three times full load torque.

B. Starting Current: Less than five times full load current.

C. Pull-up Torque: Up to 350 percent of full load torque.

2.07 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Comply with NEMA MG 00001 for Design B motors.

2.08 ELECTRONICALLY COMMUTATED MOTORS (ECM)

A. Applications:
   1. Commercial:
      a. Roof Top Unit:
         1) Input: Motor manufacturer to coordinate control requirements with the control board of the roof top unit and/or specified sequence of operation.
      b. DX Fan Coil Unit:
         1) Input: Motor manufacturer to coordinate control requirements with the control board of the DX fan coil unit and/or specified sequence of operation.
      c. Fan Filter Unit:
         1) Input: Motor manufacturer to coordinate control requirements with the control board of the fan filter unit and/or specified sequence of operation.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION

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SECTION 230516
EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible pipe connectors.

B. Expansion joints and compensators.

1.02 RELATED REQUIREMENTS

A. Section 232113 - Hydronic Piping.

1.03 REFERENCE STANDARDS

A. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

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

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with UL (DIR) requirements.

2.02 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Manufacturers:
   1. Flex-Weld, Inc: www.kelcoind.com/#sle.
   2. FNW: www.fnw.com/#sle.
   3. Mercer Rubber Company: www.mercer-rubber.com/#sle.
   4. The Metraflex Company: www.metraflex.com/#sle.
   5. Unisource Manufacturing, Inc; Series 401, Stainless Steel Threaded Connectors: www.unisource-mfg.com/#sle.
   6. Substitutions: See Section 016000 - Product Requirements.

B. Inner Hose: Bronze.

C. Exterior Sleeve: Single braided, stainless steel.

D. Pressure Rating: 125 psi up to 12 inch.

2.03 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

A. Manufacturers:
   1. FNW: www.fnw.com/#sle.
   2. Mercer Rubber Company: www.mercer-rubber.com/#sle.
   3. The Metraflex Company: www.metraflex.com/#sle.
   4. Unisource Manufacturing, Inc; Series 411, Bronze Braided Flex Connectors: www.unisource-mfg.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

B. Inner Hose: Bronze.

C. Exterior Sleeve: Braided bronze.

D. Pressure Rating: 125 psi up to 2 inch.

E. Maximum Service Temperature: 450 degrees F.

F. End Connections: Flanged.

G. Size: Use pipe sized units.

H. Maximum offset: 3/4 inch on each side of installed center line.

I. Application: Copper piping.

2.04 EXPANSION JOINTS - SINGLE SPHERE, FLEXIBLE CONNECTOR

A. Manufacturers:
   1. Flex-Hose Co. Inc: www.flexhose.com/#sle.
   2. Flex-Weld, Inc; Rubber Expansion Joints: www.kelcoind.com/#sle.

3. FNW: www.fnw.com/#sle.
4. Mercer Rubber Company: www.mercer-rubber.com/#sle.
5. The Metraflex Company; Cablesphere: www.metraflex.com/#sle.
6. Unisource Manufacturing, Inc; Series 301, Single Sphere Connectors: www.unisource-mfg.com/#sle.
7. Substitutions: See Section 016000 - Product Requirements.

B. Body Construction: Nylon-reinforced rubber tube.

C. Cover and Tube Elastomer: EPDM and EPDM.

D. End Connections: Carbon steel flanges.

E. Maximum Elongation: 3/8 inch.

F. Maximum Angular Movement: 15 degrees.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

END OF SECTION

SECTION 230517
SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.

B. Pipe-sleeve seals.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 230719 - HVAC Piping Insulation.

1.03 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2024.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

C. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

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

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.

1.05 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 work of the type specified this section.
   1. Minimum three years experience.
   2. Approved by manufacturer.

C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.07 WARRANTY

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

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Manufacturers:
   1. American Polywater Corporation; PZVR Watertight Wall Sleeves for Pipes: www.polywater-haufftechnik.com/#sle.
   2. Flexicraft Industries; Pipe Wall Sleeve: www.flexicraft.com/#sle.
   3. Substitutions: See Section 016000 - Product Requirements.

B. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.
   3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.

4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

C. Plastic or Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

D. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:
1. Galvanized steel pipe or black iron pipe with asphalt coating.
2. Connect sleeve with floor plate except in mechanical rooms.

E. Clearances:
1. Provide allowance for insulated piping.
2. Wall, Floor, Partitions, and Beam Flanges: 1 inch greater than external pipe diameter.
3. All Rated Openings: Caulked tight with fire stopping material in compliance with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.02 PIPE-SLEEVE SEALS

A. Manufacturers:
1. Advance Products & Systems, LLC; Innerlynx: www.apsonline.com/#sle.
2. American Polywater Corporation; PGKD Modular Seals: www.polywater-haufftechnik.com/#sle.
3. Flexicraft Industries; PipeSeal: www.flexicraft.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Modular Mechanical Sleeve-Seal:
1. Elastomer-based interlocking links continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
3. Size and select seal component materials in accordance with service requirements.
4. Service Requirements:
   a. Corrosion resistant.
   b. Oil, fuel, gas, and solvent resistant.
   c. Underground, buried, and wet conditions.
   d. Fire Resistant: 1 hour, UL (DIR) approved.
   e. High Temperature, up to 400 degrees F.
   f. Low temperature, down to minus 67 degrees F.
5. Glass-reinforced plastic pressure end plates.

C. Sealing Compounds:
1. Provide packing and sealing compound to fill pipe to sleeve thickness.
2. Combined packing and seal compound is to match partition fire-resistance hourly rating.

D. Pipe Sleeve Material:
1. Bearing Walls: Steel, cast iron, or terra-cotta pipe.
2. Masonry Structures: Sheet metal or fiber.

E. Wall Sleeve: Steel material with waterstop collar, and nailer end-caps.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Inserts:
1. Provide inserts for placement in concrete formwork.

2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Structural Considerations:
1. Do not penetrate building structural members unless indicated.

F. Provide sleeves when penetrating footings, floors, walls, partitions, and other structural elements. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
1. Aboveground Piping:
a. Pack solid using mineral fiber in compliance with ASTM C592.
b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
2. All Rated Openings: Caulk tight with fire stopping material in compliance with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.
3. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

G. Manufactured Sleeve-Seal Systems:
1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a water-tight seal.
6. Install in accordance with manufacturer's recommendations.

H. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.03 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

C. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.

END OF SECTION

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SECTION 230519
METERS AND GAUGES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure gauges and pressure gauge taps.

B. Thermometers and thermometer wells.

C. Static pressure gauges.

1.02 RELATED REQUIREMENTS

A. Section 232113 - Hydronic Piping.

1.03 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014 (Reapproved 2025).

C. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

C. Project Record Documents: Record actual locations of components and instrumentation.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.

1.05 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
   2. FNW: www.fnw.com/#sle.
   3. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.
   4. Omega Engineering, Inc: www.omega.com/#sle.
   5. Winters Instruments: www.winters.com/#sle.
   6. Substitutions: See Section 016000 - 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 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.

B. Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi.

2.03 STEM TYPE THERMOMETERS

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
   2. Omega Engineering, Inc: www.omega.com/#sle.

3. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.
4. Winters Instruments: www.winters.com/#sle.
5. Substitutions: See Section 016000 - Product Requirements.

B. Thermometers - Fixed Mounting: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish.
1. Size: 9 inch scale.
2. Window: Clear Lexan.
3. Stem: 3/4 inch brass.
4. Calibration: Degrees F.

2.04 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.05 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

2.06 STATIC PRESSURE GAUGES

A. Manufacturers:
1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
2. Omega Engineering, Inc: www.omega.com/#sle.
3. Veris Industries: www.veris.com/#sle.
4. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.
5. Substitutions: See Section 016000 - Product Requirements.

B. 3-1/2 inch diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge.

C. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

D. Install thermometers in air duct systems on flanges.

E. Install thermometer sockets adjacent to controls system thermostat, transmitter, or sensor sockets. Refer to Section 230943. Where thermometers are provided on local panels, duct or pipe mounted thermometers are not required.

F. Locate duct mounted thermometers minimum 10 feet downstream of mixing dampers, coils, or other devices causing air turbulence.

G. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

H. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

I. Locate test plugs adjacent thermometers and thermometer sockets.

3.02 SCHEDULE

A. Pressure Gauges, Location and Scale Range:

B. Pressure Gauge Tappings, Location:
1. Control valves 3/4 inch & larger - inlets and outlets.
2. Major coils - inlets and outlets.

3. Heat exchangers - inlets and outlets.

C. Stem Type Thermometers, Location and Scale Range:
   1. Heat exchangers - inlets and outlets, 0 to 200 degrees F.

D. Thermometer Sockets, Location:
   1. Cabinet heaters - inlets and outlets.
   2. Unit heaters - inlets and outlets.

END OF SECTION

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SECTION 230523
GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Globe valves.

B. Ball valves.

C. Butterfly valves.

D. Check valves.

E. Gate valves.

1.02 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. PTFE: Polytetrafluoroethylene.

G. RS: Rising stem.

H. TFE: Tetrafluoroethylene.

I. WOG: Water, oil, and gas.

1.03 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2026.

C. ASME B31.9 - Building Services Piping; 2025.

D. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).

E. ASTM A536 - Standard Specification for Ductile Iron Castings; 2024.

F. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017 (Reapproved 2025).

G. MSS SP-67 - Butterfly Valves; 2022.

H. MSS SP-68 - High Pressure Butterfly Valves with Offset Design; 2021.

I. MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends; 2011.

J. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.

K. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010a.

L. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.

M. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

N. MSS SP-125 - Check Valves: Gray Iron and Ductile Iron, In-Line, Spring-Loaded, Center-Guided; 2018.

1.04 SUBMITTALS

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

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

1.05 QUALITY ASSURANCE

A. Manufacturer:
   1. Obtain valves for each valve type from single manufacturer.
   2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Use the following precautions during storage:
   1. Maintain valve end protection and protect flanges and specialties from dirt.
      a. Provide temporary inlet and outlet caps.
      b. Maintain caps in place until installation.
   2. Store valves in shipping containers and maintain in place until installation.
      a. Store valves indoors in dry environment.
      b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

B. Exercise the following precautions for handling:
   1. Handle large valves with sling, modified to avoid damage to exposed parts.
   2. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).

B. Provide the following valves for the applications if not indicated on drawings:
   1. Isolation (Shutoff): Butterfly, Gate, Ball, and Plug.
   2. Swing Check (Pump Outlet):
      a. Size 2 inch and Smaller: Bronze with bronze disc.
      b. Size 2-1/2 inch and Larger: Iron with lever and weight, lever and spring, center-guided metal, or center-guided with resilient seat.

C. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.

D. Chilled Water Valves:
   1. Size 2 inch and Smaller, Brass and Bronze Valves:
      a. Threaded ends.
      b. Ball: Full port, one piece, brass trim.
      c. Swing Check: Bronze disc, Class.
      d. Gate: NRS, Class 125.
      e. Globe: Bronze disc, Class 125.
   2. Size 2-1/2 inch and Larger, Iron Valves:
      a. 2-1/2 inch to 4 inch: Threaded ends.
      b. Ball: 2-1/2 NPS to 10 inch, Class 150.
      c. Single-Flange Butterfly: 2-1/2 inch to 12 inch, aluminum-bronze disc, EPDM seat, 200 CWP.
      d. Butterfly: High performance, single flange, Class 150.
      e. Swing Check: Metal seats, Class 125.
      f. Center-Guided Check: Compact-wafer, metal seat, Class 125.
      g. Gate: NRS, Class 125.

E. Heating Hot Water Valves:
   1. Size 2 inch and Smaller, Brass and Bronze Valves:
      a. Threaded ends.
      b. Ball: Full port, one piece, brass trim.
      c. Swing Check: Bronze disc, Class 125.
      d. Gate: NRS, Class 125.
   2. Size 2-1/2 inch and Larger, Iron Valves:

a. 2-1/2 inch to 4 inch: Threaded ends.
b. Ball: 2-1/2 inch to 10 inch, Class 150.
c. Single-Flange Butterfly: 2-1/2 inch to 12 inch, aluminum-bronze disc, EPDM seat, 200 CWP.
d. Swing Check: Metal seats, Class 125.
e. Gate: NRS, Class 125.

F. Low Pressure Steam Valves for Pressures of 15 psi or Less:
1. Size 2 inch and Smaller, Brass and Bronze Valves:
a. Ball: Full port, one piece, brass trim.
b. Gate: NRS, Class 125.
2. Size 2-1/2 inch and Larger, Iron Valves:
a. 2-1/2 inch to 4 inch: Threaded or Flanged ends.
b. Ball: 2-1/2 inch to 10 inch, Class 150.
c. Gate: NRS, Class 125.

G. Steam-Condensate Valves:
1. Size 2 inch and Smaller, Brass and Bronze Valves:
a. Gate: NRS, RS, and OS&Y, Class 125.
b. Ball: Full port, one piece, brass trim.
2. Size 2-1/2 inch and Larger, Iron Valves:
a. 2-1/2 inch to 4 inch with threaded or flanged ends.
b. Ball: 2-1/2 inch to 10 inch, Class 150.
c. Gate: NRS, Class 125.

2.02 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:
1. Hand Lever: Quarter-turn valves 6 inch and smaller.

D. Valves in Insulated Piping: Provide 2 inch stem extensions and the following features:
1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

E. Valve-End Connections:
1. Threaded End Valves: ASME B1.20.1.
2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.

F. General ASME Compliance:
1. Building Services Piping Valves: ASME B31.9.

2.03 BRONZE, GLOBE VALVES

A. CWP Rating: Class 125: 200 psi:
1. Comply with MSS SP-80, Type 1.
2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
3. Ends: Threaded or solder joint.
4. Stem and Disc: Bronze or PTFE.
5. Packing: Asbestos free.
6. Handwheel: Malleable iron.

2.04 BRASS, BALL VALVES

A. One Piece, Full Port with Brass Trim and Push-to-fit or Threaded Connections:
1. Comply with MSS SP-110.
2. CWP Rating: 200 psi.
3. Body: Forged brass.
4. Ends: Threaded.
5. Seats: PTFE or TFE.

6. Stem: Brass.
7. Ball: Chrome-plated brass.

B. Two Piece, Full Port with Stainless Steel Trim and Female Thread, Male thread, or Solder Connections:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psi.
3. WOG Rating: 600 psi.
4. Vacuum Rating: 28.9 in-Hg.
5. Body: Forged brass.
6. Seats: PTFE.
7. Stem: Stainless Steel.
8. Ball: Chrome-plated brass.
9. Hose-End Applications: Provide 3/4-inch hose connection. Include cap, gasket, and chain or tether.
10. Manufacturers:
    a. Apollo Valves: www.apollovalves.com/#sle.
    b. Bonomi North America, Inc: www.bonominorthamerica.com/#sle.
    c. Effebi; Gladiator: www.effebi.com/#sle
    d. FNW; 410A: www.fnw.com/#sle.
    e. Kitz Corporation of America; #68: www.kitzus-kca.com/#sle.
    f. Mueller Streamline, Co; Series 7700: www.muellerstreamline.com/#sle.
    g. Substitutions: See Section 016000 - Product Requirements.

2.05 BRONZE, BALL VALVES

A. General:
1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. One Piece, Reduced Port with Bronze Trim:
1. Comply with MSS SP-110.
2. CWP Rating: 400 psi.
3. Ends: Threaded.
4. Seats: PTFE.

C. Two Piece, Full Port with Bronze or Brass Trim:
1. Comply with MSS SP-110.
2. WSP Rating: 150 psi.
3. WOG Rating: 400 psi.
4. Body: Forged bronze or dezincified-brass alloy.
5. End Connections: Pipe thread or solder.
6. Seats: PTFE.
7. Stem: Bronze or brass.
8. Ball: Chrome plated brass.
9. Operator: Provide lockable handle and stem extension.
10. Manufacturers:
    a. Apollo Valves: www.apollovalves.com/#sle.
    b. Bonomi North America, Inc: www.bonominorthamerica.com/#sle.
    c. FNW; X450: www.fnw.com/#sle.
    d. Substitutions: See Section 016000 - Product Requirements.

2.06 IRON, BALL VALVES

A. Split Body, Full Port:
1. Comply with MSS SP-72.
2. CWP Rating: 200 psi.
3. Body: ASTM A126, gray iron.
4. Ends: Flanged.
5. Seats: PTFE.
6. Stem: Stainless steel.

7. Ball: Stainless steel.

2.07 IRON, SINGLE FLANGE BUTTERFLY VALVES

A. Wafer and Lug Style:
   1. Class 125 or 150.
   2. Comply with MSS SP-67, Type I.
   3. Wafer Style, CWP Ratings:
      a. Sizes 2 to 12 inches: 200 psi.
      b. Sizes 14 to 24 inches: 150 psi.
   4. Lug Style, CWP Ratings:
      a. Sizes 2 to 12 inches: 250 psi.
      b. Sizes 14 to 24 inches: 150 psi.
   5. Body Material: ASTM A126 cast iron or ASTM A536 ductile iron.
   6. Stem: One or two-piece stainless steel.
   7. Seat: NBR.
   8. Disc: Aluminum-bronze.

2.08 HIGH-PERFORMANCE, SINGLE FLANGE BUTTERFLY VALVES

A. Lug type; Bidirectional dead end service without downstream flange:
   1. Comply with MSS SP-68.
   2. Class 150: CWP Rating: 285 psi at 100 degrees F.
   3. Body: Provide carbon steel or stainless steel.
   4. Seat: Reinforced PTFE.
   5. Offset stem: Stainless steel.
   6. Disc: Stainless steel.

2.09 BRASS, HORIZONTAL SWING CHECK VALVES

A. Threaded End-Connections:
   1. Class 125: CWP Rating: 200 psi.
   2. Body: Forged brass.
   3. Disc: Forged brass.
   4. Hinge-Pin, Screw, and Cap: Forged brass.

2.10 BRONZE, SWING CHECK VALVES

A. Class 125:
   1. Pressure and Temperature Rating: MSS SP-80, Type 3.
   2. Design: Y-pattern, horizontal or vertical flow.
   3. WSP Rating: 200 psi.
   4. Body: Bronze, ASTM B62.
   5. End Connections: Threaded or soldered.
   6. Disc: Bronze.

2.11 IRON, FLANGED END SWING CHECK VALVES

A. Class 125:
   1. 150 psi with metal seats.
   2. 200 psi with metal seats and nonmetallic-to-metal seats.

2.12 IRON, SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125:
   1. Comply with MSS SP-71, Type I.
   2. Body Design: Clear or full waterway.
   3. Body Material: ASTM A126, gray iron with bolted bonnet.
   4. Ends: Flanged.
   5. Trim: Bronze.
   6. Gasket: Asbestos free.
   7. Closer Control: Factory installed, exterior lever, and spring or weight.

2.13 IRON, CENTER-GUIDED CHECK VALVES

A. Class 125, Compact-Wafer:

1. Comply with MSS SP-125.
2. Sizes 2-1/2 to 12 inch: CWP Rating; 200 psi.
3. Body Material: ASTM A126, gray iron.
4. Manufacturers:
   a. Apollo Valves: www.apollovalves.com/#sle.
   b. FNW: www.fnw.com/#sle.
   c. NIBCO INC: www.nibco.com/#sle.
   d. Substitutions: See Section 016000 - Product Requirements.

B. Class 125, Globe:
1. Comply with MSS SP-125.
2. Sizes 2-1/2 to 12 inch: CWP Rating; 200 psi.
3. Body Material: ASTM A126, gray iron.
4. Style: Spring loaded.
5. Ends: Flanged.

2.14 BRONZE, GATE VALVES

A. Rising Stem or OS&Y:
1. Pressure-Temperature Range: MSS SP-80, Type I.
2. Body: ASTM B62, bronze with integral seat and screw-in bonnet.
3. End Connections: Threaded or solder.
4. Stem: Bronze.
5. Disc: Solid wedge; bronze.
6. Packing: Asbestos free.
7. Handwheel Operator: Malleable iron, bronze, or aluminum.

2.15 IRON, GATE VALVES

A. NRS or OS&Y:
1. Comply with MSS SP-70, Type I.
2. Body Material: Gray iron with bolted bonnet.
3. Ends: Flanged.
4. Trim: Bronze.
5. Disc: Solid wedge.
6. Packing and Gasket: Asbestos free.
7. Manufacturers:
   a. Apollo Valves: www.apollovalves.com/#sle.
   b. FNW; 651B: www.fnw.com/#sle.
   c. NIBCO INC: www.nibco.com/#sle.
   d. Substitutions: See Section 016000 - Product Requirements.

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 as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

C. Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welds.

END OF SECTION

SECTION 230529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 055000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

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

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2025.

D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.

E. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

H. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

J. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

K. FM (AG) - FM Approval Guide; Current Edition.

L. MFMA-4 - Metal Framing Standards Publication; 2004.

M. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

N. UL (DIR) - Online Certifications Directory; Current Edition.

O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.

4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify COR of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.05 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

C. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.

D. Installer's Qualifications: Include evidence of compliance with specified requirements.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 4. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
   a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
   b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
   c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
   d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Materials for Metal Fabricated Supports: Comply with Section 055000.

C. Prefabricated Trapeze-Framed Metal Strut Systems:
1. Manufacturers:

a. ABB Installation Products: electrification.us.abb.com/#sle.
b. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
c. Custom Strut and Roll Forming, LLC: www.customstrut.com/#sle.
d. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
e. Gripple, Inc; Fast Track - Standard: www.gripple.com/#sle.
f. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
g. Substitutions: See Section 016000 - Product Requirements.
h. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

2. MFMA-4 compliant, pre-fabricated, MSS SP-58 type 59 continuous-slot metal strut channel with associated tracks, fittings, and related accessories.
3. MFMA-4 compliant, prefabricated, side-loading continuous-slot metal strut channel bracket with associated tracks, fittings, and related accessories.
4. Strut Channel or Bracket Material:
   a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
   b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
5. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
6. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
7. Accessories: Provide bracket covers, cable basket clips, cable tray clips, clamps, conduit clamps, fire-retarding brackets, j-hooks, protectors, and vibration dampeners.

D. Strut Channels:
1. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
2. Channel or Bracket Kits: Include rods, brackets, end-fixed fittings, covers, clips, and other related hardware required to complete sectional trapeze section for piping or other support.

E. Channel Nuts:
1. Provide carbon steel channel nut with epoxy copper or zinc finish and long, regular, or short spring.

F. Hanger Rods:
1. Threaded zinc-plated steel unless otherwise indicated.
2. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 1/2 inch diameter.
   b. Piping up to 1 inch: 1/4 inch diameter.
   c. Piping larger than 1 inch: 3/8 inch diameter.
   d. Trapeze Support for Multiple Pipes: 3/8 inch diameter.

G. Thermal Insulated Pipe Supports:
1. General Requirements:
   a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
   b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
   c. Pipe supports to be provided for nominally sized, 1/2 to 30 inch iron pipes.
   d. Insulation inserts to consist of rigid polyisocyanurate (urethane) insulation surrounded by a 360 degree, PVC jacketing.
2. PVC Jacket:
   a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
   b. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
   c. Thickness: 60 mil.
3. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.

H. Pipe Supports:

1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
2. Liquid Temperatures Up To 122 degrees F:
   a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
   b. Support From Below: MSS SP-58 Types 35 through 38.
3. Operating Temperatures from 122 to 446 degrees F:
   a. Overhead Support: MSS SP-58 Type 1 or 3 through 12, with appropriate saddle of MSS SP-58 Type 40 for insulated pipe.
   b. Roller Support: MSS SP-58 Types 41 or 43 through 46, with appropriate saddle of MSS SP-58 Type 39 for insulated pipe.
   c. Sliding Support: MSS SP-58 Types 35 through 38.

I. Beam Clamps:
1. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.
2. Beam C-Clamp: MSS SP-58 type 23, malleable iron and steel with plain, stainless steel, and zinc finish.
3. Small or Junior Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish. For inverted usage provide manufacturer listed size(s).
4. Wide Mouth Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish.
5. Centerload Beam Clamp with Extension Piece: MSS SP-58 type 30, malleable iron with plain finish.
6. FM (AG) and UL (DIR) Approved Beam Clamp: MSS SP-58 type 19, plain finish,
7. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
8. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

J. Riser Clamps:
1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
3. Medium Split Horizontal Pipe Clamp: MSS SP-58 type 4, carbon steel or stainless steel with epoxy plated, plain, stainless steel, or zinc plated finish.
4. Copper Tube Pipe Clamp: MSS SP-58 type 8, epoxy plated copper.
5. UL (DIR) listed: Pipe sizes 1/2 to 8 inch.

K. Strut Clamps:
1. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.
2. Cushioned Pipe or Tubing Strut Clamp: Provide strut clamp with thermoplastic elastomer cushion having dielectric strength of 670 V/mil.
3. Service Temperature Range: Minus 65 to 275 degrees F.

L. Pipe Hangers:
1. Split Ring Hangers:
   a. Provide hinged split ring and yoke roller hanger with epoxy copper or plain finish.
   b. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
   c. Provide hanger rod and nuts of the same type and material for a given pipe run.
   d. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.
2. Band Hangers, Adjustable:
   a. Manufacturers:
      1) Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
   b. MSS SP-58 Type 7 or 9, Zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
3. Swivel Ring Hangers, Adjustable:
   a. MSS SP-58 Type 10, epoxy-painted, zinc-colored.

b. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
c. FM (AG) and UL (DIR) listed for specific pipe size runs and loads.

4. Clevis Hangers, Adjustable:
a. Light-Duty: MSS SP-58 Type 1, zinc-colored, epoxy plated.
b. Standard-Duty: MSS SP-58 Type 1, zinc-colored, epoxy plated.
c. UL (DIR) listed: Pipe sizes 2-1/2 to 8 inch.

M. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
1. Manufacturers:
a. Anvil International; H-Block: www.anvilintl.com/#sle.
b. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
c. Erico International Corporation, a brand of Pentair: www.erico.com/#sle.
d. Green Link, Inc: www.greenlinkengineering.com/#sle.
e. PHP Systems/Design: www.phpsd.com/#sle.
f. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
3. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
4. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

N. Pipe Shields for Insulated Piping:
1. MSS SP-58 Type 40, ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel
2. General Construction and Requirements:
a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
b. Shields Material: UV-resistant polypropylene with glass fill.
c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
d. Minimum Service Temperature: Minus 40 degrees F.
e. Maximum Service Temperature: 178 degrees F.
f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

O. Anchors and Fasteners:
1. Manufacturers - Mechanical Anchors:
a. FNW; 7502: www.fnw.com/#sle.
b. Hilti, Inc: www.us.hilti.com/#sle.
c. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.
d. MKT Fastening: www.mktfasteningusa.com/#sle.
e. Powers Fasteners, Inc: www.powers.com/#sle.
f. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
g. Substitutions: See Section 016000 - Product Requirements.
2. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
3. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
4. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
5. Hollow Masonry: Use toggle bolts.
6. Hollow Stud Walls: Use toggle bolts.
7. Steel: Use beam-ceiling clamps, beam clamps, machine bolts, or welded threaded studs.
8. Beam Ceiling Flanges: ASTM A47/A47M Grade 32510, malleable iron or stainless steel with copper, plain, stainless steel, or zinc finish.
9. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
a. Comply with MFMA-4.
b. Channel Material: Use galvanized steel.
c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

PART 3 EXECUTION

3.01 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. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

C. Unless specifically indicated or approved by COR, do not provide support from suspended ceiling support system or ceiling grid.

D. Unless specifically indicated or approved by COR, do not provide support from roof deck.

E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

F. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

G. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

I. Secure fasteners according to manufacturer's recommended torque settings.

J. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

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

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 230553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe markers.

E. Ceiling tacks.

1.02 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting: Identification painting.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2025.

1.04 SUBMITTALS

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

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. 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. Air Handling Units: Nameplates.

B. Air Terminal Units: Tags.

C. Automatic Controls: Tags. Key to control schematic.

D. Control Panels: Nameplates.

E. Dampers: Ceiling tacks, where located above lay-in ceiling.

F. Major Control Components: Nameplates.

G. Piping: Tags.

H. Pumps: Nameplates.

I. Small-sized Equipment: Tags.

J. Thermostats: Nameplates.

K. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.02 NAMEPLATES

A. Manufacturers:
   1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com/#sle.
   2. Brimar Industries, Inc: www.pipemarker.com/#sle.
   3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
   4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   5. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.
   6. Substitutions: See Section 016000 - Product Requirements.

