

Project Manual

City of Port Wentworth
**ANCHOR PARK CONCESSION AND TEAM
ROOM FACILITIES**
Port Wentworth, Georgia

CD Submittal



Minneapolis

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Minneapolis, MN 55401

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Project Number: JLG 24117.01

Date: June 31, 2025

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SECTION 00 0105 - CERTIFICATIONS PAGE

CITY OF PORT WENTWORTH
ANCHOR PARK CONCESSION
AND TEAM ROOM FACILITIES

PORT WENTWORTH, GEORGIA

CERTIFICATIONS

Architect

I hereby certify that this Plan, Specification, or Report was prepared by me or under my direct supervision, and that I am a duly Licensed Architect under the laws of the State of Georgia.



Thomas J. Betti, AIA
Reg. No. RA014157

June 27, 2025

Structural Engineer

I hereby certify that this Plan, Specification, or Report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Georgia.



Matthew Pearce, PE
Reg. No. PE-050313

June 27, 2025

Mechanical Engineer

I hereby certify that this Plan, Specification, or Report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Georgia.



Micheal Anderson, PE
Reg. No. PE-048813

June 27, 2025

Electrical Engineer

I hereby certify that this Plan, Specification, or Report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Georgia.



Jeffrey A. Piehl, PE
Reg. No. PE-032442

June 27, 2025

END OF SECTION

SECTION 00 0110 - TABLE OF CONTENTS

PROCUREMENT AND CONTRACTING REQUIREMENTS

Division 00 -- Procurement and Contracting Requirements

- 00 0105 - Certifications Page
- 00 0110 - Table of Contents
- 00 2600 - Procurement Substitution Procedure
- 00 3100 - Available Project Information

SPECIFICATIONS

Division 01 -- General Requirements

- 01 2300 - Alternates
- 01 2500 - Substitution Procedures
- 01 3000 - Administrative Requirements
- 01 3329 - Sustainable Design Reporting
- 01 4533 - Code-Required Special Inspections
 - Special Inspection Forms
- 01 6000 - Product Requirements
- 01 6116 - Volatile Organic Compound (VOC) Content Restrictions
- 01 7419 - Construction Waste Management and Disposal

Division 03 -- Concrete

- 03 2000 - Concrete Reinforcing
- 03 3000 - Cast-in-Place Concrete
- 03 3511 - Concrete Floor Finishes

Division 04 -- Masonry

- 04 2000 - Unit Masonry

Division 05 -- Metals

- 05 1200 - Structural Steel Framing
- 05 2100 - Steel Joist Framing
- 05 3100 - Steel Decking
- 05 5000 - Metal Fabrications

Division 06 -- Wood, Plastics, and Composites

- 06 1000 - Rough Carpentry
- 06 8316 - Fiberglass Reinforced Paneling

Division 07 -- Thermal and Moisture Protection

- 07 1900 - Water Repellents
- 07 2100 - Thermal Insulation
- 07 2119 - Foamed-In-Place Insulation
- 07 2600 - Vapor Retarders
- 07 2700 - Air Barriers
- 07 4213 - Metal Wall Panels
- 07 5400 - Thermoplastic Membrane Roofing
- 07 6200 - Sheet Metal Flashing and Trim
- 07 9200 - Joint Sealants

Division 08 -- Openings

- 08 1113 - Hollow Metal Doors and Frames
- 08 3313 - Coiling Counter Doors

08 7100 - Door Hardware
08 7105 - Hardware Groups
08 9100 - Louvers

Division 09 -- Finishes

09 2116 - Gypsum Board Assemblies
09 3000 - Tiling
09 5100 - Acoustical Ceilings
09 6700 - Fluid-Applied Flooring
09 9600 - High-Performance Coatings

Division 10 -- Specialties

10 1423 - Panel Signage
10 2113.19 - Plastic Toilet Compartments
10 2600 - Wall and Door Protection
10 2800 - Toilet, Bath, and Laundry Accessories
10 4400 - Fire Protection Specialties
10 5126 - Plastic Lockers
10 7300 - Aluminum Trellis

Division 11 -- Equipment

11 4000 - Foodservice Equipment

Division 12 -- Furnishings

12 6100 - Fixed Audience Seating

Division 13 -- Special Construction

13 3100 - Fabric Structures

Division 20 -- GENERAL MECHANICAL

20 1000 - Mechanical General Provisions
20 5000 - Basic Mechanical Materials and Methods
20 7000 - Electrical Motors and Wiring
20 8000 - Painting and Identification

Division 22 -- Plumbing

22 0700 - Plumbing Insulation
22 1000 - Plumbing
22 2000 - Kitchen Equipment Plumbing
22 3000 - Plumbing Equipment
22 4000 - Plumbing Fixtures

Division 23 -- Heating, Ventilating, and Air-Conditioning (HVAC)

23 0593 - HVAC Testing, Adjusting, and Balancing
23 0700 - HVAC Insulation
23 3000 - HVAC Air Distribution
23 3423 - HVAC Power Ventilators
23 3713 - Diffusers, Registers and Grilles
23 8100 - Packaged Air Conditioners
23 8239 - Unit Heaters

Division 26 -- Electrical

26 0001 - General Provisions
26 0519 - Low-Voltage Electrical Power Conductors and Cables
26 0526 - Grounding and Bonding for Electrical Systems

- 26 0529 - Supports for Electrical Systems
- 26 0533 - Raceways and Boxes
- 26 0553 - Identification for Electrical Systems
- 26 0573 - Power System Studies
- 26 0583 - Wiring Connections
- 26 0923 - Lighting Control Devices
- 26 0943 - Network Lighting Controls
- 26 2100 - Low-Voltage Electrical Service Entrance
- 26 2200 - Low-Voltage Transformers
- 26 2413 - Switchboards
- 26 2416 - Panelboards
- 26 2726 - Wiring Devices
- 26 2813 - Fuses
- 26 2816 - Disconnect Switches
- 26 2913 - Motor Starters
- 26 4300 - Surge Protective Devices
- 26 5100 - Lighting
- 26 6000 - Electrical Heaters
- 26 7000 - Electrical Hand Dryers

Division 27 -- Communications

- 27 0528 - Low Voltage Raceway System - Communications

Division 28 -- Electronic Safety and Security

- 28 0528 - Low Voltage Raceway System - Security

Division 31 -- Earthwork

- 31 2316 - Excavation
- 31 2323 - Fill
- 31 3116 - Termite Control

SECTION 00 2600 - PROCUREMENT SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Requirements for submitting substitution requests for materials, products, equipment and methods of construction from those required by the Procurement Documents, during the procurement phase and prior to execution of the Owner/Contractor Agreement.

1.02 SUBSTITUTIONS (DURING THE PROCUREMENT/BIDDING PHASE)

- A. The technical specification sections may have several materials, products, equipment and methods of construction specified under the same heading. Selection of a specified materials, products, equipment and methods of construction shall be at the option of the Bidder. Where materials, products, equipment and methods of construction are specified accompanied with the phrase "Or Equal", "Approved Substitution", or similar verbiage, the Bidder may submit materials, products, equipment and methods of construction for approval in accordance with the requirements of this Document.
- B. No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect (or Construction Manager as applicable) at least seven working days prior to the date for receipt of Bids.
 - 1. Submit each request for substitution on the Architect's "Procurement Substitution Request Form" included at the end of this Section.
 - 2. Submit one material, product, equipment and methods of construction per request form, either duplicated from the Project Manual or available from the Architect's office.
 - 3. Submittals not accompanied by this form properly filled in and endorsed, will be discarded without review. NO EXCEPTIONS.
 - 4. Where specified materials, products, and equipment are accompanied by a color, pattern or finish selection, requests for substitution shall include an actual sample of the proposed color, pattern or finish for review.
 - 5. Where multiple materials, products or equipment are specified within a single specification section, specifically identify which product you wish to substitute.
- C. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or rejection of a proposed substitution shall be final.
- D. Materials, products, equipment and methods of construction approved by this substitution procedure will be issued in an Addendum.
- E. Refer to Section 01 2500 for requests for substitutions after execution of the Owner/Contractor Agreement.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

PROCUREMENT SUBSTITUTION REQUEST FORM

TO: JLG Architects
710 S. Second Street, 8th Floor
Minneapolis, MN 55401

Phone: 612-356-5165
Contact: Erik Olson
eolson@jlgarchitects.com

PROJECT: Anchor Park Concession and Team Room Facilities, Port Wentworth, Georgia

Section Number _____ Section Title _____

Specified Product _____

Proposed Substitution _____

All of the following questions must be answered. Incomplete forms will not be reviewed.

1. The following supporting data is attached:
☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports
2. Does the proposed substitution affect dimensions shown on Drawings, or functional clearances?
☐ YES ☐ NO
3. Does the proposed substitution change the design or details shown on the Drawings?
☐ YES ☐ NO
4. Does the proposed substitution affect other trades?
☐ YES ☐ NO
5. Does the proposed substitution affect maintenance service, or source of replacement parts, if applicable?
☐ YES ☐ NO
6. Does the proposed guarantee or warranty differ from that specified?
☐ YES ☐ NO
7. If "YES" to Items 2, 3, 4, 5 or 6 above, attach a thorough explanation on your company letterhead.
8. If there are other major differences between proposed substitution and specified product, attach a thorough explanation on your company letterhead.
9. The proposed substitution was used within the last 24 months on the following project:
Project Name _____
Location _____
Architect _____ Telephone No. _____
10. Has the proposed substitution been used on a JLG Architects project within the last 12 months?
☐ YES ☐ NO; If yes, which project? _____
11. The undersigned states that the function, appearance and quality of the substitution item are equivalent or superior to the specified item.

Submitted By: Firm _____ Signature _____
Address _____
Telephone _____ Fax _____
Date _____ E-Mail _____

For Use By Design Consultant: ☐ Accepted ☐ Accepted As Noted ☐ Not Accepted ☐ Received Too Late

Name _____ Signature _____

Date _____ Remarks _____

SECTION 00 3100 - AVAILABLE PROJECT INFORMATION

PART 1 GENERAL

1.01 CIVIL SPECIFICATIONS

- A. Certain information relating to the project is available to bidders but will not be part of the Architectutural Specifications:
 - 1. Civil Specifications as prepared by:
 - Thomas & Hutton
 - 50 Park of Commerce Way
 - Savannah, GA 31405
 - 912-234-5300

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

SECTION 01 2300 - ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Description of Alternates.
- B. Procedures for pricing Alternates.
- C. Documentation of changes to Contract Sum and Contract Time.

1.02 DEFINITIONS

- A. Alternate: An alternate is an amount proposed by Bidders and stated on the Bid Form for certain construction activities defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1.03 ACCEPTANCE OF ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.
- C. Work Included Under Each Alternate: Make modifications to work required by each alternate selected at no additional cost to the Owner other than as proposed on the Bid Form. Bidders shall be responsible for alternates and shall see that all changes are covered under their related sections, whether specifically called out or not. Extra costs incurred due to modifications to or deviations from the Drawings or Specifications caused directly or indirectly by each alternate shall be included in each alternate bid.

1.04 SCHEDULE OF ALTERNATES

- A. Alternate No. 1: Card Reader Access Control.
 - 1. State the amount to be ADDED to the Base Bid to provide all materials, labor & equipment required for the addition of a card reader access control, as indicated in specification section 08 7100 - Hardware and the drawings.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

SECTION 01 2500 - SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

- A. Section 00 2600 - Procurement Substitution Procedures: Required form for substitutions requests made before the end of bidding (during procurement).
- B. Section 01 3000 - Administrative Requirements: Submittal procedures, coordination.
- C. Section 01 6000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

1.03 REFERENCE STANDARDS

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
 - 2. Agrees to provide the same warranty for the substitution as for the specified product.
 - 3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
 - 4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
 - 5. Waives claims for additional costs or time extension that may subsequently become apparent.
 - 6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- B. Where a product requirement includes sustainability documentation, this documentation is required to be included in the substitution request. If documentation is not included, the substitution will be rejected. See individual Specification Sections sustainability requirements.
- 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 included in the Project Manual are adequate for this purpose, and must be used.
- E. Limit each request to a single proposed substitution item.
 - 1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

- A. Section 00 2600 - Procurement Substitution Procedures specifies time restrictions for submitting requests for substitutions during the bidding period, and the documents required.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. Submittal Form (after award of contract):
 - 1. Submit substitution requests by completing CSI/CSC Form 13.1A - Substitution Request (After Bidding/Negotiating). See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.
- B. Architect will consider requests for substitutions only within 30 days after date of Agreement. Requests for substitutions after the bids have been received are done so at the risk of the Contractor. Substitutions may not be granted.
- C. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.
- D. 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.
- B. Architect will notify Contractor in writing of decision to accept or reject request.

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.

SECTION 01 3000 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General administrative requirements.
- B. Preconstruction meeting.
- C. Progress meetings.
- D. Submittals for review, information, and project closeout.
- E. Number of copies of submittals.
- F. Requests for Information (RFI) procedures.
- G. Submittal procedures.

1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - Product Requirements: General product requirements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 REQUESTS FOR INFORMATION (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. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
 - b. Do not forward requests which solely require internal coordination between subcontractors.
 - 2. Prepare in a format and with content acceptable to Owner.
 - 3. 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 6000 - Product Requirements)

- c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
 - d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
- 3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
- 4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, 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. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
 - 1. Indicate current status of every RFI. Update log promptly and on a regular basis.
 - 2. Note dates of when each request is made, and when a response is received.
 - 3. Highlight items requiring priority or expedited response.
 - 4. Highlight items for which a timely response has not been received to date.
 - 5. Identify and include improper or frivolous RFIs.
- 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.
 - 1. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
 - 2. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.

3.02 SUBMITTAL SCHEDULE

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

3.03 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 7800 - Closeout Submittals.

3.04 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.

3.05 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 7800 - Closeout Submittals:
 - 1. Project record documents.
 - 2. Operation and maintenance data.
 - 3. Warranties.
 - 4. Bonds.
 - 5. Other types as indicated.

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

3.06 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
 - 1. After review, produce duplicates.
 - 2. Retained samples will not be returned to Contractor unless specifically so stated.

3.07 SUBMITTAL PROCEDURES

- A. General Requirements:
 - 1. Use a separate transmittal for each item.
 - 2. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 - 3. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
 - a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
 - 4. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
 - 5. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
 - b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
 - c. Color selections will not be reviewed or approved until all related products are submitted to ensure a cohesive palette.
 - d. Products that make up a system, assembly, or that are directly related to each other often must be reviewed together. Review will not begin until all components are submitted.
 - e. Coordinate with Architect and/or Construction Manager, as applicable, where schedule dictates an expedited review of products.
 - 6. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
 - 7. Provide space for Contractor and Architect review stamps.
 - 8. When revised for resubmission, identify all changes made since previous submission.
 - 9. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
 - 10. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
- 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. Do not use shop drawings without an appropriate final stamp indicating action taken in connection with construction.

3.08 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.
- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

SECTION 01 3329 - SUSTAINABILITY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes requirements to implement sustainable design intent.

1.02 MEETINGS

- A. Include these requirements on kick-off meeting and progress meeting agendas.

1.03 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: General submittal requirements.
- B. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- C. Section 01 7419 - Construction Waste Management and Disposal.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for additional submittal procedures requirements.
- B. Submit documentation specified in this Section and in applicable individual Sections.
- C. One or more of the following documents shall be submitted when indicated in individual Sections:
 - 1. Environmental Product Declarations (EPD).
 - 2. Health Product Declarations (HPD).
 - 3. Declare product labels showing Red List Free or Red List Approved.
 - 4. Forest Stewardship Council (FSC).

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

SECTION 01 4533 - CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Submittal procedures.
- B. Section 01 4000 - Quality Requirements.
- C. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.03 DEFINITIONS

- A. Code or Building Code: ICC (IBC), International Building Code, Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements and specifically, Chapter 17 - Special Inspections and Tests.
- B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
- C. Special Inspection:
 - 1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved Contract Documents and the referenced standards.
 - 2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

1.04 REFERENCE STANDARDS

- A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
- B. AISC 360 - Specification for Structural Steel Buildings; 2022, with Errata (2025).
- C. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2024.
- D. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete; 2017.
- E. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2023.
- F. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2021.
- G. IAS AC291 - Accreditation Criteria for Special Inspection Agencies AC291; 2023.
- H. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. SDI (QA/QC) - Standard for Quality Control and Quality Assurance for Installation of Steel Deck; 2017.

1.05 SUBMITTALS

- A. See Section 01 3000 - 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.
 - 4. Submit documentation that Special Inspection Agency is accredited by IAS according to IAS AC291.
- C. Testing Agency Qualifications: Prior to the start of work, the Testing Agency is required to:
 - 1. Submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Submit certification that Testing Agency is acceptable to AHJ.
 - 4. Submit documentation that Testing Agency is accredited by IAS according to IAS AC89.
- D. 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.
- E. 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.

- F. Certificates: When specified in individual special inspection requirements, Special Inspector shall submit certification by the manufacturer, fabricator, and installation subcontractor to Architect and AHJ, in quantities specified for Product Data.
 - 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect and AHJ.
- G. Manufacturer's Field Reports: Submit reports to Architect and AHJ.
 - 1. Submit report in duplicate within 30 days of observation to Architect for information.
 - 2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in Contract Documents.
- H. Fabricator's Field Reports: Submit reports to Architect and AHJ.
 - 1. Submit report in duplicate within 30 days of observation to Architect for information.
 - 2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in Contract Documents.

1.06 SPECIAL INSPECTION AGENCY

- A. Owner will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling 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.

1.07 TESTING AND INSPECTION AGENCIES

- A. Owner may employ services of an independent testing agency to perform additional testing and sampling associated with special inspections but not required by the building code.
- B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.08 QUALITY ASSURANCE

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

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.

- B. The Special Inspector and/ or Testing Agency shall perform the inspections and/ or tests as indicated on the Structural Drawings and as noted below.

3.02 SPECIAL INSPECTIONS FOR STEEL CONSTRUCTION

- A. Structural Steel: Comply with quality assurance inspection requirements of ICC (IBC).
- B. Cold-Formed Steel Deck: Comply with quality assurance inspection requirements of SDI (QA/QC).

3.03 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION

- A. Reinforcement, Including Prestressing Tendons, and Verification of Placement: Verify compliance with ACI CODE-318, Chapters 20, 25.2, 25.3, 26.6.1-26.6.3; periodic.
- B. Bolts Installed in Concrete: Where allowable loads have been increased or where strength design is used, verify compliance with approved Contract Documents and ACI CODE-318, Sections 8.1.3 and 21.2.8 prior to and during placement of concrete; continuous.
- C. Anchors Post-Installed in Hardened Concrete: Verify compliance with ACI CODE-318.
 - 1. Adhesive Anchors: Verify horizontally or upwardly-inclined orientation installations resisting sustained tension loads - Section 17.8.2.4; continuous.
 - 2. Other Mechanical and Adhesive Anchors: Verify as per Chapter 17.8.2; periodic.
- D. Design Mix: Verify plastic concrete complies with the design mix in approved Contract Documents and with ACI CODE-318, Chapter 19, 16.4.3, 26.4.4; periodic.
- E. Concrete Sampling Concurrent with Strength Test Sampling: Each time fresh concrete is sampled for strength tests, verify compliance with ASTM C172/C172M, ASTM C31/C31M, and ACI CODE-318, Chapter 26.5, 26.12, and record the following, continuous:
 - 1. Slump.
 - 2. Air content.
 - 3. Temperature of concrete.
- F. Specified Curing Temperature and Techniques: Verify compliance with ACI CODE-318, Chapter 26.5.3 through 26.5.5; periodic.
- G. Materials: If the Contractor cannot provide sufficient data or documentary evidence that concrete materials comply with the quality standards of ACI CODE-318, the AHJ will require testing of materials in accordance with the appropriate standards and criteria in ACI CODE-318, Chapters 19 and 20.

3.04 SPECIAL INSPECTIONS FOR MASONRY CONSTRUCTION

- A. Verify each item below complies with approved Contract Documents and the applicable articles of TMS 402/602.
 - 1. Inspections and Approvals:
 - a. Verify compliance with the required inspection provisions of the approved Contract Documents; periodic.
 - b. Verify approval of submittals required by Contract Documents; periodic.
 - 2. Compressive Strength of Masonry: Verify compressive strength of masonry units prior to start of construction unless specifically exempted by code; periodic.
 - 3. Slump Flow and Visual Stability Index (VSI): Verify compliance as self consolidating grout arrives on site; continuous.
 - 4. Joints and Accessories: When masonry construction begins, verify:
 - a. Proportions of site prepared mortar; periodic.
 - b. Construction of mortar joints; periodic.
 - c. Location of reinforcement, connectors, prestressing tendons, anchorages, etc; periodic.

5. Structural Elements, Joints, Anchors, Protection: During masonry construction, verify:
 - a. Size and location of structural elements; periodic.
 - b. Type, size and location of anchors, including anchorage of masonry to structural members, frames or other construction; periodic.
 - c. Size, grade and type of reinforcement, anchor bolts and prestressing tendons and anchorages; periodic.
 - d. Welding of reinforcing bars; continuous.
 - e. Preparation, construction and protection of masonry against hot weather above 90 degrees F (50 degrees C) and cold weather below 40 degrees F (22 degrees C); periodic.
 - f. Application and measurement of prestressing force; continuous.
6. Grouting Preparation: Prior to grouting, verify:
 - a. Grout space is clean; periodic.
 - b. Correct placement of reinforcing, connectors, prestressing tendons and anchorages; periodic.
 - c. Correctly proportioned site prepared grouts and prestressing grout for bonded tendons; periodic.
 - d. Correctly constructed mortar joints; periodic.
7. Preparation of Grout Specimens, Mortar Specimens and Prisms: Observe preparation of specimens; periodic.

3.05 SPECIAL INSPECTIONS FOR SOILS

- A. Materials and Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
 1. Design bearing capacity of material below shallow foundations; periodic.
 2. Design depth of excavations and suitability of material at bottom of excavations; periodic.
 3. Materials, densities, lift thicknesses; placement and compaction of backfill: continuous.
 4. Subgrade, prior to placement of compacted fill verify proper preparation; periodic.
- B. Testing: Classify and test excavated material; periodic.

3.06 OTHER SPECIAL INSPECTIONS

- A. Provide for special inspection of work that, in the opinion of the AHJ, is unusual in nature.
- B. For the purposes of this section, work unusual in nature includes, but is not limited to:
 1. Construction materials and systems that are alternatives to materials and systems prescribed by the building code.
 2. Unusual design applications of materials described in the building code.
 3. Materials and systems required to be installed in accordance with the manufacturer's instructions when said instructions prescribe requirements not included in the building code or in standards referenced by the building code.
- C. Alternative Test Procedures: Where approved rules and standards do not exist, test materials and assemblies as required by AHJ or provide AHJ with documentation of quality and manner in which those materials and assemblies are used.

3.07 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

- A. Special Inspection Agency shall:
 1. Verify samples submitted by Contractor comply with the referenced standards and the approved Contract Documents.
 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.

3. Perform specified sampling and testing of products in accordance with specified reference standards.
 4. Ascertain compliance of materials and products with requirements of Contract Documents.
 5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
 6. Perform additional tests and inspections required by Architect.
 7. Attend preconstruction meetings and progress meetings.
 8. Submit reports of all tests or inspections specified.
- B. Limits on Special 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. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- D. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.08 TESTING AGENCY DUTIES AND RESPONSIBILITIES

- A. Testing Agency Duties:
1. Test samples submitted by Contractor.
 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 3. Perform specified sampling and testing of products in accordance with specified standards.
 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
 6. Perform additional tests and inspections required by Architect.
 7. Attend preconstruction meetings and progress meetings.
 8. 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.

3.09 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.

3.10 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. Submit qualifications of observer to Architect 30 days in advance of required observations.
 - 1. Observer subject to approval of Architect.
 - 2. Observer subject to approval of Owner.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

ACEC/SEAOG SI GL 01- 19

Georgia Special Inspections Guidelines

In Accordance with the
2018 International Building Code



Georgia Special Inspections Guidelines

PREFACE

The **Georgia Special Inspections Guidelines** are intended to assist all parties involved in building projects in Georgia to successfully comply with the special inspections requirements of the **Georgia State Minimum Standard Building Code, (2018 International Building Code** in conjunction with **Georgia State Amendments)**, hereafter referred to as the **Building Code**. These parties include owners, building officials, design professionals, contractors and special inspectors. This consensus document is the product of the parties listed below, public review and public hearings.

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Acknowledgments:

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Georgia Department of Community Affairs, Chapter 17 Task Force
Georgia State Financing and Investment Commission
Building Officials Association of Georgia



Disclaimer and Notice:

While the information presented in the report is believed to be correct, SEAOG and ACEC/G assume no responsibility for its accuracy or for the opinions expressed herein. The material presented in this publication should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability, and applicability by qualified professionals. Users of information from this publication assume all liability arising from such use.

Georgia Special Inspections Guidelines

CONTENTS

<u>Section</u>	<u>Page</u>
FORWARD	3
SPECIAL INSPECTIONS RESPONSIBILITIES	5
SPECIAL INSPECTIONS STEP-BY-STEP TIMELINE	7
SPECIAL INSPECTIONS PROGRAM INSTRUCTIONS	9
APPENDIX A: SPECIAL INSPECTIONS PROGRAM FORMS	
• Statement of Special Inspections	A1
• Special Inspections Requirements for Seismic Resistance	A2
• Special Inspections Requirements for Wind Resistance	A3
• Final Report of Special Inspections	A4
APPENDIX B: SPECIAL INSPECTION PROGRAM: SCHEDULE FORM AND COMMENTARY	
• Schedule of Special Inspections Services	B1
• Commentary on Schedule of Special Inspections Services	BC1
APPENDIX C: CONTRACTOR'S FORMS	
• Contractor's Statement of Responsibility	C1
• Fabricator's Certificate of Compliance	C2
APPENDIX D: SPECIAL INSPECTOR'S FORMS	
• Special Inspections Daily Report	D1
• Special Inspections Interim Report	D2
• Special Inspections Discrepancy Notice	D3

Georgia Special Inspections Guidelines

FORWARD

On September 12, 2001, the State of Georgia Board of Community Affairs, under the provisions of the Uniform Codes Act, updated the Georgia Standard Codes by approval of the 2000 edition of the **Standard Building Code (2000 International Building Code)** with **Georgia Amendments**. The effective date for the **Building Code** was January 1, 2002. This introduced *Special Inspection and Testing*, under Chapter 17, as a **Building Code** requirement for the first time in Georgia.

The State of Georgia Board of Community Affairs updated the Georgia Standard Codes by approval of the 2006 edition of the **International Building Code** with **State of Georgia Amendments**, hereafter referred to as the **Building Code**, with an effective date of January 1, 2007.

In 2009 the Board of Community Affairs created a Task Force to review the **International Building Code** Chapter 17, "Structural Tests and Special Inspections" and the related Georgia Amendments. One of the outcomes of the Task Force review was this update to the **Guidelines**. Other outcomes included 2010 Georgia Amendments requiring special inspection of post-installed anchors and the inclusion of special inspection information on the construction documents, as well as revisions to Table 1704.1, "Minimum Special Inspector Qualifications". The Task Force also developed a flowchart and preconstruction meeting checklist for Special Inspections and recommendations for a special inspection training program.

ACEC/SEAOG SI GL 01–19, Georgia Special Inspections Guidelines is to assist *all* parties involved in building projects in Georgia to successfully comply with the special inspections requirements of the **Building Code**. These parties include owners, building officials, design professionals, contractors and special inspectors.

Special Inspection is the monitoring of the materials and workmanship critical to the integrity of the building structure. It is a review of the work of the contractors and their employees to ensure that the approved plans and specifications are being followed and that the relevant codes and referenced standards are being observed. The Special Inspection process is *in addition* to the inspections conducted by the Building Official or authority having jurisdiction, Structural Observation by the Design Professional and tests or inspections required by the Construction Documents.

Special inspections and tests are required to be performed by qualified, independent agents with special expertise as approved by the Building Official.

Special Inspections per **Building Code** Section 1704 is required to be provided on all professionally designed projects not meeting the exception for certain residential occupancies.

As part of the general requirements Section 1704 of the **Building Code**, Special Inspections, a *Statement of Special Inspections* (which includes a *Schedule of Special Inspection Services*) prepared by the Registered Design Professional in Responsible Charge shall be submitted to the Building Official at time of permit application. The Registered Design Professional for special inspections is typically the Structural Engineer or the Architect. Often the Architect will take input from the Structural, Mechanical and Electrical Engineers and act as the overall Registered Design Professional in Responsible Charge of preparing and submitting the *Statement of Special Inspections*.

In accordance with Section 1704 of the **Building Code** the *Statement of Special Inspections*, utilizing a *Schedule of Special Inspection Services*, shall include the following items:

1. The materials, systems, components and work required to have special inspection or testing by the building official or by the registered design professional responsible for each portion of the work.
2. The type and extent of each special inspection.
3. The type and extent of each test.
4. Additional requirements for special inspection or testing for seismic or wind resistance as specified in Section 1705.11, 1705.12, and 1705.13.
5. For each type of special inspection, identification as to whether it will be continuous special inspection or periodic special inspection.

Under certain high seismic and wind conditions the *Statement of Special Inspections* shall also include additional special inspection and testing requirements for seismic and/or wind resistance where required by **Building Code** Sections 1705.11, 1705.12, or 1705.13. Once engaged for a project, each contractor responsible for the construction of a seismic or wind resistant system or component listed in the *Statement of Special Inspections* shall submit a written statement of responsibility to the building official and to the owner prior to the commencement of work on the system or component.

The *Schedule of Special Inspection Services* must be maintained during the course of a construction project and reflect any changes. For example the Schedule shall be revised if a Special Inspection Agency changes during the course of the construction or if a change in a building material or technique requires a change in the Special Inspection requirements.

Structural Observations by a registered structural design professional for certain high seismic or wind conditions shall also be provided where required by **Building Code** Section 1704.6.

At the completion of work and prior to issuing the Certificate of Occupancy, a *Final Report of Special Inspections* in accordance with **Building Code** Section 1704.2.4 shall be submitted to the Building Official. This report shall document the completion of all required special inspections and testing.

This Guideline describes the responsibilities and provides forms for all phases and all parties of the Special Inspection process.

Georgia Special Inspections Guidelines

SPECIAL INSPECTIONS RESPONSIBILITIES

Owner Responsibilities:

The Owner or the Registered Design Professional in Responsible Charge (hereafter referred to as the Design Professional) acting as the Owner's agent shall:

1. Engage the Special Inspector(s)
2. Submit to the Building Official a list of the individuals, approved agencies or firms intended to be retained for conducting special inspections.

Design Professional in Responsible Charge Responsibilities:

The Design Professional shall:

1. Where engaged as the Owner's Agent, perform the duties noted above.
2. Prepare the Special Inspection program with the assistance of the structural engineer of record.
3. Submit to the Building Official the Statement of Special Inspections, which shall include the Schedule of Special Inspections Services.
4. Respond to identified field discrepancies.

Building Official or Authority Having Jurisdiction Responsibilities:

The Building Official shall:

1. Obtain a *Statement of Special Inspections* prior to issuance of building permit.
2. Obtain a list of the individuals, agencies or firms intended to be retained for conducting special inspections.
3. Approve qualified special inspectors, firms and agencies in accordance with the **Building Code**.
4. Determine if fabricators qualify as *approved fabricators* in accordance with **Building Code** section 1704.2.5.1.
5. Obtain Special Inspections interim reports, certificates, and statements of responsibility.
6. Obtain a *Final Report of Special Inspections* prior to issuance of a Certificate of Occupancy.

Special Inspectors Responsibilities:

The Special Inspectors shall:

1. Notify the contractor of their presence and responsibilities at the job site.
2. Observe assigned work for which they are responsible for conformance with the plans and specifications.
3. Report nonconforming items to the immediate attention of the contractor for correction.
4. Write a discrepancy report about each nonconforming item containing:
 - a. Description and exact location.
 - b. Reference to applicable drawings and specifications.
 - c. Resolution or corrective action taken and the date.
5. Provide timely reports in a daily format and furnish these reports directly to the Design Professional and the contractor. The reports should:
 - a. Describe the special inspection and tests made, with locations.
 - b. Indicate nonconforming items and their resolution.
 - c. List unresolved items and parties notified.

- d. Itemize any changes authorized by the Design Professional.
6. Initial and date the "Date Completed" box in the *Schedule of Special Inspections Services* as the inspection and testing activities are completed.
7. Submit a final signed report stating that all required special inspections and testing were fulfilled and reported and that any outstanding discrepancies have been corrected.

Contractor/Construction Manager/Design Builder Responsibilities:

1. Submit a *Statement of Responsibility* where required by the *Statement of Special Inspections*.
2. Notify the Special Inspector(s) when special inspections are needed.
3. Coordinate the scheduling and timely notification of the specific individuals needed for the Special Inspection.
4. Provide direct access to the approved plans and specifications for the project.
5. Submit *Fabricator's Certificates of Compliance* for approved fabricators.
6. Provide safe access to the work to be inspected and deliver samples for testing when needed.

Georgia Special Inspections Guidelines

SPECIAL INSPECTIONS STEP-BY-STEP TIMELINE

The following is a suggested timeline for a project with special inspections. Some elements may not be applicable to all projects.

1. The Design Professional shall prepare the Special Inspections program with the assistance of the structural engineer of record.
2. The Owner or the Design Professional in Responsible Charge acting as the Owner's agent shall engage the Special Inspector(s).
3. The Design Professional shall submit to the Building Official the *Statement of Special Inspections*, which shall include the *Schedule of Special Inspections Services*. Where required the *Statement of Special Inspections* shall include additional special inspections and testing requirements for seismic and/or wind resistance.
4. The Owner or the Design Professional acting as the Owner's agent shall submit to the Building Official a list of the individuals, approved agencies or firms intended to be retained for conducting special inspections.
5. The Building Official shall approve the qualifications of the Special Inspectors and agencies in accordance with the ***Building Code***.
6. Where required by the *Statement of Special Inspections*, each contractor responsible for the construction or fabrication of a system or component described in the *Requirements for Wind or Seismic Resistance* shall submit a *Statement of Responsibility*.
7. The Contractor shall notify the Special Inspector(s) when work is ready for inspection.
8. The Special Inspector(s) shall inspect the work per the *Schedule of Special Inspection Services* and provide a daily report detailing the inspection and any deficiencies. The Special Inspector(s) shall issue interim reports to the Design Professional and the Building Official as noted in the *Statement of Special Inspections*.
9. The Design Professional shall, as needed, respond to any discrepancies identified by the Special Inspector(s).
10. Each approved fabricator that is exempt from Special Inspection of shop fabrication and implementation procedures per section 1704.2.5.1 of the ***Building Code*** must submit *Fabricator's Certificate of Compliance* at the completion of fabrication.
11. The Contractor shall remedy deficient work as construction progresses and prior to final inspection.
12. The Contractor shall submit *Fabricator's Certificates of Compliance* for approved fabricators.

13. The Special Inspector(s) shall prepare and sign a *Final Report of Special Inspections* at the completion of the project.
14. The Building Official shall not issue a Certificate of Occupancy until the *Final Report of Special Inspections* has been issued for that phase of the work.

Georgia Special Inspections Guidelines

SPECIAL INSPECTIONS PROGRAM INSTRUCTIONS

The following are general requirements and instructions for processing the Special Inspection Program forms.

Overview:

The program consists of three primary forms that shall be filled out and submitted to the Building Official. The *Statement of Special Inspections* and the *Schedule of Special Inspections Services* forms are submitted for review prior to permit issuance. These documents shall be maintained in a central location at the project site. The *Schedule of Special Inspections Services* will need to be accessed on a regular basis by the special inspector(s) for the project. The *Final Report of Special Inspections* is submitted at the completion of construction. Several other forms that may be utilized are also included.

Statement of Special Inspections:

This form provides the general project information. It identifies the project location, the project architect, the project structural engineer, and the registered design professional in responsible charge, referred to in the forms and hereafter as the Design Professional. Depending on the project organization, the Design Professional could be the project architect, a project engineer, or an independent third party representing the Owner. In accordance with section 1704.2 of the **Building Code**, the Design Professional is responsible for preparation of the special inspection program and would complete the “Prepared by” section of this form.

This form establishes the frequency interim reports should be furnished. For complex projects, the Design Professional, or Building Official may attach a separate schedule listing the required report frequency. Additionally, the Building Official can request reports at a different frequency than the Design Professional. A copy of this form should be kept at the project site with the *Schedule of Special Inspection Services*.

For large projects that are divided into multiple bid packages (foundation package, structural frame package, building package, etc.) the special inspection program submitted with each partial bid package would only contain the special inspection requirements for the scope of work associated with that bid package.

Schedule of Special Inspection Services:

This form provides a detailed and itemized list of which special inspection activities are required for the specific project and which individuals, firm, or agency will be performing the special inspection services associated with each required task. The project title should be inserted at the top of the form. The form lists the various tasks required by Chapter 17 of the **Building Code** and provides a column for the Design Professional to identify with a “yes” or “no” which items apply to the specific project.

The “Extent” column is where the Design Professional can provide additional information or detail regarding the scope of the special inspections. This column identifies which items require continuous inspection and which require periodic inspections as defined by the **Building Code**. For periodic inspections, the frequency of inspections can be identified here or it could be included in the project construction documents. Exceptions to a special inspections task may be noted in this column.

Special instructions regarding how to perform inspections may also be included here. For more complex projects, this may be addressed by referring to another project document, such as the project specifications.

Multiple special inspectors may exist on one project. For example, a testing agency may perform the special inspection duties associated with testing welds, a registered structural engineer may perform special inspection duties associated with inspecting steel connections for conformance with the Construction Documents, and an architect may perform the special inspection duties associated with construction of the EIFS system. The multiple special inspectors are identified and numbered at the end of the form. The number next to the individual, firm, or agency's name would be listed in the schedule under the column heading "Agent" for the task that individual, firm, or agency will perform. In some instances, it may be desirable to have more than one special inspector involved in the same task. In this instance, the numbers for both parties would be listed adjacent to that task.

Minimum qualifications for each type of inspection and test are included in the *Georgia Amendments to the **Building Code***. In cases where the complexity of the inspection or testing activity warrants additional expertise, the Design Professional may specify more stringent qualifications. For example, inspection by a structural engineer may be specified for complex concrete reinforcing steel.

The only column not filled in on the schedule at the time it is submitted should be the "Completed" column. When an individual special inspection task in the schedule is completed for the last time on the project and the special inspector performed their final review, inspection, or test of that item for the project, the special inspector shall initial and date the cell in the "Completed" column adjacent to the task. At the conclusion of the project, a copy of the *Schedule of Special Inspections Services* form with the initials and date in the "Completed" column for each task relevant to the project shall be submitted to the Design Professional and the Building Official with the *Final Report of Special Inspections*.

Projects requiring special *Requirements for Seismic and/or Wind Resistance* should be identified at the end of the form for cross reference to the *Statement of Special Inspections*.

A commentary with specific requirements for each *Material / Activity* in the *Schedule* is included for assistance in completing the inspection program.

Final Report of Special Inspections:

This form is submitted when all the special inspections requirements for a project have been fulfilled. Each special inspector corresponding to an agent number in the *Schedule of Special Inspection Services* will be required to complete a copy of this form for submittal to the Design Professional and the Building Official for their scope of work. The special inspections program will not be considered complete until forms from all agents have been submitted and received.

STATEMENT OF SPECIAL INSPECTIONS

PROJECT: _____
LOCATION: _____
PERMIT APPLICANT: _____
APPLICANT'S ADDRESS: _____
ARCHITECT OF RECORD: _____
STRUCTURAL ENGINEER OF RECORD: MATT PEARCE (PE 050313)
MECHANICAL ENGINEER OF RECORD: _____
ELECTRICAL ENGINEER OF RECORD: _____
REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE: _____

This Statement of Special Inspections is submitted in accordance with Section 1704.3 of the 2018 International Building Code. It includes a *Schedule of Special Inspection Services* applicable to the above-referenced Project as well as the identity of the individuals, agencies, or firms intended to be retained for conducting these inspections. If applicable, it includes *Special Inspections for Seismic Resistance* and/or *Special Inspections for Wind Resistance*.

Are *Special Inspections for Seismic Resistance* included in the *Statement of Special Inspections*?

☒ Yes ☐ No

Are *Special Inspections for Wind Resistance* included in the *Statement of Special Inspections*?

☒ Yes ☐ No

The Special Inspector(s) shall keep records of all inspections and shall furnish interim inspection reports to the Building Official and to the Registered Design Professional in Responsible Charge at a frequency agreed upon by the Design Professional and the Building Official prior to the start of work. Discrepancies shall be brought to the immediate attention of the Contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and the Registered Design Professional in Responsible Charge prior to completion of that phase of work. A *Final Report of Special Inspections* documenting required special inspections and corrections of any discrepancies noted in the inspections shall be submitted to the Building Official and the Registered Design Professional in Responsible Charge at the conclusion of the project.

Frequency of interim report submittals to the Registered Design Professional in Responsible Charge:

☒ Weekly ☐ Bi-Weekly ☐ Monthly Other; specify: _____

The Special Inspection program does not relieve the Contractor of the responsibility to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

Statement of Special Inspections Prepared by:

Type or print name

Signature Date

Building Official's Acceptance:

Signature Date

Permit Number:

Frequency of interim report submittals to the Building Official:

☐ Monthly ☐ Bi- Monthly ☐ Upon Completion Other; specify: _____

Preparer's Seal

Special Inspections for Seismic Resistance

See the Schedule of Special Inspections for inspection and testing requirements

Seismic Design Category: C

Special Inspections for Seismic Resistance Required (Yes/No): NO

Description of seismic force-resisting system subject to special inspection and testing for seismic resistance:

(Where required per IBC Sections 1705.12.1, 1705.12.2, and 1705.12.3) (Special inspections for seismic resistance of structural steel, where required, shall be in accordance with AISC 341)

ORDINARY REINFORCED MASONRY SHEAR WALLS (R = 1.5)

INSPECTIONS NOT REQUIRED PER 1705.12 (EXCEPTION 2 FOR MASONRY CONSTRUCTION, $S_{ds} < 0.5$ AND BUILDING HEIGHTS LESS THAN 25FT)

Description of designated seismic systems subject to special inspection and testing for seismic resistance:

(Required for architectural, electrical and mechanical systems and their components that require design in accordance with Chapter 13 of ASCE 7, have a component importance factor, I_p , greater than one and are in Seismic Design Categories C, D, E or F.)

Description of additional seismic systems and components requiring special inspections:

(Required for systems noted in IBC Section 1705.12.5, 1705.12.6, 1705.12.7, and 1705.12.8.)

