PROJECT MANUAL

Oregon Youth Authority
MacLaren Infirmary & Pharmacy Renovation

2630 N Pacific Hwy.
Woodburn, OR 97071

Bid Set
March 6, 2026

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 OWNER:

A. Owner Name: Oregon Youth Authority
530 Center St NE, Ste. 500
Salem, OR 97301
(503) 354-4058

B. Primary Contact: All correspondence from the Contractor to the Architect will be direct, with copies to this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
1. Title: Owner's representative.

1.03 ARCHITECT:

A. Architect: Design Professional of Record.
Clark Kjos Architects
421 SW Sixth Avenue, Suite 1300
Portland, OR 97204
(503) 224-4848

1.04 ARCHITECTS CONSULTANTS:

A. All correspondence from the Contractor regarding construction documents authored by Architect's consultants will be through Architect, unless alternate arrangements are mutually agreed upon at preconstruction meeting.

B. Structural Engineering Consultant:
Lewis & Van Vleet, Inc.
18660 SW Boones Ferry Rd.
Tualtin, OR 97062
(503) 885-8605.

C. Mechanical, Electrical, Plumbing Engineering Consultant:
1. Sazan Group
111 SW 5th Ave., Suite 3210
Portland, OR 97204
(503) 416-2400.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

PROCUREMENT AND CONTRACTING REQUIREMENTS

1.01 DIVISION 00 -- PROCUREMENT AND CONTRACTING REQUIREMENTS

A. 00 01 03 - Project Directory
B. 00 01 10 - Table of Contents
C. 00 31 00 - Available Project Information
D. 00 43 25 - Substitution Request Form

SPECIFICATIONS

2.01 DIVISION 01 -- GENERAL REQUIREMENTS

A. 01 10 00 - Summary
B. 01 20 00 - Price and Payment Procedures
C. 01 25 00 - Substitution Procedures
D. 01 30 00 - Administrative Requirements
E. 01 32 16 - Construction Progress Schedule
F. 01 33 00 - Delegated Design Procedures
G. 01 40 00 - Quality Requirements
H. 01 40 50 - Coordination
I. 01 45 33 - Code-Required Special Inspections
J. 01 50 00 - Temporary Facilities and Controls
K. 01 60 00 - Product Requirements
L. 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions
M. 01 70 00 - Execution and Closeout Requirements
N. 01 73 29 - Cutting and Patching
O. 01 74 19 - Construction Waste Management and Disposal
P. 01 78 00 - Closeout Submittals
Q. 01 79 00 - Demonstration and Training
R. 01 91 13 - General Commissioning Requirements

2.02 DIVISION 02 -- EXISTING CONDITIONS

A. 02 41 00 - Demolition

2.03 DIVISION 03 -- CONCRETE

A. 03 30 00 - Cast-in-Place Concrete

2.04 DIVISION 05 -- METALS

A. 05 12 00 - Structural Steel Framing
B. 05 40 00 - Cold-Formed Metal Framing

2.05 DIVISION 06 -- WOOD, PLASTICS, AND COMPOSITES

A. 06 10 00 - Rough Carpentry
B. 06 17 33 - Wood I-Joists
C. 06 18 00 - Glued-Laminated Construction
D. 06 41 00 - Architectural Wood Casework

2.06 DIVISION 07 -- THERMAL AND MOISTURE PROTECTION

A. 07 14 00 - Fluid-Applied Waterproofing

B. 07 21 00 - Thermal Insulation
C. 07 25 00 - Weather Barriers
D. 07 42 13.23- Metal Composite Material Wall Panels
E. 07 46 16 - Aluminum Siding
F. 07 54 00 - Thermoplastic Membrane Roofing
G. 07 62 00 - Sheet Metal Flashing and Trim
H. 07 84 00 - Firestopping
I. 07 92 00 - Joint Sealants

2.07 DIVISION 08 -- OPENINGS

A. 08 11 13 - Hollow Metal Doors and Frames
B. 08 14 16 - Flush Wood Doors
C. 08 31 00 - Access Doors and Panels
D. 08 43 13 - Aluminum-Framed Storefronts
E. 08 51 13 - Aluminum Windows
F. 08 62 23 - Tubular Skylights
G. 08 63 00 - Metal-Framed Skylights
H. 08 71 00 - Door Hardware
I. 08 80 00 - Glazing
J. 08 91 00 - Louvers

2.08 DIVISION 09 -- FINISHES

A. 09 00 00 - Interior Finish Products
B. 09 00 00.1 - Interior Finish Product Schedule
C. 09 05 61 - Common Work Results for Flooring Preparation
D. 09 21 16 - Gypsum Board Assemblies
E. 09 22 16 - Non-Structural Metal Framing
F. 09 24 00 - Cement Plastering
G. 09 30 00 - Tiling
H. 09 51 00 - Suspended Acoustical Ceilings
I. 09 65 00 - Resilient Flooring
J. 09 68 13 - Tile Carpeting
K. 09 91 13 - Exterior Painting
L. 09 91 23 - Interior Painting

2.09 DIVISION 10 -- SPECIALTIES

A. 10 11 00 - Visual Display Units
B. 10 26 00 - Wall and Door Protection
C. 10 28 00 - Toilet, Bath, and Laundry Accessories
D. 10 44 00 - Fire Protection Specialties
E. 10 56 17 - Wall Mounted Standards and Shelving

2.10 DIVISION 11 -- EQUIPMENT

A. 11 05 00 - Equipment Coordination

2.11 DIVISION 12 -- FURNISHINGS

A. 12 36 00 - Countertops

2.12 DIVISION 21 -- FIRE SUPPRESSION

A. 21 00 00 - Fire Protection Design-Build Criteria
B. 21 05 00 - Common Work Results for Fire Suppression
C. 21 05 53 - Identification for Fire Suppression Piping and Equipment
D. 21 13 13 - Wet Pipe Sprinkler Systems

2.13 DIVISION 22 -- PLUMBING

A. 22 05 16 - Expansion Fittings and Loops for Plumbing Piping
B. 22 05 17 - Sleeves and Sleeve Seals for Plumbing Piping
C. 22 05 23 - General-Duty Valves for Plumbing Piping
D. 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment
E. 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment
F. 22 05 53 - Identification for Plumbing Piping and Equipment
G. 22 07 16 - Plumbing Equipment Insulation
H. 22 07 19 - Plumbing Piping Insulation
I. 22 08 00 - Commissioning of Plumbing
J. 22 10 05 - Plumbing Piping
K. 22 10 06 - Plumbing Piping Specialties
L. 22 30 00 - Plumbing Equipment
M. 22 40 00 - Plumbing Fixtures

2.14 DIVISION 23 -- HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

A. 23 01 30.51 - HVAC Air-Distribution System Cleaning
B. 23 05 13 - Common Motor Requirements for HVAC Equipment
C. 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
D. 23 05 48 - Vibration and Seismic Controls for HVAC
E. 23 05 53 - Identification for HVAC Piping and Equipment
F. 23 05 93 - Testing, Adjusting, and Balancing for HVAC
G. 23 07 13 - Duct Insulation
H. 23 07 19 - HVAC Piping Insulation
I. 23 08 00 - Commissioning of HVAC
J. 23 09 13 - Instrumentation and Control Devices for HVAC
K. 23 09 13 - HVAC Instrumentation and Controls
L. 23 11 23 - Facility Natural Gas Piping
M. 23 23 00 - Refrigerant Piping
N. 23 31 00 - HVAC Ducts and Casings
O. 23 33 00 - Air Duct Accessories
P. 23 34 23 - HVAC Power Ventilators
Q. 23 37 00 - Air Outlets and Inlets
R. 23 72 23 - Packaged Air-To-Air Energy Recovery Units
S. 23 81 26.13 - Small-Capacity Split-System Air Conditioners

T. 23 81 29 - Variable Refrigerant Flow HVAC Systems

2.15 DIVISION 26 -- ELECTRICAL

A. 26 05 05 - Selective Demolition for Electrical
B. 26 05 11 - Requirements for Electrical Installations
C. 26 05 13 - Medium-Voltage Cables
D. 26 05 19 - Low-Voltage Electrical Power Conductors and Cables
E. 26 05 26 - Grounding and Bonding for Electrical Systems
F. 26 05 29 - Hangers and Supports for Electrical Systems
G. 26 05 33.13 - Conduit for Electrical Systems
H. 26 05 33.16 - Boxes for Electrical Systems
I. 26 05 48 - Vibration and Seismic Controls for Electrical Systems
J. 26 05 53 - Identification for Electrical Systems
K. 26 05 73 - Power System Studies
L. 26 08 00 - Commissioning of Electrical
M. 26 09 23 - Lighting Control Devices
N. 26 24 16 - Panelboards
O. 26 27 13 - Electricity Metering
P. 26 27 26 - Wiring Devices
Q. 26 28 13 - Fuses
R. 26 28 16.16 - Enclosed Switches
S. 26 36 00 - Transfer Switches
T. 26 51 00 - Interior Lighting
U. 26 56 00 - Exterior Lighting

2.16 DIVISION 27 -- COMMUNICATIONS

A. 27 05 28 - Pathways for Communications Systems
B. 27 05 29 - Hangers and Supports for Communications Systems
C. 27 05 33.13 - Conduit for Communications Systems
D. 27 10 00 - Structured Cabling

2.17 DIVISION 28 -- ELECTRONIC SAFETY AND SECURITY

A. 28 13 00 - Access Control System
B. 28 20 00 - Video Surveillance
C. 28 46 00 - Fire Detection and Alarm

END OF SECTION

PART 1 GENERAL

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

3.01 OBTAINMENT OF PERMITS

A. Permits to be obtained by one of the following methods:
   1. See Supplemental General Conditions.
   2. Contractor to obtain the following required permits, and submit as a reimbursable expense to the Owner:
      a. All Delegated Design submittals (if applicable).

B. Building Permit Procedures: When required to obtain a permit:
   1. Complete and file permit application(s) with appropriate agency.
   2. Pay required fees.
   3. Advise Architect if submission of modified documents is necessary to have the authorities having jurisdiction complete the plan review and approval process. Submit modified documents expeditiously.
   4. Do not commence execution of any item of work for which a permit has not been obtained.

END OF SECTION

TO: CLARK // KJOS ARCHITECTS, 421 SW SIXTH AVE., SUITE 1300, PORTLAND, OR 97204

PROJECT: _ _____ _____

WE HEREBY SUBMIT FOR YOUR CONSIDERATION THE FOLLOWING PRODUCT INSTEAD OF THE SPECIFIED ITEM FOR THE ABOVE PROJECT:

SECTION		PARAGRAPH		SPECIFIED ITEM

PROPOSED SUBSTITUTION: _____

FILL IN BLANKS BELOW:

A. DOES THE SUBSTITUTION AFFECT DIMENSIONS SHOWN ON DRAWINGS? _____

B. WILL THE UNDERSIGNED PAY FOR CHANGES TO THE BUILDING DESIGN INCLUDING ENGINEERING AND DETAILING COSTS CAUSED BY THE REQUESTED SUBSTITUTION? _____

C. WHAT EFFECT DOES SUBSTITUTION HAVE ON OTHER TRADES? _____

D. DIFFERENCES BETWEEN PROPOSED SUBSTITUTION AND SPECIFIED ITEM? _____

E. MANUFACTURER'S GUARANTEES OF THE PROPOSED AND SPECIFIED ITEMS ARE:

_____SAME _____ DIFFERENT (EXPLAIN ON ATTACHMENT)

F. ROLE OF SUBMITTER: ___GENERAL CONTRACTOR ___SUBCONTRACTOR ___MANUFACTURER___DISTRIBUTOR ___ REPRESENTATIVE

G. ATTACH COMPLETE TECHNICAL DATA, INCLUDING LABORATORY TESTS, IF APPLICABLE.

H. INCLUDE COMPLETE INFORMATION ON CHANGES TO DRAWINGS AND/OR SPECIFICATIONS WHICH PROPOSED SUBSTITUTION WILL REQUIRE FOR ITS PROPER INSTALLATION.

I. THE UNDERSIGNED STATES THAT THE FUNCTION, APPEARANCE AND QUALITY ARE EQUIVALENT OR SUPERIOR TO THE SPECIFIED ITEM.

J. THE UNDERSIGNED AGREES THAT THE TERMS AND CONDITIONS FOR SUBSTITUTIONS FOUND IN THE BIDDING DOCUMENTS APPLY TO THIS PROPOSED SUBSTITUTION.

SUBMITTED BY:

SIGNATURE _____

FIRM _____

ADDRESS_____

_____

DATE_____

TELEPHONE _____

EMAIL _____

FOR USE BY DESIGN CONSULTANT:

___ACCEPTED ___ACCEPTED AS NOTED

___NOT ACCEPTED___RECEIVED TOO LATE

BY _____

REMARKS_____

_____

_____

END OF SECTION

PART 1 GENERAL

1.01 PROJECT

A. Project Name: OYA-MacLaren Infirmary

B. Owner's Name: Oregon Youth Authority.

C. Architect's Name: Clark Kjos Architects.

1.02 DESCRIPTION OF ALTERATIONS WORK

A. Scope of demolition and removal work is indicated on drawings and specified in Section 02 41 00.

B. Scope of alterations work is indicated on drawings.
   1. This project consists of the renovation and expansion of the infirmary at Oregon Youth Authority's MacLaren Facility. The renovation will include expanding the medical lab, a security station, med room and supply, and a receiving/storage area with the adjacent the expiation will include four patient rooms, a shared day room, a new nurse station, two supervisor offices, and a meeting room. After moving the existing med room, the walls will be removed for an enlarged general storage room.

C. General Contractor is required to provide all utility connections to and from building.

D. General Contractor is required to provide compliant site drainage from building under separate design-build agreement.

E. General Contractor should note this project is at a correctional facility and requires a heightened state of security for all Contractors their Subs, Venders etc. There shall be no smoking, or any form of weaponry permitted anywhere on the site. Tools and supplies shall be accounted for at all times and kept in locked condition when not in use or under direct survellance.

1.03 WORK BY OWNER

A. Owner will supply and install items as listed on equipment schedule in drawings.

1.04 OWNER OCCUPANCY

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

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

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

B. Arrange use of site and premises to allow (within facility established acceptable risk limits):
   1. Work by Others.
   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.

D. Utility Outages and Shutdown:
   1. Limit disruption of utility services to hours the building is unoccupied.
   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. Minimize shutdown of utility services and arrange at least 24 hours in advance with Owner.

4. Prevent accidental disruption of utility services to other facilities.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

1.02 RELATED REQUIREMENTS

A. Section 01 78 00 - Closeout Submittals: Project record documents.

1.03 SCHEDULE OF VALUES

A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.

C. Forms filled out by hand will not be accepted.

D. Submit a printed schedule on AIA Form G703 - Application and Certificate for Payment Continuation Sheet. Contractor's standard form or electronic media printout will be considered.

E. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.

F. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.

C. Forms filled out by hand will not be accepted.

D. Present required information in typewritten form.

E. Form: AIA G702 Application and Certificate for Payment and AIA G703 - Continuation Sheet including continuation sheets when required.

F. Execute certification by signature of authorized officer.

G. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed.

H. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.

I. Submit one electronic and 0 hard-copies of each Application for Payment.

1.05 MODIFICATION PROCEDURES

A. For minor changes not involving an adjustment to the Contract Price or Contract Time, Architect will issue instructions directly to Contractor.

B. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
   1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
   2. Promptly execute the change.

C. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required . Contractor shall prepare and submit a fixed price quotation within 10 days.

D. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
   1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.

E. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

F. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
   1. All closeout procedures specified in Section 01 70 00.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

A. Section 00 43 25 - Substitution Request Form: Required form for substitution requests..

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.
   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 coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.

B. OAR 125-247-0691 Brand Name or Equal Specification
   1. Applicability and Use. This Rule applies to Specifications for a Solicitation or class of Solicitations. For a Solicitation or class of Solicitations under ORS 279B.060 (Competitive sealed proposals), 279B.065 (Small procurements), 279B.070 (Intermediate procurements), 279B.085 (Special procurements), or 279A.200 (Definitions for ORS 279A.200 to 279A.225)–279A.225 (Protests and disputes), as provided in 279B.215 (Brand name or equal specification):
      a. A brand name or equal Specification may be used when the use of a brand name or equal Specification is advantageous to the Agency, because the brand name describes the standard of quality, performance, functionality and other characteristics of the product needed by the Agency.
      b. (The Agency is entitled to determine what constitutes a product that is equal or superior to the product specified, and any such determination is final.
      c. Nothing in this Subsection may be construed as prohibiting an Agency from specifying one or more comparable products as examples of the quality, performance, functionality or other characteristics of the product needed by the Agency.
   2. Determination. A brand name Specification may be prepared and used only if the Agency determines for a Solicitation or a class of Solicitations that only the identified brand name Specification will meet the needs of the Agency based on one or more of the following Written determinations:

a. That use of a brand name Specification is unlikely to encourage favoritism in the awarding of Public Contracts or substantially diminish competition for Public Contracts;
b. That use of a brand name Specification would result in substantial cost savings to the Agency;
c. That there is only one manufacturer or seller of the product of the quality, performance or functionality required; or
d. That efficient utilization of existing Goods requires the acquisition of compatible Goods or Services.

3. An Agency's use of a brand name Specification may be subject to review only as provided in ORS 279B.405 (Protests and judicial review of solicitations).
4. Single Manufacturer, Multiple Sellers. An Authorized Agency may prepare and use a brand name or equal Specification for Supplies and Services available from only one manufacturer, but available through multiple sellers, if the Authorized Agency complies with Sections (1) and (2) of this Rule and the following requirements:
   a. If the total purchase is $10,000 or more but does not exceed $150,000 and Supplies and Services are not available under an existing Mandatory Use Contract, the Authorized Agency must obtain informal, competitive Quotes, Bids, or Proposals and document this process in the Procurement File according to ORS 279B.070 (Intermediate procurements) and OAR 125-247-0270 (Intermediate Procurements);
   b. If the purchase exceeds $150,000, and the Supplies and Services are not available under an existing Price Agreement for information technology with competing products or a Mandatory Use Contract, an Authorized Agency must first request and obtain prior Written authorization from the State Chief Procurement Officer to proceed with the acquisition.
5. Single Manufacturer, Multiple Purchases. If an Authorized Agency intends to make several purchases of brand name-specified Supplies and Services from a particular manufacturer or seller for a period not to exceed five (5) years, the Authorized Agency must so state this information in: the Procurement File; the Solicitation Document, if any; or a Public Notice of a solicitation on ORPIN or other Electronic Procurement System approved by the State Chief Procurement Officer. If the Authorized Agency estimates the total purchase amount to exceed $150,000, this estimate must also be stated in the Public Notice. This Section (5) does not apply to Department Price Agreements, also known as Mandatory Use Contracts.
6. Nothing in this Rule exempts the Authorized Agency from obtaining the approval of the Attorney General for legal sufficiency according to ORS 291.047 (Public contract approval by Attorney General).
7. All State Contracting Agencies must comply with ORS 200.035 (Notice to Governor's Policy Advisor for Economic and Business Equity) and applicable related Department statewide policy, despite this Rule.

C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.

D. 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.

E. Limit each request to a single proposed substitution item.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Submittal Form (before award of contract):
   1. Before bid closing this needs to come to the Single Point of Contact as identified in the solicitation.
   2. Submit substitution requests by completing the form attached in section 00 43 25 - Substitution Request Form. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Submittal Form (after award of contract):
   1. Submit substitution requests by completing the form attached to section 00 43 25 - Substitution Request Form. See this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.

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

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

3.04 RESOLUTION

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

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.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.

B. Preconstruction meeting.

C. Progress meetings.

D. Construction progress schedule.

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

F. Deferred and delegated design submittals.

G. Number of copies of submittals.

H. Requests for Interpretation (RFI) procedures.

I. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 33 00 - Delegated Design Procedures

B. Section 01 60 00 - Product Requirements: General product requirements.

C. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.

D. Section 01 78 00 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to Architect:
   1. Requests for Interpretation (RFI).
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Correction Punch List and Final Correction Punch List for Substantial Completion.
   11. Closeout submittals.

1.04 PROJECT COORDINATOR

A. Project Coordinator: Construction Manager.

B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, traffic, and parking facilities.

C. During construction, coordinate use of site and facilities through the Project Coordinator.

D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 01 10 00 - Summary.

F. Coordinate field engineering and layout work under instructions of the Project Coordinator.

G. Make the following types of submittals to Architect through the Project Coordinator:
   1. Requests for Interpretation.
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Correction Punch List and Final Correction Punch List for Substantial Completion.
   11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Project Coordinator will schedule a meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.

C. Agenda:
   1. Execution of Owner-Contractor Agreement. (Note: This shall have occurred by the time of the pre-construction meeting)
   2. Submission of executed bonds and insurance certificates. (Note: This shall have occurred by the time of the pre-construction meeting)
   3. Distribution of Contract Documents.
   4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
   5. Designation of personnel representing the parties to Contract and Architect.
   6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   7. Scheduling.

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

3.02 PROGRESS MEETINGS

A. Project Coordinator will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

B. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect.
   4. Contractor's superintendent.
   5. Major subcontractors.

C. Agenda:
   1. Review minutes of previous meetings.
   2. Review of work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Maintenance of progress schedule.

7. Corrective measures to regain projected schedules.
8. Planned progress during succeeding work period.
9. Maintenance of quality and work standards.
10. Effect of proposed changes on progress schedule and coordination.
11. Other business relating to work.

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

3.03 CONSTRUCTION PROGRESS SCHEDULE

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

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

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

D. Submit updated schedule with each Application for Payment.

3.04 REQUESTS FOR INTERPRETATION (RFI)

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

B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
   1. Prepare a separate RFI for each specific item.
      a. Do not forward requests which solely require internal coordination between subcontractors.
   2. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
   1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
   2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
      a. Approval of submittals (use procedures specified elsewhere in this section).
      b. Approval of substitutions (see Section - 01 60 00 - Product Requirements)
      c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
      d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
   3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
   4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.

a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.

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

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

G. Review Time: Architect will respond and return RFIs to Contractor within 10 calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.

H. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.

3.05 SUBMITTALS FOR REVIEW

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

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

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

D. After review, provide copies and distribute in accordance with submittal procedures article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

3.06 SUBMITTALS FOR DELEGATED DESIGN

A. For Delegated Design elements defined in each section, submit Deferred Submittals in accordance with the specified requirements.

B. Architect or Engineer of Record, as applicable, will review Delegated Design submittals, and, if the submittal is acceptable and receives a "No Exceptions Taken" or "Make Corrections Noted" action, will forward to the Contractor for submission to the authority having jurisdiction with annotation indicating that the submittal documents have been reviewed and that they have been found to be in general conformance with the design of the building.

C. Contractor shall be responsible for submission to the authority having jurisdiction and for coordinating a timely review and approval of the submittals.

D. Contractor is responsible for obtaining applicable permits for Delegated Design elements as required by the authority having jurisdiction.

3.07 DEFERRED SUBMITTALS

A. Architect or Engineer of Record, as applicable, will review Deferred Submittals, and, if the submittal is acceptable and receives a "No Exceptions Taken" or "Make Corrections Noted" action, will forward to the Contractor for submission to the authority having jurisdiction with annotation indicating that the submittal documents have been reviewed and that they have been found to be in general conformance with the design of the building.

B. The Deferred Submittal items shall not be installed until their design and submittal documents have been approved by the authority having jurisdiction.

3.08 SUBMITTALS FOR INFORMATION

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

B. Submit for Architect's knowledge as contract administrator or for Owner.

3.09 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.10 NUMBER OF COPIES OF SUBMITTALS

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

B. Extra Copies at Project Closeout: See Section 01 78 00.

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

3.11 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Use a single transmittal for related items.
   2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.

3. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
    a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
4. Schedule submittals to expedite the Project, and coordinate submission of related items.
    a. For each submittal for review, allow 10 business days excluding delivery time to and from the Contractor.
    b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
    c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.
5. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
6. Provide space for Contractor and Architect review stamps.
7. Submittals not requested will be recognized, and will be returned "Not Reviewed",

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

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

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

E. Transmit each submittal with approved form.

F. For each submittal for review, allow 10 business days excluding delivery time to and from the Contractor.

3.12 SUBMITTAL REVIEW

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

B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

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

E. Architect's and consultants' actions on items submitted for information:

1. Items for which no action was taken:
   a. "Received" - to notify the Contractor that the submittal has been received for record only.
2. Items for which action was taken:
   a. "Reviewed" - no further action is required from Contractor.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

1.02 SUBMITTALS

A. Within 10 days after date established in Notice to Proceed, submit preliminary schedule.

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

C. Submit updated schedule with each Application for Payment.

D. Submit in PDF format.

1.03 SCHEDULE FORMAT

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

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

3.02 BAR CHARTS

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

B. Identify the first work day of each week.

3.03 REVIEW AND EVALUATION OF SCHEDULE

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

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

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

3.04 UPDATING SCHEDULE

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

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

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

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

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

F. Submit reports required to support recommended changes.

3.05 DISTRIBUTION OF SCHEDULE

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

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

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. Summary of Delegated Design portion of Work.
   2. Permitting for Delegated Design portion of Work.
   3. Delegated Design submittals.

B. Coordinate and assume full responsibility for design, engineering, submittals, fabrication, transportation, and installation of this work.

C. Delegated Design efforts include the following:
   1. Division 21 - Fire Suppression System
   2. Division 28 - Fire Alarm and Detection System

1.02 DEFINITIONS

A. Delegated Design: Professional design service or certification specifically required of the Contractor in the Specifications.

B. AHJ: Authorities Having Jurisdiction, defined in AIA Document A201.

1.03 PERFORMANCE REQUIREMENTS

A. Comply with Regulations.

B. Provide complete, operational systems that perform their intended use.

C. Engineer Delegated Design portions for gravity, lateral and seismic loads.
   1. Load criteria is indicated in the specific product Section.
   2. Indicate reactions to structure.
   3. Provide services of a qualified professional engineer licensed in the Project jurisdiction.

D. Execute the design intent as indicated in Project Drawings and Specifications.

E. Obtain Permits and inspections and pay fees required by AHJ.

1.04 OWNER'S RESPONSIBILITIES

A. The Owner will not pay for progress delays, additional Work, additional products, restocking, or re-working required by Contractor's failure to coordinate Delegated Design work with other Project work.

1.05 SUBMITTALS

A. Preliminary Design: Submit drawings and product data that describe Contractor’s design prior to performing engineering calculations and final drawings.
   1. Architect will evaluate proposed design and comment on conformance with intent of Contract Documents.
   2. Preliminary review is for aesthetic and general function concerns and will not constitute approval of engineering.
   3. Purpose of this submittal is to avoid engineering and detailing an unacceptable proposal.

B. Final Design: Submit drawings, product data and engineering calculations that describe Contractor’s final design.

C. Permit Review: Submit Delegated Design documents to AHJ for review and approval as a Deferred Submittal. Architect will deliver submittal to the AHJ and be the main point of contact with the AHJ.
   1. Review by Architect or Architect’s consultant prior to submittal to the AHJ is required. Allow adequate time for Architect’s review as described in Section 01 30 00 - Administrative Requirements.
   2. Make corrections noted by Architect.
   3. Obtain permits prior to executing work component.
   4. Comply with AHJ requirements.

5. Execute corrections to Delegated Design work required by AHJ at no cost to Owner and prior to Substantial Completion.
    a. Notify Architect of changes required by AHJ as soon as they are known.
6. Include design criteria, design assumptions, structural calculations, fabrication and construction details, required clearances, and interface requirements.
    a. Delegated Design drawings are in addition to Shop Drawings.
7. Affix Design Professional's seal for State License on Submittals.

D. Engineer’s qualifications.

E. Product Data, Shop Drawings and Samples: Comply with requirements of this Section for each product of Delegated Design portion of work. Product submittals are in addition to submittals for permit and design data.

1.06 QUALITY ASSURANCE

A. Documentation: Comply with the following:
1. Uniform Drawing System, NCS/UDS published by National Institute of Building Sciences.
2. Minimum text size: 1/8 inch
3. Legible when microfilmed
4. Other requirements of AHJ

B. Design requirements specific to Delegated Design portions are indicated in Drawings and in Sections that specify the component.

C. Engineer’s Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated.

D. Pre-Submittal Meeting: Contractor shall meet with Architect, Consultant, and Delegated Designer to discuss requirements of work-portion, submittals, scheduling and sequencing.

1.07 SCHEDULING

A. Schedule design process and submittals required for Delegated Design portions to fit within Construction Schedule.

B. Allow adequate time for AHJ review. Contact AHJ for time estimate and coordination of schedule.

C. Architect’s approval of Final Design is required prior to submittal to the AHJ. Allow time specified in Section 01 33 00 – Administrative Requirements for Architect’s review prior to submittal to the AHJ.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. Testing and inspection agencies and services.

C. Control of installation.

D. Mock-ups.

E. Manufacturers' field services.

F. Defect Assessment.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

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

C. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of test/inspection.
      h. Date of test/inspection.
      i. Results of test/inspection.
      j. Compliance with Contract Documents.
      k. When requested by Architect, provide interpretation of results.

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

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

F. Erection Drawings: Submit drawings for Architect'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.
   2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

1.03 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform specified testing and inspection.

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

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

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

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

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

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

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

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

3.02 MOCK-UPS

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

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

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

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

3.03 TESTING AND INSPECTION

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

B. 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.

C. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.

2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
3. Provide incidental labor and facilities:
    a. To provide access to Work to be tested/inspected.
    b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
    c. To facilitate tests/inspections.
    d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

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

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

F. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect. Payment for re testing will be charged to the Contractor by deducting testing charges from the Contract Price.

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.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This Section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:
   1. General project coordination procedures.
   2. Administrative and supervisory personnel.
   3. Cleaning and protection.

1.02 RELATED SECTIONS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. Section 01 30 00 - Administrative Requirements: Preconstruction, site mobilization and progress meetings, coordination meetings, and pre-installation conferences.

C. Section 01 30 00 - Administrative Requirements: Submittals for preparing and submitting the Contractor's Construction Schedule.

D. Section 01 40 00 - Quality Requirements: General coordination of installation requirements for materials and equipment.

E. Section 01 70 00 - Execution and Closeout Requirements: Coordinating contract closeout requirements.

F. Section 01 78 00 - Closeout Submittals: Required documents.

1.03 COORDINATION

A. Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair
   3. Make provisions to accommodate items scheduled for later installation.

B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Installation and removal of temporary facilities.
   2. Delivery and processing of submittals.
   3. Progress meetings.
   4. Project closeout activities.

1.04 SUBMITTALS

A. Staff Names: Within 10 days of Commencement of construction operations, submit a list of the Contractor’s principal staff assignments, including the superintendent and other personnel in attendance at the Project Site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 3.1 GENERAL COORDINATION PROVISIONS

A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

3.02 3.2 CLEANING AND PROTECTION

A. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.

B. Clean and provide maintenance on completed construction frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.

C. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading.
2. Excessively high or low temperatures.
3. Thermal shock.
4. Excessively high or low humidity.
5. Air contamination or pollution.
6. Water or ice.
7. Chemicals.
8. Light.
9. Soiling, staining, and corrosion.
10. Combustion.
11. Electrical current.
12. Improper lubrication.
13. Unusual wear or other misuse.
14. Contact between incompatible materials.
15. Excessive weathering.
16. Theft.
17. Vandalism.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Code-required special inspections.

B. Testing services incidental to special inspections.

C. Submittals.

D. Manufacturers' field services.

E. Fabricators' field services.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittal procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.03 DEFINITIONS

A. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.

B. National Institute of Standards and Technology (NIST).

C. Special Inspection:
   1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved Contract Documents and the referenced standards.
   2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency is required to:
   1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
   2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
   3. Submit certification that Special Inspection Agency is acceptable to AHJ.

C. Special Inspection Reports: After each special inspection, Special Inspector is required to promptly submit at least two copies of report; one to Architect and one to the AHJ.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of Special Inspector.
      d. Date and time of special inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of special inspection.
      h. Date of special inspection.
      i. Results of special inspection.
      j. Compliance with Contract Documents.

2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.

D. Test Reports: After each test or inspection, promptly submit at least two copies of report; one to Architect and one to AHJ.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of test or inspection.
      h. Date of test or inspection.
      i. Results of test or inspection.
      j. Compliance with Contract Documents.

E. Certificates: When specified in individual special inspection requirements, Special Inspector shall submit certification by the manufacturer, fabricator, and installation subcontractor to Architect and AHJ, in quantities specified for Product Data.
   1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

1.05 SPECIAL INSPECTION AGENCY

A. Owner will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by the building code.

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

1.06 TESTING AND INSPECTION AGENCIES

A. Owner may employ services of an independent testing agency to perform additional testing and sampling associated with special inspections but not required by the building code.

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

1.07 QUALITY ASSURANCE

A. Special Inspection Agency Qualifications:

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL

A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.
   1. Continuous Special Inspection: Special Inspection Agency is required to be present in the area where the work is being performed and observe the work at all times the work is in progress.
   2. Periodic Special Inspection: Special Inspection Agency is required to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

3.02 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

A. Special Inspection Agency shall:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified reference standards.

3. Ascertain compliance of materials and products with requirements of Contract Documents.
4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
5. Perform additional tests and inspections required by Architect.
6. Submit reports of all tests or inspections specified.

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

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

3.03 TESTING AGENCY DUTIES AND RESPONSIBILITIES

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

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

C. On instructions by Architect, perform re-testing required because of non-compliance with specified requirements, using the same agency.

D. Contractor will pay for re-testing required because of non-compliance with specified requirements.

3.04 CONTRACTOR DUTIES AND RESPONSIBILITIES

A. Contractor Responsibilities, General:
1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
2. Cooperate with agency and laboratory personnel; provide access to approved documents at project site, to the work, to manufacturers' facilities, and to fabricators' facilities.
3. Provide incidental labor and facilities:
a. To provide access to work to be tested or inspected.
b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
c. To facilitate tests or inspections.
d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

3.05 MANUFACTURERS' AND FABRICATORS' FIELD SERVICES

A. When specified in individual specification sections, require material suppliers, assembly fabricators, or product manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of

equipment, to 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.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary telecommunications services.

C. Temporary sanitary facilities.

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

E. Security requirements.

F. Vehicular access and parking.

G. Waste removal facilities and services.

H. Project identification sign.

1.02 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.

1.03 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

1.04 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.

1.05 BARRIERS

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

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

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

1.06 FENCING

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

1.07 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.

1.08 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. Existing parking areas may be used for construction parking.

1.09 WASTE REMOVAL

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

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

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

1.10 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

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

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

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

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Sustainable design-related product requirements.

C. Re-use of existing products.

D. Transportation, handling, storage and protection.

E. Product option requirements.

F. Substitution limitations.

G. Procedures for Owner-supplied products.

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

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Lists of products to be removed from existing building.

B. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

1.03 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. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

C. 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.

D. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.

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

1. See Section 01 10 00 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. 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.

C. Where other criteria are met, Contractor shall give preference to products that:

1. If used on interior, have lower emissions, as defined in Section 01 61 16.
2. If wet-applied, have lower VOC content, as defined in Section 01 61 16.
3. Are extracted, harvested, and/or manufactured closer to the location of the project.
4. Have longer documented life span under normal use.
5. Result in less construction waste. See Section 01 74 19
6. Are made of vegetable materials that are rapidly renewable.

D. Regionally-Sourced Products:
1. Overall Project Requirement: Provide materials amounting to a minimum of 10 percent of the total value of all materials (excluding plumbing, HVAC, electrical, elevators, and other equipment) that have been extracted, harvested, or recovered, as well as manufactured, within a radius of 500 miles from the project site.
2. Specific Product Categories: Provide regionally-sourced products as specified elsewhere.

E. Products with Rapidly Renewable Material Content:
1. Definition: Materials made from plants that are typically harvested within 10 years or less after planting.
2. Specific Product Categories: Provide renewable material content as specified elsewhere.
3. Calculations: Where information about renewable material content is required to be submitted and an item is not made completely of rapidly renewable material, calculate content by dividing the renewable material content by weight by the total weight of the item.

F. Sustainably Harvested Wood:
1. Definition: Wood-based materials include but are not limited to structural framing, dimension lumber, flooring, wood doors, finishes, and furnishings that are permanently installed in the project. Wood and wood-based products not permanently installed in the project are not included in the definition.
2. Specific Wood-Based Fabrications: Fabricate of sustainably harvested wood when so specified elsewhere.

G. Urea-Formaldehyde Prohibition:
1. Overall Project Requirement: Provide composite wood and agrifiber products having no added urea-formaldehyde resins.
a. Require each installer to certify compliance and submit product data showing product content.
2. Specific Product Categories: Comply with limitations specified elsewhere.

H. Adhesives and Joint Sealants:
1. Definition: This provision applies to gunnable, trowelable, and liquid-applied adhesives, sealants, and sealant primers used anywhere on the interior of the building inside the weather barrier, including duct sealers.
2. Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.
a. Require each installer to certify compliance and submit product data showing product content.
3. Specific Product Categories: Comply with limitations specified elsewhere.

I. Aerosol Adhesives:
1. Provide only products having lower volatile organic compound (VOC) content than required by GreenSeal GS-36.

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: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed except as provided for under section 01 25 00-Substitution Procedures.

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

2.04 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 OWNER-SUPPLIED PRODUCTS

A. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:
   1. Review Owner reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.

3.02 TRANSPORTATION AND HANDLING

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

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

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

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

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

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

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

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

3.03 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 74 19.

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

C. Store with seals and labels intact and legible.

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

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

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

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

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

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

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

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

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for Indoor-Emissions-Restricted products.

B. Requirements for VOC-Content-Restricted products.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittal procedures.

B. Section 07 92 00 - Joint Sealants: Emissions-compliant sealants.

1.03 DEFINITIONS

A. 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.

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

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

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

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

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

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

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

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

1.06 QUALITY ASSURANCE

A. 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. 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. 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

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Cutting and patching.

C. Surveying for laying out the work.

D. Cleaning and protection.

E. Starting of systems and equipment.

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 01 30 00 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

B. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

C. Section 01 91 13 - General Commissioning Requirements: Contractor's responsibilities in regard to commissioning.

D. Section 02 41 00 - Demolition: Demolition of whole structures and parts thereof; site utility demolition.

E. Section 07 84 00 - Firestopping.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. 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.

1.04 QUALIFICATIONS

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

1.05 PROJECT CONDITIONS

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

B. 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.

C. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

1. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.

1.06 COORDINATION

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

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

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

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

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

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

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

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

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

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

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 - 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.

D.

3.03 LAYING OUT THE WORK

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

B. Promptly notify Architect of any discrepancies discovered.

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

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

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

F. Utilize recognized engineering survey practices.

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

H. Periodically verify layouts by same means.

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

3.04 GENERAL INSTALLATION REQUIREMENTS

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

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

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

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

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

3.05 CUTTING AND PATCHING

A. 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.

B. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

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

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

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

F. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.

G. 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.

H. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

I. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new work abuts or aligns with existing, perform a smooth and even transition.

3.06 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.

3.07 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

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

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

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

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

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

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

3.08 SYSTEM STARTUP

A. Coordinate with requirements of Section 01 91 13 - General Commissioning Requirements.

3.09 ADJUSTING

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

3.10 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

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

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

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

E. Clean filters of operating equipment.

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

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.

3.11 CLOSEOUT PROCEDURES

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

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

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

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

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

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

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

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

3.12 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

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for cutting and patching.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 1 Section "Coordination" for procedures for coordinating cutting and patching with other construction activities.
   2. Division 2 Section "Demolition" for demolition of selected portions of the building for alterations.
   3. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
      a. Requirements of this Section apply to other installations. Refer to Division 20 through Division 32 for other requirements and limitations applicable to cutting and patching.

1.03 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.

B. Operational Limitations: Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safety.

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace construction cut and patched in a visually unsatisfactory manner.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

A. Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible if identical materials are unavailable or cannot be used. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed before cutting. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.
   1. Before proceeding, meet at the Project Site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.02 PREPARATION

A. Temporary Support: Provide temporary support of work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Avoid cutting existing pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until provisions have been made to bypass them.

3.03 PERFORMANCE

A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
   1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining construction.
   1. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
   3. Cut through concrete and masonry using a cutting machine, such as a Carborundum saw or a diamond-core drill.
   4. Comply with requirements of applicable Division 2 Sections where cutting and patching requires excavating and backfilling.
   5. Where services are required to be removed, relocated, or abandoned, by-pass utility services, such as pipe or conduit, before cutting. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
   1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
   2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
   3. Where removing walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform color and appearance.
      a. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing the patch after the area has received primer and second coat.
   4. Patch, repair, or re-hang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.04 CLEANING

A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

END OF SECTION

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. Owner may decide to pay for additional recycling, salvage, and/or reuse based on Landfill Alternatives Proposal specified below.

E. 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. Land clearing debris, including brush, branches, logs, and stumps; see Section 31 10 00 - Site Clearing for use options.
   6. Concrete: May be crushed and used as riprap, aggregate, sub-base material, or fill.
   7. Bricks: May be used on project if whole, or crushed and used as landscape cover, sub-base material, or fill.
   8. Concrete masonry units: May be used on project if whole, or crushed and used as sub-base material or fill.
   9. Precast concrete panels: May be used for erosion control or landscape features.
   10. Asphalt paving: May be recycled into paving for project.
   11. 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.
   12. Glass.
   13. Gypsum drywall and plaster.
   14. Plastic buckets.
   15. Carpet, carpet cushion, carpet tile, and carpet remnants, both new and removed: DuPont (http://flooring.dupont.com) and Interface (www.interfaceinc.com) conduct reclamation programs.
   16. Rigid foam insulation.
   17. Vinyl siding.
   18. Windows, doors, and door hardware.
   19. Plumbing fixtures.
   20. Mechanical and electrical equipment.
   21. Fluorescent lamps (light bulbs).
   22. Acoustical ceiling tile and panels.

F. LEED Certification for this project is dependent on diversion of 50 percent, by weight, of potential landfill trash/waste by recycling and/or salvage.

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

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

I. The following sources may be useful in developing the Waste Management Plan:

J. 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.

K. 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 01 30 00 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. Section 01 50 00 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

C. Section 01 60 00 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.

D. Section 01 70 00 - 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 01 30 00 - Administrative Requirements for submittal procedures.

B. Landfill Alternatives Proposal: Within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner, submit a projection of trash/waste that will require disposal and alternatives to landfilling, with net costs.
   1. Submit to Architect for Owner's review and approval.
   2. If Owner wishes to implement any cost alternatives, the Contract Sum will be adjusted as specified elsewhere.
   3. Include an analysis of trash/waste to be generated and landfill options as specified for Waste Management Plan described below.
   4. Describe as many alternatives to landfilling as possible:
      a. List each material proposed to be salvaged, reused, or recycled.
      b. List the proposed local market for each material.
      c. State the estimated net cost resulting from each alternative, after subtracting revenue from sale of recycled or salvaged materials and landfill tipping fees saved due to diversion of materials from the landfill.
   5. Provide alternatives to landfilling for at least the following materials:

C. Once Owner has determined which of the landfill alternatives addressed in the Proposal above are acceptable, prepare and submit Waste Management Plan; submit within 10 calendar days after notification by Architect.

D. 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.
   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.

E. 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 3 EXECUTION

2.01 WASTE MANAGEMENT PROCEDURES

A. See Section 01 30 00 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. See Section 01 50 00 for additional requirements related to trash/waste collection and removal facilities and services.

C. See Section 01 60 00 for waste prevention requirements related to delivery, storage, and handling.

D. See Section 01 70 00 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

2.02 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 Architect.

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. Provide containers as required.
   2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
   3. 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

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 01 70 00 - 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. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

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

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site 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.

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. Changes made by Addenda and modifications.

F. Record Drawings : Legibly mark each item to record actual construction including:
   1. Field changes of dimension and detail.
   2. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

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

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

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

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

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:

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

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

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

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

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

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

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

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

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

G. Include sequence of operation by controls manufacturer.

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

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

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into bookmarked PDF format for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Cover: Identify as OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

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

D. Tables of Contents: List every item using the same identification as bookmarked. Where multiple PDFs are required, include Tables of Contents in PDF.

E. Drawings: Provide in PDF format.

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.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

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

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. Finishes, including flooring, wall finishes, ceiling finishes.
   2. Fixtures and fittings.
   3. Items specified in individual product Sections.

1.02 RELATED REQUIREMENTS

A. Section 01 78 00 - Closeout Submittals: Operation and maintenance manuals.

B. Other Specification Sections: Additional requirements for demonstration and training.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
   2. Submit one copy to the Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Commissioning Authority.
   4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Commissioning Authority for review and inclusion in overall training plan.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
   1. Format: Flash Drive.
   2. Label each device with session identification and date.

1.04 QUALITY ASSURANCE

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.

C. Demonstration may be combined with Owner personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.

B. Conduct training on-site unless otherwise indicated.

C. Owner will provide classroom and seating at no cost to Contractor.

D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.

E. Provide training in minimum two hour segments.

F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.

G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

I. Product- and System-Specific Training:

1. Review the applicable O&M manuals.
2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
4. Provide hands-on training on all operational modes possible and preventive maintenance.
5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
6. Discuss common troubleshooting problems and solutions.
7. Discuss any peculiarities of equipment installation or operation.
8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by Contractor.
11. Review spare parts suppliers and sources and procurement procedures.

J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning:
   1. Verify that the work is installed in accordance with Contract Documents and the manufacturer’s recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.
   2. Verify and document that functional performance is in accordance with Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
   3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
   4. Verify that the Owner’s operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.

B. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.

1.02 RELATED REQUIREMENTS

A. Section 01 78 00 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
   1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F and resolution of plus/minus 0.1 degree F.
   2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
   3. Calibration: According to the manufacturer’s recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.

C. 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.

D. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc. of equipment.
   1. Dataloggers required to for Functional Tests will be provided by the Commissioning Authority and will not become the property of Owner.

PART 3 EXECUTION

3.01 COMMISSIONING PLAN

A. Commissioning Authority has prepared the Commissioning Plan.
   1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.

2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.

B. Contractor is responsible for compliance with the Commissioning Plan.

C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.

D. Commissioning Schedule:
1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.
2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.
3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.02 STARTUP PLANS AND REPORTS

A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.

B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.

C. Submit directly to the Commissioning Authority.

3.03 PREFUNCTIONAL CHECKLISTS

A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.
1. No sampling of identical or near-identical items is allowed.
2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.
3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:
   a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.
   b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.
   c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."
   d. Serial number of installed unit.
   e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer’s start-up checklist items and minor testing.
   f. Sensor and actuator calibration information.

B. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.
1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.
2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.

3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.
4. If any Checklist line item is not relevant, record reasons on the form.
5. Contractor may independently perform startup inspections and/or tests, at Contractor's option.
6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.
7. Submit completed Checklists to Commissioning Authority within two days of completion.

C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor.
1. Initial Drafts: Contractor is responsible for initial draft of Prefunctional Checklist where so indicated in Contract Documents.
2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in Contract Documents or not.
4. When asked to review the proposed Checklists, do so in a timely manner.

D. Commissioning Authority Witnessing: Required for:
1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.
2. A sampling of non-primary equipment, as allowed by the commissioning plan.

E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.04 FUNCTIONAL TESTS

A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.

B. Contractor is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.

C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.

D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.
1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with Contract Documents or does not perform properly.
2. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.
3. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
4. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing.

5. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.

E. Functional Test Procedures:
   1. Some test procedures are included in Contract Documents; where Functional Test procedures are not included in Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor.
   2. Examples of Functional Testing:
      a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).
      b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.
      c. Systems are run through all the HVAC control system’s sequences of operation and components are verified to be responding as the sequence's state.
      d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.

F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Contractor's responsibility regardless of timing.

3.05 SENSOR AND ACTUATOR CALIBRATION

A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gauges, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.

B. Calibrate using the methods described below; alternate methods may be used, if approved by Commissioning Authority and Owner beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.

C. All Sensors:
   1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
   2. Verify that sensors with shielded cable are grounded only at one end.
   3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.
   4. Tolerances for critical applications may be tighter.

D. Sensors Without Transmitters - Standard Application:
   1. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
   2. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
   3. If not, install offset, calibrate or replace sensor.

E. Sensors With Transmitters - Standard Application.
   1. Disconnect sensor.
   2. Connect a signal generator in place of sensor.

3. Connect ammeter in series between transmitter and building automation system control panel.
4. Using manufacturer's resistance-temperature data, simulate minimum desired temperature.
5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
7. Record all values and recalibrate controller as necessary to comply with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
8. Reconnect sensor.
9. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
10. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
11. If not, replace sensor and repeat.
12. For pressure sensors, perform a similar process with a suitable signal generator.

F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:
1. Watthour, Voltage, Amperage: 1 percent of design.
2. Pressure, Air, Water, Gas: 3 percent of design.
3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F.
4. Relative Humidity: 4 percent of design.
5. Barometric Pressure: 0.1 inch of Hg.
6. Flow Rate, Air: 10 percent of design.
7. Flow Rate, Water: 4 percent of design.
8. AHU Wet Bulb and Dew Point: 2.0 degrees F.

G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

H. 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 to 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).

I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.
1. With full pressure in the system, command valve closed.
2. Use an ultra-sonic flow meter to detect flow or leakage.

3.06 TEST PROCEDURES - GENERAL

A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.

C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:

1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.
2. Sampling is not allowed for:
   a. Major equipment.
   b. Life-safety-critical equipment.
   c. Prefunctional Checklist execution.
3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.
4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.
5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."
6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.
7. If YY percent of the units in the second sample fail, test all remaining identical units.
8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Contractor to perform and document a checkout of the remaining units prior to continuing testing.

D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”).

E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.

F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.

G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.

H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.

I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:
   1. All points that are monitored by the relevant control system shall be trended by Contractor; at the Commissioning Authority’s request, Contractor shall trend up to 20 percent more points than specified at no extra charge.
   2. Other points will be monitored by the Commissioning Authority using dataloggers.
   3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.
   4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.
   5. Graphical output is desirable and is required for all output if the system can produce it.
   6. Monitoring may be used to augment manual testing.

3.07 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 78 00 - Closeout Submittals for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building demolition excluding removal of hazardous materials and toxic substances.

B. Selective demolition of built site elements.

C. Selective demolition of building elements for alteration purposes.

D. Owner will provide a report identifying known hazardous materials and toxic substances within the project area, and will provide for removal and disposal under separate contract.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 10 00 - Summary: Description of items to be salvaged or removed for re-use by Contractor.

C. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

D. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.

E. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

1.03 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SCOPE

A. Remove portions of existing site improvements and buildings as indicated on the drawings, and as required to accomplish the work.

B. Remove other items for salvage, relocation, and recycling.

C. Notify Owner immediately if hazardous materials or toxic materials are encountered.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. 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.
   3. Provide, erect, and maintain temporary barriers and security devices.
   4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   5. Do not close or obstruct roadways or sidewalks without permit.
   6. 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.
   7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.

2. Prevent movement or settlement of adjacent structures.
3. Stop work immediately if adjacent structures appear to be in danger.

3.03 SELECTIVE DEMOLITION FOR ALTERATIONS

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

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

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

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

3.04 DEBRIS AND WASTE REMOVAL

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

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

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

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete formwork.

B. Underslab vapor barrier.

C. Floors and slabs on grade.

D. Concrete reinforcement.

E. Joint devices associated with concrete work.

F. Concrete curing.

1.02 RELATED REQUIREMENTS

A. As Indicated in Structural drawings.

B. Section 07 92 00 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

1.03 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).

B. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.

C. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).

D. ACI PRC-305 - Guide to Hot Weather Concreting; 2020.

E. ACI PRC-306 - Guide to Cold Weather Concreting; 2016.

F. ACI PRC-308 - Guide to External Curing of Concrete; 2016.

G. ACI PRC-347 - Guide to Formwork for Concrete; 2014 (Reapproved 2021).

H. ACI SPEC-117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).

I. ACI SPEC-301 - Specifications for Concrete Construction; 2020.

J. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2022a.

K. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2021.

L. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2018a.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

C. Mix Design: Submit proposed concrete mix design.
   1. Indicate proposed mix design complies with requirements of ACI SPEC-301, Section 4 - Concrete Mixtures.
   2. Indicate proposed mix design complies with requirements of ACI CODE-318, Chapter 5 - Concrete Quality, Mixing and Placing.
   3. Indicate proposed mix design complies with fiber reinforcing manufacturer's written recommendations.

D. Samples: Submit samples of underslab vapor barrier to be used.

E. Test Reports: Submit report for each test or series of tests specified.

F. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.

B. Follow recommendations of ACI PRC-305 when concreting during hot weather.

C. Follow recommendations of ACI PRC-306 when concreting during cold weather.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 FORMWORK

A. Formwork Design and Construction: Comply with guidelines of ACI PRC-347 to provide formwork that will produce concrete complying with tolerances of ACI SPEC-117.

B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
   1. Earth Cuts: Do not use earth cuts as forms for vertical surfaces. Natural rock formations that maintain a stable vertical edge may be used as side forms.
   2. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
   3. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.

2.02 REINFORCEMENT MATERIALS

A. As indicated in structural drawings.

2.03 CONCRETE MATERIALS

A. As indicated in structural drawings.

2.04 ACCESSORY MATERIALS

A. Underslab Vapor Barrier: Multi-layer reinforced polyolefin or equivalent, complying with ASTM E 1745, Class A, 0.01 perms.
   1. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
   2. Products:
      a. ISI Building Products; Viper VaporCheck II 15-mil (Class A): www.isibp.com/#sle.
      b. Tex-Trude, LP; Xtreme Vapor Barrier (15-mil): www.tex-trude.com/#sle.
      c. W. R. Meadows, Inc; PERMINATOR Class A - 15 mils (0.38 mm): www.wrmeadows.com/#sle.
      d. StegoWrap by Stego
      e. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 BONDING AND JOINTING PRODUCTS

A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
   1. Products:
      a. Euclid Chemical Company; AKKRO-7T: www.euclidchemical.com/#sle.
      b. W. R. Meadows, Inc; ACRY-LOK: www.wrmeadows.com/#sle.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 CURING MATERIALS

A. As indicated in Structural drawings.

B. Curing and Sealing Compound, Low Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.

1. Products:
   a. Euclid Chemical Company; DIAMOND CLEAR VOX: www.euclidchemical.com/#sle.
   b. W. R. Meadows, Inc; VOCOMP-25: www.wrmeadows.com/#sle.
   c. Substitutions: See Section 01 60 00 - Product Requirements.

2.07 CONCRETE MIX DESIGN

A. As indicated in structural drawings.

2.08 MIXING

A. As indicated in structural drawings.

B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

A. Underslab Vapor Barrier: Install vapor barrier in the floor slab assembly as shown on drawings and according to manufacturer's written recommendations.

B. Verify that forms are clean and free of rust before applying release agent.

C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
   1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
   2. Use latex bonding agent only for non-load-bearing applications.

E. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.

F. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

G. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Comply with requirements of ACI SPEC-301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.

C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

3.04 PLACING CONCRETE

A. Place concrete in accordance with ACI PRC-304.

3.05 SLAB JOINTING

A. Locate joints as indicated on drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

D. Repair underslab vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.

E. Install joint devices in accordance with manufacturer's instructions.

3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.07 CONCRETE FINISHING

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

3.08 CURING AND PROTECTION

A. Comply with requirements of ACI PRC-308. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
   1. Normal concrete: Not less than seven days.
   2. High early strength concrete: Not less than four days.

3.09 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

3.10 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

3.11 PROTECTION

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

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural steel framing members, support members and struts.

B. Structural steel support members and struts.

C. Base plates.

D. Grouting under base plates.

1.02 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual; 2017.

B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2022, with Errata (2025).

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

E. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

F. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.

G. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2022.

H. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.

I. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2019.

J. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2022.

K. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
   2. Connections not detailed.

C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

1.04 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel Angles, Plates, and Channels: ASTM A36/A36M.

B. Steel W Shapes and Tees: ASTM A992/A992M.

C. Rolled Steel Structural Shapes: ASTM A992/A992M.

D. Hot-Formed Structural Tubing: ASTM A501/A501M, seamless or welded.

E. Pipe: ASTM A53/A53M, Grade B, Finish black.

F. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563/A563M nuts and ASTM F436/F436M washers.

G. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C1107/C1107M and capable of developing a minimum compressive strength of 7,000 psi at 28 days.

2.02 FABRICATION

A. Shop fabricate to greatest extent possible.

B. Fabricate connections for bolt, nut, and washer connectors.

2.03 FINISH

A. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

PART 3 EXECUTION

3.01 ERECTION

A. Erect structural steel in compliance with AISC 303.

B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Do not field cut or alter structural members without approval of Architect.

D. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.02 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed steel stud framing as indicated in drawings.

B. Formed steel joist framing and bridging.

1.02 RELATED REQUIREMENTS

A. See Structural drawings for additional information.

B. Section 07 25 00 - Weather Barriers: Water-resistive barrier over sheathing.

1.03 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).

B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

E. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2025.

F. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).

G. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on cold-formed steel structural members; include material descriptions and base steel thickness.

C. Product Data: Provide manufacturer's data on factory-made connectors and mechanical fasteners, showing compliance with requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Structural Framing:
   1. As Indicated in Structural drawings..
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Connectors:
   1. Same manufacturer as metal framing.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. As Indicated in Structural drawings.

B. Design Requirements: Design cold-formed framing systems, components and connectors to withstand specified design loads in compliance with ICC (IBC), ASCE 7, AISI S100, and AISI S240.

2.03 MATERIALS

A. As Indicated in Structural drawings.

B. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.
   1. Structural Grade: As required to meet design criteria.