B. Letter Color: White.

C. Letter Height: 1/4 inch.

D. Background Color: Black.

E. Plastic: Comply with ASTM D709.

2.03 TAGS

A. Manufacturers:
   1. Advanced Graphic Engraving: www.advancedgraphicengraving.com/#sle.
   2. Brady Corporation: www.bradycorp.com/#sle.
   3. Brimar Industries, Inc: www.pipemarker.com/#sle.
   4. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
   5. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   6. Seton Identification Products, a Tricor Company: www.seton.com/#sle.
   7. Substitutions: See Section 016000 - Product Requirements.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 STENCILS

A. Manufacturers:
   1. Brady Corporation: www.bradycorp.com/#sle.
   2. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
   3. Insite Solutions, LLC: www.stop-painting.com/#sle.
   4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

B. Stencils: With clean cut symbols and letters of following size:
   1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
   2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
   3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.
   4. 8 to 10 inch Outside Diameter of Insulation or Pipe: 24 inch long color field, 2-1/2 inch high letters.
   5. Over 10 inch Outside Diameter of Insulation or Pipe: 32 inch long color field, 3-1/2 inch high letters.
   6. Ductwork and Equipment: 2-1/2 inch high letters.

C. Stencil Paint: As specified in Section 099123, semi-gloss enamel, colors complying with ASME A13.1.

2.05 PIPE MARKERS

A. Manufacturers:
   1. Brady Corporation: www.bradycorp.com/#sle.
   2. Brimar Industries, Inc: www.pipemarker.com/#sle.
   3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
   4. Seton Identification Products, a Tricor Company: www.seton.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

B. Color: Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Color code as follows:
   1. Heating, Cooling, and Boiler Feedwater: Green with white letters.

2.06 CEILING TACKS

A. Description: Steel with 3/4 inch 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.

B. Prepare surfaces in accordance with Section 099123 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 099123.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

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SECTION 230593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic, steam, and refrigerating systems.

C. Measurement of final operating condition of HVAC systems.

D. Sound measurement of equipment operating conditions.

E. Commissioning activities.

1.02 RELATED REQUIREMENTS

A. Section 012100 - Allowances: Inspection and testing allowances.

B. Section 019113 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

C. Section 230800 - Commissioning of HVAC.

1.03 PRICE AND PAYMENT PROCEDURES

A. Cash Allowance: See Section 012100 for additional requirements.

B. Allowance includes testing, adjusting, and balancing of mechanical systems.

1.04 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2024, with Errata (2025).

C. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2023.

1.05 SUBMITTALS

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

B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit to COR.
   2. Submit to the Commissioning Provider.
   3. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   4. Include certification that the plan developer has reviewed Contract Documents, the equipment and systems, and the control system with the COR and other installers to sufficiently understand the design intent for each system.
   5. Include at least the following in the plan:
      a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      c. Identification and types of measurement instruments to be used and their most recent calibration date.
      d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      e. Final test report forms to be used.
      f. Detailed step-by-step procedures for TAB work for each system and issue, including:
         1) Terminal flow calibration (for each terminal type).
         2) Diffuser proportioning.
         3) Branch/submain proportioning.
         4) Total flow calculations.
         5) Rechecking.
         6) Diversity issues.

g. Expected problems and solutions, etc.
h. Details of how TOTAL flow will be determined; for example:
   1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
   2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
i. Confirmation of understanding of the outside air ventilation criteria under all conditions.
j. Method of checking building static and exhaust fan and/or relief damper capacity.
k. Proposed selection points for sound measurements and sound measurement methods.
l. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. Progress Reports.

D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
1. Revise TAB plan to reflect actual procedures and submit as part of final report.
2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for COR and for inclusion in operating and maintenance manuals.
3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
5. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
6. Include the following on the title page of each report:
   a. Name of Testing, Adjusting, and Balancing Agency.
   b. Telephone number of Testing, Adjusting, and Balancing Agency.
   c. Project name.
   d. Project location.
   e. Project COR.
   f. Project Engineer.
   g. Project Contractor.
   h. Report date.

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. SMACNA (TAB).

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. TAB Agency Qualifications:
1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
2. Having minimum of three years documented experience.
3. Certified by one of the following:
   a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
   b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
   c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.

D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

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. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

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.
   1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to COR to facilitate spot checks during testing.

C. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 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. 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.

D. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

E. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

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. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

I. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

J. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

3.06 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

E. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.07 COMMISSIONING

A. See Sections 019113 - General Commissioning Requirements and 230800 for additional requirements.

B. Perform prerequisites prior to starting commissioning activities.

C. Fill out Prefunctional Checklists for:
   1. Air side systems.
   2. Water side systems.

D. Furnish to the Commissioning Provider, upon request, any data gathered but not shown in the final TAB report.

E. Re-check minimum outdoor air intake flows and maximum and intermediate total airflow rates for 25 percent of the air handlers plus a random sample equivalent to 10 percent of the final TAB report data as directed by Commissioning Provider.
   1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Provider.
   2. Use the same test instruments as used in the original TAB work.
   3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
   4. For purposes of re-check, failure is defined as follows:
      a. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.
      b. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.
      c. Temperatures: Deviation of more than one degree F.
      d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.
      e. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.
   5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.

F. In the presence of the Commissioning Provider, verify that:

1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.
3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

3.08 SCOPE

A. Test, adjust, and balance the following:
   1. HVAC Pumps.
   2. Packaged Roof Top Heating/Cooling Units.
   3. Air Handling Units.
   4. Fans.
   5. Air Filters.
   6. Air Terminal Units.
   7. Air Inlets and Outlets.

3.09 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer.
   2. Model/Frame.
   3. HP/BHP.
   4. Phase, voltage, amperage; nameplate, actual, no load.
   5. RPM.
   6. Service factor.

B. Pumps:
   1. Identification/number.
   2. Manufacturer.
   3. Size/model.
   4. Impeller.
   5. Discharge pressure.
   6. Suction pressure.
   7. Total operating head pressure.
   8. Shut off, discharge and suction pressures.
   9. Shut off, total head pressure.

C. Air Cooled Condensers:
   1. Identification/number.
   2. Location.
   3. Manufacturer.
   4. Model number.
   5. Serial number.
   6. Entering DB air temperature, design and actual.
   7. Leaving DB air temperature, design and actual.
   8. Number of compressors.

D. Cooling Coils:
   1. Identification/number.
   2. Location.
   3. Service.
   4. Manufacturer.
   5. Air flow, design and actual.

6. Entering air DB temperature, design and actual.
7. Entering air WB temperature, design and actual.
8. Leaving air DB temperature, design and actual.
9. Leaving air WB temperature, design and actual.
10. Water flow, design and actual.

E. Heating Coils:
1. Identification/number.
2. Location.
3. Service.
4. Air flow, design and actual.
5. Water flow, design and actual.
6. Water pressure drop, design and actual.
7. Entering water temperature, design and actual.
8. Leaving water temperature, design and actual.
9. Entering air temperature, design and actual.
10. Leaving air temperature, design and actual.
11. Air pressure drop, design and actual.

F. Air Moving Equipment:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.
7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.

G. Return Air/Outside Air:
1. Identification/location.
2. Design air flow.
3. Actual air flow.
4. Design return air flow.
5. Actual return air flow.
6. Design outside air flow.
7. Actual outside air flow.
8. Return air temperature.
9. Outside air temperature.
10. Required mixed air temperature.
11. Actual mixed air temperature.
12. Design outside/return air ratio.
13. Actual outside/return air ratio.

H. Exhaust Fans:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.
9. Fan RPM.

I. Duct Traverses:
1. System zone/branch.

2. Duct size.
3. Area.
4. Design velocity.
5. Design air flow.
6. Test velocity.
7. Test air flow.
8. Duct static pressure.
9. Air temperature.

J. Duct Leak Tests:
1. Description of ductwork under test.
2. Duct design operating pressure.
3. Duct design test static pressure.
4. Duct capacity, air flow.
5. Maximum allowable leakage duct capacity times leak factor.
6. Test apparatus:
   a. Blower.
   b. Orifice, tube size.
   c. Orifice size.
   d. Calibrated.
7. Test static pressure.
8. Leakage.

K. Air Monitoring Stations:
1. Identification/location.
2. System.
3. Size.
4. Area.
5. Design velocity.
6. Design air flow.
7. Test velocity.
8. Test air flow.

L. Terminal Unit Data:
1. Manufacturer.
2. Type, constant, variable, single, dual duct.
3. Identification/number.
4. Location.
5. Model number.
6. Size.
7. Minimum static pressure.
8. Minimum design air flow.
9. Maximum design air flow.
10. Maximum actual air flow.
11. Inlet static pressure.

M. Air Distribution Tests:
1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.
10. Percent of design air flow.

END OF SECTION

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SECTION 230713
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

C. Weather barrier coatings.

D. Jacketing and accessories.

1.02 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2024.

D. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2020.

E. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2025.

F. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2019 (Reapproved 2022).

G. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers; 2015 (Reapproved 2022).

H. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.

I. ASTM C1775 - Standard Specification for Laminate Protective Jacket and Tape for Use Over Thermal Insulation for Outdoor Applications; 2022.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

K. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

L. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

M. SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth; 2016b.

N. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

O. UL 181A - Closure Systems for Use with Rigid Air Ducts; Current Edition, Including All Revisions.

P. UL 181B - Closure Systems for Use with Flexible Air Ducts and Air Connectors; Current Edition, Including All Revisions.

Q. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

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

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.04 QUALITY ASSURANCE

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

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum 3 years of experience and approved by manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville: www.jm.com/#sle.
   3. Knauf Insulation; Performance+ Duct Wrap: www.knaufinsulation.com/#sle.
   4. Manson Insulation, a company of Knauf Insulation; AK FLEX with ECOSE (High-Temperature Application and Diameters Exceeding 10"): www.imanson.com/#sle.
   5. Owens Corning Corporation; SOFTR Duct Wrap FRK: www.owenscorning.com/en-us/#sle.
   6. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. K value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 250 degrees F.
   3. Maximum Water Vapor Absorption: 5.0 percent by weight.
   4. Products:
      a. Knauf Insulation; Performance+ Duct Wrap: www.knaufinsulation.com/#sle.
      b. Manson Insulation, a company of Knauf Insulation; Alley Wrap B: www.imanson.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure-sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

E. Tie Wire: Annealed steel, 16 gauge, 0.0508 inch diameter.

2.03 WEATHER BARRIER COATINGS

A. Weather-Resistive Barrier Coating: Fire-resistive, UV resistant, water-based mastic for use over closed cell polyethylene and polyurethane foam insulation; applied with glass fiber or synthetic reinforcing mesh.

1. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A, when tested in accordance with ASTM E84.
2. Water Vapor Permeance: Greater than 1.0 perm in accordance with ASTM E96/E96M.
3. Color: As selected by Architect.

2.04 JACKETING AND ACCESSORIES

A. Aluminum Jacket:
1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
2. Thickness: 0.016 inch sheet.
3. Finish: Smooth.
4. Joining: Longitudinal slip joints and 2 inch laps.
5. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.

B. Aluminum-Foil Laminate Jacket:
1. Factory-applied, pressure sensitive adhesive jacketing on paper release liner.
2. Finish: Aluminum smooth.
3. Comply with ASTM C1775.

C. Flexible Weather-Proofing Outdoor Jacket: Self-healing, field-applied outdoor cladding.
1. Material: Aluminum foil/polymer laminate with rubberized asphalt layer and acrylic adhesive.
2. Thickness: 34 mil, 0.034 inch.
3. Finish: Embossed.
4. Color: Silver.
5. Water Vapor Transmission: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
6. Mold Resistance: Pass when tested in accordance with ASTM C1338.
7. Emissivity: 0.30 when tested in accordance with ASTM C1371.

D. Reinforced Tape:
1. FSK tape suitable for sealing seams between insulation, insulated elbows, and fittings resulting in a tight, smooth surface without wrinkles.
2. Comply with UL 723 or ASTM E84.
3. Moisture Vapor Permeability: 0.00 perm inch, when tested in accordance with ASTM E96/E96M.
4. Finish: Match insulation.

E. UL181 Tape for Rigid and Flexible Ductwork:
1. Comply with UL 181A for rigid ductwork.
2. Comply with UL 181B for flexible ductwork.
3. Aluminum foil coated with pressure-sensitive adhesive on paper release liner.
4. Foil tape suitable for sealing seams between insulation, insulated elbows, and fittings resulting in a tight, smooth surface without wrinkles.
5. Finish: Printed with UL Listing for identification.

2.05 DUCT LINER

A. Manufacturers:
1. Aeroflex USA; AEROFLEX Breathe-EZ: www.aeroflexusa.com/#sle.
2. Armacell LLC; ArmaFlex Ultima: www.armacell.us/#sle.
3. CertainTeed Corporation: www.certainteed.com/#sle.
4. Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
5. Johns Manville: www.jm.com/#sle.
6. Knauf Insulation; Performance+ Duct Liner: www.knaufinsulation.com/#sle.
7. Manson Insulation, a company of Knauf Insulation; Akousti-Liner: www.imanson.com/#sle.
8. Owens Corning Corporation; QuietR Rotary Duct Insulation: www.owenscorning.com/en-us/#sle.
9. Substitutions: See Section 016000 - Product Requirements.

B. Glass Fiber Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; flexible blanket, rigid board, and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer, acrylic polymer, or black composite.
   1. Fungal Resistance: No growth when tested according to ASTM G21.
   2. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
   3. Service Temperature: Up to 250 degrees F.
   4. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.
   5. Minimum Noise Reduction Coefficients:
      a. 1/2 inch Thickness: 0.30.
      b. 1 inch Thickness: 0.45.
      c. 1-1/2 inches Thickness: 0.60.
      d. 2 inch Thickness: 0.70.

C. Adhesive: Waterproof, fire-retardant type, ASTM C916.

D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated Ducts Conveying Air Below Ambient Temperature:
   1. Provide insulation with vapor barrier jackets.
   2. Finish with tape and vapor barrier jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Insulated Ducts Conveying Air Above Ambient Temperature:
   1. Provide with or without standard vapor barrier jacket.
   2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

F. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with caulked aluminum jacket with seams located on bottom side of horizontal duct section.

G. Slope exterior ductwork to shed water.

H. External Duct Insulation Application:
   1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
   2. Secure insulation without vapor barrier with staples, tape, or wires.
   3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
   4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
   5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

I. Duct and Plenum Liner Application:
   1. Adhere insulation with adhesive for 90 percent coverage.
   2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
   3. Seal and smooth joints. Seal and coat transverse joints.
   4. Seal liner surface penetrations with adhesive.
   5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

3.03 SCHEDULES

A. Exhaust Ducts Within 10 ft of Exterior Openings:
   1. Flexible Glass Fiber Duct Insulation: [1-1/2 inches] thick, 3/4 pound per cubic foot density.

B. Exhaust Ducts Exposed to Outdoor Air:
   1. Flexible Glass Fiber Duct Insulation: [1-1/2 inches] thick, 3/4 pound per cubic foot density.

C. Outside Air Intake Ducts:
   1. Flexible Glass Fiber Duct Insulation: [3] inches thick, 3/4 pound per cubic foot density.

D. Supply Ducts and Return:
   1. Flexible Glass Fiber Duct Insulation: [2] inches thick, 3/4 pound per cubic foot density.

E. Supply ducts After Terminal Boxes:
   1. Flexible Glass Fiber Duct Insulation: [2] inches thick, 3/4 pound per cubic foot density.

END OF SECTION

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SECTION 230716
HVAC EQUIPMENT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment insulation.

B. Weather barrier coatings.

C. Jacketing and accessories.

1.02 REFERENCE STANDARDS

A. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

D. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

E. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2025.

F. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2022.

G. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2024.

H. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2024.

I. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

J. ASTM C1393 - Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks; 2025.

K. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.

L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

M. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

N. SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth; 2016b.

O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

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

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.

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 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturers:

1. CertainTeed Corporation: www.certainteed.com/#sle.
2. Johns Manville Corporation: www.jm.com/#sle.
3. Knauf Insulation: www.knaufinsulation.com/#sle.
4. Manson Insulation, a company of Knauf Insulation: www.imanson.com/#sle.
5. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: ASTM C553; flexible, noncombustible.
1. K Value: 0.36 at 75 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
2. Maximum Service Temperature: 1,000 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Insulation: ASTM C1393; pipe and tank, end grain adhered to jacket.
1. K Value: ASTM C177, 0.27 at 75 degrees F.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.
4. Products:
   a. Knauf Insulation; Performance+ Earthwool Pipe and Tank Insulation: www.knaufinsulation.com/#sle.
   b. Knauf Insulation; Performance+ KwikFlex Pipe and Tank Insulation: www.knaufinsulation.com/#sle.
   c. Manson Insulation, a company of Knauf Insulation; AK FLEX with ECOSE: www.imanson.com/#sle.
   d. Substitutions: See Section 016000 - Product Requirements.

D. Vapor Barrier Jacket: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.

2.03 GLASS FIBER, RIGID

A. Manufacturer:
1. CertainTeed Corporation: www.certainteed.com/#sle.
2. Johns Manville Corporation: www.jm.com/#sle.
3. Knauf Insulation; Earthwool Insulation Board: www.knaufinsulation.com/#sle.
4. Manson Insulation, a company of Knauf Insulation; AK Board: www.imanson.com/#sle.
5. Owens Corning Corporation: www.owenscorning.com/en-us/#sle.
6. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: ASTM C612 or ASTM C592; rigid, noncombustible.

2.04 CELLULAR GLASS

A. Pipe and Tubing Insulation: ASTM C552, Type II, Grade 6.
1. K Value: 0.35 at 100 degrees F.
2. Service Temperature Range: From 250 degrees F to 800 degrees F.
3. Water Vapor Permeability: 0.005 perm inch maximum per inch.
4. Water Absorption: 0.5 percent by volume, maximum.
5. Density: At least 6.12 pcf, minimum.

B. Block Insulation: ASTM C552, Type I, Grade 6.
1. K Value: 0.35 at 100 degrees F.
2. Service Temperature: 800 degrees F, maximum.
3. Water Vapor Permeability: 0.005 perm inch maximum per inch.
4. Water Absorption: 0.5 percent by volume, maximum.
5. Density: 6.12 pcf, minimum.

2.05 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
1. Aeroflex USA; AEROFLEX EPDM Sheet/Roll: www.aeroflexusa.com/#sle.
2. Armacell LLC; AP ArmaFlex: www.armacell.us/#sle.
3. Jones Stephens; Rubber Pipe Insulation: www.jonesstephens.com/#sle.
4. K-Flex USA LLC; Insul-Sheet: www.kflexusa.com/#sle.
5. Substitutions: See Section 016000 - Product Requirements

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

2.06 WEATHER BARRIER COATINGS

A. Weather-Resistive Barrier Coating: Fire-resistive, UV resistant, water-based mastic for use over closed cell polyethylene and polyurethane foam insulation; applied with glass fiber or synthetic reinforcing mesh.
   1. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A, when tested in accordance with ASTM E84.
   2. Water Vapor Permeance: Greater than 1.0 perm in accordance with ASTM E96/E96M.

2.07 JACKETING AND ACCESSORIES

A. Aluminum Jacket:
   1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
   2. Thickness: 0.016 inch sheet.
   3. Finish: Smooth.
   4. Joining: Longitudinal slip joints and 2 inch laps.
   5. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.

B. Stainless Steel Jacket: ASTM A666/A666M, Type 304 stainless steel.

C. Reinforced Tape:
   1. FSK tape suitable for sealing seams in insulation, insulated pipe bends, and fittings resulting in a tight, smooth surface without wrinkles.
   2. Comply with UL 723 or ASTM E84.
   3. Moisture Vapor Permeability: 0.00 perm inch, when tested in accordance with ASTM E96/E96M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Factory Insulated Equipment: Do not insulate.

C. Exposed Equipment: Locate insulation and cover seams in least visible locations.

D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

F. Insulated equipment containing fluids below ambient temperature; insulate entire system.

G. Fiber glass insulated equipment containing fluids below ambient temperature; provide vapor barrier jackets, factory-applied or field-applied. Finish with glass cloth and vapor barrier adhesive.

H. For hot equipment containing fluids 140 degrees F or less, do not insulate flanges and unions, but bevel and seal ends of insulation.

I. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.

J. Fiber glass insulated equipment containing fluids above ambient temperature; provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Finish with glass cloth and adhesive.

K. Exterior Applications:
   1. Provide vapor barrier jacket or finish with glass mesh reinforced vapor barrier cement.
   2. Cover with aluminum, stainless steel, or PVC.

L. Cover glass fiber insulation with metal mesh and finish with heavy coat of insulating cement.

END OF SECTION

SECTION 230719
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Flexible removable and reusable blanket insulation.

C. Weather barrier coatings.

D. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

1.03 REFERENCE STANDARDS

A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2025.

E. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2025.

F. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

G. ASTM D610 - Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces; 2025.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 3 years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 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 or UL 723.

2.02 GLASS FIBER, RIGID

A. Manufacturers:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Knauf Insulation; Performance+ Earthwool 1000 Pipe Insulation: www.knaufinsulation.com/#sle.
   4. Manson Insulation, a company of Knauf Insulation; Alley-K Pipe Insulation: www.imanson.com/#sle.
   5. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.owenscorning.com/en-us/#sle.
   6. Owens Corning Corporation; VaporWick Pipe Insulation: www.owenscorning.com/en-us/#sle.
   7. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. K Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
   1. K Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 650 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

D. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

E. Vapor Barrier Lap Adhesive: Compatible with insulation.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
   1. Aeroflex USA; AEROFLEX Self-Seal: www.aeroflexusa.com/#sle.
   2. Armacell LLC; AP ArmaFlex: www.armacell.us/#sle.
   3. Jones Stephens; Rubber Pipe Insulation: www.jonesstephens.com/#sle.
   4. K-Flex USA LLC; Insul-Tube: www.kflexusa.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

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.
   2. Maximum Service Temperature: 180 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

D. Weather Barrier Coating: Air dried, contact adhesive, compatible with insulation and ASTM E84 compliant.

2.04 WEATHER BARRIER COATINGS

A. Weather-Resistive Barrier Coating: Fire-resistive, UV resistant, water-based mastic for use over closed cell polyethylene and polyurethane foam insulation; applied with glass fiber or synthetic reinforcing mesh.
   1. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A, when tested in accordance with ASTM E84.
   2. Water Vapor Permeance: Greater than 1.0 perm in accordance with ASTM E96/E96M.

3. Color: As selected by Architect.

2.05 JACKETING AND ACCESSORIES

A. PVC Plastic.
   1. Manufacturers:
      a. Johns Manville Corporation: www.jm.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.
   2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil, 0.010 inch.
      e. Connections: Brush on welding adhesive.
   3. Covering Adhesive Mastic: Compatible with insulation.

B. Aluminum Jacket:
   1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.

2.06 ACCESSORIES

A. General Requirements:
   1. Furnish compatible materials which do not contribute to corrosion, soften, or otherwise attack surfaces to which applied, in either the wet or dry state.
   2. Comply with ASTM C795 requirements for materials to be used on stainless steel surfaces.
   3. Supply materials that are asbestos free.

B. Corrosion Inhibitors:
   1. Corrosion Control Gel:
      a. Corrosion Protection: Comply with ASTM B117 and ASTM D610.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

E. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

F. 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.

G. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.

5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 078400.

I. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

J. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV-resistant finish for flexible elastomeric cellular insulation without jacketing.

3.03 SCHEDULE

A. Heating Systems:
   1. Heating Water Supply and Return:
      a. Insulation: Glass Fiber Rigid.
      b. Thickness:
         1) Piping size 1-1/2 inches and less, 1-1/2 inches of insulation.
         2) Piping greater than 1-1/2 inches, 2 inches of insulation.
   2. Glycol Heating Supply and Return:
      a. Insulation: Glass Fiber Rigid.
      b. Thickness:
         1) Piping size 1-1/2 inches and less, 1-1/2 inches of insulation.
         2) Piping greater than 1-1/2 inches, 2 inches of insulation.
   3. Low Pressure Steam Piping:
      a. Insulation: Glass Fiber Rigid.
      b. Thickness: 2-1/2 inches.
   4. Low Pressure Steam Condensate:
      a. Insulation: Glass Fiber Rigid.
      b. Thickness: 2-1/2 inches.

B. Cooling Systems:
   1. Chilled Water:
      a. Insulation: Glass Fiber Rigid.
      b. Thickness:
         1) Piping size 1-1/2 inches and less, 1-1/2 inches of insulation.
         2) Piping greater than 1-1/2 inches, 2 inches of insulation.

END OF SECTION

SECTION 230800
COMMISSIONING OF HVAC

PART 1 GENERAL

1.01 SUMMARY

A. See Section 019113 - General Commissioning Requirements for overall objectives; comply with the requirements of Section 019113.

B. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

C. The Commissioning Provider (CxP) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.

D. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
   1. Control system.
   2. Major and minor equipment items.
   3. Piping systems and equipment.
   4. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

E. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 - Application of the Commissioning Process to New HVAC&R Systems; 2025.

1.03 SUBMITTALS

A. Updated Submittals: Keep Commisioning Provider (CxP) informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Provider.

C. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
   1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
   2. Full as-built set of control drawings.
   3. Full as-built sequence of operations for each piece of equipment.
   4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
      a. Floor.
      b. Room number.
      c. Room name.
      d. Air handler unit ID.
      e. Reference drawing number.
      f. Air terminal unit tag ID.
      g. Heating and/or cooling valve tag ID.
      h. Minimum air flow rate.
      i. Maximum air flow rate.
   5. Full print out of all schedules and set points after testing and acceptance of the system.
   6. Full as-built print out of software program.
   7. Electronic copy on disk of the entire program for this facility.

8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
10. Control equipment component submittals, parts lists, etc.
11. Warranty requirements.
12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
    a. Sequences of operation.
    b. Control drawings.
    c. Points lists.
    d. Controller and/or module data.
    e. Thermostats and timers.
    f. Sensors and DP switches.
    g. Valves and valve actuators.
    h. Dampers and damper actuators.
    i. Program setups (software program printouts).

D. Project Record Documents: See Section 017800 for additional requirements.
1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

E. Draft Training Plan: In addition to requirements specified in Section 017900, include:
1. Follow the recommendations of ASHRAE Guideline 1.1.
2. Control system manufacturer's recommended training.
3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

F. Training Manuals: See Section 017900 for additional requirements.
1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 EXECUTION

3.01 PREPARATION

A. Cooperate with CxP in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by CxP.

C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by CxP; update the schedule as appropriate.

D. Notify CxP when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction, notify ahead of time and be

proactive in seeing that CxP has the scheduling information needed to efficiently execute the commissioning process.

E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.

F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

G. Provide temperature and pressure taps in accordance with Contract Documents.

3.02 INSPECTING AND TESTING - GENERAL

A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.

B. Perform the Functional Tests directed by CxP for each item of equipment or other assembly to be commissioned.

C. Provide two-way radios for use during the testing.

D. Valve/Damper Stroke Setup and Check:
   1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
   2. Set pump/fan to normal operating mode.
   3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
   4. Command valve/damper open; verify position is full open and adjust output signal as required.
   5. Command valve/damper to a few intermediate positions.
   6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

E. Isolation Valve or System Valve Leak Check: For valves not by coils.
   1. With full pressure in the system, command valve closed.
   2. Use an ultra-sonic flow meter to detect flow or leakage.

F. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.03 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of HVAC.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.

D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.

E. Have all required Prefunctional Checklists, calibrations, startup, and component Functional Tests of the system completed and approved by CxP prior to starting TAB.

F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.04 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by CxP.

D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
   1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to Owner.
   2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.

E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F. Demonstrate the following to CxP during testing of controlled equipment; coordinate with commissioning of equipment.
   1. Setpoint changing features and functions.
   2. Sensor calibrations.

G. Demonstrate to CxP:
   1. That all specified functions and features are set up, debugged and fully operable.
   2. That scheduling features are fully functional and setup, including holidays.
   3. That all graphic screens and value readouts are completed.
   4. Correct date and time setting in central computer.
   5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.
   6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.
   7. Power failure and battery backup and power-up restart functions.
   8. Global commands features.
   9. Security and access codes.
   10. Occupant over-rides (manual, telephone, key, keypad, etc.).
   11. O&M schedules and alarms.
   12. Occupancy sensors and controls.
   13. All control strategies and sequences not tested during controlled equipment testing.

H. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.05 OPERATION AND MAINTENANCE MANUALS

A. See Section 017800 for additional requirements.

B. Add design intent documentation furnished by COR to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Provider for review; make changes recommended by Commissioning Provider.

D. Commissioning Provider will add commissioning records to manuals after submission to Owner.

3.06 DEMONSTRATION AND TRAINING

A. See Section 017900 for additional requirements.

B. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to CxP during Functional Testing.

D. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide the following minimum durations of training:

E. TAB Review: Instruct Owner's personnel for minimum 2 hours, after completion of TAB, on the following:
   1. Review final TAB report, explaining the layout and meanings of each data type.
   2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
   3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
   4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
   5. Other salient information that may be useful for facility operations, relative to TAB.

F. HVAC Control System Training: Perform training in at least three phases:
   1. Phase 1 - Basic Control System: Provide minimum of 4 hours of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
      a. This training may be held on-site or at the manufacturer's facility.
      b. If held off-site, the training may occur prior to final completion of the system installation.
      c. For off-site training, Contractor shall pay expenses of up to two attendees.
   2. Phase 2 - Integrating with HVAC Systems: Provide minimum of 8 hours of on-site, hands-on training after completion of Functional Testing. Include instruction on:
      a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.
      b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
      c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends; provide practice in setting up trend logging and monitoring during training session.
      d. Every display screen, allowing time for questions.
      e. Point database entry and modifications.
   3. Phase 3 - Post-Occupancy: Six months after occupancy conduct minimum of 2 hours of training. Tailor training session to questions and topics solicited beforehand from Owner. Also be prepared to address topics brought up and answer questions concerning operation of the system.

G. Provide the services of manufacturer representatives to assist instructors where necessary.

H. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION

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SECTION 230913
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Compressed-Air Stations:
   1. Pressure reducing stations.
   2. Control and instrumentation tubing.

B. Control panels.

C. Control Valves:
   1. Ball valves with factory-mounted actuators.

D. Dampers.

E. Damper Operators:
   1. Electric operators.
   2. Inlet vane operators.

F. Humidistats:
   1. Room humidistats.
   2. Limit duct humidistats.

G. Wall-, Surface-, and Duct-Mounted Sensors:
   1. Temperature sensors.
   2. Humidity sensors.
   3. Room pressure monitors.
   4. Static air pressure sensors.
   5. Airflow meters; pitot tubes.
   6. Nitrogen dioxide sensors.
   7. Carbon monoxide sensors.

H. Thermostats:
   1. Freezestats.
   2. Line voltage thermostats.
   3. Room-mount thermostat accessories.

I. Pipe-Mounted Sensors and Transmitters:
   1. Differential pressure transmitters.

1.02 RELATED REQUIREMENTS

A. Section 253513 - Integrated Automation Actuators and Operators.

B. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

C. Section 262726 - Wiring Devices: Elevation of exposed components.

1.03 REFERENCE STANDARDS

A. ANSI/FCI 70-2 - Control Valve Seat Leakage; 2021.

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

C. ASTM B32 - Standard Specification for Solder Metal; 2020.

D. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

E. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

F. ASTM B819 - Standard Specification for Seamless Copper Tube for Medical Gas Systems; 2019.

G. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

H. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

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

B. 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. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.07 WARRANTY

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

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 COMPRESSED-AIR STATIONS

A. Pressure Reducing Stations:
   1. Pressure Regulator:
      a. Zinc or aluminum castings, rated for service with elastomeric diaphragm, balanced construction to automatically prevent pressure build up, and producing flat, reduced pressure curve for system capacity demand.
   2. Particle Filter:
      a. Zinc or aluminum castings with filtration efficiency at rated airflow of 97 percent, rated for service with threaded connections, quick-disconnect service devices, aluminum bowl or plastic bowl with metal guard equipped with manual drain cock, to separate liquid and solid particles.
   3. Pressure Relief Valve:
      a. ASME Code Rated and labeled for high pressure side and sized for installed capacity of pressure regulators at low pressure. Set at maximum 20 percent above low pressure.
   4. Provide piping and accessories to assemble and arrange two pressure regulators in parallel for high flow demand loads.

B. Control and Instrumentation Tubing:
   1. Copper Tubing:
      a. ASTM B819 Type K, or ASTM B88 (ASTM B88M) Type K (A), seamless, H or O temper (drawn or annealed).
      b. Fittings: ASME B16.22, wrought copper.
      c. Joints: Solder, lead free, ASTM B32 HB alloy (95-5 tin-antimony), or tin and silver.

2.03 CONTROL PANELS

A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.

B. NEMA EN 10250, general purpose utility enclosures with enameled finished face panel.

C. Provide common keying for all panels.

2.04 CONTROL VALVES

A. High-Performance Segmented and Characterized Ball Valves with Factory-Mounted Actuators:

1. Service: Use for chilled water, hot water, condenser water, brine (50 percent glycol), or steam.
2. Flow Characteristic: Fully proportioning, equal percentage.
3. Rangeability: 300 to 1.
4. Leakage: Class VI when tested in accordance with ANSI/FCI 70-2.
5. Service Temperature Range: Minus 20 to 450 degrees F.
6. Valve Body:
   a. Connection Type: Flanged.
   b. ANSI Rating: Class 150.
   c. Materials:
      1) Body: Carbon steel.
      2) Ball: 300 series stainless steel.
      3) Stem: 300 series stainless steel.
      4) Seat: Graphite-reinforced PTFE.
      5) Stem Seal: PTFE.
7. Hydronic Systems: Size for 5 psig maximum pressure drop at design flow rate.
8. Actuator Requirements:
   a. Assembly: Factory-mounted.
   b. Input: 0 to 5 VDC configured for proportional control.
   c. Accessories: Provide with valve position indicator and manual override.

B. Segemented and Characterized Ball Valves with Factory-Mounted Actuators:
1. Manufacturers:
   a. Belimo Aircontrols (USA), Inc: www.belimo.com/#sle.
   b. Bray Commercial Division: www.braycommercialdivision.com/#sle.
   c. Johnson Controls International, PLC: www.johnsoncontrols.com/#sle.
   d. KMC Controls: www.kmccontrols.com/#sle.
   e. Schneider Electric: www.schneider-electric.us/#sle.
   f. Substitutions: See Section 016000 - Product Requirements.
2. Service: Use for chilled water, hot water, condenser water, brine (50 percent glycol), or steam.
3. Flow Characteristic: Fully proportioning, equal percentage.
4. Rangeability: 500 to 1.
5. Leakage: Tested in accordance with ANSI/FCI 70-2.
   a. Straight-Through Flow on 2-Way and 3-Way Valves: Class IV.
   b. Bypass Flow on 3-Way Valves: Class III.
6. Service Temperature Range: Minus 20 to 250 degrees F.
7. Valve Body:
   a. Under 2-1/2 inches:
      1) Connection: NPT.
      2) Pressure Rating: 400 psi.
      3) Materials:
         (a) Body: Brass.
         (b) Ball: Chrome-plated brass.
         (c) Stem: Nickel-plated brass.
         (d) Seat: Graphite-reinforced PTFE with EPDM O-Ring backing.
         (e) Stem Seal: EPDM O-Rings.
         (f) Flow Control Disk: Thermoplastic synthetic-resin.
   b. 2-1/2 inches and Above:
      1) Connection Type: Flanged.
      2) ANSI Rating: Class 125 or 150.
      3) Materials:
         (a) Body: Manufactured from brass with ductile iron flanges, cast iron, carbon steel, or stainless steel.
         (b) Ball: 300 series stainless steel.
         (c) Stem: 300 series stainless steel.
         (d) Seat: Graphite-reinforced PTFE with EPDM O-Ring backing.

(e) Stem Seal: EPDM O-Rings.
(f) Flow Control Disk: Thermoplastic synthetic-resin.
c. Service Temperature:
8. Hydronic Systems: Size for 3 psig maximum pressure drop at design flow rate.
9. Steam Systems: Size for 5 psig maximum pressure drop at design flow rate.
10. Actuator Requirements:
a. Assembly: Factory-mounted.
b. Input: 0 to 5 VDC configured for proportional control.
c. Accessories: Provide with valve position indicator and manual override.

2.05 DAMPERS

A. See Section 233300 for dampers and this section for actuators and operators.

2.06 DAMPER OPERATORS

A. General:
1. Provide actuators with torque capacity sized for minimum of 20 percent greater than maximum design stream velocity and hold tight seal against maximum system pressures.
2. Provide spring return for two position control and for fail safe operation.
3. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
4. Provide one operator for maximum 36 sq ft damper section.
5. See Section 253513 for field-mount damper actuators and operators.

B. Electric Operators:
1. Manufacturers:
a. Bray Commercial Division: www.braycommercialdivision.com/#sle.
b. Honeywell International, Inc: buildingcontrols.honeywell.com/#sle.
c. Johnson Controls International, PLC: www.johnsoncontrols.com/#sle.
d. Schneider Electric: www.schneider-electric.us/#sle.
e. Substitutions: See Section 016000 - Product Requirements.

C. Inlet Vane Operators:
1. High pressure with pilot positioners and sufficient force to move vanes when fan is started with vanes in closed position. Return vane operator to closed position on fan shutdown.

2.07 HUMIDISTATS

A. Room Humidistats:
1. Manufacturers:
a. Honeywell International, Inc: buildingcontrols.honeywell.com/#sle.
b. Johnson Controls International, PLC: www.johnsoncontrols.com/#sle.
c. Siemens Industry, Inc: www.siemens.com/#sle.
d. Veris Industries: www.veris.com/#sle.
e. Substitutions: See Section 016000 - Product Requirements.
2. Wall mounted, proportioning type.
3. Throttling Range: Adjustable 2 percent relative humidity.

B. Limit Duct Humidistats:
1. Manufacturers:
a. Honeywell International, Inc: buildingcontrols.honeywell.com/#sle.
b. Johnson Controls International, PLC: www.johnsoncontrols.com/#sle.
c. Siemens Industry, Inc: www.siemens.com/#sle.
d. Veris Industries: www.veris.com/#sle.
e. Substitutions: See Section 016000 - Product Requirements.
2. Insertion, two-position type.
3. Throttling Range: Adjustable 2 percent relative humidity.
4. Operating Range: 20 to 80 percent.
5. Maximum Temperature: 150 degrees F.

2.08 WALL-, SURFACE-, AND DUCT-MOUNT SENSORS

A. Temperature Sensors:

1. Use thermistor or RTD type temperature sensing elements with characteristics resistant to moisture, vibration, and other conditions consistent with the application without affecting accuracy and life expectancy.
2. Construct RTD of nickel or platinum with base resistance of 1000 ohms at 70 degrees F.
3. 100 ohm platinum RTD is acceptable if used with project DDC controllers.
4. Temperature Sensing Device: Compatible with project DDC controllers.
5. Performance Characteristics:
   a. RTD:
      1) Room Sensor Accuracy: Plus/minus 0.50 degrees F minimum.
      2) Duct Averaging Accuracy: Plus/minus 0.50 degrees F minimum.
      3) Chilled Water Accuracy: Plus/minus 0.50 degrees F minimum.
      4) All Other Accuracy: Plus/minus 0.75 degrees F minimum.
      5) Range: Minus 40 degrees F through 220 degrees F minimum.
   b. Temperature Transmitter:
      1) Accuracy: 0.10 degree F minimum or plus/minus 0.20 percent of span.
   c. Sensing Range:
      1) Provide limited range sensors if required to sense the range expected for a respective point.
      2) Use RTD type sensors for extended ranges beyond minus 30 to 230 degrees F.
      3) Use temperature transmitters in conjunction with RTDs when RTDs are incompatible with DDC controller direct temperature input.
   d. Room Temperature Sensors:
      1) Construct for surface or wall box mounting.

B. Humidity Sensors, Duct-Mounted:
   1. Manufacturers:
      a. Dwyer Instruments Inc: www.dwyer-inst.com/#sle.
      b. Johnson Controls International, PLC: www.johnsoncontrols.com/#sle.
      c. Setra Systems, Inc: www.setra.com/#sle.
      d. Veris Industries; HD Series: www.veris.com/#sle.
      e. Substitutions: See Section 016000 - Product Requirements.
   2. Digitally profiled thin-film capacitive sensor probe extended from die-cast metal, weather-proof plastic or metal housing designed for duct mounting.
   3. Measuring Scale: 0 to 100 percent RH, noncondensing, temperature compensated.
   4. Hardwired Output: Two-wire, 4 to 20 mA, loop powered.
   5. Accuracy: Plus/minus 1 percent between 20 to 40 percent RH linear range, NIST traceable with multi-point calibration.

C. Room Pressure Monitors:
   1. Manufacturers:
      a. Dwyer Instruments Inc: www.dwyer-inst.com/#sle.
      b. Ebtron, Inc: www.ebtron.com/#sle.
      c. Setra Systems, Inc: www.setra.com/#sle.
      d. Veris Industries: www.veris.com/#sle.
      e. Substitutions: See Section 016000 - Product Requirements.
   2. Transmitter: Five percent accuracy, adjustable zero and span, 100 to 1 turndown, 0.1 percent of calibrated span linearity, 30 to 50 millisecond response time, minimum overpressure of 150 percent over highest range value, alphanumeric indicating display, wired or wireless connectivity for configuration, and terminal strip within enclosed electronic components.
   3. Differential Pressure Monitoring Range: 0 to 0.05 in-wc, bidirectional.
   4. Temperature Monitoring Range: 32 to 104 degrees F.
   5. BAS, SCADA, or other Integrated Automation System Output: Two-wire, 4 to 20 mA.

D. Static-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.
   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.

E. Airflow Meters; Pitot Tubes:
1. Manufacturers:
   a. Air Monitor, a brand of Onicon, Inc; VOLU-flo/OAM-II: www.onicon.com/#sle.
   b. Dwyer Instruments Inc: www.dwyer-inst.com/#sle.
   c. KMC Controls; Conquest Airflow Measurement System: www.kmccontrols.com/#sle.
   d. Paragon Controls, Inc: www.paragoncontrols.com/#sle.
   e. Ruskin Company: www.ruskin.com/#sle.
   f. Substitutions: See Section 016000 - Product Requirements.
2. Sensor Type: Provide duct-inserted probe, duct-inserted pitot-tube assembly, and wall-mounted assembly for outside air with built-in transmitter.
3. Flow Range: Equivalent velocity pressure required to match scheduled flow range with a 100 to 1 signal turndown ratio.
4. Linearity: 0.1 percent of calibrated span.
5. Minimum Overpressure: 150 percent over highest range value.
6. Output: Two-wire, 4 to 20 mA.
7. Access Box: NEMA EN 10250, Type 1 with hinged cover housing and cable access ports.

F. Nitrogen Dioxide Sensors:
1. Gas sensing module that holds fixed or replaceable nitrogen dioxide gas-sensor cartridge.
2. Form Factor: IEC 60529, IP20 enclosure, single-gang electrical box mounted.
3. Electromechanical sensor with 0 to 15 ppm measurement range.
4. Accuracy: Plus/minus Five percent of range with 0.1 ppm resolution.
5. Hardwired Output: Three-wire, 4 to 20 mA, loop powered.
6. Alarm: Auxiliary dry contact relay driven by setpoint adjustable between 1 to 180 ppm.

G. Carbon Monoxide Sensors:
1. Gas sensing module that holds fixed or replaceable carbon monoxide gas-sensor cartridge.
2. Form Factor: IEC 60529, IP20 enclosure, single-gang electrical box mounted.
3. Electromechanical sensor with 0 to 500 ppm measurement range.
4. Accuracy: Plus/minus Five percent of range with 1 ppm resolution.
5. Hardwired Output: Three-wire, 4 to 20 mA, loop powered.
6. Alarm: Auxiliary dry contact relay driven by setpoint adjustable between 25 to 180 ppm.

2.09 THERMOSTATS

A. Freezestats:
1. Configuration: Vapor-filled capillary.
2. Probe Sensing Length: 20 feet.
3. Setpoint Adjust Control: Screw with manual reset switch.
4. Switch Type: SPDT, snap-action, form C in dust-protected enclosure.
5. Mounting: Locate on cooling coil intake side.
6. Field Interface: Connect load line-voltage to starter.
7. Electrical Rating: As indicated on drawings.

B. Line Voltage Thermostats:
1. Dead Band: Maximum 2 degrees F.
2. Cover: Locking with set point adjustment, with thermometer.
3. Rating: Motor load.

C. Room-Mounted Thermostat Accessories:
1. Thermostat Covers: Brushed aluminum.
2. Insulating Bases: For thermostats located on exterior walls.

2.10 PIPE-MOUNTED SENSORS AND TRANSMITTERS

A. Differential Pressure Transmitters:
1. General: Provide wet media differential pressure transducers with 6 ft (1.83 m) armored cable, to allow local or remote pressure sensing capability using existing plumbing runs.
   a. Output: 3-wire transmitter; 4 to 20 mA, 0 to 5V, or 0 to 10V, selectable,
   b. Sensor:

1) Media Compatibility: 17 to 4 PH stainless steel.
2) Status Indication: Dual color LED.
3) Proof Pressure: 2x max. F.S. range.
4) Burst Pressure: 5x max. F.S. range.
5) Accuracy at 77 degrees F for less than or equal 20 ft:
6) Surge Damping: Electronic; 1 second averaging.
7) Long Term Stability: Plus/minus 0.25 percent.

c. Pressure Ranges:
1) 0 psi to 50 psi (Gauge): 5 psid/10 psid/25 psid/50 psid (pressure differential).

d. Enclosure: NEMA EN 10250, Type 4.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

C. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

D. Ensure installation of components is complementary to installation of similar components.

E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Supply instrument air from compressor units through filter, pressure reducing valve, pressure relief valve, with pressure gauges, and shutoff and bypass valves.

C. Use copper tubing in mechanical rooms, where subject to damage or temperatures in excess of 200 degrees F, where adjacent to heating pipes passing through common sleeve, and where not readily accessible. In mechanical rooms, bundled plastic tubing with suitable junction boxes or single plastic tubing with tray or raceway may be used.

D. Solder copper tubing except at instruments or equipment where compression fittings may be used.

E. Mechanically attach tubing to supporting surfaces. Sleeve through concrete surfaces in minimum 1 inch sleeves, extended 6 inches above floors and 1 inch below bottom surface of slabs.

F. Purge tubing with dry, oil-free compressed air before connecting control instruments.

G. Check and verify location of thermostats with plans and room details before installation. Locate 48 inches above floor. Align with lighting switches and humidistats; see Section 262726.

H. Mount freeze protection thermostats using flanges and element holders.

I. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.

J. 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.

K. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.

L. Provide conduit and electrical wiring in accordance with Section 260583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

3.03 MAINTENANCE

A. Provide service and maintenance of control system for one year from Date of Substantial Completion.

B. Provide complete service of controls systems, including call backs, and submit written report of each service call.

C. In addition to normal service calls, make minimum of 2 complete normal inspections of approximately 4 hours duration to inspect, calibrate, and adjust controls.

END OF SECTION

SECTION 230923
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. System description.

B. Operator interface.

C. Controllers.

D. System software.

E. Controller software.

F. HVAC control programs.

1.02 RELATED REQUIREMENTS

A. Section 230913 - Instrumentation and Control Devices for HVAC.

B. Section 230993 - Sequence of Operations for HVAC Controls.

C. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks; 2024, with Errata (2026).

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 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.

1.05 SUBMITTALS

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

B. Operation and Maintenance Data:
   1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
   2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
   3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 70.

B. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

C. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Delta Controls: www.deltacontrols.com/#sle.

B. Honeywell International, Inc: www.honeywell.com/#sle.

C. Johnson Controls, Inc: www.johnsoncontrols.com/#sle.

D. KMC Controls; Conquest: www.kmccontrols.com/#sle.

E. Schneider Electric: www.schneider-electric.us/#sle.

F. Siemens AG, Building Technologies Division: www.siemens.com/#sle.

G. Substitutions: See Section 016000 - Product Requirements.

2.02 SYSTEM DESCRIPTION

A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.

B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

D. Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units. Individual terminal unit control is specified in Section 230913.

E. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

F. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

2.03 OPERATOR INTERFACE

A. PC Based Work Station:

B. Workstation, controllers, and control backbone to communicate using BACnet protocol and addressing.

C. BACnet protocol to comply with ASHRAE Std 135.

D. Hardware:

2.04 CONTROLLERS

A. Building Controllers:
   1. General:
      a. Manage global strategies by one or more, independent, standalone, microprocessor based controllers.
      b. Provide sufficient memory to support controller's operating system, database, and programming requirements.
      c. Share data between networked controllers.
      d. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
      e. Utilize real-time clock for scheduling.
      f. Continuously check processor status and memory circuits for abnormal operation.
      g. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
      h. Communication with other network devices to be based on assigned protocol.
   2. Communication:
      a. Controller to reside on a BACnet network using ISO 8802-3 (ETHERNET) Data Link/Physical layer protocol.
      b. Perform routing when connected to a network of custom application and application specific controllers.
      c. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
   3. Anticipated Environmental Ambient Conditions:
      a. Outdoors and/or in Wet Ambient Conditions:
         1) Mount within waterproof enclosures.
         2) Rated for operation at 40 to 150 degrees F.
      b. Conditioned Space:
         1) Mount within dustproof enclosures.
         2) Rated for operation at 32 to 120 degrees F.

4. Provisions for Serviceability:
    a. Diagnostic LEDs for power, communication, and processor.
    b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:
    a. Maintain operation at 90 to 110 percent of nominal voltage rating.
    b. Perform orderly shutdown below 80 percent of nominal voltage.
    c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

B. Custom Application Controller:
1. General:
    a. Provide sufficient memory to support controller's operating system, database, and programming requirements.
    b. Share data between networked, microprocessor based controllers.
    c. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
    d. Utilize real-time clock for scheduling.
    e. Continuously check processor status and memory circuits for abnormal operation.
    f. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
    g. Communication with other network devices to be based on assigned protocol.
2. Communication:
    a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
    b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
3. Anticipated Environmental Ambient Conditions:
    a. Outdoors and/or in Wet Ambient Conditions:
        1) Mount within waterproof enclosures.
        2) Rated for operation at 40 to 150 degrees F.
    b. Conditioned Space:
        1) Mount within dustproof enclosures.
        2) Rated for operation at 32 to 120 degrees F.
4. Provisions for Serviceability:
    a. Diagnostic LED's for power, communication, and processor.
    b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:
    a. Maintain operation at 90 to 110 percent of nominal voltage rating.
    b. Perform orderly shutdown below 80 percent of nominal voltage.
    c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

C. Application Specific Controllers:
1. General:
    a. Not fully user programmable, microprocessor based controllers dedicated to control specific equipment.
    b. Customized for operation within the confines of equipment served.
    c. Communication with other network devices to be based on assigned protocol.
2. Communication:
    a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.

b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.

3. Anticipated Environmental Ambient Conditions:
   a. Outdoors and/or in Wet Ambient Conditions:
      1) Mount within waterproof enclosures.
      2) Rated for operation at 40 to 150 degrees F.
   b. Conditioned Space:
      1) Mount within dustproof enclosures.
      2) Rated for operation at 32 to 120 degrees F.
4. Provisions for Serviceability:
   a. Diagnostic LEDs for power, communication, and processor.
   b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:
   a. Maintain operation at 90 to 110 percent of nominal voltage rating.
   b. Perform orderly shutdown below 80 percent of nominal voltage.
   c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 feet.

D. Input/Output Interface:
1. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.
2. All Input/Output Points:
   a. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.
   b. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.
3. Binary Inputs:
   a. Allow monitoring of On/Off signals from remote devices.
   b. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.
   c. Sense dry contact closure with power provided only by the controller.
4. Pulse Accumulation Input Objects: Comply with all requirements of binary input objects and accept up to 10 pulses per second.
5. Analog Inputs:
   a. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).
   b. Compatible with and field configurable to commonly available sensing devices.
6. Binary Outputs:
   a. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.
   b. Outputs provided with three position (On/Off/Auto) override switches.
   c. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.
7. Analog Outputs:
   a. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.
   b. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.
   c. Drift to not exceed 0.4 percent of range per year.
8. Tri State Outputs:
   a. Coordinate two binary outputs to control three point, floating type, electronic actuators without feedback.

b. Limit the use of three point, floating devices to the following zone and terminal unit control applications:
c. Control algorithms run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.

9. System Object Capacity:
   a. System size to be expandable to twice the number of input output objects required by providing additional controllers, including associated devices and wiring.
   b. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

2.05 LOCAL AREA NETWORK (LAN)

A. Provide communication between control units over local area network (LAN).

B. LAN Capacity: Not less than 60 stations or nodes.

C. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.

D. LAN Data Speed: Minimum 19.2 Kb.

E. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.

F. Transmission Median: Fiber optic or single pair of solid 24 gauge twisted, shielded copper cable.

G. Network Support: Time for global point to be received by any station, shall be less than 3 seconds. Provide automatic reconfiguration if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.06 SYSTEM SOFTWARE

A. Operating System:
   1. Concurrent, multi-tasking capability.
      a. Common Software Applications Supported: Microsoft Excel.
   2. System Graphics:
      a. Allow up to 10 graphic screens, simultaneously displayed for comparison and monitoring of system status.
      b. Animation displayed by shifting image files based on object status.
      c. Provide method for operator with password to perform the following:
         1) Move between, change size, and change location of graphic displays.
         2) Modify on-line.
         3) Add, delete, or change dynamic objects consisting of:
            (a) Analog and binary values.
            (b) Dynamic text.
            (c) Static text.
            (d) Animation files.
   3. Custom Graphics Generation Package:
      a. Create, modify, and save graphic files and visio format graphics in PCX formats.
      b. HTML graphics to support web browser compatible formats.
      c. Capture or convert graphics from AutoCAD.
   4. Standard HVAC Graphics Library:
      a. HVAC Equipment:
         1) Air Handlers.
         2) Terminal HVAC Units.
      b. Ancillary Equipment:
         1) Fans.
         2) Pumps.
         3) Coils.
         4) Valves.
         5) Piping.
         6) Dampers.
         7) Ductwork.

B. Workstation System Applications:
   1. Automatic System Database Save and Restore Functions:
      a. Current database copy of each Building Controller is automatically stored on hard disk.
      b. Automatic update occurs upon change in any system panel.
      c. In the event of database loss in any system panel, the first workstation to detect the loss automatically restores the database for that panel unless disabled by the operator.
   2. Manual System Database Save and Restore Functions by Operator with Password Clearance:
      a. Save database from any system panel.
      b. Clear a panel database.
      c. Initiate a download of a specified database to any system panel.
   3. Software provided allows system configuration and future changes or additions by operators under proper password protection.
   4. On-line Help:
      a. Context-sensitive system assists operator in operation and editing.
      b. Available for all applications.
      c. Relevant screen data provided for particular screen display.
      d. Additional help available via hypertext.
   5. Security:
      a. Operator log-on requires user name and password to view, edit, add, or delete data.
      b. System security selectable for each operator.
      c. System supervisor sets passwords and security levels for all other operators.
      d. Operator passwords to restrict functions accessible to viewing and/or changing system applications, editor, and object.
      e. Automatic, operator log-off results from keyboard or mouse inactivity during user-adjustable, time period.
      f. All system security data stored in encrypted format.
   6. System Diagnostics:
      a. Operations Automatically Monitored:
         1) Workstations.
         2) Printers.
         3) Modems.
         4) Network connections.
         5) Building management panels.
         6) Controllers.
      b. Device failure is annunciated to the operator.
   7. Alarm Processing:
      a. All system objects are configurable to "alarm in" and "alarm out" of normal state.
      b. Configurable Objects:
         1) Alarm limits.
         2) Alarm limit differentials.
         3) States.
         4) Reactions for each object.
   8. Alarm Messages:
      a. Descriptor: English language.
      b. Recognizable Features:
         1) Source.
         2) Location.
         3) Nature.
   9. Configurable Alarm Reactions by Workstation and Time of Day:
      a. Logging.
      b. Printing.
      c. Starting programs.
      d. Displaying messages.

e. Dialing out to remote locations.
f. Paging.
g. Providing audible annunciation.
h. Displaying specific system graphics.