Description of additional seismic systems and components requiring testing:

(Where required per IBC Section 1705.13)

Statement of Responsibility:

Each contractor responsible for the construction or fabrication of a system or component described above must submit a Statement of Responsibility.

Special Inspections for Wind Resistance

See the Schedule of Special Inspections for inspection and testing requirements

Allowable Stress Design Wind Speed, V_{asd} : 103 m.p.h. **Vult = 132 mph**

Wind Exposure Category: C

Special Inspection for Wind Resistance Required (Yes/No): NO

(Required in wind exposure Category B, where the allowable stress design wind speed, V_{asd} , is 120 miles per hour or greater. Required in wind exposure Category C or D, where the allowable stress design wind speed, V_{asd} , is 110 miles per hour or greater.)

Description of structural wood and cold-formed steel light frame construction main windforce-resisting system subject to special inspections for wind resistance:

(Required for systems noted in IBC Section 1705.11.1 and 1705.11.2).

Description of windforce-resisting components subject to special inspections for wind resistance:

(Required for systems and components noted in IBC Section 1705.11.3)

Statement of Responsibility:

Each contractor responsible for the construction or fabrication of a system or component described above must submit a Statement of Responsibility.

FINAL REPORT OF SPECIAL INSPECTIONS

PROJECT: _____

LOCATION: _____

PERMIT APPLICANT: _____

APPLICANT'S ADDRESS: _____

ARCHITECT OF RECORD: _____

STRUCTURAL ENGINEER OF RECORD: MATT PEARCE (PE 050313)

MECHANICAL ENGINEER OF RECORD: _____

ELECTRICAL ENGINEER OF RECORD: _____

REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE: _____

To the best of my information, knowledge, and belief, which are based upon observations or diligent supervision of our inspection services for the above-referenced Project, I hereby state that the special inspections or testing required for this Project, and designated for this Agent in the *Schedule of Special Inspection Services*, have been completed in accordance with the Contract Documents.

The Special Inspection program does not relieve the Contractor of the responsibility to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

Interim reports submitted prior to this final report and numbered ___ to ___ form a basis for, and are to be considered an integral part of this final report. The following discrepancies that were outstanding since the last interim report dated _____ have been corrected:

(Attach 8 1/2"x11" continuation sheet(s) if required to complete the description of corrections)

Prepared By:

Special Inspection Agent/Firm

Type or print name

Signature

Date

SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
1705.1.1 Special Cases (work unusual in nature, including but not limited to alternative materials and systems, unusual design applications, materials and systems with special manufacturer's requirements - add additional rows as needed.)	Submittal review, shop (3) and/or field inspection	N			
1. Inspection of anchors post-installed in solid grouted masonry: Per research reports including verification of anchor type, anchor dimensions, hole dimensions, hole cleaning procedures, anchor spacing, edge distances, masonry unit, grout, masonry compressive strength, anchor embedment and tightening torque	Field inspection	Y	Periodic or as required by the research report issued by an approved source		
2. Aggregate Pier Inspection: The special inspector's responsibilities include, but are not limited to, review of the aggregate pier designer's use of soil parameters as presented in the project soils report, and during construction, verification of aggregate properties, type and number of lifts of aggregate, hole size and depths and top elevations of the pier elements, and applied energy. Additionally, results of qualitative tests on production aggregate pier elements such as modulus load testing, uplift pull-out testing, bottom stabilization tests and dynamic cone penetration tests, shall be reviewed to verify compliance with design specifications.	Field inspection	N	Periodic or as required by the research report issued by an approved source		
1705.2.1 Structural Steel Construction					
1. Fabricator and erector documents (Verify reports and certificates as listed in AISC 360, Section N 3.2 for compliance with construction documents)	Submittal Review	Y	Each submittal		
2. Material verification of structural steel	Shop (3) and field inspection	Y	Periodic		
3. Structural steel welding:					
a. Inspection tasks Prior to Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-1)	Shop (3) and field inspection	Y	Observe or Perform as noted (4)		
b. Inspection tasks During Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-2)	Shop (3) and field inspection	Y	Observe (4)		
c. Inspection tasks After Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-3)	Shop (3) and field inspection	Y	Observe or Perform as noted (4)		
d. Nondestructive testing (NDT) of welded joints: <i>see Commentary</i>		N			
1) Complete penetration groove welds 5/16" or greater in risk category III or IV	Shop (3) or field ultrasonic testing - 100%	N	Periodic		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
2) Complete penetration groove welds 5/16" or greater in <i>risk category II</i>	Shop (3) or field ultrasonic testing - 10% of welds minimum	N	Periodic		
3) Welded joints subject to fatigue when required by AISC 360, Appendix 3, Table A-3.1	Shop (3) or field radiographic or Ultrasonic testing	N	Periodic		
4) Fabricator's NDT reports when fabricator performs NDT	Verify reports	N	Each submittal (5)		
4. Structural steel bolting:	Shop (3) and field inspection				
a. Inspection tasks Prior to Bolting (Observe, or perform tasks for each bolted connection, in accordance with QA tasks listed in AISC 360, Table N5.6-1)		Y	Observe or Perform as noted (4)		
b. Inspection tasks During Bolting (Observe the QA tasks listed in AISC 360, Table N5.6-2)		Y	Observe (4)		
1) Pre-tensioned and slip-critical joints		Y			
a) Turn-of-nut with matching markings		Y	Periodic		
b) Direct tension indicator		Y	Periodic		
c) Twist-off type tension control bolt		Y	Periodic		
d) Turn-of-nut without matching markings		Y	Continuous		
e) Calibrated wrench		Y	Continuous		
2) Snug-tight joints		Y	Periodic		
c. Inspection tasks After Bolting (Perform tasks for each bolted connection in accordance with QA tasks listed in AISC 360, Table N5.6-3)		Y	Perform (4)		
5. Visual inspection of exposed cut surfaces of galvanized structural steel main members and exposed corners of the rectangular HSS for cracks subsequent to galvanizing	Shop (3) or field inspection	Y	Periodic		
6. Embedments (Verify diameter, grade, type, length, embedment. See 1705.3 for anchors)	Field inspection	Y	Periodic		
7. Verify member locations, braces, stiffeners, and application of joint details at each connection comply with construction documents	Field inspection	Y	Periodic		
1705.2.2 Cold-Formed Steel Deck					
1. Manufacturer documents (Verify reports and certificates as listed in SDI QA/QC, Section 2, Paragraphs 2.1 and 2.2 for compliance with construction documents)	Submittal Review	Y	Each submittal		
2. Material verification of steel deck, mechanical fasteners and welding materials	Shop (3) and field inspection	Y	Periodic		
3. Cold-formed steel deck placement:	Shop (3) and field inspection	Y			
a. Inspection tasks Prior to Deck Placement (Perform the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.1)		Y	Perform (4)		
b. Inspection tasks After Deck Placement (Perform the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.2)		Y	Perform (4)		
4. Cold-formed steel deck welding:	Shop (3) and field inspection	Y			
a. Inspection tasks Prior to Welding (Observe the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.3)		Y	Observe (4)		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
b. Inspection tasks During Welding (Observe the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.4)		Y	Observe (4)		
c. Inspection tasks After Welding (Perform the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.5)		Y	Perform (4)		
5. Cold-formed steel deck mechanical fastening:	Shop (3) and field inspection	Y			
a. Inspection tasks Prior to Mechanical Fastening (Observe the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.6)		Y	Observe (4)		
b. Inspection tasks During Mechanical Fastening (Observe the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.7)		Y	Observe (4)		
c. Inspection tasks After Mechanical Fastening (Perform the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.8)		Y	Perform (4)		
1705.2.3. Open-Web Steel Joists and Joist Girders					
1. Installation of open-web steel joists and joist girders.		N			
a. End connections - welding or bolted.	per SJI CJ or SJI 100	N	Periodic		
b.. Bridging - horizontal or diagonal.		N			
1) Standard bridging.	per SJI CJ or SJI 100	N	Periodic		
2) Bridging that differs from the specifications listed in SJI CJ or SJI 100.		N	Periodic		
1705.2.4. Cold-Formed Steel Trusses Spanning 60 feet or Greater					
Verify temporary and permanent restraint/bracing are installed in accordance with the approved truss submittal package	Field inspection	N	Periodic		
1705.3 Concrete Construction					
1. Inspection and placement verification of reinforcing steel and prestressing tendons.	Shop (3) and field inspection	Y	Periodic		
2. Reinforcing bar welding:		Y			
a. Verification of weldability of bars other than ASTM A706.		Y	Periodic		
b. Inspection of single-pass fillet welds 5/16 or less in size.		Y	Periodic		
c. Inspection of all other welds.		Y	Continuous		
3. Inspection of anchors cast in concrete.	Shop (3) and field inspection	Y	Periodic		
4. Inspection of anchors post-installed in hardened concrete members per research reports, or, if no specific requirements are provided, requirements shall be provided by the registered design professional and approved by the building official, including verification of anchor type, anchor dimensions, hole dimensions, hole cleaning procedures, anchor spacing, edge distances, concrete minimum thickness, anchor embedment and tightening torque	Field inspection	Y	Periodic or as required by the research report issued by an approved source		
a. Adhesive anchors installed in horizontal or upward-inclined orientation that resist sustained tension loads.		Y	Continuous		
b. Mechanical and adhesive anchors note defined in 4a.		Y	Periodic		
5. Verify use of approved design mix	Shop (3) and field inspection	Y	Periodic		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
6. Prior to placement, fresh concrete sampling, perform slump and air content tests and determine temperature of concrete and perform any other tests as specified in construction documents.	Shop (3) and field inspection	Y	Continuous		
7. Inspection of concrete and shotcrete placement for proper application techniques	Shop (3) and field inspection	Y	Continuous		
8. Verify maintenance of specified curing temperature and techniques	Shop (3) and field inspection	Y	Periodic		
9. Inspection of prestressed concrete:	Shop (3) and field inspection	N			
a. Application of prestressing force		N	Continuous		
b. Grouting of bonded prestressing tendons		N	Continuous		
10. Inspect erection of precast concrete members		N	Periodic		
11. Verification of in-situ concrete strength, prior to stressing of tendons in post tensioned concrete and prior to removal of shores and forms from beams and structural slabs	Review field testing and laboratory reports	N	Periodic		
12. Inspection of formwork for shape, lines, location and dimensions	Field inspection	Y	Periodic		
13. Concrete strength testing and verification of compliance with construction documents	Field testing and review of laboratory reports	Y	Periodic		
1705.4 Masonry Construction					
MINIMUM VERIFICATION REQUIREMENTS					
(A) Level 1, 2 and 3 Quality Assurance:					
1. Prior to construction, verification of compliance of submittals	Submittal Review	Y	Prior to Construction		
(B) Level 2 & 3 Quality Assurance:					
1. Prior to construction verification of f'_m and f'_{AAC} except where specifically required by the code	Testing by unit strength method or prism test method	Y	Prior to Construction		
2. During construction, verification of Slump Flow and Visual Stability Index (VSI) when self-consolidating grout is delivered to project site.	Testing by unit strength method or prism test method	Y	Periodic		
(C) Level 3 Quality Assurance:					
1. During construction, verification of f'_m and f'_{AAC} for every 5,000 SF	Testing by unit strength method or prism test method	N	Periodic		
2. During construction, verification of proportions of materials as delivered to the project site for premixed or preblended mortar, prestressing grout, and grout other than self-consolidating grout.	Field inspection	N	Periodic		
MINIMUM SPECIAL INSPECTION REQUIREMENTS					
(D) Levels 2 and 3 Quality Assurance:					
1. As masonry construction begins, verify that the following are in					
a. Proportions of the site-prepared mortar	Field inspection	Y	Periodic		
b. Grade and size of prestressing tendons and anchorages	Field Inspection	Y	Periodic		
c. Grade, type, and size of reinforcement, anchor bolts, and prestressing tendons and anchorages	Field Inspection	Y	Periodic		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
d. Prestressing technique	Field Inspection	N	Periodic		
e. Properties of thin-bed mortar for AAC masonry	Field Inspection	N	Level 2 - Continuous ^(b) Level 2 - Periodic ^(c)		
(b) Required for the first 5,000 square feet (c) Required after the first 5,000 square feet		N	Level 3 - Continuous		
f. Sample panel construction		Field Inspection	Y N	Level 2 - Periodic Level 3 - Continuous	
2. Prior to grouting, verify that the following are in compliance:					
a. Grout space	Field Inspection	Y N	Level 2 - Periodic Level 3 - Continuous		
b. Placement of prestressing tendons and anchorages	Field Inspection	N	Periodic		
c. Placement of reinforcement, connectors, and anchor bolts	Field inspection	Y N	Level 2 - Periodic Level 3 - Continuous		
d. Proportions of site-prepared grout and prestressing grout for bonded tendons	Field Inspection	Y	Periodic		
3. Verify compliance of the following during construction:					
a. Materials and procedures with the approved submittals	Field inspection	Y	Periodic		
b. Placement of masonry units and mortar joint construction	Field Inspection	Y	Periodic		
c. Size and location of structural members	Field inspection	Y	Periodic		
d. Type, size, location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction	Field inspection	Y N	Level 2 - Periodic Level 3 - Continuous		
e. Welding of reinforcement		Field inspection	Y	Continuous	
f. Preparation, construction, and protection of masonry during cold weather (temperature below 40°F) or hot weather (temperature above 90°F)	Field inspection	Y	Periodic		
g. Application and measurement of prestressing force	Field testing	N	Continuous		
h. Placement of grout and prestressing grout for bonded tendons is in compliance	Field inspection	N	Continuous		
i. Placement of AAC masonry units and construction of thin-bed mortar joints	Field inspection	N N	Level 2 - Continuous ^(b) Level 2 - Periodic ^(c) Level 3 - Continuous		
(b) Required for the first 5,000 square feet (c) Required after the first 5,000 square feet					
4. Observe preparation of grout specimens, mortar specimens, and/or prisms	Field inspection	Y N	Level 2 - Periodic Level 3 - Continuous		
1705.5 Wood Construction					
1. For prefabricated wood structural elements, inspection of the fabrication process and assemblies in accordance with Section 1704.2.5.	In-plant review (3)	N	Periodic		
2. For high-load diaphragms, verify grade and thickness of structural panel sheathing agree with approved building plans.	Field inspection	N	Periodic		
3. For high-load diaphragms, verify nominal size of framing members at adjoining panel edges, nail or staple diameter and length, number of fastener lines, and that spacing between fasteners in each line and at edge margins agree with approved building plans	Field inspection	N	Periodic		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
4. Metal-plate-connected wood trusses:		N			
a. Verification that permanent individual truss member restraint/bracing has been installed in accordance with the approved truss submittal package when the truss height is greater than or equal to 60".	Field inspection	N	Periodic		
b. For trusses spanning 60 feet or greater: verify temporary and permanent restraint/bracing are installed in accordance with the approved truss submittal package	Field inspection		Periodic		
1705.6 Soils					
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	Field inspection	Y	Periodic		
2. Verify excavations are extended to proper depth and have reached proper material.	Field inspection	Y	Periodic		
3. Perform classification and testing of compacted fill materials.	Field inspection	Y	Periodic		
4. Verify use of proper materials, densities, and lift thicknesses during placement and compaction of controlled fill	Field inspection	Y	Continuous		
5. Prior to placement of controlled fill, inspect subgrade and verify that site has been prepared properly	Field inspection	Y	Periodic		
1705.7 Driven Deep Foundations					
1. Verify element materials, sizes and lengths comply with requirements	Field inspection	N	Continuous		
2. Determine capacities of test elements and conduct additional load tests, as required	Field inspection	N	Continuous		
3. Inspect driving operations and maintain complete and accurate records for each element	Field inspection	N	Continuous		
4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element	Field inspection	N	Continuous		
5. For steel elements, perform additional inspections per Section 1705.2	See Section 1705.2	N	See Section 1705.2		
6. For concrete elements and concrete-filled elements, perform tests and additional inspections per Section 1705.3	See Section 1705.3	N	See Section 1705.3		
7. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge	Field inspection	N	In accordance with construction documents		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
1705.8 Cast-in-Place Deep Foundations					
1. Inspect drilling operations and maintain complete and accurate records for each element	Field inspection	N	Continuous		
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes	Field inspection	N	Continuous		
3. For concrete elements, perform tests and additional inspections in accordance with Section 1705.3	See Section 1705.3	N	See Section 1705.3		
1705.9 Helical Pile Foundations					
Verify installation equipment, pile dimensions, tip elevations, final depth, final installation torque and other installation data as required by construction documents.	Field inspection	N	Continuous		
1705.10 Fabricated items					
1. List of fabricated items requiring special inspection during fabrication:	Shop inspection	Y	As noted in each applicable shop activity		
2. List of fabricated items to be fabricated on the premises of a fabricator approved to perform such work without special inspection (including name of approved agency providing periodic auditing):					
1705.11.1 Structural Wood Special Inspections For Wind Resistance					
1. Inspection of field gluing operations of elements of the main windforce-resisting system	Field inspection	N	Continuous		
2. Inspection of nailing, bolting, anchoring and other fastening of components within the main windforce-resisting system, including wood shear walls, wood diaphragms, drag struts, braces and hold-downs.	Shop (3) and field inspection	N	Periodic		
1705.11.2 Cold-formed Steel Special Inspections For Wind Resistance					
1. Inspection during welding operations of elements of the main windforce-resisting system	Shop (3) and field inspection	N	Periodic		
2. Inspection of screw attachment, bolting, anchoring and other fastening of components within the main windforce-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs.	Shop (3) and field inspection	N	Periodic		
1705.11.3 Wind-resisting Components					
1. Roof covering, roof deck and roof framing connections.	Shop (3) and field inspection	N	Periodic		
2. Exterior wall covering and wall connections to roof and floor diaphragms.	Shop (3) and field inspection	N	Periodic		
1705.12.1 Structural Steel Special Inspections for Seismic Resistance					
1. Seismic force-resisting systems in SDC B, C, D, E, or F.	Shop (3) and field inspection	N	In accordance with AISC 341		
2. Structural steel elements in SDC B, C, D, E, or F other than those in Item 1. including struts, collectors, chords and foundation elements.	Shop (3) and field inspection	N	In accordance with AISC 341		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
1705.12.2 Structural Wood Special Inspections for Seismic Resistance					
1. Field gluing operations of elements of the seismic-force resisting system for SDC C, D, E or F.	Field inspection	N	Continuous		
2. Nailing, bolting, anchoring and other fastening of components within the seismic-force-resisting system including wood shear walls, wood diaphragms, drag struts, shear panels and hold-downs for SDC C, D, E or F.	Shop (3) and field inspection	N	Periodic		
1705.12.3 Cold-formed Steel Light-Frame Construction Special Inspections for Seismic Resistance					
1. During welding operations of elements of the seismic-force-resisting system for SDC C, D, E or F.	Shop (3) and field inspection	N	Periodic		
2. Screw attachment, bolting, anchoring and other fastening of components within the seismic-force-resisting system including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs for SDC C, D, E or F.	Shop (3) and field inspection	N	Periodic		
1705.12.4 Designated Seismic Systems Verification Special Inspections for Seismic Resistance					
For SDC C, D, E or F, inspect and verify that that the component label, anchorage or mounting conforms to the certificate of compliance in accordance with ASCE 7 Section 13.2.2.	Field inspection	N	Periodic		
1705.12.5 Architectural Components Special Inspections for Seismic Resistance					
1. For SDC D, E or F, inspection during the erection and fastening of exterior cladding and interior or exterior veneer more than 30 feet above grade or walking surface and weighing more than 5 psf.	Field inspection	N	Periodic		
2. For SDC D, E or F, inspection during the erection and fastening of interior nonbearing walls more than 30 feet above grade or walking surface and weighing more than 15 psf.	Field inspection	N	Periodic		
3. For SDC D, E or F, inspection during the erection and fastening of exterior nonbearing walls more than 30 feet above grade or walking surface.		N			
4. For SDC D, E or F, inspection during anchorage of access floors	Field inspection	N	Periodic		
1705.12.6 Plumbing, Mechanical and Electrical Components Special Inspections for Seismic Resistance					
1. Inspection during the anchorage of electrical equipment for emergency or standby power systems in SDC C, D, E or F	Field inspection	Y	Periodic		
2. Inspection during the anchorage of other electrical equipment in SDC E or F	Field inspection	N	Periodic		
3. Inspection during installation and anchorage of piping systems designed to carry hazardous materials, and their associated mechanical units in SDC C, D, E or F	Field inspection	Y	Periodic		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
4. Inspection during the installation and anchorage of HVAC ductwork designed to contain hazardous materials in SDC C, D, E or F	Field inspection	Y	Periodic		
5. Inspection during the installation and anchorage of vibration isolation systems in SDC C, D, E or F where nominal clearance of 1/4 inch or less is required by the approved construction documents	Field inspection	Y	Periodic		
6. Inspection during installation of mechanical and electrical equipment, including duct work, piping systems and their structural supports, where automatic fire sprinkler systems are installed in structures assigned to SDC C, D, E, or F to verify one of the following unless flexible sprinkler hose fittings are used:		Y			
a. ASCE/SEI 7, Section 13.2.3 minimum required clearances have been provided.	Field inspection	Y	Periodic		
b. A three inch or greater nominal clearance has been provided between fire protection sprinkler system drops and sprigs and: structural members not used collectively or independently to support the sprinklers; equipment attached to the building structure; and other systems' piping.	Field inspection	Y	Periodic		
1705.12.7 Storage Racks Special Inspections for Seismic Resistance					
Inspection during the anchorage of storage racks 8 feet or greater in height in structures assigned to SDC D, E or F.	Field inspection	N	Periodic		
1705.12.8 Seismic Isolation Systems					
Inspection during the fabrication and installation of isolator units and energy dissipation devices used as part of the seismic isolation system in structures assigned to SDC B, C, D, E or F.	Shop and field inspection	N	Periodic		
1705.12.9 Cold-formed Steel Special Bolted Moment Frames					
Inspection of installation of cold-formed steel special bolted moment frames in the seismic force-resisting systems in structures assigned to SDC D, E or F.	Field inspection	N	Periodic		
1705.13.1 Structural Steel Testing for Seismic Resistance					
1. Nondestructive testing of structural steel in the seismic force-resisting systems in accordance with AISC 341 in structures assigned to SDC B, C, D, E or F.	Field test	N	Periodic		
2. Nondestructive testing of structural steel elements in the seismic force-resisting systems not covered in 1 above including struts, collectors, chords and foundation elements in accordance with AISC 341 in structures assigned to SDC B, C, D, E or F.	Field test	N	Periodic		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES																				
PROJECT																				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT																		
		Y/N	EXTENT	AGENT*	DATE COMPLETED															
1705.13.2 Seismic Certification of Nonstructural Components																				
Review certificate of compliance for designated seismic system components in structures assigned to SDC B, C, D, E or F.	Certificate of compliance review	Y	Each submittal																	
1705.13.3 Seismic Certification of Designated Seismic Systems																				
Review certificate of compliance for designated seismic system components in structures assigned to SDC C, D, E or F	Certificate of compliance review	Y	Each submittal																	
1705.13.4 Seismic Isolation Systems																				
Test seismic isolation system in accordance with ASCE 7 Section 17.8 in structures assigned to SDC B, C, D, E or F.	Prototype testing	N	Per ASCE 7																	
1705.14 Sprayed Fire-resistant Materials																				
1. Verify surface condition preparation of structural members	Field inspection	Y	Periodic																	
2. Verify minimum thickness of sprayed fire-resistant materials applied to structural members	Field inspection	Y	Periodic																	
3. Verify density of the sprayed fire-resistant material complies with approved fire-resistant design	Field inspection and testing	Y	Per IBC Section 1705.14.5																	
4. Verify the cohesive/adhesive bond strength of the cured sprayed fire-resistant material	Field inspection and testing	Y	Per IBC Section 1705.14.6																	
5. Condition of finished application	Field inspection	Y	Periodic																	
1705.15 Mastic and Intumescent Fire-Resistant Coatings																				
Inspect and test mastic and intumescent fire-resistant coatings applied to structural elements and decks per AWCI 12-B	Field inspection and testing	Y	Periodic																	
1705.16 Exterior Insulation and Finish Systems (EIFS)																				
Inspection of water-resistive barrier over sheathing substrate	Field inspection	Y	Periodic																	
1705.17 Fire-Resistant Penetrations and Joints																				
1. Inspect penetration firestop systems	Field testing	N	Per ASTM E2174																	
2. Inspect fire-resistant joint systems	Field testing	N	Per ASTM E2393																	
1705.18 Smoke Control Systems																				
1. Leakage testing and recording of device locations prior to concealment	Field testing	Y	Periodic																	
2. Prior to occupancy and after sufficient completion, pressure difference testing, flow measurements, and detection and control verification	Field testing	Y	Periodic																	
* INSPECTION AGENTS <table border="1"> <thead> <tr> <th>FIRM</th> <th>ADDRESS</th> <th>TELEPHONE NO.</th> </tr> </thead> <tbody> <tr><td>1.</td><td></td><td></td></tr> <tr><td>2.</td><td></td><td></td></tr> <tr><td>3.</td><td></td><td></td></tr> <tr><td>4.</td><td></td><td></td></tr> </tbody> </table>						FIRM	ADDRESS	TELEPHONE NO.	1.			2.			3.			4.		
FIRM	ADDRESS	TELEPHONE NO.																		
1.																				
2.																				
3.																				
4.																				
Notes: 1. The inspection and testing agent(s) shall be engaged by the Owner or the Owner's Agent, and not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the Building Official prior to commencing work. The qualifications of the Special Inspector(s) and/or testing agencies may be subject to the approval of the Building Official and/or the Design Professional. 2. The list of Special Inspectors may be submitted as a separate document, if noted so above. 3. Shop Inspections of fabricated items are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.1 and listed in activity 1709.2. 4. Observe: Observe on a random basis, operations need not be delayed pending these inspections. Perform: These tasks shall be performed for each welded joint, bolted connection, or steel element. 5. NDT of welds completed in an approved fabricator's shop may be performed by that fabricator when approved by the AHJ. Refer to AISC 360, N6.																				
Are Special Inspections for Seismic Resistance included in the Statement of Special Inspections ? Are Special Inspections for Wind Resistance included in the Statement of Special Inspections ? DATE: Yes No Yes No 																				

Contractor's Statement of Responsibility

Each contractor responsible for the construction or fabrication of a main wind or seismic force-resisting system, designated seismic system or wind or seismic-resisting component listed in the Statement of Special Inspections, Special Inspections for Seismic or Wind Resistance, must submit a Statement of Responsibility.

Project: _____

Contractor's Name: _____

Address: _____

License No.: _____

Description of building systems and components included in Statement of Responsibility:

Contractor's Acknowledgement of Special Requirements

I hereby acknowledge that I have received, read, and understand the Statement of Special Inspections and Special Inspection program:

I hereby acknowledge that control will be exercised to obtain conformance with the approved construction documents.

Name and Title (type or print)

Signature

Date

Project: _____

Address: _____

Certification Number: _____

Description of structural members and assemblies that have been fabricated:

[illegible]

Date _____

SPECIAL INSPECTION DAILY REPORT

PROJECT NAME / ADDRESS:

INSPECTION TYPE(S) COVERAGE

☐ CONTINUOUS

☐ PERIODIC

TIME BEGINNING INSPECTION:

TIME ENDING INSPECTION:

DESCRIBE INSPECTIONS MADE, INCLUDING LOCATIONS:

LIST TESTS MADE:

LIST ITEMS REQUIRING CORRECTIONS, CORRECTIONS OF PREVIOUSLY LISTED ITEMS AND PREVIOUSLY LISTED UNCORRECTED ITEMS: PROVIDE COPIES OF DISCREPANCY NOTICES:

COMMENTS:

TO THE BEST OF MY KNOWLEDGE, WORK INSPECTED WAS IN ACCORDANCE WITH THE APPROVED DESIGN DRAWINGS, AND SPECIFICATIONS, EXCEPT AS NOTED ABOVE.

PRINTED FULL NAME

NOTE BY "SPECIAL INSPECTOR" OR

SIGNED:

DATE:

CERTIFICATION:

NUMBER:

One copy of this report to remain at job site with the contractor for review upon request.

SPECIAL INSPECTION INTERIM REPORT

PROJECT NAME / ADDRESS:

INSPECTION TYPE(S) COVERAGE

☐ CONTINUOUS ☐ PERIODIC
 TIME BEGINNING INSPECTION: TIME ENDING INSPECTION:

DESCRIBE INSPECTIONS MADE, INCLUDING LOCATIONS:

LIST TESTS MADE:

TOTAL INSPECTION TIME EACH DAY	DATE							
	HOURS							

LIST ITEMS REQUIRING CORRECTIONS, CORRECTIONS OF PREVIOUSLY LISTED ITEMS AND PREVIOUSLY LISTED UNCORRECTED ITEMS: PROVIDE COPIES OF DISCREPANCY NOTICES:

COMMENTS:

TO THE BEST OF MY KNOWLEDGE, WORK INSPECTED WAS IN ACCORDANCE WITH THE APPROVED DESIGN DRAWINGS, AND SPECIFICATIONS, EXCEPT AS NOTED ABOVE.

PRINTED FULL NAME	
NOTE BY "SPECIAL INSPECTOR" OR PROVIDE NAME OF TESTING AGENCY	
SIGNED:	DATE:
CERTIFICATION:	NUMBER:

One copy of this report to remain at job site with the contractor for review upon request.

SPECIAL INSPECTION DISCREPANCY NOTICE

PROJECT NAME / ADDRESS:		
INSPECTION TYPE(S) COVERAGE ☐ CONTINUOUS ☐ PERIODIC		
AREA INSPECTED	TYPE OF INSPECTION	
NOTICE DELIVERED TO: ☐ CONTRACTOR ☐ ENGINEER/ARCHITECT ☐ OWNER	DATE:	TIME:
MAKE THE FOLLOWING CORRECTIONS AND SECURE INSPECTION APPROVAL PRIOR TO PROCEEDING WITH THIS PHASE OF THE WORK.		
PRINTED FULL NAME		
NOTE BY "SPECIAL INSPECTOR" OR PROVIDE NAME OF TESTING AGENCY		
SIGNED:		DATE:
CERTIFICATION:		NUMBER:

One copy of this report to remain at job site with the contractor for review upon request.

SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Re-use of existing products.
- C. Transportation, handling, storage and protection.
- D. Product option requirements.
- E. Substitution limitations.
- F. Procedures for Owner-supplied products.
- G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Section 00 2600 - Procurement Substitution Requirements: Requests for substitution during the bidding process.
- B. Section 01 2500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- C. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 DEFINITIONS

- A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well recognized meanings in the construction industry.
 - 1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 2. "Named Products" are items identified by manufacturer's product name, including make or model designation, indicated in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
 - 3. "Materials" are products that are substantially shaped, cut, worked, mixed, finished, refined, or otherwise fabricated, processed, or installed to form a part of the Work.
 - 4. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

1.04 REFERENCE STANDARDS

- A. EN 15804 - Sustainability of Construction Works - Environmental Product Declarations - Core Rules for the Product Category of Construction Products; 2022 (Corrigendum 2021).
- B. ISO 14025 - Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures; 2006.
- C. ISO 14040 - Environmental Management - Life Cycle Assessment - Principles and Framework; 2006, with Amendment (2020).
- D. ISO 14044 - Environmental Management - Life Cycle Assessment - Requirements and Guidelines; 2006, with Amendment (2020).

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

1.05 SUBMITTALS

- A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
 - 1. Submit within 30 days after date of Agreement.
 - 2. For products specified only by reference standards, list applicable reference standards.
- B. 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.
- C. 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.
- D. 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.
- E. Sustainable Design Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

1.06 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.
- B. Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
 - 1. Each prime Contractor is responsible for providing products and construction methods that are compatible with products and construction methods of other prime or separate Contractors.
 - 2. If a dispute arises between prime Contractors over concurrently selectable, but incompatible products, the Architect will determine which products shall be retained and which are incompatible and must be replaced.
- C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.
- D. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.
- E. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
 - 1. Name of product and manufacturer.
 - 2. Model and serial number.
 - 3. Capacity.
 - 4. Speed.
 - 5. Ratings.

- F. Environmental Product Declaration (EPD): Publicly available, critically reviewed life cycle analysis having at least a cradle-to-gate scope.
 - 1. Good: Product-specific; compliant with ISO 14044.
 - 2. Better: Industry-wide, generic; compliant with ISO 21930, or with ISO 14044, ISO 14040, ISO 14025, and EN 15804; Type III third-party certification with external verification, in which the manufacturer is recognized as the program operator.
 - 3. Best: Commercial-product-specific; compliant with ISO 21930, or with ISO 14044, ISO 14040, ISO 14025, and EN 15804; Type III third-party certification with external verification, in which the manufacturer is recognized as the program operator.
 - 4. Where demonstration of impact reduction below industry average is required, submit both industry-wide and commercial-product-specific declarations; or submit at least 5 declarations for products of the same type by other manufacturers in the same industry.
- G. Health Product Declarations (HPD): Complete, published declaration with full disclosure of known hazards, prepared using one of the HPDC (HPD-OLT) online tools.
- H. Sustainably Harvested Wood: Solid wood, wood chips, and wood fiber sourced and labeled by an organization accredited by one of the following:
 - 1. Wood sourced from a sustainable harvested location. Submit any documentation available.
 - 2. Chain of Custody documents are not required.

PART 2 PRODUCTS

2.01 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.
 - 1. Provide products complete with all accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and for the intended use and effect.
 - 2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include the following:
 - 1. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated. No substitutions will be permitted.
 - 2. Semi proprietary Specification Requirements: Where two or more products or manufacturers are named, provide one of the products indicated. No substitutions will be permitted.
 - a. Where products or manufacturers are specified by name, accompanied by the term "or equal," or "or approved equal" comply with the Contract Documents provisions concerning "substitutions" to obtain approval for use of an unnamed product.
 - 3. Descriptive Specification Requirements: Where specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
 - 4. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product is specified for a specific application.

- a. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.
- 5. Compliance with Standards, Codes, and Regulations: Where the Specifications only require compliance with an imposed code, standard, or regulation select a product that complies with the standards, codes, or regulations specified.
- 6. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.
- 7. Visual Selection: Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern, and texture from the product line selected.

2.02 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.

2.03 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. Use of products having any of the following characteristics is not permitted:
 - 1. Made using or containing CFC's or HCFC's.
 - 2. Made of wood from newly cut old growth timber.
 - 3. Containing lead, cadmium, or asbestos.
- C. Where other criteria are met, Contractor shall give preference to products that:
 - 1. If used on interior, have lower emissions, as defined in Section 01 6116.
 - 2. If wet-applied, have lower VOC content, as defined in Section 01 6116.
 - 3. Are extracted, harvested, and/or manufactured closer to the location of the project.
 - 4. Have longer documented life span under normal use.
 - 5. Result in less construction waste. See Section 01 7419
 - 6. Are made of vegetable materials that are rapidly renewable.
 - 7. Are made of recycled materials.
 - 8. If made of wood, are made of sustainably harvested wood, wood chips, or wood fiber.
 - 9. Have a published Environmental Product Declaration (EPD).
 - 10. Have a published Health Product Declaration (HPD).
 - 11. Are Living Building Challenge Red List Free.
 - 12. Have a published Declare Label.

2.04 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

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

2.05 MAINTENANCE MATERIALS

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

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

- A. See Section 01 2500 - Substitution Procedures.

3.02 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.

3.03 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 7419.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.

- D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
- G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- H. Comply with manufacturer's warranty conditions, if any.
- I. Do not store products directly on the ground.
- J. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- K. Prevent contact with material that may cause corrosion, discoloration, or staining.
- L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

3.05 INSTALLATION OF PRODUCTS

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
- B. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

SECTION 01 6116 - VOLATILE ORGANIC COMPOUND (VOC) CONTENT

RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Requirements for Indoor-Emissions-Restricted products.
- B. Requirements for VOC-Content-Restricted products.

1.02 RELATED REQUIREMENTS

- A. Section 01 4000 - Quality Requirements: Procedures for testing and certifications.
- B. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.

1.03 DEFINITIONS

- A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
 - 1. Interior paints and coatings applied on site.
 - 2. Interior adhesives and sealants applied on site, including flooring adhesives.
 - 3. Flooring.
 - 4. Composite wood.
 - 5. Products making up wall and ceiling assemblies.
 - 6. Other products when specifically stated in the specifications.
- B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
 - 1. Interior paints and coatings applied on site.
 - 2. Interior adhesives and sealants applied on site, including flooring adhesives.
 - 3. Wet-applied roofing and waterproofing.
 - 4. Other products when specifically stated in the specifications.
- C. Interior of Building: Anywhere inside the exterior weather barrier.
- D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
- E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.
- F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
 - 1. Concrete.
 - 2. Clay brick.
 - 3. Metals that are plated, anodized, or powder-coated.
 - 4. Glass.
 - 5. Ceramics.
 - 6. Solid wood flooring that is unfinished and untreated.

1.04 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.
- B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005 (Reapproved 2018).
- C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.
- D. CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; Current Edition.
- E. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2020.
- F. CHPS (HPPD) - High Performance Products Database; Current Edition.
- G. CRI (GLP) - Green Label Plus Testing Program - Certified Products; Current Edition.
- H. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).
- I. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).
- J. SCS (CPD) - SCS Certified Products; Current Edition.
- K. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.05 SUBMITTALS

- A. See Section 01 3000 - 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. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
 - 1. Wet-Applied Products: State amount applied in mass per surface area.
 - 2. Paints and Coatings: Test tinted products, not just tinting bases.
 - 3. Evidence of Compliance: Acceptable types of evidence are the following;
 - a. Current UL (GGG) certification.
 - b. Current SCS (CPD) Floorscore certification.
 - c. Current SCS (CPD) Indoor Advantage Gold certification.
 - d. Current listing in CHPS (HPPD) as a low-emitting product.
 - e. Current CRI (GLP) certification.
 - f. Test report showing compliance and stating exposure scenario used.
 - 4. Product data submittal showing VOC content is NOT acceptable evidence.
 - 5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.
- B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Report of laboratory testing performed in accordance with requirements.
 - b. Published product data showing compliance with requirements.
- C. Composite Wood Emissions Standard: CARB (ATCM) for ultra-low emitting formaldehyde (ULEF) resins.
 - 1. Evidence of Compliance: Acceptable types of evidence are:

- a. Current SCS "No Added Formaldehyde (NAF)" certification; www.scscertified.com.
 - b. Report of laboratory testing performed in accordance with requirements.
 - c. Published product data showing compliance with requirements.
- D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.
- B. Indoor-Emissions-Restricted Products: Comply with Indoor Emissions Standard and Test Method, except for:
 - 1. Composite Wood, Wood Fiber, and Wood Chip Products: Comply with Composite Wood Emissions Standard or contain no added formaldehyde resins.
 - 2. Inherently Non-Emitting Materials.
- C. VOC-Content-Restricted Products: VOC content not greater than required by the following:
 - 1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
 - 2. Joint Sealants: SCAQMD 1168 Rule.
 - 3. Paints and Coatings: Each color; most stringent of the following:
 - a. 40 CFR 59, Subpart D.
 - b. SCAQMD 1113 Rule.
 - c. CARB (SCM).
 - 4. Wet-Applied Roofing and Waterproofing: Comply with requirements for paints and coatings.

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.

SECTION 01 7419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

- A. Owner requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
 - 1. Aluminum and plastic beverage containers.
 - 2. Corrugated cardboard.
 - 3. Wood pallets.
 - 4. Clean dimensional wood: May be used as blocking or furring.
 - 5. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
- E. 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.
- F. 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 1000 - Summary: List of items to be salvaged from the existing building for relocation in project or for Owner.
- B. Section 01 2500 - Substitution Procedures.
- C. Section 01 3000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
- D. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
- E. Section 01 6000 - Product Requirements: Waste prevention requirements related to product substitutions.
- F. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- G. Section 01 7000 - 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 3000 - Administrative Requirements for submittal procedures.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

- A. See Section 01 6000 and Section 01 2500.
- B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01 6000:
 - 1. Relative amount of waste produced, compared to specified product.
 - 2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Sum.
 - 3. Proposed disposal method for waste product.
 - 4. Markets for recycled waste product.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

- A. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.

- C. See Section 01 7000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

SECTION 03 2000 - CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Reinforcing steel for cast-in-place concrete.
- B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete.
- B. Section 04 2000 - Unit Masonry: Reinforcement for masonry.

1.03 REFERENCE STANDARDS

- A. ACI - Specifications for Structural Concrete 2016.
- B. ACI SP-66 - ACI Detailing Manual 2004.
- C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2016.
- D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.
- E. CRSI (DA4) - Manual of Standard Practice 2009.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Comply with requirements of ACI MNL-66 Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
- C. Manufacturer's Certificate: Certify that products supplied for this project meet or exceed specified requirements.
- D. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

1.05 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301.

PART 2 PRODUCTS

2.01 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).
 - 1. Deformed billet-steel bars.
 - 2. Unfinished.
- B. Steel Welded Wire Reinforcement (WWR): Plain type; ASTM A1064/A1064M.
 - 1. Form: Flat Sheets.
 - 2. WWR Style: 6x6 W2.9xW2.9 WWF centered on slab.
- C. Reinforcement Accessories:
 - 1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch (1.29 mm).
 - 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
 - 3. Provide stainless steel components for placement within 1-1/2 inches (38 mm) of weathering surfaces, unless noted otherwise on Structural drawings. Wood materials are prohibited.

2.02 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.
- B. Welding of reinforcement is not permitted.
- C. Locate reinforcing splices not indicated on drawings at point of minimum stress.
 - 1. Review locations of splices with Structural Engineer.

PART 3 EXECUTION

3.01 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
 - 1. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- B. Do not cut, puncture, displace or damage vapor barrier. Repair damage and reseal vapor retarder before placing concrete.
- C. Accommodate placement of formed openings.
- D. Comply with applicable code for concrete cover over reinforcement.
- E. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- F. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.02 FIELD QUALITY CONTROL

- A. An independent testing agency, as specified in Section 01 4000 - Quality Requirements, will inspect installed reinforcement for compliance with contract documents before concrete placement.

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete formwork.
- B. Concrete for composite floor construction.
- C. Floors and slabs on grade.
- D. Concrete foundation walls.
- E. Joint devices associated with concrete work.
- F. Miscellaneous concrete elements, including equipment pads.
- G. Concrete curing.