2.04 STRUCTURAL FRAMING COMPONENTS

A. As Indicated in Structural drawings.

B. Wall Studs and Track Sections: AISI S240; c-shaped studs and u-shaped track sections in stud-matching nominal width and compatible height.
   1. Provide components fabricated from ASTM A1011/A1011M Designation SS (structural steel).

C. Joists: AISI S240; manufactured, engineered open-web steel joists.
   1. Thickness and Depth: Depth as indicated on drawings; thickness and structural grade as required to meet specified design criteria.

2.05 LATERAL FORCE-RESISTING SYSTEMS

A. As Indicated in Structural drawings.

2.06 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Plates, Gussets, Clips: Formed Sheet Steel, thickness determined for conditions encountered; finish to match framing components.

C. Galvanizing Repair: Touch up bare steel with zinc-rich paint in compliance with ASTM A780/A780M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify field measurements and adjust installation as required.

3.02 INSTALLATION - GENERAL

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

3.03 INSTALLATION OF STUDS

A. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

B. Install load-bearing studs full length in one piece. Splicing of studs is not permitted.

C. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

D. Install intermediate studs above and below openings to align with wall stud spacing.

E. Provide deflection allowance in stud track, directly below horizontal building framing at non-loadbearing framing.

F. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

3.04 INSTALLATION OF JOISTS

A. Install framing components in accordance with manufacturer's instructions.

B. Make provisions for erection stresses. Provide temporary alignment and bracing.

3.05 TOLERANCES

A. Maximum Variation from True Position: 1/8 inch.

B. Maximum Variation of any Member from Plane: 1/8 inch.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural dimension lumber framing.

B. Nonstructural dimension lumber framing.

C. Rough opening framing for doors, windows, and roof openings.

D. Sheathing.

E. Preservative treated wood materials.

F. Miscellaneous framing and sheathing.

G. Concealed wood blocking, nailers, and supports.

H. Roof sheathing with factory applied roofing underlayment.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03 30 00 - Cast-in-Place Concrete: Setting anchors in concrete.

C. Section 06 17 33 - Wood I-Joists.

D. Section 06 18 00 - Glued-Laminated Construction.

E. Section 07 25 00 - Weather Barriers: Water-resistive barrier over sheathing.

F. Section 07 62 00 - Sheet Metal Flashing and Trim: Sill flashings.

1.03 REFERENCE STANDARDS

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

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

D. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing; 2019a.

E. AWC (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; 2024, with Errata.

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

G. PS 1 - Structural Plywood; 2023.

H. PS 2 - Performance Standard for Wood Structural Panels; 2019.

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

J. WWPA G-5 - Western Lumber Grading Rules; 2025.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide technical data on Roof sheathing with factory applied roofing underlayment..

C. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

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.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a two-year period 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: As indicated in structural drawings, 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.

B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

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

B. Moisture Content: S-dry or MC19.

C. Stud Framing (as indicated in Structural drawings):
   1. Species: as indicated in Structural drawings.
   2. Grade: No. 2.

D. Joist, Rafter, and Small Beam Framing (as indicated in Structural drawings):
   1. Species: Allowed under grading rules.

E. 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: APA PRP-108, Structural I Rated Sheathing, Exterior Exposure Class, and as follows:
   1. As indicated in Structural drawings

B. Wall Sheathing: Plywood, PS 1, Grade C-D, Exposure I.
   1. As indicated in Structural drawings

2.04 ACCESSORIES

A. Fasteners and Anchors:
   1. As indicated in Structural drawings.

B. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions.
   1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.
   2. Manufacturers:
      a. As indicated in Structural drawings..

C. Sill Gasket on Top of Foundation Wall: 1/4 inch thick, plate width, closed cell plastic foam from continuous rolls.

D. Sill Flashing: See Section 07 62 00.

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. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
   1. Kiln dry lumber after treatment to maximum moisture content of 19 percent.

PART 3 EXECUTION

3.01 PREPARATION

A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches and seal.

B. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

C. 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 FRAMING INSTALLATION

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. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

D. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

E. Install structural members full length without splices unless otherwise specifically detailed.

F. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AWC (WFCM) Wood Frame Construction Manual.

G. Install horizontal spanning members with crown edge up and not less than 1-1/2 inches of bearing at each end.

H. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.

I. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.04 BLOCKING, NAILERS, AND SUPPORTS

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

B. Provide the following specific nonstructural framing and blocking:
   1. Cabinets and shelf supports.
   2. Grab bars.
   3. Towel and bath accessories.

3.05 ROOF-RELATED CARPENTRY

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

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

3.06 INSTALLATION OF ACCESSORIES AND MISCELLANEOUS WOOD

A. Place sill gasket directly on sill flashing. Puncture gasket cleanly and fit tightly to protruding foundation anchor bolts.

3.07 INSTALLATION OF CONSTRUCTION PANELS

A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing or as indicated in Structural drawings.
   1. Nail panels to framing; staples are not permitted.

B. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using fasteners as indicated in Structural drawings..

3.08 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.

3.09 CLEANING

A. Waste Disposal: See Section 01 74 19 - Construction Waste Management and Disposal.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood I-joists for roof framing.

B. Bridging, bracing, and anchorage.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Installation requirements for miscellaneous framing.

B. Section 06 10 00 - Rough Carpentry: Material requirements for blocking, plates, and miscellaneous framing.

1.03 REFERENCE STANDARDS

A. ASTM D5055 - Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists; 2024.

B. PS 2 - Performance Standard for Wood Structural Panels; 2019.

1.04 DESIGN REQUIREMENTS

A. As indicated in Structural drawings.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Delegated Design Data: Provide engineering calculations and details for prefabricated wood I-joists, as required by the authority having jurisdiction.

C. Product Data: Manufacturer's literature describing materials, dimensions, allowable spans and spacings, bearing and anchor details, bridging and bracing requirements, and installation instructions; identify independent inspection agency.

D. Shop Drawings: Indicate sizes and spacing of joists, bracing and bridging, bearing stiffeners, holes to be cut (if any), and framed openings between joists.

E. Certificate: Certification by joist manufacturer that products delivered are of the same design and construction as those evaluated by the independent inspection agency.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in manufacturer's original packaging with manufacturer's name and product identification intact and legible.

B. Protect products from damage due to weather and breakage.

C. Protect joists from warping or other distortion by stacking in upright position, braced to resist movement, with air circulation under coverings and around stacks.

D. Handle individual joists in the upright position.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood I-Joists:
   1. Red-Built Corporation..
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Wood I-Joists: Laminated veneer lumber top and bottom flanges and oriented strand board (OSB) webs bonded together with structural adhesive{\ch\#3}.
   1. Span Rating: Established and monitored in accordance with ASTM D5055 by independent inspection agency.
   2. Oriented Strand Board: Comply with PS 2.
   3. Adhesive: Tested for wet/exterior service in accordance with ASTM D2559.
   4. Depth: As indicated on drawings.

5. Fabrication Tolerances:
    a. Flange Width: Plus/minus 1/32 inch.
    b. Flange Thickness: Minus 1/16 inch.
    c. Joist Depth: Plus 0, minus 1/8 inch.
6. Marking: Mark each piece with depth, joist spacing, and allowable span for joist spacing.
7. Provide bearing stiffeners if required by span rating or joist hanger manufacturer.

B. Wood-Based Components:
1. Wood fabricated from old growth timber is not permitted.

C. Joist Bridging: Type, size and spacing recommended by joist manufacturer.

D. Fasteners: Electrogalvanized steel, type to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that supports and openings are ready to receive joists.

3.02 ERECTION

A. Install joists in accordance with manufacturer's instructions.

B. Set structural members level and plumb, in correct position.

C. Make provisions for erection loads and for sufficient temporary bracing to maintain structure plumb and in true alignment until completion of erection and installation of permanent bracing.

D. Install permanent bridging and bracing.

3.03 TOLERANCES

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glue laminated wood beams.

1.02 REFERENCE STANDARDS

A. ANSI 117 - Standard Specification for Structural Glued Laminated Timber of Softwood Species; 2020.

B. WWPA G-5 - Western Lumber Grading Rules; 2025.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on wood treatment.

C. Shop Drawings: Indicate framing system, sizes and spacing of members, loads and cambers, bearing and anchor details, bridging and bracing, framed openings .

1.04 DELIVERY, STORAGE, AND HANDLING

A. Leave individual wrapping in place until finishing occurs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glued-Laminated Structural Units:
   1. As indicated in structural drawings..
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 GLUED-LAMINATED UNITS

A. Glued-Laminated Units: Fabricate in accordance with ANSI 117 Industrial grade.
   1. Verify dimensions and site conditions prior to fabrication.
   2. Cut and fit members accurately to length to achieve tight joint fit.
   3. Fabricate member with camber built in.
   4. Do not splice or join members in locations other than those indicated without permission.
   5. After end trimming, seal with penetrating sealer in accordance with AITC requirements.

B. Performance Criteria:
   1. Comply with applicable code for loads, seismic zoning, and other load criteria.

2.03 FABRICATION

A. Fabricate glue laminated structural members in accordance with AITC Industrial grade.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that supports are ready to receive units.

3.02 ERECTION

A. Lift members using protective straps to prevent visible damage.

B. Set structural members level and plumb, in correct positions or sloped where indicated.

C. Provide temporary bracing and anchorage to hold members in place until permanently secured.

3.03 TOLERANCES

A. Framing Members: 1/2 inch maximum from true position.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Hardware.

1.02 RELATED REQUIREMENTS

A. Section 06 61 16 - Solid Surfacing Fabrications: Solid-surface countertops and intergral sinks.

B. Section 09 00 00 - Interior Finish Products: Finish product information.

1.03 REFERENCE STANDARDS

A. AWI (QCP) - Quality Certification Program; Current Edition.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

E. WI (CCP) - Certified Compliance Program (CCP); Current Edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.
   1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

C. Product Data: Provide data for hardware accessories.

1.05 QUALITY ASSURANCE

A. Quality Certification:
   1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
   2. Comply with WI (CCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: https://woodworkinstitute.com/#sle.
   3. Provide designated labels on shop drawings as required by certification program.
   4. Provide designated labels on installed products as required by certification program.
   5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
   6. Replace, repair, or rework all work for which certification is refused.

B. Perform work in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Custom quality, unless other quality is indicated for specific items.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.07 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

2.02 WOOD-BASED COMPONENTS

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

B. Provide sustainably harvested wood, certified or labeled; see Section 01 60 00.

C. Provide wood harvested within a 500 mile radius of the project site.

D. Wood fabricated from timber recovered from riverbeds or otherwise abandoned is permitted, unless otherwise noted, provided it is clean and free of contamination; identify source; provide lumber re-graded by an inspection service accredited by the American Lumber Standard Committee, Inc.

2.03 PANEL MATERIALS

A. Hardboard: AHA A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth two sides (S2S); use for drawer bottoms, dust panels, and other components indicated on drawings.

2.04 LAMINATE MATERIALS

A. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
   1. As specified in Section 09 00 00 - Interior Finish Product and as indicated in drawings.

B. Low Pressure Decorative laminate (LPDL): NEMA LD 3, type as recommended for specific applications.
   1. Use at all cabinet interiors.
      a. Color: White.

2.05 COUNTERTOPS

A. Solid-surface Countertops: Section 09 00 00 - Interior Finish Products and as indicated in drawings.

B. Plywood for Supporting Substrate: PS 1 Marine Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.

2.06 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; of width to match component thickness.
   1. Acceptable Manufacturers
      a. Doellken Woodtape (www.doellken-woodtape.com)
      b. Substitutions: See section 01 60 00 - Product Requirements.
   2. Certifications: Certified by GreenGuard.
   3. Color: To match adjacent plastic laminate surface, including wood grain plastic laminate.
   4. Use at all exposed edges, including box, door, drawer and shelf edges.

C. Grommets: Standard plastic grommets for cut-outs, 2-inch diameter, in color black.

2.07 HARDWARE

A. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, satin chrome finish, for nominal 1 inch spacing adjustments.

B. Drawer and Door Pulls: "U" shaped wire pull, steel with satin finish, 4 inch centers.

C. Drawer Slides:
   1. Type: Full extension.
   2. Static Load Capacity: Commercial grade.
   3. Mounting: Side mounted.
   4. Stops: Integral type.
   5. Features: Provide self closing/stay closed type.
   6. Manufacturers:
      a. Accuride International, Inc; Light-Duty Drawer Slides: www.accuride.com/#sle.

b. Knape & Vogt Manufacturing Company; Light-Duty Drawer Slides: www.knapeandvogt.com/#sle.
c. Substitutions: See Section 01 60 00 - Product Requirements.

D. Hinges: European style concealed self-closing type, steel with satin finish.
1. Manufacturers:
a. Grass America Inc; Tiomos Hinge System: www.grassusa.com/#sle.
b. Blum, Inc: www.blum.com/#sle.
c. Substitutions: See Section 01 60 00 - Product Requirements.

E. Wall-mounted Shelf Standards:
1. Wall standard: Knape & Vogt Manufacturing Company; Product 87.
2. Bracket: Knape & Vogt Manufacturing Company; Product 187 (length to match shelf depth indicated on drawings).
3. Front clip (provide one at each bracket): Knape & Vogt Manufacturing Company; Product 212.
4. Substitutions: See Section01 60 00-Product Requirements.

F. Wall-mounted Brackets:
1. Concealed bracket- US Futaba
a. Substitutions: See Section01 60 00-Product Requirements.
2. Color: White
3. Depth 24" unless noted otherwise.
4. Load Rating: 1,800 lbs unless noted otherwise.

2.08 DESIGN STANDARDS

A. Shelf Design Weight: Assume 50-pounds per square foot for design of shelving components, including shelf thickness.

2.09 FABRICATION

A. Cabinet Style: Flush overlay.

B. Cabinet Doors and Drawer Fronts: Flush style.

C. Drawer Construction Technique: As recommended by fabricator.

D. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

E. Edging: Fit shelves, doors, and exposed edges with edging to match main surface. Do not use more than one piece for any single length.

F. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Locate counter butt joints minimum 2 feet from sink cut-outs.
1. Orient wood grain laminate the same as specified for "Matching Wood Grain" below.

G. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:
1. Orient grain vertically unless noted otherwise.
2. Orient grain on soffits, valances and toe kicks to match the orientation of adjacent field panels.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

3.02 INSTALLATION

A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

B. Use concealed joint fasteners to align and secure adjoining cabinet units.

C. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

3.03 ADJUSTING

A. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

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

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cold-applied rubberized asphalt waterproofing.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete substrate.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for membrane.

1.04 QUALITY ASSURANCE

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

1.05 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until cured.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Polyurethane Waterproofing:
   1. Tremco Commercial Sealants & Waterproofing; TREMproof 250GC: www.tremcosealants.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FLUID-APPLIED WATERPROOFING MATERIALS

A. Sprayed Thin-Film Elastomeric Waterproofing: Elastomeric, UV-resistant coating capable of being applied to damp masonry and green concrete without adverse effect on adhesion; complying with requirements of ASTM C 836 except for minimum film thickness.

2.03 ACCESSORIES

A. Surface Conditioner: As recommended by membrane manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of waterproofing system.

C. Verify that items penetrating surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces from damage not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.

C. Do not apply waterproofing to surfaces unacceptable to waterproofing manufacturer.

3.03 INSTALLATION

A. Install waterproofing to specified minimum thickness in accordance with manufacturers instructions and NRCA (WM) applicable requirements.

B. Apply primer or surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.

C. Apply waterproofing in accordance with manufacturer's instructions .

1. Applied Thickness: Nominal thickness of 60 mils; minimum thickness at any point of 50 mils.

D. Apply extra thickness of waterproofing material at corners, intersections, and angles.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at perimeter foundation wall.

B. Batt insulation in exterior construction.

C. Batt insulation for filling perimeter window and door shim spaces and perimeter window and door shim spaces.

1.02 REFERENCE STANDARDS

A. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2022.

B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.

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

E. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024c.

F. U.S. FTC R-value rule: Determining thermal resistance.

G. ASTM C272 - Insulation in contact with the ground has <=0.3% water absorption rate.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.

D. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

E. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of contractor accreditation and installer certification on project site during and after installation. Present on-site documentation upon request.

1.04 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:

1. Installer Qualification: Use accredited contractors, certified installers, evaluated materials, and third-party field quality control audit.
2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

1.05 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.

B. Insulation in Wood Framed Walls: Batt insulation with separate vapor retarder.

2.02 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with either natural skin or cut cell surfaces.
   1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   2. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
   3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   4. Board Thickness: 1 inches.
   5. Board Edges: Square.
   6. R-Value: 5 min.
   7. Type and Water Absorption: Type IV, 0.3 percent by volume, maximum, by total immersion.
   8. Surface Burning Characteristics: Flame spread/Smoke developed index of 75 and 450 respectively, when tested in accordance with ASTM E 84.

2.03 MINERAL FIBER BLANKET INSULATION MATERIALS

A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.

B. Batt Insulation: ASTM C 665; preformed batt; friction fit, conforming to the following:
   1. Surface Burning Characteristics: Flame spread index of 25 or less; smoke developed index of 450 or less, when tested in accordance with ASTM E 84.
   2. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
   3. Formaldehyde Content: Zero.
   4. Thermal Resistance: R-value (RSI-value) of 21 at exterior walls.
   5. Facing: Unfaced.
   6. Products:
      a. CertainTeed Corporation: www.certainteed.com/#sle.
      b. Johns Manville: www.jm.com/#sle.
      c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.
      d. Knauf Insulation GmbH: www.knaufinsulation.us.
      e. Substitutions: See Section01 60 00-Product Requirements.

2.04 ACCESSORIES

A. Sheet Vapor Retarder: CertainTeed Corporation; MemBrain™ Continuous Air Barrier & Smart Vapor Retarder

B. Flashing Tape: Special reinforced film with high performance adhesive.
   1. Application: Window and door opening flashing tape.
   2. Width: As required for application.

C. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide.

D. Insulation Fasteners: Appropriate for purpose intended.

E. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit 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 honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Adhere a 6 inches wide strip of polyethylene sheet over construction, control, and expansion joints with double beads of adhesive each side of joint.

1. Tape seal joints.
2. Extend sheet full height of joint.

B. Apply adhesive to back of boards:
1. Three continuous beads per board length.
2. Full bed 1/8 inch thick.

C. Install boards horizontally on foundation perimeter.
1. Place boards to maximize adhesive contact.
2. Install in running bond pattern.
3. Butt edges and ends tightly to adjacent boards and to protrusions.

D. Extend boards over expansion joints, unbonded to foundation on one side of joint.

E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

F. Immediately following application of board insulation, place protective boards over exposed insulation surfaces.
1. Apply adhesive in five continuous beads per board length.
2. Install boards horizontally from base of foundation to top of insulation.
3. Butt boards tightly, with joints staggered from insulation joints.

3.03 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Install in exterior wall and attic 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. Install with factory-applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.

F. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

G. At wood framing, place vapor retarder on warm side of insulation by stapling at 6 inches on center. Lap and seal sheet retarder joints over face of member.

H. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over face of member

I. Tape seal tears or cuts in vapor retarder.

J. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane; tape seal in place.

K. Tape wall to ceiling joints of vapor retarder.

3.04 PROTECTION

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

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water-Resistive Barrier: Under exterior wall cladding, over sheathing or other substrate.

1.02 RELATED REQUIREMENTS

A. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.

1.03 DEFINITIONS

A. Weather Barriers: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

B. Water-Resistive Barrier: A material behind an exterior wall covering that is intended to resist liquid water that has penetrated behind the exterior covering from further intruding into the exterior wall assembly.

1.04 REFERENCE STANDARDS

A. AATCC Test Method 127 - Test Method for Water Resistance: Hydrostatic Pressure; 2018, with Editorial Revision (2019).

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on material characteristics, performance criteria, and limitations.

C. Shop Drawings: Provide drawings of special joint conditions.

D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

1.06 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

PART 2 PRODUCTS

2.01 ACCESSORIES

A. Sealants, Tapes, and Accessories Used for Sealing Water-Resistive Barrier and Adjacent Substrates: As indicated or complying with water-resistive barrier manufacturer's installation instructions.

B. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.
   1. Width: 4 inches.

C. Thinners and Cleaners: As recommended by water-resistive barrier manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions comply with requirements of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Water-Resistive Barriers: Install continuous water-resistive barrier over surfaces indicated, with sheets lapped to shed water but with seams not sealed.

C. Self-Adhered Sheets:
   1. Prepare substrate in accordance with sheet manufacturer's installation instructions; fill and tape joints in substrate and between dissimilar materials.
   2. Lap sheets shingle-fashion to shed water and seal laps airtight.
   3. Upon placement of sheets, firmly press onto substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
   4. Use same material, or other material approved by sheet manufacturer, to seal sheets to adjacent substrates, and as flashing.
   5. At expansion joints, provide transition to joint assemblies approved by sheet manufacturer.

D. Openings and Penetrations in Exterior Water-Resistive Barriers:
   1. Install flashing over sills, covering entire sill framing member, and extend at least 5 inches onto water-resistive barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
   2. At openings filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
   3. At openings filled with nonflanged frames, seal water-resistive barrier to each side of framing at opening using flashing at least 9 inches wide, and covering entire depth of framing.
   4. At head of openings, install flashing under water-resistive barrier extending at least 2 inches beyond face of jambs; seal water-resistive barrier to flashing.
   5. At interior face of openings, seal gaps between window and door frames and rough framing using appropriate joint sealant over backer rod.
   6. Service and Other Penetrations: Form flashing around penetrating items and seal to surface of water-resistive barrier.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Owner’s Inspection and Testing: Cooperate with Owner’s testing agency.
   1. Allow access to work areas and staging.
   2. Notify Owner’s testing agency in writing of schedule for work of this section to allow sufficient time for testing and inspection.
   3. Do not cover work of this section until testing and inspection is accepted.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes MCM wall panels.

B. DBVR: Drained and back-ventilated rainscreen system; rainscreen system designed to drain and dry cavity entering water through drainage channels, weeps, and air ventilation.

C. MCM: MCM; cladding material formed by joining two thin metal skins to polyethylene or fire-retardant core and bonded under precise temperature, pressure, and tension.

D. Preinstallation Conference: Conduct conference at [Project site] .
   1. Meet with Owner, Architect, Owner's insurer if applicable, MCM panel Fabricator and Installer, MCM sheet manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects MCM panels, including installers of doors, windows, and louvers.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
   4. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect MCM panels.
   5. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
   6. Review temporary protection requirements for MCM panel assembly during and after installation.
   7. Review procedures for repair of panels damaged after installation.
   8. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.03 SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:
   1. Include fabrication and installation layouts of MCM panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
   2. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2 inches per 12 inches (1:10).

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. MCM Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other MCM panel accessories. Submit custom color samples in paint manufacturer's standard size.

D. Qualification Data: For Installer.

E. Product Test Reports: For each product, tests performed by a qualified testing agency.
   1. MCM Manufacturer's Material Test Reports: Certified test reports showing compliance with specific performance or third-party listing documenting compliance to comparable code sections IBC 1407.14 and IBC 1703.5.

2. MCM System Fabricator's Certified System Tests Reports: Certified system test reports showing system compliance with specific performance or third-party listing documenting compliance code section. Base performance requirements on MCM system type provided.
   a. Wet System: Tested to AAMA 501.
   b. DBVR System: Tested to AAMA 509.
   c. PER System: Tested to AAMA 508.

F. Field quality-control reports.

G. Sample Warranties: For special warranties.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For MCM panels to include in maintenance manuals.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by MCM Fabricator.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, MCM panels, and other manufactured items so as not to be damaged or deformed. Package MCM panels for protection during transportation and handling.

B. Unload, store, and erect MCM panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack MCM panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store MCM panels to ensure dryness, with positive slope for drainage of water. Do not store MCM panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on MCM panels during installation.

1.07 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of MCM panels to be performed in accordance with manufacturers' written instructions and warranty requirements.

1.08 COORDINATION

A. Coordinate MCM panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.09 WARRANTY

A. Warranty on Panel Material: Manufacturer's standard form in which manufacturer agrees to replace MCM that fails within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace MCM panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide MCM panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E330:
   1. Wind Loads: As indicated on Drawings.
   2. Other Design Loads: As indicated on Drawings .
   3. For wind loads, no greater than [1/60] of the span
   4. Framing Member Deflection Limits: For wind loads, no greater than 1/240 or of the span.
   5. .

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested in accordance with ASTM E283 at the following test-pressure difference:
   1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

C. Water Penetration under Static Pressure: No water penetration to room side of assembly when tested for 15 minutes in accordance with ASTM E331 at the following test-pressure difference:
   1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

D. Thermal Movements: Locate expansion and contraction points to allow for free and noiseless thermal movements from surface temperature changes.
   1. Temperature Change (Range): minus 20 deg F to 180 deg F (minus 29 to 82.2 deg C), material surfaces.

E. Fire Propagation Characteristics: MCM wall assembly passes NFPA 285 testing.

2.02 MCM WALL PANELS

A. MCM Wall Panel Systems: Provide factory-formed and -assembled, MCM wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment assembly components[, panel stiffeners], and accessories required for weathertight system.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide ALUCOBOND®; 3A Composites USA Inc.; ALUCOBOND® PLUS or comparable product by:
      a. .

B. Aluminum-Faced Composite Wall Panels: Formed with 0.020-inch- (0.50-mm-) thick, [coil-coated] [anodized] aluminum sheet facings.
   1. Panel Thickness: [0.157 inch (4 mm)].
   2. Core: [Fire retardant].
   3. Exterior Finish: [PVDF fluoropolymer] [FEVE fluoropolymer] [Siliconized polyester] [Clear anodized] [Color anodized].
      a. Color: [As indicated by manufacturer's designations] [As selected by Architect from manufacturer's full range] [As indicated on drawing schedule].
   4. Peel Strength: 22.5 in-lb/in. (100 N x mm/mm) when tested for bond integrity in accordance with ASTM D1781.
   5. Fire Performance: Flame spread less than 25 and smoke developed less than 450, in accordance with ASTM E84.

C. Attachment Assembly Components: Formed from [extruded aluminum] [material compatible with panel facing].

2.03 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet ASTM A653/A653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide Fabricator's standard sections as required for support and alignment of MCM panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of MCM panels unless otherwise indicated.

C. Flashing and Trim: Provide flashing and trim formed from same material as MCM panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent MCM panels.

1. Basis-of-Design Product: Subject to compliance with requirements, provide ALUCOBOND®; 3A Composites USA Inc.; ALUCOBOND® Axcent™ Trim or comparable product by one of the following:
   a. Arconic Architectural Products (USA).
   b. Mitsubishi Chemical Composites.
2. Aluminum Trim: Formed with 0.040-inch (1.00-mm-) thick, coil-coated aluminum sheet facings.
3. Color: [As indicated by manufacturer's designations] [As selected by Architect from manufacturer's full range] [As indicated on drawing schedule].

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of MCM panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in MCM panels and remain weathertight; and as recommended in writing by MCM panel manufacturer.

2.04 FABRICATION

A. General: Fabricate and finish MCM panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Fabricate MCM panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations or recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
   3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
   5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
      a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.05 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Panels and Accessories:
   1. PVDF Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   2. FEVE Fluoropolymer: AAMA 2605. One-coat [clear] [tinted] fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   3. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
   4. Exposed Anodized Finish:
      a. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, MCM panel supports, and other conditions affecting performance of the Work.
   1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by MCM wall panel manufacturer.
   2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by MCM wall panel manufacturer.
      a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and assemblies penetrating MCM panels to verify actual locations of penetrations relative to seam locations of MCM panels before installation.

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

3.02 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C754 and MCM panel manufacturer's written recommendations.

3.03 MCM PANEL INSTALLATION

A. General: Install MCM panels in accordance with Fabricator's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor MCM panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Shim or otherwise plumb substrates receiving MCM panels.
   2. Flash and seal MCM panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by MCM panels are installed.
   3. Install screw fasteners in predrilled holes.
   4. Locate and space fastenings in uniform vertical and horizontal alignment.
   5. Install flashing and trim as MCM panel work proceeds.
   6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
   7. Align bottoms of MCM panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
   8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:
   1. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by MCM panel manufacturer.

D. Attachment Assembly, General: Install attachment assembly required to support MCM wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
   1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

E. Panel Installation: Attach MCM wall panels to supports at locations, spacings, and with fasteners recommended by Fabricator to achieve performance requirements specified.
   1. Wet Seal Systems: Seal horizontal and vertical joints between adjacent MCM wall panels with sealant backing and sealant. Install sealant backing and sealant in accordance with requirements specified in Section 07 92 00 "Joint Sealants."
      a. Clip Installation: Attach panel clips to supports at locations, spacings, and with fasteners recommended in writing by Fabricator. Attach routed-and-returned flanges of wall panels to panel clips with Fabricator's standard fasteners.
      b. Panel Installation:
         1) Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant in accordance with requirements specified in Section 079200 "Joint Sealants."
         2) Seal horizontal and vertical joints between adjacent MCM wall panels with Fabricator's standard gaskets.
         3) Joint Sealing: Seal all joints in accordance with AAMA 501.
   2. PER Installation: Install using Fabricator's standard assembly with vertical channel that provides support and secondary drainage assembly, draining at base of wall. Notch vertical channel to receive support pins. Install vertical channels supported by channel brackets or adjuster angles and at locations, spacings, and with fasteners recommended by manufacturer. Attach MCM wall panels by inserting horizontal support pins into notches in vertical channels and into flanges of panels. Leave horizontal and vertical joints with open reveal.
      a. Track-Support Installation: Install support assembly at locations, spacings, and with fasteners recommended by Fabricator. Use Fabricator's standard horizontal tracks and vertical [tracks] [drain channels] that provide support and secondary drainage assembly, draining to the exterior at horizontal joints through drain tube. Attach MCM wall panels to tracks by interlocking panel edges with Fabricator's standard "T" clips.
      b. Panel Installation:
         1) Attach routed-and-returned flanges of wall panels to perimeter extrusions with Fabricator's standard fasteners.
         2) Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.
      c. Joint Sealing: Seal all joints in accordance with AAMA 508. Do not apply sealants to joints unless indicated.
   3. DBVR System: Install using Fabricator's standard assembly with vertical channel that provides support and secondary drainage assembly, draining at base of wall. Notch vertical channel to receive support pins. Install vertical channels supported by channel brackets or adjuster angles and at locations, spacings, and with fasteners recommended by Fabricator. Attach MCM wall panels by inserting horizontal support pins into notches in vertical channels and into flanges of panels. Leave horizontal and vertical joints with open reveal.
      a. Track-Support Installation: Install support assembly at locations, spacings, and with fasteners recommended by manufacturer. Use Fabricator's standard horizontal tracks and vertical [tracks] [drain channels] that provide support and secondary drainage

assembly, draining to the exterior at horizontal joints through drain tube. Attach MCM wall panels to tracks by interlocking panel edges with Fabricator's standard "T" clips.

b. Panel Installation:
   1) Attach routed-and-returned flanges of wall panels to perimeter extrusions with manufacturer's standard fasteners.
   2) Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.

c. Joint Sealing: Seal all joints in accordance with AAMA 509. Do not apply sealants to joints unless otherwise indicated.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete MCM panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by MCM panel Fabricator; or, if not indicated, provide types recommended in writing by MCM system Fabricator.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, or SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
   1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.04 ERECTION TOLERANCES

A. Site Verifications of Conditions:
   1. Verify conditions of substrate previously installed under other Sections are acceptable for the MCM system installation. Provide documentation indicating detrimental conditions to the MCM system performance.
   2. Once conditions are verified, MCM system installation tolerances are as follows:
      a. Shim and align MCM wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.05 FIELD QUALITY CONTROL

A. Water-Spray Test: After installation, test area of assembly [shown on Drawings] [as directed by Architect] for water penetration in accordance with AAMA 501.2.

B. Fabricator's Field Service: Engage a factory-authorized service representative to test and inspect completed MCM wall panel installation, including accessories.

C. MCM wall panels will be considered defective if they do not pass test and inspections.

D. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

E. Prepare test and inspection reports.

3.06 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as MCM panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of MCM panel installation, clean finished surfaces as recommended by MCM panel manufacturer. Maintain in a clean condition during construction.

B. After MCM panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace MCM panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum siding.

1.02 RELATED REQUIREMENTS

A. Section 07 25 00 - Weather Barriers: Water-resistive barrier.

B. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashings and trim associated with metal siding.

C. Section 07 92 00 - Joint Sealants: Sealing joints between siding, adjacent construction, and fixtures.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

D. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2022.

E. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films; 2007 (Reapproved 2015).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets for each product, including:
   1. Preparation instructions and recommendations.
   2. Siding materials, underlayment, flashings, fasteners and accessories.
   3. Dimensions, physical properties, and typical details.
   4. Storage and handling requirements and recommendations.
   5. Installation instructions and recommendations.

C. Shop Drawings: Indicate layout, methods of attachment and support clips, provisions for movement, flashing, trim, edge and field conditions, interface with adjacent materials, locations of cutouts or special shapes, existing construction, and details.

D. Samples: For each finish product specified, provide two complete sets of color chips representing manufacturer's full range of available colors and patterns, including the following:

1.05 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Deliver and store products in manufacturer's unopened packaging bearing brand name and manufacturer's identification until ready for installation.

C. Store products elevated above ground, within manufacturer's temperature and environmental limits, away from moisture, and protected from traffic and construction activities. Minimize on-site storage before installation.

1.06 FIELD CONDITIONS

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

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer's Warranty: Provide manufacturer's standard lifetime, non-prorated, transferable warranty, including 50 year hail protection warranty.

C. Manufacturer's warranty on siding and trim accessories finishes to cover the following:
   1. Color fading of five Hunter color-difference units, maximum, when tested in accordance with ASTM D2244.
   2. Chalk rating of eight, maximum, when tested in accordance with ASTM D4214.
   3. Cracking, checking, peeling, or failure of paint to adhere to metal substrate.

D. Extended Correction Period: Correct defective work within 5 year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Aluminum Siding and Soffit Manufacturers:
   1. Parallel Architectural Products: www.parallelrep.com.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ALUMINUM SIDING AND SOFFITS

A. Description: Extruded aluminum profiles with powder coating on exposed surfaces.

B. Aluminum extrusions: ASTM B221, alloy and temper best suited to application.

C. Powder coating: TGIC-free polyester meeting performance requirements of AAMA 2604.

D. Nominal Width:
   1. CB-8 – 8 inch nominal width.

E. Trim Profiles:
   1. Outside corner: C-CF – 2 x 2 inches.
   2. Inside corner: C-CM – 2 x 2 inches.
   3. Casing: C-EC – 1-1/8 inch width.

F. Color: To be selected by Architect from manufacturer's full range of Woodgrain Standard and Non-Standard colors.

2.03 MATERIALS

A. Precoated Aluminum Sheet: ASTM B209/B209M, 3105 alloy, O temper, with smooth surface texture; continuous-coil-coated on exposed surfaces with indicated finish coating and manufacturer's standard panel back coating.

2.04 ACCESSORIES

A. Clips and Other Attachments: Extruded aluminum, size and profile to suit project conditions.

B. Fasteners:
   1. Aluminum; nonstaining, prefinished to match siding.
   2. AISI 1016, zinc-plated steel.
   3. Fluoropolymer coated steel.
   4. Manufacturers’ recommended fastener.

C. Sealant: Comply with ASTM C920; see Section 07 92 00.

D. Flashing: Siding manufacturer's standard, factory-finished flashing accessories.

E. Provide the following accessories as required for complete installation:
   1. Starter strip.
   2. Corner post.
   3. J-Channels.
   4. Window and door trim.
   5. Drip cap.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install aluminum siding, trim, and accessories in accordance with manufacturer's written instructions.

B. Attach siding using manufacturers recommended fasteners, sealants, and adhesives, allowing for thermal expansion.

3.02 CLEANING

A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.

B. Remove grease and oil films, excess joint sealer, handling marks, and other installation debris from aluminum siding, leaving siding clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to material finishes.

3.03 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

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Adhered system with thermoplastic roofing membrane.

B. Insulation, flat and tapered.

C. Vapor retarder.

D. Cover boards.

E. Flashings.

F. Roofing cant strips, stack boots, roofing expansion joints, and walkway pads.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood cant strips and deck sheathing.

1.03 REFERENCE STANDARDS

A. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board; 2022.

B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

C. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2025.

D. ASTM D4434/D4434M - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing; 2021.

E. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin-Based Sheet Roofing; 2021.

F. FM (AG) - FM Approval Guide; Current Edition.

G. FM DS 1-28 - Wind Design; 2015, with Editorial Revision (2022).

H. NRCA (RM) - The NRCA Roofing Manual; 2023.

I. NRCA (WM) - The NRCA Waterproofing Manual; 2021.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.

C. Shop Drawings: Submit drawings that indicate joint or termination detail conditions, conditions of interface with other materials, and paver layout.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

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

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact, unless otherwise indicated.

B. Store materials in weather protected environment, clear of ground and moisture.

C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

D. 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 140 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 01 78 00 - 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Thermoplastic Polyolefin (TPO) Membrane Roofing Materials:
   1. Carlisle SynTec: www.carlisle-syntec.com.
   2. GAF Materials Corporation; EverGuard TPO: www.gaf.com.
   3. GenFlex Roofing Systems, LLC: www.genflex.com/#sle.
   4. Versico Roofing Systems: www.versico.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation:
   1. BASF Corporation; BASF Neopor GPS: www.neopor.basf.us/#sle.
   2. Carlisle SynTec Systems; SecurShield Insulation: www.carlisle-syntec.com/#sle.
   3. DuPont de Nemours, Inc: building.dupont.com/#sle.
   4. GAF: www.gaf.com/#sle.
   5. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
   6. Versico Roofing Systems: www.versico.com/#sle.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ROOFING

A. Thermoplastic Membrane Roofing: One ply membrane, fully adhered, over insulation.

B. Roofing Assembly Requirements:
   1. Insulation Thermal Resistance (R-Value): 5.5 per inch, minimum; provide insulation of thickness required.
      a. Total Minimum R-Value: R-32

C. Acceptable Insulation Types - Constant Thickness Application: Any type that meets requirements and is approved by membrane manufacturer for application.

D. Acceptable Insulation Types - Tapered Application: Any of types specified.
   1. Tapered polyisocyanurate or extruded polystyrene board.
   2. Uniform thickness polyisocyanurate or extruded polystyrene board covered with tapered polyisocyanurate or extruded polystyrene board.

2.03 MEMBRANE ROOFING AND ASSOCIATED MATERIALS

A. Membrane Roofing Materials:
   1. TPO: Thermoplastic polyolefin (TPO) complying with ASTM D6878/D6878M, sheet contains reinforcing fabrics or scrims.
      a. Thickness: 60 mil, 0.060 inch, minimum.
   2. Sheet Width:

B. Seaming Materials: As recommended by membrane manufacturer.

C. Vapor Retarder: Reinforced Kraft paper laminate complying with requirements of fire rating classification; compatible with roofing and insulation materials.

D. Flexible Flashing Material: Same material as membrane.

2.04 COVER BOARDS

A. Cover Board: Cement board complying with ASTM C1325.
   1. Board Size: 48 by 96 inches.
   2. Board Thickness: 7/16 inch.
   3. Thermal Resistance: R-value of 1.6, nominal, at 7/16 inch thick.
   4. Products:
      a. PermaBASE Building Products, LLC provided by National Gypsum Company; DEXcell Cement Roof Board: www.permabase.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 INSULATION

A. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578, with natural skin surface and drainage channels on one face.
   1. Board Size: 48 by 96 inches.
   2. Tapered Board: Slope as indicated; minimum thickness 1 inch; fabricate of fewest layers possible.
   3. Products:
      a. DuPont de Nemours, Inc: building.dupont.com/#sle.
      b. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 ACCESSORIES

A. Cant Strips: Wood, pressure preservative treated; see Section 06 10 00.

B. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches wide; self adhering.

C. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.

D. Membrane Adhesive: As recommended by membrane manufacturer.

E. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.

F. Insulation Adhesive: As recommended by insulation manufacturer.

G. Sealants: As recommended by membrane manufacturer.

H. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
   1. Composition: Asphaltic with mineral granule surface.
   2. Surface Color: White or Yellow.
   3. Products:
      a. W.R. Meadows, Inc; Whitewalk: www.wrmeadows.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

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 PREPARATION - WOOD DECK

A. Verify flatness and tightness of joints in wood decking; fill knot holes with latex filler.

B. Confirm dry deck by moisture meter with 12 percent moisture maximum.

3.03 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.

3.04 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. Ensure vapor retarder is clean and dry, continuous, and ready for application of insulation.

C. Attachment of Insulation:
   1. Mechanically fasten insulation to deck in accordance with roofing manufacturer's instructions and FM DS 1-28 Factory Mutual requirements.

D. Cover Boards: Mechanically fasten cover boards in accordance with roofing manufacturer's instructions and FM (AG) Factory Mutual requirements.

E. Lay subsequent layers of insulation with joints staggered minimum 6 inches from joints of preceding layer.

F. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.

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.

3.05 INSTALLATION - MEMBRANE

A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

B. Shingle joints on sloped substrate in direction of drainage.

C. Fully Adhered Application: Apply adhesive to substrate at rate of 40-60 square feet per gallon. 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.

D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

E. 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.

F. Around roof penetrations, seal flanges and flashings with flexible flashing.

G. Coordinate installation of roof drains and sumps and related flashings.

3.06 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Owner will provide testing services, and Contractor to provide temporary construction and materials for testing in accordance with requirements.

C. Provide daily on-site attendance of roofing and insulation manufacturer's representative during installation of this work.

3.07 CLEANING

A. See Section 01 70 00 - 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.

3.08 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

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, and exterior penetrations.

B. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. 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 B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

F. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).

G. CDA A4050 - Copper in Architecture - Handbook; current edition.

H. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

A. See Section 01 30 00 - 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, 4 by 4 inches in size, illustrating metal finish color.

1.05 QUALITY ASSURANCE

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

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-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 Architect from manufacturer's standard colors.

C. Anodized Aluminum: ASTM B209/B209M, 3005 alloy, H12 or H14 temper; 20 gauge, 0.032 inch thick; clear anodized finish.

D. Pre-Finished Aluminum: ASTM B209/B209M, 3005 alloy, H12 or H14 temper; 18 gauge, 0.040 inch thick; plain finish shop pre-coated with silicone modified polyester coating.
   1. Color: As selected by Architect from manufacturer's standard colors.

E. Stainless Steel: ASTM A666/A666M, Type 304 alloy, soft temper, 28 gauge, 0.0156 inch thick; smooth No. 4 - Brushed finish.

2.02 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 flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

2.03 EXTERIOR PENETRATION FLASHING PANELS

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.

2.04 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

B. Primer Type: Zinc chromate.

C. Concealed Sealants: Non-curing butyl sealant.

D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

E. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

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. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..

B. Apply plastic cement compound between metal flashings and felt flashings.

C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

END OF SECTION

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 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 01 70 00 - Execution and Closeout Requirements: Cutting and patching.

C. Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2026.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2024.

D. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2020.

E. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2013 (Reapproved 2017).

F. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

G. ITS (DIR) - Directory of Listed Products; Current Edition.

H. FM (AG) - FM Approval Guide; Current Edition.

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

J. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

K. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

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

1.04 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.

1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.

1.05 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.

C. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.

D. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

2.02 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.

B. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.

C. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.

D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

2.03 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.

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

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by Owner's Independent Testing Agency.

C. Do not cover installed firestopping until inspected by authorities having jurisdiction.

D. Install labeling required by code.

3.04 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.

B. Section 09 21 16 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

1.03 REFERENCE STANDARDS

A. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.

PART 2 PRODUCTS

2.01 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Do not seal the following types of joints:
      a. Joints indicated to be treated with manufactured expansion joint cover, or some other type of sealing device.
      b. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
      c. Joints where installation of sealant is specified in another section.
      d. Joints between suspended panel ceilings/grid and walls.

B. Interior Wet Areas: restrooms and food service areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

C. Sound-Rated Assemblies: Walls and ceilings identified as STC-rated, sound-rated, or acoustical.

2.02 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products with acceptable levels of volatile organic compound (VOC) content; see Section 01 61 16.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

A. 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 bond breaker backing tape where backer rod cannot be used.

D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

E. 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.

F. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Fire-rated hollow metal doors and frames.

D. Thermally insulated hollow metal doors with frames.

E. Hollow metal borrowed lites glazing frames.

1.02 RELATED REQUIREMENTS

A. Section 08 14 16 - Flush Wood Doors

B. Section 08 71 00 - Door Hardware.

C. Section 09 91 23 - 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; 2022.

C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2020.

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2017.

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2025.

H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.

I. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

J. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2017.

K. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.

L. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2023.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.02 HOLLOW METAL DOORS

A. Exterior Doors: Thermally insulated.
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 1 - Standard-duty.
      b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 1 - Full Flush.
      d. Door Face Metal Thickness: 20 gauge, 0.032 inch, minimum.
   2. Door Thickness: 1-3/4 inches, nominal.
   3. Door Face Sheets: Flush.
   4. Weatherstripping: Refer to Section 08 71 00.
   5. Door Finish: Factory primed and field finished.

2.03 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Exterior Door Frames: Full profile/continuously welded type.
   1. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.
   2. Frame Finish: Factory primed and field finished.
   3. Weatherstripping: Separate, see Section 08 71 00.

C. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
   1. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.
   2. Frame Finish: Factory primed and field finished.

D. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

E. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

F. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

2.04 FINISHES

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

2.05 ACCESSORIES

A. Glazing: As specified in Section 08 80 00, factory installed.

B. 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.

C. 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 doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Coordinate frame anchor placement with wall construction.

C. Install door hardware as specified in Section 08 71 00.

1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.

D. Coordinate installation of electrical connections to electrical hardware items.

E. Touch up damaged factory finishes.

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 edge, corner to corner.

3.04 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Adjust sound control doors so that seals are fully engaged when door is closed.

3.05 SCHEDULE

A. Refer to Door Schedule on the drawings.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; fire-rated, non-rated, acoustical, and special function.

1.02 RELATED REQUIREMENTS

A. Section 08 11 13 - Hollow Metal Doors and Frames.

B. Section 08 71 00 - Door Hardware.

C. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

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

B. ASTM E413 - Classification for Rating Sound Insulation; 2022.

C. ASTM E1408 - Standard Test Method for Laboratory Measurement of the Sound Transmission Loss of Door Panels and Door Systems; 1991 (Reapproved 2000).

D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

E. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

F. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.

G. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

H. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

I. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

J. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

K. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

L. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

M. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

N. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2021, with Errata (2022).

1.04 SUBMITTALS

A. See Section 01 30 00 - 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. Test Reports: Show compliance with specified requirements for the following:
   1. Sound-retardant doors and frames; sealed panel tests are not acceptable.

E. Warranty, executed in Owner's name.

1.05 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, and inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.06 PROJECT CONDITIONS

A. Coordinate the work with door opening construction, door frame and door hardware installation.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
   1. Graham Wood Doors: www.grahamdoors.com.
   2. Eggers Industries: www.eggersindustries.com/#sle.
   3. Marshfield DoorSystems, Inc: www.marshfielddoors.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. High Pressure Decorative Laminate (HPDL) Faced Doors:
   1. Ampco Products, Inc: www.ampco.com/#sle.
   2. VT Industries, Inc: www.vtindustries.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DOORS AND PANELS

A. Doors: See drawings for locations and additional requirements.
   1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
   2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
   3. High Pressure Decorative Laminate (HPDL) Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at each location.
   2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
   3. Smoke and Draft Control Doors (Indicated as "S" on Drawings): In addition to required fire rating, provide door assemblies tested in accordance with UL 1784 with maximum air leakage of 3.0 cfm per sq ft of door opening at 0.10 inch wg pressure at both ambient and elevated temperatures for "S" label; if necessary, provide additional gasketing or edge sealing.
   4. Smoke and Draft Control Doors (Indicated as "S" on Drawings): In addition to required fire rating, provide flush wood door assemblies in compliance with WDMA I.S. 1A requirements for "S" label; no additional gasketing or edge sealing allowed.
   5. Sound-Rated Doors: Minimum STC as indicated on drawings, calculated in accordance with ASTM E413, tested in accordance with ASTM E90.
   6. Lead Lined (X-ray) Doors: Minimum of 1/16 inch thick lead, unless otherwise indicated.
   7. Wood veneer facing for field transparent finish as indicated on drawings.
   8. High pressure decorative laminate (HPDL) finish as indicated on drawings.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

C. Sound-Rated Doors: Equivalent to type, with particleboard core (PC) construction as required to achieve STC rating specified; plies and faces as indicated above.

D. Lead Lined Doors: Equivalent to type, with bonded particleboard core (PC) with continuous lead sheet from edge to edge in center of core or between crossband and core; lead thickness; plies and faces as indicated above.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: Red oak, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:

C. Fit door edge trim to edge of stiles after applying veneer facing.

D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

F. Provide edge clearances in accordance with the quality standard specified.

2.06 FINISHES - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 1, Lacquer, Nitrocellulose.
      b. Sheen: Flat.

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. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

E. Coordinate installation of glazing.

F. Install door louvers plumb and level.

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 SCHEDULE

A. See Door and Frame Schedule appended to this section.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall- and ceiling-mounted access units.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

A. Wall-Mounted Units with Return Air Grille:
   1. Panel Material: Aluminum extrusions with gypsum board inlay.
   2. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
   3. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.

B. Wall-Mounted Units in Wet Areas:
   1. Panel Material: Steel, hot-dipped zinc, or zinc-aluminum-alloy coated.
   2. Size: 12 by 12 inches.
   3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
   4. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.

C. Ceiling-Mounted Units:
   1. Size - Lay-In Grid Ceilings: To match module of ceiling grid.
   2. Size - Other Ceilings: 12 by 12 inches.
   3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

2.02 WALL- AND CEILING-MOUNTED ACCESS UNITS

A. Manufacturers:
   1. ACUDOR Products Inc: www.acudor.com/#sle.
      a. Ceiling-Mounted Units: ACUDOR GFRG - R.
      b. Wall- and Ceiling-Mounted Units: ACUDOR DW-5058.
   2. Babcock-Davis: www.babcockdavis.com/#sle.
   3. Karp Associates, Inc: www.karpinc.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Wall and Ceiling Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
   1. Door Style: Single thickness with rolled or turned in edges.
   2. Primed and Factory Finish: Polyester powder coat; color as selected by Architect from manufacturer's standard colors.
   3. Hardware:
      a. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Aluminum doors and frames.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

B. Section 08 42 29 - Automatic Entrances.

C. Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.

D. Section 08 80 00 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.s.2/A440 for Air leakage of sliding or swinging door assemblies part of the building envelope.

B. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.

C. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

D. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

G. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

H. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

I. NFRC 100 - Procedure for Determining U-Values for Fenestration Products (Current edition).

J. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence (Currrent Edition).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

D. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

E. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

F. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

1.06 QUALITY ASSURANCE

A. 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. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

C. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

A. Front Set Style, Thermally-Broken:
   1. Basis of Design: Kawneer; TRIFAB VG 451/451T.
   2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.

B. Substitutions: See Section 01 60 00 - Product Requirements.
   1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.02 BASIS OF DESIGN -- SWINGING DOORS

A. Narrow Stile, Insulating Glazing, Thermally-Broken:

B. Substitutions: See Section 01 60 00 - Product Requirements.
   1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.03 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Finish: Class II natural anodized.
      a. Factory finish all surfaces that will be exposed in completed assemblies.
   2. Finish Color: #28, Black.
   3. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   6. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
   7. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
   8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

B. Performance Requirements
   1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
      a. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
   2. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.
   3. Door sizes shown are nominal; provide standard clearances to meet maximum air leakage rate of 0.3 cubic foot/minute per square foot of fenestration area. Maximum air leakage rate is 1.00 cfm/SF of door area.

2.04 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
   1. Framing members for interior applications need not be thermally broken.
   2. Glazing Stops: Flush.

B. Glazing: See Section 08 80 00.

2.05 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Fasteners: Stainless steel.

C. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

D. Glazing Accessories: See Section 08 80 00.

2.06 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.04 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior Architectural Performance Class (AW) behavioral care windows furnished and installed as shown on drawings, specified in this section and designated in AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS).

B. Integral Venetian Blinds

C. Factory glazing.

1.02 RELATED REQUIREMENTS

A. Section 07 25 00 - Weather Barriers: Sealing frame to weather barrier installed on adjacent construction.

B. Section 07 92 00 - Joint Sealants: Sealing joints between window frames and adjacent construction.

C. Section 08 80 00 - Glazing.

D. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights; 2022.

E. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.

F. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.

G. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

H. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, information on glass and glazing, internal drainage details, and descriptions of hardware and accessories.

C. Shop Drawings: Indicate opening dimensions, elevations of different types, framed opening tolerances, method for achieving air and vapor barrier seal to adjacent construction, anchorage locations, and installation requirements.

D. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
   1. Evidence of AAMA Certification.
   2. Evidence of WDMA Certification.
   3. Evidence of CSA Certification.
   4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.

E. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of AAMA CW-10.

B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Aluminum Windows Manufacturers:
   1. Wausau Window and Wall Systems; 4000i-DT: www.wausauwindow.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 BASIS OF DESIGN - AW PERFORMANCE CLASS WINDOWS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 having Performance Class of AW, and Performance Grade of 40.

B. Fixed, Thermally-Broken:
   1. Basis of Design: Wausau 4000i-DT.

2.03 ALUMINUM WINDOWS

A. Aluminum Windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, related flashings, and anchorage and attachment devices.
   1. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for operating hardware and imposed loads.
   2. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
   3. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
   4. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

B. Fixed, Non-Operable Type:
   1. Construction: Thermally broken.
   2. Glazing (doulbe sash)
      a. Exterior sash: Double pane, transparent, insulated glazing units
      b. Interior sash: 1/2" polycarbonate panel as specified in 08 8000 Glazing
   3. Exterior Finish: Class I natural anodized.
   4. Interior Finish: Class I natural anodized.

2.04 PERFORMANCE REQUIREMENTS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
   1. Performance Class (PC): AW.
   2. Performance Grade (PG): 40, with minimum design pressure (DP) of 40.10 psf.

B. Member Deflection: Limit member deflection to 1/175 in any direction, with full recovery of glazing materials.

C. Water Leakage: No uncontrolled leakage on interior face when tested in accordance with ASTM E331 at differential pressure of 12.11 psf.

D. Air Leakage: Maximum of 0.1 cu ft/min sq ft per unit area of outside frame dimension, with 6.27 psf differential pressure when tested in accordance with ASTM E283/E283M.

2.05 COMPONENTS

A. Frames: 3.5 inch wide by 4 inch deep profile, of 0.125 inch thick section; thermally broken with interior portion of frame insulated from exterior portion; flush glass stops of snap-on type.

B. Glazing: As specified in Section 08 80 00.

C. Glazing method shall be in general accordance with the GANA Glazing Manual for specified glass type, or as approved by the glass fabricator.

D. Glazing stops retaining security glazing shall be secured at 12” on center using ¼”-20 plated or stainless steel thread-rolling fasteners.

E. Glazing materials at the interior must be rendered tamper-resistant by a continuous extruded hood projection or other tested and approved method.

F. Provide minimum glazing “bite” as recommended by the security glazing infill fabricator and tested per 1.03

G. Provide windows factory-glazed

H. Integral Venetian Blinds
   1. 5/8" wide aluminum slat blinds - Color (selected from mfr. standard color range)
   2. Blind to be integrally mounted between the dual or triple glazing.
   3. Behavioral care tilt-control knob will be located on the interior face and incorporate a "slip clutch" feature.
   4. Raise and lower pull cords will be located between glass for access only when glazed access panel is opened.

I. Glazing Materials: As specified in Section 08 80 00.

J. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

2.06 GLAZING MATERIALS

A. Setting Blocks/Edge Blocking: Provide in sizes and locations recommended by GANA Glazing Manual. Setting blocks used in conjunction with soft-coat low-e glass shall be silicone.

B. Back-bedding tapes, expanded cellular glazing tapes, toe beads, heel beads and cap beads shall meet the requirements of applicable specifications cited in AAMA 800.

C. Glazing gaskets shall be non-shrinking, weather-resistant, and compatible with all materials in contact

D. Spacer tape in continuous contact with structural silicone shall be tested for compatibility and approved by the sealant manufacturer for the intended application.

E. Structural silicone sealant where used shall meet the requirements of ASTM C1184

F. Gaskets in continuous contact with structural silicone shall be extruded silicone or compatible material.

2.07 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall openings and adjoining air and vapor seal materials are ready to receive aluminum windows.

3.02 INSTALLATION

A. Install windows in accordance with manufacturer's instructions.

B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

D. Install sill and sill end angles.

E. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

F. Install glass and infill panels in accordance with requirements specified in Section 08 80 00.

3.03 CLEANING

A. Remove protective material from factory finished aluminum surfaces.

B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tubular skylights, consisting of skylight dome, reflective tube, and diffuser assembly.

1.02 RELATED REQUIREMENTS

A. Section 07 54 00 - Thermoplastic Membrane Roofing: Flashing-in of skylight base.

1.03 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

B. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

C. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2020a.

D. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

1.05 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.

1.06 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.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Skylights: Manufacturer's standard warranty for 10 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 TUBULAR SKYLIGHTS

A. Tubular Skylights: Transparent roof-mounted skylight dome and curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces.
   1. Fabrication and assembly of components is by single manufacturer.
   2. Non-Metal Parts: Flammability less than the following.
      a. Roof-Top Components: Class B when tested in accordance with ASTM E108 or UL 790.
      b. Combustibility - Light Transmitting Parts: Minimum 2.5 inches/min (ICC Class CC-2), when tested in accordance with ASTM D635.