10. Custom Trend Logs:
    a. Definable for any data object in the system including interval, start time, and stop time.
    b. Trend Data:
        1) Sampled and stored on the building controller panel.
        2) Archivable on hard disk.
        3) Retrievable for use in reports, spreadsheets and standard database programs.
        4) Archival on LAN accessible storage media including hard disk, tape, Raid array drive, and virtual cloud environment.
        5) Protected and encrypted format to prevent manipulation, or editing of historical data and event logs.
11. Alarm and Event Log:
    a. View all system alarms and change of states from any system location.
    b. Events listed chronologically.
    c. Operator with proper security acknowledges and clears alarms.
    d. Alarms not cleared by operator are archived to the workstation hard disk.
12. Object, Property Status and Control:
    a. Provide a method to view, edit if applicable, the status of any object and property in the system.
    b. Status Available by the Following Methods:
        1) Menu.
        2) Graphics.
        3) Custom Programs.
13. Reports and Logs:
    a. Reporting Package:
        1) Allows operator to select, modify, or create reports.
        2) Definable as to data content, format, interval, and date.
        3) Archivable to hard disk.
    b. Real-time logs available by type or status such as alarm, lockout, normal, etc.
    c. Stored on hard disk and readily accessible by standard software applications, including spreadsheets and word processing.
    d. Set to be printed on operator command or specific time(s).
14. Reports:
    a. Standard:
        1) Objects with current values.
        2) Current alarms not locked out.
        3) Disabled and overridden objects, points and SNVTs.
        4) Objects in manual or automatic alarm lockout.
        5) Objects in alarm lockout currently in alarm.
        6) Logs:
            (a) Alarm History.
            (b) System messages.
            (c) System events.
            (d) Trends.
    b. Custom:
        1) Daily.
        2) Weekly.
        3) Monthly.
        4) Annual.
        5) Time and date stamped.
        6) Title.
        7) Facility name.

c. Tenant Override:
   1) Monthly report showing total, requested, after-hours HVAC and lighting services on a daily basis for each tenant.
   2) Annual report showing override usage on a monthly basis.
d. Electrical, Fuel, and Weather:
   1) Electrical Meter(s):
      (a) Monthly showing daily electrical consumption and peak electrical demand with time and date stamp for each meter.
      (b) Annual summary showing monthly electrical consumption and peak demand with time and date stamp for each meter.
   2) Fuel Meter(s):
      (a) Monthly showing daily natural gas consumption for each meter.
      (b) Annual summary showing monthly consumption for each meter.
   3) Weather:
      (a) Monthly showing minimum, maximum, average outdoor air temperature and heating/cooling degree-days for the month.

C. Workstation Applications Editors:
1. Provide editing software for each system application at PC workstation.
2. Downloaded application is executed at controller panel.
3. Full screen editor for each application allows operator to view and change:
   a. Configuration.
   b. Name.
   c. Control parameters.
   d. Set-points.
4. Scheduling:
   a. Monthly calendar indicates schedules, holidays, and exceptions.
   b. Allows several related objects to be scheduled and copied to other objects or dates.
   c. Start and stop times adjustable from master schedule.
5. Custom Application Programming:
   a. Create, modify, debug, edit, compile, and download custom application programming during operation and without disruption of all other system applications.
   b. Programming Features:
      1) English oriented language, based on BASIC, FORTRAN, C, or PASCAL syntax allowing for free form programming.
      2) Alternative language graphically based using appropriate function blocks suitable for all required functions and amenable to customizing or compounding.
      3) Insert, add, modify, and delete custom programming code that incorporates word processing features such as cut/paste and find/replace.
      4) Allows the development of independently, executing, program modules designed to enable and disable other modules.
      5) Debugging/simulation capability that displays intermediate values and/or results including syntax/execution error messages.
      6) Support for conditional statements (IF/THEN/ELSE/ELSE-F) using compound Boolean (AND, OR, and NOT) and/or relations (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.
      7) Support for floating-point arithmetic utilizing plus, minus, divide, times, square root operators; including absolute value; minimum/maximum value from a list of values for mathematical functions.
      8) Language consisting of resettable, predefined, variables representing time of day, day of the week, month of the year, date; and elapsed time in seconds, minutes, hours, and days where the variable values cab be used in IF/THEN comparisons, calculations, programming statement logic, etc.
      9) Language having predefined variables representing status and results of the system software enables, disables, and changes the set points of the controller software.

2.07 CONTROLLER SOFTWARE

A. All applications reside and operate in the system controllers and editing of all applications occurs at the operator workstation.

B. System Security:
   1. User access secured via user passwords and user names.
   2. Passwords restrict user to the objects, applications, and system functions as assigned by the system manager.
   3. User Log On/Log Off attempts are recorded.
   4. Automatic Log Off occurs following the last keystroke after a user defined delay time.

C. Object or Object Group Scheduling:
   1. Weekly Schedules Based on Separate, Daily Schedules:
      a. Include start, stop, optimal stop, and night economizer.
      b. 10 events maximum per schedule.
      c. Start/stop times adjustable for each group object.

D. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.

E. Alarms:
   1. Binary object is set to alarm based on the operator specified state.
   2. Analog object to have high/low alarm limits.
   3. All alarming is capable of being automatically and manually disabled.
   4. Alarm Reporting:
      a. Operator determines action to be taken for alarm event.
      b. Alarms to be routed to appropriate workstation.
      c. Reporting Options:

F. Maintenance Management: System monitors equipment status and generates maintenance messages based upon user-designated run-time limits.

G. Sequencing: Application software based upon specified sequences of operation in Section 230993.

H. PID Control Characteristics:
   1. Direct or reverse action.
   2. Anti-windup.
   3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.
   4. User selectable controlled variable, set-point, and PED gains.

I. Staggered Start Application:
   1. Prevents all controlled equipment from simultaneously restarting after power outage.
   2. Order of equipment startup is user selectable.

J. Energy Calculations:
   1. Accumulated instantaneous power or flow rates are converted to energy use data.
   2. Algorithm calculates a rolling average and allows window of time to be user specified in minute intervals.
   3. Algorithm calculates a fixed window average with a digital input signal from a utility meter defining the start of the window period that in turn synchronizes the fixed-window average with that used by the power company.

K. Anti-Short Cycling:
   1. All binary output objects protected from short-cycling.
   2. Allows minimum on-time and off-time to be selected.

L. On-Off Control with Differential:
   1. Algorithm allows binary output to be cycled based on a controlled variable and set-point.
   2. Algorithm to be direct-acting or reverse-acting incorporating an adjustable differential.

M. Run-Time Totalization:
   1. Totalize run-times for all binary input objects.
   2. Provides operator with capability to assign high run-time alarm.

2.08 HVAC CONTROL PROGRAMS

A. General:
   1. Support Inch-pounds and SI (metric) units of measurement.
   2. Identify each HVAC Control system.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.02 INSTALLATION

A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 230993.

C. Provide conduit and electrical wiring in accordance with Section 260583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

3.03 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate complete and operating system to Owner.

3.04 MAINTENANCE

A. Provide service and maintenance of energy management and control systems for one years from Date of Substantial Completion.

B. Provide two complete inspections, one in each season, to inspect, calibrate, and adjust controls as required, and submit written reports.

C. Provide complete service of systems, including call backs. Make minimum of 2 complete normal inspections of approximately 4 hours duration in addition to normal service calls to inspect, calibrate, and adjust controls, and submit written reports.

END OF SECTION

SECTION 230934
VARIABLE-FREQUENCY MOTOR CONTROLLERS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable-frequency motor controllers for low-voltage (600 V and less) AC motor applications.

B. Overcurrent protective devices for motor controllers, including overload relays.

1.02 RELATED REQUIREMENTS

A. Section 230529 - Hangers and Supports for HVAC Piping and Equipment.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 262813 - Fuses.

1.03 REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

C. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

D. NEMA IA 10039 - Control Circuit and Pilot Devices; 2025.

E. NEMA IA 10030 - Industrial Control and Systems: Enclosures; 2024.

F. NEMA IS 10033 - Industrial Control and Systems: Adjustable-Speed Drives; 2026.

G. NEMA IS 10034 - Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems; 2022 (Reapproved 2025).

H. NEMA IS 10035 - Application Guide for AC Adjustable Speed Drive Systems; 2021 (Reaffirmed 2025).

I. NEMA ICS 61800-2 - Adjustable Speed Electrical Power Drive Systems, Part 2: General Requirements-Rating Specifications for Low Voltage Adjustable Frequency AC Power Drive Systems; 2023.

J. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).

K. NEMA MG 00001 - Motors and Generators; 2024.

L. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

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 508A - Industrial Control Panels; Current Edition, Including All Revisions.

Q. UL 61800-5-1 - Standard for Adjustable Speed Electrical Power Drive Systems - Part 5-1: Safety Requirements – Electrical, Thermal, and Energy (Ed. 2); Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate work to provide motor controllers suitable for use with actual motors to be installed.
   2. Coordinate work to provide controllers and associated wiring suitable for interface with control devices to be installed.
   3. Coordinate arrangement with dimensions and clearance requirements of actual equipment to be installed.

4. Verify with manufacturer that conductor terminations are suitable for use with conductors to be installed.
5. Notify COR of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain copy of each referenced document that prescribes execution requirements at project site.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
   1. Authorized service facilities located within 200 miles of project site.

D. Installer Qualifications: Company with minimum three years documented experience with variable-frequency motor control systems of similar size, type, and complexity; manufacturer's authorized installer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in clean, dry space. Maintain factory wrapping or provide 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 internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

1.09 WARRANTY

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

B. Provide minimum 18 month manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 VARIABLE-FREQUENCY MOTOR CONTROLLERS

A. Provide variable-frequency motor control system consisting of required controller assemblies, operator interfaces, control power transformers, instrumentation and control wiring, sensors, accessories, system programming, etc. as necessary for complete operating system.

B. Provide products listed, classified, and labeled as suitable for purpose intended.

C. Controller Assemblies: Comply with NEMA IS 10033, NEMA IS 10034, and NEMA ICS 61800-2; list and label as complying with UL 61800-5-1 or UL 508A as applicable.

D. Provide controllers selected for actual installed motors and coupled mechanical loads in accordance with NEMA IS 10035, NEMA MG 00001 Part 30, and recommendations of manufacturers of both controller and load, where not in conflict with specified requirements; considerations include, but are not limited to:
   1. Motor type (e.g., induction, reluctance, and permanent magnet); consider NEMA MG 00001 design letter or inverter duty rating for induction motors.
   2. Motor load type (e.g., constant torque, variable torque, and constant horsepower); consider duty cycle, impact loads, and high inertia loads.
   3. Motor nameplate data.
   4. Requirements for speed control range, speed regulation, and braking.
   5. Motor suitability for bypass starting method, where applicable.

E. Devices on Load Side of Controller: Suitable for application across full controller output frequency range.

F. Operating Requirements:
   1. Input Voltage Tolerance: Plus/minus 10 percent of nominal.
   2. Input Frequency Tolerance: Plus/minus 5 percent of nominal.
   3. Efficiency: Minimum of 96 percent at full speed and load.
   4. Input Displacement Power Factor: Minimum of 0.96 throughout speed and load range.
   5. Overload Rating:
      a. Variable Torque Loads: Minimum of 110 percent of nominal for 60 seconds.
      b. Constant Torque Loads: Minimum of 150 percent of nominal for 60 seconds.

G. Power Conversion System: Microprocessor-based, pulse width modulation type.

H. Control System:
   1. Provide microprocessor-based control system for automatic control, monitoring, and protection of motors. Include sensors, wiring, and connections necessary for functions and status/alarm indications specified.
   2. Provide integral operator interface for controller programming, display of status/alarm indications, fault reset, and local control functions including motor run/stop, motor forward/reverse selection, motor speed increase/decrease, and local/remote control selection.
   3. Control Functions:
      a. Control Method: Selectable vector and scalar/volts per hertz unless otherwise indicated.
         1) Scalar/Volts per Hertz Control: Provide IR compensation for improved low-speed torque.
         2) Vector Control: Provide selectable autotuning function.
      b. Adjustable acceleration and deceleration time; linear and S-curve ramps; selectable coast to stop.
      c. Selectable braking control; DC injection or flux braking.
      d. Adjustable minimum/maximum speed limits.
      e. Adjustable pulse width modulation switching carrier frequency.
      f. Adjustable motor slip compensation.
      g. Selectable autorestart after noncritical fault; programmable number of time delay between restart attempts.
   4. Status Indications:
      a. Motor run/stop status.
      b. Motor forward/reverse status.
      c. Local/remote control status.
      d. Output voltage.
      e. Output current.
      f. Output frequency.
      g. DC bus voltage.
      h. Motor speed.
   5. Protective Functions/Alarm Indications:
      a. Overcurrent.
      b. Motor overload.
      c. Undervoltage.
      d. Overvoltage.
      e. Controller overtemperature.
      f. Input/output phase loss.
      g. Output short circuit protection.
      h. Output ground fault protection.
   6. Inputs:
      a. Digital Input(s): Three.
      b. Analog Input(s): Two.
   7. Outputs:

8. Communications: Compatible with connected systems. Provide accessories necessary for proper interface.
9. Features:
    a. Password-protected security access.
    b. Event log.

I. Power Conditioning/Filtering:
1. Provide DC link choke or input/line reactor for each controller unless otherwise indicated or required.
2. Reactor Impedance: 3 percent, unless otherwise indicated or required.

J. Packaged Controllers: Controllers factory-mounted in separate enclosure with externally operable disconnect and specified accessories.
1. Disconnects: Circuit breaker or disconnect switch type.
    a. Disconnect Switches: Fusible type or nonfusible type with separate input fuses.
    b. Provide externally operable handle with means for locking in OFF position. Provide safety interlock to prevent opening cover with disconnect in ON position with capability of overriding interlock for testing purposes.
    c. Provide auxiliary interlock for disconnection of external control power sources where applicable.
2. Provide door-mounted remote operator interface.

K. Service Conditions:
1. Provide controllers and associated components suitable for operation under following service conditions without derating:
    a. Altitude: Less than 3,300 feet.
    b. Ambient Temperature: Between 32 degrees F and 104 degrees F.
2. Provide controllers and associated components suitable for operation at indicated ratings under service conditions at installed location.

L. Short Circuit Current Rating:
1. Provide line/input reactors where specified by manufacturer for required short circuit current rating.

M. Conductor Terminations: Suitable for use with conductors to be installed.

N. Enclosures:
1. Comply with NEMA IA 10030.
2. NEMA EN 10250 Environment Type or Equivalent IEC 60529 Rating: Unless otherwise indicated, as specified for following installation locations:
3. Finish: Manufacturer's standard unless otherwise indicated.
4. Cooling: Forced air or natural convection as determined by manufacturer.

2.02 OVERCURRENT PROTECTIVE DEVICES

A. Overload Relays:
1. Provide overload relays and, where applicable, associated current elements/heaters selected for actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
2. Comply with NEMA ICS 2.
3. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
4. Trip-free operation.
5. Visible trip indication.
6. Resettable:
    a. Employ manual reset unless otherwise indicated.
    b. Do not employ automatic reset with two-wire control.

B. Fusible Disconnect Switches:
1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA BS 31047, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated or as required.
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 OFF position. Provide means for locking switch cover in closed position. Provide safety interlock to prevent opening of cover with switch in ON position with capability of overriding interlock for testing purposes.

C. Circuit Breakers:
1. Motor Circuit Protectors:
a. Description: Instantaneous-trip circuit breakers furnished with magnetic instantaneous tripping elements for short circuit protection, but not with thermal inverse time tripping elements for overload protection; UL 489 recognized only for use as part of listed combination motor controller with overload protection; ratings, configurations, and features as indicated or as required.
b. Provide field-adjustable magnetic instantaneous trip setting.

2.03 ACCESSORIES

A. Control and Timing Relays:
1. Comply with NEMA IA 10039.
2. Provide number and type of relays indicated or required to perform necessary functions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings of controllers are consistent with indicated requirements.

C. Verify that mounting surfaces are ready to accept controllers.

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 in accordance with NEMA IS 10034 and manufacturer's instructions.

C. Do not exceed manufacturer's recommended maximum cable length between controller and motor.

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 230529.

F. Install controllers plumb and level.

G. Provide grounding and bonding in accordance with Section 260526.

H. Install field-installed devices, components, and accessories.

I. Provide fuses complying with Section 262813 for fusible switches as indicated.

J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

K. Set field-adjustable settings of controllers and associated components according to installed motor requirements, in accordance with recommendations of manufacturers of controller and load.

3.03 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.17. Insulation-resistance test on control wiring listed as optional is not required.

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 circuit breakers larger than 600 amperes. Tests listed as optional are not required.

E. Correct deficiencies and replace damaged or defective controllers 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 controller enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

3.06 PROTECTION

A. Protect installed controllers from subsequent construction operations.

END OF SECTION

SECTION 230993
SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other sections.

1.02 SUBMITTALS

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

B. Sequence of Operation Documentation: Submit written sequence of operation for entire HVAC system and each piece of equipment.
   1. Include at least the following sequences:
      a. Start-up.
      b. Warm-up mode.
      c. Normal operating mode.
      d. Unoccupied mode.
      e. Shutdown.
      f. Temperature and pressure control, such as setbacks, setups, resets, etc.
   2. Include initial and recommended values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.
   3. For packaged controlled equipment, include manufacturer's furnished sequence of operation amplified as required to describe the relationship between the packaged controls and the control system, indicating which points are adjustable control points and which points are only monitored.

C. Control System Diagrams: Submit graphic schematic of the control system showing each control component and each component controlled, monitored, or enabled.
   1. Include the system and component layout of all equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
   2. Include all monitoring, control and virtual points specified in elsewhere.

1.03 QUALITY ASSURANCE

A. Design system under direct supervision of a Professional Engineer experienced in design of this work and licensed at the State in which the Project is located.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 AIR TERMINAL UNITS

A. Single-duct Bypass:
   1. Automatic Heating/Cooling Changeover:
      a. Heating Mode (Supply air system in heating mode above 78 degrees F).
         1) On a rise in space temperature above set-point, the bypass damper modulates closed, reducing the flow of warm air to the space while simultaneously opening the bypass damper.
         2) On a fall in space temperature below the set-point, the bypass damper modulates open, increasing the flow of warm air to the space while simultaneously closing the bypass damper.

3.02 CABINET HEATERS

A. Single temperature electric room thermostat set at 68 degrees F maintains constant space temperature by cycling unit fan motor.

B. Single temperature thermostat on return heating water line from floor mounted cabinet heaters de-energizes unit on temperatures below 95 degrees F.

3.03 HUMIDIFIERS

A. When fan is running and air flow switch proves air flow, line voltage room humidistat reset from outdoors maintains humidity level of 50 percent by cycling unit fan two-way steam valve.

END OF SECTION

SECTION 232113
HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hydronic system requirements.

B. Heating water and glycol piping, above grade.

C. Chilled water piping, above grade.

D. Equipment drains and overflows.

E. Pipe hangers and supports.

F. Unions, flanges, mechanical couplings, and dielectric connections.

G. Valves:
   1. Ball valves.
   2. Butterfly valves.
   3. Check valves.

H. Flow controls.

1.02 RELATED REQUIREMENTS

A. Section 232500 - HVAC Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

D. ASME B16.51 - Copper and Copper Alloy Press-Connect Pressure Fittings; 2021.

E. ASME B31.9 - Building Services Piping; 2025.

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; 2025, with Errata.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.

C. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2025.

D. ASTM B32 - Standard Specification for Solder Metal; 2020.

E. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

F. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

G. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications; 2018, with Editorial Revision (2024).

H. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007 (Reapproved 2024).

I. ASTM F3226/F3226M - Standard Specification for Metallic Press-Connect Fittings for Piping and Tubing Systems; 2019 (Reapproved 2024).

J. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

K. AWS D10.12M/D10.12 - Guide for Welding Mild Steel Pipe; 2000.

L. AWWA C606 - Grooved and Shouldered Joints; 2022.

M. IAPMO (UMC) - 2024 Uniform Mechanical Code; 2024.

N. ICC (IMC) - International Mechanical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

O. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

1.04 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.

1.05 SUBMITTALS

A. See Section 013000 - 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. Indicate valve data and ratings.

D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.06 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 documented experience.

C. Welder Qualifications: Certify in accordance with ASME BPVC-IX.
   1. Provide certificate of compliance from authority having jurisdiction, indicating approval of welders.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers, and supports as required, as indicated, and as follows:
   1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
   2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
   3. Grooved mechanical joints may be used in accessible locations only.
      a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by COR.
      b. Use rigid joints unless otherwise indicated.
      c. Use gaskets of molded synthetic rubber with central cavity, pressure-responsive configuration, and complying with ASTM D2000, Grade 2CA615A15B44F17Z for circulating medium up to maximum 230 degrees F or Grade M3BA610A15B44Z for circulating medium up to maximum 200 degrees F.
   4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

D. Valves: Provide valves where indicated:
   1. For throttling, bypass, or manual flow control services, use globe, ball, or butterfly valves.

2. For shut-off and to isolate parts of systems or vertical risers, use gate, ball, or butterfly valves.

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 D10.12M/D10.12 welded.
   2. Threaded Joints: ASME B16.3, malleable iron fittings.
   3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.
   4. Mechanical Press Sealed Fittings: ASTM F3226/F3226M, ICC (IMC), and IAPMO (UMC) approved, with EPDM seals.

B. Copper Tube: ASTM B88 (ASTM B88M), Type L, drawn temper, 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.

2.03 CHILLED WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black; using one of the following joint types:
   1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D10.12M/D10.12 welded.
   2. Threaded Joints: ASME B16.3, malleable iron fittings.
   3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.
   4. Mechanical Press Sealed Fittings: ASTM F3226/F3226M, ICC (IMC), and IAPMO (UMC) approved, with EPDM seals.

B. Copper Tube: ASTM B88 (ASTM B88M), Type L, drawn temper.
   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.

2.04 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn; using one of the following joint types:

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.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
   3. Hangers for Cold Pipe Sizes 2 Inches and Greater: Carbon steel, adjustable, clevis.
   4. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.
   5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   6. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

B. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge-shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

2.06 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe of 2 Inches and Less:

B. Flanges for Pipe 2 Inches and Greater:

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
   1. Dimensions and Testing: In accordance with AWWA C606.
   2. Mechanical Couplings: Comply with ASTM F1476.
   3. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
   4. When pipe is field grooved, provide coupling manufacturer's grooving tools.

2.07 BALL VALVES

A. Manufacturers:
   1. Anvil International: www.anvilintl.com/#sle.
   2. Apollo Valves: www.apollovalves.com/#sle.
   3. Shurjoint Piping Products, Inc: www.shurjoint.com/#sle.
   4. Victaulic Company: www.victaulic.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

B. Up To and Including 2 Inches:
   1. Bronze one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.

C. Over 2 Inches:
   1. Ductile iron body, chrome plated stainless steel ball, teflon, Virgin TFE, or Reinforced TFE seat and stuffing box seals, lever handle, gear operated, or grooved, flanged ends, rated to 800 psi.

2.08 BUTTERFLY VALVES

A. Manufacturers:
   1. Anvil International: www.anvilintl.com/#sle.
   2. Apollo Valves: www.apollovalves.com/#sle.
   3. Victaulic Company: www.victaulic.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer, lug, grooved, or flanged ends, extended neck.

C. Disc: Construct of aluminum bronze, chrome plated ductile iron, stainless steel, ductile iron with EPDM encapsulation, Buna-N encapsulation, or EPDM.

D. Operator: 10 position lever handle.

2.09 SWING CHECK VALVES

A. Manufacturers:
   1. Anvil International: www.anvilintl.com/#sle.
   2. Apollo Valves: www.apollovalves.com/#sle.
   3. Shurjoint Piping Products, Inc: www.shurjoint.com/#sle.
   4. Victaulic Company: www.victaulic.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

B. Up To and Including 2 Inches:
   1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.

C. Over 2 Inches:
   1. Iron body, bronze or stainless steel trim, stainless steel, bronze, bronze faced rotating, or composition swing disc, renewable disc and seat, flanged, grooved, or threaded ends.

2.10 FLOW CONTROLS

A. Manufacturers:
   1. Anvil International: www.anvilintl.com/#sle.
   2. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.

3. Griswold Controls: www.griswoldcontrols.com/#sle.
4. Hays Fluid Controls: www.haysfluidcontrols.com/#sle.
5. ITT Bell & Gossett: www.bellgossett.com/#sle.
6. Shurjoint Piping Products, Inc: www.shurjoint.com/#sle.
7. Taco, Inc: www.taco-hvac.com/#sle.
8. Victaulic Company: www.victaulic.com/#sle.
9. Substitutions: See Section 016000 - 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 10 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, minimum pressure 2 psi.

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 as required by coupling manufacturer.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare piping connections to equipment using jointing system specified.

E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

F. After completion, fill, clean, and treat systems. See Section 232500 for additional requirements.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner, parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and to avoid interference with use of space.

D. Group piping whenever practical at common elevations.

E. Slope piping and arrange to drain at low points.

F. Pipe Hangers and Supports:

3.03 SCHEDULES

A. Hanger Spacing for Copper Tubing.
1. 1/2 Inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. 1 Inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. 1-1/2 Inches and 2 Inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. 2-1/2 Inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
5. 3 Inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
6. 4 Inches: Maximum span, 12 feet; minimum rod size, 1/2 inch.

B. Hanger Spacing for Steel Piping.
1. 1/2 Inch, 3/4 Inch, and 1 Inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. 1-1/4 Inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
3. 1-1/2 Inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. 2 Inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. 2-1/2 Inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
6. 3 Inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
7. 4 Inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.

END OF SECTION

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SECTION 232114
HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air vents.

B. Strainers.

C. Balancing valves.

1.02 SUBMITTALS

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

B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.

C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

D. Manufacturer's qualification statement.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements for additional provisions.

1.03 QUALITY ASSURANCE

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

1.04 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 AIR VENTS

A. Manufacturers:
   1. Armstrong International, Inc: www.armstronginternational.com/#sle.
   2. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
   3. Flamco: www.flamcogroup.us/#sle.
   4. Taco, Inc: www.taco-hvac.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

B. Float Air Vent:
   1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

C. Hygroscopic Air Vent:
   1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring-loaded ball check valve.

D. Maximum Fluid Pressure: 150 psi.

E. Maximum Fluid Temperature: 250 degrees F.

2.02 STRAINERS

A. Manufacturers:
   1. American Wheatley, a company of Global Flow Products, LLC: www.wheatleyhvac.com/#sle.
   2. Armstrong International, Inc: www.armstronginternational.com/#sle.
   3. Flexicraft Industries: www.flexicraft.com/#sle.

4. Nexus Valve, Inc: www.nexusvalve.com/#sle.
5. The Metraflex Company; LPD Y Strainer: www.metraflex.com/#sle.
6. Substitutions: See Section 016000 - Product Requirements.

B. Size 2 inch and Under:
1. Provide threaded, grooved, or sweat brass or iron body for up to 175 psi working pressure, Y-pattern strainer with 1/32 inch stainless steel perforated screen.
2. Body Material by Fluid Service:
a. Cast Iron or Brass:
1) Steam: Up to 250 psi at 450 degrees F.
2) Liquids: Up to 400 psi at 150 degrees F.

C. Size 2-1/2 inch to 4 inch:
1. Provide flanged or grooved iron body for up to 175 psi working pressure, up to 250 degrees F working temperature, Y-pattern strainer with 1/16 inch or 3/64 inch stainless steel perforated screen.
2. Body Material by Fluid Service:
a. Cast Iron:
1) Steam: Up to 125 psi at 350 degrees F.
2) Liquids: Up to 200 psi at 150 degrees F.

2.03 BALANCING VALVES

A. Manufacturers:
1. American Wheatley, a company of Global Flow Products, LLC: www.wheatleyhvac.com/#sle.
2. Armstrong International, Inc: www.armstronginternational.com/#sle.
3. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
4. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
5. FNW: www.fnw.com/#sle.
6. Nexus Valve, Inc: www.nexusvalve.com/#sle.
7. NIBCO INC: www.nibco.com/#sle.
8. Oventrop Corporation; Hydrocontrol F: www.oventrop.com/#sle.
9. Taco, Inc: www.taco-hvac.com/#sle.
10. Substitutions: See Section 016000 - Product Requirements.

B. Size 2 inch and Smaller:
1. Provide ball or globe style with flow balancing, shut-off capabilities, memory stops, and minimum of two metering ports and female sweat, NPT threaded, press, or soldered connections.
2. Metal construction materials consist of bronze, brass, or sainless steel.
3. Non-metal construction materials consist of Teflon, EPDM, engineered resin, or Buna-N.