1.02 RELATED REQUIREMENTS

- A. Section 03 2000 - Concrete Reinforcing.
- B. Section 03 3511 - Concrete Floor Finishes: Densifiers, hardeners, applied coatings, and polishing.
- C. Section 07 9200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

1.03 REFERENCE STANDARDS

- A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
- B. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.
- C. ACI PRC-302.1 - Guide to Concrete Floor and Slab Construction; 2015.
- D. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
- E. ACI PRC-305 - Guide to Hot Weather Concreting; 2020.
- F. ACI PRC-306 - Guide to Cold Weather Concreting; 2016.
- G. ACI PRC-308 - Guide to External Curing of Concrete; 2016.
- H. ACI PRC-347 - Guide to Formwork for Concrete; 2014 (Reapproved 2021).
- I. ACI SPEC-117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
- J. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
- K. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2023.
- L. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2023.
- M. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2024.
- N. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2016a.
- O. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.
- P. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.
- Q. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2020.
- R. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2023, with Editorial Revision.

- S. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.
- T. ASTM C1116/C1116M - Standard Specification for Fiber-Reinforced Concrete; 2023.
- U. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2012.
- V. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004, with Editorial Revision (2013).
- W. ASTM D2103 - Standard Specification for Polyethylene Film; 2023a.
- X. 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.
- Y. COE CRD-C 513 - Handbook for Concrete and Cement Corps of Engineers Specifications for Rubber Waterstops; 1974.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
 - 1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.
- C. Mix Design: Submit proposed concrete mix design.
 - 1. Employ an independent testing laboratory to test proposed aggregate and design concrete mixes for each type of concrete required.
 - 2. Submit aggregate test reports and mix designs for approval 14 days prior to placing concrete.
 - 3. Test each type of fine and coarse aggregate for conformance to ASTM C33-78.
 - 4. Design mixes in accordance with ACI 301, Section 3.8.2, Method 1 or Method 2.
 - 5. Indicate proposed mix design complies with fiber reinforcing manufacturer's written recommendations.
- D. Samples: Submit samples of underslab vapor retarder to be used.
- E. Test Reports: Submit report for each test or series of tests specified.
- F. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
- G. 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.

PART 2 PRODUCTS

2.01 FORMWORK

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

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

2.02 REINFORCEMENT MATERIALS

- A. Comply with requirements of Section 03 2000.

2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type I/II Portland type, unless noted otherwise in Structural Drawings.
- B. Fine and Coarse Aggregates: ASTM C33/C33M.
 - 1. Acquire aggregates for entire project from same source.
- C. Fly Ash: ASTM C618, Class C or F.
- D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.
- E. Structural Fiber Reinforcement: ASTM C1116/C1116M.
 - 1. Fiber Type: Alkali-resistant synthetic, polypropylene, 1.55#/CY.
 - 2. Products:
 - a. Euclid Chemical Company; TUF-STRAND SF: www.euclidchemical.com/#sle.
 - b. Fibermesh; Fibermesh 650: www.fibermesh.com/#sle.
 - c. GCP Applied Technologies; STRUX 90/40: www.gcpat.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ADMIXTURES

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

2.05 ACCESSORY MATERIALS

- A. Termite-Resistant Vapor Barrier Sheet (VPR RET-6): Plastic sheet complying with ASTM E1745, Class C; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs, and for exclusion of subterranean termites.
 - 1. Permeance of less than 0.01 perms as tested in accordance with ASTM F 1249.
 - 2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, prefabricated boots, etc., for sealing seams and penetrations.
 - 3. Products:
 - a. Stego Industries, LLC; Pango Wrap with Pango Tape: www.stegoindustries.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- B. Non-Shrink Cementitious Grout: Premixed compound consisting of nonmetallic aggregate, cement, water reducing and plasticizing agents.
 - 1. Grout: Comply with ASTM C1107/C1107M.
 - 2. Minimum Compressive Strength at 48 Hours, ASTM C109/C109M: 2,000 pounds per square inch (13.7 MPa).

3. Minimum Compressive Strength at 28 Days, ASTM C109/C109M: 7,000 pounds per square inch (48 MPa).

2.06 BONDING AND JOINTING PRODUCTS

- A. Waterstops: Rubber, complying with COE CRD-C 513.
 1. Configuration: As indicated on drawings.
 2. Size: As indicated on drawings.
- B. Slab Isolation Joint Filler: 1/2-inch (13 mm) thick, height equal to slab thickness, with removable top section forming 1/2-inch (13 mm) deep sealant pocket after removal.
 1. Material: ASTM D1751, cellulose fiber.
- C. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with rectangular or round knockout holes for conduit or rebar to pass through joint form at 6 inches (150 mm) on center; ribbed steel stakes for setting.

2.07 CURING MATERIALS

- A. Curing and Sealing Compound, Low Gloss (CSLR-1): Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.
 1. Apply in accordance with manufacturer's instructions during concrete curing.
 2. Near Substantial Completion, apply a final coat(s) to produce a consistent, uniform low gloss finish to floor areas indicated to receive (CSLR-1).
 3. Solids by Mass: 25 percent, minimum.
 4. Products:
 - a. Dayton Superior Corporation; Cure & Seal 1315 J22WB: www.daytonsuperior.com.
 - b. TCC Materials; Tenon Cure & Seal WB 1315: www.tccmaterials.com.
 - c. W. R. Meadows, Inc; VOCOMP-25: www.wrmeadows.com.
 - d. BASF; Kure 1315: www.buildingsystems.basf.com.
 - e. Scofield; Cureseal-W: www.scofield.com.
 - f. Substitutions: See Section 01 6000 - Product Requirements.
- B. Moisture-Retaining Sheet: ASTM C171.
 1. Curing paper, regular.
 2. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard (1.71 kg/sq m).
- C. Polyethylene Film: ASTM D2103, 4 mil, 0.004 inch (0.102 mm) thick, clear.
- D. Water: Potable, not detrimental to concrete.

2.08 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI PRC-211.1 recommendations.
- B. Admixtures: Add acceptable admixtures as recommended in ACI PRC-211.1 and at rates recommended or required by manufacturer.
- C. Fiber Reinforcement: Add to mix at rate of 1.5 pounds per cubic yard (0.89 kg per cu m), or as recommended by manufacturer for specific project conditions.

2.09 MIXING

- A. Transit Mixers: Comply with ASTM C94/C94M.
- 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. Formwork: Comply with requirements of ACI SPEC-301. Design and fabricate forms to support all applied loads until concrete is cured and for easy removal without damage to concrete.
- B. Verify that forms are clean and free of rust before applying release agent.
- C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- D. 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.
- E. 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.
- F. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches (150 mm). Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.03 PLACING CONCRETE

- A. Place concrete in accordance with ACI PRC-304.
- B. Notify Architect not less than 24 hours prior to commencement of placement operations.
- C. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- D. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- E. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

3.04 SLAB JOINTING

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

3.05 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. Maximum Variation of Surface Flatness:
 - 1. Exposed Concrete Floors: 1/4 inch (6 mm) in 10 feet (3 m).

2. Under Seamless Resilient Flooring: 1/4 inch (6 mm) in 10 feet (3 m).
 3. Under Carpeting: 1/4 inch (6 mm) in 10 feet (3 m).
 4. Under Wood Athletic Flooring: 1/8 inch (3.2 mm) in 10 feet (3 m).
- B. Correct the slab surface if tolerances are less than specified.
 - C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.06 CONCRETE FINISHING

- A. Repair surface defects, including tie holes, immediately after removing formwork.
- B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch (6 mm) or more in height.
- C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch (6 mm) or more in height. Provide finish as follows:
 1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
- D. Concrete Slabs (CFIN-1): Finish to requirements of ACI 302.1R, and as follows:
 1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI PRC-302.1; thick floor coverings include quarry tile, ceramic tile, and Portland cement terrazzo with full bed setting system.
 2. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI PRC-302.1; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.
 3. Decorative Exposed Surfaces: Trowel as described in ACI PRC-302.1; take measures necessary to avoid black-burnish marks; decorative exposed surfaces include surfaces to be stained or dyed, pigmented concrete, surfaces to receive liquid hardeners, surfaces to receive dry-shake hardeners, surfaces to be polished, and all other exposed slab surfaces.
- E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:50 nominal, unless noted otherwise in the drawings.

3.07 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.

3.08 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.
- E. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards (76 cu m) or less of each class of concrete placed.

- F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
- G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

3.09 DEFECTIVE CONCRETE

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

3.10 PROTECTION

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

SECTION 03 3511 - CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface treatments for concrete floors and slabs.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.
- B. Section 03 3000 - Cast-in-Place Concrete: Curing compounds that also function as sealers.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with concrete floor placement and concrete floor curing.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.
- C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.05 MOCK-UP

- A. For coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.
- B. Mock-Up Size: 10 feet (3 m) square.
- C. Locate where directed.
- D. Mock-up may remain as part of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

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

1.07 FIELD CONDITIONS

- A. Maintain light level equivalent to a minimum 200 W light source at 8 feet (2.5 m) above the floor surface over each 20 foot (6 m) square area of floor being finished.
- B. Do not finish floors until interior heating system is operational.
- C. Maintain ambient temperature of 50 degrees F (10 degrees C) minimum.

PART 2 PRODUCTS

2.01 DENSIFIERS AND HARDENERS

- A. Liquid Densifier and Hardener (CFIN-3): Penetrating chemical compound that reacts with concrete, filling the pores, hardening, and dustproofing.
 - 1. Composition: Lithium silicate.
 - 2. Products:
 - a. Ashford Formula: www.ashfordformula.com.
 - b. Euclid Chemical Company; ULTRASIL LI+: www.euclidchemical.com.
 - c. SpecChem, LLC; LithSeal SC: www.specchemllc.com.
 - d. W. R. Meadows, Inc; Liqui-Hard Ultra: www.wrmeadows.com.

- e. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that floor surfaces are acceptable to receive the work of this section.
- B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 GENERAL

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

SECTION 04 2000 - UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete block.
- B. Decorative insulated concrete masonry units (ICMU).
- C. Mortar and grout.
- D. Reinforcement and anchorage.
- E. Flashings.
- F. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 2000 - Concrete Reinforcing: Reinforcing steel for grouted masonry.
- B. Section 04 2219 - Insulated Concrete Unit Masonry.
- C. Section 07 6200 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.
- D. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- B. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2022.
- C. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.
- D. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2023.
- E. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.
- F. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2023.
- G. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2023a.
- H. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2017.
- I. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.
- J. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).
- K. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.
- L. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.
- M. ASTM C476 - Standard Specification for Grout for Masonry; 2023.
- N. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2017.
- O. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.
- P. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.
- Q. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.
- R. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.
- S. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- C. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
- D. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.
- E. Sustainability Design Documentation: Provide applicable sustainability documentation for each product as described in Section 01 3329 - Sustainable Design Requirements.

1.05 MOCK-UPS

- A. Construct a masonry wall as a mock-up panel sized 8 feet (2.4 m) long by 6 feet (1.8 m) high; include mortar, accessories, structural backup, wall openings, flashings (with lap joint, corner, and end dam), and wall insulation in mock-up.
- B. Locate where directed.
- C. Mock-up may not remain as part of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

- A. Products listed as Basis of Design have been selected using sustainability criteria. Products from other manufacturer's listed herein, and/or substitutions will only be accepted if they meet, or exceed, the performance of the Basis of Design. Manufacturer must be able to provide sustainability documentation showing that the product meets, or exceeds, the Basis of Design.

2.02 CONCRETE MASONRY UNITS

- A. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depths as indicated on drawings for specific locations.
 - 2. Special Shapes: Provide nonstandard blocks configured for corners.
 - 3. Load-Bearing Units: ASTM C90, normal weight.
 - a. Hollow block.
 - b. Exposed Faces: Manufacturer's standard color and texture where indicated.
 - 4. Nonloadbearing Units: ASTM C129.
 - a. Hollow block.
 - b. Normal weight.
 - 5. Patterns and Faces:
 - a. (CMU-1): Manufacturer's standard color and texture.
 - b. (CMU-8): Standard face; color as selected from manufacturer's full range.
 - c. Ground faced (burnished) masonry unit.
 - 1) (BMU-1): Color: As selected from manufacturer's full range.
 - 2) (BMU-2): Color: As selected from manufacturer's full range.

- 3) Provide manufacturer's standard factory applied sealer (such as TK 192 by TK Products) on each ground surface to facilitate cleaning.
- 4) Provide special units for bullnosed corners and where multiple faces are visible.
- d. Supplier of prefinished or integrally colored units shall guarantee that the finished product will not be stained or damaged due to iron or shale deposits in the face for a period of 5 years.

2.03 MORTAR AND GROUT MATERIALS

- A. Masonry Cement: ASTM C91/C91M, Type S.
 1. Colored Mortar: Premixed cement as required to match Architect's color sample.
- B. Portland Cement: ASTM C150/C150M, Type I.
- C. Hydrated Lime: ASTM C207, Type S.
- D. Mortar Aggregate: ASTM C144.
- E. Grout Aggregate: ASTM C404.
- F. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
 1. Color(s): As selected by Architect from manufacturer's full range.
 2. Manufacturers:
 - a. Davis Colors, a division of Venator Materials PLC: www.daviscolors.com/#sle.
 - b. Lambert Corporation: www.lambertusa.com.
 - c. Solomon Colors: www.solomoncolors.com/sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- G. Water: Clean and potable.

2.04 REINFORCEMENT AND ANCHORAGE

- A. Sustainability Requirements: Manufacturer's must be able to provide the following, or equivalent, product documentations:
 1. Environmental Product Declaration (EPD).
- B. Basis of Design: Hohmann & Barnard, Inc; www.h-b.com.
- C. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
 1. Blok-Lok Limited: www.blok-lok.com.
 2. WIRE-BOND www.wirebond.com/#sle.
 3. Substitutions: See Section 01 6000 - Product Requirements.
- D. Reinforcing Steel: Type specified in Section 03 2000; size as indicated on drawings; galvanized finish.
- E. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa), deformed billet bars; galvanized.
- F. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
- G. Single Wythe Joint Reinforcement: ASTM A951/A951M.
 1. Type: Ladder.
 2. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M Class B.
 3. Size: 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not less than 5/8 inch (16 mm) of mortar coverage on each exposure.

2.05 FLASHINGS

- A. Stainless Steel/Polymer Fabric Flashing (TWF-3): ASTM A240/A240M; 2 mil (.05 mm) type 304 stainless steel sheet bonded on one side to one sheet of polymer fabric.
 - 1. Basis of Design: York Manufacturing, Inc; 304SA: www.yorkmfg.com.
 - 2. Sustainability Requirements: Manufacturer's must be able to provide the following, or equivalent, product documentations:
 - a. Living Building Challenge Red List Free or Compliant.
 - b. Health Product Declaration (HPD).
- B. Termination Bars: Stainless steel; compatible with membrane and adhesives.
- C. Drip Edge: Stainless steel; angled drip with hemmed edge; compatible with membrane and adhesives.
- D. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

2.06 ACCESSORIES

- A. Preformed Control Joints (CJ-1): Rubber material. Provide with corner and tee accessories, fused joints.
- B. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
 - 1. Acceptable Products: Contractor's option to achieve the specified results without damage to masonry or surrounding materials, such as Sure Klean by Prosoco or other product with similar properties.
 - 2. Use in strict accordance with manufacturer's written instructions.

2.07 MORTAR AND GROUT MIXING

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
 - 1. Masonry below grade and in contact with earth: Type M.
 - 2. Exterior, loadbearing masonry: Type S.
 - 3. Exterior, non-loadbearing masonry: Type N.
 - 4. Interior, loadbearing masonry: Type S.
 - 5. Interior, non-loadbearing masonry: Type N.
- B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.
- C. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches (50 mm) or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches (50 mm).
- D. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 COLD AND HOT WEATHER REQUIREMENTS

- A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.03 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.

- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 - 1. Bond: Running.
 - 2. Mortar Joints: Concave.

3.04 PLACING AND BONDING

- A. Lay hollow masonry units with face shell bedding on head and bed joints.
- B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- C. Remove excess mortar and mortar smears as work progresses.
- D. Interlock intersections and external corners, except for units laid in stack bond.
- E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- G. Isolate masonry partitions from vertical structural framing members with a control joint.
- H. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.05 REINFORCEMENT AND ANCHORAGE - GENERAL AND SINGLE WYTHE MASONRY

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches (400 mm) on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.
- C. Lap joint reinforcement ends minimum 6 inches (150 mm).

3.06 MASONRY FLASHINGS

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
 - 1. Extend flashings full width at such interruptions and at least 6 inches (152 mm), minimum, into adjacent masonry or turn up flashing ends at least 1 inch (25.4 mm), minimum, to form watertight pan at non-masonry construction.
 - 2. Remove or cover protrusions or sharp edges that could puncture flashings.
 - 3. Seal lapped ends and penetrations of flashing before covering with mortar.
- B. Terminate flashing up 8 inches (203 mm) minimum on vertical surface of backing:
 - 1. Install vertical leg of flashing over fluid-applied or self-adhered air/vapor barriers over backing or per manufacturer's directions.
 - 2. Anchor vertical leg of flashing into backing with a termination bar and sealant.
- C. Extend membrane flashings to within 1/2 inch (12 mm) of exterior face of masonry and adhere to top of stainless steel angled drip with hemmed edge.
- D. Lap end joints of flashings at least 6 inches (152 mm), minimum, and seal watertight with flashing sealant/adhesive.

3.07 LINTELS

- A. Install loose steel lintels over openings.

- B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
 - 1. Openings over 48 inches not scheduled: Contact Structural Engineer.

3.08 GROUTED COMPONENTS

- A. Follow lap splice requirements as indicated in Structural drawings.
- B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.
- C. Place and consolidate grout fill without displacing reinforcing.

3.09 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- C. Size control joints as indicated on drawings; if not indicated, 3/4 inch (19 mm) wide and deep.

3.10 TOLERANCES

- A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).
- B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.
- C. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.
- D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).
- E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).
- F. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch (6 mm).

3.11 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
- B. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.
- C. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

3.12 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Clean soiled surfaces with cleaning solution.

3.13 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

SECTION 05 1200 - STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Structural steel framing members.
- B. Base plates, shear stud connectors.

1.02 RELATED REQUIREMENTS

- A. Section 05 2100 - Steel Joist Framing.
- B. Section 05 3100 - Steel Decking: Support framing for small openings in deck.

1.03 REFERENCE STANDARDS

- A. AISC (MAN) - Steel Construction Manual; 2023, with Errata (2025).
- 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 A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2018.
- E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
- F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
- G. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.
- H. ASTM A588/A588M - Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance; 2019.
- I. ASTM A759 - Standard Specification for Carbon Steel Crane Rails; 2021.
- J. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2022.
- K. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film; 2017.
- L. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2019.
- M. ASTM E165/E165M - Standard Practice for Liquid Penetrant Testing for General Industry; 2023.
- N. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2021.
- O. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2019.
- P. ASTM F959/F959M - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series; 2017a.
- Q. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2023.
- R. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.
- S. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- T. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.
- U. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2020.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
 - 2. Connections not detailed.
 - 3. Indicate cambers and loads.
 - 4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
- D. Mill Test Reports: Indicate structural strength, destructive test analysis and non-destructive test analysis.

1.05 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."
- B. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
- C. Erector: Company specializing in performing the work of this section with minimum five years of experience.
- D. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Steel Angles, Plates, and Channels: ASTM A36/A36M.
- B. Steel W Shapes and Tees: ASTM A992/A992M.
- C. Rolled Steel Structural Shapes: ASTM A992/A992M.
- D. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade A.
- E. Shear Stud Connectors: Made from ASTM A108 Grade 1015 bars.
- 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. Load Indicator Washers: Provide washers complying with ASTM F959/F959M at connections requiring high-strength bolts.
- H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- I. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.
- J. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Shop fabricate to greatest extent possible.
- B. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
- C. Fabricate connections for bolt, nut, and washer connectors.
- D. Develop required camber for members.

- E. Fabricate steel designated as AESS within the Contract Documents in accordance to respective Reference Standards.

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.

2.04 SOURCE QUALITY CONTROL

- A. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts", testing at least 10 percent of bolts at each connection.
- B. Welded Connections: Visually inspect all shop-welded connections and test at least 10 percent of welds using one of the following:
 - 1. Radiographic testing performed in accordance with ASTM E94/E94M.
 - 2. Ultrasonic testing performed in accordance with ASTM E164.
 - 3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
 - 4. Magnetic particle inspection performed in accordance with ASTM E709.
- C. Reference Standard: ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes and Sheet Piling.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 ERECTION

- A. Erect structural steel in compliance with AISC 303.
- B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- C. Field weld components and shear studs indicated on shop drawings.
- D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".
- E. Do not field cut or alter structural members without approval of Architect.
- F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- G. Erect steel designated as AESS within the Contract Documents in accordance to respective Reference Standards.

3.03 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
- C. Permissible tolerances for steel designated as AESS within the Contract Documents in accordance to respective Reference Standards.

3.04 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
- B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts", testing at least 10 percent of bolts at each connection.
- C. Welded Connections: Visually inspect all field-welded connections and test at least 10 percent of welds using one of the following:
 - 1. Radiographic testing performed in accordance with ASTM E94/E94M.
 - 2. Ultrasonic testing performed in accordance with ASTM E164.
 - 3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
 - 4. Magnetic particle inspection performed in accordance with ASTM E709.

SECTION 05 2100 - STEEL JOIST FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Section 05 1200 - Structural Steel Framing: Superstructure framing.
- B. Section 05 3100 - Steel Decking: Bearing plates and angles.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- B. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2018.
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
- E. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film; 2017.
- F. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2019.
- G. ASTM E165/E165M - Standard Practice for Liquid Penetrant Testing for General Industry; 2023.
- H. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2021.
- I. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- J. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.
- K. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2020.
- L. SJI 100 - Standard Specifications for K-Series, LH-Series, and DLH-Series Open Web Steel Joists, and for Joist Girders; 2020.
- M. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders; 2008.
- N. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
- O. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments.

1.05 QUALITY ASSURANCE

- A. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.
- B. Perform Work, including that for headers and other supplementary framing, in accordance with SJI 100 Standard Specifications Load Tables and SJI Technical Digest No. 9.

- C. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
- D. Erector Qualifications: Company specializing in performing the work of this section with minimum five years experience.

1.06 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Steel Joists:
 - 1. Canam Group Inc: www.canam-steeljoists.ws
 - 2. Nucor-Vulcraft Group: www.vulcraft.com/#sle.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

- A. Open Web Joists: SJI Type K Joists:
 - 1. Provide bottom chord extensions as indicated.
 - 2. Finish: Shop primed.
- B. Anchor Bolts, Nuts and Washers: ASTM A307 hot-dip galvanized per ASTM A153/A153M Class C.
- C. Shear Stud Connectors: Made from ASTM A108 Grade 1015 bars.
- D. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A36/A36M.
- E. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.03 FINISH

- A. Shop prime joists as specified.
 - 1. Do not prime surfaces that will be fireproofed, field welded, or in contact with concrete.
- B. Prepare surfaces to be finished in accordance with SSPC-SP 2.

2.04 SOURCE QUALITY CONTROL

- A. Provide shop testing of steel components as follows:
- B. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts", testing at least 10 percent of bolts at each connection.
- C. Welded Connections: Visually inspect all shop-welded connections and test at least 10 percent of welds using one of the following:
 - 1. Radiographic testing performed in accordance with ASTM E94/E94M.
 - 2. Ultrasonic testing performed in accordance with ASTM E164.
 - 3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
 - 4. Magnetic particle inspection performed in accordance with ASTM E709.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions prior to beginning work.

3.02 ERECTION

- A. Erect joists with correct bearing on supports.
- B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.
- C. Coordinate the placement of anchors for securing loose bearing members furnished as part of the work of this section.
- D. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.
- E. Position and field weld joist chord extensions and wall attachments as detailed.
- F. Install supplementary framing for floor and roof openings greater than 18 inches (450 mm).
- G. Do not permit erection of decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.
- H. Do not field cut or alter structural members without approval of joist manufacturer.
- I. After erection, prime welds, damaged shop primer, damaged galvanizing, and surfaces not shop primed , except surfaces specified not to be primed.

3.03 TOLERANCES

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

3.04 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
- B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts", testing at least 10 percent of bolts at each connection.
- C. Welded Connections: Visually inspect all field-welded connections and test at least 10 percent of welds using one of the following:
 - 1. Radiographic testing performed in accordance with ASTM E94/E94M.
 - 2. Ultrasonic testing performed in accordance with ASTM E164.
 - 3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
 - 4. Magnetic particle inspection performed in accordance with ASTM E709.

SECTION 05 3100 - STEEL DECKING

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Section 03 2000 - Concrete Reinforcing.
- B. Section 03 3000 - Cast-in-Place Concrete: Concrete topping over metal deck.
- C. Section 05 1200 - Structural Steel Framing: Support framing for openings larger than 18 inches (450 mm) and shear stud connectors.
- D. Section 05 1200 - Structural Steel Framing: Placement of embedded steel anchors for bearing plates in cast-in-place concrete.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- B. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.
- C. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018, with Errata (2022).
- D. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.
- E. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks; 2007.
- F. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittals procedures.
- B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.
- C. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.
- D. Certificates: Certify that products furnished meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Design deck layout, spans, fastening, and joints under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.
- B. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
- C. Installer Qualifications: Company specializing in performing the work of this Section with minimum five years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Steel Deck:
 - 1. Canam Steel Corporation: www.canam-steeljoists.ws.
 - 2. Nucor-Vulcraft Group: www.vulcraft.com.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 STEEL DECK

- A. All Deck Types: Select and design metal deck in accordance with SDI Design Manual.
 - 1. Calculate to structural working stress design and structural properties specified.
 - 2. Maximum Vertical Deflection of Roof Deck: 1/240 of span.
- B. Roof Deck: Non-composite type, fluted steel sheet:
 - 1. Ungalvanized Steel Sheet: ASTM A1008/A1008M, Designation SS, Grade 33, Type 1.
 - 2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
 - 3. Nominal Height: As indicated on Structural Drawings.
 - 4. Profile: As indicated on Structural Drawings.
 - 5. Formed Sheet Width: As indicated on Structural Drawings.
 - 6. Side Joints: As indicated on Structural Drawings.
 - 7. End Joints: As indicated on Structural Drawings.

2.03 ACCESSORY MATERIALS

- A. Bearing Plates and Angles: ASTM A36/A36M steel, unfinished.
- B. Fasteners: Galvanized hardened steel, self tapping.
- C. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- D. Flute Closures: Closed cell foam rubber, 1 inch (25 mm) thick; profiled to fit tight to the deck.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions prior to beginning work.

3.02 INSTALLATION

- A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.
- B. On steel supports provide minimum 1-1/2 inch (38 mm) bearing.
- C. See structural schedules for fastening patterns.
- D. Weld deck in accordance with AWS D1.3/D1.3M.
- E. At deck openings greater than 18 inches (450 mm) in size, provide steel angle reinforcement, as specified in Section 05 1200.
- F. Where deck (other than cellular deck electrical raceway) changes direction, install 6 inch (150 mm) minimum wide sheet steel cover plates, of same thickness as deck. Fusion weld 12 inches (300 mm) on center maximum.
- G. At floor edges, install concrete stops upturned to top surface of slab, to contain wet concrete. Provide stops of sufficient strength to remain stationary without distortion.

- H. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.

SECTION 05 5000 - METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated steel items.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
- E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
- F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.
- G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
- I. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.
- J. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- K. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
- L. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.
- M. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.
- F. Slotted Channel Fittings: ASTM A1011/A1011M.
- G. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.
- H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- I. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- J. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- E. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

- A. Bollards (MET FAB-1): Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish; six inch diameter unless noted otherwise in drawings.
- B. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking and masonry; prime paint finish.
- C. Door Frames for Overhead Door Openings: Channel sections; prime paint finish.
- D. Slotted Channel Framing (MET FAB-5): Fabricate channels and fittings from structural steel complying with the referenced standards; factory-applied, rust-inhibiting thermoset acrylic enamel finish.
 - 1. Basis of Design: Unistrut System by Atkore International. Provide system components sized to accommodate the equipment and material loads anticipated based on the drawings and specifications.
- E. Metal Panel (MET FAB-10): Aluminum; Alloy 3003-H14.
 - 1. Basis of Design: As indicated on drawings.

2.04 FINISHES - STEEL

- A. Prime paint steel items.
 - 1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.
- E. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.05 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).

- C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).
- D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).
- E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.

3.03 INSTALLATION

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

3.04 TOLERANCES

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

SECTION 06 1000 - ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sheathing.
- B. Preservative treated wood materials.
- C. Fire retardant treated wood materials.
- D. Concealed wood blocking, nailers, and supports.

1.02 RELATED REQUIREMENTS

- A. Section 07 6200 - Sheet Metal Flashing and Trim: Sill flashings.
- B. Section 09 2116 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- B. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2017).
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- D. AWPA U1 - Use Category System: User Specification for Treated Wood; 2024.
- E. PS 1 - Structural Plywood; 2023.
- F. PS 2 - Performance Standard for Wood Structural Panels; 2018.
- G. PS 20 - American Softwood Lumber Standard; 2025.
- H. SPIB (GR) - Standard Grading Rules; 2021.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
 - 2. 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. Wood sourced from a sustainably harvested location. Submit any documentation available.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.

- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring (WD BLKG):
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

- A. Wall Sheathing: Plywood, PS 1, Grade C-D, Exposure I.
 - 1. (WD SHTG-30): 1/2 inch.
 - 2. (WD SHTG-32F): 3/4 inch fire retardant treated.
- B. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- C. Other Applications:
 - 1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
 - 2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
 - 3. Other Locations: PS 1, C-D Plugged or better.

2.04 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
- B. Sill Gasket on Top of Foundation Wall: 3/8 inch (9.5 mm) thick, closed-cell plastic foam.
 - 1. Width: 3-1/2 inches (89 mm).
 - 2. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 30 days of weather exposure.
- C. Sill Flashing: See Section 07 6200.

2.05 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 - 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
 - 2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.
- B. Fire Retardant Treatment:
 - 1. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Do not use treated wood in direct contact with the ground.
 - 2. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum

flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.

- a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Treat rough carpentry items as indicated .
 - c. Do not use treated wood in applications exposed to weather or where the wood may become wet.
- C. Preservative Treatment:
1. Products:
 2. Preservative Pressure Treatment of Lumber Above Grade: AWP A U1, Use Category UC3B, Commodity Specification A.
 - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 3. Preservative Pressure Treatment of Plywood Above Grade: AWP A U1, Use Category UC2 and UC3B, Commodity Specification F.
 - a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
 4. Preservative Pressure Treatment of Lumber in Contact with Soil: AWP A U1, Use Category UC4A, Commodity Specification A.
 - a. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.
 - b. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA) in exposed exterior applications subject to leaching.

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 (100 mm) 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.

3.02 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.
- C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

3.04 INSTALLATION OF CONSTRUCTION PANELS

- A. Wall Sheathing: Secure with long dimension in the most efficient direction to wall studs, with ends over firm bearing and staggered, using nails or screws.
- B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
 - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 - 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 - 3. Install adjacent boards without gaps.

3.05 CLEANING

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

SECTION 06 8316 - FIBERGLASS REINFORCED PANELING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiberglass reinforced plastic panels.
- B. Trim.

1.02 REFERENCE STANDARDS

- A. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- B. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels; 2022.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- D. FDA Food Code - Chapter 6 - Physical Facilities; Current Edition.
- E. FM 4880 - Examination Standard for Class 1 Fire Rating of Building Panels or Interior Finish Materials; 2022.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Samples: Submit two samples 6 by 6 inch (150 by 150 mm) in size illustrating material and surface design of panels.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fiberglass Reinforced Plastic Panels:
 - 1. Crane Composites, Inc; Glasbord: www.cranecomposites.com.
 - 2. Marlite, Inc; Standard FRP: www.marlite.com.
 - 3. Nudo Products, Inc; FiberLite FRP: www.nudo.com.
 - 4. Panolam Industries International, Inc: www.panolam.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PANEL SYSTEMS

- A. Wall Panels (FRP-#):
 - 1. Basis of Design: As indicated on drawings.
 - 2. Attachment Method: Adhesive only with trim and sealant in joints.

2.03 MATERIALS

- A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
 - 1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
 - 2. Class 1 fire rated when tested in accordance with FM 4880.

- 3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
- 4. Surface Characteristics and Cleanability: Provide products that are smooth, durable, and easily cleanable, in compliance with FDA Food Code, Chapter 6 - Physical Facilities.
- B. Trim: Aluminum; color coordinating with panel.
- C. Adhesive: Type recommended by panel manufacturer.
- D. Sealant: Type recommended by panel manufacturer; white.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions and substrate flatness before starting work.
- B. Verify that substrate conditions are ready to receive the work of this section.

3.02 INSTALLATION - WALLS

- A. Install panels in accordance with manufacturer's instructions.
- B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.
- C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.
- D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.
- E. Install panels with manufacturer's recommended gap for panel field and corner joints.
- F. Place trim on panel before fastening edges, as required.
- G. Fill channels in trim with sealant before attaching to panel.
- H. Install trim with adhesive and screws or nails, as required.
- I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.
- J. Remove excess sealant after paneling is installed and prior to curing.

SECTION 07 1900 - WATER REPELLENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water repellents applied to exterior and interior, masonry and concrete surfaces.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 03 3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

- A. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete; 2021.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide product description, details of tests performed, limitations, and chemical composition.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.

1.05 QUALITY ASSURANCE

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

1.06 FIELD CONDITIONS

- A. Protect liquid materials from freezing.
- B. Do not apply water repellent when ambient temperature is lower than 40 degrees F (4 degrees C) or higher than 110 degrees F (43 degrees C).

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Provide one year manufacturer warranty for manufacturing defects.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Silane, Siloxane, Silane-Siloxane Blend, and Siliconate Water Repellents:
 - 1. BASF Construction Chemicals: www.basf.com.
 - 2. Concrete Sealers USA: www.concretesealersusa.com.
 - 3. Pecora Corporation: www.pecora.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

- A. Water Repellent (REPEL-1): Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.
 - 1. Applications: As indicated on Drawings.

2. Number of Coats: Two.
3. VOC Content: See Section 01 6116.
4. Moisture Absorption When Applied to Concrete: Two percent, maximum, when tested in accordance with ASTM C642 concrete sample completely coated with water repellent.
5. Water-based siloxane, silane, or blend that reacts chemically with concrete and masonry.
 - a. Basis of Design:
 - 1) BASF Construction Chemicals; MasterProtect H 400:
www.buildingsystems.basf.com/#sle.
 - 2) Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

3.02 PREPARATION

- A. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.
- B. Do not start work until concrete substrate is cured to 80% of design strength.
- C. Remove loose particles and foreign matter.
- D. Remove oil and foreign substances with a chemical solvent that will not affect water repellent.
- E. Scrub and rinse surfaces with water and let dry.

3.03 APPLICATION

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

SECTION 07 2100 - THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation at cavity wall construction, perimeter foundation wall, and exterior wall behind exterior wall finish.

1.02 RELATED REQUIREMENTS

- A. Section 07 2600 - Vapor Retarders: Separate vapor retarder materials.
- B. Section 09 2116 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.

1.03 REFERENCE STANDARDS

- A. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).
- B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.
- C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).
- D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.
- E. ASTM C726 - Standard Specification for Mineral Wool Roof Insulation Board; 2017.
- F. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- H. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2025.

1.04 SUBMITTALS

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

1.05 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

- A. Products listed as Basis of Design have been selected using sustainability criteria. Products from other manufacturer's listed herein, and/or substitutions will only be accepted if they meet, or exceed, the performance of the Basis of Design. Manufacturer must be able to provide sustainability documentation showing that the product meets, or exceeds, the Basis of Design.

2.02 FOAM BOARD INSULATION MATERIALS

- A. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with either natural skin or cut cell surfaces.

1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
 - a. (INSUL-1): Type IV, 25 psi. Provide drainage channels.
2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
4. Type and Thermal Resistance, R-value (RSI-value): Type IV, 5.0 (0.88), minimum, per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature.
5. Board Edges: Square.
6. Sustainability Requirements: Manufacturer's must be able to provide the following, or equivalent, product documentations:
 - a. Environmental Product Declaration (EPD).
 - b. Health Product Declaration (HPD).
7. Basis of Design: Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com/.
8. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
 - a. DuPont de Nemours, Inc; Styrofoam Brand Square Edge: building.dupont.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 MINERAL FIBER BOARD INSULATION MATERIALS

- A. Mineral Wool Block, Board, or Blanket Thermal Insulation: Complying with ASTM C612 or ASTM C553.
 1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
 2. Thermal Resistance: R-value (RSI-value) of 4.2 (0.74) per inch at 75 degrees F (24 C), minimum, when tested according to ASTM C518.
 3. Maximum Density: 8 pcf (128 kg/cu m), nominal.
 4. Sustainability Requirements: Manufacturer's must be able to provide the following, or equivalent, product documentations:
 - a. Environmental Product Declaration (EPD) or Declare Label.
 - b. Living Building Challenge Red List Free or Compliant.
 - c. Health Product Declaration (HPD).
 5. (INSUL-26) Basis of Design: Thermafiber, Inc; RainBarrier: www.thermafiber.com/#sle.
 6. (INSUL-27) Basis of Design: COMFORTBOARD 80: www.rockwool.com.
 7. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
 - a. ROCKWOOL; CAVITYROCK: www.rockwool.com/#.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

- A. Sheet Vapor Retarder: See Section 07 2600.
- B. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.
- C. Insulation Fasteners: Appropriate for purpose intended.
- D. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

- A. 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.
- B. Extend boards over expansion joints, unbonded to foundation on one side of joint.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION AT EXTERIOR WALLS

- A. Install boards vertically on walls.
 - 1. Butt edges and ends tightly to adjacent boards and protrusions.
- B. Extend boards over expansion joints, unbonded to wall on one side of joint.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.04 BOARD INSTALLATION AT CAVITY WALLS

- A. Install boards to fit snugly between wall ties.
- B. Install boards horizontally on walls.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.05 PROTECTION

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

SECTION 07 2119 - FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Foamed-in-place insulation.
- B. Protective intumescent coating.

1.02 REFERENCE STANDARDS

- A. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2019.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
- D. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide product description, insulation properties, and preparation requirements.
- C. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.

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 experience.
- B. Applicator Qualifications: Company specializing in performing work of the type specified, with minimum three years experience.

1.05 FIELD CONDITIONS

- A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.
- B. Do not apply foam when temperature is within 5 degrees F (2.78 degrees C) of dew point.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Foamed-In-Place Insulation (INSUL-36): Medium-density, rigid or semi-rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
 - 1. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
 - 2. Products:
 - a. BASF Corporation; SPRAYTITE 81206: www.spf.basf.com/#sle.
 - b. Enverge; NexSeal: www.envergesprayfoam.com.
 - c. Henry Company; PERMAX 2.0: www.henry.com/#sle.
 - d. Huntsman Building Solutions; ProSeal HFO: www.huntsmanbuildingsolutions.com/#sle.
 - e. Johns Manville; JM Corbond IV Closed Cell Spray Polyurethane Foam: www.jm.com/#sle.
 - f. Rhino Linings Corporation; ThermalGuard CC2: www.rhino linings.com/#sle.

- g. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACCESSORIES

- A. Primer: As required by insulation manufacturer.
- B. Protective Coating: Intumescent coating of type recommended by insulation manufacturer and as required to comply with applicable codes.
 - 1. Coating Type: Single component, water-based.
 - 2. Protected Insulation Type: Spray polyurethane foam (SPF).
 - 3. Application: Apply using brush, roller, or airless sprayer.
 - 4. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
 - 5. Color: As indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify work within construction spaces or crevices is complete before insulation application.

3.02 PREPARATION

- A. Mask and protect adjacent surfaces from over spray or dusting.
- B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

- A. Apply insulation in accordance with manufacturer's instructions.
- B. Apply insulation by spray method, to a uniform monolithic density without voids.
- C. Patch damaged areas.
- D. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.

3.04 PROTECTION

- A. Do not permit subsequent construction work to disturb applied insulation.

SECTION 07 2600 - VAPOR RETARDERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vapor retarders.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.
- B. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with vapor retarders.

1.03 DEFINITIONS

- A. Vapor Retarder: Airtight barrier made of material that is relatively water vapor impermeable, to degree specified, with seams and joints sealed to adjacent surfaces.
- B. Vapor Retarder Class: A measure of a material or assembly's ability to limit the amount of moisture that passes through that material or assembly. Vapor retarder class is defined using Procedure A, Desiccant Method at 73 degrees F (23 degrees C) and 50 percent Relative Humidity (RH), in accordance with ASTM E96/E96M and ICC (IBC)-2018, as follows:
 - 1. Class I: 0.1 perm or less.
 - 2. Class II: Greater than 0.1 perm to 1.0 perm.
 - 3. Class III: Greater than 1.0 perm to 10 perms.

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 D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.
- C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
- D. ICC (IBC)-2018 - International Building Code; 2018.
- E. ICC-ES AC148 - Acceptance Criteria for Flexible Flashing Materials; 2017, with Editorial Revision (2021).

1.05 SUBMITTALS

- A. See Section 01 3000 - 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.
- E. Sustainability Design Documentation: Provide applicable sustainability documentation for each product as described in Section 01 3329 - Sustainable Design Requirements.

1.06 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

- A. Products listed as Basis of Design have been selected using sustainability criteria. Products from other manufacturer's listed herein, and/or substitutions will only be accepted if they meet, or exceed, the performance of the Basis of Design. Manufacturer must be able to provide sustainability documentation showing that the product meets, or exceeds, the Basis of Design.

2.02 VAPOR RETARDERS

- A. Underslab Vapor Retarders: See Section 03 3000.
- B. Vapor Retarder Sheet (VPR RET-1): ASTM D4397 polyethylene film, clear.
 - 1. Thickness: 6 mil (0.15 mm).
 - 2. Water Vapor Permeance: As required by referenced standard for thickness specified.
- C. (VPR RET-10): Contractor's option to provide a self-adhesive or liquid applied membrane as described in the following paragraphs.
- D. Vapor Retarder, Self-Adhering Membranes (VPR RET-10): Rubberized asphalt bonded to aluminum foil facer.
 - 1. Thickness: 40 mil, 0.04 inch (1.0 mm), nominal.
 - 2. Vapor Retarder Class I: 0.1 perm (5.72 ng/(Pa s sq m)) or less, when tested in accordance with ASTM E96/E96M, Procedure A.
 - 3. Nail Sealability: Passed nail sealability test in accordance with ASTM D1970/D1970M.
 - 4. System Accessory Products: As recommended by membrane manufacturer.
 - 5. Sustainability Requirements: Manufacturer's must be able to provide the following, or equivalent, product documentations:
 - a. Environmental Product Declaration (EPD) or Declare Label.
 - b. Living Building Challenge Red List Free or Compliant.
 - 6. Basis of Design: Henry Company; Blueskin SA LT (Low Temp): www.henry.com/#sle.
 - 7. Other Acceptable Products provided they meet or exceed the Basis of Design performance:
 - a. Carlisle Coatings and Waterproofing; Fire Resist 705FR-A: www.carlisleccw.com/#sle.
 - b. GCP Applied Technologies; Perm-A-Barrier Low Temperature Wall Membrane: www.gcpat.com.
 - c. W. R. Meadows, Inc; Air-Shield: www.wrmeadows.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- E. Vapor Retarder Coating (VPR RET-10): Liquid applied, resilient, ultra-violet (UV) light resistant coating; associated joint treatment.
 - 1. Water Vapor Permeance: 1.0 perm (57 ng/(Pa s sq m)), maximum, when tested in accordance with ASTM E96/E96M.
 - 2. VOC Content: Less than 6.68 oz/gal (50 g/L), when tested in accordance with 40 CFR 59, Subpart D - EPA Method 24.
 - 3. Suitable for use on concrete, masonry, plywood, and gypsum sheathing.
 - 4. Joint Preparation Treatment: Provide coating manufacturer's recommended method, either tape or reinforcing mesh saturated with coating material.
 - 5. Joint Filler: As recommended by coating manufacturer and suitable to the substrate.
 - 6. Sustainability Requirements: Manufacturer's must be able to provide the following, or equivalent, product documentations:
 - a. Environmental Product Declaration (EPD).