B. Roof Assemblies: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.
   1. Glazing: Acrylic plastic, 1/8 inch minimum thickness.
   2. Dome Ring: Attached to top of base section; 0.090 inch nominal thickness injection molded high impact ABS; to prevent thermal bridging between base flashing and tubing

and channel condensed moisture out of tubing; weather seal of medium density pile weather stripping.

C. Reflective Tube: ASTM B209/B209M aluminum sheet, thickness between 0.015 inch and 0.020 inch.

D. Diffuser Assemblies: Supporting light transmitting surface at bottom termination of tube, with compression seal to minimize condensation and bug or dirt infiltration.
   1. Ceiling Ring: Edge trim for ceiling opening; injection molded high impact ABS.
   2. Diffuser Trim: Edge and attachment trim for diffuser lens; injection molded high impact ABS.
   3. Lens: Flush frosted lens.
   4. Lens Material: Acrylic plastic.
   5. Visible Light Transmission (VLT): 90 percent, minimum.
   6. Seal: Closed cell EPDM foam rubber.

2.03 ACCESSORIES

A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.

B. Sealant: Elastomeric, silicone or polyurethane; compatible with materials being sealed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Set roof assembly flashing in continuous bead of sealant.

C. Seal joints exposed to weather in accordance with sealant manufacturer's written instructions.

D. Conduct field test for water tightness; conduct water test in presence of Architect. Correct defective work and re-test until satisfactory.

3.04 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

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum skylight framing system.

B. Skylight glazing.

C. Fasteners, anchors, reinforcement, and flashings.

1.02 RELATED REQUIREMENTS

A. Section 05 12 00 - Structural Steel Framing: Structural support framing for system.

B. Section 06 10 00 - Rough Carpentry: Wood support curbs.

C. Section 07 62 00 - Sheet Metal Flashing and Trim: Skylight counterflashing.

D. Section 07 92 00 - Joint Sealants: Sealing joints between skylight frames and adjacent construction.

E. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

D. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.

G. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants 2018 (Reapproved 2022).

H. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free 2007 (Reapproved 2018).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's specifications, standard details, and installation requirements.

C. Shop Drawings: Indicate framed opening requirements and tolerances, spacing of members, anticipated deflection under load, affected related work, expansion and contraction joint locations and details, and sizes and locations for field welding.
   1. Show field measurements on record set of shop drawings.

D. Shop Drawings: Include details of proposed weather sealant joints indicating dimensions, materials, bite, thicknesses, profile, and support framing.

E. Selection Samples: Full range of aluminum finish samples for Architect's color selection.

F. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

G. Design Data: Provide framing member structural and physical characteristics and engineering calculations and identify dimensional tolerance. .

H. Test Reports: Submit results of full-size mock-up testing Reports of tests previously performed on the same design are acceptable.

I. Manufacturer's Installation Instructions: Indicate special procedures, safety precautions and perimeter conditions requiring special attention.

J. Field Quality Control Submittals: Report of field testing for water penetration<<

K. Warranty Documentation: Submit manufacturer and installer warranties and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Provide << wrapping to protect prefinished aluminum surfaces. Do not use adhesive papers or spray coatings that bond when exposed to sunlight or weather.

1.06 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F or greater than 80 degrees F. Maintain this temperature range during installation.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer Material and Workmanship Warranty: Correct work that exhibits defects in materials or workmanship, including but not limited to discoloration of metal finishes beyond normal weathering and excessive thermal or structural movement, within a ten (10) year period after Date of Substantial Completion.

C. Installer Warranty: Correct defective work, including but not limited to water leakage and loss of sealant adhesion and/or sealant failures within a ten (10) year period after Date of Substantial Completion.

PART 2 PRUDUCTS

2.01 MANUFACTURERS

A. Basis of Design:
   1. DeaMor Skylights Thermally Broken NFRC-listed System

B. Substitution requests may be submitted per 01 60 00 Product Requirements. .
   1. Substitutions for work of this section must include the following to be considered for this project:
      a. Skylight sample for proposed system
      b. NFRC CPD listing indicating thermal performance for proposed system
      c. ASTM test data
      d. Proof of compliance with all Quality Assurance, design and performance requirements.

2.02 METAL-FRAMED SKYLIGHTS

A. Metal Framed Skylights: Factory-fabricated, and field glazed.
   1. Frame: Extruded aluminum thermally broken with integral condensation collection and internal guttering system.
   2. Glazing System: Pressure glazing bar system for sloped joints and two (2)-sided weatherseal sealant glazing for horizontal joints;
   3. Glazing: Insulating glass as specified in Section 08 8000..
   4. Aluminum Finish: High performance organic coatings.
   5. Fabricate to prevent vibration harmonics, thermal movement transmitted to other building elements, and loosening, weakening, or fracturing of attachments or components of system.

2.03 MATERIALS

A. Aluminum Extrusions: Alloy and temper 6063-T5, 6063-T6, or 6061-T6 members complying with ASTM B221 (ASTM B221M), with minimum thickness 1/8 inch for structural members and 1/16 inch for non-structural members.

B. Formed Aluminum: Sheet material of alloy 5052, 5005, or 6061-T651 members complying with ASTM B209/B209M, with minimum thickness 1/8 inch for structural members and .040 inch for flashings and closures.

C. Weatherseal Sealant: Silicone, with adhesion in compliance with ASTM C794; compatible with glazing accessories.

D. Dissimilar Material Separation: Shop apply vinyl corrosion resistant tape to dry materials to separate dissimilar metals. Locate so as to be concealed after installation.

E. Fasteners: Non-magnetic, 300 series, stainless steel All fasteners are to be engineered as required.

F. Glazing gaskets minimum 1/8 inch thick by ½ inch wide extruded silicone mechanically interlocked into the glazing support and cap extrusions. Tapes or sealants are not acceptable glazing gaskets.

G. Rigidly fit and secure joints and corners; fabricate rigid joints with connections that are flush, hairline, and weatherproof.

H. Fabricate components to allow for expansion and contraction with minimum clearance and shim spacing around perimeter of assembly.

I. Drain to exterior any water entering exterior joints, condensation occurring in glazing channels, or migrating moisture occurring within system.

2.04 FINISHES

A. High Performance Organic Coatings: AAMA 2604; multiple coats, thermally cured fluoropolymer system; color to be selected from standard 2-coat finish system, non-exotic non-XL .

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that structural curb is ready to receive skylight system. Coordinate installation of roofing and other adjacent work to ensure weathertight construction.

3.02 PREPARATION

A. Apply protective coating to concealed aluminum surfaces in contact with dissimilar materials.

3.03 INSTALLATION

A. Install metal-framed skylights in accordance with manufacturer's instructions.

B. Set skylight structure plumb, level, and true to line, without warp or rack of frames or glazing panels. Anchor securely in place<< in accordance with approved shop drawings.

C. Maintain assembly dimensional tolerances, aligning with adjacent work.

D. Touch up damaged finishes so repair is imperceptible from 10- feet distance and remove and replace components that cannot be acceptably touched up.

3.04 TOLERANCES

A. Maximum Variation from Plumb, Level, or Line: << 1/8 inch per 10 feet.

B. Alignment of Two Adjoining Members Abutting in Plane: Within << 1/16 inches.

3.05 CLEANING

A. Wash down exposed surfaces; wipe surfaces clean in accordance with manufacturer instructions.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for wood and hollow metal doors.

B. Lock cylinders for doors that hardware is specified in other sections.

1.02 RELATED REQUIREMENTS

A. Section 08 14 16 - Flush Wood Doors.

B. Section 10 26 00 - Wall and Door Protection: Door and frame protection.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Keying Requirements Meeting:
   1. Schedule meeting at project site prior to Contractor occupancy.
   2. Attendance Required:
      a. Contractor.
      b. Owner.
   3. Agenda:
      a. Establish keying requirements.
      b. Verify locksets and locking hardware are functionally correct for project requirements.
      c. Verify that keying and programming complies with project requirements.
      d. Establish keying submittal schedule and update requirements.
   4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
   5. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
   6. Deliver established keying requirements to manufacturers.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
   1. Provide complete description for each door listed.
   2. Provide manufacturer's and product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
   3. Include account of abbreviations and symbols used in schedule.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide individual items of single type, of same model, and by same manufacturer.

C. Provide door hardware products that comply with the following requirements:
   1. Applicable provisions of federal, state, and local codes.

2.02 HINGES

A. Manufacturers:
   1. McKinney; an Assa Abloy Group company: www.assaabloydss.com/#sle.

2. Stanley, dormakaba Group: www.stanleyhardwarefordoors.com/#sle.
3. Ives - Allegion: us.alegion.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Hinges: Comply with BHMA A156.1, Grade 1.
1. Provide hinges on every swinging door.
2. Provide following quantity of butt hinges for each door:
a. Doors up to 60 inches High: Two hinges.
b. Doors From 60 inches High up to 90 inches High: Three hinges.

2.03 LOCK CYLINDERS

A. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
1. Provide cylinders from same manufacturer as locking device.
2. Provide cams and/or tailpieces as required for locking devices.

2.04 CYLINDRICAL LOCKS

A. Manufacturers:
1. Best, dormakaba Group: www.bestaccess.com/#sle.

B. Cylindrical Locks (Bored): Comply with BHMA A156.2, Grade 1, 4000 Series.
1. Bored Hole: 2-1/8 inch diameter.
2. Latchbolt Throw: 1/2 inch, minimum.
3. Backset: 2-3/4 inch unless otherwise indicated.
4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
a. Finish: To match lock or latch.

2.05 MORTISE LOCKS

A. Manufacturers:
1. Best, dormakaba Group: www.bestaccess.com/#sle.

B. Mortise Locks: Comply with BHMA A156.13, Grade 1, Security, 1000 Series.
1. Latchbolt Throw: 3/4 inch, minimum.
2. Deadbolt Throw: 1 inch, minimum.
3. Backset: 2-3/4 inch unless otherwise indicated.
4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
a. Finish: To match lock or latch.

2.06 CLOSERS

A. Manufacturers; Surface Mounted:
1. Norton; an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Closers: Comply with BHMA A156.4, Grade 1.
1. Type: Surface mounted to door.
2. Provide door closer on each exterior door.

2.07 OVERHEAD STOPS AND HOLDERS

A. Manufacturers:
1. Rixson; an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Glynn-Johnson, an Allegion brand: www.allegion.com/us/#sle.
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Overhead Stops and Holders (Door Checks): Comply with BHMA A156.8, Grade 1.
1. Provide stop for every swinging door, unless otherwise indicated.

2.08 FLOOR STOPS

A. Manufacturers:

1. Rockwood; an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Floor Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
1. Type: Manual hold-open, with pencil floor stop.
2. Material: Aluminum housing with rubber insert.

2.09 WALL STOPS

A. Manufacturers:
1. Rockwood; an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
1. Type: Bumper, concave, wall stop.
2. Material: Aluminum housing with rubber insert.

2.10 FINISHES

A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
1. Primary Finish: 652; satin chromium plated over nickel, with steel base material (formar US equivalent US26D); BHMA A156.18.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Use templates provided by hardware item manufacturer.

C. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.

D. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.03 ADJUSTING

A. Adjust hardware for smooth operation.

B. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.04 CLEANING

A. Clean adjacent surfaces soiled by hardware installation.

B. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.05 PROTECTION

A. Do not permit adjacent work to damage hardware or finish.

3.06 DOOR HARDWARE

HARDWARE GROUP NO. 01
FOR USE ON DOOR #(S):
101E
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CLOSER	7500	689	NOR
			BALANCE OF HARDWARE EXISTING		

HARDWARE GROUP NO. 02
FOR USE ON DOOR #(S):
103 112
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	45H7D3H	626	BES
1	EA	CLOSER	7500	689	NOR
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	SECURITY WALL STOP	412	630	ROC
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 03
FOR USE ON DOOR #(S):
104 105 107 109
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	45H7D3H	626	BES
1	EA	SECURITY WALL STOP	412	630	ROC
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 04
FOR USE ON DOOR #(S):
106
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	45H7D3H	626	BES
1	EA	SECURITY WALL STOP	412	630	ROC
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 05
FOR USE ON DOOR #(S):
108
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK W/INDICATOR	45H7TD3H-VIN	626	BES
1	EA	CLOSER	7500	689	NOR
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	SET	SEALS	S44D (FOR SOUND)	DKB	PEM

HARDWARE GROUP NO. 06
FOR USE ON DOOR #(S):
109A
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	DEADBOLT	45H7AD	626	BES
1	EA	FLUSH PULL	955	626	IVE
1	EA	OH STOP	90S	630	GLY
2	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 07
FOR USE ON DOOR #(S):
110E
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	45H7D3H	626	BES
1	EA	CLOSER	7500PA	689	NOR
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 08
FOR USE ON DOOR #(S):
111
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ANTI LIGATURE STOREROOM LOCK	45H7DSPSL	626	BES
1	EA	OH STOP	100S	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 09
FOR USE ON DOOR #(S):
41
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	45H7D3H	626	BES
1	EA	OH STOP	90S	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

END OF SECTION

SPECIFYING STRATEGY

1.01 HOW TO USE THIS SECTION

A. The most important step is the selection of companion narrow scope sections which contain the bulk of Part 2 content relevant to specific glazing product type.

B. Part 3 of this section is intended to function as a single location for "glazing methods" applicable to any number of glazing products. Therefore, installation accessories have been retained in this section. The other sections in this group have their installation methods linked to this section.

C. Edit the "Installation - Glazing Methods" list in Part 3 to correspond with types of openings and applications in the project. Glazing methods differ based on application, framing, and location (exterior or interior). Type of glazing material is a less critical criterion for selection of optimal glazing method.

PART 1 GENERAL

2.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Glazing compounds.

2.02 RELATED REQUIREMENTS

A. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

B. Section 08 51 13 - Aluminum Windows: Glazing provided by window manufacturer.

2.03 REFERENCE STANDARDS

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

B. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.

C. ASTM F1233 - Standard Test Method for Security Glazing Materials And Systems; 2021.

D. ASTM F1915 - Standard Test Methods for Glazing for Detention Facilities; 2005 (Reapproved 2025).

E. GANA (GM) - GANA Glazing Manual; 2022.

F. GANA (SM) - GANA Sealant Manual; 2008.

G. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (Reaffirmed 2016).

2.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data on Insulating Glass Unit, Glazing Unit, Plastic Sheet Glazing Unit, and Plastic Film 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.

2.05 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods. Maintain one copy on site.

2.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

3.01 MANUFACTURERS

A. Glass Fabricators:
   1. Global Security Glazing.

3.02 BASIS OF DESIGN - INSULATING GLASS UNITS

A. Basis of Design (Exterior)
   1. Type G1: 1 7/16” SB70VT #2 on Clear Tempered Insulated Secur-Tem + Poly® 2116

3.03 GLAZING UNITS

A. Basis of Design (Interior);
   1. Type G2: 11/16” Clear Secur-Tem + Poly® 211

3.04 GLAZING COMPOUNDS

A. Type GC-5 - Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

3.05 ACCESSORIES

A. As indicated for Basis of Design windows

PART 3 EXECUTION

4.01 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 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.

4.02 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.

4.03 INSTALLATION, GENERAL

A. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

4.04 FIELD QUALITY CONTROL

A. Monitor and report installation procedures and unacceptable conditions.

4.05 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. 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.

4.06 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Louvers, frames, and accessories.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices; 2021, with Editorial Revision (2022).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 LOUVERS

A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.

2.02 ACCESSORIES

A. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Install louvers level and plumb.

C. Align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

D. Secure louver frames in openings with concealed fasteners.

END OF SECTION

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 09 00 00.1 - Interior Finish Product Schedule: Interior Finish Product selections.

B. See individual spec sections for additional finish product information.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. See individual spec sections for additional product submital requirements

PART 2 PRODUCTS

2.01 BASIS OF DESIGN FOR INTERIOR FINISH PRODUCTS

A. Reference Section 09 00 00.1 - Interior Finish Product Schedule

B. Product codes on "Interior Finish Product Schedule" are referenced in drawings.

C. Products listed may not be substituted unless noted otherwise.

D. Paint manufacturers may be substituted provided that the color of the substituted paint manufacturer is an exact match of the specified product.

PART 3 EXECUTION

3.01 INSTALLATION

A. See individual Sections for product execution requirements.

3.02 SCHEDULES

A. Reference Section 09 00 00.1 - Interior Finish Product Schedule

END OF SECTION

Designation	Specification	Notes / Location
06 41 00 Architectural Wood Casework		
Plastic Laminate		
PL1	Mfr: Wilsonart Color: Antique White 1572-60 Finish: Matte	Countertop
PL2	Mfr: Wilsonart Color: Beigewood 7850-60 Finish: Matte Panel Direction: Vertical Grain	Casework
CE	Mfr: Doellken Color: match laminate Thickness .018”	Cabinet edging
06 61 16 Solid Surfacing Fabrications		
Solid Surface		
SS1	Mfr: Dupont Corian Solid Surface Color: Bisque Thickness: ½”	Counters with integrated sinks; Med Lab & Kichenette
09 65 00 Resilient Flooring		
Resilient Sheet		
LN1	Mfr: Forbo Product: Marmoleum – Striato Color: Withered Prairie 5217 Finish: Smooth Size: 6’-7” x 15’ Thickness: 2.5 mm Installation: Net-fit seams	
LN2	Mfr: Forbo Product: Marmoleum – Striato Color: Dessert Sand 5255 Finish: Smooth Size: 6’-7” x 15’ Thickness: 2.5 mm Installation: Heat-weld seams	
Ceramic Tile		
CT1	Mfr: Daltile Product: StepWise Color: Butter Pecan EP01 Size: 12 x 48 Thickness: 5/16” Installation: Subway	Shower walls
CT2	Mfr: Daltile Product: Vintage Hex Color: Wisdom White VH06 Size: 1.5 Thickness: 1/4” Installation: Stack bond	shower floor
Rubber Base		
RB1	Mfr: Tarkett Johnsonite Style: Baseworks – Thermoset Rubber Profile: Coved (Toe) Wall Heights: 4”	

Designation	Specification	Notes / Location
	Color: Toast 283 Installation: Continuous Sealant at top and Bottom	
09 91 23 Interior Paintings		
Interior Paint		
PT1	Mfr: Benjamin Moore Color: Natural Cream OC-14 Product: Regal Select Finish: Eggshell	
PT2	Mfr: Benjamin Moore Color: Spring Sky 674 Product: Regal Select Finish: Eggshell	Accent Color, exception – Supervisor offices
PT3	Mfr: Benjamin Moore Color: White Dove OC-17 Product: Regal Select Finish: Eggshell	
PT4	Mfr: Benjamin Moore Color: Beeswax 2157-40 Product: Regal Select Finish: Eggshell	Skylight walls
PT5	Mfr: Benjamin Moore Color: Dill Pickle 2147-40 Product: Regal Select Finish: Eggshell	Supervisor Offices
10 26 01 Wall and Corner Guards		
Rigid Sheet Panels		
WP1	Mfr: Inpro Style: Wall Protection Color: Weathered Ash R1513 Size: 48” Thickness: .040” nominal	

Substitutions: See Section 01 60 00 - Product Requirements

END OF TABLE

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. Carpet tile.

B. Removal of existing floor coverings.

C. Preparation of existing concrete floor slabs for installation of floor coverings.

D. Patching compound.

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.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:
   1. Preliminary cleaning.
   2. Specified remediation, if required.
   3. Patching, smoothing, and leveling, as required.
   4. Other preparation specified.
   5. Adhesive bond and compatibility test.
   6. Protection.

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 PREPARATION

A. See individual floor covering section(s) for additional requirements.

B. Comply with requirements and recommendations of floor covering manufacturer.

C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

D. Do not fill expansion joints, isolation joints, or other moving joints.

3.05 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Acoustic insulation.

C. Cementitious backing board.

D. Gypsum wallboard.

E. Joint treatment and accessories.

F. Noiseproofing compound.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Structural steel stud framing.

B. Section 06 10 00 - Rough Carpentry: Building framing and sheathing.

C. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

D. Section 07 84 00 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.

E. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

F. Section 09 22 16 - Non-Structural Metal Framing.

1.03 REFERENCE STANDARDS

A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).

B. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board; 2004 (Reapproved 2020).

C. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2025.

D. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

E. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.

F. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

G. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on gypsum board and accessories.

1.05 QUALITY ASSURANCE

A. 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. See Section 01 74 19 - 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. Fire Rated Assemblies: Provide completed assemblies as indicated in drawings

2.02 BOARD MATERIALS

A. Abuse Resistant Wallboard:
   1. Application: As indicated in drawings.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Type: Fire-resistance-rated Type X, UL or WH listed.
   4. Thickness: 5/8 inch.
   5. Edges: Tapered.

B. Impact Resistant Wallboard:
   1. Application: As indicated in drawings.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Type: Fire-resistance-rated Type X, UL or WH listed.
   4. Thickness: 5/8 inch.
   5. Edges: Tapered.

C. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
   1. Application: Vertical surfaces behind thinset tile, except in wet areas.
   2. Type: Regular and Type X, in locations indicated.
   3. Type X Thickness: 5/8 inch.
   4. Regular Board Thickness: 5/8 inch.
   5. Edges: Tapered.

D. 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: 1/2 inch.
   3. Edges: Tapered.

E. Gypsum Wallboard: ASTM C 1396/C 1396M. Sizes to minimize joints in place; ends square cut.
   1. Regular Type:
      a. Application: Use for vertical surfaces, unless otherwise indicated.
      b. Thickness: 5/8 inch.
      c. Edges: Tapered.
   2. Fire Resistant Type: Complying with Type X requirements; UL or WH rated.
      a. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X.
      b. Application: Where required for fire-rated assemblies, unless otherwise indicated.
      c. Thickness: 5/8 inch.
      d. Edges: Tapered.

F. Water-Resistant Gypsum Backing Board: ASTM C 1396/C 1396M; ends square cut.
   1. Application: Vertical surfaces behind thinset tile, except in wet areas.
   2. Core Type: Regular and Type X, as indicated.
   3. Thickness: 1/2 inch and 5/8 inch, as indicated.
   4. Edges: Tapered.

2.03 GYPSUM BOARD ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced, or as otherwise specified in drawings. Thickness as indicated in drawings.

B. Finishing Accessories: ASTM C1047, galvanized steel, rolled zinc, or rigid plastic, unless noted otherwise.
   1. Types: As detailed or required for finished appearance.

C. Joint Accessories: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.

1. Architectural Reveal Beads:
   a. Reveal Depth: 1/2 inch.
   b. Reveal Width: 3/4 inch.

D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place continuous bead at perimeter of each layer of gypsum board.
   2. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.03 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. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
   2. At exterior soffits, not more than 30 feet apart in both directions.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

D. Decorative Trim: Install at locations shown on drawings and in accordance with manufacturer's instructions.

3.05 JOINT TREATMENT

A. 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 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
   4. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
   5. Level 0: Temporary partitions.

B. Finish all gypsum board in accordance with ASTM C 840 Level 4.

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.

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.

3.06 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal partition, ceiling, and soffit framing.

B. Framing accessories.

C. This section includes drywall accessories or noise control components featuring Mullion Mate® Series 20 Extruded Aluminum Partition Gap Closure, as shown on the Architectural Drawings.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping: Sealing top-of-wall assemblies at fire-resistance-rated walls.

B. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

C. Section 09 21 16 - Gypsum Board Assemblies: Acoustic insulation.

1.03 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).

B. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

E. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2025.

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

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 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

D.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories:
   1. CEMCO: www.cemcosteel.com/#sle.
   2. ClarkDietrich: www.clarkdietrich.com/#sle.
   3. R-stud, LLC: www.rstud.com/#sle.
   4. SCAFCO Corporation: www.scafco.com/#sle.
   5. Substitutions: See Section 01 60 00 - 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 flat faces.
   2. Runners: U-shaped, sized to match studs.
   3. Furring: Hat-shaped sections, minimum depth of 7/8 inch.

C. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
   1. Products:
      a. As indicated in drawings.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

D. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code when evaluated in accordance with AISI S100.
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50.

E. 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 in drawings.
   3. Framing Connectors: ASTM A653/A653M steel clips; secures cold rolled channel to wall studs for lateral bracing.
   4. Flexible Wood Backing: Fire-retardant-treated wood with sheet steel connectors.
   5. Sheet Metal Backing: 0.036 inch thick.
   6. Fasteners: ASTM C1002 self-piercing self-tapping screws.
   7. Anchorage Devices: Powder actuated.

PART 3 EXECUTION

3.01 INSTALLATION OF STUD FRAMING

A. Comply with requirements of AISI S220.

B. Extend partition framing to structure where indicated and 6" above ceiling where indicated.

C. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

D. Align and secure top and bottom runners at 24 inches on center.

E. At partitions indicated with an acoustic rating:
   1. Provide components and install as required to produce STC ratings as indicated, based on published tests by manufacturer conducted in accordance with ASTM E90 with STC rating calculated in accordance with ASTM E413.
   2. Place one bead of acoustic sealant between runners and substrate , studs and adjacent construction.
   3. Place one bead of acoustic sealant between studs and adjacent vertical surfaces.

F. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

G. Install studs vertically at spacing indicated on drawings.

H. Align stud web openings horizontally.

I. Secure studs to tracks using crimping method. Do not weld.

J. Fabricate corners using a minimum of three studs.

K. Install double studs at wall openings, door and window jambs, not more than 2 inches from each side of openings.

L. Coordinate erection of studs with requirements of door frames; install supports and attachments.

M. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

N. Blocking: Provide blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and opening frames.

O. Blocking: Use steel channels secured to studs. Provide blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and opening frames.

P. Furring: Install at spacing and locations shown on drawings. Lap splices a minimum of 6 inches.

3.02 CEILING AND SOFFIT FRAMING

A. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

B. Install furring independent of walls, columns, and above-ceiling work.

C. Securely anchor hangers to structural members or embed them in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

D. Space main carrying channels at maximum 72 inches on center, and not more than 6 inches from wall surfaces. Lap splice securely.

E. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

F. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.

G. Laterally brace suspension system.

3.03 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

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cement plastering.

1.02 REFERENCE STANDARDS

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

B. ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster; 2023.

C. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster; 2022a.

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

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Product Data: Provide data on plaster materials and trim accessories.

C. Samples:
   1. Submit two samples, illustrating finish color and texture.

1.04 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Construct mock-up exterior wall, illustrating surface finish.
   1. Locate where directed.
   2. Mock-up may remain as part of this work.

1.05 FIELD CONDITIONS

A. Exterior Plaster Work: Do not apply plaster when substrate or ambient air temperature is 40 degrees F or lower, or when temperature is expected to drop below 40 degrees F within 48 hours of application.

PART 2 PRODUCTS

2.01 CEMENT PLASTER APPLICATIONS

A. Lath Plaster Base: Metal lath.
   1. Plaster Type: Factory prepared plaster mix.
      a. Type 1 - ST1:
         1) Mfr: Omega
            (a) Substitutions: See Section 01 60 00-Product Requirements.
         2) Product line: Colortek Colors
         3) Color: Milky Quartz 432
      b. Type 2 - ST2:
         1) Mfr: Omega
            (a) Substitutions: See Section 01 60 00-Product Requirements.
         2) Product line: Colortek Colors
         3) Color: Buterscotch 435
   2. Number of Coats: Three.
   3. First Coat: Apply to a nominal thickness of 3/8 inch.
   4. Second Coat: Apply to a nominal thickness of 3/8 inch.
   5. Leveling Coat: Apply to a nominal thickness of 1/32 to 1/16 inch.
   6. Finish Coat: Apply to a nominal thickness of 1/8 inch.

2.02 FACTORY PREPARED CEMENT PLASTER

A. Exterior Portland cement plaster system made of scratch and brown base coat, leveling coat with reinforcing mesh, and acrylic finish coat; install in accordance with ASTM C926.
   1. Provide continuous exterior insulation as part of the system, by the same manufacturer.
   2. Provide weather resistive barrier as part of the system, by the same manufacturer.
   3. Manufacturers:
      a. Dryvit Systems, Inc; Dryvit Commercial Cement Plaster 1: www.dryvit.com/systems/stucco/#sle.
      b. Master Builders Solutions; Senergy Platinum CI Stucco Ultra: www.master-builders-solutions.com/en-us/#sle.
      c. Master Wall, Inc; Cemplaster Fiberstucco: www.masterwall.com/#sle.
      d. Parex USA, Inc; Armourwall 300: www.parexusa.com/#sle.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 ACCESSORIES

A. Lath:
   1. Wire Size: 17 gauge, 0.453 inch.
   2. Galvanized: ASTM A641/A641M.
   3. Opening Size: 11/16 by 1-1/2 inches.

B. Rainscreen Drainage Material:
   1. Rainscreen Drainage Mat: Polyester or polypropylene mesh.
      a. 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.
      b. Seam Tape and Bug Screen: As recommended by rainscreen drainage mat manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. Verify lath is flat, secured to substrate, and joint and surface perimeter accessories are properly in place.

3.02 INSTALLATION - WATER-RESISTIVE BARRIER

A. Where cement plaster is installed as part of a barrier wall system, install two layers of water-resistive barrier in accordance with water-resistive barrier manufacturer's instructions.

B. Integrate water-resistive barrier with flashing accessories, and adjacent doors, windows, penetrations, and cladding transitions.

3.03 INSTALLATION - RAINSCREEN DRAINAGE MATERIAL

A. Install rainscreen drainage material and metal lath with accessories over sheathing material and water-resistive barrier with fastening system in accordance with ASTM C1063 into wood or metal studs. Install drainage material with filter fabric mortar screen to exterior.

3.04 MIXING

A. Mix only as much plaster as can be used prior to initial set.

B. Mix materials dry, to uniform color and consistency, before adding water.

C. Protect mixtures from frost or freezing temperatures, contamination, and excessive evaporation.

3.05 APPLICATION

A. Apply plaster in accordance with manufacturer's written instructions and comply with ASTM C926.

B. Base Coats:

1. Apply base coat(s) to fully embed lath and to specified thickness.
2. Follow guidelines in ASTM C926 and manufacturer's written installation instructions for moist curing base coats and application of subsequent coats.

C. Leveling Coat:
1. Apply leveling coat to specified thickness.

D. Finish Coats:
1. Cement Plaster:
a. Apply with sufficient material and pressure to ensure complete coverage of base to specified thickness.
b. Apply desired surface texture while mix is still workable.

3.06 REPAIR

A. Patching: Remove loose, damaged or defective plaster and replace with plaster of same composition; finish to match surrounding area.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Ceramic trim.

D. Metal Trim.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

B. Section 09 00 00 - Interior Finish Products: Interior finish products.

C. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

D. Section 09 21 16 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2019.

B. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2023.

C. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation; 2023.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Samples for Verification: Provide minimum of three units of each size and color of tile to be provided.

D. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Tile: 10 percent of each size, color, and surface finish combination.

1.05 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tile:
   1. As indicated in drawings.
   2. Substitutions: See Section 01 60 00 - Product Requirements.
   3. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.

B. Setting Materials:
   1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
   2. Custom Building Products: www.custombuildingproducts.com/#sle.
   3. LATICRETE International, Inc: www.laticrete.com/#sle.

4. Substitutions: See Section 01 60 00 - Product Requirements.
5. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.

C. Grout:
1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
2. Custom Building Products: www.custombuildingproducts.com/#sle.
3. LATICRETE International, Inc: www.laticrete.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.
5. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.

2.02 TILE

A. Ceramic Tile:
1. Products:
a. As indicated in drawings.
b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Porcelain Tile:
1. Products:
a. As indicated in drawings.
b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 TRIM AND ACCESSORIES

A. Ceramic Accessories: Glazed finish, same color and finish as adjacent field tile; same manufacturer as tile.

B. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
1. Applications:
a. Inside Corners: Jointed.
b. Floor to Wall Joints: Cove base.
c. Manufacturers: Same as for tile.

C. Non-Ceramic Trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, set with tile mortar or adhesive.
1. Applications:
a. Open edges of wall and floor tile.
b. Products:
1) Schluter-Systems; Schiene: www.schluter.com/#sle.
(a) Stainless Steel finish.
2) Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive tile.

B. Verify wall surfaces are smooth and flat within tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

3.02 PREPARATION

A. Vacuum clean surfaces and damp clean.

B. Seal substrate surface cracks with filler.

C. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108/A118/A136, manufacturer's instructions, and TCNA (HB) or TCNA (HB-GP) recommendations, as applicable.

B. Lay tile to pattern indicated on drawings. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install ceramic accessories rigidly in prepared openings.

G. Install non-ceramic trim in accordance with manufacturer's instructions.

H. Sound tile after setting. Replace hollow sounding units.

I. Keep control and expansion joints free of mortar, grout, and adhesive.

J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

K. Grout tile joints unless otherwise indicated on drawings. Use standard grout unless otherwise indicated on drawings.

L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 CLEANING

A. Clean tile and grout surfaces.

3.05 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Division 23 - Air diffusion devices in ceiling.

C. Division 26 - Light fixtures in ceiling.

D. Division 28 - Fire alarm components in ceiling.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

E. Delegated Design: Calculations and details, stamped by a qualified Professional Engineer, for seismic anchorage of suspended ceiling systems, as required by the local authority having jurisdiction.

F. Certifications: Manufacturer's certifications that ceiling system complies with specified seismic performance requirements, including but not limited to ICC Evaluations and engineering calculations by a licensed structural engineer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
   2. CertainTeed Corporation: www.certainteed.com/ceilings-and-walls/#sle.
   3. USG Corporation: www.usg.com/ceilings/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Suspension Systems:
   1. Same as for acoustical units.
   2. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
   3. CertainTeed Corporation: www.certainteed.com/ceilings-and-walls/#sle.
   4. USG Corporation: www.usg.com/ceilings/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions determined according to ASCE 7 for Seismic Design Category D, E, or F and complying with the following:
   1. Local authorities having jurisdiction.

B. Seismic Performance: Provide suspension system that has been evaluated by an independent party and found to be complaint with applicable Building Code seismic category requirements, including but not limited to ICC Evaluation Services Acceptance Criteria AC156 (as evidenced by ICC Evaluation Report ESR-1308).

2.03 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.

B. Acoustical Panels: Painted mineral fiber, with the following characteristics:
   1. Classification: ASTM E1264 Type III.
      a. Form: 2, water felted.
   2. Size: 24 by 24 inches.
   3. Thickness: 5/8 inch.
   4. Panel Edge: Square.
   5. Color: White.

2.04 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.

B. Exposed Suspension System: Hot-dip galvanized steel grid and cap.
   1. Structural Classification: Heavy-duty, when tested in accordance with ASTM C635/C635M.

C. Exposed Suspension System: Hot-dip galvanized steel grid and cap.
   1. Application(s): Fire-rated assemblies.
   2. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.

2.05 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.

C. Hold-Down Clips: Manufacturer's standard clips to suit application.

D. Seismic Clips: Manufacturer's standard clips for seismic conditions and to suit application.

E. Perimeter Moldings: Same metal and finish as grid.
   1. Size: As required for installation conditions and specified Seismic Design Category.
   2. Angle Molding: L-shaped, for mounting at same elevation as face of grid.
   3. Gaskets For Perimeter Moldings: Closed-cell foam, factory-applied to molding.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C 636/C 636M and ASTM E 580/E 580M and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected plan unless noted otherwise..

D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Overlap and rivet corners.

E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

F. Seismic Suspension System, Seismic Design Categories D, E, F: Hang suspension system with grid ends attached to the perimeter molding on two adjacent walls; on opposite walls, maintain a 3/4 inch clearance between grid ends and wall.

G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

I. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

J. Do not eccentrically load system or induce rotation of runners.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.05 CLEANING

A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.

B. Clean surfaces.

C. Replace damaged or abraded components.

END OF SECTION

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 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.

B. Section 09 00 00 - Interior Finish Products: Interior finish products.

C. Section 09 05 61 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

1.03 REFERENCE STANDARDS

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

B. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.

C. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; 2011.

1.04 SUBMITTALS

A. See Section 01 30 00 - 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, 10 by 8 inch in size illustrating color and pattern for each resilient flooring product specified.

E. Samples for Selection: Submit manufacturer's standard color palette for selection of edge strips.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

D. Protect roll materials from damage by storing on end.

E. Do not double stack pallets.

1.06 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

1.07 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

B. Provide 10% of flooring, 10 lineal feet of base, and 5 percent of installed stair materials of each type and color specified.

PART 2 PRODUCTS

2.01 SHEET FLOORING

A. Basis-of-Design Product: As specified in Section 09 00 00 - Interior Finish Products and as indicated in drawings.
   1. Substitutions: See Section 01 60 00-Product Requirements.

2.02 TILE FLOORING

A. Basis-of-Design Product: As specified in Section 09 00 00 - Interior Finish Products and as indicated in drawings.

2.03 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
   1. Manufacturers:
      a. Basis-of-Design Product: Each resilient flooring type is specified in Section 09 00 00 - Interior Finish Products and as indicated in drawings..
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Height: 4 inch.
   3. Thickness: 0.125 inch.
   4. Finish: Satin.
   5. Color: As specified in Section 09 0000.1 - Interior Finish Product Schedule..

2.04 ACCESSORIES

A. Provide only products meeting VOC Restrictions indicated in Section 01 61 16.

B. Concrete Slab Crack and Joint Filler: Cementitious-based compounds, pre-mixed or jobsite mixed.

C. Primers, Adhesives, and Seaming Materials: Waterproof, low VOC-types recommended by flooring manufacturer.

D. Edge and Transition Strips:
   1. Manufacturer: Provide product from one of the following manufacturers or as indicated in drawings.
      a. Flexco
      b. Johnsonite
      c. Roppe
      d. Substitutions: See Section 01 60 00-Product Requirements.

E. Filler for Coved Base: Plastic.

F. Sealer or Wax: Types recommended by flooring manufacturer.

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 sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive resilient flooring.

C. 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.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

E. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

F. Verify that concrete sub-floor surfaces are dry enough and ready for resilient flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F710; obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Pre-ventilation: Pre-ventilate carpet by unrolling in a well-ventilated and unoccupied space for a minimum of four hours.

B. Remove existing resilient flooring and flooring adhesives; follow the recommendations of RFCI (RWP).

C. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

D. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

E. Prohibit traffic until filler is fully cured.

F. Clean and fill concrete slab cracks and control joints as recommended by flooring manufacturers.

G. Clean substrate.

H. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

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. Place copper grounding strip in conductive adhesive and apply additional adhesive to top side of strip before installing static control flooring. Allow strip to extend beyond flooring in accordance with static control flooring manufacturer's instructions. Refer to Section 26 05 26 for grounding and bonding to building grounding system.
   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.

3.04 INSTALLATION - GENERAL

A. Provide transition strips at the following transitions, when they occur on the project:
   1. Resilient flooring to carpet.
   2. Resilient flooring to unfinished floor.
   3. At transitions not otherwise noted on the Drawings.

3.05 INSTALLATION - SHEET FLOORING

A. Install in accordance with manufacturer's instructions.

B. Spread only enough adhesive to permit installation of materials before initial set.

C. Set flooring in place, press with heavy roller to attain full adhesion.

D. 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.

E. Finish seams in rubber flooring by heat welding.

F. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.

G. Coved Base: Install as detailed on drawings, using coved base filler as backing at floor to wall junction. Extend sheet flooring vertically to height indicated, and cover top edge with metal cap strip.

H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.06 INSTALLATION - TILE FLOORING

A. Install in accordance with manufacturer's instructions.

B. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Set flooring in place, press with heavy roller to attain full adhesion.

E. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

F. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.

G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated. Before installation of flooring, secure metal strips with stainless steel screws.

H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.07 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.

D. Set base in a continuous bead of sealant so as to provide a continuous seal at the floor.

3.08 INSTALLATION - STAIR COVERINGS

A. Install stair coverings in one piece for full width and depth of tread.

B. Adhere over entire surface. Fit accurately and securely.

3.09 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

C. Clean, seal and/or wax resilient flooring products in accordance with manufacturer's instructions.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

1.02 RELATED REQUIREMENTS

A. Section 09 00 00 - Interior Finish Products: Interior finish products to be used in project.

1.03 REFERENCE STANDARDS

A. CRI 104 - Standard for Installation of Commercial Textile Floorcovering Materials; Carpet and Rug Institute; 2002.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

C. Samples for Selection: Submit manufacturer's standard color palette for selection of edge strips.

1.05 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

B. Provide 1 carton of carpet tiles of each color and pattern selected.

PART 2 PRODUCTS

2.01 MATERIALS

A. Basis-of-Design Product: As specified in Section 09 00 00 - Interior Finish Products and as indicated in drawings.
   1. Substitutions: See Section 01 60 00-Product Requirements.

2.02 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Edge Strips: Embossed aluminum, color as selected by Architect.

C. Edge and Transition Strips:
   1. Manufacturer: Provide product from one of the following manufacturers or as indicated in drawings.
      a. Flexco
      b. Johnsonite
      c. Roppe
      d. Substitutions: See Section 01 60 00-Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

C. Verify that concrete sub-floor surfaces are ready for carpet tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by carpet tile manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Pre-ventilation: Pre-ventilate carpet by unrolling in a well-ventilated and unoccupied space for a minimum of four hours.

B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Install carpet tile in accordance with manufacturer's instructions and CRI 104.

D. Blend carpet from different cartons to ensure minimal variation in color match.

E. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

F. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.

G. Fully adhere carpet tile to substrate.

H. Provide smooth transition between carpets of different thicknesses by feathering substrate with feathering compound.

I. Trim carpet tile neatly at walls and around interruptions.

J. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

C. 1.Use a HEPA-filtration vacuum equipment.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:

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, and operating parts of equipment.
   5. Floors, unless specifically indicated.
   6. Glass.
   7. Concealed pipes, ducts, and conduits.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

1.03 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. Provide lighting level of 80 ft candles 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. Paints:
   1. Behr Process Corporation: www.behr.com/#sle.
   2. Cloverdale Paint, Brand Products of Rodda Paint Company$: www.cloverdalepaint.com/#sle.
   3. Pittsburgh Paints: www.ppgpaints.com/#sle.
   4. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

C. Primer Sealers: Same manufacturer as top coats.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. 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.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including primed metal and Stucco wall system.
   1. Two top coats and one coat primer.

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
   1. Alkali Resistant Water Based Primer; MPI #3.

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 effect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Exterior Plaster and Stucco: 12 percent.

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 for finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Exterior Plaster: Fill hairline cracks, small holes, and imperfections with exterior patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance.

D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

3.05 COLOR SCHEDULE

A. Stucco wall system: Match existing wall color- provide sample to Architect for review and approval

B. Pre-primed or prefinished coping: Match existing building coping

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of interor 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. Floors, unless specifically indicated.
   6. Glass.
   7. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 09 91 13 - Exterior Painting.

1.03 REFERENCE STANDARDS

A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

B. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

C. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

1.05 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.

1.06 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. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Paints:
   1. Base Manufacturer: Benjamin Moore.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Supply each paint material in quantity required to complete entire project's work from a single production run.
   3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

2.03 PAINT SYSTEMS - INTERIOR

A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board and shop primed steel.
   1. Two top coats and one coat primer.

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.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Gypsum Wallboard: 12 percent.

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. 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 using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

3.05 COLOR SCHEDULE: SEE DRAWINGS AND INTERIOR FINSH PRODUCT SCHEDULE

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Porcelain enamel steel markerboards.

1.02 RELATED REQUIREMENTS

A. Section 09 22 16 - Non-Structural Metal Framing: Concealed supports in metal stud walls.

1.03 REFERENCE STANDARDS

A. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2018.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data on porcelain enamel steel markerboard.

C. Maintenance Data: Include data on regular cleaning, stain removal .

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.01 VISUAL DISPLAY UNITS

A. Porcelain Enamel Steel Markerboards:
   1. Manufacturers:
      a. ASI Visual Display Products: www.asi-visualdisplayproducts.com/#sle.
      b. Claridge Products and Equipment, Inc: www.claridgeproducts.com/#sle.
      c. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Color: White.
   3. Height: As indicated in drawings.
   4. Length: As indicated on drawings.

2.02 MATERIALS

A. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.

2.03 ACCESSORIES

A. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install boards in accordance with manufacturer's instructions.

B. Secure units level and plumb.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Corner guards.

B. Protective wall covering.

1.02 RELATED REQUIREMENTS

A. Section 09 00 00 - Interior Finish Products: Product finishes.

B. Section 09 21 16 - Gypsum Board Assemblies: 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; 2023, with Editorial Revision.

B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents; 2021.

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

D. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

1.04 SUBMITTALS

A. See Section 01 30 00 - 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.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Stock Materials: One package(s) of minimum 96 inches long unit of each kind of covers for corner guards.
   3. Extra Stock Materials: 32 square feet of each kind of protective wall covering.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.

B. Protect work from moisture damage.

C. Protect work from UV light damage.

D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

E. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 5-year manufacturer warranty for metal crash rails. Complete forms in Owner's name and register with manufacturer.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of materials beyond that expected of normal use, as intended by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Protective Wall Covering:
   1. Construction Specialties, Inc; Acrovyn High-Impact Wall Covering: www.c-sgroup.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE CRITERIA

2.03 PRODUCT TYPES

A. Corner Guards - Surface Mounted:
   1. Material: High impact vinyl with full height extruded aluminum retainer.
   2. Material: Type 304 stainless steel, No. 4 finish.
   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.
   8. Length: One piece.
   9. Preformed end caps.

B. Protective Wall Covering and Rubstrip:
   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 scheduled in Section 09 0000.1 - Interior Finish Product Schedule.
   5. Texture: Suede.
   6. Size: 48" x 96" min. To be installed without seams when possible.
   7. Mounting: Adhesive.

2.04 FABRICATION

A. Fabricate components with tight joints, corners and seams.

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 corner guard 4 inches above finished floor to ceiling.

C. Position corner guards as indicated in drawings.

D. 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. 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.
4. Use a roller to ensure maximum contact with adhesive.
5. 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.

3.04 CLEANING

A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Institutional ligature-resistant toilet accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 22 16 - Non-Structural Metal Framing: Concealed supports for accessories, including in wall framing and plates, above ceiling framing, and blocking/ strapping.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2022.

C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

D. ASTM C1036 - Standard Specification for Flat Glass; 2025.

E. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2018.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Samples: Submit two samples of each accessory, illustrating color and finish.

D. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Institutional Security and Ligature-Resistant Toilet and Bath Accessories:
   1. American Specialties, Inc: www.americanspecialties.com/#sle.
   2. Substitutions: Section 01 60 00 - Product Requirements.

B. Provide products of each category type by single manufacturer.

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. Stainless Steel Sheet: ASTM A666/A666M, Type 304.

C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

D. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

E. Adhesive: Two component epoxy type, waterproof.

F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

2.04 INSTITUTIONAL SECURITY AND LIGATURE-RESISTANT TOILET AND BATH ACCESSORIES

A. Mirrors: Unframed, Type 400 polished stainless steel mirror; exposed front mount.

1. Framed Size: 24 inches by 30 inches.
2. Frame: Solid surface material with mitered beveled edges and welded and ground corners, and tamperproof hanging system; Square corners.
3. Products:
   a. 101-14 Manufactured by American Specialties Inc..
   b. Substitutions: Section 01 60 00 - Product Requirements.

B. Grab Bars: Type 304 stainless steel, smooth surface with closure plate.
1. Standard Duty Grab Bars:
   a. Push/Pull Point Load: 250 pound-force, minimum.
   b. Dimensions: 1-1/2 inch outside diameter, minimum 0.05 inch wall thickness, 1-1/2 inch clearance between wall and inside of grab bar; 14 gauge stainless steel "L" shaped closure plate with wall mounting flange welded to bottom of tube to prevent ligature. Install grab bar and closure plate with tamper-resistant screws through grab bar circular mounting flange and wall flange of flat closure.
   c. Finish: Satin.
   d. Length and Configuration: As indicated on drawings.
   e. Products:
      1) 164 & 167 manufactured by American Specialties, Inc..
      2) Substitutions: Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. See Section 09 22 16 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. Other Accessories: As indicated on drawings.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

1.02 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

C. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

PART 2 PRODUCTS

2.01 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Class: A:B:C type.
   2. Finish: Baked polyester powder coat red color.
   3. Temperature range: Minus 40 degrees F to 120 degrees F.

2.02 FIRE EXTINGUISHER CABINETS

A. Cabinet Configuration: Recessed type.
   1. Size to accommodate accessories.

B. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.

C. Door Glazing: Float glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in openings, mounted at the following heights:
   1. For cabinets scheduled to receive extinguishers of 40 pounds or less, mount cabinet with extinguisher no more than 60-inches above finished floor.
   2. For cabinets scheduled to receive extinguishers of more than 40 pounds, mount cabinet with extinguisher no more than 42 inches above finished floor.

C. Place extinguishers in cabinets.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Steel shelf standards, brackets, and accessories.

B. Shelves.

1.02 RELATED REQUIREMENTS

A. Section 09 21 16 - Gypsum Board Assemblies: Blocking in metal stud walls for attachment of standards.

1.03 REFERENCE STANDARDS

A. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements for additional provisions.
   2. Extra Brackets: Ten of each size of standard straight bracket.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Shelf Standards and Brackets:
   1. Knape & Vogt Manufacturing Company; 87™/187™ Series: www.knapeandvogt.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Shelving:

2.02 COMPONENTS

A. Fasteners: Screws as recommended by manufacturer for intended application or as otherwise required by project conditions. Finish of exposed to view fasteners to match finish of standards and other components.

2.03 MATERIALS

A. Extra-Duty Shelf Standards and Brackets: Double-slotted channel standards for brackets adjustable in 1 inch increments along entire length of standard, drilled and countersunk for screws.
   1. Load Capacity: Recommended by manufacturer for loading of 300 to 680 pounds per pair of standards.
   2. Finish: Electroplated, chrome-look.
   3. Brackets: Double tab type, locking into slots; size to suit shelves; same finish as standards.
   4. Bracket Quantity: Provide one bracket for each 12 inches of standard length.

B. Regular-Duty Shelf Standards and Brackets: Single-slotted channel standards for brackets adjustable in 1 inch increments along entire length of standard, drilled and countersunk for screws.
   1. Load Capacity: Recommended by manufacturer for loading of 120 to 320 pounds per pair of standards.
   2. Finish: Electroplated, chrome-look.
   3. Bracket Quantity: Provide one bracket for each 12 inches of standard length.

C. Laminate Faced Shelves: Particleboard or medium density fiberboard covered with high pressure decorative laminate on both sides.
   1. Edge Finish: Matching laminate, all four edges.
   2. Substrate Thickness: 3/4 inch, nominal.

3. Laminate: NEMA LD 3 Type HGL.

D. Fasteners: Screws as recommended by manufacturer for intended application or as otherwise required by project conditions.

PART 3 EXECUTION

3.01 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.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Mount standards or brackets to solid backing capable of supporting intended loads.

C. Install brackets, shelving, and accessories.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Coordination and Installation of Owner-Furnished-Contractor-Installed (OFCI) equipment.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 01 40 50 - Coordination: Contractor responsibilities related to coordination of project related activities.

C. Section 01 33 00 - Delegated Design

1.03 COORDINATION

A. Coordinate construction operations and the work of subcontractors to assure efficient and orderly installation of OFCI equipment. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation of this equipment.

1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
3. Make provisions to accommodate items scheduled for later installation.
4. Contractor to provide and install all electrical boxes, conduits and backing for OFCI and OFOI items.

1.04 SUBMITTALS

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

B. Delegated Design: Provide calculations and details for structural engineering and seismic bracing of equipment identified in Scope of Work below, unless otherwise noted below or on Drawings.

1.05 SCOPE OF WORK

A. The Owner will provide equipment to be incorporated into the work by the contractor as indicated in the drawings. Contractor to provide installation, including structural engineering and seismic bracing, electrical and/or plumbing services as required.

B. The Owner will provide equipment to be incorporated into the work by Owner's vendor as indicated in the drawings. The installation of this equipment will be performed by the Vendor. Contractor to coordinate schedule and installation requriements (such as backing) with Vendor. Provide rough-in mechanical and electrical items and blocking for this equipment as indicated on Drawings.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.01 GENERAL

A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

3.02 CLEANING AND PROTECTION

A. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.

B. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.

C. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural cabinet work.

B. Wall-hung counters and vanity tops.

C. Sinks molded into countertops.

D. Window Sills

1.02 RELATED REQUIREMENTS

A. Section 06 41 00 - Architectural Wood Casework

1.03 REFERENCE STANDARDS

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

B. AWI (QCP) - Quality Certification Program; Current Edition.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

E. IAPMO Z124 - Plastic Plumbing Fixtures; 2022, with Editorial Revision.

F. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

G. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.

D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

G. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 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.

1.06 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:
      a. Counters without sinks: 1/2 inch, minimum.
      b. Counters with undermount sinks 3/4" minimum when available from manufacturer in specified color.
      c. Counters with integrated sinks: 3/4" minimum when available from manufacturer in specified color.
   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. Manufacturers:
         1) As indicated in drawings.
         2) Substitutions: See Section 01 60 00 - Product Requirements.
      b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
      c. Sinks and Bowls: Integral castings; minimum 3/4 inch wall thickness; comply with IAPMO Z124.
      d. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
      e. Color/Pattern Family: As indicated in drawings.
   3. Other Components Thickness: 1/2 inch, minimum.
   4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge.
   5. Integral Back and End Splashes: Same sheet material, square top; minimum 4 inches high (typ).
   6. Skirts: As indicated on drawings.
   7. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Custom Grade.

C. Solid Surface Sinks and Bowls (for installation with solid surfacing countertops).
   1. Color: As indicated in drawings.
   2. Model Number: As indicated in drawings.

D. Solid Surface Window Sills.
   1. Color as indicated in drawings.
   2. See drawings for size.

2.02 MATERIALS

A. Wood-Based Components:
   1. Wood fabricated from old growth timber is not permitted.

B. Plywood for Supporting Substrate: PS 1 Marine Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.

C. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

D. Joint Sealant: Mildew-resistant silicone sealant, white.

2.03 ACCESSORIES

A. Fixed Top-Mounted Countertop Support Brackets for surface mounted and frame mounted applications as indicated in drawings:
   1. Material: Steel.

2. Finish: Manufacturer's standard, factory-applied, textured powder coat.
3. Color: White.
4. Depth 24" unless noted otherwise.
5. Load Rating: 1,800 lbs unless noted otherwise.
6. Products:
   a. Centerline Brackets: www.countertopbracket.com/#sle.
   b. US Futaba - Concealed bracket.
   c. Substitutions: See Section 01 60 00 - 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.
      a. Outside corner radius to match overhang.
   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 and wall panels 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 Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.

C. Seal joint between back/end splashes and vertical surfaces.

3.04 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

FIRE PROTECTION DESIGN-BUILD CRITERIA

1.01 GENERAL

A. The work installed under this section shall conform to all applicable local codes, regulations, and standards.

B. Do not construe anything contained in these specifications or drawings to permit work to be installed that does not conform to code.

C. Consider interpretations and rulings of the enforcing agencies as part of these specifications.

D. Comply with specifications showing work exceeding minimum code requirements.

E. The Contractor shall furnish without any extra charge additional materials and labor required for the compliance with any rules and regulations.

F. Current State Building, Fire, Mechanical, Plumbing and energy codes shall apply.

G. The Design/Build Entity shall have responsibility for the following:
   1. Engineer-of-Record
   2. All calculations
   3. Final equipment sizing
   4. Equipment selection
   5. Construction details
   6. Seismic restraints
   7. Coordination with other trades
   8. Preparation of 100% Construction Documents
   9. Shop drawings and submittals
   10. Project construction management
   11. Construction and all field work
   12. Construction quality control
   13. Start-up & testing
   14. Training

H. The Design/Build Entity shall be the Engineer-of-Record for the project, stamping and signing the drawings for permit submission and approval.

1.02 GUARANTEES AND WARRANTIES

A. Prior to final application for payment, submit to the Owner/Architect, all guarantees in duplicate, bound and indexed in two separate, complete files. Include each Subcontractor's guarantee for his own work and all manufacturers extended guarantees for equipment. The delivery of said guarantees shall not relieve Contractor from any obligations assumed under any other provisions of the contract.

B. All materials, parts, equipment, modifications made, and workmanship shall be guaranteed for a period of one year from date of acceptance of work, not when the Subcontractor has completed his work nor when the equipment is turned on.

C. Should such parts, materials, or workmanship be found to be defective during this period, they will be rectified at no cost to the Owner. All labor required to rectify such defects will be performed during the normal working hours of the trade involved. Overtime charges will be considered on work requested during other than normal working hours.

D. This guarantee is contingent upon the system being properly maintained by a qualified mechanic familiar with this equipment and that the equipment is not abused. Excluded is normal wear and tear, replacement of filters and belts and chemical treatment.

E. A written guarantee to this effect shall be submitted prior to final payment and acceptance.

F. If the equipment manufacturers provide for a longer guarantee period, they shall also be submitted.

1.03 SUBMITTALS

A. After completion of design, six (6) complete (construction ready) and organized sets of submittals will be required. No equipment or material shall be ordered without prior review of the Owner. Submittals shall be provided in a timely manner to allow sufficient time to review information without delaying work. Included in the submittals shall be the following:
   1. Complete plans and specifications showing equipment locations, pipe layout and sizing, wiring and control diagrams, equipment schedules, details, notes, and all other items necessary for proper checking, construction permits, etc.
   2. Submittals and cut sheets on all fixtures, equipment, materials and products.
   3. Provide pump curves, operation characteristics, capacities, ambient noise criteria, etc., for all equipment.
   4. Sizing calculations for all equipment and pumps.
   5. Submittals will be reviewed for general conformance with this specification, but review in no manner is meant to verify that dimensions, quantities, or location of services are as necessary to meet the job requirements nor relieve the Contractor of any design, installation, or performance requirements.