2.04 AUTOMATIC FLOW LIMITING VALVES

A. Size 1/2 inch to 14 inch:
1. Provide ball, globe, or cartridge style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and NPT threaded, soldered, or press connections.
2. Metal construction materials consist of bronze, brass, or stainless steel.
3. Non-metal construction materials consist of Teflon, EPDM, engineered resin, or Buna-N.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install specialties and equipment in accordance with manufacturer's instructions.

B. Provide manual air vents at system high points and as indicated.

C. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

D. Provide valved drain and hose connection on strainer blowdown connection.

E. Provide radiator valves on water inlet to terminal heating units such as radiation, unit heaters, and fan coil units.

F. Provide radiator balancing valves on water outlet from terminal heating units such as radiation, unit heaters, and fan coil units.

END OF SECTION

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SECTION 232213
STEAM AND CONDENSATE HEATING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe and pipe fittings.

B. Pipe hangers and supports.

C. Steam piping system.

D. Steam condensate piping system.

1.02 RELATED REQUIREMENTS

A. Section 083100 - Access Doors and Panels.

1.03 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

D. ASME B31.9 - Building Services Piping; 2025.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.

F. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2025.

G. ASTM B32 - Standard Specification for Solder Metal; 2020.

H. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

I. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

J. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Amendment (2026).

K. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

1.04 SUBMITTALS

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

B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labelling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

2.02 LOW PRESSURE STEAM PIPING (15 PSIG MAXIMUM)

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black.
   1. Fittings: ASME B16.3 malleable iron Class 150, or ASTM A234/A234M wrought steel.
   2. Joints: Threaded, or AWS D1.1/D1.1M welded.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn.
   1. Fittings: ASME B16.18, cast brass, or ASME B16.22 wrought copper.
   2. Joints: Solder, lead free, ASTM B32, HB alloy (95-5 tin-antimony), or tin and silver.

2.03 LOW PRESSURE STEAM CONDENSATE PIPING

A. Steel Pipe: ASTM A53/A53M, Schedule 80, black.

1. Fittings: ASME B16.3 malleable iron Class 150, or ASTM A234/A234M wrought steel.
2. Joints: Threaded, or AWS D1.1/D1.1M welded.

B. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn.
1. Fittings: ASME B16.18, cast brass, or ASME B16.22, wrought copper.
2. Joints: Solder, lead free, ASTM B32, HB alloy (95-5 tin-antimony), or tin and silver.

2.04 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 2 to 4 Inches: Carbon steel, adjustable, clevis.

C. Hangers for Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.

D. Multiple or Trapeze Hangers for Pipe Sizes to 4 inches: Steel channels with welded spacers and hanger rods.

E. Multiple or Trapeze Hangers for Pipe Sizes 6 Inches and Over: Steel channels with welded spacers and hanger rods; cast iron roll and stand.

F. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

G. Wall Support for Pipe Sizes 4 to 5 Inches: Welded steel bracket and wrought steel clamp.

H. Wall Support for Pipe Sizes 6 Inches and Over: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast iron roll.

I. Vertical Support: Steel riser clamp.

J. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

K. 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.

2.05 UNIONS, FLANGES, AND COUPLINGS

A. Unions for Pipe 2 Inches and Under:
1. Ferrous Piping: 150 psig galvanized malleable iron, threaded.
2. Copper Pipe: Bronze, soldered joints.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner, plumb and 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:
1. Install in accordance with ASME B31.9.
2. Support horizontal piping as indicated.
3. Place hangers within 12 inches of each horizontal elbow.
4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
7. Provide copper plated hangers and supports for copper piping.

F. Provide clearance for installation of insulation and access to valves and fittings.

G. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 083100.

H. Slope steam piping one inch in 40 feet in direction of flow. Use eccentric reducers to maintain bottom of pipe level.

I. Slope steam condensate piping one inch in 40 feet. Provide drip trap assembly at low points and before control valves. Run condensate lines from trap to nearest condensate receiver. Provide loop vents over trapped sections.

3.02 SCHEDULES

A. Hanger Spacing for Copper Tubing.
   1. 1/2 inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
   2. 1 inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
   3. 1-1/2 inch and 2 inch: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   4. 2-1/2 inch: Maximum span, 9 feet; minimum rod size, 3/8 inch.

B. Hanger Spacing for Steel Steam Piping.
   1. 1/2 inch: Maximum span, 8 feet; minimum rod size, 1/4 inch.
   2. 3/4 inch and 1 inch: Maximum span, 9 feet; minimum rod size, 1/4 inch.
   3. 1-1/4 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
   4. 1-1/2 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
   5. 2 inches: Maximum span, 13 feet; minimum rod size, 3/8 inch.

C. Hanger Spacing for Steel Steam Condensate Piping.
   1. 1/2 inch, 3/4 inch, and 1 inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
   2. 1-1/4 inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   3. 1-1/2 inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
   4. 2 inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
   5. 2-1/2 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.

END OF SECTION

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SECTION 233100
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ducts.

B. Flexible ducts.

1.02 RELATED REQUIREMENTS

A. Section 230130.51 - HVAC Air-Distribution System Cleaning: Post install duct cleaning.

B. Section 230713 - Duct Insulation: External insulation and duct liner.

C. Section 233319 - Duct Silencers.

1.03 REFERENCE STANDARDS

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

D. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

E. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

F. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

I. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

J. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

K. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; 2012.

L. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

B. Product Data: Provide data for duct materials.

C. Manufacturer's Certificate: Certify that installation of glass fiber ductwork meets or exceed specified requirements.

D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate per appropriate seal class, following SMACNA (LEAK).

E. Manufacturer's Installation Instructions: Indicate special procedures for glass fiber ducts.

F. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

1.06 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

1.07 WARRANTY

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

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.

B. Provide metal duct unless otherwise indicated. Fibrous glass duct can be substituted at the Contractor's option.

C. Acoustical Treatment: Provide sound-absorbing liners and sectional silencers for metal-based ducts in compliance with Section 233319.

D. Duct Shape and Material in accordance with Allowed Static Pressure Range:
   1. Round: Plus or minus 2 in-wc of galvanized steel.
   2. Rectangular: Plus or minus 1/2 in-wc of galvanized steel.
   3. Flat Oval: Plus 2 in-wc of galvanized steel.

E. Duct Sealing and Leakage in accordance with Static Pressure Class:
   1. Duct Pressure Class and Material for Common Mechanical Ventilation Applications:
      a. Supply Air: 1/2 in-wc pressure class, galvanized steel.
      b. Return and Relief Air: 1/2 in-wc pressure class, galvanized steel.
      c. General Exhaust Air: 1/2 in-wc pressure class, galvanized steel.
   2. Low Pressure Service: Up to 2 in-wc:
      a. Seal: Class C, apply to seal off transverse joints.
      b. Leakage:
         1) Rectangular: Class 24 or 24 cfm/100 sq ft.
         2) Round: Class 12 or 12 cfm/100 sq ft.
   3. Low Pressure Service: From 2 in-wc to 3 in-wc:
      a. Seal: Class B, apply sealing of transverse joints and longitudinal seams.
      b. Leakage:
         1) Rectangular: Class 12 or 12 cfm/100 sq ft.
         2) Round: Class 6 or 6 cfm/100 sq ft.
   4. Medium and High Pressure Service: Above 3 in-wc:
      a. Seal: Class A, apply sealing of transverse joints, longitudinal seams, and duct wall penetrations.
      b. Leakage:
         1) Rectangular: Class 6 or 6 cfm/100 sq ft.
         2) Round: Class 3 or 3 cfm/100 sq ft.

F. Duct Fabrication Requirements:
   1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
   2. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE (FUND) Handbook - Fundamentals.
   3. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
   4. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.

5. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
6. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
7. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.
8. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.02 METAL DUCTS

A. Material Requirements:
   1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
   2. Aluminum: ASTM B209/B209M, aluminum sheet, alloy 3003-H14.
   3. Stainless Steel: ASTM A666, Type 304.

B. Fire Rated Ducts:
   1. Two-hour, Fire Rated Duct:
      a. UL labeled, construct of 18-gauge, 0.0516-inch galvanized steel.
      b. R-Value: 4.5 when tested in accordance with ASTM C177.

C. Rectangular Metal Duct:
   1. Rectangular Single Wall: Rectangular, longitudinal lock seam duct with galvanized steel wall.
   2. Rectangular Double Wall Insulated: Rectangular, longitudinal lock seam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with solid inner wall.
      a. Insulation:
         1) Thickness: 1 inch.
         2) Material: Air.

D. Flat-Oval Metal Ducts:
   1. Flat-Oval Single Wall Duct: Machine made from a round spiral lock seam duct.
      a. Fittings: Manufacture at least two gauges heavier metal than the duct.
      b. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

E. Round Metal Ducts:
   1. Round Single Wall Duct: Round lock seam duct with galvanized steel outer wall.
      a. Manufacturers:
         1) EHG, a DMI Company: www.ehgduct.com/#sle.
         2) Elgen Manufacturing Company, Inc; Snap Lock Pipes and Fittings: www.elgenmfg.com/#sle.
         3) MKT Metal Manufacturing: www.mktduct.com/#sle.
         4) Nordfab Ducting: www.nordfab.com/#sle.
         5) Substitutions: See Section 016000 - Product Requirements.
   2. Round Connection System: Interlocking duct connection system in accordance with SMACNA (DCS).

F. Connectors, Fittings, Sealants, and Miscellaneous:
   1. Fittings: Manufacture with solid inner wall of perforated galvanized steel.
   2. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
      a. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
      b. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
      c. Manufacturers:

1) Carlisle HVAC Products; Hardcast Versa-Grip 181 Water Based Fiber Reinforced Duct Sealant: www.carlislehvac.com/#sle.
2) Design Polymerics; DP 1010 Water Based Smooth Duct Sealant, Premium Quality: www.designpoly.com/#sle.
3) Elgen Manufacturing Company, Inc; Duct Sealer: www.elgenmfg.com/#sle.
4) H.B. Fuller Construction Products, Inc: www.fosterproducts.com//#sle.
5) Substitutions: See Section 016000 - Product Requirements.

3. Gasket Tape:
   a. Provide butyl rubber gasket tape for a flexible seal between transfer duct connector (TDC), transverse duct flange (TDF), applied flange connections, and angle ring connections.
   b. Manufacturers:
      1) Design Polymerics; DP 1040 100 Percent Solids, High Pressure/High-Velocity Butyl Gasket Tape: www.designpoly.com/#sle.
      2) Elgen Manufacturing Company, Inc; 440 Butyl Gasket Tape: www.elgenmfg.com/#sle.
      3) Substitutions: See Section 016000 - Product Requirements.
4. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.03 FLEXIBLE DUCTS

A. Medium Pressure Flexible Ducts: UL 181, Class 1, aluminized laminate, mechanically fastened and rolled using galvanized steel to form spiral helix.
   1. Insulation: Fiberglass insulation with metallic vapor barrier.
   2. Inner Core: Tri-laminate of polyester, fiberglass, and aluminum foil.
   3. Pressure Rating: 15 in-wc positive and 5 in-wc negative.
   4. Maximum Velocity: 5500 fpm.
   5. Temperature Range: Minus 20 degrees F to 250 degrees F.
   6. Manufacturers:
      a. Flexmaster USA, a brand of Masterduct, Inc; Type 5: www.flexmasterusa.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

B. Flexible Air Ducts:
   1. UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound spring steel wire.
   2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   3. Pressure Rating: From 10 in-wc positive to 1 in-wc negative.
   4. Maximum Velocity: 4,000 fpm.
   5. Temperature Range: Minus 20 to 210 degrees F.
   6. Manufacturers:
      a. JP Lamborn Co: www.jplflex.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install products following the manufacturer's instructions.

C. Comply with safety standards NFPA 90A and NFPA 90B.

D. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

F. Flexible Ducts: Connect to metal ducts with mechanical fastener.

G. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.

H. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

I. Connect diffusers or light troffer boots to low-pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.

J. Duct Insulation: Provide duct insulation. See Section 230713.

3.02 CLEANING

A. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

B. Clean thoroughly each duct system. See Section 230130.51.

C. Clean duct system by forcing air at high velocity through duct to remove accumulated dust. Clean half the system at a time to obtain sufficient air. Protect equipment that could be harmed by excessive dirt with temporary filters or bypass during cleaning.

END OF SECTION

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SECTION 233300
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 233100 - HVAC Ducts and Casings.

C. Section 253513 - Integrated Automation Actuators and Operators: Damper operators.

1.02 REFERENCE STANDARDS

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2018.

B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

C. NFPA 92 - Standard for Smoke Control Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

F. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.

G. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

H. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; Current Edition, Including All Revisions.

1.03 SUBMITTALS

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

B. Product Data: Provide for shop-fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Provide instructions for fire dampers.

D. Project Record Drawings: Record actual locations of access doors and test holes.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements for additional provisions.
   2. Extra Fusible Links: One of each type and size.

1.04 QUALITY ASSURANCE

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

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers:
   1. Carlisle HVAC Products; Dynair Hollow Vane and Rail (Double Wall Vane): www.carlislehvac.com/#sle.
   2. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
   3. Ruskin Company: www.ruskin.com/#sle.
   4. Titus HVAC, a brand of Johnson Controls: www.titus-hvac.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

B. Multi-blade device with radius blades attached to pivoting frame and bracket, steel construction, with push-pull operator strap.

2.02 BACKDRAFT DAMPERS - METAL

A. Manufacturers:
   1. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/#sle.
   2. Nailor Industries, Inc: www.nailor.com/#sle.
   3. Pottorff: www.pottorff.com/#sle.
   4. Ruskin Company: www.ruskin.com/#sle.
   5. United Enertech: www.unitedenertech.com/#sle.
   6. Substitutions: See Section 016000 - Product Requirements.

B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.03 BACKDRAFT DAMPERS - FABRIC

A. Fabric Backdraft Dampers: Factory-fabricated.
   1. Blades: Neoprene coated fabric material.
   2. Birdscreen: 1/2 inch nominal mesh of galvanized steel or aluminum.
   3. Maximum Velocity: 1000 fpm (5 mps) face velocity.

2.04 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:
   1. AireTechnologies, Inc, a DMI Company: www.airetechnologies.com/#sle.
   2. Lloyd Industries, Inc: www.firedamper.com/#sle.
   3. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/#sle.
   4. Nailor Industries, Inc: www.nailor.com/#sle.
   5. NCA, a brand of Metal Industries Inc: www.ncamfg.com/#sle.
   6. Pottorff: www.pottorff.com/#sle.
   7. Ruskin Company: www.ruskin.com/#sle.
   8. United Enertech: www.unitedenertech.com/#sle.
   9. Substitutions: See Section 016000 - Product Requirements.

B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

C. Provide factory sleeve and collar for each damper.

D. Multiple Blade Dampers: Fabricate with 16 gauge, 0.0598 inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.

E. Operators: UL listed and labeled; spring-return, electric-type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on interior of duct and link to damper operating shaft.

F. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure, stainless steel springs with locking devices to ensure positive closure for units mounted horizontally.

2.05 DUCT ACCESS DOORS

A. Manufacturers:
   1. Acudor Products Inc, a Division of Nelson Industrial Inc: www.acudor.com/#sle.
   2. Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
   3. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
   4. Lloyd Industries, Inc: www.firedamper.com/#sle.
   5. Nailor Industries, Inc: www.nailor.com/#sle.
   6. Ruskin Company: www.ruskin.com/#sle.
   7. SEMCO LLC: www.semcohvac.com/#sle.
   8. The Williams Brothers Corporation of America: www.wbdoors.com/#sle.
   9. Substitutions: See Section 016000 - Product Requirements.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

2.06 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.07 FIRE DAMPERS

A. Manufacturers:
   1. AireTechnologies, Inc, a DMI Company: www.airetechnologies.com/#sle.
   2. Lloyd Industries, Inc: www.firedamper.com/#sle.
   3. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/#sle.
   4. Nailor Industries, Inc: www.nailor.com/#sle.
   5. NCA, a brand of Metal Industries Inc: www.ncamfg.com/#sle.
   6. Panasonic Corporation of North America; Flex Damper: www.panasonic.com/#sle.
   7. Pottorff: www.pottorff.com/#sle.
   8. Ruskin Company: www.ruskin.com/#sle.
   9. United Enertech: www.unitedenertech.com/#sle.
   10. Substitutions: See Section 016000 - Product Requirements.

B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

2.08 FLEXIBLE DUCT CONNECTORS

A. Manufacturers:
   1. Carlisle HVAC Products; Dynair Connector Plus G90 Steel Offset Seam Neoprene Fabric: www.carlislehvac.com/#sle.
   2. Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
   3. Substitutions: See Section 016000 - Product Requirements.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Flexible Duct Connections: Fabric crimped into metal edging strip.

2.09 SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.

B. Dampers: UL Class 1 airfoil blade type smoke damper, normally open automatically operated by pneumatic actuator.

C. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

2.10 VOLUME CONTROL DAMPERS

A. Manufacturers:
   1. AireTechnologies, Inc, a DMI Company: www.airetechnologies.com/#sle.
   2. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/#sle.
   3. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
   4. MKT Metal Manufacturing: www.mktduct.com/#sle.
   5. Nailor Industries, Inc: www.nailor.com/#sle.
   6. NCA, a brand of Metal Industries Inc: www.ncamfg.com/#sle.
   7. Pottorff: www.pottorff.com/#sle.
   8. Ruskin Company: www.ruskin.com/#sle.
   9. United Enertech: www.unitedenertech.com/#sle.
   10. Substitutions: See Section 016000 - Product Requirements.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Splitter Dampers:

D. Single Blade Dampers:
   1. Fabricate for duct sizes up to 6 by 30 inch.
   2. Blade: 24 gauge, 0.0239 inch, minimum.

E. Multi-Blade Damper: Fabricate consisting of opposed blades with maximum blade sizes 8 by 72 inches. Assemble center- and edge-crimped blades in prime-coated or galvanized-channel frame with suitable hardware.
   1. Blade: 18 gauge, 0.0478 inch, minimum.

F. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

G. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

H. Constant Airflow Regulators:
   1. General Requirements:
      a. Provide bi-directional, air balancing regulator for pressure independent air volume control.
      b. Complies with UL 2043 for heat and smoke release.
      c. Complies with AMCA 500-D for the allowable leakage rates.
      d. Airflow regulator to be field adjustable.

2.11 MISCELLANEOUS PRODUCTS

A. Damper Operators: Provide electric operators; see Section 253513.

B. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.
   1. Thickness: 2 mils.
   2. High tack water based adhesive.
   3. UV stable light blue color.
   4. Manufacturers:
      a. Carlisle HVAC Products; Dynair Duct Protection Film: www.carlislehvac.com/#sle.
      b. Elgen Manufacturing Company, Inc; Shrink Wrap with PSA: www.elgenmfg.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 233100 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96 Provide minimum 8 by 8 inch size access door for hand and shoulder access, or as indicated on drawings. Provide minimum 4 by 4 inch size access door for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire-rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.

G. Demonstrate re-setting of fire dampers to Owner's representative.

H. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

I. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

J. For fans developing static pressures of 5.0 inches and over, cover flexible connections with leaded vinyl sheet, held in place with metal straps.

K. Use splitter dampers only where indicated.

L. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

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SECTION 233423
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof exhausters.

B. Upblast roof exhausters.

C. Utility vent blowers.

1.02 RELATED REQUIREMENTS

A. Section 233100 - HVAC Ducts and Casings.

B. Section 233300 - Air Duct Accessories: Backdraft dampers.

1.03 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.

B. AMCA 99 - Standards Handbook; 2025.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2020.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2025.

E. AMCA 300 - Reverberation Room Methods of Sound Testing of Fans; 2024.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.

G. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate fan roof curbs and service utilities installation according to fan size.

B. Sequencing: Ensure that utility connections are completed in an orderly and expeditious manner.

1.05 SUBMITTALS

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

B. Product Data: Provide data on fans and accessories, including fan curves with specified operating point plotted, power, rpm, sound power levels at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate installation instructions.

D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Fan Belts: One set for each individual fan.

1.06 QUALITY ASSURANCE

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

1.07 FIELD CONDITIONS

A. Permanent ventilators may be used for ventilation during construction only after ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carnes, a division of Carnes Company Inc: www.carnes.com/#sle.

B. Greenheck Fan Corporation: www.greenheck.com/#sle.

C. Loren Cook Company: www.lorencook.com/#sle.

D. PennBarry, Division of Air System Components: www.pennbarry.com/#sle.

E. Twin City Fan & Blower: www.tcf.com/#sle.

F. Substitutions will be allowed: See Section 016000 - Product Requirements.

2.02 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.

2.03 ROOF EXHAUSTERS

A. Manufacturers:
   1. Carnes, a division of Carnes Company Inc: www.carnes.com/#sle.
   2. Greenheck Fan Corporation: www.greenheck.com/#sle.
   3. Patterson Fan Company, Inc: www.pattersonfan.com/#sle.
   4. PennBarry, Division of Air System Components: www.pennbarry.com/#sle.
   5. Quietaire Corporation; RPBE Series: www.quietaire.com/#sle.
   6. Twin City Fan & Blower; BCRD: www.tcf.com/#sle.
   7. Substitutions will be allowed: See Section 016000 - Product Requirements.

B. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.

C. Roof Curb: 8 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips.

D. Disconnect Switch: Factory wired, nonfusible, in housing for thermal overload protected motor and wall mounted multiple speed switch.

E. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.

F. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm gets attained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.04 UPBLAST ROOF EXHAUSTERS

A. Manufacturers:
   1. Canarm Ltd; ALX-UB Series: www.canarm.com/#sle.
   2. Carnes, a division of Carnes Company Inc; VUBK: www.carnes.com/#sle.
   3. Greenheck Fan Corporation: www.greenheck.com/#sle.
   4. Patterson Fan Company, Inc: www.pattersonfan.com/#sle.
   5. Quietaire Corporation; RPUB Series: www.quietaire.com/#sle.
   6. Substitutions will be allowed: See Section 016000 - Product Requirements.

B. Belt Drive Fan:
   1. Fan Wheel:
      a. Type: Non-overloading, backward inclined centrifugal.
      b. Material: Aluminum, statically and dynamically balanced.
   2. Housing:
      a. Construct of heavy gauge aluminum including curb cap, windband, and motor compartment.
      b. Rigid internal support structure.

c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
d. Construct drive frame assembly of heavy gauge steel, mounted on vibration isolators.
e. Provide breather tube for fresh air motor cooling and wiring.

C. Shafts and Bearings:
1. Fan Shaft:
a. Ground and polished steel with anti-corrosive coating.
b. First critical speed at least 25 percent over maximum cataloged operating speed.
2. Bearings:
a. Permanently sealed or pillow block type.
b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
c. 100 percent factory tested.

D. Drive Assembly:
1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.
2. Belts: Static free and oil resistant.
3. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
4. Motor pulley adjustable for final system balancing.
5. Readily accessible for maintenance.

E. Disconnect Switches:
1. Factory mounted and wired.
2. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
3. Finish for Painted Steel Enclosures: Provide manufacturer's standard or factory-applied gray unless otherwise indicated.
4. Positive electrical shutoff.
5. Wired from fan motor to junction box installed within motor compartment.

F. Drain Trough: Allows for single-point drainage of water, grease, and other residues.

G. Options/Accessories:
1. Birdscreen:

2.05 UTILITY VENT BLOWERS

A. Manufacturers:
1. Canarm Ltd; BI-RM Series: www.canarm.com/#sle.
2. Greenheck Fan Corporation: www.greenheck.com/#sle.
3. Loren Cook Company: www.lorencook.com/#sle.
4. PennBarry, Division of Air System Components: www.pennbarry.com/#sle.
5. Twin City Fan & Blower; BCV: www.tcf.com/#sle.
6. Substitutions will be allowed: See Section 016000 - Product Requirements.

B. Direct Drive Fan:
1. Fan Wheel:
a. Type: Non-overloading, backward inclined centrifugal.
b. Material: Aluminum, statically and dynamically balanced.
2. Housing:
a. Construct of heavy gauge aluminum including curb cap, windband, and motor compartment.
b. Rigid internal support structure.
c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
d. Construct drive frame assembly of heavy gauge steel, mounted on vibration isolators.
e. Provide breather tube for fresh air motor cooling and wiring.

C. Shafts and Bearings:
1. Fan Shaft:
a. Ground and polished steel with anti-corrosive coating.
b. First critical speed at least 25 percent over maximum cataloged operating speed.

2. Bearings:
    a. Permanently sealed or pillow block type.
    b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
    c. 100 percent factory tested.

D. Drive Assembly:
1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.
2. Belts: Static free and oil resistant.
3. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
4. Motor pulley adjustable for final system balancing.
5. Readily accessible for maintenance.

E. Disconnect Switches:
1. Factory mounted and wired.
2. Finish for Painted Steel Enclosures: Provide manufacturer's standard or factory-applied gray unless otherwise indicated.
3. Positive electrical shutoff.
4. Wired from fan motor to junction box installed within motor compartment.

F. Drain Trough: Allows for single-point drainage of water, grease, and other residues.

G. Options/Accessories:
1. Birdscreen:

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.

C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

END OF SECTION

SECTION 233600
AIR TERMINAL UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single-duct terminal units.
   1. Constant-volume units.
   2. Variable-volume units.

B. Hose kits and valves.

1.02 RELATED REQUIREMENTS

A. Section 230548 - Vibration and Seismic Controls for HVAC.

B. Section 230913 - Instrumentation and Control Devices for HVAC: Thermostats and actuators.

C. Section 230923 - Direct-Digital Control System for HVAC.

D. Section 232113 - Hydronic Piping: Connections to heating coils.

E. Section 232114 - Hydronic Specialties: Connections to heating coils.

F. Section 233100 - HVAC Ducts and Casings.

G. Section 233300 - Air Duct Accessories.

H. Section 233700 - Air Outlets and Inlets.

I. Section 238200 - Convection Heating and Cooling Units: Air coils.

J. Section 251400 - Integrated Automation Local Control Units: HVAC controllers.

1.03 REFERENCE STANDARDS

A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001, with Addenda (2011).

B. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2017 (Reaffirmed 2023).

C. ASTM A492 - Standard Specification for Stainless Steel Rope Wire; 1995 (Reapproved 2019).

D. ASTM A603 - Standard Specification for Metallic-Coated Steel Structural Wire Rope; 2019.

E. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2024.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week before to the start of the work of this section; require attendance by affected installers.

B. Sequencing: Completion utility connections in an orderly and expeditious manner.

1.05 SUBMITTALS

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

B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate airflow, static pressure, and NC designation. Include electrical characteristics and connection requirements.

C. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.
   1. Include schedules listing discharge and radiated sound power level for each of the second through sixth-octave bands at inlet static pressures of 1 to 4 in-wc.

D. Certificates: Certify that coils are tested and rated in accordance with AHRI 410.

E. Project Record Documents: Record actual locations of units and locations of access doors required for access of valving.

F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant-volume regulators.

G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements for additional provisions.

1.06 QUALITY ASSURANCE

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

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 WARRANTY

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

B. Provide five year manufacturer warranty for air terminal units.

PART 2 PRODUCTS

2.01 SINGLE-DUCT, VARIABLE-VOLUME AND CONSTANT-VOLUME UNITS

A. Manufacturers:
   1. Carrier, a part of UTC Building and Industrial Systems, a unit of United Technologies Corp.: www.commercial.carrier.com/#sle.
   2. Johnson Controls, Inc: www.johnsoncontrols.com/#sle.
   3. Titus: www.titus-hvac.com
   4. Price Industries: www.priceindustries.com/#sle.
   5. Trane Technologies, PLC: www.trane.com/#sle.
   6. Substitutions: See Section 016000 - Product Requirements.

B. Basis of Design: Titus: www.titus-hvac.com
   1. Single-Duct Terminal Unit: DESV

C. General:
   1. Factory-assembled, AHRI 880 (I-P) rated and bearing the AHRI seal, air volume control terminal with damper assembly, flow sensor, externally mounted volume controller, duct collars, and all required features.
   2. Control box bearing identification, including but not necessarily limited to nominal cfm, maximum and minimum factory-set airflow limits, coil type and coil (right or left hand) connection, where applicable.