- b. Health Product Declaration (HPD).
- 7. Basis of Design: Henry Company; Air-Bloc 16MR: www.henry.com/#sle.
- 8. Other Acceptable Products provided they meet or exceed the Basis of Design performance, including sustainability requirements:
 - a. Carlisle Coatings and Waterproofing; Fire Resist Barritech NP: www.carlisleccw.com/#sle.
 - b. GCP Applied Technologies; Perm-A-Barrier NPL 10 LT: www.gcpat.com.
 - c. W. R. Meadows, Inc; Air-Shield LSR: www.wrmeadows.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES

- A. Sealants, Tapes, and Accessories for Sealing Vapor Retarder and Adjacent Substrates: As indicated, complying with vapor retarder manufacturer's installation instructions.
- B. Sealant for Cracks and Joints in Substrates: Resilient elastomeric joint sealant compatible with substrates and vapor retarder materials.
 - 1. Application: Apply at 30 to 40 mil, 0.030 to 0.040 inch (0.76 to 1.02 mm), nominal thickness.
 - 2. All flashing materials shall be compatible with, and approved by, the membrane manufacturer.
- C. Flexible Flashing: Self-adhering or mechanically-attached flashing used for wall penetrations in accordance with ICC-ES AC148 requirements.
- D. Thinners and Cleaners: As recommended by vapor retarder 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. Vapor Retarders: Install continuous airtight barrier over surfaces indicated, with sealed seams and sealed joints to adjacent surfaces.
- C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.
- D. Mechanically Fastened Sheets - Vapor Retarder On Exterior:
 - 1. Install sheets shingle fashion to shed water, with seams generally horizontal.
 - 2. Overlap seams as recommended by manufacturer, 6 inches (152 mm), minimum.
 - 3. Overlap at outside and inside corners as recommended by manufacturer, 12 inches (305 mm), minimum.
 - 4. For applications indicated to be airtight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners as recommended by manufacturer.
 - 5. Where stud framing rests on concrete or masonry substrate, extend lower edge of vapor retarder sheet at least 4 inches (102 mm) below bottom of framing and seal to substrate with sealant or approved mounting tape.

6. Install vapor retarder underneath jamb flashings.
 7. At framed openings with frames having nailing flanges, extend sheet into opening and over flanges; at head of opening, seal sheet over flange and flashing.
- E. Mechanically Fastened Sheets - Vapor Retarder On Interior:
1. When insulation is installed within assembly, install vapor retarder over insulation.
 2. Anchor to wood framing using large-headed nails or staples at 12 to 18 inches (305 to 460 mm) on center along each framing member covered; cover fasteners with seam tape.
 3. Anchor to metal framing using seam tape, adhering at least one-half of tape width to metal substrate.
 4. Seal seams, laps, perimeter edges, penetrations, tears, and cuts with self-adhesive tape, providing an airtight seal.
 5. Locate laps at framing members; at laps fasten one sheet to framing member then tape overlapping sheet to first sheet in shingle fashion to shed water.
 6. Seal entire perimeter to structure, window and door frames, and other penetrations.
 7. Where conduits, pipes, wires, ducts, outlet boxes, and other items are installed within insulation cavity, pass vapor retarder sheet behind these items and over insulation to maintain airtight seal.
- F. Vapor Retarder Coatings:
1. Prepare substrate in accordance with coating manufacturer's installation instructions; treat joints in substrate and between dissimilar materials as indicated.
 2. Where exterior masonry veneer is being installed, install masonry anchors before installing vapor retarder over masonry; provide airtight seal around anchors.
 3. Apply bead or trowel coat of mastic sealant with minimum thickness of 1/4 inch (6 mm) along coating seams, rough cuts, and as recommended by manufacturer.
 4. Apply flashing to seal with adjacent construction and to bridge joints in coating substrate.
- G. Openings and Penetrations in Exterior Vapor Retarders:
1. Install flashing over sills, covering entire sill framing member, and extend at least 5 inches (127 mm) onto vapor retarder and at least 6 inches (152 mm) up jambs; mechanically fasten stretched edges.
 2. At openings 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 (100 mm) wide; do not seal sill flange.
 3. At openings with nonflanged frames, seal vapor retarder to each side of framing at opening using flashing at least 9 inches (230 mm) wide, and covering entire depth of framing.
 4. At head of openings, install flashing under vapor retarder extending at least 2 inches (50 mm) beyond face of jambs; seal vapor retarder to flashing.
 5. At interior face of openings, seal gaps between window/door frame 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 vapor retarder.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - 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.
- C. Obtain approval of installation procedures from vapor retarder manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.
- D. Take digital photographs of each portion of installation prior to covering up vapor retarders.

3.05 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

SECTION 07 2700 - AIR BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air barriers.

1.02 RELATED REQUIREMENTS

- A. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with air barriers.

1.03 DEFINITIONS

- A. Air Barrier: Airtight barrier made of material that is virtually air impermeable but water vapor permeable, both to amount as specified, with sealed seams and sealed joints to adjacent surfaces.

1.04 REFERENCE STANDARDS

- A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).
- B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
- E. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.
- F. ICC-ES AC148 - Acceptance Criteria for Flexible Flashing Materials; 2017, with Editorial Revision (2021).
- G. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2025.

1.05 SUBMITTALS

- A. See Section 01 3000 - 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.
- E. Sustainability Design Documentation: Provide applicable sustainability documentation for each product as described in Section 01 3329 - Sustainable Design Requirements.

1.06 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

- A. Products listed as Basis of Design have been selected using sustainability criteria. Products from other manufacturer's listed herein, and/or substitutions will only be accepted if they meet, or exceed, the

performance of the Basis of Design. Manufacturer must be able to provide sustainability documentation showing that the product meets, or exceeds, the Basis of Design.

2.02 AIR BARRIER MATERIALS (AIR IMPERMEABLE AND WATER VAPOR PERMEABLE)

- A. (AIR BAR-3): Contractor's option to provide a self-adhesive or liquid applied membrane as described in the following paragraphs.
- B. Air Barrier Sheet, Self-Adhered (AIR BAR-3):
 - 1. Air Permeance: 0.004 cfm/sq ft (0.02 L/(s sq m)), maximum, when tested in accordance with ASTM E2178.
 - 2. Water Vapor Permeance: 10 perms (572 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M using Procedure A - Desiccant Method, at 73.4 degrees F (23 degrees C).
 - 3. Water Penetration Resistance Around Nails: Pass, when tested in accordance with ASTM D1970/D1970M (modified).
 - 4. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 180 days of weather exposure.
 - 5. 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.
 - 6. Comply with NFPA 285 requirements for wall assembly.
 - 7. Seam and Perimeter Tape: As recommended by sheet manufacturer.
 - 8. Sustainability Requirements: Manufacturer's must be able to provide the following, or equivalent, product documentations:
 - a. Environmental Product Declaration (EPD) or Declare Label.
 - b. Living Building Challenge Red List Free or Compliant.
 - 9. Basis of Design: Henry Company; Blueskin VP160: www.henry.com/#sle.
 - 10. Other Acceptable Products provided they meet or exceed the Basis of Design performance, including sustainability requirements:
 - a. GCP Applied Technologies; Perm-A-Barrier VPS 30: www.gcpat.com/#sle.
 - b. VaproShield, LLC; WrapShield SA - Self-Adhered: www.vaproshield.com/#sle.
 - c. W. R. Meadows, Inc; Air-Shield SMP: www.wrmeadows.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- C. Air Barrier, Fluid Applied (AIR BAR-3): Vapor semi-permeable, elastomeric waterproofing.
 - 1. Air Barrier Coating:
 - a. Air Permeance: 0.004 cfm/sq ft (0.02 L/(s sq m)), maximum, when tested in accordance with ASTM E2178.
 - b. Water Vapor Permeance: 11 perms (629 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M using Procedure B - Water Method, at 73.4 degrees F (23 degrees C).
 - c. Elongation: 250 percent, minimum, when tested in accordance with ASTM D412.
 - d. 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.
 - e. Comply with NFPA 285 requirements for wall assembly.
 - f. Sealants, Tapes and Accessories: As recommended by coating manufacturer.
 - g. Sustainability Requirements: Manufacturer's must be able to provide the following, or equivalent, product documentations:
 - 1) Environmental Product Declaration (EPD) or Declare Label.
 - 2) Living Building Challenge Red List Free or Compliant.

- h. Basis of Design: Henry Company; Air-Bloc 17MR: www.henry.com/#sle.
- i. Other Acceptable Products provided they meet or exceed the Basis of Design performance, including sustainability requirements:
 - 1) GCP Applied Technologies; Perm-A-Barrier VPL 50RS UV Stable: www.gcpat.com/#sle.
 - 2) PROSOCO, Inc; R-GUARD Cat 5: www.prosoco.com/r-guard/#sle.
 - 3) W. R. Meadows, Inc; Air-Shield TMP: www.wrmeadows.com/#sle.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES

- A. Sealants, Tapes, and Accessories for Sealing Air Barrier and Adjacent Substrates: As indicated or in compliance with air barrier manufacturer's installation instructions.
- B. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrate and air barrier materials.
 - 1. Application: Apply at 30 to 40 mil, 0.030 to 0.040 inch (0.76 to 1.02 mm), nominal thickness.
 - 2. All flashing materials shall be compatible with, and approved by, the membrane manufacturer.
 - 3. Comply with NFPA 285 requirements for wall assembly.
- C. Flexible Flashing: Self-adhering or mechanically-attached flashing used for wall penetrations in accordance with ICC-ES AC148 requirements.
- D. Thinners and Cleaners: As recommended by material manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and conditions are ready for work of this section.
- B. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.
- C. Do not proceed with this work until unsatisfactory conditions have been corrected.

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. Air Barriers: Install continuous airtight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.
- D. 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. Once sheets are in place, press firmly into 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 to adjacent substrates, and as flashing.
 5. At wide joints, provide extra flexible membrane allowing joint movement.
- E. Openings and Penetrations in Exterior Air Barriers:
1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches (125 mm) onto air barrier and at least 6 inches (150 mm) up jambs; mechanically fasten stretched edges.
 2. At openings 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 (100 mm) wide; do not seal sill flange.
 3. At openings with nonflanged frames, seal air barrier to each side of framing at opening using flashing at least 9 inches (230 mm) wide, and covering entire depth of framing.
 4. At head of openings, install flashing under air barrier extending at least 2 inches (50 mm) beyond face of jambs; seal air barrier to flashing.
 5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
 6. Service and Other Penetrations: Form flashing around penetrating item and seal to air barrier surface.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Obtain approval of installation procedures from air barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.
- C. Take digital photographs of each portion of installation prior to covering up air barriers.

3.05 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

SECTION 07 4213 - METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufactured metal panels for walls and soffits, with related flashings and accessory components.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Sealing joints between metal wall panel system and adjacent construction.
- B. Section 09 2116 - Gypsum Board Assemblies: Wall panel substrate.

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, and methods of anchorage.
- C. Samples: Submit two samples of wall panel, 12 inches by 12 inches (305 mm by 305 mm) in size illustrating finish color, sheen, and texture.
- D. Manufacturer's qualification statement.
- E. Installer's qualification statement.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in installing products specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- B. Store prefabricated material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.
- C. Prevent contact with materials that may cause discoloration or staining of products.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Finish Warranty: Provide 15-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.
- C. Special Warranty: Provide 2-year warranty covering water tightness and integrity of seals of metal wall panels. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Wall Panels - Concealed Fasteners:
 - 1. ATAS International, Inc: www.atas.com.
 - 2. Berridge Manufacturing Company: www.berridge.com.
 - 3. Morin Corporation: www.morincorp.com.
 - 4. Petersen Aluminum Corporation: www.pac-clad.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Metal Soffit Panels:
 - 1. ATAS International, Inc: www.atas.com.
 - 2. Berridge Manufacturing Company: www.berridge.com.
 - 3. Petersen Aluminum Corporation: www.pac-clad.com.
 - 4. Sheffield Metals International: www.sheffieldmetals.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 METAL WALL PANEL SYSTEM

- A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
 - 1. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
 - 2. Design Pressure: In accordance with applicable codes.
 - 3. Maximum Allowable Deflection of Panel: $L/180$ for length(L) of span.
 - 4. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
 - 5. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
 - 6. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
 - 7. Corners: Factory-fabricated in one continuous piece with minimum 2-inch (51 mm) returns.
- B. Exterior Wall Panels (MTL PNL-20):
 - 1. Basis of Design: As indicated on drawings.
 - 2. Material: Precoated steel sheet, 22 gauge, 0.0299 inch (0.76 mm) minimum thickness.
 - 3. Color: As selected by Architect from manufacturer's standard line.
- C. Soffit Panels:
 - 1. Profile: Style as indicated, with venting provided.
- D. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.
- E. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.
- F. Anchors: Galvanized steel.

2.03 MATERIALS

- A. Precoated Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, Structural Steel (SS) or Forming Steel (FS), with G90/Z275 coating; continuous coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

2.04 ACCESSORIES

- A. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient.
- B. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel, hot dip galvanized. Fastener cap same color as exterior panel.
- C. Bituminous Paint: Asphalt base.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify air barrier, see Section 07 2700, has been installed over wall panel substrate; see Section 05 4000.

3.02 INSTALLATION

- A. Install panels on walls in accordance with manufacturer's instructions.
- B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint; allow to dry prior to wall panel installation.
- C. Fasten panels to structural supports; aligned, level, and plumb.
- D. Locate joints over supports.
- E. Provide expansion and control joints where indicated.
- F. Use concealed fasteners unless otherwise indicated by Architect.
- G. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.03 TOLERANCES

- A. Offset From True Alignment Between Adjacent Members Abutting or In Line: 1/16 inch (1.6 mm), maximum.
- B. Variation from Plane or Location As Indicated on Drawings: 1/4 inch (6.4 mm), maximum.

3.04 CLEANING

- A. Remove site cuttings from finish surfaces.
- B. Remove protective material from wall panel surfaces.
- C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

SECTION 07 5400 - THERMOPLASTIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Adhered system with thermoplastic roofing membrane.
- B. Insulation, flat and tapered.
- C. Vapor retarder.
- D. Deck sheathing.
- E. Flashings.
- F. Roofing cant strips, stack boots, roofing expansion joints, and walkway pads.

1.02 RELATED REQUIREMENTS

- A. Section 05 3100 - Steel Decking: Placement of acoustical insulation for deck flutes.
- B. Section 06 1000 - Rough Carpentry: Wood cant strips.
- C. Division 22 - Plumbing: Roof drains.

1.03 REFERENCE STANDARDS

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
- B. ASTM C726 - Standard Specification for Mineral Wool Roof Insulation Board; 2017.
- C. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
- D. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.
- E. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin-Based Sheet Roofing; 2021.
- F. NRCA (RM) - The NRCA Roofing Manual; 2022.
- G. NRCA (WM) - The NRCA Waterproofing Manual; 2021.
- H. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, 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 Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.
- E. Sustainability Design Documentation: Provide applicable sustainability documentation for each product as described in Section 01 3329 - Sustainable Design Requirements.
- 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 the products specified in this section with minimum three years of experience.
- B. Installer Qualifications: Company specializing in performing work of this section with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. 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 to damp or frozen deck surface or when precipitation is expected or occurring.
- C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- D. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Material Warranty: Provide membrane manufacturer's warranty agreeing to replace material that shows manufacturing defects within five years after installation.
- C. 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 PRODUCT REQUIREMENTS

- A. Products listed as Basis of Design have been selected using sustainability criteria. Products from other manufacturer's listed herein, and/or substitutions will only be accepted if they meet, or exceed, the performance of the Basis of Design. Manufacturer must be able to provide sustainability documentation showing that the product meets, or exceeds, the Basis of Design.

2.02 MANUFACTURERS

- A. Thermoplastic Polyolefin (TPO) Membrane Roofing Materials:
 1. Carlisle Roofing Systems, Inc: www.carlisle-syntec.com.
 2. Elevate: www.holcimelevate.com.
 3. GAF: www.gaf.com.

4. GenFlex Roofing Systems, LLC: www.genflex.com.
 5. Johns Manville: www.jm.com.
 6. Versico, a division of Carlisle Construction Materials Inc: www.versico.com.
 7. Substitutions: See Section 01 6000 - Product Requirements.
- B. Insulation:
1. Dow Chemical Company: www.dowbuildingsolutions.com.
 2. Owens Corning Corporation: www.ocbuildingspec.com.
 3. ROCKWOOL: www.rockwool.com.
 4. Insulation manufactured by the membrane manufacturer is approved.
 5. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ROOFING - UNBALLASTED APPLICATIONS

- A. Thermoplastic Membrane Roofing (TPO-1): One ply membrane, fully adhered, over insulation.
- B. Roofing Assembly Requirements:
1. Roof Covering External Fire Resistance Classification: UL (FRD) Class A.
 2. Acceptable Insulation Types - Constant Thickness Application: Any of types specified.
 - a. Minimum 2 layers of polyisocyanurate board.
 - b. Bottom layer of polyisocyanurate board covered with single layer of polyisocyanurate board.
 3. Acceptable Insulation Types - Tapered Application:
 - a. Tapered polyisocyanurate board covered with uniform thickness polyisocyanurate board.

2.04 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 (1.5 mm), minimum.
 2. Sheet Width: Factory fabricated into widest possible sheets.
 3. Color: As selected by Architect from manufacturer's full color range.
- B. Seaming Materials: As recommended by membrane manufacturer.
- C. Vapor Retarder (VPR RET-5T): Material approved by roof manufacturer complying with requirements of fire rating classification; compatible with roofing and insulation materials.
1. Fire-retardant adhesive.
- D. Flexible Flashing Material: Same material as membrane.

2.05 DECK SHEATHING

- A. Deck Sheathing: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
1. (RF BRD-1T) Thickness: 1/2 inch (12.7 mm), fire-resistant.
 2. Products:
 - a. Georgia-Pacific; DensDeck: www.densdeck.com.
 - b. USG Corporation; Securock Ultralight Glass-Mat Roof Board: www.usg.com.
 - c. Substitutions: See Section 01 6000 - Product Requirements.

2.06 INSULATION

- A. Insulation System Identification:
1. (INSUL-50T): Constant thickness polyisocyanurate insulation; minimum two staggered layers of equal thickness; provide tapered polyisocyanurate insulation as needed.

2. (INSUL-51T): Tapered polyisocyanurate insulation over constant thickness polyisocyanurate insulation; minimum two staggered layers of equal thickness; provide tapered insulation over entire roof as indicated in the drawings.
- B. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
 1. Classifications:
 - a. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.
 - 1) Class 1 - Faced with glass fiber reinforced cellulosic facers on both major surfaces of the core foam.
 - 2) Compressive Strength: Classes 1-2-3, Grade 1, 16 psi (110 kPa), minimum.
 - 3) Thermal Resistance, R-value (RSI-value): At 1-1/2 inches (38 mm) thick; Class 1, Grades 1-2-3, 8.4 (1.48), minimum, at 75 degrees F (24 degrees C).
 2. Board Size: 48 by 96 inches (1220 by 2440 mm).
- C. Mineral Wool Board Insulation: Rigid, monolithic, dual-density mineral wool, complying with ASTM C726.
 1. Board Size: 48 by 48 inches (1220 by 1220 mm).
 2. Tapered Board: Slope as indicated; minimum thickness 1/2 inch (12.7 mm); fabricate of fewest layers possible.
 3. Board Edges: Square.
 4. Thermal Resistance: R-value (RSI-value) of 3.8 (0.68) at 75 degrees F (24 degrees C), when tested in accordance with ASTM C518.
 5. Products:
 - a. ROCKWOOL; TOPROCK DD - Flat Roof Insulation: www.rockwool.com/#sle.
 6. Substitutions: See Section 01 6000 - Product Requirements.

2.07 ACCESSORIES

- A. Cant Strips: Wood, pressure preservative treated; see Section 06 1000.
- B. Sheathing Joint Tape: Self adhering.
- C. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches (152 mm) wide; self adhering.
- 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 (PAVER-2T): 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.

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 - METAL DECK

- A. Install preformed acoustical glass fiber insulation strips in roof deck flutes in accordance with manufacturer's instructions; see Section 05 3100.
- B. Install deck sheathing on metal deck:
 - 1. Lay with long side at right angle to flutes; stagger end joints; provide support at ends.
 - 2. Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface.
 - 3. Tape joints.

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 - INSULATION, UNDER MEMBRANE

- A. Attachment of Insulation: Embed each layer of insulation in adhesive in full contact, in accordance with roofing and insulation manufacturers' instructions.
- B. Lay subsequent layers of insulation with joints staggered minimum 6 inches (152 mm) from joints of preceding layer.
- C. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.
- D. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.
- E. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
- F. Tape joints of insulation in accordance with roofing and insulation manufacturers' instructions.
- G. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 18 inches (457 mm).
- H. 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 recommended by manufacturer. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.
- D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches (76 mm). 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 (102 mm) 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 CLEANING

- A. See Section 01 7000 - 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.

3.07 PROTECTION

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sealants for joints within sheet metal fabrications.

1.02 REFERENCE STANDARDS

- A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- C. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).
- D. CDA A4050 - Copper in Architecture - Handbook; current edition.
- E. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.04 QUALITY ASSURANCE

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

1.05 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.01 SHEET MATERIALS

- A. Pre-Finished Aluminum (SMF-2): ASTM B209 (ASTM B209M); 20 gauge, 0.032 inch (0.81 mm) thick; plain finish shop pre-coated with modified silicone coating.
 - 1. Silicone Modified Polyester Coating: Pigmented organic powder coating, AAMA 2603; baked enamel finish system.
 - 2. Color: As selected by Architect from manufacturer's standard colors.

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 (13 mm); miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18-inch (450 mm) long legs; seam for rigidity, seal with sealant.

- F. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

2.03 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. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.
- C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch (0.38 mm).

3.03 INSTALLATION

- A. Insert flashings into reglets to form tight fit; secure in place with lead wedges; seal flashings into reglets with sealant.
- B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- C. Apply plastic cement compound between metal flashings and felt flashings.
- D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- E. Seal metal joints watertight.

SECTION 07 9200 - JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
- B. Section 09 3000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.03 REFERENCE STANDARDS

- A. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).
- B. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).
- C. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- E. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2023.
- F. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

1.04 SUBMITTALS

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

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of experience.
- B. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.

1. Adhesion Testing: In accordance with ASTM C794.
2. Compatibility Testing: In accordance with ASTM C1087.
3. Allow sufficient time for testing to avoid delaying the work.
4. Deliver sufficient samples to manufacturer for testing.
5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Nonsag Sealants:
 1. Bostik Inc: www.bostik-us.com.
 2. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html.
 3. Hilti, Inc: www.us.hilti.com.
 4. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com.
 5. Pecora Corporation: www.pecora.com.
 6. Sherwin-Williams Company: www.sherwin-williams.com.
 7. Sika Corporation: www.usa-sika.com.
 8. Specified Technologies Inc: www.stifirestop.com.
 9. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
 10. W.R. Meadows, Inc: www.wrmeadows.com.
 11. Substitutions: See Section 01 6000 - Product Requirements.
- B. Self-Leveling Sealants:
 1. Bostik Inc: www.bostik-us.com.
 2. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html.
 3. Pecora Corporation: www.pecora.com.
 4. Sherwin-Williams Company: www.sherwin-williams.com.
 5. Sika Corporation: www.usa-sika.com.
 6. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
 7. W.R. Meadows, Inc: www.wrmeadows.com.
 8. Substitutions: See Section 01 6000 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

- A. Scope:
 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to:
 - a. Wall expansion and control joints.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Joints between different exposed materials.
 - d. Openings below ledge angles in masonry.
 - e. Other joints indicated below.
 2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - b. Other joints indicated below.
 3. Do not seal the following types of joints:
 - a. Intentional weep holes in masonry.

- b. Joints indicated to be treated with manufactured expansion joint cover, or some other type of sealing device.
 - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - d. Joints where installation of sealant is specified in another section.
 - e. Joints between suspended panel ceilings/grid and walls.
- B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
 - 1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
- C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
 - 1. Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
 - 2. Floor Joints in Wet Areas: Non-sag polyurethane "non-traffic-grade" sealant suitable for continuous liquid immersion.
 - 3. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
 - 4. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
 - 5. Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant.
 - 6. Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.
- D. Sound-Rated Assemblies: Walls and ceilings identified as STC-rated, sound-rated, or acoustical.

2.03 JOINT SEALANTS - GENERAL

- A. Material ID's:
 - 1. (SEALANT-1): Joint sealant or caulking with or without backer rod. Type as indicated above.

2.04 NONSAG JOINT SEALANTS

- A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
 - 1. Color: To be selected by Architect from manufacturer's standard range.
 - 2. Cure Type: Multi-component, neutral curing.
 - 3. Service Temperature Range: Minus 20 to 180 degrees F (Minus 29 to 82 degrees C).
- B. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.
 - 1. Color: To be selected by Architect from manufacturer's standard range.
 - 2. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).

2.05 SELF-LEVELING JOINT SEALANTS

- A. Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
 - 1. Composition: Multicomponent, 100 percent solids by weight.
 - 2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.
 - 3. Color: To be selected by Architect from manufacturer's standard colors.
 - 4. Joint Width, Minimum: 1/8 inch (3 mm).
 - 5. Joint Width, Maximum: 1/4 inch (6 mm).
 - 6. Joint Depth: Provide product suitable for joints from 1/8 inch (3 mm) to 2 inches (51 mm) in depth including space for backer rod.

2.06 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
 - 1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
 - 2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
 - 3. Open Cell: 40 to 50 percent larger in diameter than joint width.
 - 4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- E. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- D. Install bond breaker backing tape where backer rod cannot be used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

- G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- H. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hollow metal frames for wood doors.
- B. Sound-rated hollow metal doors and frames.
- C. Hollow metal borrowed lites glazing frames.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware.
- B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.
- C. Section 09 9113 - Exterior Painting: Field painting.
- D. Section 09 9123 - Interior Painting: Field painting.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2024.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2025.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.
- F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2016.
- G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
- H. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.
- I. ASTM C476 - Standard Specification for Grout for Masonry; 2018.
- J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
- K. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- L. ASTM E413 - Classification for Rating Sound Insulation; 2022.
- M. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.
- N. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- O. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
- P. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2024.
- Q. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.
- R. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.
- S. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2023.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

1.05 QUALITY ASSURANCE

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

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Basis of Design: Steelcraft, an Allegion brand: www.allegion.com.
 - 2. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements:
 - a. Ceco Door or Curries, an Assa Abloy Group company: www.assaabloydss.com.
 - b. Republic Doors, an Allegion brand: www.republicdoor.com.
 - c. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
 - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 - 3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
 - 4. Door Edge Profile: Manufacturers standard for application indicated.
 - 5. Typical Door Face Sheets: Flush.
 - 6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.
 - 7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
 - a. Provide minimum 3/16" plate steel as reinforcement for hardware. If the manufacturer's standard is for a greater thickness at specific locations, provide the thicker of the two standards.

8. Electrified Hardware Preparation:
 - a. Provide electrical conduit and junction-boxes as required for electric power and signal routing and for electrical terminations as required to support electrical and electronic hardware indicated in Section 08 7100.
 - b. Secure conduit and boxes to the frame and doors. Extend conduit attached to frames 12 inches above frame for connection to conduit furnished by other sections.
 - c. Coordinate locations of conduit and boxes with Section 08 7100.
9. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
 - a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

- A. Exterior Doors: Thermally insulated.
 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 3 - Extra Heavy-duty.
 - b. Physical Performance Level A 1 000 000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 2 - Seamless.
 - d. Door Face Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum.
 - e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
 2. Door Core Material: Polystyrene, 1 lbs/cu ft minimum density.
 - a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
 3. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
 4. Door Finish: Factory primed and field finished.
- B. Interior Doors, Non-Fire Rated:
 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Model 2 - Seamless.
 - b. Door Face Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum.
 2. Door Core Material: Polystyrene Insulation.
 3. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
- C. Fire-Rated Doors:
 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 3 - Extra Heavy-duty.
 - b. Physical Performance Level A 1 000 000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 2 - Seamless.
 - d. Door Face Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum.

2. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
3. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
- D. Sound-Rated Interior Doors:
 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 (0.8 mm), minimum.
 2. Sound Transmission Class (STC) Rating of Door and Frame Assembly:
 3. Door Core Material: Manufacturer's standard construction as required to meet acoustic requirements indicated.
 4. Door Thickness: As required to meet acoustic requirements indicated.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished.
- C. Exterior Door Frames: Full profile/continuously welded type.
 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A60/ZF180 coating.
 2. Frame Metal Thickness: 14 gauge, 0.067 inch (1.7 mm), minimum.
- D. Interior Door Frames, Non-Fire Rated: Face welded type.
 1. Frame Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum; except 14 gage, 0.067 inch (1.7 mm) for masonry applications.
- E. Door Frames, Fire-Rated: Face welded type.
 1. Frame Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum; except 14 gage, 0.067 inch (1.7 mm) for masonry applications.
- F. Sound-Rated Door Frames: Knock-down type.
- G. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- H. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.
- I. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
- J. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches (102 mm) high to fill opening without cutting masonry units.
- K. Frames Wider than 48 inches (1219 mm): Reinforce with steel channel fitted tightly into frame head, flush with top.

2.05 FINISHES

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

2.06 ACCESSORIES

- A. Louvers: Roll formed steel with overlapping frame; finish same as door components ; factory-installed.
 1. Style: Standard straight slat blade.
 2. Fasteners: Exposed or concealed fasteners.

- B. Glazing: As specified in Section 08 8000.
- C. Astragals for Double Doors: Specified in Section 08 7100.
 - 1. Exterior Doors: Steel, Z-shaped.
- D. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches (102 mm) as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.
- E. 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.
- F. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

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

3.03 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Coordinate frame anchor placement with wall construction.
- C. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- D. Install door hardware as specified in Section 08 7100.
- E. Comply with glazing installation requirements of Section 08 8000.
- F. Coordinate installation of electrical connections to electrical hardware items.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.05 ADJUSTING

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

SECTION 08 3313 - COILING COUNTER DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated coiling counter doors and operating hardware.
- B. Electric motor operation; wiring from electric circuit disconnect to operator to control station.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Rough openings.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- C. ITS (DIR) - Directory of Listed Products; current edition.
- D. NEMA MG 1 - Motors and Generators; 2024.
- E. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's standard literature showing materials and details of construction and finish.
- C. Shop Drawings: Indicate rough and actual opening dimensions, anchorage methods, hardware locations, and installation details.
- D. Operation and Maintenance Data: Indicate modes of operation, lubrication requirements and frequency, and periodic adjustments required.
- E. Project Record Documents: Include as-built electrical diagrams for electrical operation and connection to fire alarm system.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Coiling Counter Doors:
 - 1. Overhead Door Corp: www.overheaddoor.com.
 - 2. The Cookson Company: www.cooksondoor.com.
 - 3. Cornell Iron Works, Inc: www.cornelliron.com.
 - 4. Alpine Overhead Doors, Inc.: www.alpinedoors.com.
 - 5. Raynor Garage Doors: www.raynor.com/#sle.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 COILING COUNTER DOORS

- A. Coiling Counter Doors, Non-Fire-Rated: Aluminum slat curtain.
 - 1. Mounting: Interior face mounted.
 - 2. Nominal Slat Size: 1-1/4 inches (32 mm) wide.
 - 3. Slat Profile: Flat.
 - 4. Finish, Aluminum: Anodized.

5. Color: As selected by Architect from manufacturer's full range.
6. Hood Enclosure: Manufacturer's standard; aluminum.
7. Electric operation.

2.03 COMPONENTS

- A. Metal Curtain Construction: Interlocking, single-thickness slats.
 1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
 2. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact in closed position.
- B. Guide Construction: Continuous, of profile to retain door in place, with mounting brackets of same metal.
 1. Guides for Galvanized Curtains: ASTM A36/A36M steel angles, size as indicated, hot-dip galvanized per ASTM A123/A123M.
- C. Hood Enclosure: Internally reinforced to maintain rigidity and shape.
- D. Lock Hardware:
 1. For motor operated units, additional lock or latching mechanisms are not required.
- E. Roller Shaft Counterbalance: Steel pipe and torsion steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb (10 kg) nominal force to operate.

2.04 ELECTRIC OPERATION

- A. Operator, Controls, Actuators, and Safeties: Listed and classified by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction (AHJ) as suitable for purpose specified and indicated.
 1. Provide interlock switches on motor operated units.
- B. Electric Operators:
 1. Mounting: Side mounted.
 2. Motor Enclosure: NEMA MG 1.
 3. Motor Rating: As recommended by manufacturer; continuous duty.
 4. Motor Voltage: 110-120 VAC, single phase, 60 Hz.
 5. Opening Speed: 6 inches per second (150 mm/sec).
 6. Manual override in case of power failure.
- C. Control Station: Standard three button (OPEN-STOP-CLOSE) momentary control for each electrical operator.
 1. Controls: 24 VAC circuit.
 2. Surface mounted.
- D. Safety Edge: Located at bottom of curtain, full width, electro-mechanical sensitized type, wired to stop operator upon striking object, hollow neoprene covered.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that adjacent construction is suitable for door installation.
- B. Verify that electrical services have been installed and are accessible.
- C. Verify that door opening is plumb, header is level, and dimensions are correct.

- D. Notify Architect of any unacceptable conditions or varying dimensions.
- E. Commencement of installation indicates acceptance of substrate and door opening conditions.

3.02 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- E. Coordinate installation of electrical service with Division 26.
- F. Complete wiring from disconnect to unit components.

3.03 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Maximum Variation From Plumb: 1/16 inch (1.5 mm).
- C. Maximum Variation From Level: 1/16 inch (1.5 mm).
- D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft (3 mm per 3 m) straight edge.

3.04 ADJUSTING

- A. Adjust operating assemblies for smooth and noiseless operation.

3.05 CLEANING

- A. Clean installed components.
- B. Remove labels and visible markings.

SECTION 08 7100 - DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hardware for hollow metal doors.
- B. Electrically operated and controlled hardware.
- C. Thresholds.
- D. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

- A. Section 08 1113 - Hollow Metal Doors and Frames.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. BHMA - Builders Hardware Manufacturers Association.
- C. DHI (H&S) - Sequence and Format for the Hardware Schedule; 2019.
- D. DHI (KSN) - Keying Systems and Nomenclature; 2019.
- E. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.
- F. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; 1993; also in WDHS-1/WDHS-5 Series, 1996.
- G. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2025.
- K. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.
- B. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; attendance is required by affected installers and the following:
 - 1. Architect.
 - 2. Installer's Architectural Hardware Consultant (AHC).
 - 3. Hardware Installer.
 - 4. Owner's Security Consultant.
- C. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.
- D. After receipt of approved hardware schedule, Hardware supplier shall initiate a meeting including the owner's representative to determine keying requirements. Upon completion of the initial key meeting, hardware supplier shall prepare a proposed key schedule with symbols and abbreviations as set forth in the door and hardware institute's publication "Keying Procedures, Systems, and Nomenclature".

Submit copies of owner approved key schedule for review and field use in quantities as required by Division 01 - General Conditions. Wiring diagrams shall be included in final submittals transmitted for distribution and field use.

1.05 SUBMITTALS

- A. See Section 01 3000 - 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. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
 - 2. Comply with DHI (H&S) using door numbers and hardware set numbers as indicated in construction documents.
 - a. Submit in vertical format.
 - 3. List groups and suffixes in proper sequence.
 - 4. Provide complete description for each door listed.
 - 5. Provide manufacturer name, product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
 - 6. Include account of abbreviations and symbols used in schedule.
- D. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
 - 1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).
 - 2. Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
 - 3. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.
- E. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
 - 1. Submit manufacturer's parts lists and templates.
 - 2. Bitting List: List of combinations as furnished.
- F. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Manufacturers and model numbers listed are to establish a standard of function and quality. Similar items by approved manufacturers that are equal in design, function, and quality, may be considered for prior approval of the architect, provided the required data and physical samples are submitted for approval as set forth in Division 01 - General Requirements.

- C. Obtain each type of hardware (hinges, latch & locksets, exit devices, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.
- D. Electrical drawings and electrical specifications are based on the specific electrified hardware components specified in hardware sets. When electronic hardware components other than those indicated in hardware sets are provided, the supplier shall be responsible for all costs incurred by the design team and their consultants to review, and revise electrical drawings and electrical specifications. Supplier shall also be responsible for any additional costs associated with required changes in related equipment, materials, installation, or final hook up to insure the system will operate and function as indicated in the construction documents, including hardware set operational / functional descriptions.
- E. All hardware items shall be manufactured no earlier than 6 months prior to delivery to site.
- F. Hardware supplier shall be factory trained and certified by the manufacturer to provide and support all computer managed locks and system components.
- G. Hardware supplier shall participate when reasonably requested to meet with the contractor and or architect to inspect any claim for incorrect or non-functioning materials; following such inspection, the hardware supplier shall provide a written statement documenting the cause and proposed remedy of any unresolved items.
- H. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.
- I. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) to assist in work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer's Warranty: Provide warranty against defects in material and workmanship for period indicated. Complete forms in Owner's name and register with manufacturer.
 - 1. Closers: Ten years, minimum.
 - 2. Locksets and Cylinders: Three years, minimum.
 - 3. Other Hardware: Two years, minimum.

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. Accessibility: ADA Standards and ICC A117.1.
 - 3. Applicable provisions of NFPA 101.
 - 4. Listed and certified compliant with specified standards by BHMA (CPD).
 - 5. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
 - 6. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

- D. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.
- E. Fasteners:
 - 1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
 - a. Aluminum fasteners are not permitted.
 - b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
 - 2. Concealed Fasteners: Do not use through or sex bolt type fasteners on door panel sides indicated as concealed fastener locations, unless otherwise indicated.

2.02 MANUFACTURERS

- A. Provide manufacturers, products, and product lines listed within this Section and as indicated in Section 08 7105 - Hardware Groups.
- B. Substitutions: See Section 01 6000 - Product Requirements.

2.03 HINGES

- A. Acceptable manufacturers and respective catalog numbers:
 - 1. Continuous Hinges:
 - a. Edge Mount Pin & Barrel Stainless Steel:
 - 1) Ives: 700 Series
 - 2) Markar: 300 Series
 - 3) Stanley: 650 Series
 - 4) McKinney: 300 Series
 - 2. Power Transfers:
 - a. Concealed Ten-Wire:
 - 1) Von Duprin: EPT-10
 - 2) ASSA: CEPT-10
- B. Hinges: Comply with BHMA A156.1, Grade 1.
 - 1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
 - a. Provide hinge width required to clear surrounding trim.
 - 2. Continuous Hinges: Comply with BHMA A156.26.
 - a. Continuous hinges shall be full height pin and barrel type hinge providing full height door support up to 600 lbs. Edge mount (unless noted otherwise).
 - b. Construct hinges of heavy-duty 14-gauge material. The stainless internal pin shall have a diameter of 0.25 and the exterior barrel diameter of 0.438.
 - c. Hinge shall be non-handed with symmetrical template hole pattern and factory drilled. Hinge must accept a minimum of 21 fasteners on the door and 21 fasteners on the frame.
 - d. Each knuckle to be 2 inch, including split nylon bearing at each separation for quiet, smooth, self-lubricating operation.
 - e. Hinge to be able to carry Warnock Hersey Int. or UL for fire rated doors and frames up to 3 hours.
 - f. Provide machine screws for doors which have been reinforced to accept machine screws.
 - g. Note: Fire label for doors and frames should be placed on the header and top rail of fire rated doors and frames.

3. Provide hinges on every swinging door.
4. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
5. Provide non-removable pins on exterior outswinging doors.
6. Provide power transfer hinges where electrified hardware is mounted in door leaf.
 - a. Concealed power transfers shall be concealed in the door and frame when the door is closed.
 - b. Concealed power transfers shall have a steel tube to protect wires from being cut.
 - c. Concealed power transfers with spring tubes shall be rejected.
 - d. Concealed power transfers shall be supplied with a mud box to house all terminations.
7. Unless otherwise specified, furnish hinges for exterior doors, fabricated from brass, bronze, or stainless steel. Unless otherwise specified, hinges for interior doors may be fabricated from steel.
8. Unless otherwise specified, furnish hinges in the following sizes:
 - a. 4-1/2" x 4-1/2" 1-3/4" thick doors
9. Furnish hinges with sufficient width to accommodate trim and allow for 180-degree swing.
10. Unless otherwise specified, furnish hinges with flat button tips with non-rising pins at interior doors, non-removable loose pins (NRP) at exterior and out-swinging interior doors.
11. Unless otherwise specified, furnish all hinges to template standards.
12. Unless otherwise specified, furnish hinge weight and type as follows:
 - a. Standard weight: ball bearing hinge 5BB1 for interior opening 40 inches wide.
 - b. Heavyweight: 4 ball bearing hinge 5BB1HW for interior openings over 40 inches wide, and for all vestibule doors.
 - c. Heavyweight: 4 ball bearing hinge 5BB1HWss for exterior openings unless otherwise listed in groups.
13. Provide following quantity of butt hinges for each door:
 - a. Doors up to 60 inches (1.5 m) High: Two hinges.
 - b. Doors From 60 inches (1.5 m) High up to 90 inches (2.3 m) High: Three hinges.
 - c. Doors 90 inches (2.3 m) High up to 120 inches (3 m) High: Four hinges.
 - d. Doors over 42 inches wide: One additional hinge.