1.04 FEES

A. Provide, procure, and pay for all permits, services, meters, licenses, fees, etc., required for performance or work of this section.

B. Upon completion of the work, deliver to the Architect, all certificates of approval signed by the controlling authorities.

1.05 RECORD DRAWINGS

A. Record of Job Progress: Keep an accurate, dimensional record of the as-built locations of all work. Keep records up-to-date on blue line prints as the job progresses and before any portion of the work is covered up. This print set shall be maintained at the job site and shall be available for inspection at all times.

B. Final as-built reproducible drawings (electronic and hard copy media) shall be submitted prior to final acceptance and shall include the following:
   1. Location of piping and equipment.
   2. Ceiling access panel locations.

1.06 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Furnish three (3) complete sets of operating and maintenance instructions for all equipment of all types bound in a hardboard binder and indexed. Submit no later than thirty (30) calendar days prior to substantial completion.

B. Incorporate the following:
   1. Exact model numbers for each piece of equipment.
   2. Complete operating instructions for each item of equipment.
   3. Test data and other reports.
   4. Typewritten maintenance instructions for each item of equipment, listing in detail, the lubricants to be used, frequency of lubrication, inspections required, adjustments, etc.

1.07 SITE CLEAN UP

A. After all other work has been accomplished, clean all exposed piping, fixtures, equipment, and supports.

B. See General Conditions regarding clean up. Leave all areas involving plumbing work clean.

1.08 UL LABEL

A. Furnish UL labeled and listed materials and equipment except when equipment is of a type for which labeling or listing services are not available from UL.

1.09 CURRENT MODELS

A. Materials and equipment shall be new, current models by each manufacturer and shall bear complete identification by the manufacturer. Materials and equipment shall be guaranteed by the manufacturer to equal or exceed specified, submitted, and published specifications such as pressure ratings, capacities, etc.

1.10 SERVICE CAPABILITY

A. Provide materials and equipment of major and reputable manufacturers with ability to render competent and thorough technical services through local organizations and to expeditiously furnish spare parts.

1.11 FINISHES AND PAINTING

A. Provide all equipment with a factory finish. All other painting will be done under another section.

B. Touch up scratches in factory finished surfaces to match original. Obtain touch-up paint from the manufacturer of the piece of equipment.

1.12 COORDINATION

A. Coordinate with work performed by other sections in order to accommodate the requirements of this section and to assure adequate space and proper location of all necessary work on this project whether or not the work is under this section. This coordination shall include, but not be limited to, the following:
   1. Layout support pads, curbs, sleepers, anchor bolts, etc., for all fire protection equipment and materials so as to be in the proper location for the equipment actually ordered. These pads shall be of adequate dimension to provide for proper mounting of equipment isolators and equipment mounting so that anchor bolts meet all seismic criteria. Contractor shall allow for proper service clearances.
   2. Provide templates, information, and instructions to other divisions as necessary to properly locate holes and openings to be cut or provided for plumbing work.
   3. Layout piping, and other fire protection systems and confirm all sizes of systems and components to be sure they fit the space available prior to ordering and manufacturing of components.
   4. Be certain to allow for proper pipe slopes.
   5. Provide proper clearances for access to and service of all equipment and items requiring adjustment including shutoff valves.

B. Coordination Drawings:
   1. Extra charges shall not be allowed due to lack of coordination prior to or during construction.
   2. Prepare large scale coordination drawings of any congested areas and areas where conflicts occur. Distribute and review with the General Contractor and any other trades that are affected.

1.13 WORKMANSHIP

A. Workmanship shall be first class throughout, performed only by competent and experienced workmen. Replace work falling below these standards. Constant supervision of the work either by the Contractor or his competent representative shall be maintained. Welding shall be done by certified pipe welders.

1.14 NOISE AND VIBRATION

A. Quietness is a requirement. Eliminate noise, other than that caused by specific equipment operating at optimum conditions and at design noise criteria.

B. The limiting of transmission of noise and vibration is very important. The Contractor is to pay particular attention that piping, equipment, and ductwork is installed so as not to chatter or rub against other materials, equipment, and the building structure. Provide isomode pads, insulation, or other suitable materials to avoid direct contact and noise conditions unacceptable to the Owner. Consider, in particular, pipe clamps at risers where they contact the slab, proper shields at pipe hangers, and pipe and duct penetrations of walls and floors.

1.15 SEISMIC RESTRAINTS

A. General: All equipment, piping, and materials shall be fastened to the structure with properly sized and structurally engineered anchors, bolts, and restraints to prevent permanent displacement in any direction caused by lateral motion, overturning, or uplift.

B. Calculations:
   1. Submit drawings, calculations, and specifications that clearly indicate the furnished systems for support of equipment, piping, and materials.
   2. Calculations shall be in a form that can be readily reviewed by the Architect. All engineering designs for the restraining systems shall bear the seal of a Structural or Civil Engineer registered in the state of the project's location.

C. Provide specifications of anchor bolt size and loads with installation instructions for each item.

D. All isolators shall be fastened to the structure and to the equipment with properly sized and structurally engineered anchors and bolts. The isolator manufacturers shall submit seismic calculations confirming that such bolts and anchors can handle the specified seismic requirements.

E. Provide for attachment to portions of the building structure capable of bearing the loads imposed. Design systems to not overstress the building structure. (Coordinate with the Structural Engineer.)

F. The Engineer providing the required calculations shall inspect all supports and attachments designed by him and provide a letter certifying that they have been installed as designed.

1.16 FIRE PROTECTION SYSTEM LAYOUT

A. General:
   1. Layout the fire protection system in careful coordination with the contract and approved shop drawings, determining proper elevations for all components of the system and using only the minimum number of bends to produce a satisfactorily functioning system.
   2. Follow the general layout shown on the approved shop drawings in all cases except where other work may interfere. Size any section of pipe for which size is not indicated or any intermediate section erroneously shown undersized the same size as the largest pipe connecting to it.
   3. Cut pipe accurately to job measurements and install without springing or forcing, true to line and grade, generally square with building, and adequately supported to prevent sagging or undue stress on pipe, fittings, and accessories.
   4. Provide unions at connections to equipment, on service side of valves, and elsewhere as required to facilitate maintenance.
   5. Provide chrome plated, split ring type escutcheons where pipe penetrations through wall or ceiling are exposed to view.
   6. Arrange pipe and hangers to allow for expansion, contraction, and structural settlement. No pipe shall contact structure.
   7. Make changes of size or direction with manufactured fittings. Bushings, reducing flanges, and bending of pipe is not allowed.
   8. Change pipe size within three pipe size diameters of final connection to fixtures and equipment.
   9. Enclosure of Pipes:
      a. Except where specifically permitted by the Architect, layout all pipes to fall within partition, ceiling, or roof cavities and not to require furring other than that shown on the contract documents.

1.17 INSTALLATION OF FIRE PROTECTION EQUIPMENT

A. General:
   1. Install all piping promptly capping or plugging all open ends and making pipe generally level and plumb, free from traps, and in a manner to conserve space for other work.
   2. Firmly anchor all pipes in position; provide complete isolation of dissimilar metals.
   3. Inspect each piece of pipe, tube fittings, and equipment for defects and obstructions; promptly remove all defective materials from the job site.
   4. Install pipes to clear all beams and obstructions. Do not cut structural members without the approval of the Architect.

B. Joints and Connections:
   1. Smoothly ream all cut pipe; cut all threads straight and true.

1.18 CLOSING IN UNINSPECTED WORK

A. General: Do not cover up or enclose work until it has been properly and completely inspected and approved.

B. Noncompliance: Should any of the work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required and, after it has been completely inspected and approved, make all repairs and replacements with such materials as are necessary to the approval of the Architect.

1.19 TESTS AND ADJUSTMENTS

A. Test the installations in accordance with the following requirements and all applicable codes.
   1. Notify the Architect at least seven (7) days in advance of any test.
   2. All piping shall be tested at completion of roughing-in, or at any other times as directed by the Architect.
   3. Furnish all necessary materials, test pumps, gases, instruments, and labor required for testing. Tests shall be witnessed by the Architect.

B. Protect valves and equipment from damage during tests. Include connection to previously tested sections if the systems are tested in sections.

C. Test all piping with no leaks or loss in pressure. Repair or replace defective piping until tests are accomplished successfully.

D. Perform operational test under simulated or actual service conditions, including one test of complete plumbing installation with all fixtures and other appliances connected and operating.

E. Should any material or work fail in any of these tests, it shall be immediately removed and replaced by new materials, and portion of the work replaced shall again be tested.

F. Instruct Owner's operating personnel during operating adjustment period. Lubricate each item of equipment, including motors, before operation.

1.20 CLEANING PIPING SYSTEMS

A. After the piping systems have been tested and proved tight, clean piping systems of dirt, scale, oil, grease, waste, and other foreign substances which may have accumulated during the process of installation.

1.21 FINAL CLEAN UP

A. Prior to acceptance of the buildings, thoroughly clean all exposed portions of the plumbing installation, removing all labels and all traces of foreign substance, using only a cleaning solution approved by the manufacturer of the plumbing item and being careful to avoid all damage to finished surfaces.

1.22 PIPING PENETRATIONS OF FIRE WALLS

A. Bare Pipe: All steel pipe or copper tubing penetrating fire walls or decks shall be encircled by sheet metal sleeves sized for maximum one inch annular spacing between pipe and sleeve. Spacing shall be packed on each end with UL rated ceramic fiber strip insulation.

B. Sleeve and packing shall have the same fire rating as the partition construction in which they are installed. Any substitutions must have passed the ASTM E-119 test, per UBC 43-1 for pipe penetrations.

C. Fire barrier kits shall be Pipe Shields, Inc., Model "F" series.

D. Caulking shall be applied additionally for 4-hour wall penetrations. Caulking shall be 3-M fire barrier caulking, CP-25, with 3-hour rating.

1.23 IDENTIFICATION

A. Identification of New Material:
   1. Provide pipe with manufacturer's identification and service on each length of pipe as required by ASTM Specifications.

B. Piping:
   1. Identify all pipelines with adhesive markers indicating the contents and direction of flow.
   2. Markers to be Seton type Setmark, Brady, or Perma-Color.
   3. Provide pipe marking as follows:
      a. Apply "Plastic Pipe Marker" at each valve to show identification of pipe contents.
      b. Use an "Arrow Marker" with each "Pipe Content Marker" and in direction of flow.
      c. Apply "Pipe Marker" and "Arrow Marker" at every point of pipe entry and exit where line goes through wall, floor, or roof.
      d. Apply "Pipe Marker" and "Arrow Marker" every 50' on long continuous lines.
      e. Identify branch runs from mains with "Pipe Marker" and "Arrow Marker" at point takeoff.
      f. Apply "Markers" on two lower quarters of pipe and where view is unobstructed. In this position, "Markers" are read at a glance from ground floor level and dust will not obscure "Marker." Locate roof-mounted piping "Markers" so that they can be read from a standing position on the roof.
      g. Provide at each end of each marker, Brady or equal, 2-1/4" wide self-sticking clear tape around the periphery of pipe or insulation to further secure the marker.
      h. All markers shall be installed after finish painting is complete. Coat full marker with clear lacquer after installation.
      i. Guarantee that "Pipe Markers" will stay on pipe systems for a period of not less than 5 years.
      j. Identify piping 2-1/2" and smaller with 1" minimum height lettering every 20' where exposed to view and at valves where concealed.
      k. Identify piping 3" and larger with 2" minimum height lettering every 30' where exposed to view and at valves where concealed.
      l. Where piping is provided with insulation, provide the size letters scheduled above in accordance with the outside dimensions of insulation.
      m. Use markers and adhesive suitable for the humidity and for surface temperatures ranging from –40 degrees F to 150 degrees F.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work installed under this section shall conform to all applicable local codes, regulations, and standards.

B. Do not construe anything contained in these specifications or drawings to permit work to be installed that does not conform to code.

C. Consider interpretations and rulings of the enforcing agencies as part of these specifications.

D. Comnply with sp;ecifications showing work exceeding minmum code requirements.

E. The Contractor shall furnish without any extra charge additional materials and labor required for the compliance with any rules and regulations.

F. Current State of oregon Buyilding, Fire, Mechanical Plumbing and Energy codes shall apply.

G. The Design/Build Team shall deliver a finished project that will achieve LEED certification.

H. The Design/Build Entity shall have responsibility for the following:
   1. Engineer-of-Record to sign/seal drawings and calculations
   2. All calculations
   3. Final equipment sizing
   4. Equipment selection
   5. Construction details
   6. Seismic retraints coordinated with calculations, and identifieable on drawings
   7. Coordination with other trades
   8. Preparation of 100% Construction Documents
   9. Shop drawings and submittals
   10. Project construction management
   11. Construction and all field work
   12. Construction quality control
   13. Start-up and testing
   14. Training

I. The Design/Build Entity shall be the Engineer-ofRecord for the project, stanping and signing the drawings and calculations for permit submission and approval.

1.02 RELATED REQUIREMENTS

A. Section 21 05 53 - Identification for Fire Suppression Piping and Equipment: Piping identification.

1.03 REFERENCE STANDARDS

A. ASME A112.18.1 - Plumbing Supply Fittings.

B. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications.

C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.

E. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250.

F. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings.

G. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

H. ASME B16.25 - Buttwelding Ends.

I. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.

J. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

K. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe.

L. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

M. ASTM A536 - Standard Specification for Ductile Iron Castings.

N. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

O. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

P. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

Q. AWWA C606 - Grooved and Shouldered Joints.

R. FM (AG) - FM Approval Guide.

S. ITS (DIR) - Directory of Listed Products.

T. NFPA 13 - Standard for the Installation of Sprinkler Systems.

U. UL (DIR) - Online Certifications Directory.

V. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

A. See Section 01 30 00 - 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. Project Record Documents: Record actual locations of components and tag numbering.

E. Operation and Maintenance Data: Include installation instructions and spare parts lists.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - 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 UL (DIR) 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 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a two year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 FIRE PROTECTION SYSTEMS

A. Sprinkler Systems: Comply with NFPA 13.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

2.02 ABOVE GROUND PIPING

A. Steel Pipe: Schedule 40, black.
   1. Steel Fittings: ASME B16.9 wrought steel, buttwelded or ASTM A234/A234M wrought carbon steel or alloy steel.
   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 Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
   5. 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.

2.03 ESCUTCHEONS

A. Construction:
   1. One-piece for mounting on chrome-plated pipe and one-piece type elsewhere.
   2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.04 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. Or approved equal..

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 or red 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.

2.05 MECHANICAL PRESSED FITTINGS

A. Manufacturers:
   1. Viega LLC; MegaPress: www.viega.us/#sle.
   2. Or approved equal..

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. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

C. Install piping to conserve building space, to not interfere with use of space and other work.

D. Group piping whenever practical at common elevations.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. 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. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
   4. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

G. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

H. Provide automatic air release valve at high point of project pipoing.

I. Structural Considerations:
   1. Do not penetrate building structural members unless indicated.

J. Provide sleeves when penetrating floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

K. 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. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.

L. 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.

M. 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.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

D. Ceiling tacks.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation instructions.

E. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Piping: Pipe markers.

B. Valves: Nameplates and ceiling tacks where above lay-in ceilings.

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Red.
   4. Thickness: 1/8 inch.
   5. Plastic: Comply with ASTM D709.

2.03 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

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 PIPE MARKERS

A. Color: Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Color code as follows:
   1. Fire Quenching Fluids: Red with white letters.

2.05 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

B. Color code as follows:

1. Piping: Red.
2. Sprinkler Valves: Red.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Use tags on piping 3/4 inch diameter and smaller.
   1. Identify service, flow direction, and pressure.
   2. Install in clear view and align with axis of piping.
   3. Locate identification not to exceed 20 feet 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.

E. Locate ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Pipes, fittings, and specialties.
   2. Cover system for sprinkler piping.
   3. Specialty valves.
   4. Sprinklers.
   5. Alarm devices.
   6. Manual control stations.
   7. Control panels.
   8. Pressure gages.

B. Related Requirements:
   1. Section 210000 “Fire Protection Design-Build Criteria” for bidder design requirements.
   2. Section 210500 “Common Work Results for Fire Suppression” for fire protection piping and installation.
   3. Section 284600 "Fire Detection and Alarm" for connections to alarm devices.

1.03 DEFINITIONS

A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than 250 psig.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For wet-pipe sprinkler systems.
   1. Include plans, elevations, sections, and attachment details.
   2. Include diagrams for power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Welding certificates.

C. Fire-hydrant flow test report.

D. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

E. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.08 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
   1. NFPA 13.
   2. NFPA 13R.

B. High-Pressure Piping System Component: Listed for 250-psig minimum working pressure.

C. Sprinkler system design shall be approved by authorities having jurisdiction.
   1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
   2. Sprinkler Occupancy Hazard Classifications:
      a. Residential spaces and adjacent corridors: Light Hazard or per NFPA 13 for residential sprinklers.
      b. Building Service Areas: Ordinary Hazard, Group 1.
      c. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
      d. General Storage Areas: Ordinary Hazard, Group 1.
      e. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
      f. Office and Public Areas: Light Hazard.
      g. Restaurant Service Areas: Ordinary Hazard, Group 1.
   3. Minimum Density for Automatic-Sprinkler Piping Design:
      a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
      b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
      c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
   4. Maximum Protection Area per Sprinkler: According to UL listing.

D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

2.02 STEEL PIPE AND FITTINGS

A. Standard-Weight, Black Steel Pipe: ASTM A 53/A 53M. Pipe ends may be factory or field formed to match joining method.

B. Black Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

C. Uncoated Steel Couplings: ASTM A 865/A 865M, threaded.

D. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

E. Malleable- or Ductile-Iron Unions: UL 860.

F. Cast-Iron Flanges: ASME 16.1, Class 125.

G. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
   1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick, ASME B16.21, nonmetallic and asbestos free, or EPDM rubber gasket.
      a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
      b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
   2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.

H. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.
   1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

I. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Anvil International.
   b. Corcoran Piping System Co.
   c. National Fittings, Inc.
   d. Shurjoint Piping Products USA Inc.
   e. Smith-Cooper International.
   f. Tyco Fire Products LP.
   g. Victaulic Company.
   h. Or approved equal.
2. Pressure Rating: 250-psig minimum.
3. Galvanized Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.03 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:
   1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.
   2. High-Pressure Piping Specialty Valves: 250-psig minimum.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Alarm Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Globe Fire Sprinkler Corporation.
      b. Reliable Automatic Sprinkler Co., Inc. (The).
      c. Tyco Fire Products LP.
      d. Venus Fire Protection Ltd.
      e. Victaulic Company.
      f. Viking Corporation.
   2. Standard: UL 193.
   3. Design: For horizontal or vertical installation.
   4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, and fill-line attachment with strainer.
   5. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
   6. 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.

G. Automatic (Ball Drip) Drain Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Reliable Automatic Sprinkler Co., Inc. (The).
      b. Tyco Fire Products LP.
   2. Standard: UL 1726.
   3. Pressure Rating: 175-psig minimum.
   4. Type: Automatic draining, ball check.
   5. Size: NPS 3/4.
   6. End Connections: Threaded.
   7. Or approved equal.

2.04 SPRINKLER PIPING SPECIALTIES

A. Branch Outlet Fittings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Anvil International.
      b. National Fittings, Inc.
      c. Shurjoint Piping Products USA Inc.
      d. Tyco Fire Products LP.
      e. Victaulic Company.
      f. Or approved equal.
   2. Standard: UL 213.
   3. Pressure Rating: 175-psig minimum.
   4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
   5. Type: Mechanical-tee and -cross fittings.
   6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
   7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
   8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. AGF Manufacturing, Inc.
      b. Reliable Automatic Sprinkler Co., Inc. (The).
      c. Tyco Fire Products LP.
      d. Victaulic Company.
      e. Or approved equal.
   2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
   3. Pressure Rating: 175-psig minimum.
   4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
   5. Size: Same as connected piping.
   6. Inlet and Outlet: Threaded or grooved.

C. Branch Line Testers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Elkhart Brass Mfg. Co., Inc.
      b. Fire-End & Croker Corporation.
      c. Potter Roemer LLC.
   2. Standard: UL 199.
   3. Pressure Rating: 175 psig.
   4. Body Material: Brass.
   5. Size: Same as connected piping.
   6. Inlet: Threaded.
   7. Drain Outlet: Threaded and capped.
   8. Branch Outlet: Threaded, for sprinkler.
   9. Or approved equal.

D. Sprinkler Inspector's Test Fittings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. AGF Manufacturing, Inc.
      b. Triple R Specialty.
      c. Tyco Fire Products LP.
      d. Victaulic Company.
      e. Viking Corporation.

f. Or approved equal.
2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Aegis Technologies, Inc.
b. CECA, LLC.
c. Corcoran Piping System Co.
d. Merit Manufacturing.
e. Or approved equal.
2. Standard: UL 1474.
3. Pressure Rating: 250-psig minimum.
4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

F. Flexible Sprinkler Hose Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Fivalco Inc.
b. FlexHead Industries, Inc.
c. Gateway Tubing, Inc.
d. Victaulic Company.
e. Or approved equal.
2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175-psig minimum.
5. Size: Same as connected piping, for sprinkler.

2.05 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Globe Fire Sprinkler Corporation.
2. Reliable Automatic Sprinkler Co., Inc. (The).
3. Tyco Fire Products LP.
4. Venus Fire Protection Ltd.
5. Victaulic Company.
6. Viking Corporation.
7. Or approved equal.

B. Quick Response.

C. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

D. Pressure Rating for Residential Sprinklers: 175-psig maximum.

E. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

F. Pressure Rating for High-Pressure Automatic Sprinklers: 250-psig minimum.

G. Automatic Sprinklers with Heat-Responsive Element:
1. Nonresidential Applications: UL 199.
2. Residential Applications: UL 1626.

3. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

H. Sprinkler Finishes: Chrome plated.

I. Special Coatings: Wax, or corrosion-resistant paint where appicable.

J. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

K. Sprinkler Guards:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Reliable Automatic Sprinkler Co., Inc. (The).
b. Tyco Fire Products LP.
c. Victaulic Company.
d. Viking Corporation.
e. Or approved equal.
2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.06 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Electrically Operated Alarm Bell:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Fire-Lite Alarms, Inc.; a Honeywell International company.
b. Notifier.
c. Potter Electric Signal Company, LLC.
d. Or approved equal.
2. Standard: UL 464.
3. Type: Vibrating, metal alarm bell.
4. Size: 10-inch diameter.
5. Finish: Red-enamel factory finish, suitable for outdoor use.
6. 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.

C. Water-Flow Indicators:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. ADT Security Services, Inc.
b. McDonnell & Miller.
c. Potter Electric Signal Company, LLC.
d. System Sensor.
e. Viking Corporation.
f. WATTS.
g. Or approved equal.
2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig.

7. Design Installation: Horizontal or vertical.

D. Pressure Switches:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Barksdale, Inc.
b. Detroit Switch, Inc.
c. Potter Electric Signal Company, LLC.
d. System Sensor.
e. Tyco Fire Products LP.
f. United Electric Controls Co.
g. Viking Corporation.
h. Or approved equal.
2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

E. Valve Supervisory Switches:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Fire-Lite Alarms, Inc.; a Honeywell International company.
b. Kennedy Valve Company; a division of McWane, Inc.
c. Potter Electric Signal Company, LLC.
d. System Sensor.
e. Or approved equal.
2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.07 CONTROL PANELS

A. Description: Single-area, two-area, or single-area cross-zoned control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves.
1. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" when used with thermal detectors and Class A detector circuit wiring.
2. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.

C. Panels Components:
1. Power supply.
2. Battery charger.
3. Standby batteries.
4. Field-wiring terminal strip.
5. Electrically supervised solenoid valves and polarized fire-alarm bell.
6. Lamp test facility.
7. Single-pole, double-throw auxiliary alarm contacts.
8. Rectifier.

2.08 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. AGF Manufacturing, Inc.
   2. AMETEK, Inc.
   3. Ashcroft Inc.
   4. Brecco Corporation.
   5. WIKA Instrument Corporation.
   6. Or approved equal.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gage Range: 0- to 250-psig minimum.

E. Label: Include "WATER" label on dial face.

PART 3 EXECUTION

3.01 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.02 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building.

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.03 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
   1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
   2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

K. Install alarm devices in piping systems.

L. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.

M. Pressurize and check preaction sprinkler system piping and air-pressure maintenance devices.

N. Fill sprinkler system piping with water.

3.04 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
   1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

M. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

N. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

O. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

P. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.

Q. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

R. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

S. Plastic-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
   2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

3.05 INSTALLATION OF COVER SYSTEM FOR SPRINKLER PIPING

A. Install cover system, brackets, and cover components for sprinkler piping according to manufacturer's "Installation Manual" and NFPA 13 or NFPA 13R for supports.

3.06 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:
   1. Install valves in vertical position for proper direction of flow, in main supply to system.
   2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
   3. Install deluge valves in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

3.07 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.08 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.09 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
   4. Energize circuits to electrical equipment and devices.
   5. Coordinate with fire-alarm tests. Operate as required.

6. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.11 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.12 PIPING SCHEDULE

A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. High-pressure, wet-pipe sprinkler system, NPS 4 and smaller, shall be one of the following:
1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.

D. High-pressure, wet-pipe sprinkler system, NPS 5 and larger, shall be one of the following:
1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.

3.13 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:
1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Pendent, recessed, flush, and concealed sprinklers as directed by Architect.
3. Wall Mounting: Sidewall sprinklers.
4. Spaces Subject to Freezing: Pendent, dry sprinklers; and sidewall, dry sprinklers as applicable.

B. Provide sprinkler types in subparagraphs below with finishes indicated.
1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
4. Residential Sprinklers: Dull chrome.
5. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible pipe connectors.

B. Expansion joints and compensators.

C. Pipe loops, offsets, and swing joints.

1.02 REFERENCE STANDARDS

A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

B. EJMA (STDS) - EJMA Standards.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data:
   1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
   2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

C. Design Data: Indicate selection calculations.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.

PART 2 PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Manufacturers:
   1. Mercer Rubber Company: www.mercer-rubber.com.
   2. The Metraflex Company: www.metraflex.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Inner Hose: Carbon steel.

C. Exterior Sleeve: Single braided, stainless steel.

D. Pressure Rating: 125 psi and 450 degrees F.

E. Joint: Flanged.

F. Maximum offset: 3/4 inch on each side of installed center line.

2.02 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

A. Manufacturers:
   1. Mercer Rubber Company: www.mercer-rubber.com.
   2. The Metraflex Company: www.metraflex.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Inner Hose: Bronze.

C. Exterior Sleeve: Braided bronze.

D. Pressure Rating: 125 psi and 450 degrees F.

E. Joint: Flanged.

F. Maximum offset: 3/4 inch on each side of installed center line.

G. Application: Copper piping.

2.03 EXPANSION JOINTS - STAINLESS STEEL BELLOWS TYPE

A. Manufacturers:

1. Mercer Rubber Company: www.mercer-rubber.com.
2. The Metraflex Company: www.metraflex.com/#sle.
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Maximum Compression: 1-3/4 inches.

C. Maximum Extension: 1/4 inch.

D. Joint: Flanged.

E. Application: Steel piping 4 inches and under.

2.04 EXPANSION JOINTS - EXTERNAL RING CONTROLLED STAINLESS STEEL BELLOWS TYPE

A. Manufacturers:
1. Mercer Rubber Company: www.mercer-rubber.com.
2. The Metraflex Company: www.metraflex.com/#sle.
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Pressure Rating: 125 psi and 400 degrees F.

C. Maximum Compression: 15/16 inch.

D. Maximum Extension: 5/16 inch.

E. Maximum Offset: 1/8 inch.

F. Joint: Flanged.

G. Accessories: Internal flow liner.

H. Application: Steel piping over 2 inches.

2.05 EXPANSION JOINTS - SINGLE SPHERE, ELBOW COMPENSATOR

A. Manufacturers:
1. Mercer Rubber Company: www.mercer-rubber.com.
2. The Metraflex Company: www.metraflex.com/#sle.
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Body: Teflon.

C. Pressure Rating, Sizes 3/4 Inch to 2 Inch: 150 psi and 210 degrees F.

D. Pressure Rating, Sizes 1-1/2 Inch to 12 Inch: 150 psi and 250 degrees F.

E. Pressure Rating, Sizes 14 Inch to 24 Inch: 105 psi and 250 degrees F.

F. Maximum Compression: 1/2 inch.

G. Maximum Elongation: 3/8 inch.

H. Maximum Offset: 3/8 inch.

I. Maximum Angular Movement: 15 degrees.

J. Joint: Tapped steel flanges.

K. Accessories: Control rods.

L. Application: Steel piping 2 inches and over.

2.06 EXPANSION JOINTS - TWO-PLY BRONZE BELLOWS TYPE

A. Manufacturers:
1. Mercer Rubber Company: www.mercer-rubber.com.
2. The Metraflex Company: www.metraflex.com/#sle.
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Construction: Bronze with anti-torque device, limit stops, internal guides.

C. Pressure Rating: 125 psi and 400 degrees F.

D. Maximum Compression: 1-3/4 inches.

E. Maximum Extension: 1/4 inch.

F. Joint: Soldered.

G. Application: Copper piping.

2.07 EXPANSION JOINTS - LOW PRESSURE COMPENSATOR WITH TWO-PLY BRONZE BELLOWS

A. Manufacturers:
   1. Mercer Rubber Company: www.mercer-rubber.com.
   2. The Metraflex Company: www.metraflex.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Working Pressure: 75 psi.

C. Maximum Temperatures: 250 degrees F.

D. Maximum Compression: 1/2 inch.

E. Maximum Extension: 5/32 inch.

F. Joint: Flanged.

G. Application: Copper or steel piping 3 inches and under.

2.08 ACCESSORIES

A. Stainless Steel Pipe: ASTM A269/A269M, seamless type, Grade TP304.

B. Pipe Alignment Guides:
   1. Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inches travel.

C. Swivel Joints:
   1. Fabricated steel body, double ball bearing race, field lubricated, with rubber (Buna-N) o-ring seals.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.

C. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.

D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

E. Anchor pipe to building structure where indicated. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

F. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

G. Substitute grooved piping for vibration isolated equipment instead of flexible connectors. Grooved piping need not be anchored.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.

B. Pipe sleeve-seals.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 09 91 23 - Interior Painting: Preparation and painting of interior piping systems.

C. Section 22 05 23 - General-Duty Valves for Plumbing Piping.

1.03 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).

B. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

1.05 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.

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 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Manufacturers:
   1. Flexicraft Industries; Pipe Wall Sleeve: www.flexicraft.com/#sle.
   2. Substitutions: See Section 01 60 00 - 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 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.

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 complying with ASTM E814 in accordance with Section 07 84 00 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. Flexicraft Industries; PipeSeal: www.flexicraft.com/#sle.
3. Substitutions: See Section 01 60 00 - Product Requirements.

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.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

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. 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 fire stopping material complying with ASTM E814 in accordance with Section 07 84 00 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.

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.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Applications.

B. General requirements.

C. Ball valves.

D. Check valves.

1.02 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose (Inch).

B. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves.

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

D. ASME B16.34 - Valves - Flanged, Threaded and Welding End.

E. ASTM B61 - Standard Specification for Steam or Valve Bronze Castings.

F. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.

G. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.

H. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

I. NSF 61 - Drinking Water System Components - Health Effects.

J. NSF 372 - Drinking Water System Components - Lead Content.

1.03 SUBMITTALS

A. See Section 01 30 00 - 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.

1.04 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.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.

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 NPS and smaller except plug valves.

D. Valves in Insulated Piping: With 2 NPS 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. 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.

G. Valve Materials for Potable Water: NSF 61 and NSF 372.

2.03 BRASS BALL VALVES

A. Two Piece, Full Port with Brass Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
4. Body: Forged brass.
5. Ends: Threaded.
6. Seats: PTFE.

2.04 BRONZE BALL VALVES

A. Two Piece, Regular Port with Bronze Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
4. Body: Bronze.
5. Ends: Threaded.
6. Seats: PTFE.

2.05 STAINLESS STEEL BALL VALVES

A. Two Piece, Full Port with Stainless Steel Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 1000 psig.
4. Body: Stainless steel.
5. Seats: PFTE.
6. Stem: Stainless steel.
7. Ball: Stainless steel.

2.06 BRONZE LIFT CHECK VALVES

A. Class 125:
1. Comply with MSS SP-80, Type 1, Metal Disc to Metal Seat and Type 2, Nonmetallic Disc to Metal Seat.
2. CWP Rating: 200 psig.
3. Design: Vertical flow.
4. Body: Comply with ASTM B61 or ASTM B62, bronze.
5. Ends: Threaded as indicated.
6. Disc (Type 1): Bronze.
7. Disc (Type 2): NBR.

2.07 BRONZE SWING CHECK VALVES

A. Class 125: CWP Rating: 200 psig (1380 kPa).
1. Comply with MSS SP-80, Type 3.
2. Design: Horizontal flow.
3. Body: Bronze, ASTM B62.
4. Ends: Threaded as indicated.
5. Disc: Bronze.

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. Lift Check: Install with stem plumb and vertical.
   2. Swing Check: Install horizontal maintaining hinge pin level.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, piping, and other plumbing work.

1.02 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

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

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General - Purpose Piping.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.

F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

I. MFMA-4 - Metal Framing Standards Publication.

J. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

C. 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.

1.05 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.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of 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 1.5. 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. 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. Materials for Metal Fabricated Supports: Comply with Section 05 50 00.

C. Metal Channel (Strut) Framing Systems:
   1. Manufacturers:
      a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
   2. Provide factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
   3. Comply with MFMA-4.
   4. Channel Material:
      a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
   5. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
   6. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.

D. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
   1. Minimum Size, Unless Otherwise Indicated or Required:
      a. Pipingup to 2-inch: 3/8 inch diameter.
      b. Piping larger than 1 inch (27 mm) nominal: 1/2 inch diameter.

E. Thermal Insulated Pipe Supports:
   1. General Construction and 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 inch to 30 inch iron pipes.
      d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by a 360 degree, PVC jacketing.
   2. PVC Jacket:

a. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
b. Thickness: 60 mil.

F. Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.
1. Manufacturers:
a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.
3. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

G. Riser Clamps:
1. Provide copper plated clamps for copper tubing support.
2. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.

H. Strut Clamps: Two-piece pipe clamp.
1. Manufacturers:
a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

I. Insulation Clamps: Two bolt-type clamps designed for installation under insulation.

J. Pipe Hangers: For a given pipe run, use hangers of the same type and material.
1. Manufacturers:
a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
3. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

K. Pipe Shields for Insulated Piping:
1. Manufacturers:
a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
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.

L. Anchors and Fasteners:
1. Manufacturers - Mechanical Anchors:
a. Hilti, Inc: www.us.hilti.com/#sle.
b. Powers Fasteners, Inc: www.powers.com/#sle.
c. Substitutions: See Section 01 60 00 - 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.
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. Comply with MFMA-4.
    b. Channel Material: Use galvanized steel.
    c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

M. Pipe Installation Accessories:
1. Copper Pipe Supports:
    a. Manufacturers:
        1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
        2) Substitutions: See Section 01 60 00 - Product Requirements.
        3) Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by a single manufacturer.
2. PEX Pipe Supports:
    a. Manufacturers:
        1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
        2) Substitutions: See Section 01 60 00 - Product Requirements.
        3) Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by a single manufacturer.

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 anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

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. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

J. Secure fasteners according to manufacturer's recommended torque settings.

K. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - 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

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration-isolated equipment support bases.

1.02 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications.

C. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment.

D. FEMA 413 - Installing Seismic Restraints for Electrical Equipment.

E. FEMA 414 - Installing Seismic Restraints for Duct and Pipe.

F. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; Sheet Metal and Air Conditioning Contractors' National Association.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Include the seal of the Professional Engineer registered in state in which the Project is located, on drawings and calculations which at a minimum include the following:

1.04 QUALITY ASSURANCE

A. Comply with applicable building code.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

3.02 INSTALLATION - SEISMIC

A. Suspended Equipment:

B. Wall mounted Equipment:

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.03 SUBMITTALS

A. See Section 01 30 00 - 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.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Heat Transfer Equipment: Nameplates.

B. Piping: Pipe markers.

C. Pumps: Nameplates.

D. Valves: Tags.

2.02 NAMEPLATES

A. Manufacturers:
   1. Brimar Industries, Inc.: www.pipemarker.com/#sle.
   2. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
   3. Seton Identification Products: www.seton.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Black.
   4. Plastic: Comply with ASTM D709.

2.03 TAGS

A. Manufacturers:
   1. Advanced Graphic Engraving: www.advancedgraphicengraving.com.
   2. Brady Corporation: www.bradycorp.com.
   3. Brimar Industries, Inc.: www.pipemarker.com.
   4. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
   5. Seton Identification Products: www.seton.com.
   6. Substitutions: See Section 01 60 00 - 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 PIPE MARKERS

A. Manufacturers:
   1. Brady Corporation: www.bradycorp.com.
   2. Brimar Industries, Inc: www.pipemarker.com.
   3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
   4. MIFAB, Inc: www.mifab.com.

5. Seton Identification Products: www.seton.com.
6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Color code as follows:
1. Potable, Cooling, Boiler, Feed, Other Water: Green with white letters.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible elastomeric cellular insulation.

B. Flexible removable and reusable blanket insulation.

C. Hydrous calcium silicate insulation.

D. 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.

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

D. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.

E. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

F. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

G. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

H. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

I. ASTM C1695 - Standard Specification for Fabrication of Flexible Removable and Reusable Blanket Insulation for Hot Service.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

K. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.

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: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

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. Comply with requirements in the schedule(s), plan(s), & package accompanying this document.

B. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723, when mounted per ASTM E 2231, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Formaldehyde Free: Third party certified with UL Environment Validation.

D. Recycled Content: A minimum of 50 percent recycled glass content.

E. Biosoluble: As determined by research conducted by the International Agency for Research on Cancer (IARC) and supported by revised reports from the National Toxicology Program (NTP) and the California Office of Environmental Health Hazard Assessment. Certified by European Certification Board for Mineral Wool Products (EUCEB).

F. Low Emitting Materials: For all thermal and acoustical applications of Glass Mineral Wool Insulation Products, provide materials complying with the testing and products requirements of UL GREENGUARD Gold Certification.

G. Products shall not contain, asbestos, lead, mercury, or mercury compounds if possible. Products shall be Certified UL GREENGUARD Gold or Indoor Advantage Gold.

H. Insulation materials applied to carbon steel shall be Mass Load Corrosion Rate (MLCR) tested per ASTM 1617.

I. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.

J. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

2.02 GLASS MINERAL WOOL, BLANKET

A. Manufacturer:
   1. CertainTeed Corporation[<>]: www.certainteed.com.
   2. Johns Manville Corporation[<>]: www.jm.com.
   3. Knauf Insulation[<>]: www.knaufinsulation.com.
   4. Owens Corning Corp[<>]: www.owenscorning.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulation: ASTM C 553, Types I, II, and III; ASTM C 1136 Type II, and ASTM C 1290, Type I. ; Glass mineral wool bonded with a bio-based thermosetting resin.
   1. UL GREENGUARD Gold certified and UL Environment Validated to be formaldehyde free.
   2. Product shall contain no polybrominated diphenyl ethers (PBDE) such as Penta-BDE, Octa-BDE or Deca-BDE
   3. Comply with ASTM C 1290, Type I.

2.03 FLEXIBLE REMOVABLE AND REUSABLE BLANKET INSULATION

A. Manufacturers:
   1. Auburn Manufacturing Inc: www.auburnmfg.com/#sle.

B. Insulation: ASTM C553 Type V; flexible, noncombustible.
   1. Comply with ASTM C1695.
   2. K Value: 0.37 at 100 degrees F, when tested in accordance with ASTM C177 or ASTM C518.

3. Minimum Service Temperature: 32 degrees F.
4. Maximum Service Temperature: 500 degrees F.
5. Maximum Water Vapor Absorption: Less than 5.0 percent by weight.
6. Color: Green.
7. Weight: 7.65 oz/sq ft.
8. Effective Thickness: 1.25 plus/minus 0.25 inch.

2.04 GLASS MINERAL WOOL, BOARD

A. Manufacturer:
1. CertainTeed Corporation: www.certainteed.com.
2. Johns Manville Corporation: www.jm.com.
3. Knauf Insulation: www.knaufinsulation.com.
4. Owens Corning Corp: www.owenscorning.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulation: UL/ULC Classified unfaced, Comply with ASTM C 612, Type IA or Type IB; Glass mineral wool bonded with a bio-based thermosetting resin. For equipment applications, provide insulation with factory-applied jacket when indicated.
1. UL GREENGUARD Gold certified and UL Environment Validated to be formaldehyde free.
2. Product shall contain no polybrominated diphenyl ethers (PBDE) such as Penta-BDE, Octa-BDE or Deca-BDE

2.05 HYDROUS CALCIUM SILICATE INSULATION

A. Manufacturers:
1. Johns Manville Corporation: www.jm.com.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C533; rigid molded, asbestos free, gold color.
1. K Value: 0.40 at 300 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
2. Maximum Service Temperature: 1200 degrees F.
3. Density: 15 pcf.

C. Tie Wire: 0.048 inches stainless steel with twisted ends on maximum 12 inch centers.

D. Insulating Cement: ASTM C449.

2.06 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
1. Aeroflex USA, Inc: www.aeroflexusa.com.
2. Armacell LLC: www.armacell.us.
3. K-Flex USA LLC: www.kflexusa.com.
4. Substitutions: See Section 01 60 00 - 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.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.07 JACKETING AND ACCESSORIES

A. PVC Plastic:
1. Manufacturers:
a. Johns Manville Corporation: www.jm.com.
b. Substitutions: See Section 01 60 00 - Product Requirements.
2. 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.

3. Covering Adhesive Mastic: Compatible with insulation.

B. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire-retardant lagging adhesive.
1. Lagging Adhesive: Compatible with insulation.

C. 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.
6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment has been tested and defects repaired / replaced 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. For fiberglass insulated equipment containing fluids below ambient temperature, provide vapor barrier jackets, factory-applied or field-applied, and 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. Fiberglass insulated equipment containing fluids above ambient temperature: Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Finish with glass cloth and adhesive.

K. Inserts and Shields:
1. Application: Equipment 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between hangers and inserts.
3. Insert location: Between support shield and equipment and under the finish jacket.
4. Insert configuration: Minimum 6 inches long, of same thickness and contour as 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.

L. Finish insulation at supports, protrusions, and interruptions.

M. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting, PVC jacket and fitting covers, or aluminum jacket.

N. Exterior Applications:
   1. Provide vapor barrier jacket or finish with glass mesh reinforced vapor barrier cement.
   2. Cover with aluminum.

O. Cover Glass Wool insulation with metal mesh and finish with heavy coat of insulating cement.

P. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

Q. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - 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.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric].

D. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

E. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.

F. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.

G. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

H. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.

I. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.

J. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

K. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

L. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber.

M. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

N. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

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.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

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

A. Manufacturers:
   1. CertainTeed Corporation: www.certainteed.com.
   2. Johns Manville Corporation: www.jm.com.
   3. Knauf Insulation: www.knaufusa.com.
   4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.ocbuildingspec.com/#sle.
   5. Substitutions: See Section 01 60 00 - 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; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
   1. K Value: ASTM C177, 0.23 at 75 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

D. 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.

E. 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.

F. Vapor Barrier Lap Adhesive: Compatible with insulation.

G. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

H. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

I. Outdoor Breather Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

J. Insulating Cement: ASTM C449.

2.03 CELLULAR GLASS

A. 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.

2.04 EXPANDED POLYSTYRENE

A. Insulation: ASTM C578; rigid closed cell.
   1. K Value: 0.23 at 75 degrees F.
   2. Maximum Service Temperature: 165 degrees F.
   3. Maximum Water Vapor Permeance: 5.0 perms.

2.05 POLYETHYLENE

A. Insulation: Flexible closed-cell polyethylene tubing, slit lengthwise for installation, complying with applicable requirements of ASTM D1056.
   1. K Value: ASTM C177; 0.25 at 75 degrees F.
   2. Maximum Service Temperature: 200 degrees F.
   3. Density: 2 lb/cu ft.
   4. Maximum Moisture Absorption: 1.0 percent by volume.

5. Moisture Vapor Permeability: 0.05 perm inch, when tested in accordance with ASTM E96/E96M.
6. Connection: Contact adhesive.

2.06 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
1. Aeroflex USA, Inc: www.aeroflexusa.com.
2. Armacell LLC: www.armacell.us.
3. K-Flex USA LLC: www.kflexusa.com.
4. Substitutions: See Section 01 60 00 - 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.

2.07 JACKETS

A. PVC Plastic.
1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
a. Minimum Service Temperature: 0 degrees F.
b. Maximum Service Temperature: 150 degrees F.
c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
d. Thickness: 10 mil.
e. Connections: Brush on welding adhesive.
2. Covering Adhesive Mastic: Compatible with insulation.

B. ABS Plastic:
1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
a. Minimum Service Temperature: Minus 40 degrees F.
b. Maximum Service Temperature: 180 degrees F.
c. Moisture Vapor Permeability: 0.012 perm inch, when tested in accordance with ASTM E96/E96M.
d. Thickness: 30 mil.
e. Connections: Brush on welding adhesive.

C. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.

D. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
1. Thickness: 0.016 inch sheet.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

E. 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. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

D. 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.

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.

H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.

I. 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.

J. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

K. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 SCHEDULES

A. Plumbing Systems:
   1. Domestic Hot Water Supply: Insulate all, thickness as per applicable codes
   2. Domestic Hot Water Recirculation: Insulate all, thickness as per applicable codes
   3. Domestic Cold Water: Insulate all, thickness as per domestic hot water supply

END OF SECTION

PART 1 GENERAL

1.01 DESCRIPTION

A. The purpose of commissioning is to ensure that the work has been completed as specified and that systems are functioning in the manner as described in Division 22 Section, is installed per the contract documents, and operates per Sequence of Operations (SOO).

B. The steps associated with commissioning are outlined in Section 01 9113 PART- 3.

C. The members of the commissioning team consist of the contracted Commissioning Authority (CxA), the Owner's Representative/Construction Manager (CM), the General Contractors Commissioning Coordinator (GCC), the Architect and design Engineers (A/E), the Mechanical Contractor (MC), the Electrical Contractor (EC), the testing and balancing (TAB) contractor, the Control Contractor (CC), the facility operating staff, and any other installing subcontractors or suppliers of equipment. All team members work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.

1.02 RELATED DOCUMENTS

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

B. Related Requirements:
   1. 01 9113 – COMMISSIONING GENERAL REQUIREMENTS

1.03 SYSTEMS TO BE COMMISSIONED

A. Commissioning will be performed on the following systems:
   1. Domestic Hot Water Systems
   2. Domestic Hot Water Circulating Pumps and Controls
   3. Mixing and Tempering valves
   4. Natural Gas Meter Monitoring
   5. Domestic Water Meter Monitoring

PART 2 PRODUCTS

2.01 REFER TO SECTION 01 9113, GENERAL COMMISSIONING REQUIREMENTS, PART 2 – PRODUCTS.

PART 3 EXECUTION

3.01 COMMISSIONING PROCESS AND PROCEDURES

A. Refer to Section 01 9113, GENERAL COMMISSIONING REQUIREMENTS, Part 3 – EXECUTION.

3.02 GENERAL TESTING REQUIREMENTS

A. The Contractor and/or Subcontractors shall be responsible for performing procedures presented in specification and contract drawings as detailed in the Functional Performance Tests (FPT). Members of the designated Commissioning Team shall witness various portions of the commissioning process. Responsibilities for these activities are listed in the following paragraphs. Commissioning Team members shall sign-off on appropriate sections after verifying installation, operation, or documentation. Final acceptance shall be decided by the CM and the CxA.

B. Any test ports, gauges, test equipment, etc., needed to accomplish the functional performance tests shall be provided by Contractor and/or Subcontractors.

C. The Contractor and/or Subcontractor will smoke test all sanitary and chemical waste and vent systems to ensure that there are no leaks. The subcontractor will provide a test plan to the CxA and design team at a minimum of 4 weeks prior to performing test. The subcontractor will coordinate smoke test with the contractor's coordinator at least 3 weeks in advance so that the CxA can be present to witness.

D. Contractor and/or Subcontractors shall provide to the Commissioning Team documentation of calibration of controls. Documentation shall include dates, setpoints, calibration coefficients, control loop verification, and other data required to verify system check-out. Documentation shall be dated and initialed by field engineer or technician performing the work.

3.03 OPERATIONAL AND STAFF TRAINING

A. System narrative descriptions will be prepared by the CxA and contractor and should be supported by flow diagrams, one-line diagrams, and appropriate specification sections for major systems to be commissioned.

B. The Contractor and/or Subcontractor and associated manufacturer's representatives shall provide required training to operational staff after the system description meetings have occurred. The Subcontractor training sessions will provide a more detailed analogy of systems operation and maintenance.

3.04 INSTRUMENTATION

A. Instrumentation will be provided by the Contractor and/or Subcontractor. Instruments used for measurements shall be accurate. Calibration histories for each instrument shall be available for examination. Calibration and maintenance of instruments shall be in accordance with the requirements of NEBB or AABC Standards.

B. Application of instruments and accuracy of measurements shall be in accordance with NEBB or AABC Standards.

3.05 DOCUMENTATION

A. The GCC shall be responsible for collection of pertinent data during system start-up and functional performance testing. The Subcontractor shall submit to the CxA documentation of tests performed prior to and after system start-up. Documentation shall also include start-up procedures as approved by Commissioning Team.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Sanitary sewer.
   2. Domestic water.
   3. Flanges, unions, and couplings.
   4. Pipe hangers and supports.
   5. Valves.
   6. Check.

1.02 RELATED REQUIREMENTS

A. Section 08 31 00 - Access Doors and Panels.

1.03 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems.

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

D. ASME B31.9 - Building Services Piping.

E. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers.

F. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems.

G. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.

H. ASTM B32 - Standard Specification for Solder Metal.

I. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.

J. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

K. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric).

L. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.

M. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.

N. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

O. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

P. ASTM F628 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core.

Q. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.

R. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications.

S. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

T. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements.

U. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements.

V. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements.

W. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.

X. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

Y. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

Z. NSF 61 - Drinking Water System Components - Health Effects.

AA. NSF 372 - Drinking Water System Components - Lead Content.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Product Data: Provide information for all piping systems.

D. Shop Drawings: All Plumbing Systems
1. Fabrication, assembly and installation, including plans, elevations, sections, components and attachments to other work.
2. Pipes and fittings.
3. Piping layout indicating sizes, configuration, and insulation material.
4. Elevation of top of pipes.
5. Dimensions of all piping mains from building grid lines.
6. Fittings.
7. Penetrations through fire-rated and other partitions.
8. Equipment installation based on equipment being used on Project.
9. Locations for all piping accessories.
10. Hangers and supports, including methods for piping and building attachment, seismic restraints and vibration isolation.

E. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. 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, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 extra heavy weight.
1. Fittings: Cast iron.
2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless.
1. Fittings: Cast iron.

2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

C. ABS Pipe: ASTM F628.
1. Fittings: ABS.
2. Joints: Solvent welded with ASTM D2235 cement.

2.03 SANITARY SEWER 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. Cast Iron Pipe: CISPI 301, hubless, service weight.
1. Fittings: Cast iron.
2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Pipe: ASTM B42, hard drawn.
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
2. Joints: ASTM B32, alloy Sn95 solder.

2.05 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.

2.06 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
1. Ferrous Pipe: Class 150 malleable iron threaded unions.
2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.07 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
3. Trapeze Hangers: Welded steel channel frames attached to structure.
4. Vertical Pipe Support: Steel riser clamp.

B. Plumbing Piping - Drain, Waste, and Vent:
1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

C. Plumbing Piping - Water:
1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
2. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
6. Other Types: As required.

2.08 BALL VALVES

A. Manufacturers:

1. Grinnell Products, a Tyco Business: www.grinnell.com.
2. Nibco, Inc: www.nibco.com.
3. Uponor, Inc: www.uponorengineering.com/sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

2.09 PIPING SPECIALTIES

A. Flow Controls:
1. Manufacturers:
a. ITT Bell & Gossett: www.bellgossett.com.
b. Griswold Controls: www.griswoldcontrols.com.
c. Taco, Inc: www.taco-hvac.com.
d. Substitutions: See Section 01 60 00 - Product Requirements.
2. 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.
3. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

B. WATER PRESSURE REDUCING VALVES
1. Manufacturers:
a. Amtrol Inc: www.amtrol.com.
b. Cla-Val Company: www.cla-val.com.
c. Watts Regulator Company: www.wattsregulator.com.
d. Substitutions: See Section 01 60 00 - Product Requirements.
2. Up to 2 Inches:
a. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.
3. Over 2 Inches:
a. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.

C. RELIEF VALVES
1. Temperature and Pressure:
a. Manufacturers:
1) Cla-Val Co: www.cla-val.com.
2) Henry Technologies: www.henrytech.com.
3) Watts Regulator Company: www.wattsregulator.com.
4) Substitutions: See Section 01 60 00 - Product Requirements.
b. ANSI Z21.22, AGA certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME BPVC-IV certified and labelled.

D. STRAINERS
1. Manufacturers:
a. Armstrong International, Inc: www.armstronginternational.com.
b. Green Country Filter Manufacturing: www.greencountryfilter.com.
c. WEAMCO: www.weamco.com.
d. Substitutions: See Section 01 60 00 - Product Requirements.
2. Size 2 Inches and Under:
a. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
b. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
3. Size 1-1/2 inch to 4 inches:

a. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

C. Install piping to maintain headroom, conserve space, and not interfere with use of space.

D. Group piping whenever practical at common elevations.

E. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

F. Provide access where valves and fittings are not exposed.
   1. Coordinate size and location of access doors with Section 08 31 00.

G. Prepare exposed, unfinished pipe, fittings, supports, and accessories for finish painting.

H. 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.

I. Sleeve pipes passing through partitions, walls, and floors.

J. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   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.

3.04 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Provide spring-loaded check valves on discharge of water pumps.

3.05 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed, and clean.

3.06 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer.

1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Drains.

B. Cleanouts.

C. Hose bibbs.

D. Washing machine boxes and valves.

E. Backflow preventers.

F. Water hammer arrestors.

G. Mixing valves.

1.02 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor and Trench Drains.

B. ASME A112.6.4 - Roof, Deck, and Balcony Drains.

C. ASSE 1011 - Hose Connection Vacuum Breakers.

D. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers.

E. NSF 61 - Drinking Water System Components - Health Effects.

F. NSF 372 - Drinking Water System Components - Lead Content.

G. PDI-WH 201 - Water Hammer Arresters.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

D. Certificates: Certify that grease interceptors meet or exceed specified requirements.

E. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

1.04 QUALITY ASSURANCE

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

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 DRAINS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
   2. Josam Company: www.josam.com/#sle.
   3. Zurn Industries, LLC: www.zurn.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Roof Drains:
   1. Assembly: ASME A112.6.4.
   2. Body: Lacquered cast iron with sump.

3. Strainer: Removable polyethylene dome with vandal proof screws.

C. Floor Drain (FD-1):
1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

2.03 CLEANOUTS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
2. Josam Company: www.josam.com.
3. Zurn Industries, LLC: www.zurn.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Cleanouts at Exterior Surfaced Areas (CO-1):
1. Round cast nickel bronze access frame and non-skid cover.

C. Cleanouts at Exterior Unsurfaced Areas (CO-2):
1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

D. Cleanouts at Interior Finished Floor Areas (CO-3):
1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

E. Cleanouts at Interior Finished Wall Areas (CO-4):
1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

F. Cleanouts at Interior Unfinished Accessible Areas (CO-5): Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.04 HOSE BIBBS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
2. Watts Regulator Company: www.wattsregulator.com.
3. Zurn Industries, LLC: www.zurn.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Interior Hose Bibbs:
1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with handwheel, integral vacuum breaker in compliance with ASSE 1011.

C. Interior Mixing Type Hose Bibbs:
1. Bronze or brass, wall mounted, double service faucet with hose thread spout, integral stops, chrome plated where exposed with handwheels, and vacuum breaker in compliance with ASSE 1011.

2.05 BACKFLOW PREVENTERS

A. Manufacturers:
1. Conbraco Industries, Inc: www.apollovalves.com.
2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com.
3. Zurn Industries, LLC: www.zurn.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Reduced Pressure Backflow Preventers:
1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

2.06 WATER HAMMER ARRESTORS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
   2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com.
   3. Zurn Industries, LLC: www.zurn.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Water Hammer Arrestors:
   1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F and maximum 250 psi working pressure.

2.07 MIXING VALVES

A. Thermostatic Mixing Valves:
   1. Manufacturers:
      a. ESBE: www.esbe.se/en.
      b. Honeywell International Inc: yourhome.honeywell.com.
      c. Leonard Valve Company: www.leonardvalve.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Valve: Chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.
   3. Accessories:
      a. Check valve on inlets.
      b. Volume control shut-off valve on outlet.
      c. Stem thermometer on outlet.
      d. Strainer stop checks on inlets.
   4. Cabinet: 16 gage, 0.0598 inch prime coated steel, for recessed mounting with keyed lock.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Pipe relief from backflow preventer to nearest drain.

F. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatory sinks or washing machine outlets.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water Heaters:
   1. Commercial gas fired.

B. In-line circulator pumps.

1.02 RELATED REQUIREMENTS

A. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code.

B. UL 778 - Standard for Motor-Operated Water Pumps.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.

B. Product Data:
   1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Indicate pump type, capacity, power requirements.
   3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
   4. Provide electrical characteristics and connection requirements.