D. Unit Casing:
   1. Minimum 22 gauge, 0.0299 inch galvanized steel.
   2. Air Inlet Collar: Provide round, suitable for standard flexible duct sizes.
   3. Unit Discharge: Rectangular, with slip-and-drive connections.
   4. Acceptable Liners:
      a. Liner not to contain pentabrominated diphenyl ether (CAS #32534-81-9) or octabrominated diphenyl ether.

E. Damper Assembly:
   1. Heavy-gauge, galvanized steel, or extruded aluminum construction with solid steel, nickel-plated shaft pivoting on HDPE, self-lubricating bearings.
   2. Provide integral position indicator or alternative method for indicating damper position over full range of 90 degrees.
   3. Incorporate low leak damper blades for tight airflow shutoff.

F. Hot Water Heating Coil:
   1. Coil Casing: Minimum 22 gauge, 0.0299 inch galvanized steel, factory-installed on terminal discharge with rectangular outlet, duct connection type.
   2. Coil Fins: Aluminum or aluminum plated fins, mechanically-bonded to seamless copper tubes.
   3. Coil leak tested to minimum 350 psig.
   4. Base performance data on tests run in accordance with AHRI 410 and units to bear AHRI 410 label.

G. Controls:
   1. Terminal Unit Controls:

a. Provide accessories for field interfaced controller including ball valve and thermostat.
b. Factory ship DDC controller including airflow sensor, integral airflow transmitter, integral damper actuator, and duct-mounted temperature sensor.
c. Sequence of Operation: Zone temperature control with airflow and coil discharge monitoring.

2. DDC (Direct-Digital Controls):
   a. Include a factory-installed, unit-mounted, direct-digital controller.
   b. Bi-directional Damper Actuator: 24 volt, powered closed, spring return open.
   c. Microprocessor-Based Controller: Air volume controller, pressure-independent with electronic airflow transducers, factory-calibrated maximum and minimum CFMs.
      1) Occupied and unoccupied operating mode.
      2) Remote reset of temperature or CFM set points.
      3) Proportional, plus integral control of room temperature.
      4) Monitoring and adjusting with portable terminal.
   d. Room Sensor:
      1) Compatible with temperature controls specified.
      2) Wall-mounted, system powered, with temperature set-point adjustment including connection access for portable operator terminal.
   e. See Section 25 1400.

2.02 HOSE KITS AND VALVES

A. Manufacturers:
   1. Griswold Controls: www.griswoldcontrols.com/#sle.
   2. IMI Flow Design, a brand of IMI Hydronic Engineering Division of IMI plc: www.flowdesign.com/#sle.
   3. Substitutions: See Section 016000 - Product Requirements.

B. Ball Valves:
   1. Brass body for shutoff and hydronic balancing.
   2. Provide pressure/temperature ports.

C. Y Strainers:
   1. Bronze body.
   2. "Y" type configuration with brass cap.
   3. Maximum Operating Pressure: Minimum 450 psi.
   4. Screen: Stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.

C. See drawings for the size(s) and duct location(s) of the air terminal units.

D. Provide ceiling access doors or locate units above easily removable ceiling components.

E. Support units individually from structure with wire rope complying with ASTM A492 and ASTM A603 in accordance with SMACNA (SRM). See Section 23 0548.

F. Do not support from ductwork.

G. Connect to ductwork in accordance with Section 233100.

H. Install heating coils in accordance with Section 238200.

3.03 FIELD QUALITY CONTROL

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

B. Provide manufacturer's field representative to test, inspect, instruct, and observe field-assembled components and equipment installation, including connections and to assist in field testing. Report results in writing.

1. Leak Test:
    a. After installation, fill water coils and test for leaks.
    b. Repair leaks and retest until no leaks exist.

3.04 CLEANING

A. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

B. Vacuum clean coils and inside of units.

3.05 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals for closeout submittals.

B. See Section 017900 - Demonstration and Training for additional requirements.

END OF SECTION

SECTION 233700
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Diffusers:
   1. Critical environment diffusers.
   2. Perforated ceiling diffusers.

B. Rectangular ceiling diffusers.

C. Slot ceiling diffusers.

D. Registers/grilles:
   1. Ceiling-mounted, egg crate exhaust and return register/grilles.
   2. Ceiling-mounted, exhaust and return register/grilles.
   3. Ceiling-mounted, supply register/grilles.
   4. Wall-mounted, supply register/grilles.
   5. Wall-mounted, exhaust and return register/grilles.

E. Fan filter units.

1.02 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting: Painting of ducts visible behind outlets and inlets.

1.03 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2023.

B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets; 2023.

C. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

D. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019 (Reapproved 2025).

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

F. IEST-RP-CC001 - HEPA and ULPA Filters; 2022.

G. MIL-STD-282 - Filter Units, Protective Clothing, Gas-Mask Components, and Related Products: Performance-Test Methods; 2020b (Validated 2025).

H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

I. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

J. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

L. UL 2518 - Standard for Safety Air Dispersion Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

C. Project Record Documents: Record actual locations of air outlets and inlets.

1.05 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Test and rate louver performance in accordance with AMCA 500-L.

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carnes, a division of Carnes Company Inc: www.carnes.com/#sle.

B. Krueger-HVAC: www.krueger-hvac.com/#sle.

C. Ruskin Company: www.ruskin.com/#sle.

D. Titus, a brand of Air Distribution Technologies: www.titus-hvac.com/#sle.

E. Substitutions will be allowed: See Section 016000 - Product Requirements.

2.02 RECTANGULAR CEILING DIFFUSERS

A. Type: Provide square formed backpan stamped, core removable, and multi-louvered ceiling diffusers constructed to maintain 360 degree discharge air pattern.

B. Connections: Round.

C. Fabrication: Aluminum with baked enamel finish.

D. Color: As selected by COR from manufacturer's standard range.

2.03 PERFORATED FACE CEILING DIFFUSERS

A. Type: Perforated face with fully adjustable pattern and removable face.

B. Frame: Surface mount type. In plaster ceilings, provide plaster frame and ceiling frame.

C. Fabrication: Steel with steel frame and baked enamel finish.

D. Accessories: Radial opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

2.04 CEILING SLOT DIFFUSERS

A. Type: Continuous 1/2 inch wide slot, 1 slots wide, with adjustable vanes for left, right, or vertical discharge; integral ceiling fire damper.

B. Plenum: Integral, galvanized steel, insulated.

2.05 CEILING SUPPLY REGISTERS/GRILLES

A. Construction: Made of aluminum extrusions with factory enamel finish.

B. Color: As selected by COR from manufacturer's standard range.

C. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.06 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, vertical face.

B. Fabrication: Steel with 20 gauge, 0.0359 inch minimum frames and 22 gauge, 0.0299 inch minimum blades, steel and aluminum with 20 gauge, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.

C. Color: To be selected by COR from manufacturer's standard range.

2.07 CEILING EGG CRATE EXHAUST AND RETURN GRILLES

A. Type: Egg crate style face consisting of 1/2 by 1/2 by 1/2 inch grid core.

B. Fabrication: Grid core consists of aluminum with mill aluminum finish.

C. Color: To be selected by COR from manufacturer's standard range.

D. Accessories: Provide plaster frame for surface mounted installations.

2.08 WALL SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, vertical face, double deflection.

B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

C. Fabrication: Steel with 20 gauge, 0.0359 inch minimum frames and 22 gauge, 0.0299 inch minimum blades, steel and aluminum with 20 gauge, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: To be selected by COR from manufacturer's standard range.

2.09 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, vertical face.

B. Frame: 1-1/4 inch margin with countersunk screw mounting.

C. Fabrication: Steel frames and blades, with factory baked enamel finish.

D. Color: To be selected by COR from manufacturer's standard range.

2.10 CRITICAL ENVIRONMENTS DIFFUSERS

A. General Requirements:
   1. Diffuser material to comply with ASTM E84, UL 723, UL 2518, NFPA 90A, and NFPA 90B.

B. Laminar Flow Diffusers:
   1. Construction: Stainless steel.
   2. Frame: Provide framing per manufacturer's recommendations.
   3. Dimensions: As indicated on the drawings.

C. Operating Room Particulate Control Diffusers:
   1. Construction: Stainless steel distribution system consisting of an non-aspirating, perforated panel and a perimeter air curtain.
   2. Frame: Provide framing in accordance with manufacturer's recommendations.
   3. Dimensions: As indicated on the drawings.

D. Operating Room, Integrated Ceiling Systems:
   1. Comply with ASTM C635/C635M.
   2. Install ceiling suspension system in compliance with ASTM C636/C636M.
   3. Construction: Aluminum.
   4. Frame: Provide framing in accordance with manufacturer's recommendations.
   5. Dimensions: As indicated on the drawings.
   6. Damper: Provide volume control in accordance with manufacturer's recommendations.

2.11 FAN FILTER UNITS

A. General Requirements:
   1. Nominal Size: 24 by 24 by 12 inches deep.

B. Performance Rating:
   1. Provide unit factory sealed and tested to ensure leakage consistent with filter.
   2. Filter Efficiency: 99.99 percent (HEPA) at 0.30 microns or higher particle size when tested in accordance with DOP-smoke (Dioctyl Phthalate) penetration test on MIL-STD-282.
   3. Leakage Scan Tested: Certified as pinhole-free at:
      a. Air velocity capacity of 500 fps.
      b. Resistance from 0.5 in-wc to 2.0 in-wc.

C. Face Gasket: Silicone.

D. Filters:
   1. Filter Type: HEPA in accordance with IEST-RP-CC001.
   2. Filter Replacement Type:
      a. Room side removable and replaceable, mounted in extruded aluminum frame with integral cavity filled with urethane gel to provide leak-tight seal between filter frame and border.
   3. Filter Pack Depth: 2 inches.

E. Plenum:
   1. Construction: 304 stainless steel.
   2. Walkable plenum up to 250 lb.

F. Inlet: Standard round or optional square collar for nonducted applications.

G. Face and Frame:
   1. Face: 304 stainless steel expanded metal grille with powder-coat paint finish.

H. Fan:
   1. Provide centrifugal type supplied with rubber mounts to isolate motor and blower assembly from diffuser plenum.
   2. Provide direct drive, forward-curved impeller.

I. Fan Motor:
   1. Electrically Commutated Motor (ECM):
      a. Constant Flow Program:
         1) Provide constant flow program to allow ECM to compensate for fluctuations in both upstream static pressure and filter pressure drop, providing constant airflow.
         2) Provide constant flow program for nonducted applications where inlet static pressure is zero or slightly negative.
   2. Fan motor shaft directly connected to fan and isolated from casing to prevent transmission of vibration.
   3. Directly connect fan motor shaft to fan impeller and isolated from casing to prevent transmission of vibration.
   4. Motor and Blower Access:
      a. Top and room side accessible on units with room-side replaceable filters.
   5. Fan Motor with Motor Speed Controller:
      a. ECM Standard Speed Controller:
         1) Provide ECM speed controller with BAS interface to accept 2 VDC to 10 VDC signal for variable speed remote control, and remotely shut off via BAS signal.
      b. BACnet Flow Controller:
         1) Controller to Monitor and Adjust the Following Parameters through Building Networks:
            (a) Airflow rate.
            (b) Filter status.
            (c) Filter pressure drop displayed in inches of water column.

J. Accessories:
   1. Filter replacement alarm system.
   2. Room-Side and Top-Accessible Controls Access:
      a. Provide control box that is accessible from room side by removing face, filter, and blower baffle.
         1) Control box accessible from top side.
   3. BACnet Daisy-Chain Compatible Units:
      a. Provide RJ45 networking cable for BACnet daisy-chain connection.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.

C. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

D. Install diffusers to ductwork with air tight connection.

E. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
   1. Except if the damper will be located in an inaccessible attic space, the dampers may be omitted if dampers are indicated in the face of the grille.

F. Paint ductwork visible behind air outlets and inlets matte black, see Section 099123.

G. For Installation of Fan Filter Units:
   1. Do not begin installation until substrates and openings have been properly prepped.

2. Verify location of cleanroom fan filter units for installation.
3. Verify supports, surfaces, and openings are ready for fit out.
4. Clean and prepare surfaces per manufacturer's instructions.
5. Install in accordance with manufacturer's written instructions and recommendations and in proper relationship with adjacent work.
6. Rigidly mount fan filter units level and plumb with fasteners recommended by manufacturer.
7. Startup equipment in accordance with manufacturer's instructions.
8. Seal perimeter of both sides of openings as required.
9. Record changes to system design that differs from what is shown on drawings.

3.02 CLOSEOUT ACTIVITIES

A. Demonstrate operational system to Owner's representative.

B. Instruct Owner's representative to maintain system and use occupant controls or interfaces, as required.

3.03 PROTECTION

A. Protect installed products until completion of project.

B. Replace, repair, or touch-up damaged products before Substantial Completion.

END OF SECTION

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SECTION 234000
HVAC AIR CLEANING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High-efficiency particulate (HEPA) air filters.

1.02 REFERENCE STANDARDS

A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2017, with Addendum (2022).

B. MIL-STD-282 - Filter Units, Protective Clothing, Gas-Mask Components, and Related Products: Performance-Test Methods; 2020b (Validated 2025).

C. UL 586 - High Efficiency, Particulate, Air Filter Units; Current Edition, Including All Revisions.

1.03 SUBMITTALS

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

B. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.

C. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.

1.04 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 HIGH EFFICIENCY PARTICULATE (HEPA) AIR FILTERS

A. Media: UL 586, pleated, water-resistant glass fiber with aluminum separators:
   1. Face Gasket: Neoprene expanded rubber.

B. Performance Rating:
   1. ASHRAE Std 52.2, Minimum Efficiency Reporting Valve (MERV):
      a. MERV-15, bacteria, smoke, paint, and particles of similar size.
      b. MERV-16, particles between 0.3 to 1.0 micro-meter in size.
   2. Efficiency: 99.97 percent at 0.3 micro-meter and higher when tested in accordance with the DOP-smoke (Dioctyl Phthalate) Penetration Test on MIL-STD-282.
   3. Leakage Scan Tested: Certified as pinhole-free at:
      a. Air velocity capacity of 500 fps.
      b. Resistance from 0.5 in-wc to 2.0 in-wc.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install air cleaning devices in accordance with manufacturer's instructions.

B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

C. Install filter gauge static pressure tips upstream and downstream of filters. Mount filter gauges on outside of filter housing or filter plenum, in accessible position. Adjust and level.

D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.

END OF SECTION

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SECTION 237413
PACKAGED OUTDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 230548 - Vibration and Seismic Controls for HVAC.

B. Section 253519 - Integrated Automation Control Valves.

1.02 REFERENCE STANDARDS

A. ASHRAE Std 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks; 2024, with Errata (2026).

B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

1.03 SUBMITTALS

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

B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

C. Shop Drawings: Indicate capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

D. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.

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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carrier Global Corporation: www.carrier.com/#sle.

B. Trane Technologies, PLC: www.trane.com/#sle.

C. York, a brand of Johnson Controls International, PLC: www.york.com/#sle.

D. Substitutions: See Section 016000 - Product Requirements.

2.02 MANUFACTURED UNITS

A. General: Roof mounted units having gas burner and electric refrigeration.

B. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, return fan, heat exchanger and burner, heat recovery coil, controls, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan.

C. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) no greater than that allowed by federal code.

D. Disconnect Switch: Factory mount disconnect switch in control panel.

2.03 FABRICATION

A. Cabinet: Steel with baked enamel finish, including access panels with screwdriver operated flush cam type fasteners. Structural members shall be minimum 18 gauge, 0.0478 inch, with access doors or panels of minimum 20 gauge, 0.0359 inch.

B. Insulation: 2 inch thick neoprene coated glass fiber with edges protected from erosion.

C. Heat Exchangers: Aluminized steel, of welded construction.

D. Supply and Return Fan: Forward curved centrifugal type, resiliently mounted with V-belt drive, adjustable variable pitch pulley, and rubber isolated hinge mounted high efficiency motor or direct drive; see Section 230548. Isolate complete fan assembly.

E. Air Filters:

1. 2 inch thick glass fiber disposable media in metal frames.

F. Roof Mounting Curb: 24 inches high galvanized steel, channel frame with gaskets, nailer strips.

2.04 BURNER

A. Gas Burner: Atmospheric type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame sensing device, and automatic 100 percent shut-off pilot.

B. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after airflow proven and slight delay, allow gas valve to open.

2.05 EVAPORATOR COIL

A. Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection.

B. Provide capillary tubes or thermostatic expansion valves for units of 6 Tons of refrigeration capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 Tons of refrigeration cooling capacity and larger.

2.06 COMPRESSOR

A. Provide hermetic compressors, 3600 rpm maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gauge ports, and filter drier.

2.07 CONDENSER COIL

A. Provide copper tube aluminum fin coil assembly with subcooling rows and coil guard.

B. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor. Provide high efficiency fan motors.

2.08 MIXED AIR CASING

A. Dampers: Provide outside, return, and relief dampers with damper operator and control package to automatically vary outside air quantity. Outside air damper to fall to closed position. Relief dampers may be gravity balanced.

B. Gaskets: Provide tight fitting dampers with edge gaskets and maximum leakage 5 percent at 2 in-wc pressure differential.

C. Damper Operator, Units With 7.5 Tons of refrigeration Cooling Capacity and Larger: 24 volt with gear train sealed in oil with spring return on.

2.09 OPERATING CONTROLS

A. Provide terminal strip on unit for connection of operating controls to remote panel by others. Control shall allow for two stages of heating and two stages cooling.

B. Provide low limit thermostat in supply air to close outside air damper and stop supply fan.

C. Provide night control energized by central time clock to maintain lower thermostat setting, lock out refrigeration, close outside air damper and open return air damper, stop supply air fan, for night and unoccupied operation. Provide time delay to maintain outside air damper closed and return air damper open after switching to day and occupied operation.

D. Provide remote readout panels containing signal lights indicating system status, heating system failure, cooling system failure, and dirty filters; check switches proving signal light operations; system on-off switch, and cooling system on-off switch.

E. Provide in panel a manual 12 hour timer to override night control, remote damper control, low limit manual reset, and remote thermostat temperature setpoint.

F. BAS, SCADA, or other Integrated Automation Link: ASHRAE Std 135 BACnet MS/TP.

G. Control Valves: Field-installed, modulating, ball type with position tracking; see Section 253519.

2.10 OPERATING CONTROLS - VARIABLE VOLUME UNITS

A. Temperature transmitter located in supply air shall signal electronic logic panel to control mixing dampers and cooling in sequence. Mixing section shall operate as first stage of cooling and

revert to minimum outside air above approximately 75 degrees F as determined by enthalpy of return and outdoor air.

B. Control cooling by cycling compressors, cylinder unloading, and hot gas bypass.

C. Seven day time clock with spring carry over (or electronic clock with battery backup) shall control unit on occupied/un-occupied schedule. At night, unit shall be off. Locate clock in remote control panel with status lights.

D. Provide two stage morning warm-up thermostat to hold outdoor dampers closed and energize heat until return air temperature reaches set point.

2.11 HEAT RECOVERY COIL

A. Provide copper tube aluminum fin coil assembly with multiple circuits arranged to provide heat recovery.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.

B. Verify that proper power supply is available.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NFPA 90A.

C. Mount units on factory built roof mounting curb providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

D. Locate remote panels where indicated on drawings.

END OF SECTION

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SECTION 238413.23
DIRECT-STEAM-INJECTION HUMIDIFIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Direct-steam-injection humidifiers.

1.02 RELATED REQUIREMENTS

A. Section 230529 - Hangers and Supports for HVAC Piping and Equipment.

B. Section 230719 - HVAC Piping Insulation.

1.03 REFERENCE STANDARDS

A. AHRI 640 (I-P) - Performance Rating of Commercial and Industrial Humidifiers; 2017.

1.04 SUBMITTALS

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

B. Product Data: Provide catalog sheets indicating general assembly, dimensions, weights, materials, and certified performance ratings.

C. Shop Drawings: Indicate general assembly, dimensions, weights, and materials.

D. Operation Data: Include assembly instructions, float adjustment, bleed rates, and electrical requirements.

1.05 QUALITY ASSURANCE

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

PART 2 PRODUCTS

2.01 DIRECT-STEAM-INJECTION HUMIDIFIERS

A. Description: Humidifiers using pressurized steam produced from boiler. Steam is conditioned prior to discharging to reduce pressure.
   1. Comply with AHRI 640 (I-P).

B. Steam Properties: Humidifier sized for incoming steam pressure.
   1. Discharge Pressure: Atmospheric.

C. Valve: Opens to discharge steam.
   1. Construction: Use bronze or stainless steel.
   2. Actuator: Use pneumatic modulating or electric modulating type.

D. Strainer: Inline Y-type constructed of cast iron or stainless steel body; stainless steel interior mesh; located upstream of steam separator; removes dirt and scale particles.

E. Separating Chamber: Constructed of cast iron or stainless steel; removes condensed water droplets from steam.

F. Steam Trap: Capture condensed water droplets discharged from steam separating chamber.
   1. Type: Use bucket trap or float and thermostatic.
   2. Construction: Body is cast iron or stainless steel with stainless steel internal components.
   3. Condensate: Water captured by steam trap directed to drain.
      a. Tempering: Condensate from humidifier cooled to temperature of 140 degrees F or less prior to discharging into drain.

G. Control System:
   1. Provide microprocessor-based control system for automatic control and monitoring. Include sensors, wiring, and connections necessary for functions and status/alarm indications specified.
   2. Provide digital display interface with touchscreen or button controls for automatic/manual programming and display of status, logs, and alarms.
   3. Integrate with building automation system.
      a. Scheduling: Seven-day week clock and scheduler.
   4. Network Communications Support: Modbus and BACnet.

5. Modes: Includes manual, automatic, modulate, and off.
6. Modulate humidification output to satisfy demand.
7. Provide Sensors:
    a. Room humidity sensor with acceptable upper and lower limits.
    b. Supply air humidity sensor.
    c. Steam incoming pressure.
    d. Steam trap temperature.
8. Alarms: Alarm activates upon the following events. Controller may be programmed for shutdown by one or more of the following:
    a. Sensor failure.
    b. Sensor detects high or low setpoint reached.
    c. DDC signal failure.
    d. Loss of supply airflow.
9. Emergency shut-off.
10. System Status Log: Minimum 30-day history log.
    a. Run time.
    b. Current alarms.
    c. Alarm history.
    d. Sensor reading.
    e. Zone humidity setpoint.
    f. Time of next cleaning and maintenance.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine equipment locations, connection sizes, and conditions affecting performance, maintenance, and operations.

B. Verify that field measurements are as indicated.

C. Verify exact piping connection locations.

D. Verify sufficient space for pipe routing.

E. Verify that rough-ins for field connections are in proper locations.

F. Verify clearances will be satisfied after installation is complete.

G. Verify that electric power is available and of correct characteristics.

H. Verify that steam from boiler is available and of correct characteristics.

I. Proceed with installation after correction of unsatisfactory conditions.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install control wiring.

C. Connect unit to steam supply. Provide isolation valve on steam supply line.

D. Install pressure reducing valve upstream of humidifier.

E. Install relief valve between pressure reducing valve and humidifier.

F. Install pressure gauge between pressure reducing valve and humidifier.

G. Route piping to termination points.
    1. Insulate piping.
        a. See Section 230719.
    2. Support piping from hangers.
        a. See Section 230529.

H. Pipe condensate drain connections from steam trap to nearest floor drain.

END OF SECTION

SECTION 238413.53
DISPERSION FOR HUMIDIFIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Multi-tube manifold dispersion for pressurized-source steam.

1.02 REFERENCE STANDARDS

A. AHRI 640 (I-P) - Performance Rating of Commercial and Industrial Humidifiers; 2017.

1.03 SUBMITTALS

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

B. Product Data: Provide catalog sheets indicating general assembly, dimensions, weights, materials, and certified performance ratings.

C. Shop Drawings: Indicate general assembly, dimensions, weights, and materials.

D. Operation Data: Include assembly instructions, float adjustment, bleed rates, and electrical requirements.

1.04 QUALITY ASSURANCE

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

PART 2 PRODUCTS

2.01 MULTI-TUBE MANIFOLD DISPERSION FOR PRESSURIZED-SOURCE STEAM

A. Description: Multi-tube manifold for dispersing steam from direct-steam-injection humidifiers. Steam has been generated at boiler.
   1. Comply with AHRI 640 (I-P).

B. Dispersion Tube: Compatible with humidifier type and model specified in humidifier section.
   1. Humidifier Source Type: Compatible with electric resistive element, electrode, gas-fired, or steam-to-steam heat exchanging humidifier.

C. Location of Steam Termination: As indicated on drawings.

D. Mounting Orientation: As indicated on drawings.

E. Construction: Stainless steel.

F. Dimensions: Sized to fit ductwork.

G. Air-Gap Shell: Tube cased in air-gap stainless steel shell.

H. Tube equipped with dedicated condensate collection pipe.
   1. Discharge Location: Condensate returned to humidifier tank.

I. Steam Connection:
   1. Size: Sized according to manufacturer's instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine locations, connection sizes, and conditions affecting performance, maintenance, and operations.

B. Verify that field measurements are as indicated.

C. Verify exact piping connection locations.

D. Verify sufficient space for pipe routing.

E. Verify that rough-ins for field connections are in proper locations.

F. Verify straight ductwork upstream and downstream according to manufacturer's requirements.

G. Verify clearances will be satisfied after installation is complete.

H. Verify that electric power is available and of correct characteristics.

I. Verify that steam from humidifier is available and of correct characteristics.

J. Proceed with installation after correction of unsatisfactory conditions.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Unit Mounting:
   1. Do not obstruct maintenance access to equipment by ductwork, piping, electrical conduit, or other utility.

C. Install manufacturer's supplied field devices.

END OF SECTION

SECTION 260505
SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

1.02 RELATED REQUIREMENTS

A. Section 017000 - Execution and Closeout Requirements: Additional requirements for alterations work.

1.03 SUBMITTALS

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

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field measurements and circuiting arrangements are as indicated.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observation and existing record documents.

D. Report discrepancies to COR before disturbing existing installation.

E. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with utility company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
   2. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Notify COR before partially or completely disabling system.
   2. Notify local fire service.
   3. Make notifications at least 48 hours in advance.
   4. Make temporary connections to maintain service in areas adjacent to work area.

F. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Notify COR at least 24 hours before partially or completely disabling system.
   2. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
   1. PCB- and DEHP-containing lighting ballasts.

2. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

F. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

G. Repair adjacent construction and finishes damaged during demolition and extension work.

H. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

3.04 CLEANING AND REPAIR

A. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

B. Clean and repair existing materials and equipment that remain or that are to be reused.

C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

END OF SECTION

SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Metal-clad cable.

C. Wiring connectors.

D. Electrical tape.

E. Heat shrink tubing.

F. Oxide inhibiting compound.

G. Wire pulling lubricant.

H. Cable ties.

I. Firestop sleeves.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 260526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

1.03 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2023.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).

E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2017.

F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2020.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

H. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable; 2018.

I. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.

J. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

M. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

N. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Current Edition, Including All Revisions.

O. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

P. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

Q. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

R. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

S. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   3. Notify COR of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

C. Wire Pulling Lubricant: Certification of compatibility with conductors/cables.

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.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.

1.06 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.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify COR 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 not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Service entrance cable is not permitted.

F. Armored cable is not permitted.

G. Metal-clad cable is permitted only as follows:
   1. Where not otherwise restricted, may be used:
      a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
         1) Maximum Length: 6 feet.

H. Manufactured wiring systems are not permitted.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductors for Grounding and Bonding: Also comply with Section 260526.

H. Conductor Material:
   1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
   2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
   3. Tinned Copper Conductors: Comply with ASTM B33.

I. Minimum Conductor Size:
   1. Branch Circuits: 12 AWG.
      a. Exceptions:
         1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
         2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
         3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.

J. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

K. 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. 480Y/277 V, 3 Phase, 4 Wire System:
         1) Phase A: Brown.
         2) Phase B: Orange.
         3) Phase C: Yellow.
         4) Neutral/Grounded: Gray.
      b. 208Y/120 V, 3 Phase, 4 Wire System:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Phase C: Blue.
         4) Neutral/Grounded: White.
      c. Equipment Ground, All Systems: Green.
      d. Travelers for 3-Way and 4-Way Switching: Pink.
      e. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.

f. For control circuits, comply with manufacturer's recommended color code.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
   1. Copper Building Wire:
      a. Cerro Wire LLC: www.cerrowire.com/#sle.
      b. Encore Wire Corporation: www.encorewire.com/#sle.
      c. General Cable Technologies Corporation: www.generalcable.com/#sle.
      d. Service Wire Co: www.servicewire.com/#sle.
      e. Southwire Company: www.southwire.com/#sle.
      f. Substitutions will be allowed: See Section 016000 - Product Requirements.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
   1. Feeders and Branch Circuits:
      a. Size 10 AWG and Smaller: Solid.
      b. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
   1. Copper Building Wire: Type THHN/THWN-2, except as indicated below.
      a. Size 4 AWG and Larger: Type XHHW-2.

2.04 METAL-CLAD CABLE

A. Manufacturers:
   1. AFC Cable Systems Inc: www.afcweb.com/#sle.
   2. Encore Wire Corporation: www.encorewire.com/#sle.
   3. Service Wire Co: www.servicewire.com/#sle.
   4. Southwire Company: www.southwire.com/#sle.
   5. Substitutions will be allowed.: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

F. Grounding: Full-size integral equipment grounding conductor.

G. Armor: Steel, interlocked tape.

2.05 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 260526.

C. Wiring Connectors for Splices and Taps:
   1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
   2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

D. Wiring Connectors for Terminations:
   1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
   2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.

3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
5. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
1. Manufacturers:
   a. 3M: www.3m.com/#sle.
   b. Ideal Industries, Inc: www.idealindustries.com/#sle.
   c. NSI Industries LLC: www.nsiindustries.com/#sle.
   d. Substitutions will be allowed.: See Section 016000 - Product Requirements.

H. Mechanical Connectors: Provide bolted type or set-screw type.
1. Manufacturers:
   a. Burndy LLC: www.burndy.com/#sle.
   b. nVent ILSCO: www.ilsco.com/#sle.
   c. Thomas & Betts Corporation: www.tnb.com/#sle.
   d. Substitutions will be allowed.: See Section 016000 - Product Requirements.

I. Compression Connectors: Provide circumferential type or hex type crimp configuration.
1. Manufacturers:
   a. Burndy LLC: www.burndy.com/#sle.
   b. nVent ILSCO: www.ilsco.com/#sle.
   c. Thomas & Betts Corporation: www.tnb.com/#sle.
   d. Substitutions will be allowed.: See Section 016000 - Product Requirements.

J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
1. Manufacturers:
   a. Burndy LLC: www.burndy.com/#sle.
   b. Ilsco: www.ilsco.com/#sle.
   c. Thomas & Betts Corporation: www.tnb.com/#sle.
   d. Substitutions will be allowed.: See Section 016000 - Product Requirements.

2.06 ACCESSORIES

A. Electrical Tape:
1. Manufacturers:
   a. 3M: www.3m.com/#sle.
   b. Plymouth Rubber Europa: www.plymouthrubber.com/#sle.
   c. Substitutions will be allowed.: See Section 016000 - Product Requirements.
2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.

6. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.
7. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
1. Manufacturers:
a. 3M: www.3m.com/#sle.
b. Burndy LLC: www.burndy.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.
d. Substitutions will be allowed.: See Section 016000 - Product Requirements.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
1. Manufacturers:
a. Burndy LLC: www.burndy.com/#sle.
b. Ideal Industries, Inc: www.idealindustries.com/#sle.
c. Ilsco: www.ilsco.com/#sle.
d. Substitutions will be allowed.: See Section 016000 - Product Requirements.

D. Wire Pulling Lubricant:
1. Manufacturers:
a. 3M: www.3m.com/#sle.
b. American Polywater Corporation: www.polywater.com/#sle.
c. Ideal Industries, Inc: www.idealindustries.com/#sle.
d. Substitutions will be allowed.: See Section 016000 - Product Requirements.
2. Listed and labeled as complying with UL 267.
3. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
4. Suitable for use at installation temperature.

E. Cable Ties: Material and tensile strength rating suitable for application.
1. Manufacturers:
a. Burndy LLC: www.burndy.com/#sle.
b. Substitutions will be allowed.: See Section 016000 - Product Requirements.

F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.
1. Products:
a. Menzies Metal Products; Electrical Roof Stack and Cap: www.menzies-metal.com/#sle.
b. Substitutions will be allowed.: See Section 016000 - Product Requirements.

G. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
1. Products:
a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: www.holdrite.com/#sle.
b. Substitutions will be allowed.: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated without specific routing, determine exact routing required.
   3. Arrange circuiting to minimize splices.
   4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
   5. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
   6. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:
      a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
      b. Size raceways, boxes, etc. to accommodate conductors.
   7. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install metal-clad cable (Type MC) in accordance with NECA 120.

E. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

F. 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.

G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

H. 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.

I. Terminate cables using suitable fittings.
   1. Metal-Clad Cable (Type MC):
      a. Use listed fittings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

J. Install conductors with a minimum of 12 inches of slack at each outlet.

K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

L. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

M. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.
   4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
   5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

N. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
   1. Dry Locations: Use insulating covers specifically designed for the connectors, 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.

O. Insulate ends of spare conductors using vinyl insulating electrical tape.

P. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

R. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - 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 260526
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.

1.02 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Notify COR of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Field quality control test reports.

E. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.06 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. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 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. Bonding and Equipment Grounding:
   1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
   2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
   3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
   4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
   5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
   6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
   7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
      a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
      b. Metal gas piping.
   8. Provide bonding for interior metal air ducts.
   9. Provide bonding for metal building frame.
   10. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.

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 260526:
   1. Use insulated copper conductors unless otherwise indicated.
      a. Exceptions:
         1) Use bare copper conductors where installed underground in direct contact with earth.
         2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
   1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
   2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
   3. Unless otherwise indicated, use mechanical connectors or compression connectors for accessible connections.

4. Manufacturers - Mechanical and Compression Connectors:
   a. allG Fabrication: www.allgfab.com/#sle.
   b. Burndy LLC: www.burndy.com/#sle.
   c. Harger Lightning & Grounding: www.harger.com/#sle.
   d. nVent ERICO: www.nvent.com/#sle.
   e. Thomas & Betts Corporation: www.tnb.com/#sle.
   f. Substitutions will be allowed: See Section 016000 - Product Requirements.
5. Manufacturers - Exothermic Welded Connections:
   a. Burndy LLC: www.burndy.com/#sle.
   b. nVent ERICO; Cadweld: www.nvent.com/#sle.
   c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#sle.
   d. Substitutions will be allowed.: See Section 016000 - Product Requirements.

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. 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.

D. Identify grounding and bonding system components in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - 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.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION

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SECTION 260529
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 RELATED REQUIREMENTS

A. Section 260533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

B. Section 260533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

C. Section 265100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

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

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
   2. Coordinate work to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
   4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
   5. Notify COR of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.

C. Installer's qualification statement.

D. Manufacturer's Instructions will be allowed: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Maintain at project site one copy of each referenced document that prescribes execution requirements.

B. Product Listing Organization Qualifications will be allowed: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Comply with the following. Where requirements differ, comply with most stringent.
      a. NFPA 70.
      b. Requirements of authorities having jurisdiction.
   2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
   3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
   4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported with minimum safety factor of 5. Include consideration for vibration, equipment operation, and shock loads where applicable.
   5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   6. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
   7. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
      a. Indoor Dry Locations will be allowed: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      c. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
   1. Manufacturers:
      a. ABB: www.electrification.us.abb.com/#sle.
      b. Eaton Corporation: www.eaton.com/#sle.
      c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
      d. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
      e. Substitutions will be allowed: See Section 016000 - Product Requirements.
   2. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   3. Conduit Clamps: Bolted type unless otherwise indicated.
   4. Products:
      a. Gripple, Inc; Universal Bracket: www.gripple.com/#sle.
      b. Gripple, Inc; Fast Trak: www.gripple.com/#sle.
      c. Gripple, Inc; Universal Clamp (Threaded): www.gripple.com/#sle.
      d. Gripple, Inc; Low Profile Bracket Kits: www.gripple.com/#sle.
      e. Substitutions will be allowed: See Section 016000 - Product Requirements.

C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
   1. Manufacturers:
      a. ABB: www.electrification.us.abb.com/#sle.
      b. Eaton Corporation: www.eaton.com/#sle.
      c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
      d. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
      e. Substitutions will be allowed: See Section 016000 - Product Requirements.

D. Metal Channel/Strut Framing Systems:
   1. Manufacturers:

a. ABB: www.electrification.us.abb.com/#sle.
b. Atkore International Inc; Unistrut: www.unistrut.us/#sle.
c. Eaton Corporation: www.eaton.com/#sle.
d. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
e. Substitutions will be allowed.: See Section 016000 - Product Requirements.

2. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
3. Comply with MFMA-4.
4. Channel/Strut Used as Raceway, Where Indicated: Listed and labeled as complying with UL 5B.
5. Channel Material:
   a. Indoor Dry Locations will be allowed: Use painted steel, zinc-plated steel, or galvanized steel.
6. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
7. Minimum Channel Dimensions: 1-5/8 inch wide by 13/16 inch high.

E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 1/2-inch diameter.
   b. Busway Supports: 1/2-inch diameter.
   c. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch diameter.
   d. Trapeze Support for Multiple Conduits: 3/8-inch diameter.
   e. Outlet Boxes: 1/4-inch diameter.
   f. Luminaires: 1/4-inch diameter.

F. Anchors and Fasteners:
1. Manufacturers - Mechanical Anchors:
   a. Dewalt: anchors.dewalt.com/#sle.
   b. Hilti, Inc: www.hilti.com/#sle.
   c. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.
   d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
   e. Substitutions will be allowed.: See Section 016000 - Product Requirements.
2. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
3. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
4. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
5. Hollow Masonry: Use toggle bolts.
6. Hollow Stud Walls: Use toggle bolts.
7. Steel: Use beam clamps, machine bolts, or welded threaded studs.
8. Sheet Metal: Use sheet metal screws.
9. Wood: Use wood screws.
10. Plastic and lead anchors are not permitted.
11. Powder-actuated fasteners are not permitted.
12. Hammer-driven anchors and fasteners are not permitted.
13. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
   a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
   b. Comply with MFMA-4.
   c. Channel Material: Use galvanized steel.
   d. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch minimum base metal thickness.
14. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install hangers and supports in accordance with NECA 1.

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Unless specifically indicated or approved by COR, do not provide support from suspended ceiling support system or ceiling grid.

F. Unless specifically indicated or approved by COR, do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

H. Equipment Support and Attachment:
   1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
   2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

I. Conduit Support and Attachment: See Section 260533.13 for additional requirements.

J. Box Support and Attachment: See Section 260533.16 for additional requirements.

K. Interior Luminaire Support and Attachment: See Section 265100 for additional requirements.

L. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

M. Secure fasteners in accordance with manufacturer's recommended torque settings.

N. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

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

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 260533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Galvanized steel intermediate metal conduit (IMC).

C. Flexible metal conduit (FMC).

D. Liquidtight flexible metal conduit (LFMC).

E. Galvanized steel electrical metallic tubing (EMT).

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 260526 - Grounding and Bonding for Electrical Systems.
   1. Includes additional requirements for fittings for grounding and bonding.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 262100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.

C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.

F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

I. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

J. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.

K. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

L. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

M. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

N. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
   4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
   5. Notify COR of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.05 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

C. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2-inch (53 mm) trade size and larger.

1.06 QUALITY ASSURANCE

A. Documents at Project Site: Maintain at project site one copy of manufacturer's instructions and shop drawings.

B. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. 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, manufacturer's instructions, and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use EMT.

C. Concealed Within Hollow Stud Walls: Use galvanized steel electrical metallic tubing (EMT).

D. Concealed Above Accessible Ceilings: Use galvanized steel electrical metallic tubing (EMT).

E. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC).

F. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel electrical metallic tubing (EMT).

G. Exposed, Interior, Subject to Physical Damage: Use galvanized steel intermediate metal conduit (IMC).
   1. Locations subject to physical damage include, but are not limited to:
      a. Where exposed below 8 feet, except within electrical and communication rooms or closets.

H. Exposed, Exterior, Not Subject to Severe Physical Damage: Use galvanized steel intermediate metal conduit (IMC).

I. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).
   1. Maximum Length: 6 feet.

J. Flexible Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit (FMC).
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
   3. Maximum Length: 6 feet unless otherwise indicated.

K. Fished in Existing Walls, Where Necessary: Use flexible metal conduit (FMC) or galvanized steel electrical metallic tubing (EMT).

2.02 CONDUIT - GENERAL REQUIREMENTS

A. Comply with NFPA 70.

B. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling mandrel through them.

C. Electrical Service Conduits: See Section 262100 for additional requirements.

D. Fittings for Grounding and Bonding: See Section 260526 for additional requirements.

E. Provide conduit, fittings, supports, and accessories required for complete raceway system.

F. Provide products listed, classified, and labeled as suitable for purpose intended.

G. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 3/4-inch trade size.
   2. Branch Circuit Homeruns: 3/4-inch trade size.
   3. Control Circuits: 1/2-inch trade size.
   4. Flexible Connections to Luminaires: 3/8-inch trade size.

H. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
   2. Nucor Tubular Products: www.nucortubular.com/#sle.
   3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
   4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
   5. Substitutions will be allowed: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
   1. Manufacturers:
      a. ABB; T&B: www.electrification.us.abb.com/#sle.
      b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
      c. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
      d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
      e. Substitutions will be allowed.: See Section 016000 - Product Requirements.
   2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
   3. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.
   4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.04 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:
   1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
   2. Nucor Tubular Products: www.nucortubular.com/#sle.
   3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
   4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
   5. Substitutions will be allowed.: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:
   1. Manufacturers:
      a. ABB; T&B: www.electrification.us.abb.com/#sle.
      b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
      c. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
      d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
      e. Substitutions will be allowed.: See Section 016000 - Product Requirements.

2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
3. Material: Use steel or malleable iron.
   a. Do not use die cast zinc fittings.
4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.05 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
   1. AFC Cable Systems, a division of Atkore International: www.afcweb.com/#sle.
   2. Electri-Flex Company: www.electriflex.com/#sle.
   3. International Metal Hose: www.metalhose.com/#sle.
   4. Substitutions will be allowed.: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.

C. Fittings:
   1. Manufacturers:
      a. ABB; T&B: www.electrification.us.abb.com/#sle.
      b. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
      c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
      d. Substitutions will be allowed.: See Section 016000 - Product Requirements.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.

2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
   1. Electri-Flex Company: www.electriflex.com/#sle.
   2. International Metal Hose: www.metalhose.com/#sle.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
   1. Manufacturers:
      a. ABB; T&B: www.electrification.us.abb.com/#sle.
      b. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
      c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
      d. Substitutions will be allowed.: See Section 016000 - Product Requirements.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.

2.07 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
   2. Nucor Tubular Products: www.nucortubular/#sle.
   3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
   4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
   5. Substitutions will be allowed.: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
   1. Manufacturers:
      a. ABB; T&B: www.electrification.us.abb.com/#sle.
      b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
      c. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.

d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
e. Substitutions will be allowed.: See Section 016000 - Product Requirements.

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
4. Connectors and Couplings: Use compression/gland or set-screw type.
   a. Do not use indenter type connectors and couplings.
5. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.
6. Embedded Within Concrete, Where Permitted: Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are not acceptable.

2.08 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

C. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.

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. Install conduit in accordance with NECA 1.

C. Galvanized Steel Rigid Metal Conduit (RMC): Install in accordance with NECA 101.

D. Intermediate Metal Conduit (IMC): Install in accordance with NECA 101.

E. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated without specific routing, determine exact routing required.
   3. Conceal conduits unless specifically indicated to be exposed.
   4. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
      c. Within joists in areas with no ceiling.
   5. Unless otherwise approved, do not route exposed conduits:
      a. Across floors.
      b. Across roofs.
      c. Across top of parapet walls.
      d. Across building exterior surfaces.
   6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
   7. Arrange conduit to maintain adequate headroom, clearances, and access.
   8. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
   9. Arrange conduit to provide no more than 150 feet between pull points.
   10. Route conduits above water and drain piping where possible.
   11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
   12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.

13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    a. Heaters.
    b. Hot water piping.
    c. Flues.

F. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 260529.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use conduit strap to support single surface-mounted conduit.
    a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
5. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
7. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
8. Use of spring steel conduit clips for support of conduits is not permitted.
9. Use of wire for support of conduits is not permitted.
10. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.

G. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound 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, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
7. Secure joints and connections to provide mechanical strength and electrical continuity.

H. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
6. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
7. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 078400.

I. 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 conduits are subject to earth movement by settlement or frost.

J. Conduit Sealing:
   1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
      a. Where conduits enter building from outside.
      b. Where service conduits enter building from underground distribution system.
      c. Where conduits enter building from underground.
      d. Where conduits may transport moisture to contact live parts.
   2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
      a. Where conduits pass from outdoors into conditioned interior spaces.
      b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

K. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

L. Provide grounding and bonding; see Section 260526.

M. Identify conduits; see Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - 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. 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

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SECTION 260533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Boxes and enclosures for integrated power, data, and audio/video.

D. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 083100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260533.13 - Conduit for Electrical Systems:
   1. Conduit bodies and other fittings.
   2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

D. Section 262726 - Wiring Devices:
   1. Wall plates.
   2. Additional requirements for locating boxes for wiring devices.

E. Section 271000 - Structured Cabling: Additional requirements for communications systems outlet boxes.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

I. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
   4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.

5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify COR of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for outlet and device boxes.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Project Record Documents: Record actual locations for outlet and device boxes and pull boxes.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Keys for Lockable Enclosures: Two of each different key.

1.06 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended.
   4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
   1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
   2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
   3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
   4. Use raised covers suitable for the type of wall construction and device configuration where required.
   5. Use shallow boxes where required by the type of wall construction.
   6. Do not use "through-wall" boxes designed for access from both sides of wall.

7. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
8. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
9. 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.
10. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
11. 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.
12. Wall Plates: Comply with Section 262726.
13. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
    b. Hubbell Incorporated; Bell Products: www.hubbell-rtb.com/#sle.
    c. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com/#sle.
    d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
    e. Thomas & Betts Corporation: www.tnb.com/#sle.
    f. Substitutions will be allowed: See Section 016000 - Product Requirements.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA EN 10250 Environment Type, Unless Otherwise Indicated:
    a. Indoor Clean, Dry Locations: Type 1, painted steel.
    b. Outdoor Locations: Type 3R, painted steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches:
    a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
4. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
5. Manufacturers:
    a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
    b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com/#sle.
    c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com/#sle.
    d. Substitutions will be allowed: See Section 016000 - Product Requirements.

D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may not be used.
1. Manufacturers:
    a. Hubbell Incorporated: www.hubbell.com/#sle.
    b. Legrand, Inc.; www.legrand.us.
    c. Substitutions will be allowed: See Section 016000 - Product Requirements.

2.02 ACCESSORIES

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

E. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

F. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

G. Box Locations:
   1. Locate boxes to be accessible. Provide access panels in accordance with Section 083100 as required where approved by the Architect.
   2. Unless dimensioned, box locations indicated are approximate.
   3. Locate boxes as required for devices installed under other sections or by others.
      a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 262726.
      b. Communications Systems Outlets: Comply with Section 271000.
   4. Locate boxes so that wall plates do not span different building finishes.
   5. Locate boxes so that wall plates do not cross masonry joints.
   6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
   7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
   8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
   9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
      a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
   10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 260533.13.
   11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by theCOR:
      a. Concealed above accessible suspended ceilings.
      b. Within joists in areas with no ceiling.
      c. Electrical rooms.
      d. Mechanical equipment rooms.

H. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
   3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
   4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

I. Install boxes plumb and level.

J. Flush-Mounted Boxes:

1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

K. Install boxes as required to preserve insulation integrity.

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 078400.

N. Close unused box openings.

O. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

P. Provide grounding and bonding in accordance with Section 260526.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

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SECTION 260553
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. Floor marking tape.

F. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Section 099113 - Exterior Painting.

B. Section 099123 - Interior Painting.

C. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

C. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

D. Manufacturer's Instructions will be allowed: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

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. 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 to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
   5) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
b. Enclosed switches:
   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.

2. Use identification nameplate on inside of door at each fused switch to identify required NEMA fuse class and size.
3. 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.
4. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
   a. Minimum Size: 3.5 by 5 inches.
   b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.

B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations will be allowed:
   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.

C. Identification for Raceways:
1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.
2. Use voltage markers, color-coded bands, or factory-painted conduits to identify systems other than normal power system for accessible conduits.
   a. Maximum Intervals: 20 feet.
   b. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
      1) Field-Painting: Comply with Section 099123 and 099113.
      2) Vinyl Color Coding Electrical Tape: Comply with Section 260519.

c. Color Code:
1) Emergency Power System:
(a) Life Safety Branch: _____.
(b) Critical Branch: match existing color scheme..
(c) Equipment Branch: match existing color scheme..
2) Fire Alarm System: Red.

D. Identification for Devices:
1. Wiring Device and Wallplate Finishes: Comply with Section 262726.
2. Use identification label to identify fire alarm system devices.
3. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
a. For receptacles in public areas or in areas as directed by COR, provide identification on inside surface of wallplate.
4. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

E. Identification for Luminaires:
1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Manufacturers:
a. Brimar Industries, Inc: www.brimar.com/#sle.
b. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
c. Seton Identification Products: www.seton.com/#sle.
2. Materials:
a. Indoor Clean, Dry Locations will be allowed: Use plastic nameplates.
b. Outdoor Locations will be allowed: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
1. Manufacturers:
a. Brady Corporation: www.bradyid.com/#sle.
b. Brother International Corporation: www.brother-usa.com/#sle.
c. Panduit Corp: www.panduit.com/#sle.
d. Substitutions will be allowed: See Section 016000 - Product Requirements.
2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
a. Use only for indoor locations.
3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
a. System designation where applicable:
b. Equipment designation or other approved description.

3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
   a. System Designation: 1 inch.
   b. Equipment Designation: 1/2 inch.
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 by 1.5 inches.
2. Legend: Power source and circuit number or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

E. Format for Control Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

F. Format for Fire Alarm Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Red text on white background.

2.03 WIRE AND CABLE MARKERS

A. Manufacturers:
1. Brady Corporation: www.bradyid.com/#sle.
2. HellermannTyton: www.hellermanntyton.com/#sle.
3. Panduit Corp: www.panduit.com/#sle.
4. Substitutions will be allowed: See Section 016000 - Product Requirements.

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, or plastic sleeve type markers suitable for the conductor or cable to be identified.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
1. Do not use handwritten text.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

A. Manufacturers:
1. Brady Corporation: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Seton Identification Products: www.seton.com/#sle.
4. Substitutions will be allowed: See Section 016000 - Product Requirements.

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

C. Minimum Size:
1. Markers for Equipment: 1 1/8 by 4 1/2 inches.

2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
4. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

D. Legend:
1. Markers for Voltage Identification: Highest voltage present.
2. Markers for System Identification:
a. Emergency Power System: Text "EMERGENCY".

E. Color: Black text on orange background unless otherwise indicated.

2.05 FLOOR MARKING TAPE

A. Manufacturers:
1. Brady Corporation: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Seton Identification Products: www.seton.com/#sle.
4. Substitutions will be allowed: See Section 016000 - Product Requirements.

B. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlaminate, 3 inches wide, with alternating black and white stripes.

2.06 WARNING SIGNS AND LABELS

A. Manufacturers:
1. Brimar Industries, Inc: www.brimar.com/#sle.
2. Clarion Safety Systems, LLC: www.clarionsafety.com/#sle.
3. Insite Solutions, LLC: www.stop-painting.com/#sle.
4. Seton Identification Products: www.seton.com/#sle.
5. Substitutions will be allowed: See Section 016000 - Product Requirements.

B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. Warning Signs:
1. Materials:
a. Indoor Dry, Clean Locations will be allowed: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
b. Outdoor Locations will be allowed: Use factory pre-printed rigid aluminum signs.
2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
3. Minimum Size: 7 by 10 inches unless otherwise indicated.

D. Warning Labels:
1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
a. Do not use labels designed to be completed using handwritten text.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Branch Devices: Adjacent to device.

6. Interior Components: Legible from the point of access.
7. Conduits: Legible from the floor.
8. Conductors and Cables: Legible from the point of access.
9. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
   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. Secure rigid signs using stainless steel screws.

G. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - 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 262416
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Lighting and appliance panelboards.

B. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2025.

D. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

E. NEMA PB 1 - Panelboards; 2011.

F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000V or Less; 2023.

G. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

K. UL 67 - Panelboards; Current Edition, Including All Revisions.

L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

M. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify COR of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

1. Include characteristic trip curves for each type and rating of overcurrent protective device.

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.

D. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.

E. Field Quality Control Test Reports.

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. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Panelboard Keys: Two of each different key.

1.06 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.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric: www.se.com/#sle.

D. Siemens Industry, Inc: www.new.siemens.com/#sle.

E. Substitutions: See Section 016000 - Product Requirements.

F. Source Limitations: Provide panelboards and associated components produced by same manufacturer as existing facility equipment and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet.
2. Ambient Temperature:
   a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

C. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

F. 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.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
      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.
      c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
   4. Lockable Doors: All locks keyed alike unless otherwise indicated.

I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

2.03 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
   2. Phase and Neutral Bus Material: Aluminum.
   3. Ground Bus Material: Aluminum.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
   1. Provide surface-mounted enclosures as indicated.
   2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   3. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
   1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
   2. Interrupting Capacity:
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   3. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. 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. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
   6. Provide the following circuit breaker types where indicated:
      a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
   7. Do not use tandem circuit breakers.
   8. Do not use handle ties in lieu of multi-pole circuit breakers.

2.05 SOURCE QUALITY CONTROL

A. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 260529.

F. Install panelboards plumb.

G. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

H. Provide grounding and bonding in accordance with Section 260526.
   1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.

I. Install all field-installed branch devices, components, and accessories.

J. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

K. Provide filler plates to cover unused spaces in panelboards.

L. 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.

3.03 FIELD QUALITY CONTROL

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

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. 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 25 amperes. Tests listed as optional are not required.

D. Test GFCI circuit breakers to verify proper operation.

E. 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

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SECTION 262813
FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fuses.

1.02 RELATED REQUIREMENTS

A. Section 262816.16 - Enclosed Switches: Fusible switches.

1.03 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.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
      a. Fusible Enclosed Switches: See Section 262816.16.
   2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
   3. Notify COR of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

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

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/#sle.

B. Littelfuse, Inc: www.littelfuse.com/#sle.

C. Mersen: ep-us.mersen.com/#sle.

D. Substitutions: See Section 016000 - Product Requirements.

2.02 APPLICATIONS

A. General Purpose Branch Circuits: Class RK1, time-delay.

B. Individual Motor Branch Circuits: Class RK1, time-delay.

2.03 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 as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION

SECTION 262816.16
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 262813 - Fuses.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

C. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).

D. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

I. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Notify COR of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

C. Field Quality Control Test Reports.

D. Manufacturer's Installation Instructions will be allowed: 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. See Section 016000 - Product Requirements, for additional provisions.
2. See Section 262813 for requirements for spare fuses and spare fuse cabinets.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications will be allowed: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

PART 2 PRODUCTS

2.01 ENCLOSED SAFETY SWITCHES

A. Manufacturers:
   1. ABB: www.electrification.us.abb.com/#sle.
   2. Eaton Corporation: www.eaton.com/#sle.
   3. Schneider Electric: www.se.com/#sle.
   4. Siemens Industry, Inc: www.siemens.com/#sle.
   5. Substitutions will be allowed: See Section 016000 - Product Requirements.
   6. Source Limitations will be allowed: Furnish products produced by same manufacturer as other electrical distribution equipment for project and obtained from single supplier.

B. 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.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions will be allowed:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

E. Horsepower Rating: Suitable for connected load.

F. Voltage Rating: Suitable for circuit voltage.

G. 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.

H. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

I. Provide with switch blade contact position that is visible when the cover is open.

J. Conductor Terminations will be allowed: 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 EN 10250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:

a. Indoor Clean, Dry Locations will be allowed: Type 1.
b. Outdoor Locations will be allowed: Type 3R.

2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

N. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

O. Heavy Duty Switches:
1. Comply with NEMA BS 31047.
2. Conductor Terminations will be allowed:
a. Provide mechanical lugs unless otherwise indicated.
b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 260529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 260526.