2.04 FLUSH BOLTS

- A. Acceptable manufacturers and respective catalog numbers:
 1. Constant Latch Flush Bolt:
 - a. Ives: FB51P/FB61P
 - b. Door Controls: 805/905
 - c. Hager: 293D/294D
 - d. Rockwood: 2849/2949
- B. Flush Bolts: Comply with BHMA A156.16, Grade 1.
 1. Flush Bolt Throw: 3/4 inch (19 mm), minimum.
 2. Provide dustproof floor strike for bolt into floor, except at metal thresholds.
 3. Unless otherwise specified, provide 12" rods for manual flush bolts for door 7'-6" or less, 24" top rods for doors over 7'-6" to 8'-6".
 4. Self-Latching Flush Bolts: Automatically latch upon closing of door; manually retracted; located on inactive leaf of pair of doors.
 5. All flush-bolt applications shall be UL listed to be installed with top flush-bolt only. Provide auxiliary fire bolt as required for fire rated openings where less bottom bolt has been specified.

2.05 ELECTRIC STRIKES

- A. Acceptable manufacturers and respective catalog numbers:
 - 1. Von Duprin 6000 Series.
 - 2. HES 1006 Series.
- B. Electric Strikes: Comply with BHMA A156.31, Grade 1.
 - 1. Provide UL (DIR) listed burglary-resistant electric strike; style to suit locks.
 - 2. Provide non-handed (verify voltage with electrical contractor) electric strike suitable for door frame material and scheduled lock configuration.
 - 3. Provide transformer and rectifier as necessary for complete installation.

2.06 LOCK CYLINDERS

- A. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
 - 1. Provide full size interchangeable core (FSIC) type cylinders, Grade 1, with six-pin core in compliance with BHMA A156.5 at locations indicated.
 - 2. Provide cams and/or tailpieces as required for locking devices.
 - 3. Within specific Door Sections, when provisions for lock cylinder are being referenced to this Section, provide specified lock cylinder and keyed to building keying system, unless otherwise indicated.

2.07 MORTISE LOCKS

- A. Acceptable manufacturers and respective catalog numbers:
 - 1. Schlage L9000 Series 17A
 - 2. Sargent 8200 Series LNP
 - 3. Corbin ML2000 Series PS
 - 4. Best 45H Series 14H
- B. Mortise Locks: Complying with BHMA A156.13, Grade 1.
 - 1. Latchbolt Throw: 3/4 inch (19 mm), minimum.
 - 2. Deadbolt Throw: 1 inch (25.4 mm), minimum.
 - 3. Backset: 2-3/4 inch (70 mm) 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.
 - 5. Provide guarded latch bolts for all locksets, and latch bolts with sufficient throw to maintain fire rating of both single and paired door assemblies.
 - 6. Length of strike lip shall be sufficient to clear surrounding trim.
 - 7. Provide wrought boxes for strikes at inactive doors, wood frames, and metal frames without integral mortar covers.

2.08 CLOSERS

- A. Acceptable manufacturers and respective catalog numbers:
 - 1. LCN 4050/4050 EDA
 - 2. Norton R7500/PR75
 - 3. Sargent 351/351P10
- B. Closers: Comply with BHMA A156.4, Grade 1.
 - 1. Type: Surface mounted to door.

2. Obtain door closers from a single manufacturer, although several may be indicated as offering products complying with requirements.
3. Provide extra heavy duty arm (EDA / HD) when closer is to be installed using parallel arm mounting.
4. Hardware supplier shall coordinate with related trades to ensure aluminum frame profiles will accommodate specified door closers.
5. Closers shall use high strength cast cylinders, forged main arms, and 1 piece forged steel pistons.
6. Closers shall utilize a stable fluid withstanding temperature range of +120 deg F to -30 deg F without seasonal adjustment of closer speed to properly close the door. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with standards UL10C.
7. Unless otherwise specified, all door closers shall have full covers and separate adjusting valves for sweeps, latch, and backcheck.
8. Provide closers for all labeled doors. Provide closer series and type consistent with other closers for similar doors specified elsewhere on the project.
9. Provide closers with adjustable spring power. Size closers to ensure exterior and fire rated doors will consistently close and latch doors under existing conditions. Size all other door closers to allow for reduced opening force not to exceed 5 lbs.
10. Install closers on the room side of corridor doors, stair side of stairways and interior side of exterior doors.
11. Closers shall be furnished complete with all mounting brackets and cover plates as required by door and frame conditions, and by adjacent hardware.
12. Door closers shall be provided with a powder coat finish to provide superior protection against the effects of weathering. Powder coat finish shall successfully pass a 100 hour salt spray test.
13. Pressure Relief Valve, PRV, shall not be acceptable.

2.09 OVERHEAD STOPS AND HOLDERS

- A. Acceptable manufacturers and respective catalog numbers:
 1. Surface Mount:
 - a. Glynn-Johnson GJ900 Series
 - b. Rixson 9 Series
 - c. Sargent 590
- B. Overhead Stops and Holders (Door Checks): Comply with BHMA A156.8, Grade 1.
 1. Overhead stops (including slide block and end caps) shall be fabricated from metal.
 2. Unless otherwise specified, furnish GJ900 series overhead stop for doors equipped with regular arm surface type closers that swing more than 140 degrees before striking a wall, for doors that open against equipment, casework, sidelights, or other objects that would make wall bumpers inappropriate, and as specified in hardware groups.
 3. Furnish sex bolt attachments for wood and mineral core doors unless doors are supplied with proper reinforcing blocks.
 4. Provide special stop only ("SE" suffix) overhead stops when used in conjunction with electronic hold open closers.
 5. Do not provide holder function for labeled doors.

2.10 PROTECTION PLATES

- A. Acceptable manufacturers and respective catalog numbers:
 1. Rockwood K1050

2. Hager 190S
 3. Ives 8400
 4. Hiawatha J102
- B. Protection Plates: Comply with BHMA A156.6.
1. Where specified, provide 10" kick plates, 34" armor plates, and 4" mop plates. Unless otherwise specified, metal protective plates shall be .050" thick; plastic plates shall be 1/8" thick.
 2. Protective plates shall be 2" less door width, or 1" less door width at pairs. Protection plates over 16" shall not be provided for labeled doors unless specifically approved by door manufacturers listing.
 3. Where specified, provide surface mounted door edges. Edges shall butt to protective plates. Provide edges with cutouts as required adjacent hardware.
 4. Adjust dimensions of protection plates to accommodate stile and rail dimensions, lite and louver cutouts, and adjacent hardware. Where required by adjacent hardware, protection plates shall be factory drilled for cylinders or other mortised hardware.
- C. Metal Properties: Stainless steel.
1. Metal, Standard Duty: Thickness 0.050 inch (1.27 mm), minimum.
- D. Edges: Beveled, on four sides unless otherwise indicated.
- E. Fasteners: Countersunk screw fasteners.

2.11 WALL STOPS

- A. Acceptable manufacturers and respective catalog numbers:
1. Wrought Concave Wall Bumper:
 - a. Ives WS406
 - b. Hager 236W
 - c. Burns 575
 - d. Rockwood 409
- B. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
1. Furnish a stop or holder for all doors. Furnish floor stops or hinge pin stops only where specifically specified.
 2. Where wall stops are not applicable, furnish overhead stops.
 3. Do not provide holder function for labeled doors.

2.12 THRESHOLDS

- A. Acceptable manufacturers and respective catalog numbers:
1. Zero 8655
 2. Pemko 171
 3. National Guard Products 425
 4. Reese S205
- B. Thresholds: Comply with BHMA A156.21.
1. Provide threshold at each exterior door, unless otherwise indicated.
 2. Material: Aluminum.
 3. Threshold Surface: Fluted horizontal grooves across full width.
 4. Provide non-corroding fasteners at exterior locations.
 5. Hardware supplier shall verify all finish floor conditions and coordinate proper threshold as required to insure a smooth transition between threshold and interior floor finish.

6. Threshold Types:
 - a. Unless otherwise specified, provide saddle threshold similar to Zero 8655 for all exterior openings with an interior floor finish less than or equal to 1/4" in height.
 - b. Unless otherwise specified, provide half saddle threshold similar to Zero 1674 for all exterior openings with an interior floor finish greater than 1/4" in height. Threshold height shall match thickness of interior floor finish.

2.13 WEATHERSTRIPPING AND GASKETING

- A. Acceptable manufacturers and respective catalog numbers:
 1. Weatherstrip:
 - a. Zero 429
 - b. Pemko 2981_PK
 - c. National Guard Products 700NA
 - d. Reese 755
 2. Sweeps with Drip:
 - a. Zero 8198
 - b. Pemko 345_N
 - c. National Guard Products C627
 - d. Reese 354
 3. Drip Cap:
 - a. Zero 142
 - b. Pemko 346
 - c. National Guard Products 16
 - d. Reese R201
- B. Weatherstripping and Gasketing: Comply with BHMA A156.22.
 1. Head and Jamb Type: Adjustable.
 2. Door Sweep Type: Encased in retainer.
 3. Material: Aluminum, with brush weatherstripping.
 4. Provide gasketing (equal to Zero 188S) for smoke and draft control doors that complies with local codes, requirements of assemblies tested in accordance with UL 1784.
 5. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
 6. Provide door bottom sweep on each exterior door, unless otherwise indicated.

2.14 LATCH PROTECTOR

- A. Latch Protector: Provide on door to protect latch from being tampered with while in locked position.
 1. Type: Standard latch protector.
 2. Material: Stainless steel.

2.15 KEY CONTROL SYSTEMS

- A. Key Control Systems: Comply with guidelines of BHMA A156.28.
 1. Provide keying information in compliance with DHI (KSN) standards.
 2. Keying: Grand master keyed.
 3. Include control keying with removable core cylinders.
 4. Supply keys in following quantities:
 - a. 1 each Grand Master keys.
 - b. 2 each Control keys if new system.

- c. 2 each Change keys for each keyed core.
- 5. Deliver keys with identifying tags to Owner by security shipment direct from hardware supplier.
- 6. Permanent Keys and Cores: Stamped with applicable key marking for identification. Do not include actual key cuts within visual key control marks or codes. Stamp permanent keys "Do Not Duplicate."
- 7. Owner or Owner's agent install permanent cores and return construction cores to hardware supplier. Construction cores and keys to remain property of hardware supplier.

2.16 KEY CABINET

- A. Acceptable manufacturers and respective catalog numbers:
 - 1. Lund 1200-1205 AA
 - 2. Key Control M228-2480
 - 3. Telkee RWC-AWC
- B. Key Cabinet: Sheet steel construction, piano hinged door with key lock; BHMA A156.28.
 - 1. Mounting: Wall-mounted.
 - 2. Capacity: Actual quantity of keys, plus 50 percent additional capacity.
 - 3. Size key hooks to hold 6 keys each.
 - 4. Finish: Baked enamel, manufacturer's standard color.
 - 5. Key cabinet lock to building keying system.
 - 6. Furnish key cabinet complete with cam lock, permanent key tags, and change key cards.
 - 7. Hardware supplier shall prepare all key change index records, tag all keys and place permanent file keys in cabinet.

2.17 POWER SUPPLY

- A. Power Supply: Hard wired, with multiple zones providing eight (8) breakers for each output panel with individual control switches and LED's; UL (DIR) Class 2 listed.
 - 1. Operating Temperature: 32 to 110 degrees F (0 to 43 degrees C).
 - 2. 12/24 VDC Output, field selectable.
 - 3. Class 2 Rated power limited output.
 - 4. Universal 120-240 VAC input.
 - 5. Low voltage DC, regulated and filtered.
 - 6. Polarized connector for distribution boards.
 - 7. Fused primary input.
 - 8. AC input and DC output monitoring circuit w/LED indicators.
 - 9. Cover mounted AC Input indication.
 - 10. Tested and certified to meet UL294.
 - 11. NEMA 1 enclosure.
 - 12. Hinged cover w/lock down screws.
 - 13. High voltage protective cover.
 - 14. All electro-mechanical systems requiring fail safe circuits shall be capable of interfacing with the fire alarm system to cut power to appropriate system components. Unless already provided in another system component, all power supplies utilized in fail safe circuits shall include an integral relay which when connected to the N/C fire alarm contact will cut power to all openings connected to the individual power supply. Power supply, unless otherwise specified, will automatically reset itself when fire alarm relay returns to normal state following a fire alarm.

2.18 FINISHES

- A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
 - 1. Primary Finish: 626; satin chromium plated over nickel, with brass or bronze base material (former US equivalent US26D); BHMA A156.18.
 - 2. Secondary Finish: 630; satin stainless steel, with stainless steel 3000 series base material (former US equivalent US32D); BHMA A156.18.
 - a. Use secondary finish in kitchens, bathrooms, and other spaces containing chrome or stainless steel finished appliances, fittings, and equipment; provide primary finish on one side of door and secondary finish on other side if necessary.
 - b. Use secondary finish in exterior or high humidity locations.
 - 3. Exceptions:
 - a. Where base material metal is specified to be different, provide finish that is an equivalent appearance in accordance with BHMA A156.18.
 - b. Door Closer Covers and Arms: Color as selected by Architect from manufacturer's standard colors unless otherwise indicated.
 - c. Aluminum Surface Trim and Gasket Housings: Anodized to match door panel finish, not other hardware, unless otherwise indicated.
 - d. Hardware for Aluminum Entrance Doors: Finished to match door panel finish, except at hand contact surfaces provide stainless steel with satin finish, unless otherwise indicated.

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. Install hardware for smoke and draft control doors in accordance with NFPA 105.
- C. Use templates provided by hardware item manufacturer.
- D. 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.
 - 1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
 - 2. For Wood Doors: Install in compliance with DHI WDHS.3 recommendations.
 - 3. Mounting heights in compliance with ADA Standards:
 - a. Locksets: 40-5/16 inch (1024 mm).
- E. 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 work under provisions of Section 01 7000 - Execution and Closeout Requirements.
- B. Adjust hardware for smooth operation.
- C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.04 CLEANING

- A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

- B. Clean adjacent surfaces soiled by hardware installation.
- C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.05 PROTECTION

- A. Protect finished Work under provisions of Section 01 7000 - Execution and Closeout Requirements.
- B. Do not permit adjacent work to damage hardware or finish.

SECTION 08 7105 - HARDWARE GROUPS

HDWE GROUP 1.0

Qty	Description	Product Number	Manufacturer
1 EA	Continuous hinges	700 Series	IVE
1 EA	Passage Lockset	L9010	SCH
1 EA	Wall Stop	WS406	IVE

Function:

Latch bolt by lever at all times.

HDWE GROUP 1.2

Qty	Description	Product Number	Manufacturer
1 EA	Continuous hinges	700 Series	IVE
1 EA	Passage Lockset	L9010	SCH
1 EA	Constant latch flushbolt	FB51T/FB61T	IVE
2 EA	Overhead stop/holder	90H	GLY

Function:

Latch bolt by lever at all times.

HDWE GROUP 118.0

Qty	Description	Product Number	Manufacturer
1 EA	Continuous hinges	700 Series	IVE
1 EA	Storeroom lock	L9080	SCH
1 EA	Electric strike	6000 Series, fail seuvre	VON
1 EA	Surface Closer	4050/4050 EDA	LCN
1 EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1 EA	Overhead stop	90S	GLY
1 EA	Lock guard	LG	IVE
1 EA	Rain Drip	142	ZER
1 Set	Weatherstripping	429	ZER
1 EA	Door Sweep w/ Drip	8198	ZER
1 EA	Threshold	8655	ZER
1 EA	Card Reader	By Owner	
1 EA	Door Contact	By Owner	
1 EA	Power Supply	As required	
1 EA	Elevation drawing		
1 EA	Wire Diagram	Point to point	

Function:

Outside lever fixed. Entrance by key only. Inside lever always unlocked. Presentation of valid credential momentarily unlocks doors.

HDWE GROUP 118.1

Qty		Description	Product Number	Manufacturer
1	EA	Continuous hinges	700 Series	IVE
1	EA	Power transfer	EPT10	VON
1	EA	Lockset with integral access control	CO-200-MS-70-PRK-SPA	SCH
1	EA	Lock guard	LG	IVE
1	EA	Surface Closer	4050/4050 EDA	LCN
1	EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1	EA	Overhead stop	90S	GLY
1	EA	Rain Drip	142	ZER
1	Set	Weatherstripping	429	ZER
1	EA	Door Sweep w/ Drip	8198	ZER
1	EA	Threshold	8655	ZER
1	EA	Elevation drawing		
1	EA	Wire Diagram	Point to point	

Function:

Outside lever fixed. Entrance by key only. Inside lever always unlocked. Presentation of valid credential momentarily unlocks doors.

HDWE GROUP 118.2

Qty		Description	Product Number	Manufacturer
1	EA	Continuous hinges	700 Series	IVE
1	EA	Storeroom lock	L9080	SCH
1	EA	Electric strike	6000 Series, fail seure	VON
1	EA	Surface Closer	4050/4050 EDA	LCN
1	EA	Armor plate	8400 34" x 2" LDW B4E	IVE
1	EA	Overhead stop/holder	90H	GLY
1	EA	Lock guard	LG	IVE
1	EA	Rain Drip	142	ZER
1	Set	Weatherstripping	429	ZER
1	EA	Door Sweep w/ Drip	8198	ZER
1	EA	Threshold	8655	ZER
1	EA	Card Reader	By Owner	
1	EA	Door Contact	By Owner	
1	EA	Power Supply	As required	
1	EA	Elevation drawing		
1	EA	Wire Diagram	Point to point	

Function:

Outside lever fixed. Entrance by key only. Inside lever always unlocked. Presentation of valid credential momentarily unlocks doors.

HDWE GROUP 118.3

Qty		Description	Product Number	Manufacturer
1	EA	Continuous hinges	700 Series	IVE
1	EA	Power transfer	EPT10	VON
1	EA	Lockset with integral access control	CO-200-MS-70-PRK-SPA	SCH
1	EA	Lock guard	LG	IVE
1	EA	Surface Closer	4050/4050 EDA	LCN
1	EA	Armor plate	8400 34" x 2" LDW B4E	IVE

1	EA	Overhead stop/holder	90H	GLY
1	EA	Rain Drip	142	ZER
1	Set	Weatherstripping	429	ZER
1	EA	Door Sweep w/ Drip	8198	ZER
1	EA	Threshold	8655	ZER
1	EA	Elevation drawing		
1	EA	Wire Diagram	Point to point	

Function:

Outside lever fixed. Entrance by key only. Inside lever always unlocked. Presentation of valid credential momentarily unlocks doors.

END OF SECTION

SECTION 08 9100 - LOUVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Louvers, frames, and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 6200 - Sheet Metal Flashing and Trim.
- B. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

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. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2023.
- C. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices; 2021, with Editorial Revision (2022).
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.
- C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, and tolerances; head, jamb and sill details; blade configuration, screens, blank-off areas required, and frames.
- D. Test Reports: Independent agency reports showing compliance with specified performance criteria.

1.05 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Provide five year manufacturer's warranty against distortion, metal degradation, and connection failures of louver components.
 - 1. Finish: Include twenty year coverage against degradation of exterior finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Louvers:
 - 1. Airolite Company, LLC: www.airolite.com.
 - 2. Construction Specialties, Inc: www.c-sgroup.com.
 - 3. Industrial Louvers, Inc: www.industriallouvers.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LOUVERS

- A. Louvers (LOUVER-1): Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.
 - 1. Basis of Design: Industrial Louvers Model 653XP.

2. Wind Load Resistance: Design to resist positive and negative wind load as required by code without damage or permanent deformation.
 3. Intake Louvers: Design to allow maximum of 0.01 oz/sq ft (3.1 g/sq m) water penetration at calculated intake design velocity based on design air flow and actual free area, when tested in accordance with AMCA 500-L.
 4. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.
- B. Stationary Louvers: Horizontal blade, formed galvanized steel sheet construction.
1. Free Area: 50 percent, minimum.
 2. Blades: Drainable.
 3. Frame: Depth as indicated on drawings, channel profile; corner joints mitered and , with continuous recessed caulking channel each side.
 4. Steel Thickness, Galvanized: Frame 16 gauge, 0.0598 inch (1.52 mm) minimum base metal; blades 16 gauge, 0.0598 inch (1.52 mm) minimum base metal.
 5. Steel Finish: Superior performing organic coating, finished after fabrication.

2.03 MATERIALS

- A. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

2.04 FINISHES

- A. Superior Performing Organic Coatings System: Manufacturer's standard multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch (0.030 mm).
- B. Color: As indicated on drawings.

2.05 ACCESSORIES

- A. Bird Screen: Interwoven wire mesh of steel, 14 gauge, 0.0641 inch (1.63 mm) diameter wire, 1/2 inch (13 mm) open weave, diagonal design.
- B. Insect Screen: 18 x 16 size aluminum mesh.
- C. Fasteners and Anchors: Galvanized steel.
- D. Head and Sill Flashings: See Section 07 6200.
- E. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.

3.02 INSTALLATION

- A. Install louver assembly in accordance with manufacturer's instructions.
- B. Coordinate with installation of flashings by others.
- C. Install louvers level and plumb.
- D. Align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
- E. Secure louver frames in openings with concealed fasteners.

3.03 CLEANING

- A. Strip protective finish coverings.
- B. Clean surfaces and components.

SECTION 09 2116 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- D. Acoustic insulation.
- E. Gypsum sheathing.
- F. Cementitious backing board.
- G. Gypsum wallboard.
- H. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 2600 - Vapor Retarders: Vapor-impermeable membranes.
- B. Section 07 8400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
- C. Section 07 9200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

- A. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.
- B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).
- C. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.
- D. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2023.
- E. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.
- F. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.
- G. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
- H. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- I. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.
- J. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.
- K. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2018.
- L. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2022, with Editorial Revision (2023).
- M. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

- N. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- O. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.
- P. GA-600 - Fire Resistance and Sound Control Design Manual; 2024.
- Q. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on metal framing, gypsum board, glass mat faced gypsum board, accessories, and joint finishing system.
- C. Sustainability Design Documentation: Provide applicable sustainability documentation for each product as described in Section 01 3329 - Sustainable Design Requirements.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

- A. Products listed as Basis of Design have been selected using sustainability criteria. Products from other manufacturer's listed herein, and/or substitutions will only be accepted if they meet, or exceed, the performance of the Basis of Design. Manufacturer must be able to provide sustainability documentation showing that the product meets, or exceeds, the Basis of Design.

2.02 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
- B. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:
 - 1. Gypsum Association File Numbers: Comply with requirements of GA-234 and GA-600 for the particular assembly.
 - 2. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.03 METAL FRAMING MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.
- B. Sustainability Requirements: Manufacturers must be able to provide the following, or acceptable alternate, product documentations:
 - 1. Environmental Product Declaration (EPD) or Declare Label.
 - 2. Health Product Declaration (HPD).
- C. Basis of Design: ClarkDietrich; www.clarkdietrich.com.
- D. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements - Metal Framing, Connectors, and Accessories:
 - 1. Marino: www.marinoware.com.
 - 2. SCAFCO Corporation: www.scafco.com.
 - 3. Steel Construction Systems: www.steelconsystems.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- E. Nonstructural Framing System Components: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf (L/120 at 240 Pa).

1. Provide minimum CP 90 corrosion protection where installed in exterior applications and humid environments.
2. Studs: "C" shaped with flat or formed webs with knurled faces.
 - a. (MET STUD-2): Provide 20 gauge studs unless noted otherwise.
3. Runners: U shaped, sized to match studs.
4. Furring Members : Zee-shaped sections, minimum depth as indicated on drawings.

2.04 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 1. CertainTeed Corporation: www.certainteed.com/.
 2. Georgia-Pacific Gypsum: www.gpgypsum.com.
 3. Gold Bond Building Products, LLC provided by National Gypsum Company: www.goldbondbuilding.com.
 4. USG Corporation: www.usg.com.
 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Backing Board For Wet Areas: One of the following products:
 1. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 2. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
 - a. Sustainability Requirements: Manufacturers must be able to provide the following, or equivalent, product documentations:
 - 1) Environmental Product Declaration (EPD) or Declare Label.
 - 2) Health Product Declaration (HPD).
 - b. Basis of Design: USG Corporation; Durock Brand Cement Board with EdgeGuard: www.usg.com.
 - c. Thickness (CEM BD-2): 5/8 inch (15.9 mm).
 - d. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
 - 1) PermaBASE Building Products, LLC provided by National Gypsum Company; PermaBase Cement Board: www.goldbondbuilding.com/#sle.
 - 2) Substitutions: See Section 01 6000 - Product Requirements.
 3. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
 - a. Regular Type (GYP BD-16): Thickness: 5/8 inch (15.9 mm).
 - b. Sustainability Requirements: Manufacturers must be able to provide the following, or equivalent, product documentations:
 - 1) Environmental Product Declaration (EPD) or Declare Label.
 - 2) Health Product Declaration (HPD).
 - c. Basis of Design: USG Corporation; Durock Brand Glass Mat Tile Backer Board: www.usg.com.
 - d. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
 - 1) Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Fire-Shield Tile Backer: www.goldbondbuilding.com.
 - 2) Substitutions: See Section 01 6000 - Product Requirements.

- 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 X Thickness (GYP BD-6): 5/8 inch (16 mm).
 - 3. Edges: Tapered.
 - 4. Sustainability Requirements: Manufacturers must be able to provide the following, or equivalent, product documentations:
 - a. Living Building Challenge Red List Free or Compliant.
 - b. Declare Label.
 - c. Environmental Product Declaration (EPD).
 - d. Health Product Declaration (HPD).
 - 5. Basis of Design: USG Corporation; Sheetrock Brand Mold Tough EcoSmart.
 - 6. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
 - a. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Fire-Shield Gypsum Board: www.goldbondbuilding.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.05 GYPSUM BOARD ACCESSORIES

- A. Acoustic Insulation (INSUL-80): ASTM C665; preformed fiber glass or mineral fiber, friction fit type, unfaced. Thickness: 3-1/2 inch (84 mm), minimum. Insulation should fill the cavity.
 - 1. Sustainability Requirements: Manufacturers must be able to provide the following, or equivalent, product documentations:
 - a. Living Building Challenge Red List Free or Compliant.
 - b. Declare Label.
 - c. Environmental Product Declaration (EPD).
 - d. Health Product Declaration (HPD).
 - 2. Basis of Design: Owens Corning Unfaced Ecotouch Insulation.
 - a. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements.
- B. Backing Plate (MET BLKG-1): Metal backing plate. 20 gauge. Width and length as required for application.
- C. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- D. Vapor Retarder: See Section 07 2600.
- E. Finishing Accessories: ASTM C1047, extruded aluminum alloy (6063 T5) or galvanized steel sheet ASTM A924/A924M G90, unless noted otherwise.
 - 1. Types: As detailed or required for finished appearance.
- F. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 - 1. Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners.
 - 2. Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C1007/AISI S220 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
- C. Studs: Space studs at 16 inches on center (at 406 mm on center).
 - 1. Extend partition framing to structure where indicated and to ceiling in other locations.
 - 2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches (100 mm) from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches (600 mm) on center.
- F. Acoustic Furring: Install resilient channels at maximum 24 inches (600 mm) on center. Locate joints over framing members.
- G. Furring for Fire-Resistance Ratings: Install as required for fire-resistance ratings indicated and to GA-600 requirements.

3.03 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.

3.04 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
 - 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- D. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- E. Installation on Metal Framing: Use screws for attachment of gypsum board.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 - 1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
 - 2. Provide a control joint at both sides of the wall at every door frame. Locate at hinge side of door.

3. Provide a control joint at both sides of the wall at openings in the wall. Provide on one side of the opening for openings 48 inches wide or less. For openings over 48 inches, provide on both sides of the opening.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.
- B. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
- C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish 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: Wall areas above finished ceilings, whether or not accessible in the completed construction.
- D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
- E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.07 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

SECTION 09 3000 - TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Ceramic trim.
- D. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- B. Section 09 2116 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

- A. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2023.
- B. ANSI A108.1b - Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar; 2023.
- C. ANSI A108.1c - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar; 2023.
- D. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship; 2019.
- E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive; 2023.
- F. ANSI A108.5 - Setting of Ceramic Tile with Dry-Set Cement Mortar, Modified Dry-Set Cement Mortar, EGP (Exterior Glue Plywood) Modified Dry-Set Cement Mortar, or Improved Modified Dry-Set Cement Mortar; 2023.
- G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy; 2023.
- H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2024).
- I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 2023.
- J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 2017 (Reaffirmed 2022).
- K. ANSI A108.12 - Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Modified Dry-Set Mortar; 2023.
- L. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2021).
- M. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2020.

- N. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs; 2020.
- O. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2019.
- P. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2023.
- Q. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2023.
- R. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2025.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Samples: Provide two tiles, actual size, illustrating pattern and color.
- 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 6000 - Product Requirements, for additional provisions.
 - 2. Extra Tile: 10 square feet (1 square meters) of each size, color, and surface finish combination.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature above 50 degrees F (10 degrees C) and below 100 degrees F (38 degrees C) during installation and curing of setting materials.

1.08 WARRANTY

- A. Tile and Stone Installation System Warranty: Manufacturer's standard system warranty protecting against break down or deterioration of the tile setting system under normal usage, and ensuring the products are free from manufacturer defects. Manufacturer shall pay for replacement of its own products and replacement of finishing materials, including labor, for defective portions of the project.
 - 1. Warranty Period: 25 years.

PART 2 PRODUCTS

2.01 TILE

- A. Manufacturers: All products of each type by the same manufacturer.
- B. Ceramic or Porcelain Tile (T-#), (WT-#): ANSI A137.1 standard grade.
 - 1. Basis of Design: See drawings for product information.

2.02 TRIM AND ACCESSORIES

- A. Ceramic Trim (TB-#): Matching bullnose and cove base ceramic shapes in sizes coordinated with field tile.
 - 1. Basis of Design: See drawings for product information.
 - 2. Applications:
 - a. Open Edges: Bullnose.
 - b. Inside Corners: Jointed.
 - c. Floor to Wall Joints: Cove base.
 - 3. Manufacturers: Same as for tile.
- B. Non-Ceramic Trim (MT-#): Satin natural anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
 - 1. Basis of Design: See drawings for product information.
 - 2. Manufacturers:
 - a. Schluter-Systems: www.schluter.com.
 - b. Profilitec Corp.: www.us.profilitec.com/en-us.
 - c. Substitutions: See Section 01 6000 - Product Requirements.

2.03 SETTING MATERIALS

- A. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.
 - 1. Applications: Use this type of bond coat where indicated, and where no other type of bond coat is indicated.
 - a. Typical Floors:
 - 1) LATICRETE 254 Platinum.
 - 2) TEC Specialty Full Flex.
 - b. Typical Walls:
 - 1) LATICRETE Tri Lite.
 - 2) TEC Specialty Ultimate Large Tile.

2.04 GROUTS

- A. Manufacturers:
 - 1. (GT-#1) Grout: Basis of Design: See Finish Schedule on drawings.
 - 2. H.B. Fuller Construction Products, Inc: www.tecspecialty.com/#sle.
 - 3. LATICRETE International, Inc: www.laticrete.com/#sle.
 - 4. Mapei Corporation: www.mapei.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. High Performance Polymer Modified Grout (GT-#): ANSI A118.7 polymer modified cement grout.
 - 1. Applications: Use this type of grout for typical walls.
 - 2. Use sanded grout for joints 1/8 inch (3.2 mm) wide and larger; use unsanded grout for joints less than 1/8 inch (3.2 mm) wide.
 - 3. Color(s): As selected by Architect from manufacturer's full line.
 - 4. Basis of Design:
 - a. H.B. Fuller Construction Products, Inc; TEC AccuColor Plus Grout: www.tecspecialty.com/#sle.
 - b. LATICRETE International, Inc; LATICRETE PERMACOLOR Select Grout: www.laticrete.com/#sle.
 - c. Substitutions: See Section 01 6000 - Product Requirements.

- d. See drawings for product information

2.05 MAINTENANCE MATERIALS

- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
 - 1. Applications: Between tile and plumbing fixtures.
 - 2. Color(s): As selected by Architect from manufacturer's full line.
 - 3. Products:
 - a. LATICRETE International, Inc; LATICRETE LATASIL: www.laticrete.com/#sle.
 - b. TEC Specialty; Silicone Caulk.
 - c. Substitutions: See Section 01 6000 - Product Requirements.

2.06 ACCESSORY MATERIALS

- A. Waterproofing Membrane: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
 - 1. Application: Provide at walls and ceilings in showers only. Provide at all floors.
 - 2. Fluid or Trowel Applied Type:
 - a. Products:
 - 1) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
 - 2) TEC Specialty; HydraFlex.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

- A. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.20, manufacturer's instructions, and TCNA (HB) recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Install non-ceramic trim in accordance with manufacturer's instructions.
- G. Sound tile after setting. Replace hollow sounding units.
- H. Keep control and expansion joints free of mortar, grout, and adhesive.
- I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- J. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F115, with epoxy grout. Provide waterproofing membrane under all tile.
 - 1. Use uncoupling membrane under all tile unless other underlayment is indicated.

3.05 INSTALLATION - SHOWERS AND BATHTUB WALLS

- A. At walls install in accordance with TCNA (HB) Method B412, over cementitious backer units with waterproofing membrane.
- B. Grout with polymer modified grout.

3.06 INSTALLATION - WALL TILE

- A. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.
- B. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.

3.07 CLEANING

- A. Clean tile and grout surfaces.

3.08 PROTECTION

- A. Do not permit traffic over finished floor surface for 4 days after installation.

SECTION 09 5100 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Divisions 21 through 28 for mechanical and electrical components in acoustical ceilings.

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- B. ASTM 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 E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.
- E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on suspension system components and acoustical units.
- C. Samples: Submit two samples 4 x 6 inch (100 x 150 mm) in size illustrating material and finish of acoustical units.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.06 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc: www.armstrongceilings.com.
 - 2. CertainTeed Corporation: www.certainteed.com.
 - 3. USG Corporation: www.usg.com/ceilings.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Suspension Systems:
 - 1. Armstrong World Industries, Inc: www.armstrongceilings.com.
 - 2. CertainTeed Corporation: www.certainteed.com.
 - 3. Rockfon, LLC: www.rockfon.com.
 - 4. USG Corporation: www.usg.com/ceilings.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACOUSTICAL UNITS

- A. Acoustical Units - General: ASTM E1264, Class A.
 - 1. VOC Content: As specified in Section 01 6116.
- B. Acoustical Panels (ACT-#):
 - 1. Basis of Design: See drawings for product information.

2.03 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.
 - 1. Materials:
 - a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
- B. Exposed Suspension System: Hot-dipped galvanized steel grid with aluminum cap.
 - 1. Profile: Tee; 15/16 inch (24 mm) face width.
 - 2. Finish: Baked enamel.
 - 3. Color: White.
- C. Exposed Suspension System: Hot-dipped galvanized steel grid and cap.
 - 1. Profile: Tee; 9/16 inch (14 mm) face width.
 - 2. Finish: Baked enamel.
 - 3. Color: White.

2.04 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch (2 mm) galvanized steel wire.
- C. Hold-Down Clips: Manufacturer's standard clips to suit application.
- D. Perimeter Moldings: Same metal and finish as grid.
 - 1. Size: As required for installation conditions.
 - 2. Angle Molding: L-shaped, for mounting at same elevation as face of grid.
- E. Metal Edge Trim for "Cloud" Suspension Systems (CLG TRIM-1): Steel or extruded aluminum; provide attachment clips, splice plates, and preformed corner pieces for complete trim system.
 - 1. Trim Height: 6 inches (152 mm).

2. Finish: Baked enamel.
3. Color: White.
4. Basis of Design:
 - a. USG Corporation; Compasso Suspension Trim: www.usg.com/ceilings/.
- F. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, ASTM C636/C636M, ASTM E580/E580M, ASTM C636/C636M, and ASTM E580/E580M and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Locate system on room axis according to reflected plan.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 1. Use longest practical lengths.
 2. Miter 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. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.
- I. 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.
 2. Double cut and field paint exposed reveal edges.
- F. Where round obstructions occur, provide preformed closures to match perimeter molding.
- G. Install hold-down clips on panels within 20 ft (6 m) of an exterior door.

3.04 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

SECTION 09 6700 - FLUID-APPLIED FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fluid-applied flooring and base.

1.02 RELATED REQUIREMENTS

- A. Section 09 9600 - High-Performance Coatings: Base coating for fluid-applied flooring.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.
- C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and application rate for each coat.
- D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Top Coat Materials: 2 gallons (8 liters).

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section.
 - 1. Minimum five years of documented experience.
 - 2. Approved by manufacturer.

1.05 MOCK-UPS

- A. Mock-ups: Before installing fluid-applied flooring, build mockups to verify selections made under sample submittals and to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship. Build mock-ups in areas indicated by Construction Manager (areas not intended for fluid-applied flooring, but used for the mockup, such as a janitor's closet. Anticipate that a minimum of three mockups will be required. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Obtain Architect's approval of mockups before installing flooring in other areas.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store resin materials in a dry, secure area.
- B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.07 FIELD CONDITIONS

- A. Maintain minimum temperature in storage area of 55 degrees F (13 degrees C).

- B. Store materials in area of installation for minimum period of 24 hours prior to installation.
- C. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fluid-Applied Flooring:
 - 1. Tnemec, Inc: www.tnemec.com.
 - 2. Key Resin Company: www.keyresin.com/#sle.
 - 3. Sherwin-Williams Company: High Performance Flooring: www.generalpolymers.com/#sle.
 - 4. Stonhard: www.stonhard.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FLUID-APPLIED FLOORING SYSTEMS

- A. Fluid-Applied Flooring (HPF-1):
 - 1. Basis of Design: As indicated on drawings.

2.03 ACCESSORIES

- A. Base Caps: Zinc with projecting base of 1/8 inch (3 mm); color as selected.
- B. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.
- C. Primer: Type recommended by fluid-applied flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive flooring.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for fluid-applied flooring installation by testing for moisture and alkalinity (pH).
 - 1. Obtain instructions if test results are not within limits recommended by fluid-applied flooring manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.
- B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.
- C. Vacuum clean substrate.
- D. Apply primer to surfaces required by flooring manufacturer.

3.03 INSTALLATION - FLOORING

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

- B. Apply each coat to minimum thickness required by manufacturer.
- C. Finish to smooth level surface.
- D. Cove at vertical surfaces.

3.04 PROTECTION

- A. Prohibit traffic on floor finish for 48 hours after installation.
- B. Barricade area to protect flooring until fully cured.

SECTION 09 9600 - HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. High performance coatings.
- B. Surface preparation.

1.02 REFERENCE STANDARDS

- A. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2023.
- B. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.
- C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- D. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- E. SSPC-SP 2 - Hand Tool Cleaning; 2024.
- F. SSPC-SP 6 - Commercial Blast Cleaning; 2007.
- G. SSPC-SP 13 - Surface Preparation of Concrete; 2018.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide complete list of all products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified coating system(s) product is to be used in; include description of each system.
 - 4. Manufacturer's installation instructions.
- C. Samples: Submit two samples 8 by 8 inch (203 by 203 mm) in size illustrating colors available for selection.
- D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- E. Maintenance Data: Include cleaning procedures and repair and patching techniques.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Coating Materials: 1 gallon (4 liters) of each type and color.
 - 2. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

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 coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Coating Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.06 FIELD CONDITIONS

- A. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the coating product manufacturer.
- C. Do not install materials when temperature is below 55 degrees F (13 degrees C) or above 90 degrees F (32 degrees C).
- D. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.
- E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.
- F. Restrict traffic from area where coating is being applied or is curing.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. High-Performance Coatings:
 - 1. ICP Building Solutions Group: www.scuffmaster.com.
 - 2. PPG Paints: www.ppgpaints.com.
 - 3. Sherwin-Williams Company: www.protective.sherwin-williams.com/industries.
 - 4. Tennant Company: www.tennantcoatings.com.
 - 5. Tnemec Company, Inc: www.tnemec.com.
 - 6. Substitutions: Section 01 6000 - Product Requirements.

2.02 HIGH-PERFORMANCE COATINGS

- A. MPI Standards: Provide products that comply with MPI standards indicated and are listed in MPI Approved Products List.

2.03 TOP COAT MATERIALS

- A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.
- B. Basis of Design:
 - 1. (HPC-#): See finish schedule on drawings for products and colors.
- C. Masonry Filler: Vehicle and resin compatible with topcoats, formulated for applied thickness of 10-20 mils (0.25-0.50 mm); Basis of Design: Kem Cati-Coat HS Epoxy Filler/Sealer manufactured by Sherwin Williams.

2.04 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Do not begin application of coatings until substrates have been properly prepared.
- C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.
- D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- E. Masonry: Verify masonry joints are struck flush.

3.02 PREPARATION

- A. Clean surfaces of loose foreign matter.
- B. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.
- C. Remove finish hardware, fixture covers, and accessories and store.
- D. Concrete:
 - 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - 2. Clean concrete according to ASTM D4258. Allow to dry.
 - 3. Prepare surface as recommended by coating manufacturer and according to SSPC-SP 13.
- E. Masonry:
 - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 - 2. Prepare surface as recommended by coating manufacturer.
- F. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
 - 2. Prepare surface according to SSPC-SP 2.
- G. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning", and protect from corrosion until coated.

3.03 PRIMING

- A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

- B. Concrete Masonry: Apply masonry filler to thickness required to fill holes and produce smooth surface; minimum thickness of 10 mils (0.250 mm).

3.04 COATING APPLICATION

- A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in MPI - Architectural Painting and Specification Manual.
- B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. Clean surfaces immediately of overspray, splatter, and excess material.
- C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.06 PROTECTION

- A. Protect finished work from damage.

SECTION 10 1423 - PANEL SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Panel signage.

1.02 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's product literature for each type of panel sign, indicating styles, font, foreground and background colors, locations, and overall dimensions of each sign.
- C. Shop Drawings:
 - 1. Include dimensions, locations, elevations, materials, text and graphic layout, attachment details, and schedules.
 - 2. Schedule: Provide information sufficient to completely define each panel sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - a. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
 - b. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
 - c. Submit for approval by Owner through Architect prior to fabrication.
- D. Verification Samples: Submit samples showing colors, materials, and finishes specified.
- E. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store under cover and elevated above grade.

1.05 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain minimum ambient temperature during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Panel Signage:
 - 1. Best Sign Systems, Inc: www.bestsigns.com.
 - 2. Inpro Corporation: www.inprocorp.com.
 - 3. Mohawk Sign Systems, Inc: www.mohawksign.com.
 - 4. Seton Identification Products: www.seton.com.