C. Shop Drawings:
   1. Indicate heat exchanger dimensions, size of tappings, and performance data.
   2. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

E. Project Record Documents: Record actual locations of components.

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. Certifications:
   1. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

C. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.01 OWNER-FURNISHED PRODUCTS

A. New Products: Dental equipment, including but not limited to dental air, dental vacuum, dental alarms, dental chairs..

2.02 WATER HEATERS

A. Manufacturers:

1. A.O. Smith Water Products Co: www.hotwater.com.
2. HTP: www.htproducts.com
3. Intellihot: www.intellihot.com
4. Rheem Manufacturing Company: www.rheem.com.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Commercial Gas Fired:
   1. Type: Automatic, natural gas-fired or propane fired, condensing tankless.
   2. Product: Unit shall be wall mounted and vented with PVC.
   3. Performance:
      a. Water heater(s) design certified to the ANSI Z21.10.3 standard for gas fired water heaters.
      b. Water Heater(s) shall be configured to operate with natural gas and a 120 volt/60 Hz AC power source.
      c. Water Heater(s) shall have a BTU input range of 15,000 BTU/hr to 199,000 BTU/hr, and a maximum hot water outlet capacity of 8.0 gallons per minute (with a 30 °F temperature rise).
      d. Water Heater(s) shall be microprocessor controlled and utilize a direct electronic ignition system (with no standing pilot), fully modulating gas control valve, turbine flow meter, automatic electro-mechanical water flow control valve, and water temperature thermistors to maintain outlet water temperature between ± 2 °F of set point temperature. Microprocessor shall have built in recirculation logic to control a pump's heating cycles.
      e. Water Heater(s) shall incorporate the following internal safety devices: flame failure lockout, boiling protection lockout, thermal overheat protection, internal freeze protection for ambient temperatures as low as – 4 °F, and lockout protection in the event of a blocked flue.
      f. Water Heater(s) shall be provided with a temperature thermostat with an adjustable set point range of 98 °F to 185 °F.
      g. Water Heater(s) shall also be capable of storing and displaying a history of up to 9 diagnostic maintenance codes, via the display on the temperature thermostat controller.
      h. Water Heater(s) shall have downward fired fiber mesh burners, solid brass water flow control valve, and solid brass inlet and outlet water connections.

C. Commercial Gas Fired:
   1. Type: Automatic, natural gas-fired, tank type.
   2. Controls: Automatic water thermostat with temperature range adjustable from 120 to 180 degrees F, automatic reset high temperature limiting thermostat factory set at 195 degrees F, gas pressure regulator, multi-ribbon or tubular burner, 100 percent safety shut-off pilot and thermocouple, flue baffle and draft hood.

D. Commercial Electric:
   1. Tank: Glass lined welded steel; 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.
   2. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F, flanged or screw-in nichrome elements, high temperature limit thermostat.
   3. Accessories:
      a. Water Connections: Brass.
      b. Drain valve.
      c. Anode: Magnesium.
      d. Temperature and Pressure Relief Valve: ASME labeled.

2.03 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:
   1. Armstrong Fluid Technology: www.armstrongfluidtechnology.com.

2. Bell & Gossett, a xylem brand: www.bellgossett.com.
3. Sterling SIHI GmbH: www.sterlingsihi.com.
4. Grunfos Pumps.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Casing: Stainless Steel or Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.

C. Impeller: Stainless Steel or Bronze.

D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.

E. Seal: Carbon rotating against a stationary ceramic seat.

F. Drive: Flexible coupling.

2.04 ELECTRICAL WORK

A. Provide electrical motor driven equipment specified complete with motors, motor starters, controls, and wiring.

B. Electrical characteristics to be as specified or indicated.

C. Supply manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices not shown.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related electrical work to achieve operating system.

C. Pumps:
1. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.
2. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water closets.

B. Urinals.

C. Lavatories.

D. Sinks.

E. Service sinks.

F. Under-lavatory pipe supply covers.

G. Electric water coolers.

H. Showers.

1.02 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping.

B. Section 22 10 06 - Plumbing Piping Specialties.

C. Section 22 30 00 - Plumbing Equipment.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

B. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use.

C. ASME A112.18.1 - Plumbing Supply Fittings.

D. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures.

E. ASME A112.19.2 - Ceramic Plumbing Fixtures.

F. ASME A112.19.3 - Stainless Steel Plumbing Fixtures.

G. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping.

H. ASTM D570 - Standard Test Method for Water Absorption of Plastics.

I. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.

J. ASTM D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between - 30 C and 30 C with a Vitreous Silica Dilatometer.

K. ASTM D785 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials.

L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

M. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

N. ICC A117.1 - Accessible and Usable Buildings and Facilities.

O. NSF 61 - Drinking Water System Components - Health Effects.

P. NSF 372 - Drinking Water System Components - Lead Content.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

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. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 REGULATORY REQUIREMENTS

A. Comply with applicable codes for installation of plumbing systems.

B. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of installation.

2.03 FLUSH VALVE WATER CLOSETS

A. Water Closets: Vitreous china, ASME A112.19.2, wall hung, siphon jet flush action, china bolt caps.
   1. Bowl: ASME A112.19.2; 16.5 inches high with elongated rim.
   2. Flush Valve: Exposed (top spud).
   3. Flush Operation: Sensor operated.
   4. Handle Height: 44 inches or less.
   5. Supply Size: 1-1/2 inches.
   6. Manufacturers:
      a. American Standard, Inc: www.americanstandard-us.com.
      b. Gerber Plumbing Fixtures LLC: www.gerberonline.com.
      c. Kohler Company: www.kohler.com.
      d. Zurn Industries, Inc: www.zurn.com.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

B. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
   1. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.
   2. Manufacturers:
      a. American Standard, Inc: www.americanstandard-us.com.
      b. Delany Products: www.delanyvalve.com.
      c. Sloan Valve Company: www.sloanvalve.com.
      d. Zurn Industries, Inc: www.zurn.com.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

C. Seats:
   1. Manufacturers:
      a. American Standard, Inc: www.americanstandard-us.com.
      b. Bemis Manufacturing Company: www.bemismfg.com.
      c. Zurn Industries, Inc: www.zurn.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, with cover.

D. Water Closet Carriers:
   1. 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 WALL HUNG URINALS

A. Wall Hung Urinal Manufacturers:
   1. American Standard, Inc: www.americanstandard-us.com.
   2. Gerber Plumbing Fixtures LLC: www.gerberonline.com.
   3. Kohler Company: www.kohler.com.

4. Zurn Industries, Inc; EcoVantage Z5798 High-Efficiency Urinal System: www.zurn.com/#sle.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Urinals: Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.
1. Flush Volume: 1.0 gallons, maximum.
2. Flush Valve: Exposed (top spud).
3. Flush Operation: Sensor operated.
4. Trap: Integral.
5. Removable stainless steel strainer.
6. Supply Size: 3/4 inch.
7. Outlet Size: 2 inches.

C. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
1. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.
2. Manufacturers:
a. American Standard, Inc: www.americanstandard-us.com.
b. Sloan Valve Company: www.sloanvalve.com.
c. Zurn Industries, Inc: www.zurn.com.
d. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 LAVATORIES

A. Lavatory Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com.
2. Kohler Company: www.kohler.com.
3. Zurn Industries, Inc: www.zurn.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Vitreous China Wall Hung Basin: ASME A112.19.2; vitreous china wall hung lavatory, Size as per plans minimum, with 4 inch high back, rectangular basin with splash lip, front overflow, and soap depression.

C. Supply Faucet Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com.
2. Kohler Company: www.kohler.com.
3. Zurn Industries, Inc: www.zurn.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

D. Supply Faucet: ASME A112.18.1; chrome plated combination supply fitting with pop-up waste, water economy aerator with maximum flow of 0.5 gallon per minute (low-flow), indexed handles.

2.06 SINKS

A. Sink Manufacturers:
1. Elkay.
2. Franke.
3. Just.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Single Compartment Bowl: ASME A112.19.3; see drawings by see drawings by see drawings inch outside dimensions 20 gage, 0.0359 inch thick, Type 302 stainless steel, self rimming and undercoated, with ledge back drilled for trim.

2.07 UNDER-LAVATORY PIPE SUPPLY COVERS

A. General:
1. Insulate exposed drainage piping including hot, cold and tempered water supplies under lavatories or sinks per ADA Standards.
2. Adhesives, sewing threads and two ply laminated materials are prohibited.

3. Exterior Surfaces: Smooth nonabsorbent with no finger recessed indentations for easy cleaning.
4. Construction: 1/8 inch PVC with antimicrobial, antifungal and UV resistant properties.
   a. Comply with ASTM E84 for flame and smoke development.
   b. Comply with ASTM C1822 Type III for covers on accessible lavatory piping.
   c. Comply with ASME A112.18.9 for covers on accessible lavatory piping.
   d. Comply with ICC A117.1.

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.

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.

3.04 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.05 CLEANING

A. Clean plumbing fixtures and equipment.

3.06 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Repair or replace damaged products before Date of Substantial Completion.

3.07 SCHEDULES

A. Fixture Heights: Install fixtures to heights above finished floor as indicated.
   1. Water Closet:
      a. Accessible: 18 inches to top of seat.
   2. Lavatory:
      a. Accessible: 34 inches to top of basin rim.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cleaning of HVAC duct system, equipment, and related components.

1.02 DEFINITIONS

A. HVAC System: For purposes of this section, the surfaces to be cleaned include all interior surfaces of the heating, air-conditioning, and ventilation system from the points where the air enters the system to the points where the air is discharged from the system, including the inside of air distribution equipment, coils, and condensate drain pans; see NADCA ACR for more details, and is limited to the project area as outlined in the mechanical drawings.
   1. The existing above-ceiling and exposed ductwork for supply air is required to be cleaned.
   2. The existing above-ceiling and exposed ductwork for return air is required to be cleaned.

1.03 REFERENCE STANDARDS

A. NADCA ACR - The NADCA Standard for Assessment, Cleaning, and Restoration of HVAC System.

B. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors.

C. UL 181A - Closure Systems for Use with Rigid Air Ducts.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.

C. Qualifications Statement: Submit qualifications of proposed cleaning contractor for approval.

D. Project Cleanliness Evaluation and Cleaning Plan, as specified.

E. Material Safety Data Sheets (MSDS): For all chemical products proposed to be used in the cleaning process; submit directly to Owner.

F. Project Closeout Report: Include field quality control reports, evidence of satisfactory cleaning, and documentation of items needing further repair.

1.05 QUALITY ASSURANCE

A. Information Available to Contractor: No existing system documentation is available. Conduct field investigation to determine scope of existing ductwork.

B. Cleaning Contractor Qualifications: Company specializing in the cleaning and restoration of HVAC systems as specified in this section.
   1. Certified by one of the following:
      a. NADCA, National Air Duct Cleaners Association: www.nadca.com.
      b. Nationally recognized certification program and organization dedicated to the cleaning of HVAC systems.
   2. Having minimum of three years documented experience.
   3. Acceptable Cleaning Contractors:
      a. Contractor meeting the requirements listed herein
      b. Better Air Northwest
      c. Willard Power Vac
      d. Ductz
      e. AdvantaClean of Southwest Washington
      f. Or Approved Equal

PART 2 PRODUCTS

2.01 TOOLS AND EQUIPMENT

A. Vacuum Devices and Other Tools: Exceptionally clean, in good working order, and sealed when brought into the facility.

B. Vacuum Devices That Exhaust Air Inside Building, Including Hand-Held and Wet Vacuums: Equipped with HEPA filtration with 99.97 percent collection efficiency for minimum 0.3-micron size particles and DOP test number.

C. Vacuum Devices That Exhaust Air Outside Building, Including Truck- and Trailer-Mounted Types: Equipped with particulate collection including adequate filtration to contain debris removed from the HVAC system; exhausted in manner that prevents contaminant re-entry to building; compliant with applicable regulations as to outdoor environmental contamination.

2.02 SURFACE TREATMENTS

A. Anti-Microbial Materials: EPA registered specifically for use on non-porous HVAC system surfaces and applied per manufacturer's instructions.

PART 3 EXECUTION

3.01 PROJECT CONDITIONS

A. Comply with applicable federal, state, and local requirements.

B. Perform cleaning, inspection, and remediation in accordance with the recommendations of NADCA "Assessment, Cleaning and Restoration of HVAC Systems" (ACR) and as specified herein.

C. Where NADCA ACR uses the terms "recommended", "highly recommended", or "ideally" in regard to a certain procedure or activity, do that unless it is clearly inapplicable to the project.

D. Take precautions to prevent introduction of additional hazards into occupied spaces.

E. Obtain Owner's approval of proposed temporary locations for large equipment.

F. Designate a decontamination area and obtain Owner's approval.

G. When portions of the facility are to remain occupied or in operation during cleaning activities, provide adequate controls or containment to prevent access to spaces being cleaned by unauthorized persons and provide detailed instructions to Owner as to these controls or containment.

H. If unforeseen mold or other biological contamination is encountered, notify Architect immediately, identifying areas affected and extent and type of contamination.

3.02 EXAMINATION

A. Inspect the system as required to determine appropriate methods, tools, equipment, and protection.

B. Start of cleaning work constitutes acceptance of existing conditions.

C. When concealed spaces are later made accessible, examine and document interior conditions prior to beginning cleaning.

D. Document all instances of mold growth, rodent droppings, other biological hazards, and damaged system components.

3.03 PREPARATION

A. When cleaning work might adversely affect life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with authorities having jurisdiction.

B. Ensure that electrical components that might be adversely affected by cleaning are de-energized, locked out, and protected prior to beginning work.

C. Air-Volume Control Devices: Mark the original position of dampers and other air-directional mechanical devices inside the HVAC system prior to starting cleaning.

D. Access to Concealed Spaces: Use existing service openings and make additional service openings as required to accomplish cleaning and inspection.
   1. Do not cut openings in non-HVAC components without obtaining the prior approval of Owner.

2. Make new openings in HVAC components in accordance with NADCA Standard 05; do not compromise the structural integrity of the system. Openings to be made by HVAC contractor.
3. Do not cut service openings into flexible duct; disconnect at ends for cleaning and inspection.

E. Ceiling Tile: Lay-in ceiling tile may be removed to gain access to HVAC systems during the cleaning process; protect tile from damage and reinstall upon completion; replace damaged tile.

3.04 CLEANING

A. Use any cleaning method recommended by NADCA ACR unless otherwise specified; do not use methods prohibited by NADCA ACR, or that will damage HVAC components or other work, or that will significantly alter the integrity of the system.

B. Obtain Owner's approval before using wet cleaning methods; ensure that drainage is adequate before beginning.

C. Ducts: Mechanically clean all portions of existing ducts to remain.

D. Hoses, Cables, and Extension Rods: Clean using suitable sanitary damp wipes at the time they are being removed or withdrawn from their normal position.

E. Collect debris removed during cleaning; ensure that debris is not dispersed outside the HVAC system during the cleaning process.

3.05 REPAIR

A. Repair openings cut in the ventilation system so that they do not significantly alter the airflow or adversely impact the facility's indoor air quality. Opening repairs to be conducted by HVAC contractor.

B. At insulated ducts and components, accomplish repairs in such a manner as to achieve the equivalent thermal value.

C. Reseal new openings in accordance with NADCA Standard 05 or SMACNA duct construction standards.

D. Reseal rigid fiber glass duct systems using closure techniques that comply with UL 181 or UL 181A.

E. When new openings are intended to be capable of being re-opened in the future, clearly mark them and report their locations to Owner in project report documents.

3.06 FIELD QUALITY CONTROL

A. Ensure that the following field quality control activities are completed prior to application of any treatments or coatings and prior to returning HVAC system to normal operation.

B. Visually inspect all portions of the cleaned components; if not visibly clean as defined in NADCA ACR, re-clean and reinspect.

C. Notify Architect when cleaned components are ready for inspection, and provide a report with photos of cleaned ductwork.

D. When directed, re-clean components until they pass.

E. Submit evidence that all portions of the system required to be cleaned have been cleaned satisfactorily.

3.07 ADJUSTING

A. After satisfactory completion of field quality control activities, restore adjustable devices to original settings, including, but not limited to, dampers, air directional devices, valves, fuses, and circuit breakers.

3.08 WASTE MANAGEMENT

A. Double-bag waste and debris in 6 mil, 0.006 inch thick polyethylene plastic bags.

B. Dispose of debris off-site in accordance with applicable federal, state and local requirements.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General construction and requirements.

B. Applications.

C. Single phase electric motors.

1.02 REFERENCE STANDARDS

A. NEMA MG 00001 - Motors and Generators.

B. NFPA 70 - National Electrical Code.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

C. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than 1/2 horsepower.

D. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

E. Operation Data: Include instructions for safe operating procedures.

F. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.04 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of high efficiency motors.

C. 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.

PART 2 PRODUCTS

2.01 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 104 degrees F environment.
   3. Design for temperature rise in accordance with NEMA MG 00001 limits for insulation class, service factor, and motor enclosure type.

B. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

C. Wiring Terminations:
   1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
   2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.02 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.

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

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components.

B. Retrofit piping cover system.

1.02 RELATED REQUIREMENTS

A. Section 23 05 48 - Vibration and Seismic Controls for HVAC.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

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

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General - Purpose Piping.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.

H. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

I. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

K. FM (AG) - FM Approval Guide.

L. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

M. NFPA 101 - Life Safety Code.

N. UL (DIR) - Online Certifications Directory.

O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

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 Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.05 SUBMITTALS

A. See Section 01 30 00 - 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.
   1. Fiberglass Channel (Strut) Framing Systems: Include requirements for strength derating according to ambient temperature.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

1.06 QUALITY ASSURANCE

A. Comply with applicable building code.

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 the manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 2. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Prefabricated Trapeze-Framed Metal Strut Systems:
   1. 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.
   2. Accessories: Provide bracket covers, cable basket clips, cable tray clips, clamps, conduit clamps, fire-retarding brackets, j-hooks, protectors, and vibration dampeners.

C. Prefabricated Trapeze-Framed Fiberglass Strut Systems:
   1. MSS SP-58 type 59, prefabricated continuous-slot fiberglass strut channel, associated fittings, and related accessories.
   2. Flammability: Fire retardant with NFPA 101, Class A flame spread index (maximum of 25) when tested in accordance with ASTM E84; self-extinguishing in accordance with ASTM D635.

D. Hanger Rods:
   1. Threaded zinc-plated steel unless otherwise indicated.

E. Steel Cable

F. Cable Hanging System Kits:
   1. Provide cable-wire in bulk or precut lengths with respective cable hangers as required to hold minimum weight of 120 lb.

G. 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.

H. 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.

I. 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.

J. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
1. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
2. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
3. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

K. Pipe Shields for Insulated Piping:
1. General Construction and Requirements:
    a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
    b. Shields Material: UV-resistant polypropylene with glass fill.
    c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
    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.

L. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

2.02 RETROFIT PIPING COVER SYSTEM

A. General Requirements:
1. Surface Burning Characteristics: Flame spread index/smoke developed index of 20/250, maximum, when tested in accordance with ASTM E84 or UL 723.

B. Materials:

1. Piping Cover System: Removal-resistant, modular, snap-fit cover units, clips, and anchors for use with CPVC, steel, and copper piping systems.
2. Cover Units: L-shaped and U-shaped cross-section units of flame retardant resin material, paintable finish.
3. Unit Length: 7.5 feet.
4. Provide coupling fittings for joining units end to end and prefabricated inside and outside corner fittings and end caps as required.
5. Provide mounting clips to secure covers to wall-ceiling per manufacturer requirements.

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 Architect, do not provide support from suspended ceiling support system or ceiling grid.

D. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

F. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

G. Secure fasteners according to manufacturer's recommended torque settings.

H. Remove temporary supports.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolators.

B. Seismic restraint systems.

1.02 REFERENCE STANDARDS

A. ASCE 19 - Structural Applications of Steel Cables for Buildings.

B. MFMA-4 - Metal Framing Standards Publication.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Include the seal of the Professional Structural Engineer registered in the State of Oregon in which the Project is located, on the drawings and calculations which at a minimum include the following:

1.04 QUALITY ASSURANCE

A. Comply with applicable building code.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Kinetics Noise Control, Inc: www.kineticsnoise.com.

B. Mason Industries: www.mason-ind.com.

C. Vibration Eliminator Company, Inc: www.veco-nyc.com.

D. Or Approved Equal.

2.02 VIBRATION ISOLATORS

A. General Requirements:
   1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.

2.03 SEISMIC RESTRAINT SYSTEMS

A. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.

B. Cable Restraints:
   1. Comply with ASCE 19.
   2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
   3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
   4. Use protective thimbles for cable loops where potential for cable damage exists.

C. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials.

1.03 SUBMITTALS

A. See Section 01 30 00 - 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.

PART 2 PRODUCTS

2.01 NAMEPLATES

A. Manufacturers:
   1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com.
   2. Brimar Industries, Inc: www.pipemarker.com.
   3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
   4. Or Approved Equal.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Letter Color: White.

C. Letter Height: 1/4 inch.

D. Background Color: Black.

E. Plastic: Comply with ASTM D709.

2.02 TAGS

A. Manufacturers:
   1. Advanced Graphic Engraving: www.advancedgraphicengraving.com.
   2. Brady Corporation: www.bradycorp.com.
   3. Brimar Industries, Inc: www.pipemarker.com.
   4. Or Approved Equal.
   5. Substitutions: See Section 01 60 00 - 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.

2.03 PIPE MARKERS

A. Manufacturers:
   1. Brady Corporation: www.bradycorp.com.
   2. Brimar Industries, Inc: www.pipemarker.com.
   3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
   4. Or Approved Equal.

B. Color: Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Use tags on piping 3/4 inch diameter and smaller.
   1. Identify service, flow direction, and pressure.
   2. Install in clear view and align with axis of piping.
   3. Locate identification not to exceed 20 feet 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

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Commissioning activities.

1.02 REFERENCE STANDARDS

A. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems.

B. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing.

1.03 SUBMITTALS

A. See Section 01 30 00 - 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 the Commissioning Authority.
   2. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   3. Include at least the following in the plan:
      a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      d. Final test report forms to be used.
      e. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. Field Logs: Submit at least twice a week to the Commissioning Authority.

D. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

E. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. 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 Architect 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.

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. 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. 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.

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 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.

3.04 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. 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.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

3.05 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
1. Manufacturer.
2. Model/Frame.
3. HP/BHP.
4. Phase, voltage, amperage; nameplate, actual, no load.
5. RPM.
6. Service factor.
7. Starter size, rating, heater elements.
8. Sheave Make/Size/Bore.

B. 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.

C. Heating Coils:
1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Water flow, design and actual.
7. Water pressure drop, design and actual.
8. Entering water temperature, design and actual.
9. Leaving water temperature, design and actual.
10. Entering air temperature, design and actual.
11. Leaving air temperature, design and actual.
12. Air pressure drop, design and actual.

D. 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.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

1.02 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

D. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation.

E. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

H. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.04 QUALITY ASSURANCE

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

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.

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. Knauf Insulation: www.knaufinsulation.com.
   2. Johns Manville: www.jm.com.
   3. Owens Corning Corporation: www.ocbuildingspec.com.
   4. CertainTeed Corporation: www.certainteed.com.
   5. Or Approved Equal.

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: 1200 degrees F.
   3. Maximum Water Vapor Absorption: 5.0 percent by weight.

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.

2.03 GLASS FIBER, RIGID

A. Manufacturer:
   1. Knauf Insulation: www.knaufinsulation.com.
   2. Johns Manville: www.jm.com.
   3. Owens Corning Corporation; 700 Series FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.
   4. CertainTeed Corporation: www.certainteed.com.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C612; rigid, noncombustible blanket.
   1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 450 degrees F.
   3. Maximum Water Vapor Absorption: 5.0 percent.
   4. Maximum Density: 8.0 lb/cu ft.

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. Indoor Vapor Barrier Finish:
   1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.
   2. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.04 DUCT LINER

A. Manufacturers:
   1. Knauf Insulation: www.knaufinsulation.com.
   2. Johns Manville: www.jm.com.
   3. Owens Corning Corporation: www.ocbuildingspec.com/sle.
   4. CertainTeed Corporation: www.certainteed.com.
   5. Substitutions: See Section 01 60 00 - 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.

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. 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.

C. 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.

3.03 SCHEDULES

A. Exhaust Ducts Within 10 ft of Exterior Openings: As per Energy Code

B. Outside Air Intake Ducts: As per Energy Code

C. Supply Ducts: Glass Fiber, Flexible: As per Energy Code

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Flexible removable and reusable blanket insulation.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

1.03 REFERENCE STANDARDS

A. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

C. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

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.

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 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
   1. Aeroflex USA, Inc: www.aeroflexusa.com.
   2. Armacell LLC: www.armacell.us.
   3. K-Flex USA LLC: www.kflexusa.com.
   4. Or Approved Equal.

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.

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. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.

3.03 SCHEDULE

A. Heating Systems:
   1. Heating Water Supply and Return:

B. Cooling Systems:
   1. Chilled Water:

END OF SECTION

PART 1 GENERAL

1.01 DESCRIPTION

A. The purpose of commissioning is to ensure that the work has been completed as specified and that systems are functioning in the manner as described in Division 23 Section, is installed per the contract documents, and operate per Sequence of Operations (SOO).

B. The steps associated with commissioning are outlined in Section 01 9113 PART- 3.

C. The members of the commissioning team consist of the contracted Commissioning Authority (CxA), the Owner's Representative/Construction Manager (CM), the General Contractors Commissioning Coordinator (GCC), the Architect and design Engineers (A/E), the Mechanical Contractor (MC), the Electrical Contractor (EC), the testing and balancing (TAB) contractor, the Control Contractor (CC), the facility operating staff, and any other installing subcontractors or suppliers of equipment. All team members work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.

1.02 RELATED DOCUMENTS

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

B. Related Requirements:
   1. 01 9113 – COMMISSIONING GENERAL REQUIREMENTS

1.03 SYSTEMS TO BE COMMISSIONED

A. The section includes commissioning process requirements for all HVAC&R systems, assemblies, and equipment, including but not limited to:
   1. Air Handling, DOAS, Heat Recovery Units, and including VAV distribution systems
   2. Split Cooling Units
   3. Controls and instrumentation, including BAS, EMCS, or DDC system.
   4. Systems TAB verification, including supply-air systems, and exhaust-air systems.

1.04 P2 PRODUCTS:

A. Refer to Section 01 9113, GENERAL COMMISSIONING REQUIREMENTS, Part 2 – PRODUCTS.

PART 3 EXECUTION

2.01 COMMISSIONING PROCESS AND PROCEDURES

A. Refer to Section 01 9113, GENERAL COMMISSIONING REQUIREMENTS Part 3 – EXECUTION.

2.02 GENERAL TESTING REQUIREMENTS

A. Certify that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents and approved Shop Drawings and submittals.

B. Certify that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents and approved Shop Drawings and submittals, and that pretest set points have been recorded.

C. Certify that TAB procedures have been completed and that TAB reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into an operating mode to be tested according to approved test procedures (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment, and components, including operational and control functions to verify compliance with acceptance criteria.

F. Test systems, assemblies, subsystems, equipment, and components operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and response according to acceptance criteria.

G. System Readiness Plan or Checklists: Prepare and submit detailed construction in accordance with Section 01 9113 GENERAL COMMISSIONING REQUIREMENTS 3.5 System Readiness Documentation and applicable equipment and or systems specification.

H. Coordinate schedule in accordance with 01 9113 section 3.6.

2.03 FUNCTIONAL PERFORMANCE TESTING

A. Comply with construction checklist requirements, including material verification, installation checks, start-up, and performance test requirements specified in Sections specifying HVAC systems and equipment.

B. The GCC shall coordinate the subcontractors, with the CxA's input, in developing, performing, and demonstrating the Working FPT.

C. The Functional Performance Test (FPT) Procedures shall be developed, performed, and demonstrated in accordance with Section 01 9113.

D. At a minimum, the contractors and equipment suppliers listed in the FPTs Minimum Participants Table in this section of the specifications are required to participate in developing, performing, and demonstrating the indicated FPTs.

E. The Contractor shall test all systems within the commissioning scope of work, using the FPTs until the acceptable results specified in the FPT procedure are verified and documented. The Contractor may consult with the CxA, as necessary, to acquire clarification and resolve issues. The CxA shall be available for on-site assistance of this nature.

F. The Contractor shall submit documentation that verifies that the acceptable results specified in the FPT procedures have been verified and that they are ready to demonstrate the FPTs with acceptable results. Acceptable documentation consists of completed FPT record forms that document acceptable FPT results.

G. Provide technicians, instrumentation, tools, and equipment to complete and document the following:
   1. Performance tests.
   2. Demonstration of a sample of performance tests.
   3. Commissioning tests.
   4. Commissioning test demonstrations.

2.04 INSTRUMENTATION

A. Instrumentation will be provided by the Contractor and/or Subcontractor. Instruments used for measurements shall be accurate. Calibration histories for each instrument shall be available for examination. Calibration and maintenance of instruments shall be in accordance with the requirements of NEBB or AABC Standards.

B. Application of instruments and accuracy of measurements shall be in accordance with NEBB or AABC Standards.

2.05 DOCUMENTATION

A. The GCC shall be responsible for the collection of pertinent data during system start-up and functional performance testing. The Subcontractor shall submit to the CxA documentation of tests performed prior to and after system start-up. Documentation shall also include start-up procedures as approved by Commissioning Team.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Time clocks.

1.02 RELATED REQUIREMENTS

A. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

B. Section 26 27 26 - Wiring Devices: Elevation of exposed components.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

D. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Substantial Completion.

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 TIME CLOCKS

A. Seven day programming switch timer with synchronous timing motor and seven day dial, continuously charged Ni-cad battery driven power failure 8 hour carry over and multiple switch trippers to control systems for minimum of two and maximum of eight signals per day with two normally open and two normally closed output switches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that systems are ready to receive work.

C. Beginning of installation means installer accepts existing conditions.

D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

F. Ensure installation of components is complementary to installation of similar components.

G. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check and verify location of thermostats with plans and room details before installation. Locate 60 inches above floor. Align with lighting switches and humidistats. Refer to Section 26 27 26.

C. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.

D. Provide guards on thermostats in entrances.

E. Provide conduit and electrical wiring in accordance with Section 26 05 83. Electrical material and installation shall be in accordance with appropriate requirements of .

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for natural gas piping systems.

1.02 RELATED REQUIREMENTS

A. Section 08 31 00 - Access Doors and Panels.

B. Section 09 91 13 - Exterior Painting.

C. Section 09 91 23 - Interior Painting.

1.03 REFERENCE STANDARDS

A. ANSI LC 1/CSA 6.26 - Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing.

B. ANSI Z223.1 - National Fuel Gas Code.

C. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications.

D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.

E. ASME B31.1 - Power Piping.

F. ASME B31.9 - Building Services Piping.

G. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

H. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

J. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems.

K. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Welders' Certificates: Submit certification of welders' compliance with ASME BPVC-IX.

D. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.

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. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

E. Identify pipe with marking including size, ASTM material classification, and ASTM specification.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M, Schedule 40 black with factory applied portetive coatings and wrapping.
   1. Fittings: ASTM A234/A234M, wrought steel welding type.
   2. Joints: ANSI Z223.1, welded.
   3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape at joints and fittings.

2.02 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
   2. Joints: Threaded or welded to ASME B31.1.

B. Flexible Gas Piping:
   1. Corrugated Stainless Steel Tubing: Comply with ANSI LC 1/CSA 6.26.
   2. Comply with ASTM E84.
   3. Fittings: Provided by piping system manufacturer.
   4. Provide piping with integral lightning protection.

2.03 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous Pipe: Class 150 malleable iron threaded unions.
   2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

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.
   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.

2.05 BALL VALVES

A. Manufacturers:
   1. Apollo Valves: www.apollovalves.com/#sle.
   2. Grinnell Products: www.grinnell.com/#sle.
   3. Milwaukee Valve Company: www.milwaukeevalve.com/#sle.
   4. Nibco, Inc: www.nibco.com/#sle.
   5. Viega LLC: www.viega.us/#sle.
   6. Or Approved Equal.

B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, Teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder, 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 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not exposed.
   1. Coordinate size and location of access doors with Section 08 31 00.

I. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
   1. Painting of interior piping systems and components is specified in Section 09 91 23.
   2. Painting of exterior piping systems and components is specified in Section 09 91 13.

J. 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.

3.04 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Install ball valves for throttling, bypass, or manual flow control services.

E. Provide plug valves in natural gas systems for shut-off service.

3.05 SERVICE CONNECTIONS

A. Provide new gas service complete with gas meter and regulators in accordance with Section 33 52 16. Gas service distribution piping to have initial minimum pressure of 7 inch wg. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

3.06 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe Size: 1/2 inches to 1-1/4 inches:
         1) Maximum Hanger Spacing: 6.5 ft.
         2) Hanger Rod Diameter: 3/8 inches.
      b. Pipe Size: 1-1/2 inches to 2 inches:
         1) Maximum Hanger Spacing: 10 ft.
         2) Hanger Rod Diameter: 3/8 inch.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping.
B. Refrigerant.
C. Moisture and liquid indicators.
D. Valves.
E. Strainers.
F. Check valves.
G. Pressure regulators.
H. Pressure relief valves.
I. Filter-driers.
J. Solenoid valves.
K. Expansion valves.
L. Receivers.
M. Flexible connections.

1.02 RELATED REQUIREMENTS

A. Section 08 31 00 - Access Doors and Panels.
B. Section 09 91 23 - Interior Painting.
C. Section 23 07 19 - HVAC Piping Insulation.

1.03 REFERENCE STANDARDS

A. AHRI 495 - Performance Rating of Refrigerant Liquid Receivers.
B. AHRI 750 - Standard for Thermostatic Refrigerant Expansion Valves.
C. AHRI 760 - Standard for Performance Rating of Solenoid Valves for Use With Volatile Refrigerants.
D. ASHRAE Std 15 - Safety Standard for Refrigeration Systems.
E. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels.
F. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications.
G. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
H. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
I. ASME B31.5 - Refrigeration Piping and Heat Transfer Components.
J. ASME B31.9 - Building Services Piping.
K. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
L. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
M. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
N. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
O. UL 429 - Electrically Operated Valves.

1.04 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

C. Liquid Indicators:
   1. Use line size liquid indicators in main liquid line leaving condenser.
   2. If receiver is provided, install in liquid line leaving receiver.
   3. Use line size on leaving side of liquid solenoid valves.

D. Valves:
   1. Use service valves on suction and discharge of compressors.
   2. Use gauge taps at compressor inlet and outlet.

E. Strainers:
   1. Use line size strainer upstream of each automatic valve.
   2. Use shut-off valve on each side of strainer.

F. Filter-Driers:
   1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.
   2. Use a filter-drier on suction line just ahead of compressor.
   3. Use sealed filter-driers in lines smaller than 1/2 inch outside diameter.
   4. Use sealed filter-driers in low temperature systems.
   5. Use sealed filter-driers in systems utilizing hermetic compressors.
   6. Use replaceable core filter-driers in lines of 1/2 inch outside diameter or greater.
   7. Use replaceable core liquid-line filter-driers in systems utilizing receivers.
   8. Use filter-driers for each solenoid valve.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

C. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum 3 years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with ASME B31.9 for installation of piping system.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

C. Welders Certification: In accordance with ASME BPVC-IX.

D. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

2.02 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.

B. Copper Tube to 7/8 inch OD: ASTM B88 (ASTM B88M), Type K (A), annealed.
   1. Fittings: ASME B16.26 cast copper.
   2. Joints: Flared.

C. Pipe Supports and Anchors:
   1. Provide hangers and supports that comply with MSS SP-58.
      a. 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 Inch: Malleable iron adjustable swivel, split ring.
   3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   6. Vertical Support: Steel riser clamp.
   7. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
   8. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
   9. 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.
   10. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
      a. Bases: High density, UV tolerant, polypropylene or reinforced PVC.
      b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
      c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
      d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
      e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.
      f. Manufacturers:
         1) PHP Systems/Design: www.phpsd.com.
         2) Portals Plus; Pedestal Plus: www.portalsplus.com/#sle.
         3) Substitutions: See Section 01 60 00 - Product Requirements.

2.03 REFRIGERANT

A. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

2.04 MOISTURE AND LIQUID INDICATORS

A. Manufacturers:
   1. Henry Technologies: www.henrytech.com.
   2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com.
   3. Sporlan, a Division of Parker Hannifin: www.parker.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.05 VALVES

A. Manufacturers:

1. Hansen Technologies Corporation: www.hantech.com.
2. Henry Technologies: www.henrytech.com.
3. Flomatic Valves: www.flomatic.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Diaphragm Packless Valves:
1. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends, with positive backseating; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

C. Packed Angle Valves:
1. Forged brass or nickel plated forged steel, forged brass seal caps with copper gasket, rising stem and seat with backseating, molded stem packing, solder or flared ends; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

D. Ball Valves:
1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.

E. Service Valves:
1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

2.06 STRAINERS

A. Manufacturers:
1. Hansen Technologies Corporation: www.hantech.com.
2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com.
3. Sporlan, a Division of Parker Hannifin: www.parker.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Straight Line or Angle Line Type:
1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

2.07 CHECK VALVES

A. Manufacturers:
1. Hansen Technologies Corporation: www.hantech.com.
2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com.
3. Sporlan, a Division of Parker Hannifin: www.parker.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Globe Type:
1. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc; for maximum temperature of 300 degrees F and maximum working pressure of 425 psi.

C. Straight Through Type:
1. Brass body and disc, phosphor-bronze or stainless steel spring, neoprene seat; for maximum working pressure of 500 psi and maximum temperature of 200 degrees F.

2.08 PRESSURE REGULATORS

A. Manufacturers:
1. Hansen Technologies Corporation: www.hantech.com.
2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com.
3. Sporlan, a Division of Parker Hannifin: www.parker.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Brass body, stainless steel diaphragm, direct acting, adjustable over 0 to 80 psi range, for maximum working pressure of 450 psi.

2.09 PRESSURE RELIEF VALVES

A. Manufacturers:
   1. Hansen Technologies Corporation: www.hantech.com.
   2. Henry Technologies: www.henrytech.com.
   3. Sherwood Valve/Harsco Corporation: www.sherwoodvalve.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Straight Through or Angle Type: Brass body and disc, neoprene seat, factory sealed and stamped with ASME UV and National Board Certification NB, selected to ASHRAE Std 15, with standard setting of 235 psi.

2.10 FILTER-DRIERS

A. Manufacturers:
   1. Flow Controls Division of Emerson Electric: www.emersonflowcontrols.com.
   2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com.
   3. Sporlan, a Division of Parker Hannifin: www.parker.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Performance:
   1. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.
   2. Design Working Pressure: 350 psi, minimum.

C. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

D. Construction: UL listed.
   1. Replaceable Core Type: Steel shell with removable cap.
   2. Sealed Type: Copper shell.
   3. Connections: As specified for applicable pipe type.

2.11 SOLENOID VALVES

A. Manufacturers:
   1. Flow Controls Division of Emerson Electric: www.emersonflowcontrols.com.
   2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com.
   3. Sporlan, a Division of Parker Hannifin: www.parker.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Valve: AHRI 760 I-P, pilot operated, copper, brass or steel body and internal parts, synthetic seat, stainless steel stem and plunger assembly (permitting manual operation in case of coil failure), integral strainer, with flared, solder, or threaded ends; for maximum working pressure of 500 psi.

C. Coil Assembly: UL 429 UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires, integral junction box with pilot light.

2.12 EXPANSION VALVES

A. Manufacturers:
   1. Flow Controls Division of Emerson Electric: www.emersonflowcontrols.com.
   2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com.
   3. Sporlan, a Division of Parker Hannifin: www.parker.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Angle or Straight Through Type: AHRI 750; design suitable for refrigerant, brass body, internal or external equalizer, bleed hole, adjustable superheat setting, replaceable inlet strainer, with non-replaceable capillary tube and remote sensing bulb and remote bulb well.

C. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10 degrees F superheat. Select to avoid being undersized at full load and excessively oversized at part load.

2.13 RECEIVERS

A. Manufacturers:
   1. Henry Technologies: www.henrytech.com.
   2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com.
   3. Sherwood Valve/Harsco Corporation: www.sherwoodvalve.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Internal Diameter 6 inch and Smaller:
   1. AHRI 495, UL listed, steel, brazed; 400 psi maximum pressure rating, with tappings for inlet, outlet, and pressure relief valve.

C. Internal Diameter Over 6 inch:
   1. AHRI 495, welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; 400 psi with tappings for liquid inlet and outlet valves, pressure relief valve, and magnetic liquid level indicator.

2.14 FLEXIBLE CONNECTORS

A. Manufacturers:
   1. Circuit Hydraulics, Ltd: www.circuit-hydraulics.co.uk.
   2. Flexicraft Industries: www.flexicraft.com.
   3. Penflex: www.penflex.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure of 500 psi.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

G. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.5.
   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. 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.

H. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

I. Provide clearance for installation of insulation and access to valves and fittings.

J. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Section 08 31 00.

K. Flood piping system with nitrogen when brazing.

L. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.

M. Prepare unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 91 23.

N. Insulate piping and equipment; refer to Section and Section 23 07 16.

O. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

P. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.

Q. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

R. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

S. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

T. Fully charge completed system with refrigerant after testing.

U. Provide electrical connection to solenoid valves. Refer to Section 26 05 83.

3.03 SCHEDULES

A. Hanger Spacing for Copper Tubing.
   1. 1/2 inch, 5/8 inch, and 7/8 inch OD: Maximum span, 5 feet; minimum rod size, 1/4 inch.
   2. 1-1/8 inch OD: Maximum span, 6 feet; minimum rod size, 1/4 inch.
   3. 1-3/8 inch OD: Maximum span, 7 feet; minimum rod size, 3/8 inch.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

B. Duct cleaning.

1.02 REFERENCE STANDARDS

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

F. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for duct materials.

C. Shop Drawings: All Systems
   1. Fabrication, assembly and installation, including plans, elevations, sections, components and attachments to other work.
   2. Factory and shop fabricated ducts and fittings.
   3. Duct layout indicating sizes, configuration, liner material, and static pressure classes.
   4. Elevation of top of ducts.
   5. Dimensions of main duct runs from building grid lines.
   6. Fittings.
   7. Reinforcing and spacing.
   8. Seam and joint construction.
   9. Penetrations through fire-rated and other partitions.
   10. Equipment installation based on equipment being used on Project.
   11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
   12. Hangers and supports, including methods for duct and building attachment, seismic restraints and vibration isolation.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items below:
   1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
   2. Suspended ceiling components.
   3. Structural members to which duct will be attached.
   4. Size and location of initial access modules for acoustical tile.
   5. Penetrations of smoke barriers and fire rated construction.
   6. Items penetrating finished ceiling including the following:
      a. Lighting fixtures.
      b. Air outlets and inlets.
      c. Speakers.
      d. Sprinklers.
      e. Permiter moldings
      f. Access Panels.

1.05 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES

A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.

B. Ducts: Galvanized steel, unless otherwise indicated.

C. Low Pressure Supply (Heating Systems): 1/2 inch w.g. pressure class, galvanized steel.

D. Low Pressure Supply (System with Cooling Coils): 1/2 inch w.g. pressure class, galvanized steel.

E. Return and Relief: 1/2 inch w.g. pressure class, galvanized steel.

F. General Exhaust: 1/2 inch w.g. pressure class, galvanized steel.

G. Grease Exhaust: 1/2 inch w.g. pressure class, stainless steel.
   1. Construct of 18 gage, 0.0500 inch stainless steel.
   2. Construction:
      a. Liquid tight with continuous external weld for all seams and joints.
      b. Where ducts are not self draining back to equipment, provide low point drain pocket with copper drain pipe to sanitary sewer.
   3. Access Doors:
      a. Provide for duct cleaning inside horizontal duct at drain pockets, every 20 feet and at each change of direction.
      b. Use same material and thickness as duct with gaskets and sealants rated 1500 degrees F for grease tight construction.

H. Fume Hood Exhaust: 1/2 inch w.g. pressure class, stainless steel.

I. Outside Air Intake: 1/2 inch w.g. pressure class, galvanized steel.

J. Combustion Air: 1/2 inch w.g. pressure class, galvanized steel.

2.02 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   2. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.

C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.03 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.

B. 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.

C. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

2.04 MANUFACTURED DUCTWORK AND FITTINGS

A. Flexible Ducts: Two ply vinyl film supported by helically wound spring steel wire.
   1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   2. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
   3. Maximum Velocity: 4000 fpm.
   4. Temperature Range: Minus 10 degrees F to 160 degrees F.

B. Flexible Ducts: Black polymer film supported by helically wound spring steel wire.
   1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   2. Pressure Rating: 4 inches WG positive and 0.5 inches WG negative.
   3. Maximum Velocity: 4000 fpm.
   4. Temperature Range: Minus 20 degrees F to 175 degrees F.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install in accordance with manufacturer's instructions.

C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

D. Flexible Ducts: Connect to metal ducts with adhesive.

E. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

F. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

H. Connect terminal units to supply ducts directly or with one foot maximum length of flexible duct. Do not use flexible duct to change direction.

3.02 CLEANING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment that could be harmed by excessive dirt with temporary filters, or bypass during cleaning.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Backdraft dampers - metal.

B. Duct access doors.

C. Duct test holes.

D. Flexible duct connectors.

E. Volume control dampers.

1.02 RELATED REQUIREMENTS

A. Section 23 05 48 - Vibration and Seismic Controls for HVAC.

B. Section 23 31 00 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

B. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

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.

PART 2 PRODUCTS

2.01 BACKDRAFT DAMPERS - METAL

A. Manufacturers:
   1. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com.
   2. Nailor Industries, Inc: www.nailor.com.
   3. Ruskin Company, a brand of Johnson Controls: www.ruskin.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Gravity Backdraft Dampers, Size 18 by 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

C. 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.

D. Manufacturers:
   1. Acudor Products Inc, a Division of Nelson Industrial Inc: www.acudor.com.
   2. Elgen Manufacturing, Inc: www.elgenmfg.com.
   3. Nailor Industries, Inc: www.nailor.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

E. Fabricate in accordance with SMACNA (DCS) and as indicated.

2.02 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.
   1. Manufacturers:
      a. Carlisle HVAC Products; Dynair Test Port with Red Cap with O-Ring Seal: www.carlislehvac.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 FLEXIBLE DUCT CONNECTORS

A. Manufacturers:
   1. Carlisle HVAC Products; Dynair Connector Plus G90 Steel Offset Seam Neoprene Fabric: www.carlislehvac.com/#sle.
   2. Elgen Manufacturing: www.elgenmfg.com.
   3. Or Approved Equal.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Flexible Duct Connections: Fabric crimped into metal edging strip.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.

2.04 VOLUME CONTROL DAMPERS

A. Manufacturers:
   1. Louvers & Dampers, Inc: www.louvers-dampers.com.
   2. Nailor Industries Inc: www.nailor.com.
   3. Ruskin Company: www.ruskin.com.
   4. Or Approved Equal.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Splitter Dampers:
   1. Material: Same gage as duct to 24 inches size in either direction, and two gages heavier for sizes over 24 inches.
   2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
   3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw .

D. Single Blade Dampers:
   1. Fabricate for duct sizes up to 6 by 30 inch.
   2. Blade: 24 gage, 0.0239 inch, minimum.

E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
   1. Blade: 18 gage, 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.

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). Refer to Section 23 31 00 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 for hand access, size for shoulder access, and as indicated. Provide 4 by 4 inch 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. Demonstrate re-setting of fire dampers to Owner's representative.

G. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

H. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

I. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

J. Use splitter dampers only where indicated.

K. 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

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof ventilators.

B. Cabinet exhaust fans.

C. Ceiling exhaust fans.

D. Upblast roof exhausters.

1.02 RELATED REQUIREMENTS

A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

B. Section 23 05 48 - Vibration and Seismic Controls for HVAC.

C. Section 23 33 00 - Air Duct Accessories: Backdraft dampers.

1.03 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program.

B. AMCA 99 - Standards Handbook.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.

E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

G. UL 705 - Power Ventilators.

1.04 SUBMITTALS

A. See Section 01 30 00 - 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. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

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 FIELD CONDITIONS

A. Request Owner permission to use permanent ventilator(s) for ventilation during construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Greenheck: www.greenheck.com.

B. Loren Cook Company: www.lorencook.com.

C. PennBarry: www.pennbarry.com.

D. Substitutions: See Section 01 60 00 - 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. UL Compliance: UL 705, listed, labeled, designed, manufactured, and tested.

F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.03 ROOF VENTILATORS

A. 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.

B. Roof Curb: 8 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips.

C. Disconnect Switch: Factory wired, nonfusible, in housing for thermal overload protected motor and wall mounted multiple speed switch.

D. 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.

E. 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 CABINET EXHAUST FANS

A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resiliently mounted motor, gravity backdraft damper in discharge.

B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.

C. Grille: Molded white plastic.

D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is reached with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.

C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

D. Hung Cabinet Fans:
   1. Install flexible connections specified in Section 23 33 00 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

E. Provide sheaves required for final air balance.

F. Install backdraft dampers on inlet to roof and wall exhausters.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Diffusers:
   1. Perforated ceiling diffusers.

B. 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.

1.02 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Painting of ducts visible behind outlets and inlets.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets.

B. SMACNA (ASMM) - Architectural Sheet Metal Manual.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.05 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carnes, a division of Carnes Company Inc: www.carnes.com.

B. Hart & Cooley, Inc: www.hartandcooley.com.

C. Price Industries: www.price-hvac.com.

D. Titus: www.titus-hvac.com.

E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 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: Stainless steel.

D. Color: As selected by Architect from manufacturer's standard range.

2.03 CEILING SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, one-way deflection.

B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

C. Construction: Made of aluminum extrusions with factory enamel finish.

D. Color: As selected by Architect from manufacturer's standard range.

2.04 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. Frame: 1-1/4 inch margin with countersunk screw mounting.

C. Fabrication: Steel with 20 gage, 0.0359 inch minimum frames and 22 gage, 0.0299 inch minimum blades, steel and aluminum with 20 gage, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: To be selected by Architect from manufacturer's standard range.

2.05 CEILING EGG CRATE EXHAUST AND RETURN GRILLES

A. Type: Egg crate style face consisting of 1/2 by 1/2 by 1/2 inch, 1/2 by 1/2 by 1 inch, and 1 by 1 by 1 inch grid core.

B. Fabrication: Grid core consists of aluminum with mill aluminum finish.

C. Color: To be selected by Architect from manufacturer's standard range.

D. Frame: 1-1/4 inch margin with countersunk screw mounting.

E. Frame: Channel lay-in frame for suspended grid ceilings.

2.06 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, single deflection.

B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

C. Fabrication: Steel with 20 gage, 0.0359 inch minimum frames and 22 gage, 0.0299 inch minimum blades, steel and aluminum with 20 gage, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: To be selected by Architect from manufacturer's standard range.

2.07 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 Architect from manufacturer's standard range.

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.

F. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 91 23.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Energy recovery units.

B. Filters.

C. Roof curbs.

1.02 RELATED REQUIREMENTS

A. Section 07 72 00 - Roof Accessories: Roof curb.

1.03 REFERENCE STANDARDS

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating.

B. AHRI 1060 (I-P) - Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment.

C. ASHRAE Std 84 - Method of Testing Air to Air Heat/Energy Exchangers.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's installation instruction, product data, and engineering calculations.

C. Shop Drawings: Show design and assembly of energy recovery unit and installation and connection details.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Energy Recovery Ventilators:
   1. RenewAire: www.renewaire.com/#sle.
   2. Or Approved Equal.

2.02 ENERGY RECOVERY UNITS

A. Energy Recovery Units: prefabricated packaged system designed by manufacturer.
   1. Provide unit with a AHRI 1060 (I-P) compliant air-to-air exchanger.
   2. Access: Hinged and/or screwed access panels on front.
   3. Lifting holes at the unit base.

2.03 FILTERS

A. Efficiency: 13 MERV.

B. Mount 1/2 inches thick permanent aluminum washable type filter in the outside air hood and in the return plenum air.

2.04 ROOF CURBS

A. Curbs: Provide full perimeter roof curb fabricated from 10 gage, 0.1345 inch aluminized steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that structure is ready for installation of unit, that openings in deck for ductwork, if required, are correctly sized and located, and that mechanical and electrical utilities supplying unit are of correct capacities and are accessible.

3.02 INSTALLATION

A. Provide openings for suitable ductwork connection.

B. Outdoor Installations:

3.03 SYSTEM STARTUP

A. Provide services of manufacturer's authorized representative to provide start up of unit.

3.04 CLEANING

A. Clean filters, air plenums, interior and exposed-to-view surfaces prior to Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air-source heat pumps.

B. Indoor air handling (fan and coil) units for ductless systems.

C. Controls.

1.02 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units.

C. ASHRAE Std 23 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Compressor Units.

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

E. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

F. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

D. Design Data: Indicate refrigerant pipe sizing and routing.

E. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

F. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.04 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide three year manufacturers warranty for solid state ignition modules.

C. Provide five year manufacturers warranty for heat exchangers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carrier Corporation: www.carrier.com.

B. Daikin: https://daikincomfort.com/

C. LG: https://www.lg.com/global

D. Samsung: https://www.samsunghvac.com/

E. Trane Inc: www.trane.com.

F. Or Approved Equal.

2.02 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.

1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator; auxiliary electric heat.
2. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

B. Performance Requirements: See Drawings for additional requirements.

2.03 INDOOR AIR HANDLING UNITS FOR DUCTLESS SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.
   1. Location: Ceiling.
   2. Fan: Line-flow fan direct driven by a single motor.
   3. Filter return air with washable, antioxidant pre-filter and a pleated anti-allergy enzyme filter.
   4. Wall-Mounted Units

B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
   1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
   2. Manufacturer: System manufacturer.

2.04 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
   1. Comply with AHRI 210/240.
   2. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.
   3. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23 and UL 207.

B. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.
   1. Condenser Fans: Direct-drive propeller type.
   2. Condenser Fan Motor: Enclosed, 1-phase type, permanently lubricated.

C. Coil: Air-cooled, aluminum fins bonded to copper tubes.

D. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gauge ports, thermometer well (in liquid line).
   1. Provide thermostatic expansion valves.
   2. Provide heat pump reversing valves.

E. Operating Controls:
   1. Control by room thermostat to maintain room temperature setting.
   2. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig and off when pressure drops below 140 psig for operation to 0 degrees F.

2.05 ACCESSORY EQUIPMENT

A. Room Thermostat: Wall-mounted, electric solid state microcomputer based room thermostat with remote sensor to maintain temperature setting; low-voltage; with following features:
   1. Automatic switching from heating to cooling.
   2. Preferential rate control to minimize overshoot and deviation from setpoint.
   3. Thermostat Display:
      a. Actual room temperature.
      b. System Mode Indication: Heating, Cooling, Fan Auto, Off, and On, Auto or On, Off.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available and in correct location.

C. Verify that proper fuel supply is available for connection.

3.02 INSTALLATION

A. Install in accordance with NFPA 90A and NFPA 90B.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable refrigerant volume HVAC system includes:
   1. Outdoor/condensing unit(s).
   2. Indoor/evaporator units.
   3. Branch Selector / Heat Recovery units.
   4. Refrigerant piping.
   5. Control panels.
   6. Control wiring.

1.02 RELATED REQUIREMENTS

A. Section 23 23 00 - Refrigerant Piping: Additional requirements for refrigerant piping system.

1.03 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

B. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals.

C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

D. ITS (DIR) - Directory of Listed Products.

E. NFPA 70 - National Electrical Code.

F. UL 1995 - Heating and Cooling Equipment.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Pre-Bid Submittals: For proposed substitute systems/products, as defined in PART 2, and alternate systems/products, as defined above, proposer shall submit all data described in this article, under the terms given for substitutions stated in PART 2.

C. Product Data: Submit manufacturer's standard data sheets showing the following for each item of equipment, marked to correlate to equipment item markings indicated in Contract Documents:
   1. Outdoor/Central Units:
      a. Refrigerant Type and Size of Charge.
      b. Cooling Capacity: Btu/h.
      c. Heating Capacity: Btu/h.
      d. Cooling Input Power: Btu/h.
      e. Heating Input Power: Btu/h.
      f. Operating Temperature Range, Cooling and Heating.
      g. Air Flow: Cubic feet per minute.
      h. Fan Curves.
      i. External Static Pressure (ESP): Inches WG.
      j. Sound Pressure Level: dB(A).
      k. Electrical Data:
         1) Maximum Circuit Amps (MCA).
         2) Maximum Fuse Amps (MFA).
         3) Maximum Starting Current (MSC).
         4) Full Load Amps (FLA).
         5) Total Over Current Amps (TOCA).
         6) Fan Motor: HP.
      l. Weight and Dimensions.
      m. Maximum number of indoor units that can be served.
      n. Maximum refrigerant piping run from outdoor/condenser unit to indoor/evaporator unit.

o. Maximum height difference between outdoor/condenser unit to indoor/evaporator unit, both above and below.
p. Control Options.

2. Indoor/Evaporator Units:
a. Cooling Capacity: Btu/h.
b. Heating Capacity: Btu/h.
c. Cooling Input Power: Btu/h.
d. Heating Input Power: Btu/h.
e. Air Flow: Cubic feet per minute.
f. Fan Curves.
g. External Static Pressure (ESP): Inches WG.
h. Sound Pressure level: dB(A).
i. Electrical Data:
1) Maximum Circuit Amps (MCA).
2) Maximum Fuse Amps (MFA).
3) Maximum Starting Current (MSC).
4) Full Load Amps (FLA).
5) Total Over Current Amps (TOCA).
6) Fan Motor: HP.
j. Maximum Lift of Built-in Condensate Pump.
k. Weight and Dimensions.
l. Control Options.