H. Provide fuses complying with Section 262813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Identify enclosed switches in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - 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.

END OF SECTION

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SECTION 265100
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Exit signs.

C. Ballasts and Drivers.

1.02 RELATED REQUIREMENTS

A. Section 260529 - Hangers and Supports for Electrical Systems.

B. Section 260533.16 - Boxes for Electrical Systems.

C. Section 262726 - Wiring Devices: Manual wall switches and wall dimmers.

1.03 REFERENCE STANDARDS

A. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2024.

B. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

C. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2025.

D. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

E. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2023.

F. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2023.

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 1598 - Luminaires; Current Edition, Including All Revisions.

K. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
   2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
   3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
   4. Notify COR of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

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

B. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting

requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

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.

D. Field quality control 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. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.

H. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.06 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.

1.07 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.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

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

B. Provide 3-year manufacturer warranty for LED luminaires, including drivers.

C. Provide 5-year pro-rata warranty for batteries for emergency lighting units.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions will be allowed: See Section 016000 - Product Requirements.

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.
3. Hubbell Lighting, Inc: www.hubbelllighting.com/#sle.
4. Lutron Electronics Company, Inc: www.lutron.com/#sle.
5. Axis Lighting: https://www.axislighting.com/#sle.

6. Visa Lighting, Inc: https://www.visalighting.com//#sle.
7. H.E. Williams, Inc..
8. Substitutions will be allowed: See Section 016000 - 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. 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.

I. LED Luminaires:
1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.03 EXIT SIGNS

A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
1. Number of Faces: Single- or double-face as indicated or as required for installed location.
2. Directional Arrows: As indicated or as required for installed location.

B. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.
1. Manufacturers:
a. Acuity Brands, Inc: www.acuitybrands.com/#sle.
b. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com/#sle.
c. Hubbell Lighting, Inc: www.hubbelllighting.com/#sle.
d. Philips Lighting North America Corporation: www.lightingproducts.philips.com/#sle.
e. H.E. Williams, Inc..
f. Substitutions will be allowed: See Section 016000 - Product Requirements.
2. Self-Powered Exit Signs:
a. 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.
b. Battery: Sealed, maintenance-free, nickel cadmium unless otherwise indicated.
c. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
d. Provide low-voltage disconnect to prevent battery damage from deep discharge.
e. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

2.04 BALLASTS AND DRIVERS

A. Manufacturers:
1. Alloy LED: www.alloyled.com/#sle.

2. General Electric Company/GE Lighting: www.gelighting.com/#sle.
3. Lutron Electronics Company, Inc: www.lutron.com/#sle.
4. OSRAM Sylvania, Inc: www.osram.us/ds/#sle.
5. Philips Lighting North America Corporation: www.usa.lighting.philips.com/#sle.
6. Substitutions will be allowed: See Section 016000 - Product Requirements.
7. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by a single manufacturer.
8. 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. 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.
3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

C. Dimmable LED Drivers:
1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.
a. Wall Dimmers: See Section 262726.

2.05 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as 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 260533.16 as required for installation of luminaires provided under this section.

B. Install products in accordance with manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

D. Provide required support and attachment in accordance with Section 260529.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Suspended Ceiling Mounted Luminaires:
1. Do not use ceiling tiles to bear weight of luminaires.

2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
3. Secure 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. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.
7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

G. 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.

H. Suspended Luminaires:
1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
4. Install canopies tight to mounting surface.
5. Unless otherwise indicated, support pendants from swivel hangers.

I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

J. Install accessories furnished with each luminaire.

K. Bond products and metal accessories to branch circuit equipment grounding conductor.

L. 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.

M. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - 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 COR.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by COR. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by COR or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by COR 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. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to COR, and correct deficiencies or make adjustments as directed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 284600
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire alarm system and associated components, including control units, related equipment, initiating devices, and notification appliances.

1.02 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: For non-power-limited cables.

B. Section 260533.16 - Boxes for Electrical Systems.

1.03 ABBREVIATIONS AND ACRONYMS

A. AHJ: Authorities having jurisdiction.

B. BAS: Building automation system.

C. DMNS: Distributed mass notification system.

D. ECS: Emergency communications system.

E. EoL: End-of-line.

F. EVACS: Emergency voice/audio communication systems.

G. FACU: Fire alarm control unit.

H. HVAC: Heating, ventilation, and air conditioning.

I. IDC: Initiating device circuit.

J. LAN: Local area network.

K. MNS: Mass notification system.

L. NAC: Notification appliance circuit.

M. NPLFA: Non-power-limited fire alarm.

N. PLFA: Power-limited fire alarm.

O. SLC: Signaling line circuit.

P. SOO: Sequence of operation.

1.04 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NECA 305 - Standard for Fire Alarm System Job Practices; 2018.

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.

G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

H. UL 38 - Standard for Manual Signaling Boxes for Fire Alarm Systems; Current Edition, Including All Revisions.

I. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems; Current Edition, Including All Revisions.

J. UL 268A - Standard for Smoke Detectors for Duct Application; Current Edition, Including All Revisions.

K. UL 464 - Standard for Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories; Current Edition, Including All Revisions.

L. UL 521 - Standard for Heat Detectors for Fire Protective Signaling Systems; Current Edition, Including All Revisions.

M. UL 864 - Control Units and Accessories for Fire Alarm Systems; Current Edition, Including All Revisions.

N. UL 1971 - Standard for Signaling Devices for the Hearing Impaired; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate arrangement of equipment with dimensions and clearance requirements of actual equipment.
   2. Coordinate placement of devices and notification appliances with potential conflicts or view obstructions.
   3. Coordinate work to provide power for equipment at required locations (e.g., smoke dampers, type of actuators, line or local control transformer, zoning, grouping and circuit activations).
   4. Coordinate requirements for branch circuit protection, identification, and shunt trip if applicable.
   5. Coordinate reflected ceiling plans to avoid conflicting placements; maintain minimum diffuser and detector clearances as indicated.
   6. Coordinate submittals to confirm equipment and associated components are capable of indicated settings, and manufacturer documentation identifies required compatible product listings.
   7. Notify COR of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Verify exact termination locations required for boxes, enclosures, and equipment.
   2. Do not install devices or notification appliances until final surface finishes, painting, and cleaning are complete, unless otherwise required by AHJ.
   3. Do not begin installation of conductors and cables until installation of conduit and pathways between termination points is complete.
   4. Sequence work to protect cabling (e.g., overspray painting, physical stress, and insulation damage or covering markings).
   5. Verify naming convention for equipment identification, including room names and numbers, prior to creation of final drawings, reports, and labels.

C. Scheduling:
   1. Arrange access to facility for data collection with facility representative.
   2. Where work involves interruption of existing electrical or fire alarm system service, arrange interruption with Owner.
      a. Arrange test start and end with responsible reporting service. Confirm system normal operating mode and record as-found and as-left settings.
      b. Arrange work to disable individual devices or circuits for minimal disruption if possible.
      c. Arrange in accordance with NFPA 72 fire alarm system impairment requirements.
      d. Where required by AHJ, arrange systems or partial system out of service interruption in accordance with requirements of building, life safety, and fire codes (e.g., approved fire watch plus required notifications, tags at each fire department connection and control valve, and AHJ notification when excess hours).

1.06 SUBMITTALS

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

B. Evidence of designer qualifications.

C. Comply with NFPA 72 chapter "Documentation," including noting names of installers, owners, and system classification information.

D. Design Documents: Submit all information required for plan review and permitting by AHJ, including floor plans, riser diagrams, and description of operation.

1. Copy (if any) of list of data required by AHJ.
2. NFPA 72 "Record of Completion", filled out to extent known at time.
3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A, and complete listing of software required.
4. Manufacturer's detailed product data sheet for each component, including wiring diagrams, and circuit length limitations. Catalog pages and product descriptions include ratings, dimensions, finishes, service conditions, and included features.
5. Certification by manufacturer of FACU that system design complies with Contract Documents.
6. Certification by Contractor that system design complies with Contract Documents.

E. Shop Drawings: Submit installation documentation required for plan review and permitting by AHJ, including floor plans showing locations of fire alarm system components, enlarged drawn to identified scale plan view, and riser diagrams.
1. System zone boundaries and interfaces to fire safety systems.
2. Show locations of components, circuits, and raceways; mark components with identifiers used in control unit programming.
3. Include elevations and details of proposed equipment arrangements.
4. Include system interconnection schematic riser diagram showing proposed and approved cable size and type; coordinated with floor plans and describing circuit class, survivability, and application specific information required by NFPA 72.
5. Include typical wiring diagrams for devices, notification appliances, remote indicators, annunciators, remote test stations, and EoL and power supervisory devices.
6. Include requirements and control diagrams for interfacing with other systems.
7. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; standby and spare capacity calculations; notification appliance circuit loop resistance and voltage drop calculations, including spare capacity.
8. List of devices and notification appliances on each SLC, with spare capacity indicated.
9. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
10. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
11. Detailed drawing of graphic annunciators, displays, and interfaces.
12. Certification by either FACU manufacturer or manufacturer of related equipment.
13. Certification by FACU manufacturer that system design complies with Contract Documents.
14. Certification by Contractor that system design complies with Contract Documents.

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. Evidence of installer qualifications.

H. 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," filled out.

I. Operating and Maintenance Data: See Section 01 7800 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 AHJ.
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 require recording of system trouble events by qualified personnel, such as when routine testing is being conducted for fire drills and when entering into contracts for building renovations.

J. Project Record Documents: See Section 01 7800 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, and updated input/output chart.

K. Closeout Documents:
   1. Certification by manufacturer that 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 AHJ.

1.07 QUALITY ASSURANCE

A. Designer Qualifications: NICET Level III (three) or Level IV (four) certified fire alarm technician or registered fire protection engineer, employed by FACU manufacturer, Contractor, or installer, with experience designing fire alarm systems in jurisdictional area of AHJ.

B. Installer Qualifications: Firm with minimum three years documented experience installing fire alarm systems of specified type and providing contract maintenance service as regular part of their business.
   1. Authorized representative of FACU manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
   2. Installer Personnel: At least two years of experience installing fire alarm systems.
   3. Supervisor: Level III (three) or Level IV (four) certified fire alarm technician; furnish name and address.

C. Manufacturer Qualifications: Company specialized in manufacturing products specified in this section with at least three years of documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Receive, inspect, handle, and store products in accordance with manufacturer's instructions and NECA 305.

C. Handle carefully to avoid damage to internal components, enclosure, and finish.

D. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.09 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

B. Do not exceed maximum ambient temperature requirements for batteries at any time, which reduces battery service life. Replace batteries exposed to temperatures in excess of manufacturer's requirements.

C. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify COR and obtain direction before proceeding with work.

D. Existing Conditions:
   1. Modifications to Existing System:
      a. Remove inactive or abandoned cables and components from existing fire alarm system.

1.10 WARRANTY

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

B. Fire Alarm Manual Pull Stations: Provide minimum 1-year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

C. Fire Alarm System Detectors: Provide minimum 1-year year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

D. Fire Alarm System Notification Appliances: Provide minimum 1-year year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 FIRE ALARM SYSTEM

A. General Requirements:
   1. Provide modifications and extensions to existing fire alarm system complying with NFPA 70, NFPA 72, NFPA 90A, and consisting of required equipment, conduit, cabinets, outlet boxes, wiring, connectors, hardware, supports, accessories, components, software, and system programming as necessary for complete operating system that provides functional intent indicated.
   2. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
      a. 36 CFR 1191 and ADA Standards.
      b. Requirements of AHJ.
      c. Applicable local codes.
      d. Contract Documents.
      e. NFPA 72; "should" is mandatory; where conflicts between requirements require deviation, identify deviations clearly on design documents.
   3. Fire Alarm System Products:
      a. Listed, classified, and labeled as suitable for purpose intended.
      b. Installation Environments: Provide products suitable for their respective indoor and outdoor applications.
   4. Fire Alarm System Design Information:
      a. Building Code: Comply with applicable building code.
         1) Principle Occupancy: As indicated on Architect code summary drawings.
         2) Principle Use: As indicated on Architect code summary drawings.
      b. NFPA 72 Fire Alarm System Classification: Protected premises.
      c. Smoke and Heat Detector Coverage: Partial or selective coverage in accordance with NFPA 72.
   5. Provide fire alarm circuits in accordance with NFPA 70.
      a. Comply with methods of interconnecting FACUs in accordance with NFPA 72 and NFPA 70.
      b. Power Sources:
         1) Comply with requirements for power supplies of emergency systems in accordance with NFPA 70.
         2) Primary: Dedicated branch circuits from facility power distribution system.
         3) Secondary: Storage batteries with capacity to operate system for period specified by NFPA 72.
      c. Wiring and Wiring Methods:
         1) General Requirements:
            (a) Comply with requirements for wiring and wiring methods in accordance with NFPA 70.
            (b) 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.
            (c) Special Occupancies: Comply with NFPA 70.
            (d) Comply with NFPA 70 for wire and cable plenum, riser, general-purpose, limited-use, undercarpet, and underground applications.
         2) Fire Alarm Circuits:

(a) Comply with NFPA 70 for conditions and types required for multiconductor cable systems.
(b) Non-Power-Limited Fire Alarm (NPLFA) Circuits:
(1) Provide dedicated NPLFA non-GFCI branch circuits for fire alarm equipment and marked by red identification in accordance with NFPA 70.
(c) Power-Limited Fire Alarm (PLFA) Circuits:
(1) Provide identification for PLFA circuits in accordance with NFPA 70.

6. Provide pathway class designations and pathway survivability, as defined in NFPA 72.
a. Provide monitoring of conductors and other signaling channels for integrity and circuit performance.
b. Pathway Class Designations:
1) Unless otherwise indicated or required, pathways to meet the following requirements:
(a) SLCs: Class B (star, tee-tap, multi-tap, with no return).
(b) IDCs: Class B (daisy-chain with EoL resistor device installed at end of circuit).
(c) NACs: Class B (daisy-chain with EoL resistor device installed at end of circuit).

B. Fire Alarm System Interfaces and Control Functions:
1. UL 864 listed unless otherwise indicated.
2. Descriptions below are intended to provide means for interface. See project SOOs, narrative, and input/output matrix for execution requirements.
3. Provide initiating devices, interfaces, and control functions for emergency control function interfaces in accordance with NFPA 72.
4. Provide monitoring of interconnected systems. Coordinate notification appliance alternate markings as indicated on drawings.
5. HVAC Systems:
a. Air Handling Units (AHUs) and Roof Top Units (RTUs):
1) Provide duct smoke detector on supply side of air stream for units over 2,000 cfm.
2) Provide duct smoke detector on return side of air stream for units over 15,000 cfm.
3) Provide remote test station for each duct smoke detector unless explicitly indicated as not required.
4) Provide output signal to shut down units with at least one duct smoke detector via addressable relay module.
5) Where fire/smoke dampers are located downstream of unit, provide monitoring point input to determine that unit is not operational and subsequently provide output signal to close such dampers via addressable relay module and power isolation relay.
b. Remote Test Stations: Provide remote test station for each duct smoke detector unless explicitly indicated as not required. Unless otherwise indicated, use remote test stations only in clean, dry, indoor, nonhazardous locations.

2.02 FIRE ALARM SYSTEM INITIATING DEVICES

A. Manufacturers:
1. Provide devices matching existing building fire alarm system..
2. Source Limitations: Furnish initiating devices produced by same manufacturer as FACUs where possible.

B. General Requirements:
1. Addressable Systems:
a. Addressable Devices: Individually identifiable by addressable FACU; suitable for connection to FACU SLCs.
b. Conventional/Nonaddressable Devices: Provide addressable interface modules as indicated or as required for connection to addressable FACU. Unless devices are explicitly permitted to be connected together as one zone, provide separate

addressable monitoring point for each device in order to be individually identifiable by addressable FACU.

2. Provide devices and associated accessories suitable for intended application and location to be installed. Unless otherwise indicated, use addressable devices and addressable interface modules only in clean, dry, indoor, nonhazardous locations.
3. Surface-Mounted Devices: Provide manufacturer's accessory surface mount backboxes or suitable outlet/device box.
4. Devices for Outdoor and Damp/Wet Locations: Weatherproof, suitable for outdoor use; provide manufacturer's accessory backboxes or enclosures in accordance with product listing.
5. Devices for Hazardous/Classified Locations: Listed and labeled as suitable for classification of installed location.

C. Manual Fire Alarm Boxes/Pull Stations:
1. Description: Noncoded manual signaling boxes listed and labeled as complying with UL 38.
2. Alarm Initiation: Configured for general alarm initiation unless otherwise indicated; presignal stations (where indicated) require use of key to initiate general alarm.
3. Operation: Dual-action unless otherwise indicated or required.
a. Dual-Action Operation: First requires pushing, pulling, or lifting, then pulling of lever.
4. Color: Red, in accordance with NFPA 72.
5. Station Reset: Requires use of key or tool.
6. Products:
a. Provide devices matching existing fire alarm system..

D. Spot-Type Detectors:
1. Utilize plug-in mounting to separate base with tamper-resistant feature; provide bases as indicated or as required.
2. Addressable Detectors:
a. Provide LED indication of normal operation and regular communication with FACU and alarm condition.
3. Smoke Detectors:
a. Listed and labeled as complying with UL 268.
b. Provide sensor type (e.g., photoelectric, ionization) as indicated.
4. Thermal/Heat Detectors:
a. Listed and labeled as complying with UL 521.
b. Provide sensor type (e.g., fixed temperature, rate-of-rise) and rating as indicated.
5. Products:
a. Provide devices matching existing fire alarm system..

E. Duct Smoke Detectors:
1. Listed and labeled as complying with UL 268A.
2. Ratings: Compatible with air velocity, temperature, and humidity requirements for installed duct.
3. Housing: Select as required for application.
4. Sampling Tubes: Select as required for installation in duct to be monitored.

2.03 FIRE ALARM SYSTEM NOTIFICATION APPLIANCES

A. Manufacturers:
1. Provide devices matching existing fire alarm system..

B. General Requirements:
1. Provide signaling notification appliances listed for fire-protective service and intended operating mode, public or private; suitable for connection to FACU notification appliance circuits.
2. Provide notification appliances and associated accessories suitable for intended application and location to be installed. Use notification appliances only according to listed mounting (e.g. ceiling, wall).
3. Surface-Mounted Notification Appliances: Provide manufacturer's accessory surface mount backboxes or suitable outlet/device box.

4. Concealed Notification Appliances:
    a. Upon activation from fire alarm system, expose device for operation; return to concealed position upon system deactivation; motor-driven.
    b. Provide door position monitoring system for remote indication of concealed and exposed positions.
5. Exterior Notification:
    a. In addition to required occupant notification, provide notification appliances on exterior of building.
6. Notification Appliance Derating: Include device derating adjustments in accordance with listing where applicable, including the following.
    a. Where accessory protective guards or enclosures are utilized.
    b. Where required by field conditions (e.g., ambient temperature and sound).

C. Visible Notification Appliances:
1. Public Mode Operation: Listed and labeled as complying with UL 1971.
2. Strobes: Clear or nominal white lens with flash rate of 1 Hz unless otherwise indicated or required; xenon or LED light source with maximum pulse duration of 0.02 seconds; candela rating as indicated.

D. Audible Notification Appliances:
1. Listed and labeled as complying with UL 464.
2. Rated Sound Pressure Level: As required to achieve design sound pressure levels, but not less than 75 dBA at 10 feet for public mode operation or 45 dBA at 10 feet for private mode operation in accordance with UL 464.
3. Horns: Selectable tone, including at minimum NFPA 72 temporal 3 pattern and continuous; minimum of two selectable volume levels.

E. Combination Notification Appliances: Comply with respective requirements for each signaling method.

2.04 WIRE AND CABLE

A. General Requirements:

B. Power-Limited Fire Alarm Cables (PLFA):

C. Non-Power-Limited Fire Alarm Cables (NPLFA):
1. Comply with listing requirements in Chapter 7 of NFPA 70.

2.05 ACCESSORIES

A. Provide components as indicated or as required for connection of fire alarm system to devices and other systems indicated.

B. Provide EoL resistors as required for wiring supervision.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that mounting surfaces are ready to accept components and equipment, with suitable support frames and anchors installed where required.

B. Verify ratings, configurations, and characteristics of system components.

C. Verify rough-ins for field connections.

D. Verify that work likely to damage fire alarm system has been completed.

E. Verify that interior of building has been protected from weather.

F. Perform preinstallation tests and inspections per manufacturer's instructions and in accordance with NECA 305.

G. Verify that system bonding is in accordance with Section 260526.

H. Do not energize system until deficiencies have been corrected.

I. Verify that branch circuit wiring installation is completed, tested, and ready for connection to fire alarm system. Overcurrent protection ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

3.02 PREPARATION

A. Prior to installation, confirm environment of installation area is clean, and with ambient temperature, humidity, and ventilation requirements are per manufacturer's written instructions.
   1. Clean and vacuum in accordance with manufacturer's written instructions. Confirm equipment ventilation holes are absent of obstructions and free for air flow.
   2. Clean pathways thoroughly to remove foreign materials before installing conductors and cables.
   3. Clean dirt, debris, plaster, and other foreign materials from equipment enclosures, cabinets, and outlet boxes.
   4. Clean surfaces to receive adhesive products according to manufacturer's instructions.

B. Follow tool requirements for installation, including torquing adjustments, as listed in manufacturer documentation.

C. Remove detector dust covers prior to system energization.

3.03 INSTALLATION

A. Install field-devices, components, FACU and related equipment, and accessories in accordance with the following:

B. Field Locations:
   1. Obtain Owner's approval of locations of devices and notification appliances before installation.
   2. Arrange equipment to provide minimum operational clearances and required maintenance access in accordance with manufacturer's instructions and NFPA 70.
   3. Conceal wiring, conduit, outlet boxes, and supports where installed in finished areas; maintain code-required access.

C. Raceways and Supports:
   1. Coordinate locations of outlet boxes as required for installation. Only install boxes and equipment at locations based on application standards indicated in NFPA 72.
   2. Secure and support raceways at intervals complying with NFPA 70. Provide supports where vertical rise exceeds permissible limits.
   3. Install firestopping to preserve fire resistance rating of partitions and other elements.

D. Wiring and Connections:
   1. Maintain separation of Class 1, Class 2, Class 3 remote-control, signaling, fire alarm circuits, and power-limited circuits in accordance with cable insulation class and NFPA 70.
   2. Maintain circuit pathway and class designations in accordance with NFPA 72 for configuration, separation, and survivability.
   3. Comply with permitted and not permitted installations for wires, cables, cable routing assemblies, communications circuits, and fire alarm circuits in accordance with NFPA 70.
   4. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by AHJ. Provide independent support from building structure and suspended ceiling systems. Do not provide support from raceways, piping, ductwork, or other systems.
   5. Provide grounding and bonding in accordance with Section 260526.
   6. Comply with manufacturer's minimum cable sizes or ratings.
   7. Do not exceed manufacturer's recommended maximum power, signal, or network cable lengths between components.
   8. Provide network wiring in accordance with NFPA 70.
   9. Neatly train and bundle conductors inside boxes, wireways, and cabinets.
   10. See manufacturer's instructions for batteries.

E. Fire Alarm System Components:
   1. Install field-installed devices, components, relays, notification appliances, accessories, and when applicable EoL resistors.
      a. Install wiring to supervisory devices and associated EoL resistors as required for supervision of hardwired connections
   2. Install Wall-Mounted Equipment: Assemble component hardware within (e.g., card bays, sub-bays, expansion bays, signal cards, other card frames, networking, signal transmission, application modules, tamper monitoring devices, interconnecting modules,

and auxiliary power supplies), including space for required spare capacity, and configure settings.

3. Install Interconnect Wiring: Connect system cabinets, install processor and cards, cabling, connectors, terminations, and bonding.

F. Branch Power:
   1. After installation confirmations, follow manufacturer instructions to connect branch circuit power cables to premises fire alarm system components; comply with NFPA 70.
   2. Where accessories require auxiliary power, provide control power source and monitoring as indicated or as required to complete installation.
   3. Install auxiliary power supplies, including indicated monitoring, and connections necessary for remote equipment.

G. System Identification:
   1. Identify devices, notification appliances, components, cables, and equipment in accordance with approved submittals. See Section 260553.
   2. Confirm fire alarm system programming meets requirements of SOO and sub-system SOOs.
   3. Mark location of disconnecting means for NPFLA circuits.
   4. Coordinate to provide red branch power circuit protective devices or identify them accordingly as required by NFPA 72 and NFPA 70.
   5. Mark date of batteries installed on inside cover of panels and formal maintenance logs.

H. Troubleshooting and Installer Checks:
   1. Field test connectivity periodically during installation process to avoid unexpected troubleshooting.
   2. Check system operation for notification, FACU functions, circuit supervision, alarm initiating devices, supervisory initiating devices, dress panels/doors/covers, and programming before performing field tests.

I. Fire Alarm System Tests:
   1. Perform required tests of NFPA 72. Record measured values during operational checks.
   2. Confirm functional testing of fire alarm system is as indicated in Contract Documents.

3.04 FIELD QUALITY CONTROL

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

B. Provide services of manufacturer's authorized representation to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's detailed testing procedures and field reports and with submittals.

C. Provide equipment, two-way radios for testing personnel use, tools, and supplies required to accomplish inspection and testing.

D. Notify Owner and COR at least two weeks prior to scheduled inspections and tests.

E. Inspect and test in accordance with manufacturer's instructions.

F. Inspect wiring and components for damage and defects.

G. Batteries and Power Supplies: Perform inspections and tests listed in manufacturer installation instructions.

H. Perform additional requirements related to testing and inspection during system startup.

I. Test for interface with other systems.

J. Test shunt trips to verify operation.

K. Correct defective work, adjust for operation, and retest until entire system complies with Contract Documents.

L. Submit detailed reports indicated inspection and testing results, corrective actions taken, and as-found and final adjusted settings.

3.05 SYSTEM STARTUP

A. Obtain Owner approval prior to performing system startup.

B. Manufacturer Services: Provide services of manufacturer's authorized representation to systems startup. Include manufacturer's detailed startup procedures with submittals.

3.06 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust initiating device and notification appliance settings to achieve desired operation as indicated in submittals.

C. Measure power supply primary and secondary voltages, log values for records, and make appropriate adjustments.

D. Adjust alignment of equipment covers and doors. Provide keys and spare keys to Owner.

E. Reprint and reinstall damaged or misinstalled labels; maintain neat and square to installed location good workmanship - see NECA 1; maintain consistent placements for identification on products of similar type.

F. Adjust devices or notification appliances and associated bases to be flush and level.

G. Program system parameters according to requirements of Owner.

3.07 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. See Section 017419 - Construction Waste Management and Disposal for field-generated construction waste requirements.

C. Check tightness of electrical connections. Replace damaged components and provide closure plates for vacant positions. Provide circuit directory updates for related power branch circuits.

D. Clean and repair existing materials and equipment that remain or are indicated for reuse.

E. Clean dirt, debris, plaster, and other foreign materials from outlet boxes and fire alarm system equipment and components.

F. Clean fire alarm system equipment and components according to manufacturer's instructions and NECA 305.

G. Clean surfaces and interiors of boxes and device cover plates in accordance with manufacturer's instructions to remove dirt, fingerprints, debris, plaster, and other foreign materials.

H. Repair scratched or marred exposed surfaces to match original factory finish.

I. Comply with federal (EPA), state, and local regulations for battery handling and disposal. Do not spill battery fluids down plumbing drains. Only use containers safe for transportation marked 'nonspillable.'

3.08 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Notify AHJ and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide services of installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that work is complete and correct; perform preliminary tests as required.

E. Provide tools, software, and supplies required to accomplish inspection, testing, and document results.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of AHJ; document each inspection and test.

G. Correct defective work, adjust for operation, and retest until entire system complies with Contract Documents.

3.09 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals for additional submittals.

B. See Section 017900 - Demonstration and Training for additional requirements.

C. Closeout Demonstration: Demonstrate operation of all functions to Owner.
   1. Be prepared to conduct any of required tests.
   2. Have minimum 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 FACU manufacturer present during demonstration.
   4. Demonstration may be combined with inspection and testing required by AHJ; notify AHJ with enough time to schedule demonstration.
   5. Repeat demonstration until successful.

3.10 PROTECTION

A. Protect installed fire alarm system from subsequent construction operations.

END OF SECTION