5. Gemini: www.signletters.com.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 REGULATORY REQUIREMENTS

- A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

2.03 PANEL SIGNAGE

- A. Panel Signage:
 1. Description: Flat signs with engraved panel media, tactile characters.
 2. Sign Size: 8 inches square, unless noted otherwise on the drawings.
 3. Sign Edges: Bevelled.
 4. Letter Edges: Squared.
 5. Corners: Squared.
 6. Material: Acrylic plastic base with applied plastic letters and braille.
 7. Profile: Flat panel without frame.
 - a. Clear Cover: For customer produced sign media, provide clear cover of polycarbonate plastic, glossy on back, non glare on front.
 8. Tactile Letters: Raised 1/32 inch minimum.
 9. Braille: Grade II, ADA-compliant.
 10. One-Sided Wall Mounting: Tape adhesive.

2.04 SIGNAGE APPLICATIONS

1. Office Doors: Identify with room names and numbers to be determined later, not those indicated on drawings; provide "window" section for replaceable occupant name.
2. Conference and Meeting Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings; provide "window" section with sliding "In Use/Vacant" indicator.
3. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
4. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.

2.05 ACCESSORIES

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install with horizontal edges level.
- C. Locate panel signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

SECTION 10 2113.19 - PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Solid plastic toilet compartments.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Blocking and supports.
- B. Section 10 2800 - Toilet, Bath, and Laundry Accessories.

1.03 REFERENCE STANDARDS

- A. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2024.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on panel construction, hardware, and accessories.
- C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
- D. Samples: Submit two samples of partition panels, 6 x 6 inch (152 x 152 mm) in size illustrating panel finish, color, and sheen.
- E. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Solid Plastic Toilet Compartments:
 - 1. All American Metal Corp - AAMCO: www.allamericanmetal.com.
 - 2. ASI Accurate Partitions: www.asi-accuratepartitions.com.
 - 3. ASI Global Partitions: www.asi-globalpartitions.com.
 - 4. Metpar Corp: www.metpar.com.
 - 5. Sanymetal Products Company: www.sanymetal.com.
 - 6. Scranton Products: www.scrantonproducts.com.
 - 7. Substitutions: Section 01 6000 - Product Requirements.

2.02 PLASTIC TOILET COMPARTMENTS

- A. Solid Plastic Toilet Compartments (COMP-1): Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), Class A, tested in accordance with NFPA 286; floor-mounted unbraced.
 - 1. Color: Single color as selected.
- B. Doors:
 - 1. Thickness: 1 inch (25 mm).
 - 2. Width: 24 inch (610 mm).
 - 3. Width for Handicapped Use: 36 inch (915 mm), out-swinging.
 - 4. Height: 72 inch (1829 mm).
- C. Panels:

1. Thickness: 1 inch (25 mm).
 2. Height: 72 inch (1829 mm).
 3. Depth: As indicated on drawings.
- D. Pilasters:
1. Thickness: 1 inch (25 mm).
 2. Width: As required to fit space; minimum 3 inch (76 mm).

2.03 ACCESSORIES

- A. Pilaster Shoes: Stainless steel, satin finish, 3 inches (76 mm) high; concealing floor fastenings.
1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
- B. Head Rails: Extruded aluminum, anti-grip profile.
1. Size: Manufacturer's standard size.
- C. Wall and Pilaster Brackets: Stainless steel; manufacturer's standard type for conditions indicated on drawings.
- D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.
 2. Continuous brackets, 68 inches (1727 mm).
- E. Hinges: Stainless steel, manufacturer's standard finish.
1. Continuous-type hinge, self closing, full height, 71 inches (1778 mm).
- F. Door Hardware: Stainless steel, manufacturer's standard finish.
1. Door Latch: Slide type with exterior emergency access feature.
 2. Occupancy indicator.
 3. Door Strike and Keeper with Rubber Bumper: Mount on pilaster in alignment with door latch.
- G. Coat Hook with Rubber Bumper: One per compartment, mounted on door.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 inch to 1/2 inch (9 mm to 13 mm) space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

3.03 TOLERANCES

- A. Maximum Variation From True Position: 1/4 inch (6 mm).
- B. Maximum Variation From Plumb: 1/8 inch (3 mm).

3.04 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).

- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.
- C. Adjust adjacent components for consistency of line or plane.

SECTION 10 2600 - WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Corner guards.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Blocking for wall and corner guard anchors.

1.03 REFERENCE STANDARDS

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2023, with Editorial Revision.
- B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents; 2021.
- C. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2023.
- 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 3000 - 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. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
 - 1. Submit two sections of corner guards, 6 inches (152 mm) long.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Stock Materials: One package(s) of minimum 96 inches (2438 mm) long unit of each kind of covers for corner guards.

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 7800 - 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. Structural failures or internal connection failures.

- b. Deterioration of materials beyond that expected of normal use, as intended by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Corner Guards:
 - 1. Construction Specialties, Inc: www.c-sgroup.com.
 - 2. Inpro: www.inprocorp.com.
 - 3. Koroseal Interior Products: www.koroseal.com.
 - 4. Nystrom, Inc: www.nystrom.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE CRITERIA

- A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.
- B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.
- C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

2.03 PRODUCT TYPES

- A. Corner Guards - Surface Mounted (CG-3):
 - 1. Material: Type 304 stainless steel, No. 4 satin finish, 20 gauge, minimum thickness; surface mount.
 - 2. Width of Wings: 2 inches (51 mm)
 - 3. Corner: Square.
 - 4. Length: As indicated on drawings.
- B. Adhesives and Primers: As recommended by manufacturer.
- C. See Section 06 1000 for wood blocking for wall and corner guard anchors.

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.
- 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.

3.03 TOLERANCES

- A. Maximum Variation From Required Height: 1/4 inch (6 mm).
- B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch (6 mm).

3.04 CLEANING

- A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.
- B. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

SECTION 10 2800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Commercial shower and bath accessories.
- C. Diaper changing stations.
- D. Utility room accessories.

1.02 RELATED REQUIREMENTS

- A. Section 10 2113.19 - Plastic Toilet Compartments.

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 A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.
- E. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- F. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2024.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. All Owner purchased toilet accessories are to be coordinated with Architect and Contractor prior to purchase by the Owner and installation by the Contractor.
- D. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Commercial Toilet, Shower, and Bath Accessories:
 - 1. AJW Architectural Products: www.ajw.com.
 - 2. American Specialties, Inc: www.americanspecialties.com.
 - 3. Bradley Corporation: www.bradleycorp.com.
 - 4. Bobrick Washroom Equipment Inc: www.bobrick.com.
 - 5. Substitutions: Section 01 6000 - Product Requirements.
- B. Electric Hand/Hair Dryers:
 - 1. Excel Dryer; Xlerator Hand Dryer: www.exceldryer.com/#sle.
 - 2. Substitutions: Section 01 6000 - Product Requirements.
- C. Diaper Changing Stations:

1. Koala Kare Products: www.koalabear.com/#sle.
 2. Foundations Worldwide: www.foundationsworldwide.com..
 3. Substitutions: 01 6000 - Product Requirements.
- D. 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.
 1. Grind welded joints smooth.
 2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.
- B. Stainless Steel Sheet: ASTM A666, Type 304.
- C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- D. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.03 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.
- C. Powder-Coated Steel: Clean, degrease, and neutralize. Follow immediately with a phosphatizing treatment, prime coat, and two finish coats of powder coat enamel.
- D. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 COMMERCIAL TOILET ACCESSORIES

- A. Toilet Paper Dispenser (TP-2): Furnished by Owner, installed by Contractor.
- B. Paper Towel Dispenser (PTD-2): Furnished by Owner, installed by Contractor.
- C. Soap Dispenser (SP-1): Furnished by Owner, installed by Contractor.
- D. Frameless Mirrors (MIR-50): Frameless, 6 mm thick mirror.
 1. Size: As indicated on drawings.
 2. Installation: Secure mirror with metal mounting clips to wall with screws, then engage mirror into clips.
 3. Basis of Design: 747 Series manufactured by Bradley.
- E. Grab Bars: Stainless steel, textured surface.
 1. Standard Duty Grab Bars:
 - a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
 - b. Dimensions: 1-1/2 inch (38 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, concealed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
 - c. Finish: Satin.
 - d. Length and Configuration (see drawings for which of the following are used):
 - 1) (GB-18): 18 inches. Basis of Design 812 Series by Bradley.
 - 2) (GB-24): 24 inches. Basis of Design 812 Series by Bradley.
 - 3) (GB-36): 36 inches. Basis of Design 812 Series by Bradley.
 - 4) (GB-42): 42 inches. Basis of Design 812 Series by Bradley.

- 5) (GB-L): L-Shaped. Basis of Design 800 Series by Bradley.
- F. Sanitary Napking Disposal Unit (ND-1): Furnished by Owner, installed by Contractor.
- G. Coat Hook (HK-1): Stainless steel, 3 inch (75 mm) extension from wall; rectangular-shaped bracket and backplate for concealed attachment, satin finish.
 1. Basis of Design: Model 9134 manufactured by Bradley.

2.05 COMMERCIAL SHOWER AND BATH ACCESSORIES

- A. Shower Curtain Rod (ROD-1): Stainless steel tube, 1 inch (25 mm) outside diameter, 0.04 inch (1.0 mm) wall thickness, satin-finished, with 3 inch (75 mm) outside diameter, minimum 0.04 inch (1.0 mm) thick satin-finished stainless steel flanges, for installation with exposed fasteners.
- B. Shower Curtain (SCT-1):
 1. Material: Opaque vinyl, 0.008 inch (0.2 mm) thick, matte finish, with antibacterial treatment, flameproof and stain-resistant.
 2. Size: 36 by 72 inches (914 by 1830 mm), hemmed edges.
 3. Grommets: Stainless steel; pierced through top hem on 6 inch (150 mm) centers.
 4. Color: As selected from manufacturer's standard colors.
 5. Shower Curtain Hooks: Chrome-plated or stainless steel spring wire designed for snap closure.
- C. Folding Shower Seat: (SST-1) Wall-mounted surface; welded tubular seat frame, structural support members, swing-down legs, hinges, and mechanical fasteners of Type 304 stainless steel, L-shaped, right hand seat.
 1. Basis of Design: Model 9569 manufactured by Bradley.
 2. Seat: Phenolic or polymeric composite one-piece seat or seat slats, of color as selected.
 3. Size: ADA Standards compliant.

2.06 ELECTRIC HAND DRYERS

- A. Electric Hand Dryers (HAND DRY-1): Traditional fan-in-case type, with downward fixed nozzle.
 1. Basis of Design: Xlerator Hand Dryer, Model XL, manufactured by Excel
 2. Operation: Automatic, sensor-operated on and off.
 3. Mounting: Surface mounted.
 4. Cover: Epoxy painted steel or die-cast zinc alloy.
 - a. Color: XL-GR Graphite Textured Painted.
 - b. Tamper-resistant screw attachment of cover to mounting plate.
 5. Wall Guard: Model #89B, antimicrobial wallguard.
 6. Air Velocity: 15,000 linear feet per minute (76 m/s), minimum.
 7. Fan Control: Field adjustable down to approximately half-speed.
 8. Total Wattage: 450 W, maximum; no heater.
 9. Supply Voltage: 208-277V, single phase, 60 Hz, nominal.
 10. Warranty: 3 years.

2.07 DIAPER CHANGING STATIONS

- A. Diaper Changing Station (BCS-1): Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
 1. Basis of Design (BCS-1): Model 962-11 manufactured by Bradley.
 2. Material: Polyethylene.

2.08 UTILITY ROOM ACCESSORIES

- A. Combination Utility Shelf/Mop and Broom Holder (MOP-1): 0.05 inch (1.3 mm) thick stainless steel, Type 304, with 1/2 inch (12 mm) returned edges, 0.06 inch (1.6 mm) steel wall brackets.
 - 1. Basis of Design: Model 9933 manufactured by Bradley.
 - 2. Hooks: Two, 0.06 inch (1.6 mm) stainless steel rag hooks at shelf front.
 - 3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
 - 4. Length: Manufacturer's standard length for number of holders/hooks.
 - 5. Provide one in each janitor's closet, locations indicated as (MOP-1), unless otherwise noted.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
- D. Verify that field measurements are as indicated on drawings.
- E. See Section 06 1000 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.

3.04 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

SECTION 10 4400 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

- A. FM (AG) - FM Approval Guide; Current Edition.
- B. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.
- C. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, and anchorage details.
- C. Shop Drawings: Indicate locations of cabinets, cabinet physical dimensions, and rough-in measurements for recessed cabinets.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Extinguishers:
 - 1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com.
 - 2. Ansul, a Tyco Business: www.ansul.com.
 - 3. Kidde, a unit of United Technologies Corp: www.kidde.com.
 - 4. Nystrom, Inc: www.nystrom.com.
 - 5. Pyro-Chem, a Tyco Business: www.pyrochem.com.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.
 - 7. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com.
 - 8. Larsen's Manufacturing Co: www.larsensmfg.com.
 - 9. Nystrom, Inc: www.nystrom.com.
 - 10. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
 - 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
 - 1. Provide one fire extinguisher for each cabinet or bracket indicated on the drawings.
 - 2. Basis of Design: Cosmic by JL Industries.
 - 3. Class: A:B:C type.
 - 4. Size: 10 pound (4.54 kg).
 - 5. Finish: Baked polyester powder coat color as selected.
 - 6. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to 120 degrees F (49 degrees C).

2.03 FIRE EXTINGUISHER CABINETS

- A. Fire-Rated Construction: Provide fire-rated cabinets in fire-rated walls (see drawings for locations).
- B. Cabinet Configuration (FCAB-1): Semi-recessed type.
 - 1. Size to accommodate accessories.
 - 2. Basis of Design: JL Industries "Ambassador Series" sized for 10 lb fire extinguisher.
 - 3. Projected Trim: Returned to wall surface, with 2-1/2 inch (63 mm) projection, and 1-3/4 inch (44 mm) wide face.
 - 4. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.
- C. Door: 0.036 inch (0.9 mm) metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.
- D. Door Glazing: Float glass, clear, 1/8 inch (3 mm) thick, and set in resilient channel glazing gasket.
- E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- F. Fabrication: Weld, fill, and grind components smooth.
- G. Finish of Cabinet Exterior Trim and Door: Baked enamel, color as selected.
- H. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

- A. Extinguisher Brackets (FBRKT-1): Formed steel, chrome-plated.
- B. Lettering: FIRE EXTINGUISHER decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure rigidly in place.
- C. Place extinguishers in cabinets.

SECTION 10 5126 - PLASTIC LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shelving and Coat Hook
- B. Locker benches.

1.02 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on shelves and b construction, sizes and accessories.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Protect shelves and benches and adjacent surfaces from damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Solid Plastic Lockers:
 - 1. Becker Arena Products: www.beckerarena.com.
 - 2. Columbia Lockers, a division of PSISC: www.psisc.com.
 - 3. List Industries, Inc: www.listindustries.com.
 - 4. Scranton Products: www.scrantonproducts.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LOCKER APPLICATIONS

- A. Shelving: Recycled plastic plank; powder coated steel support angle, wall mounted.
 - 1. Basis of Design: Becker Arena Products.
 - 2. Shelving: Solid profile, high-density polyethylene.
 - a. Size: 2 inches x 8 inches.
 - b. Color: As selected b
 - 3. Support Angle: 10 gauge steel with 7-gauge steel double sided coat hook.
 - 4. Locker Configuration: Single tier.
 - 5. Fittings: Size and configuration as indicated on drawings.
- B. Locker Benches (BENCH-70): Solid recycled plastic seat planks; high-density polyethylene; stationary bench.
 - 1. Basis of Design: Becker Arena Products.
 - 2. Seat plank size: 2 inches x 10 inches.
 - 3. Brackets: 7 gauge steel; 16 inches by 12-3/4 inches.
 - 4. Top Plates: Qty (2) 3/8 inch holes for mounting.
 - 5. Size: As indicated on drawings.
 - 6. Mounting Bracket Spacing: 36 inches maximum.
 - 7. Color: As selected by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared surfaces are in correct position and configuration.

- B. Verify shelves and benches are properly sized.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install shelves and benches plumb and square.
- C. Install fittings if not factory installed.
- D. Replace components that do not operate smoothly.

3.03 CLEANING

- A. Clean shelf and bench surfaces.

SECTION 10 7300 - ALUMINUM TRELLIS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum framing and fittings.

1.02 RELATED REQUIREMENTS

- A. Section 05 1200 - Structural Steel Framing.

1.03 REFERENCE STANDARDS

- A. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes 2012.
- B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes 2020.
- C. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube 2016.
- D. ASTM B483/B483M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications 2020.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on trellis, color fastness, attachment devices to steel framing system.
- C. Shop Drawings: Indicate trellis profiles, sizes, connection attachments, anchorage, size and type of fasteners, accessories.
- D. Samples, Framing: Submit two samples, 12 inches long of framing members, elbow, tee and brackets; prefinished.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. C.R. Laurence (CRL): www.crlaurence.com.
- B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 A

- A. Trellis System
 - 1. Basis of Design: AT710KNC by CR Laurence.
- B. Fittings: Elbows, T-shapes, brackets; cast aluminum.
- C. Mounting: Brackets and flanges, with stainless steel inserts to mount in steel framing.
- D. Splice Connectors: Concealed spigot; cast aluminum.
- E. Exposed Fasteners: Flush countersunk stainless steel screws or bolts; consistent with design of system.

2.03 FABRICATION - FRAMING

- A. Fit and shop assemble components in largest practical sizes, for delivery to site.
- B. Fabricate components with joints tightly fitted and secured.
- C. Exposed Fastenings: Unobtrusively located; consistent with design of component, except where specifically noted otherwise.

- D. Supply components required for anchorage of framing. Fabricate anchors and related components of same material and finish as framing, except where specifically noted otherwise.
- E. Accurately form components to suit each other and to building structure.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that framing is acceptable and are ready to receive work.

3.02 INSTALLATION - FRAMING

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects.
- C. Provide anchors required for connecting framing to structure. Anchor framing to structure.
- D. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Misalignment from True Position: 1/4 inch.

Foodservice Equipment Specification For: Anchor Park Concessions Port Wentworth, GA.

SECTION 114000 - FOOD SERVICE EQUIPMENT

SECTION 1 - GENERAL

1.0 RELATED DOCUMENTS

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

1.1 SUMMARY

- A. The work of this section includes, but is not limited to:
 - 1. Removal of existing foodservice equipment.
 - 2. Food service equipment as shown on drawings noted FS sheets..
 - 3. The equipment shall be delivered and installed on schedule. The K.E.C. (kitchen equipment contractor) shall be responsible for coordinating his work with the General, Mechanical Plumbing, and Electrical contractors.
 - 4. All work involved in making stands and supports for all equipment requiring them.

5. Cutting of equipment holes for pipes, drains, electrical outlets, soda lines, fire protection piping, etc., as required for this installation. The work shall conform to the highest standards of workmanship.
6. Repair all damage to the premises and remove all debris as a result of this installation.
7. All food service equipment and fixtures shall be cleaned and ready for operation at the time it is turned over to the owner.
8. All faucets and drains shall be part of each sink and be furnished as part of this work.
9. All motor starters or switches are to be part of the equipment, and this work. All electrical disconnects shall be part of the electrical contract. Any wiring between remote refrigeration systems or fire protection systems shall be by the electrical contractor.
10. This section shall include a Service/Maintenance Contract for a period of one year after date of substantial completion, for all compressors and refrigeration systems.

B. Related work specified elsewhere:

1. Division 15 Mechanical Work; water supply piping and final connections to equipment, including all valves, etc., needed floor drains, waste piping and final connections to equipment including all traps, valves etc. as required; ventilating ductwork and final connections of same to equipment including ventilating exhaust fans.
2. Division 16 Electrical Work: Electrical wiring and final connections to equipment and remote controls, including all disconnect switches, etc.

1.2 FOODSERVICE EQUIPMENT DEMOLITION

- A. The Kitchen Equipment Contractor is responsible for obtaining written permission from owner, owner's agent or the general contractor, for each piece of kitchen equipment to be discarded. Owner has option to retain all equipment being discarded in scope of work.

- B. The K.E.C. shall work with the general contractor and his sub-contractors to disconnect designated kitchen equipment according to all applicable codes.
- C. The K.E.C. is responsible for removal of all kitchen equipment as planned by the owner and general contractor. If any equipment is to be reused, the K.E.C. shall service, clean and store equipment until scheduled installation. For kitchen equipment to be discarded, the K.E.C. shall use an authorized (if not himself) demolition contractor for disposal of equipment. All equipment not being reused shall be recycled when possible.

1.3 SUBMITTALS

- A. Shop Drawings: For food service equipment not manufactured as standard production and catalog items by manufacturers. Include plans, elevations, sections, roughing-in dimensions, fabrication details, service requirements, and attachments to other work.
 - 1. Wiring Diagrams: Details of wiring for power, signal, and control systems and differentiating between manufacturer-installed and field-installed wiring.
 - 2. Piping Diagrams: Details of piping systems and differentiating between manufacturer-installed and field-installed piping.
- B. Product Certificates: Signed by manufacturers of refrigeration systems or their authorized agents certifying that systems furnished comply with requirements and will maintain operating temperatures indicated in the areas or equipment that they will serve.

1.4 QUALITY ASSURANCE

- A. Installer qualifications: Engage an experienced installer to perform work of this section who has specialized in installing food service equipment, who has completed installations similar in design and extent of this project, and who has a record of successful in-service performance.
- B. This contractor shall submit any drawings or specification cutsheets to local Health Department, Building Inspector or any other regulatory agencies as may be required, and obtain prior approval before fabrication of any equipment.

Regulatory requirements: Comply with the following National Fire Protection Association (NFPA) codes:

1. NFPA 70, "National Electrical Code."
 2. NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations."
- C. NSF Standards: Comply with applicable NSF International (NSF) standards and criteria and provide NSF Certification Mark on each equipment item, unless otherwise indicated.
- D. SMACNA Standard: Where applicable, fabricate food service equipment to comply with the Sheet Metal and Air Conditioning Contractors National Association's (SMACNA) "Kitchen Equipment Fabrication Guidelines, unless otherwise indicated.
- E. Seismic Restraints: Provide seismic restraints for food service equipment according to the Sheet Metal and Air Conditioning Contractors National Association's (SMACNA) "Kitchen Equipment Fabrication Guidelines," appendix 1, "Guidelines for seismic restraints of kitchen equipment, unless otherwise indicated.
- F. If the drawings and specifications require larger sizes or higher standards than are required by the regulations, the drawings and specifications shall govern.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver food service equipment as factory-assembled units with protective crating and covering.
- B. Store food service equipment in original protective crating and covering and in a dry location.
- C. All equipment shall be delivered to the job site in first class condition, free from any defects or manufacturing damage due to handling in shipping or

delivering. Any items, which are rejected because of damage or defect prior to acceptance must be removed and replaced without additional cost.

- D. Coordinate works with other contractors. If equipment is too large to be moved through the permanent openings in the building, this contractor shall make arrangements with the General Contractor to have suitable temporary openings provided, or he shall furnish his equipment in subassemblies which may be moved through the permanent openings and then assembled.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions of food service equipment installation areas by field measurements before equipment fabrication and indicate measurements on shop drawings and coordination drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the work, establish required dimensions and proceed with fabricating equipment without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.
- B. The Food Service equipment drawings indicate the general arrangement, location and point of connection of equipment. Refer to Architectural and Structural for building dimensions, and refer to Mechanical and Electrical drawings for general location of mechanical and electrical work.

1.7 COORDINATION

- A. Coordinate equipment layout and installation with other work, including light fixtures, HVAC equipment, and fire-suppression system components.
- B. Coordinate location and requirements of service-utility connections.
- C. Coordinate size, location, and requirements of concrete bases, positive slopes to drains, floor depressions, and insulated floors. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."

Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

1.8 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the owner of other rights the owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Refrigeration Compressor Warranty: Submit a written warranty signed by manufacturer agreeing to repair or replace compressors that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:
 - 1. Breakage.
 - 2. Faulty operation.
- C. Warranty Period: 1 Year Parts and Labor Service Warranty, 5 years Compressor Warranty from date of substantial completion.

SECTION 2 – PRODUCT FABRICATION

2.1 FABRICATED EQUIPMENT

One company shall manufacture all custom fabricated equipment items. All equipment shall have the same design and style.

- 1. All custom fabricated items and equipment shall conform to the current National Sanitation Foundation and/or E.T.L. standards.
- A. Stainless Steel: All stainless steel shall be U.S. standard gauges Type 304 18-8, not over .013% maximum carbon. Exposed surfaces shall have No: 4 finish.
 - 1. Stainless steel tops shall be 14 gauge s/s, Type 304 18-8, unless otherwise specified.
 - 2. Undershelves and enclosed base cabinets where exposed shall be 16 gauge s/s Type 304 18-8, unless otherwise specified.
 - 3. Overshelves shall be 16 gauge s/s 304 18-8, unless otherwise specified.

B. Legs and Cross-Bracing: All legs shall be 1-5/8" O.D. stainless steel tubing unless otherwise specified. All welds at cross bracing shall be welded and ground smooth. Bottom of legs at floor shall be fitted with a s/s bullet type foot with not less than a 3/4" adjustment. Legs shall be fastened to equipment as follows:

1. To sinks by means of enclosed gussets welded in place. Gussets shall be completely enclosed sanitary stainless steel, reinforced with bushings and have set screws for securing legs.
2. To metal tops and dish tables with enclosed gussets (as above) which shall be welded to the closed formed galvanized steel hat channel section 14 gauge or heavier. Bracing shall be welded to underside of tops.

C. Gussets: Gussets shall be enclosed types having a minimum 3" diameter at top being continuously welded to frame members or sink bottom.

D. Sinks: Sink compartments shall have fully coved vertical and horizontal interior corners. Where one or more sink compartments are adjacent, partitions shall be double thickness continuously welded where sheets joint at the top. Multiple compartment sinks shall be creased to insure complete drainage to waste opening. All sink bowls shall be 14 gauge stainless steel polished, and be welded into tops as integral part of top. Where sink bowls are exposed, the exterior shall be polished to a No: 4 finish. Underside of sinks shall be coated with a minimum 1/16" thick approved hard-drying sound-deadening mastic material.

1. All custom fabricated sinks, such as outlined above, and shall have lever handle drains without overflows. Valves shall be chrome plated 2" size with 1-1/2" threaded adapter. Die-drawn inserts type sinks shall have 3-1/2" basket type drains, without overflow.
2. Drainboards: Minimum 0.0781-inch- (1.984-mm-) thick stainless steel, pitched to sink at a ratio of 1/8" to 12"(3 mm/300 mm) of length. Reinforce drainboards with minimum 0.0781 inch-1.984-mm-) thick stainless steel, unless otherwise indicated.

3. Drainboard braces: 1 inch (25 mm) OD, minimum 0.0625-inch- (1.588-mm-) thick stainless steel, unless otherwise indicated. This is to be applied to any drainboards over 30" long.
- E. Faucets: Furnish faucets on all sinks, water stations, and other fixtures as specified with each item.
- F. Metal Tops: All metal tops shall be one piece s/s (unless otherwise specified) welded construction, reinforced on the underside with closed galvanized steel hat channel sections welded into place so tops can support heavy weights without deflection. Cross bracing shall not be more than 30" on centers. All reinforcements shall be sealed. All seams and joints shall be shop welded. Welds to be ground smooth and polished to match the original finish. All materials 18 gauge or heavier shall be welded. Field joints in tops, where required due to limitations of equipment sizes or installation requirements, shall be made sanitary, tight, leak proof and without open seam by means of welding. This also can be accomplished if a detailed, specified and properly designed draw fastening trim strip or by welding joints to suit the purpose required, is within written specs. or shown on drawings. Butt joints made by riveting straps under seams and then filled with solder will not be acceptable. Apply sound dampening to underside of metal work surfaces, including sinks and similar units. Provide coating with smooth surface and hold coating 1 inch (25 mm) back from open edges for cleaning.
- G. Backsplash, Edges and Ends: All backsplashes shall be 8" high (unless otherwise specified) with a 2" return to the wall on a 45 degree angle with a crimp at the top and 1/2" to the wall and 1/2" turn down, to accept fill with silicone. All marine edges shall be 5/8" deep with 2" facing down and 1/2" in. All rolled edges shall be 1-3/4" diameter except as detailed with corner bull nosed. All bull nose edges shall be 1-3/4". All welds to be ground and polished smooth.
- H. Dishtables: All draitables, backsplashes, and turn-up edges shall have radius bends in all horizontal and vertical corners, coved at intersections. Rounded and coved corners or bends shall be 1/2" radius or larger and be constructed in accordance with specifications set forth under metal tops.

- I. Cabinet Bases: Enclosed cabinet type bases shall be made of formed steel sheet reinforced with formed steel sections to create a rigid structure. Steel shall be 18 gauge or heavier. Base to be formed of sheets with front rails, mullions, etc., welded to appear as one piece construction. All exposed sections of exterior and interior shall be stainless steel. Unexposed sections to be galvanized unless otherwise specified.
 - 1. Shelves in fixtures with enclosed bases shall be turned up on back and sides and be feathered slightly to insure a tight fit to enclosed panels. Bottom shelves shall be made for easy removal unless otherwise noted. Shelves in fixtures with open bases shall be notched a full 90 degree and shall be removable and supported by cross structures. When enclosed base cabinets are specified below sinks and disposers, provide removable access panels with access to lever drain handles and louvers in access panels at disposer locations.
 - 2. Sliding doors shall be mounted on large ball bearing quiet rollers in 14 gauge metal overhead tracks and be removable without tools. No bottom track, door guides only.
 - 3. Hinged doors shall be flush type mounted on heavy duty stainless steel NSF approved hinges.
- J. Drawers: All drawers to have a removable royalite insert pan of selected color and size. Fronts of drawers shall be stainless steel, double cased, with recessed pulls. Fill void in drawer front with semi rigid fiberglass sound dampening. Mount drawers on 14 gauge interlocking channel supports with large size quiet ball bearing wheel suspension and stops to prevent drawers from being pulled out of the fixture. Support heavy loads without deflection. Drawers shall be easily removable without the use of tools. Exposed drawers shall have a stainless steel enclosed frame housing, which shall be mounted to the underside of the counter top frame.

- K. Hardware: All hardware shall be fabricated of solid materials, and where exposed, cast bronze or brass chrome plated, except where specified to the contrary. Hardware shall be locking type, keyed as standard by the manufacturer. All hardware shall be identified with manufacturer's name and number so that broken parts may be ordered and replaced.
- L. Casters: Casters shall be heavy duty type, ball bearing, and disc wheel replaceable greaseproof rubber or neoprene tire. Wheel shall be 5" in diameter, min. width of tire tread 1-1/2", min. capacity per caster 250 lbs. Provide pressure type grease fittings, tread guards, and polished plated finish. Provide locks on two casters per unit unless otherwise indicated.
- M. Refrigerated Compartments: Fabricated compartments, refrigerated shelves, shall be provided with a 20 gauge stainless steel box to house expansion valves. Install in base of fixture or in concealed position in cooperation with Contractor for refrigeration system. All openings into fabricated refrigerated spaces shall be separated from adjacent metal surfaces by means of black thermoplastic breaker strips of sufficient size and thickness to prevent transfer of cold to exterior of fixture.
- N. Gas Quick Disconnects: All portable gas equipment that has a quick disconnect shall be Dormont (or as specified) with flexible s/s (coated) hose. Where disconnects are furnished, the K.E.C. shall furnish and install a pull out prevention cable.
- O. Fasteners: No exposed screw or bolt heads will be permitted on fixtures or installation materials. Rivets, if specified, shall be counter sunk flush and of the same material as the pieces jointed together.
- P. Verification: The K.E.C. shall verify size and location of all duct connections for exhaust ventilators, hoods and dishwasher pant leg with the Mechanical Contractor before fabrication. Provide stainless steel formed duct collars at the ceiling where exposed, with exception of pant leg ducts. Mechanical contractor to provide stainless steel ducts from

dish machine through ceiling. K.E.C. shall verify building corridors, rooms and elevators (where required) to get his equipment into the correct location. Where self-leveling dispensers are specified, KEC shall verify make of ware, dimensions and weight and submit it to factory so that the correct springs may be properly calibrated. Field verify wall lengths and ceiling heights before proceeding with custom fabricated equipment.

Q. Cooler/Freezer Specifications:

1. PANELS:

Panels shall be pre-fabricated, sectional, constructed and designed for accurate assembly.

Panels shall be a minimum of four inches thick and shall be completely filled with rigid 100% foamed-in-place Class 1 urethane between interior and exterior metal "skins" which have been die-formed and gauged for uniformity in size. Slab urethane, high-density rails or wood shall not be acceptable in any panel, including doors, walls, floor, and ceiling.

The insulation shall have a 97% closed cell structure with an average in-place density of 2.2 lbs. per cubic foot, and compression strength at yield point of 19 lbs. per square inch.

Panels shall be of tongue and groove design with foamed-in-place gaskets for a tight fit and maximum insulation. Corner panels shall be 90 degree with coved interiors and actual 12" exterior horizontal measurements. Partition walls shall utilize one-piece "T" panels with coved interiors.

2. DOORS:

The entrance doors shall be flush in fitting type, self-closing with cam-lift hinges and posi-seal hydraulic (not spring) door closure. Door hardware shall be brushed chrome. Door latches shall lock and have a safety release to prevent entrapment. The freezer door section will be provided with a low wattage heater strip and a tri-action heated pressure relief port. The cooler door section shall be void of any heater strip. A digital thermometer, pre-wired vapor proof light fixture and pilot light switch shall be made of durable FRP (fiberglass reinforced plastic).

3. FINISH:

See equipment schedule for interior and exterior finishes on walk in coolers and freezers.

4. REFRIGERATION SYSTEMS:

Refrigeration units to be pre-assembled, with all components factory installed including thermostatic expansion valves, solenoid valves, temperature controls, sight glasses, filter dryers, and pressure controls.

Evaporators shall be forced air types (UL listed) with seamless copper tubing expanded into rippled aluminum fins for maximum heat transfer. Motors to have a built-in thermal overload protection. Components to be protected by a sturdy aluminum housing.

The freezer evaporator shall have an automatic electric defrost system with heaters, time clock, and fan delay control. Defrost shall be time initiated and temperature terminated with built in fail-safe control.

5. WARRANTIES:

Panels to be covered by a ten year warranty. The manufacturer shall warrant the refrigeration systems to be free from defects in material and workmanship under normal use for a period of 90 days, plus a one year parts and labor service warranty. An additional five year compressor warranty shall be provided.

6. REMOTE COMPRESSOR LOCATION:

Roof mounted systems. Units are to be housed in individual enclosures or in one central enclosure that houses the compressors for all walk-in coolers, freezers and any other remote compressors with the possible exception of ice machine units. Roof screeds, roofing work and roof penetrations to be furnished by General Contractor for proper installation.

7. FLOORLESS WALK-IN COOLERS AND FREEZERS:

General Contractor to install and furnish 4" rigid insulation, 3" concrete topping, 2" x 8" redwood screeds placed at centerline of walk-in walls, full perimeter of all floor less walk-ins. At door locations, screeds to be cut 1/2" to service areas, into walk-ins. In areas where there is no floor finish (i.e. tile), general contractor to cut (rip) screed, so it's flush with floor. The K.E.C. is responsible for door location and placement.

8. ACCESSORIES:

Provide and install the following:

- a. Extra vapor proof light fixtures and lamps per individual item specification.

b. Vertical trim strips as required.

c. Aluminum kickplates on both sides of door.

d. Interior and exterior, (if specified), stainless steel coved base as required.

R. EXHAUST HOOD FABRICATION

1. General: Fabricate hoods indicated from minimum 0.050-inch- (1.27-mm-) thick stainless steel, unless otherwise indicated. Comply with NFPA 96 and requirements of authorities having jurisdiction.
2. Grease Removal: Provide removable, stainless steel, high velocity, and baffle type grease filters with spring-loaded fastening. Provide minimum 0.0781-inch- (1.984-mm-) thick, stainless steel filter frame and removable collection basins or troughs.
3. Light Fixtures: Provide NSF-certified fixtures with lamps, vapor-tight sealed lenses, and wiring in stainless-steel conduit on hood exterior.
4. Exhaust-Duct Collars: Minimum 0.0625-inch- (1.588-mm-) thick stainless steel.
5. Provide 3" standoffs on sides and back as indicated on drawings. Refer to Electrical and plumbing rough-in schedules for installation instructions on exhaust hood and related fire protection system. The manufacturer is to provide complete shop drawings detailing installation.

SECTION 3 - EXECUTION

3.1 INSTALLATION

- A. Food service equipment shall be installed in strict accordance with approved shop drawings and manufacturer's instructions.
1. Anchor bolts, sleeves and other items required to be built into masonry and concrete will be set by the masonry and concrete

contractors and shall be furnished promptly so that they may be built in as the work progresses.

2. Install equipment level, and securely fasten fixed equipment in place.

Space between all units to walls, ceilings, floors and adjoining units not portable and with enclosed bodies shall be completely sealed against entrance of food particles or vermin by means of trim strips, welding, soldering or commercial joint material as suited to the nature of the equipment. Ends of all hollow sections shall be closed

3. Enclosed fixtures without legs not mounted on bases shall be sealed watertight to floor, except when specified to be portable.
4. Existing equipment to be reused, shall be serviced, cleaned and reinstalled by the Kitchen Equipment Supplier/Installer.

3.2 CLEANING DEMONSTRATION AND TESTS

- A. After completion of work, thoroughly clean, polish and lubricate fixtures and equipment, and leave in condition satisfactory to the Architect or Owner. After installation all equipment shall be inspected and tested under operating conditions in the presence of the Owner.

- B. Demonstration / Operation:

1. Demonstrate the use and operation to owners authorized personnel, including periodic maintenance and preventive maintenance.
2. Distribution of operation manuals and service/parts manuals to the architect. Provide two complete sets.
3. K.E.C. to meet with the Owner to complete and file guarantee and warranty registrations. In addition to the above distributions, provide one complete brochure consisting of all final floor plans, shop

drawings, booklet of cut sheets, with names, addresses and phone numbers of all involved servicing agencies to the Architect.

3.3 BID FORM

A. K.E.C. to furnish consultant an itemized breakdown of all equipment and the cost of each individual item on the plans at the time of submitting pricing for the entire job.

B. See section #016000 for the submittals of substitutions. Only consultant pre-approved equals will be allowed for bidding.

3.4 ERRORS & OMISSIONS

A. It is the responsibility of the General Contractor and K.E.C. to review TriMark's foodservice consultant drawings and specifications. Any errors, omissions, or discrepancies requires communication with Trimark for clarification. Failure to act by the GC or KEC waves Trimark of any responsibility during equipment procurement and installation.