3. Control Panels: Complete description of options, control points, zones/groups.

D. Shop Drawings: Installation drawings custom-made for this project; include as-designed HVAC layouts, locations of equipment items, refrigerant piping sizes and locations, condensate piping sizes and locations, remote sensing devices, control components, electrical connections, control wiring connections. Include:
1. Detailed piping diagrams, with branch balancing devices.
2. Condensate piping routing, size, and pump connections.
3. Detailed power wiring diagrams.
4. Detailed control wiring diagrams.
5. Locations of required access through fixed construction.
6. Drawings required by manufacturer.

E. Design Data:
1. Provide design calculations showing that system will achieve performance specified.
2. Provide design data required by ASHRAE Std 90.1 I-P.

F. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.

G. Project Record Documents: Record the following:
1. As-installed routing of refrigerant piping and condensate piping.
2. Locations of access panels.
3. Locations of control panels.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. Company that has been manufacturing variable refrigerant volume heat pump equipment for at least 5 years.
2. Company that provides system design software to installers.

B. Installer Qualifications: Trained and approved by manufacturer of equipment.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle equipment and refrigerant piping according to manufacturer's recommendations.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Daikin

B. LG

C. Samsung

D. Systems designed and manufactured by other manufacturers will be considered by Owner and Engineer under the terms described for substitutions with the following exceptions:
   1. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Substitution requests will be considered only if required submittal data is complete; see article SUBMITTALS above.
   3. Contractor (not equipment supplier) shall certify that the use of the substitute system and equipment will not require changes to other work or re-design by Architect.
   4. Contractor or HVAC subcontractor shall certify that the substitute system will achieve the performance specified.
   5. Do not assume substitution has been accepted until formal written notice has been issued by Architect.

2.02 HVAC SYSTEM DESIGN

A. System Operation: Heating and cooling, simultaneously.
   1. Zoning: Provide capability for temperature control for each individual indoor/evaporator unit independently of all other units.
   2. Zoning: Provide heating/cooling selection for each individual indoor/evaporator unit independently of all other units.
   3. Provide a complete functional system that achieves the specified performance based on the specified design conditions and that is designed and constructed according to the equipment manufacturer's requirements.
   4. Conditioned spaces are indicated on drawings.
   5. Outdoor/Condenser unit locations are indicated on drawings.
   6. Indoor/Evaporator unit locations are indicated on drawings.
   7. Branch selector unit locations are shown on the drawings.
   8. Required equipment unit capacities are indicated on drawings.
   9. Refrigerant piping sizes are not indicated on drawings.
   10. Connect equipment to condensate piping provided by others; condensate piping is shown on the drawings.

B. Cooling Mode Interior Performance:
   1. Daytime Setpoint: 68 degrees F, plus or minus 2 degrees F.
   2. Setpoint Range: 57 degrees F to 77 degrees F.
   3. Night Setback: 78 degrees F.
   4. Interior Relative Humidity: 20 percent, maximum.

C. Heating Mode Interior Performance:
   1. Daytime Setpoint: 68 degrees F, plus or minus 2 degrees F.
   2. Setpoint Range: 59 degrees F to 80 degrees F.
   3. Night Setback: 60 degrees F.
   4. Interior Relative Humidity: 10 percent, minimum.

D. Outside Air Design Conditions:
   1. Summer Outside Air Design Temperature: 0.4 percent cooling design condition listed in ASHRAE Fundamentals Handbook - ASHRAE (FUND).
   2. Winter Outside Air Design Temperature: 99.6 percent heating design condition listed in ASHRAE Fundamentals Handbook - ASHRAE (FUND).

E. Energy Design Wind Speed: 25 mph.

F. Operating Temperature Ranges:

1. Simultaneous Heating and Cooling Operating Range: minus 4 degrees F to 60 degrees F dry bulb.
2. Cooling Mode Operating Range: minus 4 degrees F to 110 degrees F dry bulb.
3. Heating Mode Operating Range: 0 degrees F to 77 degrees F dry bulb; minus 4 degrees F to 60 degrees F wet bulb; without low ambient controls or auxiliary heat source.

G. Refrigerant Piping Lengths: Provide equipment capable of serving system with following piping lengths without any oil traps:
1. Minimum Piping Length from Outdoor/Central Unit(s) to Furthest Terminal Unit: 540 feet, actual; 620 feet, equivalent.
2. Total Combined Liquid Line Length: 3280 feet, minimum.
3. Maximum Vertical Distance Between Outdoor/Central Unit(s) and Terminal Units: 295 feet.
4. Minimum Piping Length Between Indoor Units: 49 feet.

H. Control Wiring Lengths:
1. Between Outdoor/Condenser Unit and Indoor/Evaporator Unit: 6,665 feet, minimum.
2. Between Outdoor/Condenser Unit and Central Controller: 3,330 feet, minimum.
3. Between Indoor/Evaporator Unit and Remote Controller: 1,665 feet.

I. Controls: Provide the following control interfaces:
1. For Each Indoor/Evaporator Unit: One wall-mounted wired "local" controller, with temperature sensor; locate where indicated.
2. One central remote control panel for entire system; locate where directed.
3. The building automation system by the VRV manufacturer is not specified in this section. Consult the manufacturer for details.

J. Local Controllers: Wall-mounted, wired, containing temperature sensor.

K. Remote Temperature Sensors: In addition to temperature sensors integral with indoor/evaporator units, provide wall-mounted, wired remote temperature sensors located in the same room for the following:
1. In-ceiling mounted units.
2. Exception: Where a local controller with temperature sensor is provided for the particular unit and is located in the same space.

2.03 EQUIPMENT

A. All Units: Factory assembled, wired, and piped and factory tested for function and safety.
1. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.
2. Performance Certification: AHRI Certified; www.ahrinet.org.
3. Safety Certification: Tested to UL 1995 by UL or Intertek-ETL, listed in ITS (DIR), and bearing the certification label.
4. Provide outdoor/condensing units capable of serving indoor unit capacity up to 140 percent of the capacity of the outdoor/condensing unit.
5. Provide units capable of serving the zones indicated.
6. Thermal Performance: Provide heating and cooling capacity as indicated, based on the following nominal operating conditions: As Scheduled
7. Energy Efficiency: Report EER and COP based on tests conducted at “full load” in accordance with AHRI 210/240 or alternate test method approved by U.S. Department of Energy.

B. Electrical Characteristics:
1. Power - Branch Selector Units: 208 to 230 Volts, single phase, 60 Hz.
2. Power - Indoor Units: 208 to 230 Volts, single phase, 60 Hz.
3. 208-230 Voltage Range: 187 to 253 volts.

C. System Controls:
1. Include self diagnostic, auto-check functions to detect malfunctions and display the type and location.

D. Unit Controls: As required to perform input functions necessary to operate system; provided by manufacturer of units.
   1. Provide interfaces to remote control and building automation systems as specified.

E. Refrigerant Piping:
   1. Provide three-pipe refrigerant system, including high/low pressure dedicated hot gas, liquid and suction lines; two-pipe systems utilizing lower temperature mixed liquid/gas refrigerant to perform heat recovery are permitted if capabilities are proven comperable.
   2. Refrigerant Flow Balancing: Provide refrigerant piping joints and headers specifically designed to ensure proper refrigerant balance and flow for optimum system capacity and performance; T-style joints are prohibited.
   3. Insulate each refrigerant line individually between the condensing and indoor units.

2.04 OUTDOOR/CONDENSING UNITS

A. Outdoor/Condensing Units: Air-cooled DX refrigeration units, designed specifically for use with indoor/evaporator units; factory assembled and wired with all necessary electronic and refrigerant controls; modular design for ganging multiple units.
   1. Refrigeration Circuit: Scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports and refrigerant regulator.
   2. Refrigerant: Factory charged.
   3. Variable Volume Control: Modulate compressor capacity automatically to maintain constant suction and condensing pressures while varying refrigerant volume to suit heating/cooling loads.
   4. Capable of being installed with wiring and piping to the left, right, rear or bottom.
   5. Capable of heating operation at low end of operating range as specified, without additional low ambient controls or auxiliary heat source; during heating operation, reverse cycle (cooling mode) oil return or defrost is not permitted, due to potential reduction in space temperature.
   6. Sound Pressure Level: As specified, measured at 3 feet from front of unit; provide night setback sound control as a standard feature; three selectable sound level steps of 55 dB, 50 dB, and 45 dB, maximum.
   7. Power Failure Mode: Automatically restart operation after power failure without loss of programmed settings.
   8. Safety Devices: High pressure sensor and switch, low pressure sensor/switch, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.
   9. Provide refrigerant sub-cooling to ensure the liquid refrigerant does not flash when supplying to us indoor units.
   10. Oil Recovery Cycle: Automatic, occurring 2 hours after start of operation and then every 8 hours of operation; maintain continuous heating during oil return operation.
   11. Controls: Provide contacts for electrical demand shedding.

B. Unit Cabinet: Weatherproof and corrosion resistant; rust-proofed mild steel panels coated with baked enamel finish.
   1. Designed to allow side-by-side installation with minimum spacing.

C. Fans: One or more direct-drive propeller type, vertical discharge, with multiple speed operation via DC (digitally commutating) inverter.
   1. Provide minimum of 2 fans for each condensing unit.
   2. External Static Pressure: Factory set at 0.12 in WG, minimum.
   3. Indoor Mounted Air-Cooled Units: External static pressure field set at 0.32 in WG, minimum; provide for mounting of field-installed ducts.
   4. Fan Airflow: As indicated for specific equipment.
   5. Fan Motors: Factory installed; permanently lubricated bearings; inherent protection; fan guard; output as indicated for specific equipment.

D. Condenser Coils: Copper tubes expanded into aluminum fins to form mechanical bond; waffle louver fin and rifled bore tube design to ensure high efficiency performance.

E. Compressors: Scroll type, hermetically sealed, variable speed inverter-driven and fixed speed in combination to suit total capacity; minimum of one variable speed, inverter driven compressor per condenser unit; minimum of two compressors per condenser unit; capable of controlling capacity within range of 6 percent to 100 percent of total capacity.
   1. Multiple Condenser Modules: Balance total operation hours of compressors by means of duty cycling function, providing for sequential starting of each module at each start/stop cycle, completion of oil return, and completion of defrost, or every 8 hours.
   2. Failure Mode: In the event of compressor failure, operate remaining compressor(s) at proportionally reduced capacity; provide microprocessor and associated controls specifically designed to address this condition.
   3. Provide each compressor with crankcase heater, high pressure safety switch, and internal thermal overload protector.
   4. Provide oil separators and intelligent oil management system.
   5. Provide spring mounted vibration isolators.

2.05 BRANCH SELECTOR / HEAT RECOVERY UNITS

A. Branch Selector Units: Concealed boxes designed specifically for this type of system to control heating/cooling mode selection of downstream units; consisting of electronic expansion valves, subcooling heat exchanger, refrigerant control piping and electronics to facilitate communications between unit and main processor and between branch unit and indoor/evaporator units.
   1. Control direction of refrigerant flow using electronic expansion valves; use of solenoid valves for changeover and pressure equalization is not permitted due to refrigerant noise; use of multi-port branch selector boxes is not permitted unless spare ports are provided for redundancy.
   2. Provide one electronic expansion valve for each downstream unit served, except multiple indoor/evaporator units may be connected, provided balancing joints are used in downstream piping and total capacity is within capacity range of the branch selector.
   3. When branch unit is simultaneously heating and cooling, energize subcooling heat exchanger.
   4. Casing: Galvanized steel sheet; with flame and heat resistant foamed polyethylene sound and thermal insulation.
   5. Refrigerant Connections: Braze type.
   6. Condensate Drainage: Provide unit that does not require condensate drainage.

2.06 INDOOR/EVAPORATOR UNITS

A. All Indoor/Evaporator Units: Factory assembled and tested DX fan-coil units, with electronic proportional expansion valve, control circuit board, factory wiring and piping, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
   1. Refrigerant: Refrigerant circuits factory-charged with dehydrated air, for field charging.
   2. Temperature Control Mechanism: Return air thermistor and computerized Proportional-Integral-Derivative (PID) control of superheat.
   3. Coils: Direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond; waffle louver fin and high heat exchange, rifled bore tube design; factory tested.
      a. Provide thermistor on liquid and gas lines.
   4. Fans: Direct-drive, with statically and dynamically balanced impellers; high and low speeds unless otherwise indicated; motor thermally protected.
   5. Return Air Filter: Washable long-life net filter with mildew proof resin, unless otherwise indicated.
   6. Condensate Drainage: Built-in condensate drain pan with PVC drain connection.
      a. Units With Built-In Condensate Pumps: Provide condensate safety shutoff and alarm.
   7. Cabinet Insulation: Sound absorbing foamed polystyrene and polyethylene insulation.

B. Recessed Ceiling Units - 3 FT by 3 FT: Four-way airflow cassette with central return air grille, for installation in a fixed ceiling.
   1. Face Size: 33 inches square, nominal.
   2. Cabinet Height: Maximum of 10 inches above face of ceiling.
   3. Exposed Housing: White, impact resistant, with washable decoration panel.
   4. Supply Airflow Adjustment:
      a. Via motorized louvers which can be horizontally and vertically adjusted from 0 to 90 degrees.
      b. Field-modifiable to 3-way and 2-way airflow.
      c. Three auto-swing positions, including standard, draft prevention and ceiling stain prevention.
   5. Return Air Filter: Manufacturer's standard.
   6. Minimum Capacity: As indicated on drawings.
   7. Sound Pressure Range: Between 28 dB(A) to 33 dB(A) at low speed measured at 5 feet below the unit.
   8. Fan: Direct-drive turbo type, with motor output range of 0.06 to 0.12 HP.
   9. Condensate Pump: Built-in, with lift of 21 inches, minimum.
   10. Provide side-mounted supply air branch duct connection.
   11. Provide side-mounted fresh air intake duct connection.

C. Recessed Ceiling Units - 2 FT by 2 FT: Four-way airflow cassette with central return air grille, sized for installation in standard 24 by 24 inch lay-in ceiling grid.
   1. Cabinet Height: Maximum of 12 inches above face of ceiling.
   2. Exposed Housing: White, impact resistant, with washable decoration panel.
   3. Maintenance Access: All electrical components accessible through decoration panel.
   4. Supply Airflow Adjustment:
      a. Via motorized louvers which can be horizontally and vertically adjusted from 0 to 90 degrees.
      b. Field-modifiable to 3-way and 2-way airflow.
      c. Three auto-swing positions, including standard, draft prevention and ceiling stain prevention.
   5. Sound Pressure: Measured at low speed at 5 feet below unit.
   6. Fan: Direct-drive turbo type.
   7. Condensate Pump: Built-in, with lift of 21 inches, minimum.
   8. Provide side-mounted supply air branch duct connection.
   9. Provide side-mounted fresh air intake duct connection.

D. Concealed-In-Ceiling Units: Ducted horizontal discharge and return; galvanized steel cabinet.
   1. Return Air Filter: Manufacturer's standard.
   2. Sound Pressure: Measured at low speed at 5 feet below unit.
   3. Provide external static pressure switch adjustable for high efficiency filter operation
   4. Condensate Pump: Built-in, with lift of 9 inches, minimum.
   5. Switch box accessible from side or bottom.

E. Ceiling Surface-Mounted Units: White, finished casing, with removable front grille; foamed polystyrene and polyethylene sound insulation, and mounting brackets; mildew-proof polystyrene drain pan.
   1. Airflow Control: Auto-swing louver that closes automatically when unit stops; five (5) steps of discharge angle, set using remote controller; upon restart, discharge angle defaulting to same angle as previous operation.
   2. Sound Pressure Range: Measured at low speed at 3.3 feet below and away from unit.
   3. Condensate Pump: Built-in, concealed, wide drain connection concealed in ceiling.
   4. Fan: Two-speed, direct-drive cross-flow type.

F. Wall Surface-Mounted Units: Finished white casing, with removable front grille; foamed polystyrene and polyethylene sound insulation; wall mounting plate; polystyrene condensate drain pan.

1. Airflow Control: Auto-swing louver that closes automatically when unit stops; five (5) steps of discharge angle, set using remote controller; upon restart, discharge angle defaulting to same angle as previous operation.
2. Sound Pressure Range: Measured at low speed at 3.3 feet below and away from unit.
3. Condensate Pump: Built-in, concealed.
4. Condensate Drain Connection: Back, with piping concealed in wall.
5. Fan: Direct-drive cross-flow type.

G. Exposed Console Units: Top discharge grille, bottom return air; finished casing, sound-insulated with fiberglass urethane foam; auto-swing louver that closes automatically when unit stops.
1. Wall Mounting: Side (horizontal) refrigerant and condensate connections; manufacturer-supplied wall mounting template.
2. Maintenance Access Required: Not more than 3/4 inch in rear, 4 inch on each side.
3. Sound Pressure Range: Measured at high speed at 5 feet away and 5 feet above floor.
4. Fan: Sirocco type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that required electrical services have been installed and are in the proper locations prior to starting installation.

B. Verify that condensate piping has been installed and is in the proper location prior to starting installation.

C. Notify Architect if conditions for installation are unsatisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install refrigerant piping in accordance with equipment manufacturer's instructions.

C. Perform wiring in accordance with NFPA 70, National Electric Code (NEC).

D. Coordinate with installers of systems and equipment connecting to this system.

3.03 SYSTEM STARTUP

A. Provide manufacturer's field representative to perform system startup.

B. Prepare and start equipment and system in accordance with manufacturer's instructions and recommendations.

C. Adjust equipment for proper operation within manufacturer's published tolerances.

3.04 CLEANING

A. Clean exposed components of dirt, finger marks, and other disfigurements.

3.05 CLOSEOUT ACTIVITIES

A. 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 one day of training.
3. Instructor: Manufacturer's training personnel.
4. Location: At project site.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

1.02 RELATED REQUIREMENTS

A. Section 01 70 00 - Execution and Closeout Requirements: Additional requirements for alterations work.

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 non-destuctive field observation and existing documents provided by the Owner.

D. Report discrepancies to Owner before disturbing existing installation.

E. Report discrepancies to Architect before disturbing existing installation.

F. 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. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Obtain permission from Owner at least 72 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 Owner before partially or completely disabling system.
   2. Notify local fire service.
   3. Make notifications at least 72 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 Owner at least 24 hours before partially or completely disabling system.
   2. Notify telephone utility company at least 24 hours before partially or completely disabling system.
   3. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Remove abandoned wiring to source of supply.

C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

D. 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.

E. Disconnect and remove abandoned panelboards and distribution equipment.

F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

G. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

H. Repair adjacent construction and finishes damaged during demolition and extension work.

I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

J. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR

A. See Section 01 74 19 - 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.

D. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, LED drivers and broken electrical parts.

END OF SECTION

PART 1 GENERAL

1.01 DESCRIPTION

A. This section applies to all sections of Division 26, and electrical work in related Divisions for which Division 26 is an integral part. Additional requirements may be provided in specific Sections of Division 26.

B. Furnish and install electrical systems, materials, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, conductors and cable, switchboards, switchgear, panelboards, motor control centers, generators, automatic transfer switches, and other items and arrangements for the specified items are shown on the drawings.

C. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company's system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company's system, and obtain electric utility company approval for sizes and settings of these devices.

1.02 MINIMUM REQUIREMENTS

A. The International Building Code (IBC), National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL), and National Fire Protection Association (NFPA) codes and standards are the minimum requirements for materials and installation.

B. The drawings and specifications shall govern in those instances where requirements are greater than those stated in the above codes and standards.

1.03 TEST STANDARDS

A. All materials and equipment shall be listed, labeled, or certified by a Nationally Recognized Testing Laboratory (NRTL) to meet Underwriters Laboratories, Inc. (UL), standards where test standards have been established. Materials and equipment which are not covered by UL standards will be accepted, providing that materials and equipment are listed, labeled, certified or otherwise determined to meet the safety requirements of a NRTL. Materials and equipment which no NRTL accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as ANSI, NEMA, and NETA. Evidence of compliance shall include certified test reports and definitive shop drawings.

B. Definitions:
   1. Listed: Materials and equipment included in a list published by an organization that is acceptable to the Authority Having Jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production or listed materials and equipment or periodic evaluation of services, and whose listing states that the materials and equipment either meets appropriate designated standards or has been tested and found suitable for a specified purpose.
   2. Labeled: Materials and equipment to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the Authority Having Jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled materials and equipment, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
   3. Certified: Materials and equipment which:
      a. Have been tested and found by a NRTL to meet nationally recognized standards or to be safe for use in a specified manner.
      b. Are periodically inspected by a NRTL.
      c. Bear a label, tag, or other record of certification.
   4. Nationally Recognized Testing Laboratory: Testing laboratory which is recognized and approved by the Secretary of Labor in accordance with OSHA regulations.

1.04 QUALIFICATIONS (PRODUCTS AND SERVICES)

A. Manufacturer’s Qualifications: The manufacturer shall regularly and currently produce, as one of the manufacturer's principal products, the materials and equipment specified for this project, and shall have manufactured the materials and equipment for at least three years.

B. Product Qualification:
   1. Manufacturer's materials and equipment shall have been in satisfactory operation, on three installations of similar size and type as this project, for at least three years.
   2. The Owner reserves the right to require the Contractor to submit a list of installations where the materials and equipment have been in operation before approval.

C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.05 APPLICABLE PUBLICATIONS

A. Applicable publications listed in all Sections of Division 26 are the latest issue, unless otherwise noted or enforced by the Authority Having Jurisdiction.

B. Products specified in all sections of Division 26 shall comply with the applicable publications listed in each section.

1.06 MANUFACTURED PRODUCTS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, and for which replacement parts shall be available.

B. When more than one unit of the same class or type of materials and equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:
   1. Components of an assembled unit need not be products of the same manufacturer.
   2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
   3. Components shall be compatible with each other and with the total assembly for the intended service.
   4. Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory wiring and terminals shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Testing Is Specified:
   1. The Owner shall have the option of witnessing factory tests. The Contractor shall notify the Owner and Project Engineer a minimum of 15 working days prior to the manufacturer’s performing the factory tests.
   2. One electronic copy in PDF format of certified test reports shall be furnished to the Owner and Project Engineer two weeks prior to final inspection and not more than 90 days after completion of the tests.
   3. When materials and equipment fail factory tests, and re-testing and re-inspection is required, the Contractor shall be liable for all additional expenses for the Government to witness re-testing.

1.07 VARIATIONS FROM CONTRACT REQUIREMENTS

A. Where the Owner or the Contractor requests variations from the contract requirements, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.08 MATERIALS AND EQUIPMENT PROTECTION

A. Materials and equipment shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.

1. Electrical switchboards, generators, transformers rated 500kVA or larger, and factory assembled equipment shall be shipped to the site using Shockwatch or equivalent impact indicators on each shipping unit.
2. Store materials and equipment indoors in clean dry space with uniform temperature to prevent condensation.
3. During installation, equipment shall be protected against entry of foreign matter, and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
4. Damaged equipment shall be repaired or replaced, as determined by the Owner.
5. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
6. Damaged paint on equipment shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.09 WORK PERFORMANCE

A. All electrical work shall comply with the requirements of NFPA 70 (NEC), NFPA 70B, NFPA 70E, OSHA Part 1910 subpart J – General Environmental Controls, OSHA Part 1910 subpart K – Medical and First Aid, and OSHA Part 1910 subpart S – Electrical, in addition to other references required by contract.

B. Job site safety and worker safety is the responsibility of the Contractor.

C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished in this manner for the required work, the following requirements are mandatory:
   1. Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with NFPA 70E.
   2. Before initiating any work, a job specific work plan must be developed by the Contractor with review conducted and documented by the Owner, and the Project Engineer at the Owner's request. The work plan must include procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used, and exit pathways.
   3. Work on energized circuits or equipment cannot begin until prior written approval is obtained from the Owner.

D. For work that affects existing electrical systems, arrange, phase and perform work to assure minimal interference with normal functioning of the facility.

E. New work shall be installed and connected to existing work neatly, safely and professionally. Provide good workmanship per NECA 1. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required.

F. Coordinate location of equipment and conduit with other trades to minimize interference.

1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Equipment location shall be as close as practical to locations shown on the drawings.

B. Working clearances shall not be less than specified in the NEC.

C. Inaccessible Equipment:
   1. Where the Owner determines that the Contractor has installed equipment not readily accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Owner.
   2. "Readily accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

D. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company's system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company's system, and obtain electric utility company approval for sizes and settings of these devices.

1.11 EQUIPMENT AND SYSTEMS IDENTIFICATION

A. Electrical equipment and installations shall be identified, signed and/or labeled as specified in Section 26 05 53, IDENTIFICATION FOR ELECTRICAL SYSTEMS. Additional identification, signage or labeling shall be provided according to requirements listed in specific sections of Divisions 25 through 28.

1.12 SUBMITTALS

A. Submit to the Owner and Project Engineer in accordance with Section 01 33 00, SUBMITTAL PROCEDURES.

B. The Owner's approval shall be obtained for all materials and equipment before delivery to the job site. Delivery, storage or installation of materials and equipment which has not had prior approval will not be permitted.

C. All submittals shall include one electronic copy in PDF format of adequate descriptive literature, catalog cuts, shop drawings, test reports, certifications, samples, and other data necessary for the Owner and Project Engineer to ascertain that the proposed materials and equipment comply with drawing and specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify specific materials and equipment being submitted.

D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
   1. Mark the submittals, "SUBMITTED UNDER SECTION_____".
   2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
   3. Submit each section separately.

E. The submittals shall include the following:
   1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, manuals, pictures, nameplate data, and test reports as required. Catalog information shall be marked to indicate actual products used; unmarked catalog sections covering a range of similar products shall not be acceptable in submittals.
   2. Submittals are required for all equipment anchors and supports. Submittals shall include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion, etc.) associated with equipment or piping so that the proposed installation can be properly reviewed. Include sufficient fabrication information so that appropriate mounting and securing provisions may be designed and attached to the equipment.
   3. Elementary and interconnection wiring diagrams for communication and signal systems, control systems, and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
   4. Parts list which shall include information for replacement parts and ordering instructions, as recommended by the equipment manufacturer.

F. Maintenance and Operation Manuals:
   1. Submit as required for systems and equipment specified in Section 01 78 23, OPERATIONS AND MAINTENANCE DATA, and the technical sections. In addition to an electronic copy in PDF format, furnish four sets in hardcover binders or an approved equivalent.

2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, material, equipment, building, name of Contractor, and contract name and number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the material or equipment.
3. Provide a table of contents and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
4. The manuals shall include:
    a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
    b. A control sequence describing start-up, operation, and shutdown.
    c. Description of the function of each principal item of equipment.
    d. Installation instructions.
    e. Safety precautions for operation and maintenance.
    f. Diagrams and illustrations.
    g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers.
    h. Performance data.
    i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare and replacement parts, and name of servicing organization.
    j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.

G. Approvals will be based on complete submission of shop drawings, manuals, test reports, certifications, and samples as applicable.

H. After approval and prior to installation, furnish the Owner with one sample of each of the following:
1. A minimum 300 mm (12 inches) length of each type and size of wire and cable along with the tag from the coils or reels from which the sample was taken. The length of the sample shall be sufficient to show all markings provided by the manufacturer.
2. Each type of conduit coupling, bushing, and termination fitting.
3. Conduit hangers, clamps, and supports.
4. Duct sealing compound.
5. Each type of receptacle, toggle switch, lighting control sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

1.13 SINGULAR NUMBER

A. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.14 ACCEPTANCE CHECKS AND TESTS

A. The Contractor shall furnish the instruments, materials, and labor for tests.

B. Where systems are comprised of components specified in more than one section of Division 26, the Contractor shall coordinate the installation, testing, and adjustment of all components between various manufacturer’s representatives and technicians so that a complete, functional, and operational system is delivered to the Government.

C. Test new and reworked systems and equipment per manufacturers’ standard tests and NETA ATS.

D. When test results indicate any defects, the Contractor shall repair or replace the defective materials or equipment, and repeat the tests. Repair, replacement, and retesting shall be accomplished at no additional cost to the Owner.

1.15 WARRANTY

A. All work performed and all equipment and material furnished under this Division shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the Owner.

1.16 INSTRUCTION

A. Instruction to designated Owner personnel shall be provided for the particular equipment or system as required in each associated technical specification section.

B. Furnish the services of competent instructors to give full instruction in the adjustment, operation, and maintenance of the specified equipment and system, including pertinent safety requirements. Instructors shall be thoroughly familiar with all aspects of the installation, and shall be trained in operating theory as well as practical operation and maintenance procedures.

C. A training schedule shall be developed and submitted by the Contractor and approved by the Owner at least 30 days prior to the planned training.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Medium voltage cable.

B. Cable accessories.

1.02 RELATED REQUIREMENTS

A. Section 26 05 53 - Identification for Electrical Systems.

1.03 REFERENCE STANDARDS

A. IEEE 48 - IEEE Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV.

B. NEMA WC 71 - Nonshielded Cables Rated 2001-5000 Volts for Use in the Distribution of Electric Energy.

C. NEMA WC 74 - 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

E. NFPA 70 - National Electrical Code.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide for cable, terminations, and accessories.

C. Test Reports: Indicate results of cable test in tabular form and in plots of current versus voltage for incremental voltage steps, and current versus time at 30 second intervals at maximum voltage.

1.05 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MEDIUM-VOLTAGE CABLE

A. Manufacturers:
   1. General Cable Technologies Corporation: www.generalcable.com/#sle.
   2. Okonite: www.okonite.com/#sle.
   3. Southwire Company: www.southwire.com/#sle.
   4. Or approved equal.

B. Medium Voltage Cable: NEMA WC 74 rubber insulated cable.
   1. Voltage: 15 kV, grounded.
   2. Conductor: Copper, concentric, stranded, with wire-woven conductor shield.
   3. Construction: Single conductor with metal wire insulation shielding.
   4. Insulation Jacket: PVC, 220 mils minimum thickness.

2.02 CABLE ACCESSORIES

A. Manufacturers:
   1. 3M: www.3m.com/#sle.
   2. TE Connectivity; Raychem Products: www.te.com/#sle.
   3. Or approved equal.

B. Modular Cable Terminations: IEEE 48, Class 1, molded-rubber cable termination in kit form with stress cone, ground clamp, non-tracking rubber skirts, load break connector, rubber cap, and aerial lug.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conduit, duct, trench, or manholes are ready to receive cable.

B. Cable routing is shown in approximate locations unless dimensioned. Route as required to complete wiring system.

3.02 PREPARATION

A. Use swab to clean conduits before pulling cables.

3.03 INSTALLATION

A. Avoid abrasion and other damage to cables during installation.

B. Use suitable lubricants and pulling equipment.

C. Sustain cable pulling tensions and bending radii below recommended limits.

D. Ground cable shield at each termination and splice.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect exposed cable sections for physical damage.

C. Inspect cable for proper connections as indicated.

D. Inspect shield grounding, cable supports, and terminations for proper installation.

E. Inspect and test in accordance with NETA ATS, except Section 4.

3.05 PROTECTION

A. Protect installed cables from entrance of moisture.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal-clad cable.

B. Wiring connectors.

C. Electrical tape.

D. Heat shrink tubing.

E. Oxide inhibiting compound.

F. Wire pulling lubricant.

G. Cable ties.

H. Firestop sleeves.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 26 05 05 - Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.

C. Section 26 05 13 - Medium-Voltage Cables: Cables and terminations for systems 601 V through 35,000 V.

D. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire.

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes.

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation.

E. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers.

F. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy Wire for Subsequent Covering of Insulation.

G. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape.

H. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes.

I. NECA 1 - Standard for Good Workmanship in Electrical Construction.

J. NECA 104 - Recommended Practice for Installing Aluminum Building Wire and Cable.

K. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC).

L. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.

M. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

N. NFPA 70 - National Electrical Code.

O. UL 44 - Thermoset-Insulated Wires and Cables.

P. UL 83 - Thermoplastic-Insulated Wires and Cables.

Q. UL 267 - Outline of Investigation for Wire-Pulling Compounds.

R. UL 486A-486B - Wire Connectors.

S. UL 486C - Splicing Wire Connectors.

T. UL 486D - Sealed Wire Connector Systems.

U. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape.

V. UL 1569 - Metal-Clad Cables.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - 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. Field Quality Control Test Reports.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - 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. 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 Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 METAL-CLAD CABLE IS PERMITTED ONLY AS FOLLOWS:

A. Where not otherwise restricted, may be used:
   1. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
      a. Maximum Length: 6 feet.
   2. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.

B. In addition to other applicable restrictions, may not be used:
   1. Unless approved by Owner.
   2. Where exposed to view.
   3. Where exposed to damage.
   4. For damp, wet, or corrosive locations, unless provided with a PVC jacket listed as suitable for those locations.

C. CONDUCTOR AND CABLE GENERAL REQUIREMENTS
   1. Provide products that comply with requirements of NFPA 70.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended.
   3. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
   4. Comply with NEMA WC 70.
   5. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
   6. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
   7. Conductors for Grounding and Bonding: Also comply with Section 26 05 26.
   8. Conductor Material:
   9. Minimum Conductor Size:
      a. Branch Circuits: 12 AWG.
         1) Exceptions:
            (a) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
            (b) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
      b. Control Circuits: 14 AWG.
   10. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   11. Conductor Color Coding:
      a. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
      b. Color Coding Method: Integrally colored insulation.
         1) Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
      c. Color Code:
         1) 208Y/120 V, 3 Phase, 4 Wire System:
            (a) Phase A: Black.
            (b) Phase B: Red.
            (c) Phase C: Blue.
            (d) Neutral/Grounded: White.
         2) Equipment Ground, All Systems: Green.

D. METAL-CLAD CABLE
   1. 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.
   2. Conductor Stranding:
      a. Size 10 AWG and Smaller: Solid.
      b. Size 8 AWG and Larger: Stranded.
   3. Insulation Voltage Rating: 600 V.

4. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
5. Grounding: Full-size integral equipment grounding conductor.
6. Armor: Steel, interlocked tape.
7. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

E. WIRING CONNECTORS
1. 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.
2. Connectors for Grounding and Bonding: Comply with Section 26 05 26.
3. Wiring Connectors for Splices and Taps:
   a. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
   b. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
   c. Connectors for Aluminum Conductors: Use compression connectors.
4. Wiring Connectors for Terminations:
   a. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
   b. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
   c. 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.
   d. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
   e. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
   f. Aluminum Conductors: Use compression connectors for all connections.
   g. Conductors for Control Circuits: Use crimped terminals for all connections.
5. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
6. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.
7. 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.
   a. Manufacturers:
      1) 3M: www.3m.com/#sle.
      2) Ideal Industries, Inc: www.idealindustries.com/#sle.
      3) NSI Industries LLC: www.nsiindustries.com/#sle.
      4) Substitutions: See Section 01 60 00 - Product Requirements.
8. Mechanical Connectors: Provide bolted type or set-screw type.
   a. Manufacturers:
      1) Burndy LLC: www.burndy.com/#sle.
      2) Ilsco: www.ilsco.com/#sle.
      3) Thomas & Betts Corporation: www.tnb.com/#sle.
      4) Substitutions: See Section 01 60 00 - Product Requirements.
9. Compression Connectors: Provide circumferential type or hex type crimp configuration.
   a. Manufacturers:
      1) Burndy LLC: www.burndy.com/#sle.
      2) Ilsco: www.ilsco.com/#sle.
      3) Thomas & Betts Corporation: www.tnb.com/#sle.
      4) Substitutions: See Section 01 60 00 - Product Requirements.

10. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
    a. Manufacturers:
        1) Burndy LLC: www.burndy.com/#sle.
        2) Ilsco: www.ilsco.com/#sle.
        3) Thomas & Betts Corporation: www.tnb.com/#sle.
        4) Substitutions: See Section 01 60 00 - Product Requirements.

F. ACCESSORIES
1. Electrical Tape:
    a. Manufacturers:
        1) 3M: www.3m.com/#sle.
        2) Plymouth Rubber Europa: www.plymouthrubber.com/#sle.
        3) Shurtape Technologies, LLC: www.shurtape.com
        4) Substitutions: See Section 01 60 00 - Product Requirements.
    b. 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.
    c. 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.
    d. 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.
    e. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
    f. 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.
    g. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.
2. 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.
    a. Manufacturers:
        1) 3M: www.3m.com/#sle.
        2) Burndy LLC: www.burndy.com/#sle.
        3) Thomas & Betts Corporation: www.tnb.com/#sle.
        4) Substitutions: See Section 01 60 00 - Product Requirements.
3. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
    a. Manufacturers:
        1) Burndy LLC: www.burndy.com/#sle.
        2) Ideal Industries, Inc: www.idealindustries.com/#sle.
        3) Ilsco: www.ilsco.com/#sle.
        4) Substitutions: See Section 01 60 00 - Product Requirements.
4. Wire Pulling Lubricant:
    a. Manufacturers:
        1) 3M: www.3m.com/#sle.
        2) American Polywater Corporation: www.polywater.com/#sle.
        3) Ideal Industries, Inc: www.idealindustries.com/#sle.
        4) Substitutions: See Section 01 60 00 - Product Requirements.
    b. Listed and labeled as complying with UL 267.

c. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
d. Suitable for use at installation temperature.

5. Cable Ties: Material and tensile strength rating suitable for application.
6. 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.
7. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:
1. Unless dimensioned, circuit routing indicated is diagrammatic.
2. When circuit destination is indicated without specific routing, determine exact routing required.
3. Arrange circuiting to minimize splices.
4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:
   a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
   b. Increase size of conductors as required to account for ampacity derating.
   c. Size raceways, boxes, etc. to accommodate conductors.
8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
   a. Branch circuits feeding electrified furniture systems will have shared neutrals and shared ground conductors].

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install aluminum conductors in accordance with NECA 104.

E. Install metal-clad cable (Type MC) in accordance with NECA 120.

F. 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.

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.

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. Variable-Frequency Drive Cable: Terminate shielding at both variable-frequency motor controller and associated motor using glands or termination kits recommended by manufacturer.

K. Install conductors with a minimum of 12 inches of slack at each outlet.

L. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.

M. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

N. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

O. 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. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

P. 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.

b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical 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.

Q. Insulate ends of spare conductors using vinyl insulating electrical tape.

R. 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.

S. Identify conductors and cables in accordance with Section 26 05 53.

T. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

U. 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 01 40 00 - 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 only required for services and feeders. The resistance test for parallel conductors listed as optional is 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

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

1.02 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
   1. Includes oxide inhibiting compound.

B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

E. NFPA 70 - National Electrical Code.

F. UL 467 - Grounding and Bonding Equipment.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify exact locations of underground metal water service pipe entrances to building.
   2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 SUBMITTALS

A. See Section 01 30 00 - 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. Electronic copy is acceptable.

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 products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Grounding System Resistance:
   1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect/Engineer. Precipitation within the previous 48 hours does not constitute normally dry conditions.
   2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.

F. Grounding Electrode System:
   1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.
      b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
   2. Metal Underground Water Pipe(s):
      a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
      b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
      c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
   3. Metal In-Ground Support Structure:
      a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
   4. Concrete-Encased Electrode:
      a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
   5. Ground Ring:
      a. Provide a ground ring encircling the transformer pad consisting of bare copper conductor not less than 2 AWG in direct contact with earth, installed at a depth of not less than 30 inches.

6. Ground Rod Electrode(s):
    a. Provide two electrodes unless otherwise indicated or required.
    b. Space electrodes not less than 10 feet from each other and any other ground electrode.
    c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
    d. Provide ground access well for each electrode.
7. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
8. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
    a. Ground Bar Size: 1/4 by 4 by 12 inches unless otherwise indicated on the drawings.
    b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
    c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
9. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.

G. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

H. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
    a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
8. Provide bonding for metal building frame.

I. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.

2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
   a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
   b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
   c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:
   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.
      a. Exceptions:
         1) Use mechanical connectors for connections to electrodes at ground access wells.
   3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
   4. Manufacturers - Mechanical and Compression Connectors:
      a. Advanced Lightning Technology (ALT): www.altfab.com/#sle.
      b. Burndy LLC: www.burndy.com/#sle.
      c. Harger Lightning & Grounding: www.harger.com/#sle.
      d. Thomas & Betts Corporation: www.tnb.com/#sle.
      e. Substitutions: See Section 01 60 00 - Product Requirements.
   5. Manufacturers - Exothermic Welded Connections:
      a. Burndy LLC: www.burndy.com/#sle.
      b. Cadweld, a brand of Erico International Corporation: www.erico.com/#sle.
      c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

D. Ground Bars:
   1. Description: Copper rectangular ground bars with mounting brackets and insulators.
   2. Size: As indicated.
   3. Holes for Connections: As required for the connections to be made unless noted on the drawings..
   4. Manufacturers:
      a. Advanced Lightning Technology (ALT): www.altfab.com/#sle.
      b. Erico International Corporation: www.erico.com/#sle.
      c. Harger Lightning & Grounding: www.harger.com/#sle.
      d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#sle.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

E. Ground Rod Electrodes:
   1. Comply with NEMA GR 1.
   2. Material: Copper-bonded (copper-clad) steel.
   3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated on the drawings.

4. Manufacturers:
   a. Advanced Lightning Technology (ALT): www.altfab.com/#sle.
   b. Erico International Corporation: www.erico.com/#sle.
   c. Galvan Industries, Inc: www.galvanelectrical.com/#sle.
   d. Harger Lightning & Grounding: www.harger.com/#sle.
   e. Substitutions: See Section 01 60 00 - Product Requirements.

F. Oxide Inhibiting Compound: Comply with Section 26 05 19.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70.
   1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.
   2. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.

D. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
   3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
   4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - 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

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 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 05 33.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

C. Section 26 05 33.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

D. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.

E. Section 26 51 00 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

F. Section 26 56 00 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

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

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

D. MFMA-4 - Metal Framing Standards Publication.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction.

F. NFPA 70 - National Electrical Code.

G. UL 5B - Strut-Type Channel Raceways and Fittings.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
   2. Coordinate work to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
   4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
   5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 03 30 00.

1.05 SUBMITTALS

A. See Section 01 30 00 - 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. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

D. 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.

1.06 QUALITY ASSURANCE

A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Comply with the following. Where requirements differ, comply with most stringent.
      a. NFPA 70.
      b. Requirements of authorities having jurisdiction.
   2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
   3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
   4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. 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: 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. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel.
   2. Conduit Clamps: Bolted type unless otherwise indicated.
   3. Manufacturers:
      a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
      b. Erico International Corporation: www.erico.com/#sle.
      c. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.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. Or approved equal.

C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
   1. Manufacturers:
      a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
      b. Erico International Corporation: www.erico.com/#sle.

c. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.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: See Section 01 60 00 - Product Requirements.

D. Metal Channel/Strut Framing Systems:
1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
2. Comply with MFMA-4.
3. Channel/Strut Used as Raceway, Where Indicated: Listed and labeled as complying with UL 5B.
4. Channel Material:
a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
5. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
6. Minimum Channel Dimensions: 1-5/8 inch wide by 13/16 inch high.
7. Manufacturers:
a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
b. Thomas & Betts Corporation: www.tnb.com/#sle.
c. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.

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. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch diameter.
c. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch diameter.
d. Trapeze Support for Multiple Conduits: 3/8-inch diameter.
e. Outlet Boxes: 1/4-inch diameter.
f. Luminaires: 1/4-inch diameter.

F. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
1. Description: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.
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.
5. Manufacturers:
a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
b. Erico International Corporation: www.erico.com/#sle.
c. PHP Systems/Design: www.phpsd.com/#sle.

G. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Plastic and lead anchors are not permitted.
10. Powder-actuated fasteners are permitted only as follows:
a. Where approved by Architect.

b. Use only threaded studs; do not use pins.
11. Hammer-driven anchors and fasteners are not permitted.
12. 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.
13. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.
14. Manufacturers - Mechanical Anchors:
    a. Hilti, Inc: www.us.hilti.com/#sle.
    b. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.
    c. Powers Fasteners, Inc: www.powers.com/#sle.
    d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
    e. Or approved equal
15. Manufacturers - Powder-Actuated Fastening Systems:
    a. Hilti, Inc: www.us.hilti.com/#sle.
    b. ITW Ramset, a division of Illinois Tool Works, Inc: www.ramset.com/#sle.
    c. Powers Fasteners, Inc: www.powers.com/#sle.
    d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
    e. Or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install hangers and supports in accordance with NECA 1.

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

H. Provide required vibration isolation and/or seismic controls; see Section 26 05 48.

I. Field Welding, Where Approved by Architect:

J. Equipment Support and Attachment:
1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.

4. Unless otherwise indicated, mount floor-mounted equipment on properly sized concrete pad 3 inches in height; see Section 03 30 00.
5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

K. Conduit Support and Attachment: See Section 26 05 33.13 for additional requirements.

L. Box Support and Attachment: See Section 26 05 33.16 for additional requirements.

M. Interior Luminaire Support and Attachment: See Section 26 51 00 for additional requirements.

N. Exterior Luminaire Support and Attachment: See Section 26 56 00 for additional requirements.

O. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

P. Secure fasteners in accordance with manufacturer's recommended torque settings.

Q. Remove temporary supports.

R. Identify independent electrical component support wires above accessible ceilings, where permitted, with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - 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

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Galvanized steel intermediate metal conduit (IMC).

C. PVC-coated galvanized steel rigid metal conduit (RMC).

D. Flexible metal conduit (FMC).

E. Liquidtight flexible metal conduit (LFMC).

F. Galvanized steel electrical metallic tubing (EMT).

G. Rigid polyvinyl chloride (PVC) conduit.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete encasement of conduits.

B. Section 07 84 00 - Firestopping.

C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
   1. Includes additional requirements for fittings for grounding and bonding.

D. Section 26 05 29 - Hangers and Supports for Electrical Systems.

E. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.

F. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

G. Section 26 21 00 - 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).

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S).

C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC).

D. NECA 1 - Standard for Good Workmanship in Electrical Construction.

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT).

F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC).

G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.

H. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

I. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit.

J. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.

K. NFPA 70 - National Electrical Code.

L. UL 1 - Flexible Metal Conduit.

M. UL 6 - Electrical Rigid Metal Conduit-Steel.

N. UL 360 - Liquid-Tight Flexible Steel Conduit.

O. UL 514A - Metallic Outlet Boxes.

P. UL 514B - Conduit, Tubing, and Cable Fittings.

Q. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.

R. UL 797 - Electrical Metallic Tubing-Steel.

S. UL 1242 - Electrical Intermediate Metal Conduit-Steel.

T. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
   4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
   5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

C. Shop Drawings:

D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2-inch (53 mm) trade size and larger.

1.06 QUALITY ASSURANCE

A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store 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 galvanized steel rigid metal conduit.

C. Underground:
   1. Under Slab on Grade: Use PVC-coated galvanized steel rigid metal conduit or rigid PVC conduit.
   2. Exterior, Direct-Buried: Use rigid PVC conduit.
   3. Exterior, Embedded Within Concrete: Use rigid PVC conduit.
   4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit or PVC-coated galvanized steel rigid metal conduit where emerging from underground.
   5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use PVC-coated galvanized steel rigid metal conduit elbows for bends.
   6. Where steel conduit is installed in direct contact with earth, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.

7. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.

D. Embedded Within Concrete:
   1. Within Slab on Grade: Not permitted.
   2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer) only as approved by Architect: Use rigid PVC conduit.
   3. Within Concrete Walls Above Ground: Use intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
   4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT) where emerging from concrete.
   5. Where galvanized steel electrical metallic tubing (EMT) emerges from concrete into salt air, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches on either side of where conduit emerges.

E. Concealed Within Masonry Walls: Use electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).

I. Exposed, Interior, Not Subject to Physical Damage: Use electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit.
   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.

K. Exposed, Exterior: Use galvanized steel rigid metal conduit.

L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use electrical metallic tubing (EMT).

M. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).
   1. Maximum Length: 6 feet.

N. Flexible Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit (FMC).
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
   3. Maximum Length: 6 feet unless otherwise indicated.
   4. Vibrating equipment includes, but is not limited to:
      a. Transformers.
      b. Motors.

2.02 CONDUIT - GENERAL REQUIREMENTS

A. Comply with NFPA 70.

B. Electrical Service Conduits: See Section 26 21 00 for additional requirements.

C. Fittings for Grounding and Bonding: See Section 26 05 26 for additional requirements.

D. Provide conduit, fittings, supports, and accessories required for complete raceway system.

E. Provide products listed, classified, and labeled as suitable for purpose intended.

F. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 3/4 inch (21 mm) trade size.
   2. Branch Circuit Homeruns: 3/4-inch trade size.

3. Control Circuits: 1/2-inch trade size.
4. Flexible Connections to Luminaires: 3/8-inch trade size.
5. Underground, Interior: 1 inch (27 mm) trade size.
6. Underground, Exterior: 1-inch trade size.

G. 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: See Section 01 60 00 - 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. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
b. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
c. Substitutions: See Section 01 60 00 - 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.
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: See Section 01 60 00 - 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. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
b. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
c. Substitutions: See Section 01 60 00 - 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.
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 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
1. Thomas & Betts Corporation: www.tnb.com/#sle.
2. Robroy Industries: www.robroy.com/#sle.
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil, 0.040 inch.

D. PVC-Coated Boxes and Fittings:
   1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
   2. Nonhazardous Locations: Use boxes and fittings listed and labeled as complying with UL 514A, UL 514B, or UL 6.
   3. Material: Use steel or malleable iron.
   4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil, 0.040 inch.

E. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil, 0.015 inch.

2.06 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
   1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
   2. Electri-Flex Company: www.electriflex.com/#sle.
   3. International Metal Hose: www.metalhose.com/#sle.
   4. Substitutions: See Section 01 60 00 - 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. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
      b. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
      c. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel.
      a. Do not use die cast zinc fittings.

2.07 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.

2.08 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: See Section 01 60 00 - 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. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
      b. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel.
   a. Do not use die cast zinc fittings.
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 acceptable.

2.09 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
   1. Cantex Inc: www.cantexinc.com/#sle.
   2. JM Eagle: www.jmeagle.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.10 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.

E. Foam Conduit Sealant:
   1. Removable, two-part, closed-cell foam, specifically designed for sealing conduit openings against water, moisture, gases, and dust.
   2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
   3. Rated to hold minimum of 10 ft water head pressure.

F. Sealing Compound for Hazardous/Classified Location Sealing Fittings: Listed for use with particular fittings to be installed.

G. Sealing Systems for Concrete Penetrations:
   1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
   2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.

H. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.

I. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

J. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

K. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.

L. Bore Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for installation within casing; furnished with roller wheels to facilitate installation, openings to facilitate grout flow, and holes for stabilization cable; suitable for casing and conduit/duct arrangement to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in accordance with NECA 1.

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install intermediate metal conduit (IMC) in accordance with NECA 101.

E. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by manufacturer.

F. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

G. 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.
   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. Route conduits above water and drain piping where possible.
   10. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
   11. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
   12. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
      a. Heaters.
      b. Hot water piping.
      c. Flues.
   13. Group parallel conduits in same area on common rack.

H. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 26 05 29.
2. Provide required vibration isolation and/or seismic controls; see Section 26 05 48.
3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
4. 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.
5. 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.
6. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
7. Use conduit clamp to support single conduit from beam clamp or threaded rod.
8. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
9. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
10. Use of wire for support of conduits is permitted only as follows:
    a. For securing conduits to studs in hollow stud walls.
    b. For suspending conduits supported by spring steel conduit clips, where specifically indicated or permitted.
11. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.

I. 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.

J. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Provide suitable sealing system where conduits penetrate exterior wall below grade.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
8. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07 84 00.

K. Underground Installation:
1. Provide trenching and backfilling; see Section 31 23 16.13.
2. Minimum Cover, Unless Otherwise Indicated or Required:

a. Underground, Exterior: 36 inches.
b. Under Slab on Grade: 12 inches to bottom of slab.

3. Provide underground warning tape in accordance with Section 26 05 53 along entire conduit length.

L. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Maximum Conduit Size: 1-inch trade size unless otherwise approved.
2. Install conduits within middle one third of slab thickness.
3. Secure conduits to prevent floating or movement during pouring of concrete.

M. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide minimum concrete cover of 3 inches on all sides unless otherwise indicated; see Section 03 30 00.

N. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where conduits are subject to earth movement by settlement or frost.

O. 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.

P. 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.

Q. Provide grounding and bonding; see Section 26 05 26.

R. Identify conduits; see Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

D. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

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. Underground boxes/enclosures.

D. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 08 31 00 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

D. Section 26 05 33.13 - Conduit for Electrical Systems:
   1. Conduit bodies and other fittings.
   2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 27 26 - Wiring Devices:
   1. Wall plates.
   2. Additional requirements for locating boxes for wiring devices.

G. Section 26 28 13 - Fuses: Spare fuse cabinets.

H. Section 27 10 00 - Structured Cabling: Additional requirements for communications systems outlet boxes.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

F. NFPA 70 - National Electrical Code.

G. SCTE 77 - Specification for Underground Enclosure Integrity.

H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.

I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.

J. UL 508A - Industrial Control Panels.

K. UL 514A - Metallic Outlet Boxes.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for outlet and device boxes, junction and pull boxes, and cabinets and enclosures.

C. Project Record Documents: Record actual locations for cabinets and enclosures and underground boxes/enclosures.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - 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 suitable concrete type boxes where flush-mounted in concrete.
5. Use suitable masonry type boxes where flush-mounted in masonry walls.

6. Use raised covers suitable for the type of wall construction and device configuration where required.
7. Use shallow boxes where required by the type of wall construction.
8. Do not use "through-wall" boxes designed for access from both sides of wall.
9. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
10. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
11. 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.
12. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
13. 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: Comply with Section 27 10 00.
    c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
14. Wall Plates: Comply with Section 26 27 26.

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. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
    a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
    b. Back Panels: Painted steel, removable.
    c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
6. 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: See Section 01 60 00 - Product Requirements.

D. Underground Boxes/Enclosures:
1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
2. Size: As indicated on drawings.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
4. Provide logo on cover to indicate type of service.
5. Applications:
    a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 8 load rating.
    b. Parking Lots, in Areas Subject Only To Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 15 load rating.
    c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.

6. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
   a. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.

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. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:
   1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 31 00 as required.
   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 26 27 26.
      b. Communications Systems Outlets: Comply with Section 27 10 00.
   4. Locate boxes so that wall plates do not span different building finishes.
   5. Locate boxes so that wall plates do not cross masonry joints.
   6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
   7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
   8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
   9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
      a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
      b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
   10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 05 33.13.

11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
    a. Concealed above accessible suspended ceilings.
    b. Within joists in areas with no ceiling.
    c. Electrical rooms.
    d. Mechanical equipment rooms.

I. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

J. Install boxes plumb and level.

K. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

L. Install boxes as required to preserve insulation integrity.

M. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

N. Underground Boxes/Enclosures:
1. Install enclosure on gravel base, minimum 6 inches deep.
2. Flush-mount enclosures located in concrete or paved areas.
3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
4. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

O. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

Q. Close unused box openings.

R. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

S. Provide grounding and bonding in accordance with Section 26 05 26.

T. Identify boxes in accordance with Section 26 05 53.

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

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Seismic control requirements.
   1. Includes requirements for seismic qualification of equipment not specified in this section.

1.02 RELATED REQUIREMENTS

A. Section 26 05 29 - Hangers and Supports for Electrical Systems.

1.03 DEFINITIONS

A. Electrical Component: Where referenced in this section in regards to seismic controls, applies to any portion of the electrical system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., conduit, cable tray).

B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.04 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

B. ASCE 19 - Structural Applications of Steel Cables for Buildings.

C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications.

D. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.

E. FEMA 413 - Installing Seismic Restraints for Electrical Equipment.

F. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage.

G. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components.

H. MFMA-4 - Metal Framing Standards Publication.

I. NECA 1 - Standard for Good Workmanship in Electrical Construction.

J. NFPA 70 - National Electrical Code.

K. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; Sheet Metal and Air Conditioning Contractors' National Association.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Seismic Controls:
      a. Coordinate the arrangement of seismic restraints with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
      b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
   1. Seismic Controls: Include seismic load capacities.

D. Shop Drawings - Vibration Isolation Systems:
   1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.

E. Shop Drawings - Seismic Controls:
   1. Include dimensioned plan views and sections indicating proposed electrical component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
   2. Identify mounting conditions required for equipment seismic qualification.
   3. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
   4. Indicate proposed arrangement of distributed system trapeze support groupings.
   5. Indicate proposed locations for distributed system flexible fittings and/or connections.
   6. Indicate locations of seismic separations where applicable.

F. Seismic Design Data:
   1. Compile information on project-specific characteristics of actual installed electrical components necessary for determining seismic design forces required to design appropriate seismic controls, including but not limited to the following.
      a. Component operating weight and center of gravity.
      b. Component elevation in the building in relation to the roof elevation (z/h).
      c. Component importance factor (Ip).
      d. For distributed systems, component materials and connection methods.
      e. Component amplification factor (ap) and component response modification factor (Rp), determined in accordance with ASCE 7 tables.
      f. Applicability of overstrength factor (for certain anchorage in concrete and masonry).
   2. Include structural calculations, stamped or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.

G. Certification for seismically qualified equipment; identify basis for certification.

H. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.

I. 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.

J. Evidence of qualifications for seismic controls designer.

K. Evidence of qualifications for manufacturer.

L. Manufacturer's detailed field testing and inspection procedures.

M. Field quality control test reports.

1.07 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

D. Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with minimum five years experience designing seismic restraints for nonstructural components.
   1. Designer may be employed by the manufacturer of the seismic restraint products.