SECTION 4 – EQUIPMENT SPECIFICATIONS

ITEM 1 - WIRE STORAGE SHELVING (1 REQ'D)

Olympic

To include the following:

- 12 ea Model J2148K Shelf, wire, 21" x 48", chromate with Olympic Green-Guard™ epoxy finish, NSF
- 16 ea Model J2448K Shelf, wire, 24" x 48", chromate with Olympic Green-Guard™ epoxy finish, NSF
- 28 ea Model J74K Post 74", stationary, grooved at 1" increments, includes leveling bolt & cap, chromate with Olympic Green-Guard™ epoxy finish, NSF
- 1 ea 1 year warranty against manufacturing defects
- 1 ea 7 year warranty against rust and corrosion

ITEM 2 - LOCKER (5 REQ'D)

SPG International Model 4K0071 Dimensions: 66(h) x 12(w) x 15(d)

Kelmax Locker, 12"W x 15"D x 66"H, five tier, single wide, (5) 12"H doors, 16 gauge powder coated steel, padlock hasp latch, 6" legs, ADA (ships fully assembled)

ITEM 3 - CHEMICAL STORAGE SHELVING (1 REQ'D)

Olympic

To include the following:

- 4 ea Model J2436K Shelf, wire, 24" x 36", chromate with Olympic Green-Guard™ epoxy finish, NSF
- 4 ea Model J74K Post 74", stationary, grooved at 1" increments, includes leveling bolt & cap, chromate with Olympic Green-Guard™ epoxy finish, NSF
- 1 ea 1 year warranty against manufacturing defects
- 1 ea 7 year warranty against rust and corrosion
- 1 ea 1 year warranty against manufacturing defects
- 1 ea 7 year warranty against rust and corrosion

ITEM 4 - MOP SINK (1 REQ'D)

John Boos Model PBMS2820-12-X Dimensions: 16(h) x 32.63(w) x 23.38(d)

Mop Sink, floor mounted, 32-5/8"W x 23-3/8"D x 16"H overall size, 28"W x 20" front-to-back x 12" deep compartment, 3-1/2" diameter drain, marine edge on front & sides, tile edge on rear, 16/300 stainless steel construction, NSF (Available in Effingham)

- 1 ea Model PBF-SS-6-X Service Sink Faucet, 8" centers, vacuum breaker nozzle with 3-4" garden hose thread, pail hook, top support arm, 1/2" NPT female flanged, with adjustable inlet with screwdriver stop (Available in Effingham and Nevada)

ITEM 5 - SHELVING, WALL MOUNTED (1 REQ'D)

John Boos Model PB-MSS836 Dimensions: 7.5(h) x 8(w) x 36(d)

Utility Shelf, wall-mounted, 36"W x 8"D, Stallion Safety Edge front, 1-1/2" riser on sides & rear, includes hooks & (3) mop/broom holder with locking cam, 16/300 stainless steel, KD

ITEM 6 - THREE (3) COMPARTMENT SINK (1 REQ'D)

John Boos Model 3B18244-2D24-X Dimensions: 44(h) x 105.25(w) x 29.5(d)

"B" Series Sink, 3-compartment, 105-1/4"W x 29-1/2"D x 44"H overall size, (3) 18"W x 24" front-to-back x 14" deep compartments, (2) 24" left & right drainboards, 10"H boxed backsplash with 45° top and 2" return, (1) set of splash mount faucet holes with 8" centers, 3-1/2" die-stamped drain openings, 16/300 stainless steel construction, stainless steel legs, adjustable side bracing, adjustable bullet feet, NSF, CSA-Sanitation (Available in Effingham and Nevada)

- 3 ea Model PB-LWB Lever waste support arm bracket. Not for use with PB-LWS-1 or PB-LWS-10V straight handle lever waste.
- 1 ea Standard flyer accessories only, NO modifications to flyer items allowed or their accessories
- 1 ea Note: Provisions made at factory for installation.
- 1 ea T&S Brass Model B-0133-A12-B08 EasyInstall Pre-Rinse Unit, 8" wall mount, adjustable centers, EasyInstall 12" add-on faucet with stream regulator, spring action gooseneck, quarter-turn Eterna cartridges with spring checks, lever handles with color coded indexes, 18"rigid riser, 44" flexible stainless steel hose, 1.07 GPM JetSpray spray valve, 6" adjustable wall bracket, 1/2" NPT, low lead, NSF, cCSAus
- 3 ea T&S Brass Model B-3950 Waste Valve, twist handle, 3-1/2" sink opening, 2" drain outlet with 1-1/2" adapter (replaces B-3912, B-3916)

ITEM 7 - SHELVING, WALL MOUNTED (4 REQ'D)

John Boos Model BHS1248-X Dimensions: 9.5(h) x 48(w) x 12(d)

Shelf, wall-mounted, 48"W x 12"D x 9-1/2"H overall size, 1-1/2" rear up-turn, Stallion Safety Edge front, 18/300 stainless steel, NSF, KD (Available in Effingham and Nevada)

ITEM 8 - REACH-IN FREEZER (2 REQ'D)

Hoshizaki Model F2A-FS Dimensions: 79.5(h) x 55(w) x 33.5(d)

Steelheart Series Freezer, reach-in, two-section, 50.37 cu. ft., top mounted self-contained refrigeration system, (6) epoxy-coated wire shelves, (2) full-height solid hinged doors, digital temperature display/controls, audible/visual alarms, LED interior lighting, stainless steel interior, stainless steel exterior front & sides, (4) 4" heavy duty casters (2 with brakes), R290 Hydrocarbon refrigerant, 1 HP, NEMA 5-15P, cETLus, ETL-Sanitation

2 ea	Warranty: 7-Year labor on entire machine
2 ea	Warranty: 7-Year parts on entire machine
2 ea	Warranty: 7-Year parts on compressor
2 ea	115v/60/1-ph, 8.7 amps, standard
2 st	Casters, 4" (set of 4), standard

ITEM 9 - REACH-IN REFRIGERATOR (1 REQ'D)

Hoshizaki Model R2A-FS Dimensions: 79.5(h) x 55(w) x 33.5(d)

Steelheart Series Refrigerator, reach-in, two-section, 50.37 cu. ft., top mounted self-contained refrigeration, (6) epoxy coated wire shelves, (2) full height solid hinged doors, digital temperature display/controls, LED interior lighting, stainless steel exterior front & sides, stainless steel interior, (4) 4" heavy duty casters (2 with brakes), R290 Hydrocarbon refrigerant, 1/2 HP, NEMA 5-15P, cETLus, ETL-Sanitation

1 ea	Warranty: 7-Year labor on entire machine
1 ea	Warranty: 7-Year parts on entire machine
1 ea	Warranty: 7-Year parts on compressor
1 ea	115v/60/1-ph, 8 amps, standard
1 st	Casters, 4" (set of 4), standard

ITEM 10 - MOP BUCKET WRINGER COMBINATION (1 REQ'D)

CFS Brands Model 3690804

Carlisle - Mop Bucket Combo, 26 qt., with side press wringer, non-marking casters, corrosion resistant, polyethylene, yellow

ITEM 11 - FLOOR TROUGH (1 REQ'D)

Advance Tabco Model FFTG-1830 Dimensions: 4(h) x 30(w) x 18(d)

Floor Trough, 30"W x 18"D x 4" deep, with fiberglass grating, stainless steel removable strainer basket, 4" O.D. waste pipe 3"L, pitched towards waste, NSF

ITEM 12 - ICE MAKER, CUBE-STYLE (1 REQ'D)

Hoshizaki Model KMD-860MAJ Dimensions: 28(h) x 30(w) x 24.63(d)

Ice Maker, Cube-Style, 30"W, air-cooled, self-contained condenser, production capacity up to 855 lb/24 hours at 70°/50° (665 lb AHRI certified at 90°/70°), stainless steel finish, crescent cube style, R-404A refrigerant, 208-230v/60/1-ph, 9.9 amps, NSF, UL

1 ea	Warranty: 3-Year parts & labor on entire machine
1 ea	Warranty: 5-Year parts & labor on evaporator
1 ea	Warranty: 5-Year parts on compressor & air-cooled condenser
1 ea	Model B-500SF Ice Bin, 30"W, top-hinged front-opening door, 500-lb ice storage capacity, for top-mounted ice maker, stainless steel exterior, painted legs included, protected with H-GUARD Plus Antimicrobial Agent, ETL, ETL-Sanitation
1 ea	Warranty: 3-Year parts & labor for bin
1 ea	Model HS-2129 Top kit extension, for KMD, KMS or FD application on B-500 bins
1 ea	Model H9320-52 Water Filtration System, twin configuration, 19.11" H (manifold & cartridge)
1 ea	Warranty: 1-Year on entire water filtration system & replaceable elements, standard

ITEM 12A - ICE BIN - INCLUDED WITH #12

ITEM 12B - WATER FILTER - INCLUDED WITH #12

ITEM 13 - WORK TABLE, 72", STAINLESS STEEL TOP (1 REQ'D)

John Boos Model ST4R5-3072SBK Dimensions: 40.75(h) x 72(w) x 30(d)

Work Table, 72"W x 30"D, 14/300 stainless steel top with 5" backsplash, with Stallion Safety Edge front, 90° turndown on sides, box channel understructure with sound deadening tape, stainless steel legs, side & rear adjustable bracing, adjustable bullet feet, NSF, CSA-Sanitation, KD

- 1 ea Model CUT1014104 Weld-In Undermount Sink, 1-compartment, 10"W x 14" front-to-back x 10" deep, 3-1/2" drain opening, 14/300 stainless steel fabricated bowl, includes cutout, bowl, faucet holes & welding/polishing (Not available for FBLG & UFBLG)
- 1 ea Model PB-LWB Lever waste support arm bracket. Not for use with PB-LWS-1 or PB-LWS-10V straight handle lever waste.
- 1 ea Note: Provisions made at factory for installation.
- 1 ea Model X-0204H (2) Additional stainless steel legs (modification)
- 4 ft Model X-0470AB Undershelf, 18 gauge 300 stainless steel (per foot) (3 foot MINIMUM) (modification)
- 1 ea T&S Brass Model B-3950 Waste Valve, twist handle, 3-1/2" sink opening, 2" drain outlet with 1-1/2" adapter (replaces B-3912, B-3916)
- 1 ea T&S Brass Model B-1141 Faucet, gooseneck nozzle, deck mount, quarter-turn Eterna cartridges, lever handles, low lead, ADA Compliant

ITEM 14 - COFFEE BREWER - BY OTHERS

ITEM 15 - TEA BREWER - BY OTHERS

ITEM 16 - WASTE RECEPTACLE - BY OTHERS

ITEM 17 - HAND SINK (3 REQ'D)

John Boos Model PBHS-W-1410-SSLR-X Dimensions: 13.13(h) x 17(w) x 15.5(d)

Pro-Bowl Hand Sink, wall mount, 14"W x 10" front-to-back x 5" deep bowl, splash mount faucet holes with 4" centers, 1-7/8" drain opening with basket drain, with left & right side splashes, includes mounting bracket, all stainless steel construction, NSF, CSA-Sanitation (faucet NOT included) (Available in Effingham and Nevada)

- 3 ea Standard flyer accessories only, NO modifications to flyer items allowed or their accessories
- 3 ea T&S Brass Model B-1141-01 Workboard Mixing Faucet, deck mount, 4" centers, 2-15/16" swivel gooseneck nozzle (131X-A22) with 2.2 GPM aerator, quarter-turn Eterna cartridges with spring checks, lever handles with color-coded indexes, 1/2" NPT male inlets, low lead, cCSAus, ADA Compliant
- 3 ea T&S Brass 1 year limited warranty, standard

ITEM 18 - WORK TABLE, 96", STAINLESS STEEL TOP (1 REQ'D)

John Boos Model ST4R5-3096SBK Dimensions: 40.75(h) x 96(w) x 30(d)

Work Table, 96"W x 30"D, 14/300 stainless steel top with 5" backsplash, with Stallion Safety Edge front, 90° turndown on sides, box channel understructure with sound deadening tape, stainless steel legs, side & rear adjustable bracing, adjustable bullet feet, NSF, CSA-Sanitation, KD

6 ft Model X-0470AB Undershelf, 18 gauge 300 stainless steel (per foot) (3 foot MINIMUM)
 (modification)
1 ea Model X-0204H (2) Additional stainless steel legs (modification)

ITEM 19 - MICROWAVE OVEN, SHELF (1 REQ'D)
John Boos Model BMS2024-X Dimensions: 15(h) x 24(w) x 20(d)
Microwave Shelf, wall mount, 24"W x 20"D x 15"H, Stallion Safety Edge front, 2-1/2" electric cord cut-out
with rubber grommet, 16/300 stainless steel construction, NSF (Available in Effingham and Nevada)

ITEM 20 - SPARE NO. <

ITEM 21 - SPARE NO.

ITEM 22 - MICROWAVE OVEN (1 REQ'D)
MenuMaster Model MCS10TS Dimensions: 13.8(h) x 22(w) x 19(d)
MenuMaster® Commercial Microwave Oven, 1000 watts, 1.2 cu. ft. capacity, stackable, medium volume,
stainless steel exterior wrap & interior, 4-stage cooking, (5) power levels, (100) memory settings, ADA
compliant braille touch pads, sealed in ceramic shelf, side hinged door with glass window, stationary air
filter, power consumption 120v/60/1-ph, 1550 total watts, 13.0 amps, cord, NEMA 5-15P, cETLus, ETL
1 ea 3-year limited warranty (1 year full)

ITEM 23 - CUTTING BOARD - BY OTHERS

ITEM 24 - RAPID COOK OVEN (1 REQ'D)
TurboChef (Middleby) Model BULLET Dimensions: 23(h) x 21.17(w) x 29.98(d)
(QUICKSHIP) (ENC-9600-801) Bullet™ Convection/Microwave Oven, Rapid Cook, electric, 21.1" wide,
ventless, countertop, fully insulated cook chamber, stores over 1,000 recipes, internal catalytic converter,
smart voltage sensor technology (US only), One Touch Controls, removable rack and grease collection
pan, bottom jet plate, pull down door with ergonomic handle, 13 1/2" x 14 1/4", (2) solid PTFE
baskets, TurboChef Cleaner and Guard Starter Kit, includes (1) cleaner packet, (1) 24oz bottle, (1) Guard
bottle and (2) foamer trigger, aluminum paddle, (1) baking stone, side hand grips, stainless steel front,
top & sides, cULus, CE, UL EPH Classified, ANSI/NSF 4, TUV (Max qty - 5 per order, ships within 4 days)
1 ea All items FOB: Carrollton, Texas: Consumable/accessory orders less than \$5,000 will
 incur a handling fee. Orders shipping standard ground will incur a \$15.00 handling fee.
 Orders shipping other than standard ground will incur \$25.00 handling fee
1 ea One year parts and labor warranty
1 ea 208/240v/60/1-ph, 30.0 amps, 6 foot cord (nominal), NEMA 6-30P, standard

ITEM 25 - GLASS DOOR MERCHANDISERS - BY OTHERS

ITEM 26 - SERVING BACK COUNTER (1 REQ'D)
INFINITY METAL FABRICATING INC Model CUSTOM FAB
Custom stainless steel fabrication, open base construction, approximately 14'-6" long x 30" deep x 36"
tall, (2) drawers, partial undershelf, partial open under for refrigerator, per plan and approved shop
drawing

ITEM 27 - POPCORN POPPER (1 REQ'D)

Gold Medal Products Model 2001ST Dimensions: 43.5(h) x 28(w) x 20.5(d)

Citation Popcorn Machine, electric, countertop, 16 oz. Unimaxx® kettle, forced air popcorn crisping system, stainless steel dome, 1920 watts, 120v/60/1-ph, NEMA 5-20P, cULus, NSF

1 ea All information & pricing is subject to change without notice; contact Gold Medal Products Co. for the most up-to-date pricing and information.

1 ea 2 year parts & 6 months labor warranty, standard (contact factory for more information)

ITEM 28 - DISPLAY CASE, HOT FOOD, COUNTERTOP (1 REQ'D)

Hatco Model FDWD-1 Dimensions: 28.82(h) x 19.38(w) x 20.86(d)

Flav-R-Fresh® Holding & Display Cabinet, counter model, (1) door, (4) tier interior revolving circular rack & rack motor, 1390 watts, CE, cULus, UL EPH Classified, Made in USA

1 ea NOTE: Sale of this product must comply with Hatco's Minimum Resale Price Policy; consult order acknowledgement for details

1 ea NOTE: Includes 24/7 parts & service assistance, call 414-671-6350

1 ea One year on-site parts & labor warranty, plus one additional year parts only warranty on all Flav-R-Fresh metal sheathed air heating elements

1 ea 120v/60/1-ph, 1360 watts, 11.3 amps, NEMA 5-15P (domestic voltage)

1 ea Model STANDARD Clear Anodized Aluminum housing, finish, standard (available at time of purchase only)

ITEM 29 - NACHO CHEESE / CHIPS WARMER, DISPLAY (1 REQ'D)

Gold Medal Products Model 2185ST Dimensions: 23.5(h) x 15.38(w) x 12.88(d)

Servalot Chip Warmer, 15", holds 10 lbs. of chips, top loading, yellow accent light, stainless steel top & bottom with plexiglass windows, 61 watts, 120v/60/1-ph, NEMA 5-15P, cULus, NSF

1 ea All information & pricing is subject to change without notice; contact Gold Medal Products Co. for the most up-to-date pricing and information.

ITEM 30 - SPARE NO.

ITEM 31 - SPARE NO.

ITEM 32 - FOOD TOPPING WARMER, COUNTERTOP (1 REQ'D)

Gold Medal Products Model 2197NS Dimensions: 14(h) x 8.5(w) x 16(d)

Nacho Cheese Warmer with Heated Pump, no lighted sign, heated spout, pump style, cabinet design, for use with 3-1/2 quart #2238 insert (not included), 330 watts, 120v/60/1-ph, NEMA 5-15P, cULus

1 ea All information & pricing is subject to change without notice; contact Gold Medal Products Co. for the most up-to-date pricing and information.

ITEM 33 - HOT DOG GRILL (1 REQ'D)

Star (Middleby) Model 30CBD Dimensions: 12.5(h) x 23.75(w) x 20.63(d)

Grill-Max® Hot Dog Grill, roller-type with integrated bun drawer, stadium seating, chrome-plated rollers, capacity 30 hot dogs & 32 buns, analog controls for front and rear zones, stainless steel construction, cULus, UL EPH Classified, Made in USA

1 ea [30CBD-120V] 120v/60/1-ph, 1150 watts, 9.6 amps, NEMA 5-15P, standard

1 ea Model 30SG-1D Grill-Max™ Hot Dog Roller Grill Sneeze Guard, for 23" x 20" grills, (1) door, polycarbonate, UL EPH Classified, NSF, Made in USA

1 ea Model THU Tong Holder

ITEM 34 - DISPLAY CASE, HOT FOOD, COUNTERTOP (1 REQ'D)

Hatco Model FDWD-1 Dimensions: 28.82(h) x 19.38(w) x 20.86(d)

Flav-R-Fresh® Holding & Display Cabinet, counter model, (1) door, (4) tier interior revolving circular rack & rack motor, 1390 watts, CE, cULus, UL EPH Classified, Made in USA

- 1 ea NOTE: Sale of this product must comply with Hatco's Minimum Resale Price Policy; consult order acknowledgement for details
- 1 ea NOTE: Includes 24/7 parts & service assistance, call 414-671-6350
- 1 ea One year on-site parts & labor warranty, plus one additional year parts only warranty on all Flav-R-Fresh metal sheathed air heating elements
- 1 ea 120v/60/1-ph, 1360 watts, 11.3 amps, NEMA 5-15P (domestic voltage)
- 1 ea Model STANDARD Clear Anodized Aluminum housing, finish, standard (available at time of purchase only)

ITEM 35 - DISPLAY CASE, HOT FOOD, COUNTERTOP (1 REQ'D)

Hatco Model FDWD-1 Dimensions: 28.82(h) x 19.38(w) x 20.86(d)

Flav-R-Fresh® Holding & Display Cabinet, counter model, (1) door, (4) tier interior revolving circular rack & rack motor, 1390 watts, CE, cULus, UL EPH Classified, Made in USA

- 1 ea NOTE: Sale of this product must comply with Hatco's Minimum Resale Price Policy; consult order acknowledgement for details
- 1 ea NOTE: Includes 24/7 parts & service assistance, call 414-671-6350
- 1 ea One year on-site parts & labor warranty, plus one additional year parts only warranty on all Flav-R-Fresh metal sheathed air heating elements
- 1 ea 120v/60/1-ph, 1360 watts, 11.3 amps, NEMA 5-15P (domestic voltage)
- 1 ea Model STANDARD Clear Anodized Aluminum housing, finish, standard (available at time of purchase only)

ITEM 36 - DISPOSABLE CUP DISPENSER (2 REQ'D)

Dispense-Rite Model BFL-S-3BT Dimensions: 24.25(h) x 8(w) x 23(d)

Cup Dispensing Cabinet, adjustable, (3) BFL-2F, holds 8 oz. to 44 oz. cups, rim dia. 3" - 4-1/2", black texture polystyrene cabinet, black bezels, 24-1/4"H x 8"W x 23"D, NSF cup dispensers

- 2 ea 1 year limited warranty, standard

ITEM 37 & 38 - COFFEE DISPENSER & STAND - BY OTHERS

ITEM 39 - UNDERCOUNTER REFRIGERATOR (1 REQ'D)

Hoshizaki Model UR27B-LP Dimensions: 31.9(h) x 27(w) x 31(d)

Steelheart Series Undercounter Refrigerator, reach-in, one-section, 27"W, 7.21 cu. ft., self-contained rear mounted refrigeration system, (1) solid hinged door, (1) adjustable shelf, stainless steel interior, stainless steel exterior front, sides & top, (4) 2.25" stem casters (2 with brakes), R290 Hydrocarbon refrigerant, 1/6 HP, cord, NEMA 5-15P, ADA compliant, cETLus, ETL-Sanitation, ENERGY STAR®

- 1 ea Warranty: 5-Year labor on entire machine
- 1 ea Warranty: 6-Year parts on entire machine
- 1 ea Warranty: 7-Year parts on compressor
- 1 ea 115v/60/1-ph, 2.5 amps, standard

ITEM 40 - ICED TEA DISPENSER - BY OTHERS

ITEM 41 - SPARE NO.

ITEM 42 - WORK TABLE, 96", STAINLESS STEEL TOP (2 REQ'D)
John Boos Model ST6-2496SBK Dimensions: 35.75(h) x 96(w) x 24(d)
Work Table, 96"W x 24"D, 16/300 stainless steel flat top, with Stallion Safety Edge front & back, 90°
turndown on sides, box channel understructure with sound deadening tape, stainless steel legs, side &
rear adjustable bracing, adjustable bullet feet, NSF, CSA-Sanitation, KD
16 ft Model X-0470AB Undershelf, 18 gauge 300 stainless steel (per foot) (3 foot MINIMUM)
(modification)

ITEM 43 - POS - BY OTHERS

ITEM 44R - REACH-IN REFRIGERATOR (1 REQ'D)
Hoshizaki Model R1A-FS Dimensions: 79.5(h) x 27.5(w) x 33.5(d)
Steelheart Series Refrigerator, reach-in, one-section, 23.1 cu. ft., top mounted self-contained refrigeration
system, (3) epoxy coated wire shelves, (1) full-height solid right hinged door, digital temperature
display/controls, LED interior lighting, stainless steel exterior front & sides, stainless steel interior, (4) 4"
heavy duty casters (2 with brakes), R290 Hydrocarbon refrigerant, 1/4 HP, NEMA 5-15P, cETLus,
ETL-Sanitation, ENERGY STAR®
1 ea Warranty: 5-Year labor on entire machine
1 ea Warranty: 6-Year parts on entire machine
1 ea Warranty: 7-Year parts on compressor
1 ea 115v/60/1-ph, 5 amps, standard
1 ea Casters, 4" (set of 4), field installed, standard

ITEM 44L - REACH-IN REFRIGERATOR (1 REQ'D)
Hoshizaki Model R1A-FSL Dimensions: 79.5(h) x 27.5(w) x 33.5(d)
Steelheart Series Refrigerator, reach-in, one-section, 23.1 cu. ft., top mounted self-contained refrigeration
system, (3) epoxy coated wire shelves, (1) full-height solid left hinged door, digital temperature
display/controls, LED interior lighting, stainless steel exterior front & sides, stainless steel interior, (4) 4"
heavy duty casters (2 with brakes), R290 Hydrocarbon refrigerant, 1/4 HP, cord, NEMA 5-15P, cETLus,
ETL-Sanitation, ENERGY STAR®
1 ea Warranty: 5-Year labor on entire machine
1 ea Warranty: 6-Year parts on entire machine
1 ea Warranty: 7-Year parts on compressor
1 ea 115v/60/1-ph, 5 amps, standard
1 ea Casters, 4" (set of 4), field installed, standard

ITEM 45 - HEATED HOLDING CABINET (2 REQ'D)
Alto-Shaam Model 1000-UP Dimensions: 75.81(h) x 23.94(w) x 32.69(d)
Halo Heat® Heated Holding Cabinet, mobile, double-compartment, on/off simple control with adjustable
thermostats, insulated, capacity for (8) 18" x 26" x 1" sheet pans in each compartment, heavy-duty
stainless steel exterior and interior, 5" heavy-duty casters (2 rigid & 2 swivel with brake), EcoSmart®,
cULus, UL EPH ANSI/NSF 4, CE, IPX3, TUV NORD, ENERGY STAR®
2 ea NOTE: Subject to Manufacturer's Terms & Conditions. See Documents Section
2 ea 120v/60/1-ph, 16.0 amps, 1.9kW, 9'(2743mm) cord, NEMA 5-20P
4 ea Reach-in design, standard
4 ea Solid Door, hinged on left (factory installed)

ITEM 46 - BOTTLE COOLER (1 REQ'D)
Krowne Model BC48-BG Dimensions: 34(h) x 48(w) x 24(d)
Bottle Cooler, flat top, 48"W x 24"D, self-contained refrigeration, (15.5) cases/12oz bottles capacity, (2)
sliding lids, (2) adjustable chrome plated divider racks, digital thermostat, includes condensate
evaporator, stainless steel interior, black vinyl clad exterior front & sides, R290 Hydrocarbon refrigerant,
1/3 HP, 115v/60/1-ph, 2.18 amps, cord with NEMA 5-15P, NSF7, ETL-Sanitation

1 ea	This equipment is intended for the storage & display of non-potentially-hazardous bottle or canned products only.
1 ea	2 year parts & labor warranty, 5 year compressor warranty, standard
1 ea	Doors standard with no locks
1 st	Model BC-132 Casters, 2" low profile with brakes (set of 4), plate, raises unit 3"

ITEM 47-51 - SPARE NO.

ITEM 52 - CONDIMENT COUNTER - BY OTHERS <By Other>

END OF DIVISION 114000 FOODSERVICE EQUIPMENT SPECIFICATIONS

SECTION 12 6100 - FIXED AUDIENCE SEATING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fixed, upholstered chairs.
- B. Fixed, non-upholstered seats.
- C. Support standards.
- D. Chair accessories.

1.02 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- C. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.
- D. ASTM A879/A879M - Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface; 2022.
- E. ASTM D3597 - Standard Performance Specification for Woven Upholstery Fabrics—Plain, Tufted, or Flocked; 2002, with Editorial Revision (2018).

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed data sheets for products specified.
- C. Shop Drawings: Fabrication and installation details, chair layouts and dimensions and seat numbering scheme.
- D. Selection Samples: Manufacturer's color charts and swatches for fabric upholstery, indicating full range of materials, colors, and patterns available.
- E. Maintenance Materials:
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Seats (including all components for a complete installation, except cup holders): Quantity equal to 5 percent of total installed, but not less than one of each type and width of seat, furnished from same production run as that installed.
 - 3. Extra Cup Holders: Quantity equal to 10 percent of total installed, but not less than one of each type and width of seat, furnished from same production run as that installed.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver seats to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.
- B. Store seating units in dry and clean location until needed for installation. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fixed Seating:
 - 1. American Seating, Inc: www.americanse.com
 - 2. Hussey Seating Company: www.husseyseating.com.

3. Theatre Solutions, Inc: www.theatresolutions.com.
4. Irwin Seating Company: www.irwinseating.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

- A. Cast Iron: ASTM A48/A48M, Class 25A minimum, free of air holes and casting imperfections, all edges ground smooth.
- B. Sheet Steel: ASTM A879/A879M, Commercial Steel (CS) or Drawing Steel (DS) electrogalvanized sheet, 04Z (12G) coating class on both surfaces; chemically treated for baked enamel finish.
- C. Steel Plates, Bars, and Tubes: ASTM A36/A36M.
- D. Polyurethane Foam: Density not less than 1.8 lb/cu ft (28.8 kg/cu m), fire retardant, non-hardening and non-oxidizing, with high resistance to alkalis, oils, moisture, and mildew.
- E. Upholstery Fabric: ASTM D3597 heavy-duty plain woven nylon fabric, treated to resist cigarette ignition and staining; color and pattern as selected from manufacturer's standards.

2.03 UPHOLSTERED CHAIRS

- A. Basis of Design: Quattro Chair System by Hussey Seating.
- B. Fixed seating system designed to permit radial installation using common middle support standards in each row and aisle standards aligned as indicated on drawings. Width of seats not less than 22 inches (559 mm), except exit seat locations may be reduced to 20 inches (508 mm) to complete specific row dimensions.
- C. Backs: Fixed type; two-panel construction with fabric covering over padding and protective back panel, with installed height not less than 32 inches (813 mm) above finished floor, except as indicated below.
- D. Seats: Hinged type, constructed to permit reupholstering without removing seat from chair.
 1. Steel Seat Construction: One-piece sheet steel pan construction, reinforced at stress points; supporting not fewer than 16 coil springs or five non-sag serpentine springs. Separate padding from springs with burlap sheeting cemented to polyurethane foam padding formed with minimum thickness of 1-3/4 in (44 mm). Upholster with fabric sewn into box construction without welts and securely fastened to supporting frame to provide smooth, wrinkle-free surface.
 - a. For serpentine spring construction, provide not less than 3 in (75 mm) thick foam padding at front edge of seat.
- E. Hinges: Self-lubricating, noiseless steel hinges with brass alloy bearings or nylon bushings, equipped with spring mechanism that causes unoccupied seat to rise automatically to uniform 3/4 fold, with 100 percent fold when additional pressure is applied.
- F. Arm Rests: Locate at aisles and between chairs; mount to support standard with concealed fasteners; exposed surfaces of solid hardwood lumber with smoothed edges.
 1. See drawings for cup holder locations; cup holder opening sized to accommodate cups up to 40 ounces (1200 ml).
- G. End Panels: One piece panels fastened securely to aisle standards with concealed fasteners, configured as follows:
 1. For (STAD SEAT-10, -11, -12, & -13): Provide integral cast logo; logo provided by Owner.
 2. For (STAD SEAT-14): Provide wood veneer panel; finish to be selected by Architect; provide integral cast logo; logo provided by Owner.
 3. For (STAD SEAT-15): Provide wood veneer panel; finish to be selected by Architect; provide integral cast logo; logo provided by Owner.
- H. Aisle Lighting: Locations as indicated on drawings.

1. Basis of Design: Irwin model Tivoli Beacon 2-1/4 inch diameter; surface mounted 12 volt LED aisle light.

2.04 NON-UPHOLSTERED SEATS

- A. Basis of Design:
 1. (STADIUM BENCH-1): Southern Bleacher Aluminum Riser Mounted Bleacher with Elite Seat.
- B. Bench Seats:
 1. Construction: Contoured seat construction with rolled edges, fabricated from molded fiberglass or injection-molded high-impact polypropylene.
 2. Color: Custom color as selected by Owner/Architect.

2.05 STANDARDS

- A. Support Standards: Tubular steel with welded mounting points for backs, seats, and arm rests, and welded floor anchor plates.

2.06 ACCESSORIES

- A. Seat and Aisle Numbers: Manufacturer's standard seat numbers securely fastened to front edge of folding seats and row numbers securely fastened to aisle arm rests; anodized aluminum finish, with letters and numbers countersunk and filled with black paint.

2.07 FINISHES

- A. Ferrous Metals: Manufacturer's standard two-coat baked enamel finish, applied over conversion coating appropriate to base metal.
 1. Color and Gloss: Custom colors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates for conditions detrimental to installation of fixed theater seating. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Comply with manufacturer's installation instructions and approved shop drawings.
- B. Anchor support standards securely to substrate with at least two anchoring devices recommended by manufacturer.

3.03 ADJUSTING

- A. Adjust seat mechanisms to ensure that seats in each row are aligned when unoccupied.
- B. Repair minor abrasions and imperfections in painted finishes with a coating that matches factory-applied finish; replace units that cannot be repaired to unblemished appearance.
- C. Replace upholstery fabric damaged or soiled during installation.

SECTION 13 3100 - FABRIC STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tensile membrane structures.
- B. Tensile membranes.
- C. Flexible structural elements.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete.
- B. Section 05 1200 - Structural Steel Framing.

1.03 DEFINITIONS

- A. See ASCE 55 for definitions of terms used in this section.

1.04 REFERENCE STANDARDS

- A. ASCE 55 - Tensile Membrane Structures; 2016.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- C. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
- D. ASTM A436 - Standard Specification for Austenitic Gray Iron Castings; 1984 (Reapproved 2020).
- E. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2021a.
- F. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric); 2021a.
- G. ASTM A586 - Standard Specification for Metallic-Coated Parallel and Helical Steel Wire Structural Strand; 2018.
- H. ASTM A603 - Standard Specification for Metallic-Coated Steel Structural Wire Rope; 2019.
- I. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- J. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2022.
- K. ASTM F594 - Standard Specification for Stainless Steel Nuts; 2022.
- L. ASTM F844 - Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use; 2019 (Reaffirmed 2024).
- M. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2020.
- N. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2023.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Erection Drawings:
 - 1. Indicate erection plan for tensile membrane structure installation activity; include detailed sequence or work and procedures that ensure structural integrity of tensile membrane structure during erection.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

1.07 WARRANTY

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Tensile Membrane Structures:
 - 1. Birdair, Inc: www.birdair.com.
 - 2. Tension Structures, a division of Eide Industries Inc: www.tensionstructures.com.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 TENSILE MEMBRANE STRUCTURES

- A. Tensile membrane structures consisting of tensioned membranes stretched over flexible and nonflexible structural support elements.
 - 1. Provide smooth uniform membrane surface with even-curved edges and interfaces; without wrinkles, cuts, abrasions, stains, marks, surface defects, or seaming aberrations.
 - 2. Configuration as indicated on drawings.

2.03 STRUCTURAL DESIGN CRITERIA

- A. Comply with requirements for contractor's design-related professional design services; see Section 01 4000 - Quality Requirements.

2.04 TENSILE MEMBRANES

- A. High-Density Polyethylene (HDPE) Membranes.
- B. Polyester Fabric, PVDF-Coated Membranes.
 - 1. Base Fabric: Polyester.
 - 2. Topcoating: Polyvinylidene fluoride (PVDF).
- C. Fiberglass Fabric, PTFE-Coated Membranes.
 - 1. Base Fabric: Fiberglass.
 - 2. Topcoating: PTFE.
- D. Polyarylate Mesh and Transparent Fluoropolymer Film Membranes.
 - 1. Outer Surface: Transparent, hybrid fluoropolymer film.
 - 2. Inner Surface: Extruded polyarylate fiber mesh with fluoropolymer coating.

2.05 FLEXIBLE STRUCTURAL ELEMENTS

- A. Cables, Fittings, and Anchorages:
 - 1. Structural Stainless Steel Cables: ASTM A666, Type 304 or Type 316.
 - 2. Structural Wire Rope Cables: Metallic-coated and prestretched, ASTM A603 with Single-Class, Class A coating weight throughout.
 - 3. Structural Strand Cables: Metallic-coated and prestretched, ASTM A586 with Grade 1 breaking strength, Class A coating weight throughout.
 - 4. Cables in Contact with Tensile Membranes: PVC-sleeved.
 - 5. Cable Length Tolerance: As indicated on drawings.
 - 6. Swaged End Fittings, Pins, Nuts, and Washers: Electrogalvanized steel.

7. Fasteners in Membrane Clamping Systems: Stainless steel.
- B. Shackles, Rigging Screws, Clamps, and Tensioning Hardware:
 1. Stainless steel, ASTM A666, Type 304 or Type 316.

2.06 NONFLEXIBLE STRUCTURAL ELEMENTS

- A. Concrete Foundations: See Section 03 3000, and structural drawings.
- B. Structural Steel Support Elements: See Section 05 1200, and structural drawings.

2.07 FABRICATION

- A. Fabricate tensile membrane structures and flexible structural elements in accordance with fabrication requirements of ASCE 55.

2.08 ACCESSORIES

- A. Anchorage Devices: Provide anchorage devices and mechanical fasteners for securing tensile membranes and flexible structural elements to in-place construction as determined by the Structural Engineer of Record for design of tensile membrane structure.
- B. Carbon Steel Fasteners:
 1. Bolts and Nuts: ASTM A307 bolts and ASTM A563 (ASTM A563M) nuts.
 2. High-Strength Structural Bolts and Nuts: ASTM F3125/F3125M bolts and ASTM A563 (ASTM A563M) nuts.
 3. Unheaded Anchor Rods: ASTM F1554, Grade 36, with matching ASTM A563 (ASTM A563M) nuts.
 4. Washers: ASTM A436 or ASTM F844 in finish matching bolts.
 5. Zinc Coating Finish: Galvanized by hot-dip process in compliance with ASTM A153/A153M.
- C. Stainless Steel Fasteners:
 1. Bolts: ASTM F593.
 2. Nuts: ASTM F594.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine area to receive flexible structural elements and tensile membrane; notify Architect if area is not acceptable and do not begin installation until unacceptable conditions have been corrected.
- B. Examine foundations and anchor bolts for location and elevation; notify Architect of inaccuracies, and do not begin installation until unacceptable conditions have been corrected.

3.02 PREPARATION

- A. Prepare a clear, flat, smooth, and clean layout area on ground of sufficient size for assembly of tensile membrane panels; prepare area adjacent to location of structure installation.
- B. Check contact surfaces to remove sharp objects, dirt, grease, oil, and other causes for rips, scratching, or other damage to tensile membrane panels during installation.

3.03 ERECTION

- A. Erect tensile membrane structures and flexible structural elements in accordance with erection requirements of ASCE 55.
- B. Comply with approved erection plan.
- C. Do not undertake erection of tensile membranes during inclement weather conditions; installer has sole responsibility to determine when conditions are safe for erection.
- D. Concrete Foundations:

1. As indicated on drawings.
- E. Support Steel:
 1. As indicated on drawings.
- F. Install tensile membranes and flexible structural elements in accordance with manufacturer's instructions.
 1. Install to avoid damage to tensile membranes.
 2. Ensure tensile membranes surfaces are smooth, uniform, and clean, with even-curved edges and interfaces, and with no cuts, scratches, abrasions, stains, marks, blemishes, or welding irregularities.

3.04 REPAIR

- A. Repair or replace defective or damaged materials as directed by Architect.

3.05 ADJUSTING

- A. Make final adjustments to tensile membranes and flexible structural elements as required for structural integrity, and in accordance with shapes and configuration indicated on drawings.

3.06 CLEANING

- A. Clean and touchup flexible structural elements in accordance with manufacturer's field repair recommendations.

3.07 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals for additional submittals.

SECTION 20 10 00 MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The General Provisions of the Contract, including Conditions of the Contract, and Division 1 of the Specifications, apply to the work in Divisions 20 - 23.
- B. This Section is hereby made a part of all other Sections of Divisions 20 – 23 as fully as if repeated in each therein.

1.2 DESCRIPTION

- A. Definitions: The terms listed below are defined as follows when used in Divisions 20 - 23 and only Divisions 20 - 23.
 - 1. Work: labor and/or Subcontractor.
 - 2. Furnish: obtain, coordinate, submit the necessary drawings, deliver to the job site in new condition and guarantee.
 - 3. Install: receive at the job site, unload, store, set in place or construct, connect, place in operation and guarantee.
 - 4. Provide: furnish and install.
 - 5. Connect: bring service to the equipment and make final attachment including necessary valves, traps, etc.
 - 6. Piping: includes, in addition to pipe, all fittings, valves, hangers, and other supports and accessories related to such piping.
 - 7. Ductwork: includes, in addition to ducts, all fittings, transitions, dampers, hangers and other supports and accessories related to such ductwork.
 - 8. Concealed: hidden from sight in chases, furred spaces, shafts, hung ceilings, embedded in construction, in crawl spaces or buried.
 - 9. Exposed: not installed underground or "concealed" as defined above.
 - 10. Invert Elevations: the elevation of the inside bottom of pipe or duct.
 - 11. Structure or Structural Members: steel columns, steel beams, steel joists (top chord at panel points), concrete wall panels or concrete block walls. Metal decking, joist bridging or bottom chords of joists shall not be construed to be a structural member.
 - 12. Remove: dismantle, disconnect duct and/or piping connections and cap in concealed location. Discard unless otherwise noted. Patch finishes to match surrounding area unless patching is noted on Architectural Drawings.
- B. Provide Mechanical work which is finished work, tested and ready for operation.
 - 1. Contractor is required to provide complete systems. The components listed are not intended to limit the scope of work. Items not specified but necessary for system operation are to be provided at no additional cost.
 - 2. Should there be any discrepancies or a question of intent, refer the matter to the Architect for decision before ordering any equipment or materials or before starting any related work.
 - 3. Where work connects to that of another trade, or to piping or equipment in place, take measurements in the field to make connecting work come true and line up with the item being connected.
 - 4. Where work specified under other Divisions of the Specifications connects to equipment which is a part of Divisions 20 - 23, provide proper connection(s) to such equipment.

1.3 QUALITY ASSURANCE

- A. Workmanship
 - 1. All workmanship shall be first class in every respect and shall be performed only by skilled mechanics.
 - 2. Work is to be done by contractors holding current licenses for practicing their trade in the jurisdiction in which the project is located.
- B. Codes and Standards
 - 1. Materials and workmanship to comply with applicable codes. As a minimum, codes include: all State and Federal laws, local ordinances, utility company regulations and requirements and recommendations of the following:
 - a. State and Local Building Codes

- b. State Plumbing Codes, Federal Accessibility Regulations
 - c. State Industrial Commission Regulations
 - d. State and Local Fire Codes and Regulations
 - e. State and Local Mechanical Codes, Energy Code
 - f. National Electric Code
 - g. State and Local Electrical Installation Codes
 - h. Municipal Water and Sewer Regulations
 - i. Occupational Safety and Health Administration Regulations
2. By submitting a bid on the project, the Contractor acknowledges their responsibility to install the work in accordance with governing codes. Contractor agrees to perform work necessary to attain code authority approval of the installation, under the initial contract compensation. If the Contract Documents indicate work not in compliance with Code, the local authority's direction shall govern the installation. Where work is indicated to be of higher quality than that required by Code, it shall be installed in accordance with the Contract Documents.
3. The following standards shall be used where referenced by the following abbreviations:
- | | |
|---------|---|
| AABC: | Associated Air Balance Council |
| ADC: | Air Diffusion Council |
| AGA: | American Gas Association |
| AIA: | American Institute of Architects |
| AMCA: | Air Moving and Conditioning Association |
| ANSI: | American National Standards Institute |
| ARI: | Air Conditioning and Refrigeration Institute |
| ASE: | Association of Safety Engineers |
| ASHRAE: | American Society of Heating, Refrigeration and Air Conditioning Engineers |
| ASME: | American Society of Mechanical Engineers |
| ASSE: | American Society of Sanitary Engineering |
| ASPE: | American Society of Plumbing Engineers |
| ASTM: | American Society of Testing and Materials |
| AWS: | American Welding Society |
| AWWA: | American Water Works Association |
| CSA: | Canadian Standards Association |
| CISPI: | Cast Iron Soil Pipe Institute |
| EPA: | Environmental Protection Agency |
| FIA: | Factory Insurance Association |
| FM: | Factory Mutual Insurance Association |
| FS: | Federal Specifications |
| HIS: | Hydraulic Institute Standards |
| IBR: | Institute of Boiler and Radiator Manufacturers |
| IEEE: | Institute of Electrical and Electronics Engineers |
| IRI: | Industrial Risk Insurers |
| MCAA: | Mechanical Contractors' Association of America |
| NBS: | National Bureau of Standards |
| NEBB: | National Environmental Balancing Bureau |
| NEMA: | National Electrical Manufacturers Association |
| NFPA: | National Fire Protection Association |
| NSC: | National Safety Council |
| NSF: | National Sanitation Foundation |
| SBI: | Steel Boiler Institute Industry |
| SMACNA: | Sheet Metal and Air Conditioning Contractors National Association |
| UL: | Underwriters' Laboratories |
- Note: Some of these may not be referenced for this project.

1.4 SUBMITTALS

- A. Shop Drawings and Samples: Submit in accordance with the General Conditions and Division 1. Refer to individual sections of Divisions 20 - 23 for supplementary requirements.
- B. Shop Drawings requiring special processing to meet production and delivery schedules shall be so marked.
- C. Shop drawings and other pertinent information shall be submitted and reviewed before equipment is purchased or before fabrication or erection of materials is started.
- D. Check drawings relative to capacity, arrangement and physical dimensions and mark the drawings approved prior to submitting for final review.
- E. Substituted equipment which requires additional costs by other trades for their application shall have such costs borne by the contractor furnishing said equipment.

1.5 APPROVAL OF MATERIALS

- A. Refer to General Provisions and Division 1 for approval requirements.
- B. Where approved substitutes are used, the Contractor assumes responsibility for physical dimensions and other resulting changes. This responsibility extends to include extra work required by other trades as a result of the substitution.

1.6 PERMITS, LICENSES AND FEES

- A. The Contractor shall secure all permits and licenses, both temporary and permanent required for his work. The Contractor shall pay all fees and expenses required for the permits and licenses.
- B. The Contractor shall make all arrangements with each utility company and pay all service charges associated with new or modifications to existing services.
- C. The Contractor shall request inspections as required by regulating agencies and/or regulations. The Contractor shall pay all charges for inspections.
- D. SAC and WAC charges will be paid for by the Owner.

1.7 INSPECTION OF SITE

- A. Before submitting a proposal on the work contemplated, Bidder shall examine the site of the proposed work and become thoroughly familiar with existing conditions and limitations affecting the performance of the work. No extra compensation will be allowed because of misunderstanding as to the amount of work involved or bidders lack of knowledge of existing conditions which could have been discovered or reasonably anticipated prior to bidding.

1.8 CORRELATION OF WORK

- A. Consult the Divisions 25 – 28 Documents of Electrical and other trades for correlating information and lay out work so that it will coordinate. Verify dimensions and conditions, i.e. finished ceiling heights, footing and foundation elevations, beam depths, etc., with the Architectural and Structural drawings. If conflicts occur such that resolution is not possible by the affected trades on the job, the Architect/Engineer shall be notified so that the proper changes can be made to avoid extra cost to the Owner.
- B. Where work must be replaced due to the failure of the Contractor to verify the conditions existing on the job, such replacement must be accomplished at no extra cost to the Owner. This shall apply to shop fabricated work as well as to work fabricated in place.
- C. Throughout the course of the work, minor changes and adjustments to the installation may be requested by the Engineer. The Contractor shall make such adjustments without additional cost to the Owner, where such adjustments are necessary to the proper installation and operation within the intent of the Contract Documents. This does not include work already completed.