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

1.08 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SEISMIC CONTROL REQUIREMENTS

A. Design and provide electrical component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor electrical components.

B. Seismic Design Criteria: Obtain from project Structural Engineer of Record.

C. Component Importance Factor (Ip): Electrical components essential to life safety to be assigned a component importance factor (Ip) of 1.5 as indicated or as required. This includes but is not limited to:
   1. Electrical components required to function for life safety purposes after an earthquake.
   2. Electrical components that support or otherwise contain hazardous substances.

D. Seismic Qualification of Equipment:
   1. Provide special certification for electrical equipment furnished under other sections and assigned a component importance factor (Ip) of 1.5, certifying that equipment will remain operable following a design level earthquake.
   2. Seismic qualification to be by shake table testing in accordance with recognized testing standard procedure, such as ICC-ES AC156, acceptable to authorities having jurisdiction.
   3. Notify Architect and obtain direction where mounting restrictions required by conditions of seismic certification conflict with specified requirements.
   4. Seismically qualified equipment to be furnished with factory-installed labels referencing certificate of compliance and associated mounting restrictions.

E. Seismic Restraints:
   1. Provide seismic restraints for electrical components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
   2. Seismic Restraint Exemptions:
      a. Conduit, Cable Tray, and Raceway Exemptions, All Seismic Design Categories:
         1) Raceways with component importance factor (Ip) of 1.0 where flexible connections are provided between cable tray or raceway and associated components, where cable tray or raceway is positively attached to the structure, and where one of the following apply:
            (a) Trapeze supported conduits, cable trays, or raceways with trapeze assemblies using 3/8 inch diameter rod hangers not exceeding 12 inches in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 100 pounds or less.
            (b) Trapeze supported conduits, cable trays, or raceways with trapeze assemblies using 1/2 inch diameter rod hangers not exceeding 12 inches in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 200 pounds or less.
            (c) Trapeze supported conduits, cable trays, or raceways with trapeze assemblies using 1/2 inch diameter rod hangers not exceeding 24 inches in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 100 pounds or less.

(d) Hanger supported conduits, cable trays, or raceways with individual rod hangers 3/8 inch or 1/2 inch in diameter not exceeding 12 inches in length from support point connection to the supporting structure, and the total weight supported by any single rod is 50 pounds or less.

2) Conduits less than 2-1/2 inch trade size.

b. Lighting Exemptions, All Seismic Design Categories:

1) Suspended luminaires where attachments are designed to accommodate 1.4 times the operating weight acting in both the vertical and horizontal directions and connections to structure allow for 360 degree range of motion in the horizontal plane; arrange to prevent impact between luminaires and the structure or other nonstructural components.

2) Lay-in luminaires weighing less than 56 pounds secured to ceiling grid and provided with safety wires in accordance with ASTM E580/E580M.

3. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
   a. ASHRAE (HVACA).
   b. FEMA 413.
   c. FEMA E-74.
   d. SMACNA (SRM).
4. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party registered professional engineer acceptable to authorities having jurisdiction.
5. Seismic Type Vibration Isolators:
   a. Comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
6. External Seismic Snubber Assemblies:
   a. Provide quantity and arrangement of external seismic snubber assemblies as required to restrain equipment in all directions (both lateral and vertical).
   b. Do not use external seismic snubber assemblies that restrain equipment only in one or more lateral directions (but not vertical) except where uplift forces are zero or are addressed by other restraints.
7. Seismic Restraint Systems:
   a. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
   b. Use only cable restraints to restrain vibration-isolated electrical components, including distributed systems.
   c. Use only one restraint system type for a given electrical component or distributed system (e.g., conduit, cable tray) run; mixing of cable and rigid restraints on a given component/run is not permitted.
   d. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain electrical component in all lateral directions; consider bracket geometry in anchor load calculations.
   e. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported electrical component weight.
   f. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported electrical component weight.
   g. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.
   h. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.
   i. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.

F. Seismic Attachments:
   1. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
   2. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
   3. Do not use power-actuated fasteners.
   4. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps.
   5. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
   6. Concrete Housekeeping Pads:
      a. Increase size of pad as required to comply with anchor requirements.
      b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.

G. Seismic Interactions:
   1. Include provisions to prevent seismic impact between electrical components and other structural or nonstructural components.
   2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.
   3. Comply with minimum clearance requirements between electrical equipment, distribution systems, and associated supports and fire protection sprinkler system drops and sprigs.

H. Seismic Relative Displacement Provisions:
   1. Use suitable fittings or flexible connections to accommodate:
      a. Relative displacements at connections between components, including distributed systems (e.g., conduit, cable tray); do not exceed load limits for equipment utility connections.
      b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
      c. Design displacements at seismic separations.
      d. Anticipated drifts between floors.

2.02 SEISMIC RESTRAINT SYSTEMS

A. Manufacturers:
   1. Seismic Restraint Systems:
      a. AFCON, a brand of Anvil International: www.anvilintl.com/#sle.
      b. Eaton Corporation: www.eaton.com/#sle.
      c. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
      d. Mason Industries: www.mason-ind.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.
   3. Source Limitations: Furnish seismic restraint system components and accessories produced by a single manufacturer and obtained from a single supplier.

B. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.

C. Cable Restraints:
   1. Comply with ASCE 19.
   2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
   3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
   4. Use protective thimbles for cable loops where potential for cable damage exists.

D. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 CODE-REQUIRED SPECIAL INSPECTIONS

A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or Architect in accordance with Section 01 45 33 and statement of special inspections as required by applicable building code.

B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.
   1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
   2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

C. Seismic special inspections include, but are not limited to:
   1. Seismically Qualified Equipment: Verification that label, anchorage, and mounting comply with certificate of compliance.
   2. Verification of required clearances between electrical equipment, distribution systems, and associated supports and fire protection sprinkler system drops and sprigs for Seismic Design Categories C, D, E, and F; periodic inspection.

D. Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.

E. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install products in accordance with applicable requirements of NECA 1 (general workmanship).

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Secure fasteners according to manufacturer's recommended torque settings.

E. Install flexible conduit and cable connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

F. Seismic Controls:
   1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris or other obstructions.
   2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
   3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.
   4. Equipment with Sheet Metal Housings:
      a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.

b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.

5. Concrete Housekeeping Pads:
   a. Size in accordance with seismic design to meet anchor requirements.
   b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.
6. Seismic Restraint Systems:
   a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.
   b. Install restraints within permissible angles in accordance with seismic design.
   c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
   d. Install cable restraints for vibration-isolated components slightly slack to prevent short-circuiting of isolation.
   e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect vibration isolation and/or seismic control components for damage and defects.

C. Seismic Controls:
   1. Verify snubbing element air gaps.

D. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

E. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Underground warning tape.

D. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

B. Section 26 05 73 - Power System Studies: Arc flash hazard warning labels.

C. Section 27 10 00 - Structured Cabling: Identification for communications cabling and devices.

1.03 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels.

C. NFPA 70 - National Electrical Code.

D. UL 969 - Marking and Labeling Systems.

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 01 30 00 - 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.

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.

4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device.Identify spares and spaces using an identification label.

b. Transformers:
1) Identify kVA rating.
2) Identify voltage and phase for primary and secondary.
3) Identify power source and circuit number. Include location.
4) Identify load(s) served. Include location when not within sight of equipment.

c. Enclosed switches, circuit breakers, and motor controllers:
1) Identify voltage and phase.
2) Identify power source and circuit number. Include location.
3) Identify load(s) served. Include location.

d. Enclosed Contactors:
1) Identify ampere rating.
2) Identify voltage and phase.
3) Identify configuration, e.g., E.O.E.H. (electrically operated, electrically held) or E.O.M.H. (electrically operated, mechanically held).
4) Identify coil voltage.
5) Identify load(s) and associated circuits controlled. Include location.

e. Transfer Switches:
1) Identify voltage and phase.
2) Identify power source and circuit number for both normal power source and standby power source. Include location.
3) Identify load(s) served. Include location.
4) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.

f. Electricity Meters:
1) Identify load(s) metered.

2. Service Equipment:
a. Use identification nameplate to identify each service disconnecting means.
b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.

3. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
4. Use identification nameplate or identification label to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.
5. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
6. Use identification label on inside of door at each fused switch to identify required NEMA fuse class and size.
7. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
8. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Section 09 91 23 and 09 91 13.

9. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
    a. Service equipment.
10. Arc Flash Hazard Warning Labels: Comply with Section 26 05 73.

B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
2. Identification for Communications Conductors and Cables: Comply with Section 27 10 00.
3. Use identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
4. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
    a. 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.
    d. In cable tray, at maximum intervals of 20 feet.
5. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
6. Use underground warning tape to identify direct buried cables.

C. Identification for Raceways:
1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.
2. Use color-coded bands or factory painted conduit to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet.
    a. Color-Coded Bands: Use field-painting to mark bands 3 inches wide. See conduit color codes above.
        1) Field-Painting: Comply with Section 09 91 23 and 09 91 13.
3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
4. Use plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
5. Use underground warning tape to identify underground raceways.
6. Use voltage markers to identify highest voltage present for wireways at maximum intervals of 20 feet.

D. Identification for Cable Tray: Comply with Section 26 05 36.

E. Identification for Boxes:
1. Use voltage markers to identify highest voltage present.
2. Use color coded boxes to identify systems other than normal power system.
    a. Color-Coded Boxes: Field-painted in accordance with Section 09 91 23 and 09 91 13 per the same color code used for raceways.
    b. For exposed boxes in public areas, do not color code.
3. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
    a. For exposed boxes in public areas, provide identification on inside face of cover.
4. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

F. Identification for Devices:
1. Identification for Communications Devices: Comply with Section 27 10 00.
2. Wiring Device and Wallplate Finishes: Comply with Section 26 27 26.

3. Factory Pre-Marked Wallplates: Comply with Section 26 27 26.
4. Use identification label to identify fire alarm system devices.
   a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
5. Use identification label to identify serving branch circuit for all receptacles.
   a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.
6. Use identification label 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.

G. Identification for Luminaires:
   1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

H. Identification for Photovoltaic Systems: Comply with Section 26 31 00

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
   1. Manufacturers:
      a. Brady Corporation
      b. Brimar Industries, Inc: www.brimar.com/#sle.
      c. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
      d. Seton Identification Products: www.seton.com/#sle.
      e. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Materials:
      a. Indoor Clean, Dry Locations: Use plastic nameplates.
      b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
   3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; 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. Seton Identification Products.
      e. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
      a. For exterior applications, use labels listed for outdoor use.
   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. Equipment designation or other approved description.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height:

a. Equipment Designation: 1/2 inch.
5. Color:
a. Normal Power System: White text on black background.
b. Fire Alarm System: White text on red background.

D. Format for General Information and Operating Instructions:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch.
5. Color: Black text on white background unless otherwise indicated.
a. Exceptions:
1) Provide white text on red background for general information or operational instructions for emergency systems.
2) Provide white text on red background for general information or operational instructions for fire alarm systems.

E. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches by 4 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/2 inch.
5. Color: Black text on yellow background unless otherwise indicated.

F. 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.
a. Include voltage and phase for other than 120 V, single phase circuits.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

G. 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.

H. 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 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: See Section 01 60 00 - Product Requirements.

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

D. Minimum Size:
   1. Markers for 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.

E. Legend:
   1. Markers for Voltage Identification: Highest voltage present.

F. Color: Black text on orange background unless otherwise indicated.

2.04 UNDERGROUND WARNING TAPE

A. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.

B. Legend: Type of service, continuously repeated over full length of tape.

C. Color:
   1. Tape for Buried Power Lines: Black text on red background.
   2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.05 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
   1. Materials:
      a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
      b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
   2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
   3. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
      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. Boxes: Outside face of cover.
   9. Conductors and Cables: Legible from the point of access.

10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
   1. Do not use adhesives on exterior surfaces except where substrate cannot be penetrated.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - 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

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Short-circuit study.

B. Arc flash and shock risk assessment.
   1. Includes arc flash hazard warning labels.

C. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.02 RELATED REQUIREMENTS

A. Section 26 05 53 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.

B. Section 26 21 00 - Low-Voltage Electrical Service Entrance.

C. Section 26 24 16 - Panelboards.

D. Section 26 29 13 - Enclosed Controllers.

1.03 REFERENCE STANDARDS

A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels.

B. IEEE 141 - IEEE Recommended Practice for Electrical Power Distribution for Industrial Plants.

C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.

D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis.

E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems.

F. IEEE 1584 - IEEE Guide for Performing Arc Flash Hazard Calculations - Includes 1584, 1584A and 1584B.

G. NEMA MG 00001 - Motors and Generators.

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

I. NFPA 70 - National Electrical Code.

J. NFPA 70E - Standard for Electrical Safety in the Workplace.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Existing Installations: Coordinate with equipment manufacturer(s) to obtain data necessary for completion of studies.
   2. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Submit study reports prior to or concurrent with product submittals.
   2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.
   3. Verify naming convention for equipment identification prior to creation of final drawings, reports, and arc flash hazard warning labels (where applicable).

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Study preparer's qualifications.

C. Study reports, stamped or sealed and signed by study preparer.

D. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.
   1. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
   2. Identify modifications made in accordance with studies that:
      a. Can be made at no additional cost to Owner.
      b. As submitted will involve a change to the contract sum.

E. Site-specific arc flash hazard warning labels.

F. Field quality control reports.

G. Certification that field adjustable protective devices have been set in accordance with requirements of studies.

H. Project Record Documents: Revise studies as required to reflect as-built conditions.
   1. Include hard copies with operation and maintenance data submittals.
   2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

1.06 POWER SYSTEM STUDIES

A. Scope of Studies:
   1. Perform analysis of existing electrical distribution system as indicated on drawings.
   2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
   3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
      a. Known Operating Modes:
         1) Utility as source.

B. General Study Requirements:
   1. Comply with NFPA 70.
   2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:
   1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
      a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
         1) Obtain up-to-date information from Owner.
      b. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 00001 code letter designation.
      c. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
      d. Protective Devices:
         1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
         2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).

e. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.

2. Existing Installations:
   a. Collect data on existing electrical distribution system necessary for completion of studies, including field verification of available existing data (e.g. construction documents, previous studies). Include actual settings for field-adjustable devices.

D. Short-Circuit Study:
1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.
2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
   a. Maximum utility fault currents.
   b. Maximum motor contribution.
   c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.

E. Arc Flash and Shock Risk Assessment:
1. Comply with NFPA 70E.
2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
3. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
   a. Maximum and minimum utility fault currents.
   b. Maximum and minimum motor contribution.
   c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

F. Study Reports:
1. General Requirements:
   a. Identify date of study and study preparer.
   b. Identify study methodology and software product(s) used.
   c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
   d. Identify base used for per unit values.
   e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
   f. Include conclusions and recommendations.
2. Short-Circuit Study:
   a. For each scenario, identify at each bus location:
      1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
      2) Fault point X/R ratio.
      3) Associated equipment short circuit current ratings.
   b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
3. Arc Flash and Shock Risk Assessment:
   a. For the worst case for each scenario, identify at each bus location:
      1) Calculated incident energy and associated working distance.
      2) Calculated arc flash boundary.
      3) Bolted fault current.
      4) Arcing fault current.
      5) Clearing time.
      6) Arc gap distance.

b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.

1.07 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in preparation of studies of similar type and complexity using specified computer software.

B. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

PART 2 PRODUCTS

2.01 ARC FLASH HAZARD WARNING LABELS

A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
   1. Materials: Comply with Section 26 05 53.
   2. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
      a. Include the following information:
         1) Arc flash boundary.
         2) Available incident energy and corresponding working distance.
         3) Site-specific PPE (personnel protective equipment) requirements.
         4) Nominal system voltage.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install arc flash warning labels in accordance with Section 26 05 53.

3.02 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Provide the services of field testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting.

C. Inspect and test in accordance with NETA ATS, except Section 4.

D. Adjust equipment and protective devices for compliance with studies and recommended settings.

E. Notify Architect of any conflicts with or deviations from studies. Obtain direction before proceeding.

F. Submit detailed reports indicating inspection and testing results, and final adjusted settings.

3.03 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Training: Include as part of the base bid training for Owner's personnel on electrical safety pertaining to arc flash and shock hazards.
   1. Use site-specific arc flash and shock risk assessment report as training reference, supplemented with additional training materials as required.
   2. Instructor: Representative of entity performing study.
   3. Location: At project site.

END OF SECTION

PART 1 GENERAL

1.01 DESCRIPTION

A. The purpose of commissioning is to ensure that the work has been completed as specified and that systems are functioning in the manner as described in Division 26 Section, is installed per the contract documents, and operates per Sequence of Operations (SOO).

B. The steps associated with commissioning are outlined in Section 01 9113 PART - 3.

C. The members of the commissioning team consist of the contracted Commissioning Authority (CxA), the Owner's Representative/Construction Manager (CM), the General Contractors Commissioning Coordinator (GCC), the Architect and design Engineers (A/E), the mechanical contractor (MC), the Electrical Contractor (EC), the testing and balancing (TAB) contractor, the control contractor (CC), the facility operating staff, and any other installing subcontractors or suppliers of equipment. All team members work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.

D. RELATED DOCUMENTS
   1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
   2. Related Requirements:
      a. 01 9113 – COMMISSIONING GENERAL REQUIREMENTS

E. SYSTEMS TO BE COMMISSIONED
   1. Commissioning will be performed on the following systems:
      a. Lighting Controls systems for exterior and interior including daylighting
      b. Electricity Metering
      c. Fire Alarm System
      d. Electronic Access Control System
      e. Video Surveillance System
      f. Staff Assistance System

PART 2 PRODUCTS

2.01 REFER TO SECTION 01 9113, GENERAL COMMISSIONING REQUIREMENTS, PART 2 – PRODUCTS.

PART 3 EXECUTION

3.01 COMMISSIONING PROCESS AND PROCEDURES

A. Refer to Section 01 9113, GENERAL COMMISSIONING REQUIREMENTS, Part 2 – PRODUCTS.

B. GENERAL TESTING REQUIREMENTS
   1. Provide a Systems Readiness Plan as specified under Section 1.5B
   2. Contractor's Commissioning Coordinator shall verify completion of all items, sign and return the System Readiness checklists to the CxA as an indication of final completion with all installation criteria as specified in the Project Contract Documents
   3. A separate completed checklist shall be submitted for each system and item of equipment within the commissioning scope of work, as specified in Section 01 9113.
   4. The System Readiness Checklists do not represent all the contract documents for the associated equipment.

C. FUNCTIONAL PERFORMANCE TESTING
   1. The Functional Performance Test (FPT) Procedures shall be developed, performed, and demonstrated in accordance with Section 01 9113.
   2. At a minimum, the contractors and equipment suppliers listed in the FPTs Minimum Participants Table in this section of the specifications are required to participate in developing, performing, and demonstrating the indicated FPTs.
   3. The GCC shall coordinate the subcontractors, with the CxA's input in developing, performing, and demonstrating the Working FPT.

4. The Contractor shall test all systems within the commissioning scope of work, using the FPTs until the acceptable results specified in the FPT procedure are verified and documented. The Contractor may consult with the CxA, as necessary, to acquire clarification and resolve issues. The CxA shall be available for on-site assistance of this nature.
5. The Contractor shall submit documentation that verifies that the acceptable results specified in the FPT procedures have been verified and that they are ready to demonstrate the FPTs with acceptable results. Acceptable documentation consists of completed FPT record forms which document acceptable FPT results.

D. OPERATIONAL AND STAFF TRAINING
1. System narrative descriptions will be prepared by the CxA and contractor and should be supported by flow diagrams, one-line diagrams, and appropriate specification sections for major systems to be commissioned.
2. The Contractor and/or Subcontractor and associated manufacturer's representatives shall provide required training to operational staff after the system description meetings have occurred. The Subcontractor training sessions will provide a more detailed analogy of systems operation and maintenance.

E. INSTRUMENTATION
1. Instrumentation will be provided by the Contractor and/or Subcontractor. Instruments used for measurements shall be accurate. Calibration histories for each instrument shall be available for examination. Calibration and maintenance of instruments shall be in accordance with the requirements of NEBB or AABC Standards.
2. Application of instruments and accuracy of measurements shall be in accordance with NEBB or AABC Standards.

F. DOCUMENTATION
1. The GCC shall be responsible for collection of pertinent data during system start-up and functional performance testing. The Subcontractor shall submit to the CxA documentation of tests performed prior to and after system start-up. Documentation shall also include start-up procedures as approved by Commissioning Team.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Occupancy sensors.

B. Outdoor photo controls.

C. Daylighting controls.

D. Lighting contactors.

E. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems

C. Section 26 05 33.16 - Boxes for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 27 26 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.
   1. Includes finish requirements for wall controls specified in this section.

F. Section 26 51 00 - Interior Lighting.

G. Section 26 56 00 - Exterior Lighting.

1.03 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction.

C. NECA 130 - Standard for Installing and Maintaining Wiring Devices.

D. NFPA 70 - National Electrical Code.

E. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control.

F. UL 1472 - Solid-State Dimming Controls.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
   3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
   4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
   5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

C. Shop Drawings:

1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.
2. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.

D. Field Quality Control Reports.

E. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions 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 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

2.02 OCCUPANCY SENSORS

A. All Occupancy Sensors:
1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
2. Sensor Technology:
   a. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
6. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
7. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above the selected level.
8. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.

9. Where wired sensors are indicated, wireless sensors are acceptable provided that all components and wiring modifications necessary for proper operation are included.
10. Wireless Sensors:
    a. RF Range: 30 feet through typical construction materials.
    b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.
    c. Power: Battery-operated with minimum ten-year battery life.

B. Wall Switch Occupancy Sensors:
1. All Wall Switch Occupancy Sensors:
    a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
    b. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.
    c. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
2. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.

C. Wall Dimmer Occupancy Sensors:
1. General Requirements:
    a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated dimming control capability , and no leakage current to load in off mode.
    b. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.
    c. Finish: Match finishes specified for wiring devices in Section 26 27 26, unless otherwise indicated.

D. Ceiling Mounted Occupancy Sensors:
1. All Ceiling Mounted Occupancy Sensors:
    a. Description: Low profile occupancy sensors designed for ceiling installation.
    b. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
    a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

E. Luminaire Mounted Occupancy Sensors: Designed for direct luminaire installation and control, suitable for use with specified luminaires.

F. Power Packs for Low Voltage Occupancy Sensors:
1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
3. Input Supply Voltage: Dual rated for 120/277 V ac.

G. Power Packs for Wireless Occupancy Sensors:
1. Description: Plenum rated, self-contained relay compatible with specified wireless occupancy sensors for switching of line voltage loads.
2. Input Supply Voltage: Dual rated for 120/277 V ac.

2.03 OUTDOOR PHOTO CONTROLS

A. Stem-Mounted Outdoor Photo Controls:

1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
2. Housing: Weatherproof, impact resistant polycarbonate.
3. Photo Sensor: Cadmium sulfide.
4. Provide external sliding shield for field adjustment of light level activation.
5. Light Level Activation: 1 to 5 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
6. Voltage: As required to control the load indicated on the drawings.
7. Failure Mode: Fails to the on position.
8. Load Rating: As required to control the load indicated on the drawings.

2.04 DAYLIGHTING CONTROLS

A. System Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors and manual override controls.

B. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.
   1. Sensor Type: Filtered silicon photo diode.
   2. Sensor Range:
   3. Where wired sensors are indicated, wireless sensors are acceptable provided that all components and wiring modifications necessary for proper operation are included.
   4. Wireless Daylighting Control Photo Sensors:
      a. RF Range: 30 feet through typical construction materials.
      b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.
      c. Power: Battery-operated with minimum ten-year battery life.

C. Power Packs for Low Voltage Daylighting Control Modules:
   1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage daylighting control modules for switching of line voltage loads. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
   2. Input Supply Voltage: Dual rated for 120/277 V ac.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 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. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of lighting control devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switch Occupancy Sensors: 48 inches above finished floor.
   2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Install lighting control devices plumb and level, and held securely in place.

F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 27 26.

G. Provide required supports in accordance with Section 26 05 29.

H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

I. Occupancy Sensor Locations:
   1. Location Adjustments: Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage.
   2. Locate dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

J. Outdoor Photo Control Locations:
   1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
   2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.

K. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.

L. Daylighting Control Photo Sensor Locations:
   1. Location Adjustments: Within the design intent, reasonably minor adjustments to locations may be made in order to optimize control and avoid conflicts or problems affecting proper detection of light levels.
   2. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
   3. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.

M. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

D. Test outdoor photo controls to verify proper operation, including time delays where applicable.

E. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.

F. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on dual technology occupancy sensor lenses to block undesired motion detection.

D. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect.

E. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Architect.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Lighting and appliance panelboards.

B. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
   1. Includes requirements for the seismic qualification of equipment specified in this section.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 05 73 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

F. Section 26 27 13 - Electricity Metering: For interface with equipment specified in this section.

G. Section 26 28 13 - Fuses: Fuses for fusible switches and spare fuse cabinets.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction.

C. NECA 407 - Standard for Installing and Maintaining Panelboards.

D. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. NEMA PB 1 - Panelboards.

F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

H. NFPA 70 - National Electrical Code.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.

K. UL 67 - Panelboards.

L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.

M. UL 869A - Reference Standard for Service Equipment.

N. UL 943 - Ground-Fault Circuit-Interrupters.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
   4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - 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.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
   2. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB/GE: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Siemens Industry, Inc: www.usa.siemens.com/#sle.

E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Seismic Qualification: Provide panelboards and associated components suitable for application under the seismic design criteria specified in Section 26 05 48 where required. Include certification of compliance with submittals.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

D. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.

E. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

F. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

G. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

H. 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.

I. Conductor Terminations: Suitable for use with the conductors to be installed.

J. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
      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.

K. 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: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
   2. Phase and Neutral Bus Material: Aluminum.
   3. Ground Bus Material: Aluminum.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
   1. Provide surface-mounted or flush-mounted enclosures as indicated.
   2. Fronts: Provide 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:
      1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
   b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
3. Conductor Terminations:
   a. Provide mechanical lugs unless otherwise indicated.
   b. 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.
9. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 26 05 29.

F. Provide required seismic controls in accordance with Section 26 05 48.

G. Install panelboards plumb.

H. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

I. 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.

J. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

K. Provide grounding and bonding in accordance with Section 26 05 26.

L. Install all field-installed branch devices, components, and accessories.

M. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

N. Provide filler plates to cover unused spaces in panelboards.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - 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 100 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.

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

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment for Owner electricity metering:
   1. Single circuit electricity meters.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 33.16 - Boxes for Electrical Systems: Cabinets and enclosures for metering system components.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 24 16 - Panelboards: For interface with meters specified in this section.

F. Section 26 28 13 - Fuses.

1.03 REFERENCE STANDARDS

A. ANSI C12.1 - Electric Meters Code for Electricity Metering.

B. IEC 62053-21 - Electricity Metering Equipment (A.C.) - Particular Requirements - Part 21: Static Meters for Active Energy (Classes 1 and 2).

C. IEC 62053-23 - Electricity Metering Equipment (A.C.) - Particular Requirements - Part 23: Static Meters for Reactive Energy (Classes 2 and 3).

D. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction.

F. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

H. NFPA 70 - National Electrical Code.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate work to provide equipment suitable for interface with electricity metering systems to be provided.
   2. Coordinate the work with other installers to provide communication lines required for electricity metering system interface.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for electricity metering systems and associated components and accessories. Include ratings, configurations, standard wiring diagrams, dimensions, service condition requirements, and installed features.

C. Shop Drawings: Include system interconnection schematic diagrams showing all factory and field connections. Include requirements for interface with other systems.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.01 EQUIPMENT FOR OWNER ELECTRICITY METERING

A. Provide microprocessor-based digital electricity metering systems including all instrument transformers, wiring, and connections necessary for measurements specified.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Provide electricity metering systems and associated components compatible with the equipment and associated circuits to be metered.

D. Service Conditions: Provide electricity meters suitable for operation under the service conditions at the installed location.

E. Enclosures:
   1. Where not furnished by manufacturer, provide required cabinets and enclosures in accordance with Section 26 05 33.16.
   2. 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 or Type 4.
   3. Finish: Manufacturer's standard unless otherwise indicated.

F. Instrument Transformers:
   1. Comply with IEEE C57.13, where applicable.
   2. Select suitable ratio, burden, and accuracy as required for connected devices.
   3. Current Transformers: Compatible with connected meters; replace meters damaged by connection of incompatible current transformers. Provide shorting terminal blocks for connection of secondaries where applicable.
   4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

2.02 SINGLE CIRCUIT ELECTRICITY METERS

A. Single Circuit Electricity Meter:
   1. Basis of Design: EATON; PMX1000 Series.
   2. Accuracy:
      a. Real/Active Power/Energy: Revenue grade; plus/minus 1.0 percent; complying with ANSI C12.1 and/or IEC 62053-21 Class 1.
      b. Reactive Power/Energy: Plus/minus 2.0 percent, complying with IEC 62053-23 Class 2.
   3. Measured Parameters:
      a. Voltage (Volts AC); line-to-line and line-to-neutral; per phase.
      b. Current (Amps); per phase.
      c. Frequency (Hz).
      d. Real/active power (kW); per phase and total of all phases.
      e. Reactive power (kVAR); per phase and total of all phases.
      f. Apparent power (kVA); per phase and total of all phases.
      g. Power factor; per phase and total of all phases.
      h. Real/active energy (kWh).
      i. Reactive energy (kVARh).
      j. Apparent energy (kVAh).
      k. Power demand; real/active, reactive, and apparent; present and maximum.
   4. Data logging.

5. Alarm capability, with configurable setpoints.
6. Communications: Compatible with connected systems. Provide all accessories necessary for proper interface.
    a. Serial Communications: RS-485; support for Modbus RTU protocol.
    b. Ethernet Communications: Support for Modbus TCP protocol.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of metering systems and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive meters.

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. Provide required support and attachment components in accordance with Section 26 05 29.

D. Provide grounding and bonding in accordance with Section 26 05 26.

E. Provide fuses complying with Section 26 28 13 as required.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.

D. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.

E. Correct deficiencies and replace damaged or defective metering system components.

3.04 ADJUSTING

A. Program system parameters according to requirements of Owner.

3.05 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
    1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Wall plates.

1.02 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 33.16 - Boxes for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 05 83 - Wiring Connections: Cords and plugs for equipment.

F. Section 27 10 00 - Structured Cabling: Voice and data jacks.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Federal Specification.

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Federal Specification.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices.

E. NEMA WD 1 - General Color Requirements for Wiring Devices.

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications.

G. NFPA 70 - National Electrical Code.

H. UL 20 - General-Use Snap Switches.

I. UL 498 - Attachment Plugs and Receptacles.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices.

K. UL 943 - Ground-Fault Circuit-Interrupters.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

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 PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide GFCI protection for receptacles installed within 6 feet of sinks.

E. Provide GFCI protection for receptacles installed in kitchens.

2.02 WIRING DEVICE FINISHES

A. Provide wiring device finishes as described below unless otherwise indicated.

B. Wiring Devices, Unless Otherwise Indicated: White with stainless steel wall plate.

2.03 WALL SWITCHES

A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

B. Standard Wall Switches: Commercial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.04 RECEPTACLES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.
   3. Hospital Grade Receptacles: Listed as complying with UL 498 Supplement SD, with green dot hospital grade mark on device face.

C. Convenience Receptacles:
   1. Standard Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
   2. Weather Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

3. Tamper Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.

D. GFCI Receptacles:
1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
2. Standard GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

2.05 WALL PLATES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell-wiring.com/#sle.
2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Standard.
3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that core drilled holes for poke-through assemblies are in proper locations.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of wiring devices provided under this section.
1. Mounting Heights: Unless otherwise indicated, as follows:
a. Wall Switches: 48 inches above finished floor.
b. Receptacles: 18 inches above finished floor or 6 inches above counter.
2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.

3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Unless otherwise indicated, GFCI receptacles may be connected to provide feed-through protection to downstream devices. Label such devices to indicate they are protected by upstream GFCI protection.

I. Install wiring devices plumb and level with mounting yoke held rigidly in place.

J. Install wall switches with OFF position down.

K. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

L. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

M. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fuses.

1.02 RELATED REQUIREMENTS

A. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

B. Section 26 05 73 - Power System Studies: Additional criteria for the selection of protective devices specified in this section.

C. Section 26 24 16 - Panelboards: Fusible switches.

D. Section 26 28 16.16 - Enclosed Switches: Fusible switches.

1.03 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses.

B. NFPA 70 - National Electrical Code.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements.

D. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses.

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 26 28 16.16.
   2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - 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.

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. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 APPLICATIONS

A. Feeders:
   1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.

B. General Purpose Branch Circuits: Class RK1, time-delay.

C. 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.
   1. Class RK1, Time-Delay Fuses:
   2. Class RK5, Time-Delay Fuses:

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

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 05 73 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.

F. Section 26 28 13 - Fuses.

G. Section 26 36 00 - Transfer Switches: Automatic and non-automatic switches listed for use as transfer switch equipment.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

C. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum).

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

E. NFPA 70 - National Electrical Code.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.

H. UL 98 - Enclosed and Dead-Front Switches.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - 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. Manufacturer's equipment seismic qualification certification.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB/GE: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Siemens Industry, Inc: www.usa.siemens.com/#sle.

E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Seismic Qualification: Provide enclosed safety switches suitable for application under the seismic design criteria specified in Section 26 05 48 where required. Include certification of compliance with submittals.

D. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

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 determined by short circuit study performed in accordance with Section 26 05 73.
   2. Minimum Ratings:
      a. General Duty Single Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.

H. Provide with switch blade contact position that is visible when the cover is open.

I. Conductor Terminations: Suitable for use with the conductors to be installed.

J. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

K. 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.

L. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

M. Heavy Duty Switches:
   1. Comply with NEMA BS 31047.
   2. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 05 29.

E. Provide required seismic controls in accordance with Section 26 05 48.

F. Install enclosed switches plumb.

G. 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.

H. Provide grounding and bonding in accordance with Section 26 05 26.

I. Provide fuses complying with Section 26 28 13 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - 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

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Transfer switches for low-voltage (600 V and less) applications and associated accessories:
   1. Manual transfer switches.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

D. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
   1. Includes requirements for the seismic qualification of equipment specified in this section.

E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 05 73 - Power System Studies: Additional criteria for the selection of equipment specified in this section.

G. Section 26 28 16.16 - Enclosed Switches: Safety switches not listed for use as transfer switch equipment.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

C. NEMA IA 10042-1 - Industrial Control and Systems Part 1: Electromechanical AC Transfer Switch Equipment.

D. NFPA 70 - National Electrical Code.

E. NFPA 110 - Standard for Emergency and Standby Power Systems.

F. UL 1008 - Transfer Switch Equipment.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate compatibility of transfer switches to be installed with work provided under other sections or by others.
   2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
   3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Coordinate the work with placement of supports, anchors, etc. required for mounting.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.

C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.
   1. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

E. Source quality control test reports.

1.06 QUALITY ASSURANCE

A. Comply with the following:
   1. NFPA 70 (National Electrical Code).
   2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for system Level specified in Section 26 32 13.

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 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store transfer switches in accordance with manufacturer's instructions.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's instructions to avoid damage to transfer switch components, enclosure, and finish.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Transfer Switches:
   1. ABB/GE: www.electrification.us.abb.com/#sle.
   2. Eaton Corporation: www.eaton.com/#sle.
   3. Generac.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 TRANSFER SWITCHES

A. Provide complete power transfer system consisting of all required equipment, conduit, boxes, wiring, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Construction Type: Only "contactor type" (open contact) transfer switches are acceptable. Do not use "breaker type" (enclosed contact) transfer switches.

D. Manual Transfer Switch:
   1. Voltage: As indicated on the drawings.
   2. Ampere Rating: As indicated on the drawings.
   3. Neutral Configuration: Solid neutral (unswitched), except as indicated.
   4. Load Served: As indicated on the drawings.
   5. Primary Source: As indicated on the drawings.
   6. Alternate Source: As indicated on the drawings.

E. Comply with NEMA IA 10042-1, and list and label as complying with UL 1008 for the classification of the intended application (e.g. emergency, optional standby).

F. Do not use double throw safety switches or other equipment not specifically designed for power transfer applications and listed as transfer switch equipment.

G. Load Classification: Classified for total system load (any combination of motor, electric discharge lamp, resistive, and tungsten lamp loads with tungsten lamp loads not exceeding 30 percent of the continuous current rating) unless otherwise indicated or required.

H. Switching Methods:
   1. Open Transition:

a. Provide break-before-make transfer without a neutral position that is not connected to either source, and with interlocks to prevent simultaneous connection of the load to both sources.

2. Obtain control power for transfer operation from line side of source to which the load is to be transferred.

I. Seismic Qualification: Provide transfer switches and associated components suitable for application under the seismic design criteria specified in Section 26 05 48 where required. Include certification of compliance with submittals.

J. Service Conditions: Provide transfer switches suitable for continuous operation at indicated ratings under the service conditions at the installed location.

K. Enclosures:
1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
a. Outdoor Locations: Type 3R or Type 4.
2. Finish: Manufacturer's standard unless otherwise indicated.

L. Short Circuit Current Rating:
1. Withstand and Closing Rating: Provide transfer switches, when protected by the supply side overcurrent protective devices to be installed, with listed withstand and closing rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.

M. Manual Transfer Switches:
1. Description: Transfer switches with manually initiated transfer between sources; mechanically operated and mechanically held.

2.03 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Perform production tests on transfer switches at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of transfer switches are consistent with the indicated requirements.

C. Verify that rough-ins for field connections are in the proper locations.

D. Verify that mounting surfaces are ready to receive transfer switches.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Provide required support and attachment in accordance with Section 26 05 29.

E. Provide required seismic controls in accordance with Section 26 05 48.

F. Install transfer switches plumb and level.

G. Unless otherwise indicated, mount floor-mounted transfer switches on properly sized 3 inch high concrete pad constructed in accordance with Section 03 30 00.

H. Provide grounding and bonding in accordance with Section 26 05 26.

I. Identify transfer switches and associated system wiring in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Prepare and start system in accordance with manufacturer's instructions.

C. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.04 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of transfer switches to Owner, and correct deficiencies or make adjustments as directed.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. Ballasts and drivers.

E. Lamps.

F. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 26 05 29 - Hangers and Supports for Electrical Systems.

B. Section 26 05 33.16 - Boxes for Electrical Systems.

C. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 09 23 - Lighting Control Devices.

F. Section 26 27 26 - Wiring Devices: Manual wall switches and wall dimmers.

G. Section 26 56 00 - Exterior Lighting.

1.03 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices.

B. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code).

C. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits.

D. IES LM-63 - IESNA Standard File Format for Electronic Transfer of Photometric Data and Related Information.

E. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products.

F. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction.

H. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems.

I. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems.

J. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts.

K. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility.

L. NFPA 70 - National Electrical Code.

M. NFPA 101 - Life Safety Code.

N. UL 844 - Luminaires for Use in Hazardous (Classified) Locations.

O. UL 924 - Emergency Lighting and Power Equipment.

P. UL 935 - Fluorescent-Lamp Ballasts.

Q. UL 1029 - High-Intensity-Discharge Lamp Ballasts.

R. UL 1598 - Luminaires.

S. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
   2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
   3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
   4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   2. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, 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.
   2. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.

D. Samples:
   1. Provide one sample(s) of each specified luminaire where indicated.
   2. Provide one sample(s) of each custom luminaire where indicated.
   3. Provide one sample(s) of each luminaire proposed for substitution upon request.
   4. Provide one sample(s) of each product finish illustrating color and texture upon request.

E. Field quality control 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. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - 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.
   3. Extra Lamps: Ten percent of total quantity installed for each type, but not less than two of each type.
   4. Extra Ballasts: Two percent of total quantity installed for each type, but not less than one of each type.

I. 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 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for all LED luminaires, including drivers.

C. Provide 2-year manufacturer warranty for linear fluorescent ballasts.

D. Provide 5-year pro-rata warranty for batteries for emergency lighting units.

E. Provide 10-year pro-rata warranty for batteries for self-powered exit signs.

F. Provide 3-year full warranty for fluorescent emergency power supply units.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Provide products complying with Federal Energy Management Program (FEMP) requirements.

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.
4. Air-Handling Recessed Fluorescent Luminaires: Suitable for air supply/return, heat removal, or combination as indicated.
    a. Luminaires for Air Supply/Return: Provide air control blades where indicated.
    b. Luminaires for Heat Removal: Provide heat removal dampers where indicated.

I. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.

J. 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.

K. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.
1. LED Tape - General Requirements:
    a. Listed.
    b. Designed for field cutting in accordance with listing.
    c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.
2. White LED Tape:
    a. Correlated Color Temperature (CCT): 2700-3000 K unless otherwise indicated.
    b. Color Rendering Index (CRI): Not less than 80.

L. Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.

M. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

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.

C. Accessories:
1. Provide compatible accessory high-impact polycarbonate vandal shields where indicated.
2. Provide compatible accessory wire guards where indicated.

2.04 BALLASTS AND DRIVERS

A. Manufacturers:
1. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by a single manufacturer.
2. 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 zero 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 26 27 26.
b. Daylighting Controls: See Section 26 09 23.

2.05 LAMPS

A. Manufacturers:
1. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

B. Lamps - General Requirements:
1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

2.06 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 26 05 33.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E. Provide required support and attachment in accordance with Section 26 05 29.

F. Provide required seismic controls in accordance with Section 26 05 48.

G. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

H. 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.

I. Recessed Luminaires:
1. Install trims tight to mounting surface with no visible light leakage.
2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

J. 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.

K. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

L. Install accessories furnished with each luminaire.

M. Bond products and metal accessories to branch circuit equipment grounding conductor.

N. Air Handling Luminaires: Interface with air handling accessories furnished and installed under Section 23 36 00.

O. Fluorescent Luminaires Controlled by Dual-Level Switching: Connect such that each switch controls the same corresponding lamps in each luminaire.

P. Emergency Lighting Units:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
2. Install lock-on device on branch circuit breaker serving units.

Q. Exit Signs:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
2. Install lock-on device on branch circuit breaker serving units.

R. Remote Drivers: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.

S. Identify luminaires connected to emergency power system in accordance with Section 26 05 53.

T. Install lamps in each luminaire.

U. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Air-Handling Luminaires with Air Control Blades or Heat Removal Dampers: Adjust as indicated or as required for proper airflow as directed by Architect.

D. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.06 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 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

D. Just prior to Substantial Completion, replace all lamps that have failed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

3.09 ATTACHMENTS

A. Luminaire schedule.

B. Luminaire cut sheets.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaires.

B. Ballasts.

C. Luminaire accessories.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 33.16 - Boxes for Electrical Systems.

D. Section 26 09 23 - Lighting Control Devices.

E. Section 26 27 26 - Wiring Devices: Receptacles for installation in poles.

F. Section 26 51 00 - Interior Lighting.

1.03 REFERENCE STANDARDS

A. IES LM-63 - IESNA Standard File Format for Electronic Transfer of Photometric Data and Related Information.

B. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products.

C. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction.

E. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems.

F. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility.

G. NFPA 70 - National Electrical Code.

H. UL 1598 - Luminaires.

I. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - 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, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
   2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.

D. Field Quality Control Reports.

1. Include test report indicating measured illumination levels.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide 2-year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

H. 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.

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 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:
1. Provide ballasts containing no polychlorinated biphenyls (PCBs).

2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

2.04 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 26 05 33.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires in accordance with NECA/IESNA 501.

E. Provide required support and attachment in accordance with Section 26 05 29.

F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.

H. Suspended Luminaires:
   1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   2. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet between supports.

I. Install accessories furnished with each luminaire.

J. Bond products and metal accessories to branch circuit equipment grounding conductor.

K. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

3.06 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Metal conduits and fittings.
   2. Nonmetallic conduits and fittings.
   3. Optical-fiber-cable pathways and fittings.
   4. Metal wireways and auxiliary gutters.
   5. Nonmetallic wireways and auxiliary gutters.
   6. Surface pathways.
   7. Boxes, enclosures, and cabinets.

B. Related Requirements:
   1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
   2. Section 260533 "Raceways and Boxes for Electrical Systems" for conduits, wireways, surface raceways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.
   3. Section 280528 "Pathways for Electronic Safety and Security" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving electronic safety and security.

1.03 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

1.04 ACTION SUBMITTALS

A. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

C. Samples: For wireways, nonmetallic wireways, and surface pathways and for each color and texture specified, 12 inches (300 mm) long.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
   1. Structural members in paths of pathway groups with common supports.
   2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Qualification Data: For professional engineer.

C. Seismic Qualification Certificates: For pathway racks, enclosures, cabinets, equipment racks and their mounting provisions, including those for internal components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which certification is based and their installation requirements.
   4. Detailed description of conduit support devices and interconnections on which certification is based and their installation requirements.

D. Source quality-control reports.

PART 2 PRODUCTS

2.01 METAL CONDUITS AND FITTINGS

A. Insert list of manufacturers and products

B. General Requirements for Metal Conduits and Fittings:
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Comply with TIA-569-B.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. ARC: Comply with ANSI C80.5 and UL 6A.

E. IMC: Comply with ANSI C80.6 and UL 1242.

F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit and IMC.
   1. Comply with NEMA RN 1.
   2. Coating Thickness: 0.040 inch (1 mm), minimum.

G. EMT: Comply with ANSI C80.3 and UL 797.

H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
   1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
   2. Fittings for EMT:
      a. Material: Steel
      b. Type: Setscrew and Compression.
   3. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
   4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

I. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 NONMETALLIC CONDUITS AND FITTINGS

A. General Requirements for Nonmetallic Conduits and Fittings:
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Comply with TIA-569-B.

B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

C. Rigid HDPE: Comply with UL 651A.

D. Continuous HDPE: Comply with UL 651B.

E. RTRC: Comply with UL 1684A and NEMA TC 14.

F. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

G. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.03 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

A. Description: Comply with UL 2024; flexible-type pathway, approved for plenum, plenum riser, or general-use installation unless otherwise indicated.
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Comply with TIA-569-B.

2.04 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
   1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Comply with TIA-569-B.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Wireway Covers:Hinged type unless otherwise indicated.

D. Finish: Manufacturer's standard enamel finish.

2.05 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. General Requirements for Nonmetallic Wireways and Auxiliary Gutters:
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Comply with TIA-569-B.

B. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.

C. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

E. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.06 SURFACE PATHWAYS

A. General Requirements for Surface Pathways:
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Comply with TIA-569-B.

B. Surface Metal Pathways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect

C. Surface Nonmetallic Pathways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL-94 V-0 requirements for self-extinguishing characteristics.
   1. Insert list of manufacturers and products

D. Tele-Power Poles:
   1. Material: Aluminum with clear anodized finish
   2. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

2.07 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets:

1. Comply with TIA-569-B.
2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.

D. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

E. Metal Floor Boxes:
1. Material: Cast metal or Sheet metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Nonmetallic Floor Boxes: Nonadjustable, round.
1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

I. Device Box Dimensions:5 inches square by 2-1/8 inches deep (125 mm square by 60 mm deep).

J. Gangable boxes are allowed.

K. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures:
   a. Material: Plastic.
   b. Finished inside with radio-frequency-resistant paint.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

M. Cabinets:
1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 EXECUTION

3.01 PATHWAY APPLICATION

A. Indoors: Apply pathway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT or RNC.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC. Pathway locations include the following:
   a. Mechanical, electrical rooms.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Damp or Wet Locations: GRC.

6. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical-fiber-cable pathway.
7. Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts: Riser-type, optical-fiber-cable pathway.
8. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable:General-use, optical-fiber-cable pathway
9. Boxes and Enclosures: NEMA 250 Type 1, except use NEMA 250 Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

B. Minimum Pathway Size: 3/4-inch (21-mm) trade size. Minimum size for optical-fiber cables is 1 inch (27 mm).

C. Pathway Fittings: Compatible with pathways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.

D. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

E. Install surface pathways only where indicated on Drawings.

F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.02 INSTALLATION

A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

B. Keep pathways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

C. Complete pathway installation before starting conductor installation.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches (300 mm) of changes in direction. Utilize long radius ells for all optical-fiber cables.

F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

G. Support conduit within 12 inches (300 mm) of enclosures to which attached.

H. Pathways Embedded in Slabs:
1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot (3-m) intervals.
2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
3. Arrange pathways to keep a minimum of 1 inch (25 mm) of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from ENT to GRC before rising above floor.

I. Stub-ups to Above Recessed Ceilings:
1. Use EMT, IMC, or RMC for pathways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.

K. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.

L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

M. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

O. Cut conduit perpendicular to the length. For conduits of 2-inch (53-mm) trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

P. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg)tensile strength. Leave at least 12 inches (300 mm)of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.

Q. Surface Pathways:
   1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
   2. Install surface pathway with a minimum 2-inch (50-mm) radius control at bend points.
   3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

R. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
   1. 3/4-Inch (21-mm) Trade Size and Smaller: Install pathways in maximum lengths of 50 feet (15 m).
   2. 1-Inch (27-mm) Trade Size and Larger: Install pathways in maximum lengths of 75 feet (23 m).
   3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

S. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.

T. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where an underground service pathway enters a building or structure.
   3. Where otherwise required by NFPA 70.

U. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

V. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
   c. Indoor Spaces Connected with Outdoors without Physical Separation: 155 deg F (86 deg C) temperature change.
   d. Attics: 135 deg F (75 deg C) temperature change.
3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

W. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

X. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Y. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

Z. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

AA. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

BB. Set metal floor boxes level and flush with finished floor surface.

CC. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.03 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

3.04 PROTECTION

A. Protect coatings, finishes, and cabinets from damage or deterioration.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other communications work.

1.02 RELATED REQUIREMENTS

A. Section 26 0529 - Hangers and Supports for Electrical Systems.

B. Section 27 0533.13 - Conduit for Communications Systems: Additional support and attachment requirements for conduits.

C. Section 27 1000 - Structured Cabling.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2019.

D. BICSI ITSIMM - Information Technology Systems Installation Methods Manual (ITSIMM), 8th Edition; 2022.

E. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.

F. MFMA-4 - Metal Framing Standards Publication; 2004.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. TIA-569 - Telecommunications Pathways and Spaces; 2019e.

J. 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.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
   2. Coordinate work to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
   4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
   5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 03 3000.

1.05 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cable supports, channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by the product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of the product.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with the 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. TIA-569.
      b. NFPA 70.
      c. Requirements of authorities having jurisdiction.
   2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of communications 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. Include consideration for vibration, equipment operation, and shock loads where applicable.
   5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   6. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
      a. 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. Conduit Supports Straps and clamps suitable for the conduit to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Cable Supports: Suitable for cables to be supported, including but not limited to J-hooks, bridle rings, drive rings, and flexible harnesses/slings.
   1. Applications:
      a. Do not exceed 5 feet (1.5 m) between cable supports.
      b. Maximum Number of Cables per Cable Support:
         1) J-Hooks: 50, regardless of capacity.
      c. Allowable Cable Types:
         1) J-Hooks: Category 6e.
   2. Comply with TIA-569.
   3. Cable Supports Installed in Spaces Used for Environmental Air: Plenum rated; listed and labeled as complying with UL 2043, suitable for use in air-handling spaces.
   4. J-Hooks: Noncontinuous cabling support with removable top retainer clip.
      a. Material: Use galvanized steel, factory-painted steel, or stainless steel.
      b. Provide support surfaces with smooth, beveled edges and radius not less than minimum allowable bend radius of cables supported.
      c. Provide multitiered J-hooks where required to support multiple cabling systems.

D. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.

E. Metal Channel/Strut Framing Systems:
   1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
   2. Comply with MFMA-4.

F. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.

G. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
   1. Description: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.
   2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
   3. Attachment/Support Fixtures: As recommended by the manufacturer, the same type as indicated for equivalent indoor hangers and supports.
   4. Mounting Height: Provide minimum clearance of 6 inches (150 mm) under supported component to top of roofing.

H. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
   2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
   3. Hollow Stud Walls: Use toggle bolts.
   4. Steel: Use beam clamps, machine bolts, or welded threaded studs.
   5. Sheet Metal: Use sheet metal screws.
   6. Wood: Use wood screws.
   7. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
      a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
      b. Comply with MFMA-4.
      c. Channel Material: Use galvanized steel.

PART 3 EXECUTION

3.01 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, BICSI ITSIMM, and BICSI N1.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:
   1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment 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 in accordance with manufacturer's recommended torque settings.

J. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - 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

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).
B. Aluminum rigid metal conduit (RMC).
C. Galvanized steel intermediate metal conduit (IMC).
D. Flexible metal conduit (FMC).
E. Liquidtight flexible metal conduit (LFMC).
F. Galvanized steel electrical metallic tubing (EMT).
G. Aluminum electrical metallic tubing (EMT).
H. Rigid polyvinyl chloride (PVC) conduit.
I. Electrical nonmetallic tubing (ENT).
J. Liquidtight flexible nonmetallic conduit (LFNC).
K. Reinforced thermosetting resin conduit (RTRC).
L. High-density polyethylene (HDPE) conduit.
M. Polyvinyl chloride (PVC) plastic utilities duct.
N. Inside-plant flexible nonmetallic communications raceway/innerduct.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.
B. Section 26 0533.13 - Conduit for Electrical Systems.
C. Section 27 1000 - Structured Cabling.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2015.
B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2015.
C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A); 2015.
D. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2018.
E. ASTM F512 - Standard Specification for Smooth-Wall Poly(Vinyl Chloride) (PVC) Conduit and Fittings for Underground Installation; 2019.
F. ASTM F2160 - Standard Specification for Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter (OD); 2016.
G. ASTM F2176 - Standard Specification for Mechanical Couplings Used on Polyethylene Conduit, Duct and Innerduct; 2017.
H. BICSI ITSIMM - Information Technology Systems Installation Methods Manual (ITSIMM), 8th Edition; 2022.
I. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.
J. BICSI TDMM - Telecommunications Distribution Methods Manual, 14th Edition; 2020.
K. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
L. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.
M. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit; 2004.
N. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2017.

O. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

P. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.

Q. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2016.

R. NEMA TC 6&8 - Polyvinyl Chloride (PVC) Plastic Utilities for Underground Installations; 2020.

S. NEMA TC 7 - Solid-Wall Coilable and Straight Electrical Polyethylene Conduit; 2021.

T. NEMA TC 9 - Fittings for Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installation; 2020.

U. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT); 2014 (Reaffirmed 2019).

V. NEMA TC 14 (SERIES) - Reinforced Thermosetting Resin Conduit and Fittings Series; 2015.

W. NEMA TC 14.BG - Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings; 2015.

X. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Y. TIA-568.0 - Generic Telecommunications Cabling for Customer Premises; 2020e.

Z. TIA-569 - Telecommunications Pathways and Spaces; 2019e.

AA. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

BB. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

CC. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.

DD. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

EE. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

FF. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

GG. UL 651A - Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit; Current Edition, Including All Revisions.

HH. UL 746C - Polymeric Materials – Use in Electrical Equipment Evaluations; Current Edition, Including All Revisions.

II. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

JJ. UL 797A - Electrical Metallic Tubing - Aluminum and Stainless Steel; Current Edition, Including All Revisions.

KK. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

LL. UL 1653 - Electrical Nonmetallic Tubing; Current Edition, Including All Revisions.

MM. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

NN. UL 2024 - Standard for Cable Routing Assemblies and Communications Raceways; Current Edition, Including All Revisions.

OO. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

PP. UL 2420 - Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with actual type and quantity of cables to be installed.

2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not begin installation of communications cables until installation of conduit between termination points is complete.

1.05 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

C. Shop Drawings:
1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
2. Include proposed locations of roof penetrations and methods for sealing.

D. Project Record Documents: Record actual routing for conduits installed underground and conduits embedded within concrete slabs.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, TIA-569, BICSI ITSIMM, BICSI TDMM, manufacturers' instructions, and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.

C. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

D. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), stainless steel electrical metallic tubing (EMT), or inside-plant flexible nonmetallic communications raceway/innerduct.

E. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

F. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

G. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), stainless steel electrical metallic tubing (EMT), or schedule 80 rigid PVC conduit.

H. Exposed, Interior, Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or stainless steel intermediate metal conduit (IMC).

I. Exposed, Exterior, Not Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

J. Exposed, Exterior, Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or stainless steel intermediate metal conduit (IMC).

K. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

2.02 CONDUIT - GENERAL REQUIREMENTS

A. Comply with NFPA 70 and TIA-569.

B. Provide conduit, fittings, supports, and accessories required for complete communications pathway.

C. Provide products listed, classified, and labeled as suitable for purpose intended.

D. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Communications Outlet Box: 3/4-inch (21 mm) trade size.
   2. Continuous Conduit Homerun Serving One Communications Outlet Box: 1-inch (27 mm) trade size.
   3. Continuous Conduit Homerun Serving Two Communications Outlet Boxes: 1-inch (27 mm) trade size.
   4. Continuous Conduit Homerun Serving Three Communications Outlet Boxes: 1-1/4-inch (35 mm) trade size.

E. Where conduit size is not indicated, size to comply with NFPA 70, TIA-569, and BICSI TDMM, but not less than applicable minimum size requirements specified. Where specified standards differ, comply with most stringent.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

B. Fittings:
   1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use threaded fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
   4. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
      a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.04 ALUMINUM RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.

B. Fittings:

1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6A
2. Material: Use aluminum.
3. Connectors and Couplings: Use threaded fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
4. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
   a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.05 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

B. Fittings:
   1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use threaded fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
   4. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
      a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.06 FLEXIBLE METAL CONDUIT (FMC)

A. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Conduit Bodies: Standard conduit bodies designed for electrical raceways are not permitted.

2.07 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
      a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.08 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use compression/gland or set-screw type.
      a. Do not use indenter type connectors and couplings.
   4. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
      a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.09 ALUMINUM ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT aluminum electrical metallic tubing listed and labeled as complying with UL 797A.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; listed for use with aluminum EMT.
   2. Material: Use aluminum.
   3. Connectors and Couplings: Use compression/gland or set-screw type.
      a. Do not use indenter type connectors and couplings.
   4. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
      a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.10 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage.

B. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.
   3. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
      a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.11 ELECTRICAL NONMETALLIC TUBING (ENT)

A. Description: NFPA 70, Type ENT electrical nonmetallic tubing complying with NEMA TC 13 and listed and labeled as complying with UL 1653.

B. Fittings:
   1. Manufacturer: Same as manufacturer of ENT to be connected.
   2. Use solvent-welded type fittings.
   3. Solvent-Welded Fittings: Rigid PVC fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; suitable for use with ENT.

2.12 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

A. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.

B. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for type of conduit to be connected.

2.13 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC)

A. Applications:
   1. Underground, Direct-Buried: Use belowground (BG), DB (direct-burial) RTRC.
   2. Underground, Embedded in Concrete: Use belowground (BG), EB (encased-burial) RTRC or belowground (BG), DB (direct-burial) RTRC.

B. Description: NFPA 70, Type RTRC reinforced thermosetting resin conduit complying with NEMA TC 14 (SERIES).
   1. Belowground (BG) RTRC: Comply with NEMA TC 14.BG and list and label as complying with UL 2420.

C. Supports: As recommended by manufacturer.

D. Fittings: Same type and manufacturer as conduit to be connected.

1. Conduit Bodies: Standard conduit bodies designed for electrical raceways are not permitted.

2.14 HIGH-DENSITY POLYETHYLENE (HDPE) CONDUIT

A. Description: NFPA 70, Type HDPE high-density polyethylene solid-wall conduit complying with ASTM F2160 and NEMA TC 7; list and label as complying with UL 651A; Schedule 40 unless otherwise indicated.

B. Joining Methods: Approved by HDPE conduit manufacturer.

C. Mechanical Fittings: Comply with ASTM F2176; list and label as complying with UL 651A.

2.15 POLYVINYL CHLORIDE (PVC) PLASTIC UTILITIES DUCT

A. Description: Rigid polyvinyl chloride plastic utilities duct complying with NEMA TC 6&8 and ASTM F512; Type EB-20 listed and labeled as complying with UL 651, suitable for burial with concrete encasement.

B. Fittings: Comply with NEMA TC 9.
   1. Manufacturer: Same as manufacturer of duct to be connected.

2.16 INSIDE-PLANT FLEXIBLE NONMETALLIC COMMUNICATIONS RACEWAY/INNERDUCT

A. Description: Flexible, corrugated, nonmetallic communications raceway and associated fittings listed and labeled as complying with UL 2024; also suitable for installation as innerduct.

B. Use only with approved cables in accordance with listing.

2.17 ACCESSORIES

A. Inside-Plant Fabric Innerduct: Listed as complying with UL 2024; plenum rated.

B. Outside-Plant Fabric Innerduct: Designed for installation in underground raceways.

C. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch (0.51 mm).

D. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

E. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

F. Epoxy Adhesive for RTRC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

G. Adhesive for HDPE and RTRC Conduit:
   1. Specifically designed for bonding dissimilar materials in lieu of transition fittings, including but not limited to polyethylene, fiberglass, PVC, aluminum, and steel; UL 746C recognized.
   2. Approved by adhesive manufacturer for use with materials to be joined.

H. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf (5.6 kN).

I. Foam Conduit Sealant:
   1. Removable, two-part, closed-cell foam, specifically designed for sealing conduit openings against water, moisture, gases, and dust.
   2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
   3. Rated to hold minimum of 10 ft (3.0 m) water head pressure.

J. Sealing Systems for Concrete Penetrations:
   1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
   2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.

K. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.

L. 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.

M. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

N. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in accordance with NECA 1, BICSI ITSIMM, and BICSI N1.

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.

E. Install galvanized steel intermediate metal conduit (IMC) in accordance with NECA 101.

F. Install galvanized steel electrical metallic tubing (EMT) in accordance with NECA 101.

G. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

H. Install electrical nonmetallic tubing (ENT) in accordance with NECA 111.

I. Install liquidtight flexible nonmetallic conduit (LFNC) in accordance with NECA 111.

J. 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. Communications rooms.
      c. Mechanical equipment rooms.
      d. Within joists in areas with no ceiling.
   5. 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.
   6. Arrange conduit to maintain adequate headroom, clearances, and access.
   7. Arrange conduit to provide no more than equivalent of two 90-degree bend(s) between pull points.
      a. The equivalent of three 90-degree bends between pull points is permitted only under conditions described in BICSI TDMM.
   8. Arrange conduit to provide no more than 100 feet (33 m) between pull points.
   9. Arrange conduit to provide minimum bend radii in accordance with BICSI TDMM.
   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. Group parallel conduits in same area on common rack.

K. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
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 conduit clamp to support single conduit from beam clamp or threaded rod.
6. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple, parallel, suspended conduits.
7. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
8. Use of spring steel conduit clips for support of conduits is permitted only as follows:
   a. Support of electrical metallic tubing (EMT) up to 1-inch (27 mm) trade size concealed above accessible ceilings and within hollow stud walls.
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.

L. 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. Where spare conduits stub up through concrete floors and are not terminated in box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect cables.
8. Secure joints and connections to provide mechanical strength and electrical continuity.

M. 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 and/or slots for penetrations as indicated or as required to facilitate installation.
4. Conceal bends for conduit risers emerging above ground.
5. Provide suitable sealing system where conduits penetrate exterior wall below grade.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
8. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07 8400.

N. Underground Installation:
1. Minimum Cover, Unless Otherwise Indicated or Required:
   a. Underground, Exterior: 18 inches (460 mm).

b. Under Slab on Grade: 12 inches (300 mm) to bottom of slab.

2. Provide underground warning tape along entire conduit length where not concrete-encased.
3. Provide copper conductor for use with toning location in conduit systems where only nonmetallic fiber optic cables are installed.

O. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Maximum Conduit Size: 1-inch (27 mm) trade size unless otherwise approved.
2. Secure conduits to prevent floating or movement during pouring of concrete.

P. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed cables or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where calculated in accordance with NFPA 70 for reinforced thermosetting resin conduit (RTRC) conduit installed above ground to compensate for thermal expansion and contraction.
4. Where conduits are subject to earth movement by settlement or frost.

Q. 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.

R. Provide pull string in each empty conduit and innerduct/cell, and in each conduit where cables are to be installed by others. Leave minimum slack of 12 inches (300 mm) at each end.

S. Provide grounding and bonding.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - 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 cables.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Communications system design requirements.

B. Communications pathways.

C. Copper cable and terminations.

D. Fiber optic cable and interconnecting devices.

E. Communications equipment room fittings.

F. Communications outlets.

G. Communications grounding and bonding.

H. Communications identification.

I. Reuse and expand the existing structured cabling system. Provide a complete bidder-designed cabling system to include devices, cabling, terminations, and equipment, as indicated on the drawings and specified herein. Devices shown on the drawings convey design intent and exact mounting locations shall be coordinated with architect/owner prior to rough-in. System to include all equipment wiring and accessories as required. The contractor is to design and provide the system including all raceways, boxes, conductors, cables, and equipment required to meet design intent. D-B Contractor to coordinate exact cabling type with owner IT group.

J. This specification section is provided as a basis of design. Please refer to responsibility matrix schedule for clarification of what items are to be provided within these contract documents. This specification section is to provide clarification on system specifications the design team designed around. The responsibility matrix schedule shall take precedence over all other statements within these contract documents for determination in what shall be provided by the contractor.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0533.16 - Boxes for Electrical Systems.

D. Section 26 0553 - Identification for Electrical Systems: Identification products.

E. Section 26 2726 - Wiring Devices.

F. Section 27 0529 - Hangers and Supports for Communications Systems.

G. Section 27 0533.13 - Conduit for Communications Systems.

1.03 REFERENCE STANDARDS

A. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.

B. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment; Revision E, 2005.

C. ICEA S-83-596 - Indoor Optical Fiber Cables; 2016.

D. ICEA S-90-661 - Category 3, 5, & 5e Individually Unshielded Twisted Pair Indoor Cables (With or Without An Overall Shield) For Use in General Purpose and LAN Communications Wiring Systems Technical Requirements; 2012.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. TIA-455-21 - FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices; 1988a (Reaffirmed 2012).

G. TIA-492AAAC - Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; 2009b.

H. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2019.

I. TIA-568.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; 2009c, with Addendum (2016).

J. TIA-568.3 - Optical Fiber Cabling and Components Standard; 2016d.

K. TIA-569 - Telecommunications Pathways and Spaces; 2019e.

L. TIA-598 - Optical Fiber Cable Color Coding; 2014d.

M. TIA-606 - Administration Standard for Telecommunications Infrastructure; 2017c.

N. TIA-607 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2019d.

O. UL 444 - Communications Cables; Current Edition, Including All Revisions.

P. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

Q. UL 1651 - Fiber Optic Cable; Current Edition, Including All Revisions.

R. UL 1863 - Communications-Circuit Accessories; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate requirements for service entrance and entrance facilities with Communications Service Provider.
   2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
   3. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.

B. Arrange for Communications Service Provider to provide service.

1.05 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding, prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).

D. Evidence of qualifications for installer.

E. Field Test Reports.

F. Project Record Documents: Prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).
   1. Record actual locations of outlet boxes and distribution frames.
   2. Show as-installed color coding, pair assignment, polarization, and cross-connect layout.
   3. Identify distribution frames and equipment rooms by room number on drawings.

G. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: At least 3 years experience manufacturing products of the type specified.

B. Installer Qualifications: A company having at least 3 years experience in the installation and testing of the type of system specified, and:
   1. Employing a BICSI Registered Communications Distribution Designer (RCDD).

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep stored products clean and dry.

1.08 WARRANTY

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

B. Correct defective Work within a 2 year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 SYSTEM DESIGN

A. Provide a complete permanent system of pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.
   1. Comply with TIA-568 (SET) (cabling) and TIA-569 (pathways) (commercial standards).
   2. Comply with Communications Service Provider requirements.
   3. Provide fixed cables and pathways that comply with NFPA 70 and TIA-607 and are UL listed or third party independent testing laboratory certified.
   4. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F (0 to 60 degrees C) at relative humidity of 0 to 95 percent, noncondensing.
   5. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.

B. System Description:
   1. Building Entrance Cable: By Internet Service Provider.

C. Backbone Cabling: Cabling, pathways, and terminal hardware connecting intermediate distribution frames (IDF's) with main distribution frame (MDF), wired in star topology with main distribution frame at center hub of star.

D. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".

2.02 PATHWAYS

A. Conduit: See section 27 0533.13.

B. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

2.03 COPPER CABLE AND TERMINATIONS

A. Copper Backbone Cable:
   1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568.2, ICEA S-90-661, and listed and labeled as complying with UL 444; arranged in 25-pair binder groups.
   2. Cable Type: TIA-568.2 Category 6e UTP (unshielded twisted pair); 24 AWG.
   3. Cable Applications:
      a. Plenum Applications: Use listed NFPA 70 Type CMP plenum cable.
      b. Riser Applications: Use listed NFPA 70 Type CMR riser cable or Type CMP plenum cable.

B. Copper Horizontal Cable:
   1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568.2 and listed and labeled as complying with UL 444.
   2. Cable Type - Voice and Data: TIA-568.2 Category 6e UTP (unshielded twisted pair); 23 AWG.
   3. Cable Capacity: 4-pair.
   4. Cable Applications:
      a. Plenum Applications: Use listed NFPA 70 Type CMP plenum cable.
      b. Riser Applications: Use listed NFPA 70 Type CMR riser cable or Type CMP plenum cable.

c. General Purpose Applications: Use listed NFPA 70 Type CM/CMG general purpose cable, Type CMR riser cable, or Type CMP plenum cable.
5. Cable Jacket Color - Data Cable: Blue.
6. Cable Jacket Color - Voice Cable: White.
7. Cable Jacket Color - Video Cable: Yellow.

C. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.

D. Jacks and Connectors: Modular RJ-45 for data, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.
1. Performance: 500 mating cycles.
2. Voice and Data Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.
3. Modular RJ11 for voice

E. Copper Patch Cords:
1. Description: Factory-fabricated 4-pair cable assemblies with 8-position modular connectors terminated at each end.
2. Patch Cords for Patch Panels:
a. Quantity: One for each pair of patch panel ports.

2.04 FIBER OPTIC CABLE AND INTERCONNECTING DEVICES

A. Fiber Optic Backbone Cable:
1. Reuse the existing backbone fiber optic cabling. Temporarily disconnect as required to allow for IDF room remodel.
2. Description: Tight buffered, non-conductive fiber optic cable complying with TIA-568.3, TIA-598, ICEA S-83-596 and listed as complying with UL 444 and UL 1651.
3. Cable Type: Multimode, laser-optimized 62.5/125 um (OM1) complying with TIA-492AAAC.
4. Cable Applications:
a. Plenum Applications: Use listed NFPA 70 Type OFNP plenum cable.
b. Riser Applications: Use listed NFPA 70 Type OFNR riser cable or Type OFNP plenum cable.
5. Cable Jacket Color:
a. Laser-Optimized Multimode Fiber (OM1): Orange.

B. Fiber Optic Interconnecting Devices:
1. Connector Type: Type LC-ST.
2. Connector Performance: 500 mating cycles, when tested in accordance with TIA-455-21.
3. Maximum Attenuation/Insertion Loss: 0.3 dB.

C. Fiber Optic Patch Cords:
1. Description: Factory-fabricated 2-fiber cable assemblies with suitable connectors at each end.
2. Patch Cords for Patch Panels:
a. Quantity: One for each pair of patch panel ports.

2.05 COMMUNICATIONS EQUIPMENT ROOM FITTINGS

A. Copper Cross-Connection Equipment:
1. Connector Blocks for Category 6e and Up Cabling: Type 110 insulation displacement connectors; capacity sufficient for cables to be terminated plus 25 percent spare.
2. Patch Panels for Copper Cabling: Sized to fit EIA/ECA-310 standard 19 inch (482.6 mm) wide equipment racks; 0.09 inch (2.2 mm) thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface.
a. Jacks: Non-keyed RJ-45, RJ-11 suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel.
b. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.

c. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.
d. Provide incoming cable strain relief and routing guides on back of panel.

B. Fiber Optic Cross-Connection Equipment:
1. Patch Panels for Fiber Optic Cabling: Sized to fit EIA/ECA-310 standard 19 inch (482.6 mm) wide equipment racks; 0.09 inch (2.2 mm) thick aluminum.
a. Adapters: As specified above under FIBER OPTIC CABLE AND INTERCONNECTING DEVICES; maximum of 24 duplex adaptors per standard panel width.
b. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.
c. Provide incoming cable strain relief and routing guides on back of panel.
d. Provide rear cable management tray at least 8 inches (203 mm) deep with removable cover.
e. Provide dust covers for unused adapters.

C. Backboards: Interior grade plywood without voids, 3/4 inch (19 mm) thick; UL-labeled fire-retardant.
1. Size: As indicated on drawings.
2. Do not paint over UL label.

D. Equipment Frames, Racks and Cabinets:
1. Component Racks: EIA/ECA-310 standard 19 inch (482.6 mm) wide.
2. Wall Mounted Racks: Steel construction, hinged to allow access to back of installed components.

2.06 COMMUNICATIONS OUTLETS

A. Outlet Boxes: Comply with Section 26 0533.16.
1. Provide depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.
2. Minimum Size, Unless Otherwise Indicated:
a. Data or Combination Voice/Data Outlets: 4 inch square by 2-1/8 inch deep (100 by 54 mm) trade size.

B. Wall Plates:
1. Comply with system design standards and UL 514C.
2. Accepts modular jacks/inserts.

2.07 GROUNDING AND BONDING COMPONENTS

A. Comply with TIA-607.

B. Comply with Section 26 0526.

2.08 IDENTIFICATION PRODUCTS

A. Comply with TIA-606.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569 (pathways), TIA-607 (grounding and bonding), BICSI N1, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

B. Comply with Communication Service Provider requirements.

C. Grounding and Bonding: Perform in accordance with TIA-607 and NFPA 70.

D. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

3.02 INSTALLATION OF PATHWAYS

A. Install pathways with the following minimum clearances:

1. 48 inches (1220 mm) from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
2. 12 inches (300 mm) from power conduits and cables and panelboards.
3. 5 inches (125 mm) from fluorescent and high frequency lighting fixtures.
4. 6 inches (150 mm) from flues, hot water pipes, and steam pipes.

B. Minimum Cover - Underground Service Entrance: Comply with NFPA 70 and Communications Service Provider requirements.

C. Outlet Boxes:
1. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of telecommunications outlets provided under this section.
a. Mounting Heights: Unless otherwise indicated, as follows:
1) Telephone and Data Outlets: 18 inches (450 mm) above finished floor.
2) Telephone Outlets for Forward-Reach Wall-Mounted Telephones: 48 inches (1.2 m) above finished floor to top of telephone.
b. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
c. Provide minimum of 24 inches (600 mm) horizontal separation between flush mounted outlet boxes installed on opposite sides of fire rated walls.
d. Unless otherwise indicated, provide separate outlet boxes for line voltage and low voltage devices.
e. Locate outlet boxes so that wall plate does not span different building finishes.
f. Locate outlet boxes so that wall plate does not cross masonry joints.

3.03 INSTALLATION OF EQUIPMENT AND CABLING

A. Cabling:
1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
2. Do not over-cinch or crush cables.
3. Do not exceed manufacturer's recommended cable pull tension.
4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.

B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
1. At Distribution Frames: 120 inches (3000 mm).
2. At Outlets - Copper: 12 inches (305 mm).
3. At Outlets - Optical Fiber: 39 inches (1000 mm).

C. Copper Cabling:
1. Category 5e and Above: Maintain cable geometry; do not untwist more than 1/2 inch (12 mm) from point of termination.
2. For 4-pair cables in conduit, do not exceed 25 pounds (110 N) pull tension.
3. Use T568B wiring configuration.

D. Fiber Optic Cabling:
1. Prepare for pulling by cutting outer jacket for 10 inches (250 mm) from end, leaving strength members exposed. Twist strength members together and attach to pulling eye.
2. Support vertical cable at intervals as recommended by manufacturer.

E. Wall-Mounted Racks and Enclosures:
1. Install to plywood backboards only, unless otherwise indicated.
2. Mount so height of topmost panel does not exceed 78 inches (1980 mm) above floor.

F. Floor-Mounted Racks and Enclosures: Permanently anchor to floor in accordance with manufacturer's recommendations.

G. Floor-Mounted Enclosures: Connect adjacent cabinets together and remove interior side panels.

H. Identification:

1. Use wire and cable markers to identify cables at each end.
2. Use manufacturer-furnished label inserts, identification labels, or engraved wallplate to identify each jack at communications outlets with unique identifier.
3. Use identification nameplate to identify cross-connection equipment, equipment racks, and cabinets.

3.04 FIELD QUALITY CONTROL

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

B. Comply with inspection and testing requirements of specified installation standards.

C. Visual Inspection:
1. Inspect cable jackets for certification markings.
2. Inspect cable terminations for color coded labels of proper type.
3. Inspect outlet plates and patch panels for complete labels.

D. Testing - Copper Cabling and Associated Equipment:
1. Test backbone cables after termination but before cross-connection.
2. Test backbone cables for DC loop resistance, shorts, opens, intermittent faults, and polarity between connectors and between conductors and shield, if cable has overall shield.
3. Test operation of shorting bars in connection blocks.
4. Category 5e and Above Backbone: Perform near end cross talk (NEXT) and attenuation tests.
5. Category 5e and Above Links: Perform tests for wire map, length, attenuation, NEXT, and propagation delay.

E. Testing - Fiber Optic Cabling:
1. Backbone: Perform optical fiber end-to-end attenuation test using an optical time domain reflectometer (OTDR) and manufacturer's recommended test procedures; perform verification acceptance tests and factory reel tests.

F. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Access Control Software.
   2. Access Control Software Collaborations.
   3. Access Control Hardware Software Integrations.
   4. Access Control Software Interface.
   5. Access Control Software Administration.
   6. Accessory Software Schedule.
   7. This specification section is provided as a basis of design. Please refer to responsibility matrix schedule for clarification of what items are to be provided within these contract documents. This specification section is to provide clarification on system specifications the design team designed around. The responsibility matrix schedule shall take precedence over all other statements within these contract documents for determination in what shall be provided by the contractor.

B. Related Sections:
   1. Section 08 71 00 - Door Hardware
   2. Section 28 20 00 – Video Surveillance.

C. Definitions:
   1. Anti Passback (APB): A security measure that aims to prevent consecutive entries for one access card or prevent multiple people from using the same access card.
   2. Open Supervised Device Protocol (OSDP): An access control communications standard.
   3. Secure Copy Protocol (SCP): A means of securely transferring computer files between a local host and a remote host or between two remote hosts.
   4. Software Development Kit (SDK): A collection of software development tools in one installable package.
   5. Video Management System (VMS): A component of a security camera system that collects video from cameras and other sources, records and stores that video to a storage device, and provides an interface to both view the live video, and access recorded video.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate with Owner or Owner’s representative regarding network configuration and estimated bandwidth utilization prior to performing network connections.

B. Sequencing / Scheduling: Provide to Owner or Owner’s representative a schedule and list of participants required to attend coordination and progress update meetings.
   1. Owner representative(s) for Facilities Management, Information Technology (IT) Services, and Security Management.
   2. General Contractor.
   3. Project Manager.
   4. Manufacturer’s Representative.
   5. Project Architect.
   6. Project Engineer.
   7. Security Consultant.

1.03 INFORMATIONAL SUBMITTALS

A. Product Data: Manufacturer's product information and data sheets for each product specified in this section, including:
   1. System overview drawings.
   2. Typical installation means and methods.
   3. Recommendations and requirements for proper storage and handling.

B. Shop Drawings:
   1. Submit Manufacturer’s approved shop drawings detailing the section and elevation views of each product to be installed.

2. Coordinate with locations listed on Contract Drawings.

C. Warranty Information:
1. Submit confirmation and details of manufacturer's warranty, extended warranty, and replacement policies.

D. System Support Resources:
1. Submit a list of available manufacturers providing fee based professional services available to the Contractor or Owner, including but not limited to the following:
a. Training.
b. Installation.
c. Commissioning.
d. Remote diagnostics and integration with 3rd party software and hardware systems.

1.04 CLOSEOUT SUBMITTALS

A. Supply licensing and registration information for all software, hardware, firmware, operational, and administrative licenses.

B. Supply network configuration backup files, restoration application and instructions.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide products from manufacturer(s) with a minimum of 5 years in manufacturing access control specified in this section.

B. Supplier Certifications: Provide products from a supplier in compliance with the following:
1. Department of Homeland Security Safety Act Certified.
2. NISPOM Compliance (National Industrial Security Program Operating Manual).
3. HSPD-12 and FIPS201-2 Certified.
4. GSA Approved product list.

C. Installer Qualifications:
1. Installer must be licensed to install access control and security equipment as required by authority having jurisdiction.
2. Installer must have certified staff on access control products prior to bid date.
3. Installer must be in good standing by the manufacturer prior to bid date.
4. Installer must be capable of providing references that will attest to successful completion of projects of similar scope as the work noted in this section.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer: Motorola Solutions.
1. Address: 415 E Exchange Pkwy, Allen, TX 75002
2. Phone: (888) 281-5182.
3. Website: www.motorolasolutions.com

B. Manufacturer List:
1. Motorola Solutions: Access Control Manager.

C. Substitution Limitations:
1. Submit substitution requests in accordance with provisions of Section 01 60 00.
2. Single supplier will provide, from a single source, a fully integrated physical security system consisting of the following components:
a. Access Control Software.
b. Access Control Server Appliance.
c. Access Control Panel Hardware.
d. Reader Hardware.
e. Biometrics.
f. Wireless Locksets.
g. Visitor Management.
h. Power Supplies.
i. Video Management System.

j. Video Management System Interfaces.
k. Storage Appliances for Electronic Safety and Security.
l. Video Surveillance Positioning Equipment.
m. Video Surveillance Sensors.

2.02 ACCESS CONTROL SOFTWARE

A. Basis of Design: Access Control Manager, by Motorola Solutions.

B. Operating System: Secure embedded Linux OS.

C. Access Control Software Capacities:
1. Intelligent Controllers: 1024 per appliance allowing geographic independence from appliance via IP communication.
2. Access Control System Appliances Supported: Up to 100 linked appliances using replication.
3. Events Stored: Up to 150,000,000 per appliance.
4. Events Stored: Up to 75,000,000. Per professional appliance.
5. Sub-Panels: Up to 32 per intelligent controller.
6. Doors: Up to 64 per intelligent controller.
7. PIN Length: Between 4 and 8 digits.
8. Card Formats: Up to 128 per appliance.
9. Time Schedules: 255 per intelligent controller.
10. Holidays: 255 per intelligent controller.
11. Identity and Operator Database: Up to 500,000.
12. Client Connections: Up to 50.

2.03 ACCESS CONTROL SOFTWARE COLLABORATIONS

A. Database Collaborations and Integrations: Provide access control software capable of integration with the following industry standard third-party databases.
1. Bidirectional:
a. REST API Integration.
2. Pull Only:
a. Lightweight Directory Access Protocol (LDAP/Active Directory).
b. Structured Query Language (SQL) Server.
c. Oracle Relational Database Management System (RDBMS).
d. Comma Separated Value (CSV).
3. Push Only:
a. Extensible Markup Language (XML) for Event Push.

B. Visitor Management Integration:
a. HID Global: Easy Lobby.
b. Splan.
c. Envoy.
d. Savance.
e. Alert Enterprise.

C. Custom Integrations
1. Custom Integrations using RestAPI (as needed for project requirements)

D. Video Integrations: Coordinate integration and unification requirements with 28 05 45.
1. Avigilon Control Center.
2. Milestone Xprotect.
3. Johnson Controls ExacqVision.
4. Pelco VideoXpert.

2.04 ACCESS CONTROL HARDWARE INTEGRATIONS

A. Panel Hardware:
1. Mercury: Controllers; Series 3 (LP1501, LP1502, LP2500, and LP4502).
2. Mercury: Controllers; Series 2 (EP1501, EP1502, and EP2500).
3. Mercury: Controllers; Legacy (SCP, SCP-C, and SCP-E.

4. Mercury: Sub Panels; MR50, MR52, MR16IN, MR16OUT, MR51E, and MR62E).
5. Mercury: Conversion Boards; M5 Bridge.
6. Mercury: Conversion Boards; MS Bridge.
7. HID: Controllers; V2000 and V1000.
8. HID: Sub Panels; V100, V200, and V300.
9. Salto: Controllers; CU42E0XXX and CU4200XXX via SALTO SHIP integration to Pro Access Space.
10. Schlage: GWE and PIM Modules.
11. SimonsVoss: SmartIntego Series.
12. Assa Abloy: Aperio Hubs.
13. Assa Abloy: IPPOE .

B. Supported Reader Hardware:
1. Readers capable of OSDP and Wiegand data format.
2. HID: Prox.
3. HID: R Series.
4. HID: Signo.
5. Allegion: Schlage Series.
6. Farpointe: Pyramid.
7. Farpointe: Delta.
8. Farpointe: Conekt.
9. Salto: XS4 Readers via SALTO SHIP integration to Pro Access Space.
10. Assa Abloy: SN Line of readers.
11. STid Readers.

C. Credential Technologies:
1. Credentials capable of Open Card format (PROX, MiFare, DESFire CSN).
2. HID Global: All Physical (SEOS, iClass, Prox, Mifare, DESFire) and Mobile (Origo).
3. Schlage: All Physical (Mifare, Prox, DESFire).
4. Farpointe Data: All Physical (Mifare/Prox) and Mobile.
5. Salto Credentials: All Physical (MiFare/DESfire or SEOS, iClass) and Mobile (JustIN) via SALTO SHIP integration to Pro Access Space.

D. Intrusion Detection Control Panels:
1. Bosch B series: (B3512, B4512, B5512, B6512, B8512G, B9512G).
2. Bosch D Series: (D9412GV4, D9412GV4 V2).
3. DMP (Digital Monitoring Products): XR150 & XR550.

E. Biometrics:
1. Third party via Weigand or OSDP data format.
2. ViRDI Biometrics: AC2000, AC5000.
3. EyeLock.
4. StoneLock.
5. Suprema.

F. Wireless Locksets:
1. Allegion/Schlage/Von Duprin: Wireless locksets.
    a. RU & RM Crashbar
    b. NDEB locks, including RS-485 gateway mode.
    c. LEB locks, including RS-485 gateway mode.
    d. Control Smart Deadbolt (BE467F, FE410F).
    e. AD200.
    f. AD300.
    g. AD400.
2. Assa Abloy: Aperio.
    a. IN100.
    b. R100.
    c. K100.
    d. KS100.

e. ES100.
f. SN Series.

3. Assa Abloy: Gen 4 & 5 Hubs.
   a. AH20.
   b. AH30.
   c. AH40.
4. Assa Abloy: Wi-Fi & POE via integration to DSR.
   a. Sargent.
      1) Passport 1000 P1.
      2) Passport 1000 P2.
      3) Profile Series v.S1.
      4) Profile Series v.S2.
      5) IN120.
      6) IN220.
   b. Corbin Russwin.
      1) Access 700 PIP1.
      2) Access 700 PWI1.
      3) Access 800 IP1.
      4) Access 800 WI1.
      5) IN120.
      6) IN220.
5. Salto Systems: Locks via SALTO SHIP integration to Pro Access Space.
6. SimonsVoss: SmartIntego Series.

G. Power Supplies: Provide one of the following power supplies that are manufacturer-prepared to support access control panels:
   1. Life Safety Power
      a. Unified Power: Mercury Security;
      b. Multi-door enclosures with or without network module.
         1) Doors: 2.
         2) Doors: 4.
         3) Doors: 8.
         4) Doors: 16.
         5) Doors: 24.
      c. ProWire Pre-Wired Power.
      d. Tie Wrapped multi-door enclosures.
         1) Doors: 4.
         2) Doors: 8.
         3) Doors: 16.
      e. Panduit multi-door enclosures with or without network module.
         1) Doors: 8.
         2) Doors: 16.
         3) Doors: 24.
      f. Unified Power: Salto; multi-door enclosures with or without network module.
         1) Doors: 4.
         2) Doors: 6.
         3) Doors: 8.
         4) Doors: 10.

H. US Federal Government FICAM Solution:
   1. HID pivCLASS Software Suite.
   2. HID pivCLASS PAM.
   3. HID pivCLASS Readers.
      a. SE Series.
      b. Signo Series.
   4. Mercury Embedded LP4502.
   5. Veridt PIV Readers.

6. Assa Abloy FICAM Certified Locks.

2.05 ACCESS CONTROL SOFTWARE INTERFACE

A. Web-Based Access Support: Provide access control software with browser-based access to system applications including support for industry standard desktop and mobile web browsers.

B. Tabbed User Interface: System supports the following functionality in a tabbed view:
   1. Monitor events, alarms, and hardware status in real time.
   2. Verify identifies in real time.
   3. Search historical events and alarms.

C. Events and Alarms: Provide system that allows administrators the ability to create, configure, and prioritize events and alarms and communicate information about the generation of the event or alarm to the operator with guidance for responding to the event or alarm. Events will support two levels: system level events affect all objects in the system; field level events affect only the object they are configured on.

D. Access Groups: Provide system that allows administrators the ability to create groups of card readers and schedules such that card readers can allow or restrict access to areas based on schedules.

E. Identity Records: Provide a system with integrated identity management, allowing imports of data from supported databases. Each identity supports access control based on groups and roles as well as individual overrides. Include functionality to customize identity and token forms in base software. Provide identity records capable of management and synchronization between multiple sites.

F. Roles: Support a role-based permission method allowing one or more roles to be assigned to identities to determine physical and logical access.

G. Anti-Passback: Provide access control software capable of designating areas to require a card to enter and exit the area before it is used to enter the area again.
   1. Soft and Hard Area APB: Tracks each badge that enters a specific area and defines which areas the badge may access next.
   2. Door-Based APB: Tracks each badge that enters and does not allow the same badge to enter twice in a row until after the APB time limit is reached.
   3. Token-Based, Timed APB: Tracks each door a badge has accessed. After the badge has accessed one door, it must access a second door or wait until the APB time limit is reached before it may access the first door again.
   4. Timed Area APB: Time based hard area APB. When the time limit expires, the hard area APB becomes a soft area APB.
   5. Hard Door APB: Tracks each badge that enters a door and does not allow the same badge to enter twice in a row.
   6. Soft Door APB: Tracks each badge that enters a door and generates a warning transaction if the same badge is used at the same door twice in a row.

H. Badging: Provide a tool to support the creation of custom badge layouts including the following content:
   1. Static Information: Badge size, background color, text strings, and graphics common to every badge.
   2. Dynamic Information: Text fields and images from the identities database unique to each badge.

I. Enrollment: Provide integrated identity management and enrollment functionality as part of the core system functionality.
   1. Includes integration with HID Origo Credential Management or deployment of Origo mobile credentials directly from the access control web interface.

J. Macros: Provide system capable of linking one or more events to macros such that a single event may execute up to 30 macros. System must support minimum of 255 macros per intelligent field controller.

K. Device Template Configuration: Provide access control system that supports templates to automatically populate standard parameter fields in groups for new or existing doors, wires, readers, and input/output devices.

L. Encryption: Provide access control system that supports the following encryption methods:
   1. TLS 1.2: Require TLS encryption between the access control system and Mercury controller.
   2. Custom Certificates: Require self-signed or certificate authority certificate to harden access control system. Certificates will authenticate Mercury panels to the access control system.
   3. FIPS 140-2: Require access control server to utilize FIPS 140-2 compliant ciphers only.
   4. FIPS 201-2: Require large-encoded card formats for FIPS 201-2 certified pivClass solution.

M. Custom Device Mappings: Administrators may assign a unique group of alarm attributes to specific device-alarm combinations to override global settings of generic attributes.

N. Dashboard: Allow creation of a dashboard for real-time status and actions of hardware components on a single screen that can also filter by name, status, appliance, or group.
   1. Hardware Status:
      a. Panels: Communication, power, tamper, and battery.
      b. Sub-Panels: Communication, power, and tamper.
      c. Inputs: Inactive, active, trouble, and masked.
      d. Outputs: Off, on, and trouble.
      e. Doors: Communication, tamper, battery, unlocked, help, masked, and forced.
      f. Appliances: RAM, program, database, CPU load, and port status.
   2. Monitor:
      a. Panels: Device status, security status, name, model, firmware, IP address, MAC address, access port, callback port, cards in use, and last communication.
      b. Sub-Panels: Device status, name, panel, type, port, address, and firmware.
      c. Inputs: Device status, input name, subpanel, EOL resistance, and address.
      d. Outputs: Device status, output name, subpanel, schedule, and address.
      e. Power Supplies: Power supply name, installed status, status, and logs.
      f. Access Control Doors: Status, name, panel, door state, door mode, and override status.
   3. Manipulate Access Control Doors:
      a. Door actions: Grant, restore, unlock, locks no access, disable.
      b. Door mode: Card only, card and PIN, card or PIN, PIN only, facility code only, exit leaves open, toggle + exit leaves open.
      c. Door Forced: Mask forced, unmasked forced.
      d. Door Held: Masked held, unmasked held.
      e. Installed: Install, uninstall.

O. Map Interface: Provide interface for creating customizable layouts including floorplans, reader locations, and buttons that can trigger actions.
   1. Actions: Card readers indicate alarm via icon and allow for card only, card and pin, card or pin, pin only, facility code only, disable, unlock, lock, grant, restore, mask held, unmask held, and trace actions.
   2. Occupancy/Mustering: Maps will provide real-time occupancy of a defined area.
   3. Programmable Buttons: Maps will provide mapping of buttons and text to perform actions.

P. Verification Interface: Provide web-browser-enabled connection to access control software allowing a user to review information about card holders entering or existing up to four (4) doors in real time. Information to include badge photo, transaction time, and date via any device with a compatible browser.

Q. Virtual Verification Station: Provide web-browser-enabled connection to the access control software to allow a user to visually confirm the identity and authorization of a person attempting entry to a controller area via a mobile device such as a tablet or smartphone.

R. Intrusion Interface: Provide interface to see real-time status of linked Intrusion Panels.
   1. Display Intrusion Panels with following status:
      a. Communication, Battery, Power, Tamper, Phone Line.
   2. Display and Interact with Configured Areas.
      a. Status, Area Name, Panel Name.
      b. Silence, Disarm, Master, and Perimeter.
   3. Display and Interact with Intrusion Points.
      a. Status, Point, and Area.
      b. Bypass and Un-bypass.
   4. Display and Interact with Intrusion Output.
      a. Status, Outpoint, Panel.
      b. Activate and Deactivate.

S. Access Control Software Reporting: Generate, filter, edit, and customize system reports including the automated generation and distribution of customized reports in PDF and CSV formats.

2.06 ACCESS CONTROL MOBILE APPLICATION

A. Basis of Design Product: ACM Expedite, by Motorola Solutions.

B. Provide mobile app, compatible with ACM platform, available on the following mobile platforms:
   1. Apple App Store.
   2. Google Play Store.

C. Mobile Application Functionality:
   1. Change made on Access Control system are dynamically reflected in Mobile app without Operator intervention.
   2. Execute global actions with a single click:
      a. Lock Doors.
      b. Lockdown.
      c. Change Door Modes.
      d. Deactivate User Groups.
   3. Issue Door Commands.
   4. Review Door Transactions.
   5. Quick access to your favorite global actions and doors.
   6. Connection to multiple access control systems.

2.07 ACCESS CONTROL SOFTWARE VIDEO INTEGRATIONS.

A. Refer to 28 05 45 Systems Integration and Interconnection Requirements.

B. Video Management System Unification: Provide the following features in video management system when used in conjunction with access control software.
   1. Link cameras and doors on a single screen.
   2. Search video by card swipe identity last or first name using identity search.
   3. Grant door access.
   4. Monitor live door swipes with video for identity verification.
   5. Display video and alarm information in video management client.

C. Access Control System: Provide following features in access control software when used in conjunction with video management system.
   1. Link cameras and doors to specific events.
   2. Notifications for events includes live video and recording of even from before and after in web browser interface.

2.08 ACCESS CONTROL SOFTWARE ADMINISTRATION

A. Backup: Provide access control software capable of backing up via USB drive, local appliance, windows network share, or secure copy protocol.

B. Database Replication: Replicate database from 1 to 100 appliances for distributed identity control.

C. Password Update: Provide ability for administrator to require operator update password at next login.

D. Failover and Redundancy: Provide access control software that supports switching to backup system automatically in the event of a fatal failure without loss of monitoring or hardware control.
   1. Provide failover technology supporting LDAP data replication.
   2. Provide failover technology supporting either a 1:1 or N:1 architecture.

E. Updates: Provide access control software capable of automatically updating the following:
   1. Operating System: Version, service packs, and security vulnerabilities.
   2. Field Devices: Firmware versions.

F. Upgrade Functionality: Provide access control software capable of automatically upgrading software licensing.

2.09 ACCESSORY SOFTWARE SCHEDULE:

A. Reader Licensing:
   1. Additional Readers: AC-SW-LIC-16RCU-6-P; perpetual, adds 16 reader software licenses to any appliance to expand door capacity up to the appliance's maximum capacity.
   2. Wireless Lock License AC-SW-LIC-WIRELESS-LOCK-6-P; required for all wireless locks not purchased from Access Control Manufacturer

B. Badging Application Software Licenses:
   1. Badging Application: AC-SW-LIC-BDGE-6-P; perpetual, one per appliance.

C. Video Integration Licenses:
   1. Exacq: AC-SW-LIC-EXACQ-6-P; perpetual, one per appliance.
   2. Milestone: AC-SW-LIC-MILEST-6-P; perpetual, one per appliance.

D. Intrusion Integration Licenses:
   1. Bosch: AC-SW-LIC-BOSCHINTR-1PANEL-6-P; perpetual, per panel, one per appliance.
   2. Bosch: AC-SW-LIC-BOSCHINTR-10PANEL-6-P; perpetual, for 10 panels, one per appliance.
   3. DMP: AC-SW-LIC-DMPINTR-1PANEL-6-P; perpetual, per panel, one per appliance.
   4. DMP: AC-SW-LIC-DMPINTR-10PANEL-6-P; perpetual, for 10 panels, one per appliance.

E. Verify Integration Licenses:
   1. Verify: AC-SW-LIC-AVO-VER-5VS-6-P; perpetual, for five virtual stations, one per appliance.
   2. Verify: AC-SW-LIC-AVO-VER-16VS-6-P; perpetual, for sixteen virtual stations, one per appliance.

F. Biometric Integration Licenses:
   1. VIRDI: AC-SW-LIC-VIRDI-BIO-6-P; perpetual, for Virdi Biometric readers, one per appliance.

G. Redundancy and Failover Software Licenses
   1. Replication: AC-SW-LIC-REP-6-P; for multi-appliance replication, one per appliance.
   2. Auto FailoverAC-SW-LIC-AF-6-P; hot standby auto failover software license, one per appliance.
   3. Partitioning: AC-SW-LIC-PART-6-P; for additional partitions, one per appliance.

H. IT Collaboration Software Licenses:
   1. Microsoft SQL: AC-SW-LIC-SQL-6-P; from Microsoft SQL Server 2000 forward, one per appliance.
   2. Oracle: AC-SW-LIC-ORCL-6-P; from Oracle DB 9i Server forward, one per appliance.
   3. LDAP Directory: AC-SW-LIC-LDAP-6-P; for Microsoft Active Directory or other, one per appliance.
   4. XML: AC-SW-LIC-XML-6-P; for XML events, one per appliance.
   5. REST: AC-SW-LIC-REST-6-P; perpetual, for unlocking REST-based API for custom integrations, one per appliance.

PART 3 EXECUTION

3.01 PREPARATION

A. Prior to installation, ensure Access Control Hardware Appliance is capable of required Access Control Software Features and Integrations.

3.02 INSTALLATION

A. Install system according to manufacturer's written instructions.
   1. Develop, install, and test software and databases for complete and proper operation of systems involved. Activate and install all software and accessory software licenses.
   2. Setup and program entire system so that no additional programming is required after Substantial Completion, including setup of available software features.
   3. Perform a full system back-up at completion of initial programming and deliver configuration and transaction backups to Owner.
   4. Perform field software changes after the initial programming session to "fine tune" operating parameters and sequence of operations based on revisions to the Owner's operating requirements including the creation of time schedules, holidays, new card formats, etc. Create user hierarchy with access permissions. Set up notifications.
   5. Test equipment and configure system in accordance with instructions provided by manufacturer prior to installation.

B. Ensure products are equipped with latest and most up-to-date firmware and/or software by manufacturer.

C. Review configurable features of device with Owner's Representative and establish a punch list for standard, device specific, location specific and access control software-specific configuration of device(s).

D. Program and configure devices in accordance with this punch list so no additional programming is required for operation by user.

E. Configure equipment requiring users to log on using a password with user/site-specific password/passwords.

F. No system/product default passwords allowed.

3.03 CLOSEOUT ACTIVITIES

A. Demonstration:
   1. Demonstrate administration and operation of access control system.
   2. Demonstrate how an authorized user can log in and make changes to configuration of card holders, door access, and run reports.
   3. Demonstrate how to operate functionality configured for this project as defined by configuration punch list.

B. Fine Tuning:
   1. Perform field software changes after initial programming session to "fine tune" operating parameters and sequence of operations based on any revisions to Owner's operating requirements.

C. License Assignment:
   1. Register software, hardware, firmware, operational or administrative licenses necessary for to operate or administer devices to Owner including the end user license agreement (EULA).
   2. Deliver to Owner's Representative proof of license registration from product manufacturer.

D. Device Configuration Backup:
   1. Using access control system backup functionality, perform a full system backup at the completion of the initial programming to a USB drive or customer local network shared folder (preferred option). Schedule backup function to execute system backup periodically.

2. Deliver configuration backup files, restoration application and instructions detailing for restoration of back-up configuration.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Video surveillance system requirements.

B. Video recording and viewing equipment.

C. Cameras.

D. Accessories.

E. Reuse and expand the existing video surveillance system (VSS). Provide a complete bidder-designed VSS to include devices, cabling, terminations, and equipment, as indicated on the drawings and specified herein. Devices shown on the drawings convey design intent and exact mounting locations shall be coordinated with architect/owner prior to rough-in. System to include all equipment wiring and accessories as required. The contractor is to design and provide the system including all raceways, boxes, conductors, cables, and equipment required to meet design intent.

F. This specification section is provided as a basis of design. Please refer to responsibility matrix schedule for clarification of what items are to be provided within these contract documents. This specification section is to provide clarification on system specifications the design team designed around. The responsibility matrix schedule shall take precedence over all other statements within these contract documents for determination in what shall be provided by the contractor.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 0533.13 - Conduit for Electrical Systems.

E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 27 1000 - Structured Cabling: Data cables for IP video surveillance system network connections.

G. Section 28 13 00 - Access Control: For interface with video surveillance system.

1.03 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NECA 303 - Standard for Installing and Maintaining Closed-Circuit Television (CCTV) Systems; 2019.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of cameras with structural members, ductwork, piping, equipment, luminaires, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
   2. Coordinate the work with other installers to provide power for cameras and equipment at required locations.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meetings:

1. Conduct meeting with facility representative to review camera and equipment locations and camera field of view objectives.
2. Conduct meeting with facility representative and other related equipment manufacturers to discuss video surveillance system interface requirements.

1.05 SUBMITTALS

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

B. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include elevations and details of proposed equipment arrangements. Include system interconnection schematic diagrams. Include requirements for interface with other systems.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.

D. Design Data:
1. Standby battery/UPS calculations.
2. Video storage capacity calculations.

E. Project Record Documents: Record actual locations of system components and installed wiring arrangements and routing.

F. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

G. Maintenance contracts.

1.06 QUALITY ASSURANCE

A. Comply with the following:
1. NFPA 70.
2. Applicable TIA/EIA standards.

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

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with video surveillance systems of similar size, type, and complexity and providing contract maintenance service as a regular part of their business; authorized manufacturer's representative.

D. Maintenance Contractor Qualifications: Same entity as installer.

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 and NECA 303.

B. Store products in manufacturer's unopened packaging, keep dry 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 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cameras: Coordinate Owner-Furnished Camera Manufacturer with OYA.

B. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

2.02 VIDEO SURVEILLANCE SYSTEM

A. Provide an expanded video surveillance system consisting of all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. System Description: IP system with connection to network (IP) cameras.
   1. System Battery Backup: Provide batteries/uninterruptible power supplies (UPS) as required for 10 minutes full operation.
   2. NDAA Compliant System
   3. Surge Protection:
      a. Provide equipment power surge protection where electrical distribution system surge protection is not provided.

C. Interface with Other Systems:
   1. Provide products compatible with other systems requiring interface with video surveillance system.
   2. Interface with access control system as specified in Section 28 1000.
      a. Capable of affecting camera/video operation for selected access control system events.

D. Provide products listed, classified, and labeled as suitable for the purpose intended.

E. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B, consumer application.

2.03 VIDEO RECORDING AND VIEWING EQUIPMENT

A. Provide subscription, cloud-based video recording and viewing equipment compatible with cameras to be connected.

B. Network Video Recorders (NVRs):
   1. Supports connection of network (IP) cameras.
   2. Supports continuous and event-based recording.

C. Computers:
   1. Workstation Computers: Unless otherwise indicated, workstation computer hardware not furnished by video surveillance system manufacturer to be provided by Contractor as part of work of this section, meeting video surveillance system equipment manufacturer's minimum requirements.
   2. Servers: Unless otherwise indicated, server hardware not furnished by video surveillance system manufacturer to be provided by Contractor as part of work of this section, meeting video surveillance system equipment manufacturer's minimum requirements.

D. Software:
   1. Unless otherwise indicated, provide all software and licenses required for fully operational system.

E. Monitors:
   1. Unless otherwise indicated, monitors to be provided by Contractor as part of work of this section.

2.04 CAMERAS

A. Provide cameras and associated accessories suitable for operation under the service conditions at the installed location. Provide additional components (e.g. enclosures, heaters, blowers, etc.) as required.

B. Where not factory-installed, provide additional components (e.g. lenses, mounting accessories, etc.) as necessary for complete installation.

C. Network (IP) Cameras:
   1. Signal-to-Noise Ratio: Not less than 50 dB.
   2. Provide the following standard features:
      a. Automatic electronic shutter.
      b. Automatic gain control.
      c. Automatic white balance.
      d. Web-based interface for remote viewing and setup.
      e. Password protected security access.
   3. Network (IP) Indoor/Outdoor Fixed Dome Camera:
      a. Camera Type: True day/night with IR cut filter.
      b. Image Sensor: 1/4 inch CMOS.
      c. Resolution: Up to 1080p (1920 x 1080).
      d. Video Streaming: Supports two simultaneous video streams using H.264 and H.264/MJPEG compression .
      e. Power: Power over Ethernet (IEEE 802.3af) or 24 VAC as indicated or as required.

2.05 ACCESSORIES

A. Camera Enclosures: Where not factory-installed, provide camera enclosures suitable for operation under service conditions at installed location.

B. Camera Mounting Supports: Where not factory installed, provide mounting supports necessary for installation.

C. Provide components as indicated or as required for connection of video surveillance system to devices and other systems indicated.

D. Provide components as indicated or as required for system power and network connections.

E. Provide accessory controllers as indicated or as required for operator control.

F. Provide cables as indicated or as required for connections between system components.
   1. Data Cables for IP Network Connections: Unshielded twisted pair (UTP), minimum Category 5e, complying with Section 27 1000.

G. Provide accessory racks/cabinets as indicated or as required for equipment mounting.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that ratings and configurations of system components are consistent with the indicated requirements.

B. Verify that mounting surfaces are ready to receive system components.

C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to system where applicable.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install video surveillance system in accordance with NECA 1 (general workmanship) and NECA 303.

B. Install products in accordance with manufacturer's instructions.

C. Provide required support and attachment in accordance with Section 26 0529.

D. Wiring Method: Unless otherwise indicated, use cables (not in conduit).

1. Use suitable listed cables in wet locations, including underground raceways.
2. Use suitable listed cables for vertical riser applications.
3. Use listed plenum rated cables in spaces used for environmental air.
4. Install wiring in conduit for the following:
    a. Where required for rough-in.
    b. Where required by authorities having jurisdiction.
    c. Where exposed to damage.
    d. Where installed outside the building.
    e. For exposed connections from outlet boxes to cameras.
5. Conduit: Comply with Section 26 0533.13.
6. Conceal all cables unless specifically indicated to be exposed.
7. Cables in the following areas may be exposed, unless otherwise indicated:
    a. Equipment closets.
8. Route exposed cables parallel or perpendicular to building structural members and surfaces.

E. Provide grounding and bonding in accordance with Section 26 0526.

F. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

G. Identify system wiring and components in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

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

B. Prepare and start system in accordance with manufacturer's instructions.

C. Adjust cameras to provide desired field of view and produce suitable images under all service lighting conditions.

D. Program system parameters according to requirements of Owner.

E. Test for proper interface with other systems.

F. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.04 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 7900 - Demonstration and Training, for additional requirements.

B. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

C. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Location: At project site.

3.06 PROTECTION

A. Protect installed system components from subsequent construction operations.

3.07 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide to Owner, a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of video surveillance system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule. This bid alternate to include all work as described by the equipment manufacturer as required during this time period as required to ensure the viability of all warranties and service coverages.

C. Provide trouble call-back service upon notification by Owner:
   1. Include allowance for call-back service during normal working hours at no extra cost to Owner.
   2. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire alarm system design and installation, including all components, wiring, and conduit.

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

C. Reuse and expand the existing building Silent Knight 5820XL Series addressable fire detection and alarm system. Provide a complete bidder-designed fire detection and alarm system to include automatic and manual fire alarm system devices and equipment specified herein. System to include all equipment wiring as required. The contractor is to design and provide the system including all raceways, boxes, conductors, cables, and equipment required for the additional building coverage.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping: Materials and methods for work to be performed by this installer.

B. Section 08 7100 - Door Hardware: Electrically operated locks and door holder devices to be monitored and released by fire alarm system.

C. Section 23 3300 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.

D. Section 26 0548 - Vibration and Seismic Controls for Electrical Systems: Requirements for the seismic qualification of equipment specified in this section.

1.03 REFERENCE STANDARDS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. The most current edition applies except where specifically identified otherwise by the Authority Having Jurisdiction (AHJ). Publications are referenced in the text by designation only.

B. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

C. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

D. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

1.04 SUBMITTALS

A. Proposal Documents: Submit the following with cost/time proposal:
   1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   2. Manufacturer's detailed data sheet for each control unit, initiating device, and notification appliance.
   3. Certification by Contractor that the system design will comply with Contract Documents.
   4. Proposed maintenance contract.

B. Drawings must be prepared using AutoCAD Release 2020.

C. Evidence of designer qualifications.

D. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
   1. Copy (if any) of list of data required by authority having jurisdiction.
   2. NFPA 72 "Record of Completion", filled out to the extent known at the time.

3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
4. System zone boundaries and interfaces to fire safety systems.
5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
7. List of all devices on each signaling line circuit, with spare capacity indicated.
8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
11. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
12. Certification by Contractor that the system design complies with Contract Documents.
13. Do not show existing components to be removed.

E. Manufacturer's equipment seismic qualification certification.

F. Evidence of installer qualifications.

G. Evidence of maintenance contractor qualifications, if different from installer.

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 Form," filled out.

I. Operating and Maintenance Data: Revise and resubmit until acceptable; have one set available during closeout demonstration:
1. Complete set of specified design documents, as approved by authority having jurisdiction.
2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
4. List of recommended spare parts, tools, and instruments for testing.
5. Replacement parts list with current prices, and source of supply.
6. Detailed troubleshooting guide and large scale input/output matrix.
7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

J. Project Record Documents: Have one set available during closeout demonstration:
1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
2. "As installed" wiring and schematic diagrams, with final terminal identifications.
3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

K. Closeout Documents:
1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
   1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
   2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
   3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.

C. Maintenance Contractor Qualifications: Same entity as installer.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 WARRANTY

A. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.

B. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
   1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
   2. Protected Premises: Entire building shown on drawings.
   3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
      a. ADA Standards.
      b. The requirements of the local authority having jurisdiction, which is City of Woodburn.
      c. Applicable local codes.
      d. Contract Documents (drawings and specifications).
      e. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
   4. Evacuation Alarm: Single smoke zone; general evacuation of entire premises.
   5. Hearing Impaired Occupants: Provide visible notification devices in all public areas and in dwelling units.
   6. Fire Alarm Control Unit: Existing, located in the main electrical room..
   7. Combined Systems: Do not combine fire alarm system with other non-fire systems.

B. Circuits:
   1. Initiating Device Circuits (IDC): Class B, Style A.
   2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
   3. Notification Appliance Circuits (NAC): Class B, Style W.

C. Spare Capacity:
   1. Initiating Device Circuits: Minimum 25 percent spare capacity.
   2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
   3. Speaker Amplifiers: Minimum 25 percent spare capacity.

4. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

D. Power Sources:
1. Primary: Dedicated branch circuits of the facility power distribution system.
2. Secondary: Storage batteries.
3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
4. Each Computer System: Provide uninterruptible power supply (UPS).

E. Seismic Qualification: Provide fire alarm system and associated components suitable for application under the seismic design criteria specified in Section 26 0548 where required. Include certification of compliance with submittals.

2.02 EXISTING COMPONENTS

A. Existing Fire Alarm System: Remove existing components indicated and incorporate remaining components into new system, under warranty as if they were new; do not take existing portions of system out of service until new portions are fully operational, tested, and connected to existing system.

B. Clearly label components that are "Not In Service."

C. Remove unused existing components and materials from site and dispose of properly.

2.03 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
1. Sprinkler water control valves.
2. Dry-pipe sprinkler system pressure.
3. Dry-pipe sprinkler valve room low temperature.

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
1. Sprinkler water flow.
2. Duct smoke detectors.

C. HVAC:
1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

D. Doors:
1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 7100.
2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from. Refer to Section 08 7100.

2.04 COMPONENTS

A. General:
1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.

C. Addressable Modules:
1. Provide addressable modules suitable for connection to fire alarm control unit signaling line circuits.
2. Unless otherwise indicated, use addressable modules only in clean, dry, indoor, nonhazardous locations.

D. Initiating Devices:
1. Addressable Systems:
a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.

b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.

E. Notification Appliances:

F. Circuit Conductors: Copper or optical fiber; provide 200 feet (60 m) extra; color code and label.

G. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.

H. Locks and Keys: Deliver keys to Owner.

I. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
   1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
   2. Provide one for each control unit where operations are to be performed.
   3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
   4. Provide extra copy with operation and maintenance data submittal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.

B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

C. Obtain Owner's approval of locations of devices, before installation.

D. Install instruction cards and labels.

3.02 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E. Provide all tools, software, and supplies required to accomplish inspection and testing.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.03 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
   1. Be prepared to conduct any of the required tests.
   2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
   3. Have authorized technical representative of control unit manufacturer present during demonstration.
   4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
   5. Repeat demonstration until successful.

3.04 MAINTENANCE

A. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
   1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
   2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
   3. Record keeping required by NFPA 72 and authorities having jurisdiction.

B. Provide trouble call-back service upon notification by Owner:
   1. Provide on-site response within 2 hours of notification.
   2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
   3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

C. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

D. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

E. Comply with Owner's requirements for access to facility and security.

END OF SECTION