1.9 CORRECTIVE PERIOD

- A. The Contractor shall guarantee and maintain the stability of work and materials and keep same in perfect repair and condition for the period of one (1) year after the Date of Substantial Completion of the Project.
- B. Defects of any kind due to faulty work or materials appearing during the above mentioned period must be immediately made good by the Contractor at Contractor's own expense to the entire satisfaction of the Owner and Architect/Engineer. Such reconstruction and repairs shall include damage to the finish of the building resulting from the original defect or repairs thereto.
- C. This guarantee shall not apply to injuries occurring after final acceptance and due to wind, fire, violence, abuse, carelessness of other Contractors or their employees or the agents of the Owner.
- D. This guarantee shall not apply where other guarantees for different lengths of time are specifically called for.

1.10 START-UP OF SYSTEMS AND OPERATING INSTRUCTIONS

- A. Equipment prior to start-up shall be fully lubricated, charged, filled, etc. per manufacturer's recommendations. However, the make of the lubricant, charge, fill etc. to be used by the Contractor shall have the Owner's specific approval prior to application.
- B. The Owner's designated operating personnel shall be fully instructed by the Contractor in the operation of each mechanical system at the time it is put into service. A statement from the Owner shall be obtained to the effect that Owner's designated personnel have been instructed. A video copy of all the training and instructions, in a format acceptable to the Engineer shall also be provided.
- C. Each Contractor shall submit to the Engineer three (3) Maintenance and Operating Manuals. These manuals shall be submitted in portfolio form neatly edited, with similar equipment grouped, tabbed and indexed. Materials shall be printed or typewritten. A digital copy of the Maintenance and Operating Manual, in a format acceptable to the Engineer, shall also be provided.
- D. Each manual shall contain the following:
 - 1. List of mechanical equipment together with the equipment manufacturer, local representative and local distributor and installing contractor. List shall be arranged in neat columnar form with current telephone numbers and addresses provided for listed representative and distributors.
 - 2. Shop drawings, approved manufacturer's bulletins, and other appropriate data (from specific manufacturer and other sources) relating to the approved care, maintenance, and operating instructions required of each piece of equipment furnished and/or installed. Shop drawings, manufacturer's bulletins, and other data shall be appropriately marked to reflect the "as-built" condition. Furnish a copy of the Engineer reviewed submittals with each Manual.
 - 3. Test reports.

1.11 CONSTRUCTION RECORD DRAWINGS

- A. Provide construction record drawings in accordance with the requirements of the General Conditions and Division 1.

1.12 TEMPORARY UTILITIES

- A. Refer to Division 0 and Division 1 for temporary utility requirements.

1.13 REBATES

- A. It is the intention of the Owner to apply available utility rebates to the project.
- B. The Contractor shall secure on behalf of the Owner the maximum rebate. This shall include negotiations, providing substantiation where required, and making all necessary arrangements on behalf of the Owner.
- C. The rebates shall be paid directly to the Owner by the applicable utility company.

PART 2 - PRODUCTS (DOES NOT APPLY)

PART 3 - EXECUTION

3.1 CLEAN UP

- A. Contractor shall at all times keep the premises free from accumulation of waste material or rubbish caused by Contractor's employee or work. Upon completion of the work Contractor shall remove all rubbish from and above the building, tools, scaffolding, surplus materials and shall leave the work areas "broom clean" or its equivalent. Mechanical equipment shall be cleaned with temporary identification removed. In case of dispute the Owner shall remove the rubbish and charge the cost to the Contractor.
- B. After tests have been made and accepted, go over the entire job and clean pipes, fittings and other equipment installed under Divisions 20 - 23, leaving the entire plant clean and in complete working order.

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SECTION 20 50 00 BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The General Provisions of the Contract, including Conditions of the Contract and Division 1 of the Specifications apply to the work in this section.
- B. This Section is hereby made a part of all other Sections of Divisions 20 - 23 as fully as if repeated in each therein.

1.2 QUALITY ASSURANCE

- A. Each major component of equipment shall have the manufacturer's name, address, model number and rating on a plate securely affixed in a conspicuous place.
- B. Code Ratings, labels or other data which are die-stamped or otherwise affixed to the surface of the equipment to be in visible location.
- C. All equipment provided under Divisions 20 - 23 to perform with the least possible noise and vibration consistent with its duty. Quietness of operation of all equipment is a requirement. Any equipment, as determined by the Owner's Representative, or Engineer to be producing objectionable noise or transmitting noise or vibration to the building to be repaired or removed and replaced.
- D. Materials and equipment to be the standard product of a manufacturer regularly engaged in the production of a required type of material or equipment for at least three years, unless specifically exempted and to be the manufacturer's latest design with published properties.
- E. All grooved joint couplings and fittings shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
 - 1. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

1.3 SUBMITTALS

- A. Submit descriptive data in accordance with Section 20 10 00 for the following:
 - 1. Pipe Hangers.
 - 2. Valves.
 - 3. Piping Specialties
 - 4. Fire Stopping
 - 5. Grooved Joint Couplings.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Follow manufacturer's directions in the delivery, storage protection and handling of all equipment and materials.
- B. Deliver and store equipment and materials at the site in original containers, sheltered from the elements and mechanical injury. Items subject to moisture damage shall be stored in dry, heated spaces.
- C. Ascertain whether temporary access openings in the building will be required for the admission of apparatus and notify the Prime Contractor accordingly.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. Furnish and install pipe and fittings of type and material scheduled herein of sizes shown on the Contract Documents and as required to connect fixtures and equipment.
- B. Galvanized Steel Pipe & Fittings
 - 1. Pipe

- a. Piping to be Scheduled 40 hot dipped galvanized, seamless or butt welded, carbon steel, ASTM A-53 (Type F,E or S) and ANSI B36.20.
 - b. Each length of pipe to be legibly identified at the mill, indicating manufacturer and class of pipe.
 2. Low Pressure Fittings
 - a. 4" and smaller; 150 psi galvanized malleable iron threaded fittings.
 - b. Larger than 4 inches; Standard Class 125 psig, cast iron, faced and drilled galvanized threaded flanges.
 - c. Bolts and nuts to conform to ASTM A-307, Grade.
- C. Stainless Steel Pipe and Fittings
 1. Pipe: ASTM A312, Schedule 10S, Type 304/304L stainless steel with plain ends.
 2. Fittings: Precision, cold drawn, austenitic stainless steel with elastomer O-ring seals, suitable for working pressure to 500-psig (3450-kPa).
 3. Basis of Design: Victaulic Vic-Press for Schedule 10S Pipe.
- D. Copper Pipe and Fittings
 1. Pipe to be hard tempered, seamless copper tubing, ASTM B-88 and Federal Specification WW-T-799. Manufacturer's name or trademark and type of tubing to be identified at 3-foot intervals. Pipe to be Type K, L or M as hereinafter specified.
 2. Fittings in copper tubing 2-1/2" and smaller to be wrought sweat type fittings manufactured of seamless tubing forged bronze or brass rod to meet ANSI B16.22 and ASTM B-75. Fittings in copper tubing 3" and larger to be cast red bronze solder type fittings, meeting ANSI B16.18 and ASTM B-62. Fittings of either type to have tubing stops.
 3. Grooved end fittings shall be wrought copper to ANSI B16.22 and cast bronze to ANSI B16.18, manufactured to copper-tubing dimensions. (Flaring the adjoining tube or fitting ends to accommodate alternate sized couplings is not permitted.)
 - a. Couplings shall be Installation-Ready, for direct stab installation without field disassembly.
 - b. UL classified in accordance with ANSI / NSF-61 for potable water service, and shall be certified to the low lead requirements of NSF-372.
 - c. Basis of Design: Victaulic Copper-Connection with Series 607H couplings.
 4. If allowed by local code, Copper Press Fittings are an acceptable method of installation. Joints created in this manner to be installed in compliance with code and manufacturer's instructions and Article on "Installation, Copper Tubing" in Part 3 – Execution of this Section.
 - a. Acceptable Manufacturers:
 - 1) Viega
17545 Daleview Dr.
Lakewood, OH 44107 877.620.0016.
 - 2) Ridge Tool Co.
400 Clark Street
Elyria, OH 44035
800.519.3456.
 - b. Material: Copper press fittings to conform to material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings to be EPDM.
- E. Polyethylene (PEX) tubing and fittings
 1. Tubing:
 - a. Material: Crosslinked polyethylene (PEX) manufactured by PEX-a (Engle method).
 - b. Material Standard: Manufactured in accord with ASTM F 876 and ASTM F 877 and tested for compliance by an independent third party agency.
 - c. Minimum Bend Radius (Cold Bending): No less than 6 times outside diameter. Use PEX tubing manufacturer bend supports if radius is less than stated.
 2. Fittings:
 - a. Furnished by PEX tubing manufacturer. Comply with requirements in ASTM F 877.
 - b. Manufactured in accord with and from materials listed in ASTM F 1960.
 - c. Fitting assembly consisting of barbed adapter and applicable sized PEX ring. Barbed insert manufactured with O-ring to facilitate pressure testing with air.
 3. Manufacturers:
 - a. Uponor, Inc. – Wirsbo AQUAPEX® tubing and ProPEX® fittings.
 - b. REHAU North America – RAUPEX® tubing and EVERLOC® fittings.
- F. Cast Iron Soil Pipe & Fittings

1. Acceptable Manufacturers for Cast Iron and Hubless Cast Iron Soil Pipe and Fittings (no substitutions allowed):
 - a. AB&I Foundry.
 - b. Charlotte Pipe and Foundry.
 - c. Tyler Pipe.
 2. Service weight cast iron piping and fittings with hub and spigot conforming to ANSI A122.5.2 and ASTM A74.
 3. No hub cast iron piping and fittings conforming to CISPI standards 301-99. Couplings shall be made of 24 gauge type 304 stainless steel and with neoprene gaskets that are in conformance with ASTM C-564.
- G. Galvanized Waste and Vent Piping
1. Pipe to be standard weight threaded galvanized steel pipe, ASTM A-53, galvanized and tested in accordance with ASTM A-120. Each length of pipe to be legibly identified at the mill by paint, stenciling or raised symbols identifying the manufacturer and class of pipe.
 2. Fittings to be long pattern threaded and recessed coated cast iron drainage fittings.
- H. Plastic Pipe & Fittings
1. ABS Pipe & Fittings
 - a. Schedule 40 conforming to ASTM D-2661 specification.
 - b. Schedule 80 conforming to ASTM D-2661 specification.
 2. DWV PVC Pipe & Fittings
 - a. Schedule 40 conforming to ASTM D-2665 specifications.
 - b. Schedule 80 conforming to ASTM D-2665 specifications.
- I. Ductile Iron Pipe & Fittings
1. Pipe to be mechanical joint ductile iron with ductile iron glands, Style "A" conductive gaskets and Corten steel bolts. Pipe barrel to conform to ANSI A-21.51 and AWWA C-151. Mechanical joints to conform to ANSI A-21.11 and AWWA C-111.
 2. Fittings to be mechanical joint ductile iron, of the same type and with same glands, gaskets and bolts as specified for ductile iron pipe.
- J. Miscellaneous Piping
1. Nipples to be of same material as pipe.
 2. Close nipples are prohibited.
- K. Miscellaneous Fittings
1. Tees for branch connections to be welding tees.
 2. Long turn welding ells to be used on welded piping.
 3. Where welded pipe connections are allowed, Bonnie Weldolets or Thredolets may be used in place of welding tees.
 4. Mechanical Coupling Piping as manufactured by Victaulic, Central or Grinnell.
 - a. Where approved by the local authorities having jurisdiction, mechanical couplings and fittings may be used in lieu of threaded, welded or flanged joints and fittings.
 - b. Rigid couplings to be self-centering and to engage and lock the grooved pipe and/or fitting ends in a positive airtight couple. Rigid couplings are not to be used for expansion, contraction or deflection.
 - 1) Coupling housings shall be cast with offsetting, angle-pattern, bolt pads. Installation-Ready, for direct stab installation without field disassembly. Victaulic Style 107N
 - 2) Couplings shall be fully installed at visual pad-to-pad offset contact. Couplings that require gapping of bolt pads or specific torque ratings for proper installation are not permitted
 - c. Flexible couplings to be used to provide angular pipe deflection, contraction and expansion. Victaulic Installation-Ready Style 177 and Style 77.
 - d. 14" and Larger: AGS series two-segment couplings with lead-in chamfer on housing key and wide-width FlushSeal gasket. Basis of Design: Victaulic Style W07 (rigid) and Style W77 (flexible).
 - e. Coupling housing to be 2-piece ductile iron ASTM A-536.
 - f. Sealing gasket to be suitable for the intended service and designed to seal under pressure or vacuum.
 - g. Provide steel track-head bolts and steel hex-head nuts.

2.2 PIPING SPECIALTIES

- A. Unions: Make connections at each piece of equipment with unions or flanges located for quick and easy disconnect for maintenance.

1. For Steel Pipe:
 - a. 2" and smaller; malleable iron unions with ground joint brass to iron seat, 150 lb. working pressure. Grinnell #463, black or galvanized.
 - b. 2-1/2" and larger (welded); forged steel flanges, 150 lb. welding neck or slip-on with raised faces and 1/16" cross laminated gaskets and carbon steel bolts. Grinnell Fig. 1911 and 1921.
 - c. 2-1/2" and larger (screwed) use cast iron flanged unions, threaded, galvanized or black 175 lb. water gasket type with carbon steel bolts. Grinnell #487.
2. For Copper Pipe:
 - a. Up to 3"; Wrought, solder joint ANSI B16.22, Nibco 633.
 - b. 3"; cast copper alloy solder joint, ANSI B16.18, Nibco 733.
3. Dielectric Unions:
 - a. In cases where copper pipe connections are made to piping or items of equipment of dissimilar metal, provide dielectric unions.
 - b. 2" and smaller; steel body and nut with insulating gasket (250 lb. @ 210 F.) and copper connector. EPCO models, FX, EA and FB.
 - c. 2-1/2" and larger; cast iron body flanges with insulating gasket (250 lb. @ 210 F.) and copper connector. EPCO model GX & GA.
 - d. Dielectric Waterway: Copper silicon casting conforming to UNS C87850 with grooved and/or threaded ends. UL classified in accordance with NSF-61 for potable water service, and shall meet the low-lead requirements of NSF-372. Basis of Design: Victaulic Series 647.
- B. Floor Wall & Ceiling Plates (Escutcheons)
 1. Escutcheons for pipes passing through floors in unexposed areas shall be a split hinged stamped brass, type designed to fit the pipe and to cover the projecting pipe sleeve.
 2. Escutcheons for pipe exposed to view in finished areas and toilets shall be chrome plated brass.
- C. Pressure Gauges
 1. Bourdon-spring pressure type with non-corrodible movements, set in cast aluminum case, flared type construction. Gauges shall have 4-1/2" dials with white background, black lines and figures, full scale to be 2 times working pressure. Gauges shall be as manufactured by Terice, Ashcroft, U.S. Gauges Company, Crosby, Marsh or Weiss.
- D. Thermometers
 1. Red reading mercury filled lens tube type with separable socket, adjustable angle style with 9" cast aluminum case; 30 F to 300 F range with 5 F maximum scale division for hot water, with maximum numeral spacing every 25 F. 30 F to 100 F range with 2 F maximum scale divisions for chilled water with maximum numeral spacing every 10 F. Accuracy of plus-minus one scale division. Thermometers shall include a Celsius temperature scale in addition to the Fahrenheit scale. Thermometers shall be as manufactured by Palmer, Taylor, Wexler, Terice or Weiss.
 2. Solar powered industrial thermometer with separable socket, adjustable angle style with high impact ABS case; -50°F - 300°F temperature range; 10 Lux rating; 3/8" LCD digit display. Thermometers shall be as manufactured by Wika, or acceptable substitute.
- E. Strainers
 1. Y-pattern or T pattern (Victaulic) type, cast ductile iron or semi-steel (bronze when installed on copper or brass pipe), pressure rated for intended service. Stainless steel screen, perforations shall be 1/32" for steam, gas and air and 3/16" for liquids. A 16 mesh start-up screen shall be provided which shall be removed after system start-up operations. Gasketed machined flanged cap with threaded blow down opening. Strainers shall be screwed for size 2" and smaller and flanged for 2-1/2" and larger. Armstrong, Mueller, Gustin Bacon, Victaulic.

2.3 PIPE SLEEVES

- A. Provide pipe sleeves and openings necessary for the installation of the work of Divisions 20 - 23 as follows:
 1. Exterior wall sleeves - schedule 40 galvanized steel pipe sleeves.
 2. Floor sleeves in exposed areas - schedule 40 galvanized steel pipe sleeve.
 3. Masonry wall sleeves - schedule 40 galvanized steel pipe sleeves.
 4. Gypsum wall sleeves and sleeve through existing construction - 22 gauge galvanized
 5. Roof sleeve and floor sleeves in concealed location - 22 gauge galvanized steel.

- B. Water tight or gas tight poured in place walls and slabs and masonry walls shall have Link-Seal, or acceptable substitute between the pipe and the sleeve.

2.4 PIPE HANGERS, SUPPORTS & ANCHORS

- A. Provide concrete inserts, clamps, pipe hangers, anchors and equipment supports required to rigidly support the systems and equipment installed under Divisions 20 - 23. Hanger design shall permit vertical adjustment and lateral movement to allow pipe expansion. The figure numbers referred to below are Elcen Metal Products Co.
 - 1. Approved manufactures:
 - a. Grinnell Company, Inc.
 - b. PHD Manufacturing, Inc.
 - c. B - Line Systems
 - 2. Provide solid steel hanger rods for each pipe hanger. Equip each hanger rod with three semi-finished hex nuts not including the insert nut.
 - 3. Provide an Elcen Figure 33 or 34 beam clamp for each hanger rod attached to structural steel sections. Duct work hangers and pipe hangers supporting individual pipes 2" and smaller may be attached to structural steel using Elcen Figure 29V "C" clamps with lock nuts.
 - 4. Provide Elcen Figure 12 clevis hangers for all individually supported ferrous piping of the following systems:
 - a. Waste and Vent.
 - 5. Provide Elcen Figure 260 clevis hangers with Fig. 167 or Fig. 240 shields for insulated lines on all piping of the following systems:
 - a. Domestic cold water, hot water and circulating hot water.
 - b. Condensate drain.
 - c. Rain water leaders.
 - 6. Provide Elcen Figure 70C protective hangers for all plastic piping of the following systems.
 - a. Waste and vent.
 - 7. Provide concrete tight formed steel concrete inserts suitable for 1200 lb. maximum loads, Elcen Figure 88 for each hanger rod attached to cast-in-place concrete. Where several pipes are run parallel and hung at different levels, Elcen Figure PS349 continuous steel insert with end caps and a closure strip may be used providing the total load placed on the insert will not exceed 2000 lb. per foot of insert.
 - 8. When inserts are required in existing concrete or have been omitted or improperly positioned in new concrete provide Elcen Figure 212E self-drilling expansion shells.
- B. Pipe hangers supporting and in direct contact with copper piping shall be copper plated, or epoxy coated.
- C. Hangers for fire protection piping to be U.L. listed.
- D. Vertical piping and risers shall be supported at each floor with riser clamps. Where unforeseen conditions require special supporting construction, the design shall be approved by the Architect/Engineer. Exposed risers shall be supported by a steel plate washer 1" larger in diameter than the pipe welded to the pipe. Piping subject to expansion may be guided at each floor in lieu of riser clamps.

2.5 VALVES

- A. Valves for each system shall be of one manufacturer unless noted otherwise.
- B. Valve shall be for not less than 125 lb. water working pressure, and in any event shall be compatible in working pressure to the pipe and fittings to which they are attached. Valves shall be designed for the service for which they are attached.
- C. Valves 2" and smaller, shall have screw end or solder end connection except as otherwise shown in the Contract Documents. Valves 2-1/2" and larger shall have flange end construction except as otherwise shown in these specifications or Drawings. Victaulic valves 2-1/2" and larger shall have grooved connections.
- D. Manufacturers shall be Apollo, Victaulic, Crane, Grinnell, Hammond, Milwaukee, Mueller, Nibco, Stockham, Watts or as noted. Name of manufacturer, service and pressure marking to be cast into valve body, or identified by attached name plate.
- E. Gate Valves:
 - 1. 2" and smaller: ASTM-584 bronze body and trim, screw-in bonnet, threaded or solder ends, rising stem, 125 lb. S.W.P., 200 lb. W.O.G., Nibco T134 or S-111.

2. 2-1/2" and larger: iron body, bolted bonnet bronze trim, flanged ends, O.S. & Y. rising stem, 125 lb. S.W.P., 200 lb. W.O.G., Nibco #F-617-0.
 3. Cast Iron ball valves with Teflon coated cast iron ball, flanged ends, 125lb. S.W.P., 200lb. W.O.G., is an acceptable substitute for iron body gate valves. American Valve Series 4000.
- F. Ball Valves:
1. 2" and smaller: ASTM-584 bronze body, stainless steel ball and stem, threaded or solder ends, vinyl coated handle, 125 lb. S.W.P., 200 lb. W.O.G., Nibco T-580-SS, S-580-SS, Apollo 70 Series.
 2. Where full port valves are required by local codes they shall be used. Apollo 77 series for 3/4" thru 2".
 3. Victaulic Series P569 stainless steel ball valves may be used with the Vic-Press piping system.
- G. Globe Valves:
1. 2" and smaller: ASTM-584 bronze body and trim, screw-in bonnet, threaded or solder ends, rising stem, 125 lb. S.W.P., 200 lb. W.O.G., Nibco, T-211-Y or S-211-Y.
- H. Butterfly Valves:
1. Valve bodies shall be of ductile iron or high grade cast iron with extended neck to accommodate pipe insulation and shall be grooved end or of lug body design using stainless steel bolts to provide end of line service.
 2. Discs shall be of aluminum bronze or coated ductile iron construction with no external fasteners.
 3. Seat material shall be EPDM, pressure responsive in sizes through 12". Stems shall be 316 stainless steel, 2-piece type, with infinitely adjustable, corrosion resistant throttling handle with memory stop.
 4. Stems shall be 316 stainless steel, 2-piece type. Stem shall be offset from the disc centerline to provide complete 360-degree circumferential seating.
 5. Valves 2" to 6" shall have throttling levers. Valves 8" and larger shall utilize worm gear operators.
 6. Valves shall be rated for 150 PSIG or better.
 7. Valve shall be designed for bi-directional, dead end services to full working pressure.
 8. Approved manufacturers: Demco, Victaulic, Kitz Valves, Keystone, Centerline, Mueller, Dezurik and Grinnell.
- I. Check Valves:
1. 2" and smaller ASTM-584 bronze body and trim, horizontal swing thread or solder ends, 125 lb. S.W.P., 200 lb. W.O.G., Nibco T433Y or S-413B.
 2. Size 2-1/2" thru 6": iron body, bronze trim, flanged ends, 125 lb. S.W.P. 200 lb. W.O.G. Nibco F-968-B.
 3. 2" thru 4": Victaulic Series 712 with stainless steel trim.
- J. Drain Valves
1. Bronze body, threaded or solder inlet end with hose thread outlet, 125 lb. Nibco Fig. No. 72,73 or 74.

2.6 EARTHQUAKE PROTECTION

- A. Seismic sway brace devices for suspended piping, ductwork, and equipment:
1. Cable Type:
 - a. Loos & Co., Inc., Seismic Wire Rope/Cable™ Bracing for plumbing piping, gas piping, fire protection sprinkler system piping, and HVAC ductwork, UL listed (FM approval N/A).
 - b. Ductmate® Industries, Inc., Clutcher™, mechanical system hanger, and EZ-Lock™, wire rope beam clamp in conformance with ICC Code Guideline For HVAC duct supports, Evaluation Service, Inc, EG284.
 2. Rigid Type:
 - a. Tolco™ A Brand of Nibco: Sway brace fittings for plumbing piping, gas piping, fire protection sprinkler system piping, and HVAC ductwork, UL listed (FM approval N/A).
- B. Flexible Expansion Loop
1. Flexible expansion / seismic loops to be "Metraloop®" as manufactured by The Metraflex Company, Chicago, IL.
 2. Flexible loops to consist of two flexible sections of hose and braid, two 90 degree elbows and a 180 degree return, assembled in such a way that the piping does not change direction, but will maintain its course along a single axis. Loops to include a factory supplied (center, centre) support nut located at bottom of 180 degree return and a drain/air release plug.
 3. Materials of construction and fitting type to be consistent with pipe material and equipment/pipe connection fittings.

4. Connectors to be UL classified in accord with NSF/ANSI std. 61.

2.7 FIRESTOPPING

- A. 3M brand 7900 Series system.
- B. 3M brand CP 25 caulk. Dow Corning firestop sealant. GE RTV 7403.
- C. 3M brand FS 195 wrap.
- D. Similar products manufactured by Tremco, Dow Corning, GE., Hevi-Duty Nelson.

2.8 ACCESS PANELS

- A. Where items such as valves, traps, specialties, or any piece of equipment or device requiring adjustment or service, are concealed in the construction, an access panel is to be provided to permit adjustment or service.
- B. Access panels shall be furnished by Divisions 20 - 23. Refer to Section **xxxxx** for the products which are to be furnished.
- C. Each trade to confer with other trades with respect to access panel locations, and wherever practical group valves, traps, dampers and other like items, in such a way as to be accessible from a single panel.

PART 3 - EXECUTION

3.1 GENERAL

- A. In general, all piping, ductwork and similar items to be installed concealed from view above the ceiling, in partitions, shafts, chases, unless otherwise indicated.
- B. The Contract Documents for Divisions 20 - 23 are diagrammatic and are a graphic representation of requirements intended to convey the scope of work and to indicate the fixtures and other included work. Duct and pipe rerouting and duct size changes are to be added at no additional cost to the Owner.
- C. Locations of items not definitely fixed by dimensions are approximate only and exact locations necessary to secure the best conditions and results shall be determined at the site and be subject to review.
- D. Follow Contract Documents in laying out work, check work or other trades to verify spaces in which work will be installed and maintain maximum headroom and space conditions at all points.
- E. Where pipes are in partitions, furred out spaces and chases, obtain information as to their exact location and size and install work so as to be entirely concealed in the allotted space. If conflicts arise making this impossible, obtain instructions from the Engineer before proceeding with the work.
- F. Wherever two or more pipes are to be installed in parallel, or parallel to the piping of other trades, the piping shall be installed with sufficient space between pipes to allow for the proper application of pipe covering, painting and servicing.
- G. Furnish advance information on locations and size of frames, boxes, sleeves and openings needed for the work, and also furnish information of other work without delay.
- H. Where there is evidence that parts of the work in Divisions 20 - 23 will interfere with other work and/or the structure, assist in working out space conditions and make necessary adjustments to accommodate the work.
- I. Work installed before coordinating with other trades which causes interference with other work shall be changed to correct such condition without additional cost to Owner. This shall apply to shop fabricated work as well as work fabricated in place.
- J. Products, appliances and equipment are to be installed and connected using standard industry practices and in accordance with the manufacturer's instructions.
- K. Singular Number - In case where a device or part of the equipment is herein referred to in the singular number (such as a lavatory) it is intended that such reference shall apply to as many such items as are required to complete the installation.

3.2 GENERAL METHODS FOR PIPING INSTALLATION

- A. Pipes shall be round and straight. Cutting shall be done with proper tools and pipes shall be reamed to full size after cutting.
- B. Piping shall be properly enclosed, supported, guided, anchored, sway braced, connected, tested, cleaned and flushed out and shall be properly insulated and protected where required.
- C. Pipes shall be run with proper grade to provide for easy draining, in group runs where applicable, and in a neat and orderly manner to the satisfaction of the Engineer.
- D. Pipe runs shall be carefully laid out to provide maximum utilization of space.
- E. Sizes shown in the Contract Documents are nominal pipe sizes and not outside diameters.
- F. Pipes shall be run substantially as indicated in the Contract Documents.
- G. Piping shall be installed with ample provisions for expansion and contraction. Such provisions shall be made by means of piping offsets, changes in direction, expansion loops, and expansion joints. Expansion joints shall not be used in lieu of offsets, changes in direction or loops, except where specified or indicated in the Contract Documents or where otherwise obviously necessary.
- H. Horizontal runouts from mains and/or risers shall be made with swing joints and shall be of sufficient length to absorb vertical expansion and/or contraction of risers and horizontal expansion or contraction of mains.
- I. Connections to apparatus and equipment shall be with flanges, unions etc., for easy removal.
- J. Piping shall be arranged to provide access to openings and to permit convenient removal of coils and pulling of tubes. Provide additional flanges or unions as required to provide these features.
- K. Provide shut-off valve or cock between every automatic air vent discharge to drains.
- L. Install manual drain valves at every low point of water piping systems and a manual air vent at every high point of water piping systems. Drain valves attached to piping sizes 4" and larger shall be 2" size. Exact location of drain valves to be verified and approved by Engineer.
- M. Changes in pipe shall be made with reducing elbows, reducing tees or increasers. Increasers may be concentric. Reducers shall be eccentric; flat on top for water, flat on bottom for steam.
- N. Piping up to 2" inclusive shall be reamed after cutting.
- O. Piping shall be cleaned internally immediately prior to installation into the pipe line.
- P. Cap or cover all open piping during erection to prevent entry of foreign material.

3.3 PIPE & PIPE FITTINGS

- A. Copper Pipe & Fittings
 - 1. Sweated joints in copper tubing to be made with the proper paste flux and 95-5 tin antimony solder.
 - 2. Both male and female parts of each joint must be hand-burnished with wire brushes or abrasive cloth.
 - 3. Mechanically Formed Tee Connections
 - a. Mechanically formed tee connections may be used where permitted by local code and authorities having jurisdiction.
 - b. Mechanically extracted collars shall be formed in a continuous operation consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the tube wall.
 - c. The joining branch tube shall be permanently deformed to set the proper penetration of the branch tube into the fitting.
 - d. Joints shall be brazed in accordance with the Copper Development Association Copper Tube Handbook using B-cup series filler metal. Note: Soldered joints will not be permitted.
 - e. Mechanically formed tee connections may be used for branch line connections up to one pipe size smaller than main pipe size.
 - 4. Press Connections:
 - a. Make copper press fittings in accord with manufacturer's installation instructions.
 - 1) Fully insert tubing inserted into fitting and mark tubing at shoulder of fitting.
 - 2) Check Fitting alignment against mark on tubing to assure tubing is fully engaged (inserted) in fitting.

- 3) Press joints using tool approved by manufacturer.
- B. Polyethylene (PEX) tubing and fittings installation
1. Install tubing in accord with tubing manufacturer's recommendations and as indicated in tubing manufacturer's installation handbook.
 2. Do not install within 6-inches of gas appliance vents and within 12-inches of recessed light fixtures.
 3. Do not solder within 18-inches of tubing in same waterline. Make sweat connections prior to making tubing connections.
 4. Do not expose tubing to direct sunlight for more than 30 days. If construction delays are encountered, cover tubing that is exposed to direct sunlight.
 5. Ensure that no glues, solvents, sealants, and chemicals come in contact with tubing without prior permission from tubing manufacturer.
 6. Use grommets or sleeves at penetrations for tubing passing through metal studs.
 7. Protect tubing with sleeves where abrasion may occur.
 8. Install engineered secondary pipe positioning and support systems where tubing penetrates stud and joists, and for horizontal supports.
 9. Use tubing manufacturer supplied bend supports where bends are less than 6 times outside pipe diameter.
 10. Locate supports at not less than 32-inches between hangers in accord with manufacturer's tubing installation handbook.
- C. Cast Iron Soil Pipe & Fittings
1. Join hub and spigot cast iron pipe fittings with:
 - a. Premolded neoprene gaskets conforming to ASTM specification C-564-70.
 - b. Lead and Oakum.
 2. Join No-Hub Cast Iron and Fittings with:
 - a. No-hub premolded neoprene gaskets and stainless steel compression band conforming to CISPI standard 310-97.
 - b. Coupling consisting of the housing fabricated in two parts of grey-cast iron coating in accordance with ASTM A48. The coupling gasket shall be molded neoprene rubber per ASTM C564. Coupling bolts and nuts shall be, made of 18-8 stainless steel.
 3. Join cast iron fittings to threaded steel pipe using Rectorseal pipe joint compound on male threads only.
- D. Plastic Pipe & Fittings - Thoroughly clean all joint surfaces before starting the joining process. Make all connections to other piping systems using adapters. Do not thread schedule 40 pipe. Schedule 80 pipe may be threaded.
1. PVC - Join piping by solvent welding using only PVC solvent and primer as recommended by the pipe and fitting manufacturer. Primer shall be a contrasting color to the pipe and solvent.
 2. ABS - Join piping by solvent welding using only ABS solvent and primer as recommended by the pipe manufacturer. Primer shall be a contrasting color to the pipe and solvent.
 3. Below grade piping shall be laid on a continuous granular bed. Installation shall comply with ASTM D2321.
- E. Ductile iron pipe
1. Ductile iron pipe shall be wrapped with Polyethylene Wrap: conform to AWWA C105/A21.5, Class C (Black), tube form. Material shall conform to ASTM A674.

3.4 PIPE SPECIALTIES

- A. Unions
1. Use the same material and finish as the pipe system.
 2. Use dielectric unions or flanges in water lines where copper or brass piping is connected to ferrous pipe or equipment.
 3. Unions or flange unions shall not be used in straight runs or pipe or in concealed locations except for flanged valve applications.
- B. Floor, Wall & Ceiling Plates (Escutcheons)
1. Cut plates as necessary to fit in close quarters.
- C. Pressure Gauges
1. Each gauge shall be connected to its respective pipe line, and located where shown by means of suitable brass pipe and fittings containing a brass cock.

2. Install shut-off ahead of each gauge. Provide snubbers for gauges in water systems and single coil syphon for gauges in steam service.
3. Install gauges to indicate pressures on each side of pumps, and elsewhere as noted.
4. Install pressure gauge at building water service, downstream of meter.

D. Thermometers

1. Locate accessibly for ease in reading. Thermometers located more than 6'-6" above the floor shall be installed at an angle of 30 degrees above horizontal.
2. Scale shall be adjusted at mid-range after immersing in a constant temperature water bath for 30 minutes.
3. Install thermometers on hot and tempered water pipes at thermostatic mixing valves.
4. Install thermometer at inlet and outlet to water heater.
5. Install thermometers on hydronic piping mains at inlet and outlet of heat transfer equipment.
6. Install thermometers on inlet and outlet of air handling unit hydronic coils (not including unitary equipment).

E. Strainers

1. Install on the upstream side of backflow preventors, automatic valves, steam traps, pressure regulators, ahead of pumps and elsewhere as indicated.

3.5 PIPE HANGERS, SUPPORTS AND ANCHORS

- A. All hangers shall be attached to structural members as defined in Section 20 10 00-1.02 of the specifications.

- B. Piping shall be supported as follows:

1. Horizontal Steel Piping:

PIPE SIZE	ROD DIAMETER	MAXIMUM SPACING	MAXIMUM DISTANCE TO ELBOW, WALL, VALVE OR EQUIPMENT
Up to 1-1/4"	3/8"	8'-0"	2'-0"
1-1/2" – 3"	1/2"	8'-0"	3'-0"
4" – 6"	3/4"	10'-0"	3'-0"
8" – 10"	7/8"	10'-0"	3'-0"
12"	7/8"	10'-0"	3'-0"

Pipe 10" and larger shall be supported by steel rods attached to 4 x 3 x 1/4 inch steel angles spanning a minimum of 3 bar joists.

2. Horizontal Copper Piping:

PIPE SIZE	ROD DIAMETER	MAXIMUM SPACING	MAXIMUM DISTANCE TO ELBOW, WALL, VALVE OR EQUIPMENT
Up to 1-1/2"	3/8"	6'-0"	2'-0"
2"	3/8"	10'-0"	3'-0"
2-1/2" – 4"	1/2"	10'-0"	3'-0"

3. Horizontal ABS or PVC Piping:

PIPE SIZE	ROD DIAMETER	MAXIMUM SPACING
Up to 1-1/2"	3/8"	2'-8"
2" & Larger"	3/8"	2'-8"

- C. At a minimum hanger spacing and requirements shall comply with MSS SP-69 and SP-89.

- D. Regardless of any of the above listed hanger spacings, provide a hanger not more than 12" from each change in direction of piping and at each drop and riser.

- E. Hangers supporting cast iron soil pipe for the hub and spigot type in 5'-0" lengths shall be located at the pipe hub connections.
- F. In no case will any pipe be installed where it is supported on or suspended from another pipe, conduit or duct.
- G. Hangers on insulated pipe shall be large enough to encompass the insulation and metal saddle for same.
- H. Saddles for 4" and larger piping shall be fabricated of 14 gauge galvanized iron and for smaller piping shall be fabricated of 16 gauge galvanized iron. Saddles shall encompass one half of the diameter of the covering and lengths shall be as follows:

PIPE SIZE	SADDLE LENGTH
Up to 6"	12"
8" thru 12"	16"
Over 12"	20"

3.6 PIPE SLEEVES

- A. Fabricate sleeves from new material, with ends cut square. Install sleeves 1 1/2" larger than O.D. of pipe or pipe insulation, where insulated. Caulk annular space between pipe and sleeve with a waterproof caulking material,
 - 1. Exterior Wall Sleeves: Install sleeve reamed with welded flanged ends flush with wall.
 - 2. Floor Sleeves: Install sleeves reamed with the top of the sleeve 4" above the floor in equipment rooms and wet areas and 1/4" above the floor in all other locations.
 - 3. Masonry Wall Sleeves (Interior): Install sleeves reamed and finished flush with wall.
 - 4. Gypsum Wall Sleeve & Sleeves Through Existing Construction: Terminate ends flush with wall.
- B. Sleeves shall be set and maintained in place by Divisions 20 - 23 during the progress of the work.

3.7 VALVES

- A. Valves shall be installed ahead of control valves and at all mechanical apparatus and fixtures to permit maintenance of the same without shutting down the service of the piping systems in the building. Provide main shut-off valve at domestic water service entry to building. Valve each domestic water branch at the main except at plumbing fixtures having integral stops. Provide drain valves at low points of piping.
- B. Install valves with stems extending above the horizontal position.
- C. Install gate valves with the stem in the vertical position.
- D. Install each valve to be easily accessible for operation, visual inspection and preventive maintenance.
- E. Each main branch valve installed in a mechanical room or boiler room over 7 feet above the floor to be equipped with adjustable sprocket rim with chain guide and continuous chain.
 - 1. Valves to be installed with the wheel in a vertical plane.
 - 2. The continuous chain to reach within 4 feet of the floor.
- F. Provide valves where indicated in the Contract Documents and where necessary for proper control of piping and equipment.

3.8 CHASES, SLEEVES AND WALL OPENINGS

- A. The placing of sleeves in walls, floors, etc. shall be the responsibility of Divisions 20 - 23. Verify that chases, shafts, etc. indicated on Drawings for Divisions 20 - 23 work are provided. In case of failure to do so, chase or openings will be cut by Divisions 20 - 23 and patched as required to accommodate work.

3.9 EXCAVATING AND BACKFILLING FOR MECHANICAL WORK

- A. Excavating and backfilling for work provided under Divisions 20 - 23 shall be provided under this section. Excavation for all pipes, ducts, conduits, etc., shall be carefully protected from damage due to frost, water or other causes, and work damage shall be promptly and properly repaired. No excavating shall be done as to undermine or damage bearing of column or wall footings. Excavations below footings shall not be deeper than one-half the horizontal distance from such footings or foundations. Provide necessary barricades, shoring, sheeting, etc. for protection of the work and personnel. No backfilling shall be done until all work which is to be covered has been inspected, tested as required and approved.
- B. Backfilling below floor slabs on grade shall be done with free draining granular fill, maximum of 5 percent passing a 200 sieve. Fill shall be placed in maximum of 6" layers, each properly compacted to a relative density of at least 95% of the modified proctor density ASTM D-1557.
- C. Excavation outside the building walls below sidewalks, paved and parking areas shall be backfilled as specified for areas below slabs on grade. Other outside areas shall be backfilled with material similar to those removed but free from rubbish and other perishable material and compacted to 95 modified Proctor density.
- D. Where streets are cut into for any service, they shall be replaced or repaired to the specifications and requirements of the municipality.

3.10 CUTTING AND PATCHING

- A. Cutting and patching required to install any portion of this work or to correct defects in work shall be the responsibility of Divisions 20 - 23. Patching shall be done in a manner to match existing construction.
- B. Cutting and patching necessary to install any work shall be carefully done under the direction of the Architect/Engineer. Damage caused by neglect of this clause shall be made good under this Section.
- C. Patching of surfaces remaining after Mechanical demolition shall be done under this section unless indicated on the Architectural drawings.

3.11 PROTECTION

- A. Openings and equipment, where set shall be covered to prevent obstruction to pipes, breakage, misuse or disfigurement of equipment. Openings in equipment shall be immediately covered upon uncrating or receipt at the job site and shall remain covered until permanent connection is made.
- B. Damage to piping, fixtures or equipment shall be the responsibility of Divisions 20 - 23. Material installed under Divisions 20 - 23 shall be kept clean until final acceptance of entire building by Owner.
- C. Provide protective guards for devices such as thermostats, valves, switches and sprinkler heads which are located in mechanical rooms, loading docks, stairwells.
- D. Protect all work against injury by freezing or exposure to weather while stored or installed in place. All motors to be wrapped for protection against moisture until the building is enclosed.
- E. Fans not in operation to have shafts rotated by hand each week.

3.12 THRUST BLOCKS

- A. Ferrous underground water pressure pipes shall have tees and bends braced with cast-in-place concrete thrust blocks. Thrust blocks should be sized for an allowable soil bearing pressure of 2500 psf, or as listed in the soils report. Concrete thrust blocks shall be placed against undisturbed soil and constructed so that joints will be accessible for inspection.
- B. Where the use of thrust blocks is not practical, such as piping within vaults and pipe entrances into buildings, socket clamps with tie rods shall be used and fittings shall have integral lugs designed for use with tie rods. In lieu of tie rods mechanical joint cast iron pipe may have tie rods threaded into flanges. Refer to Standard of the National Fire Protection Association for Outside Protection, No. 24 for acceptable methods of installation.

3.13 MECHANICAL SUPPORTING DEVICES

- A. Roof Supports

1. Supporting curbs for power roof ventilators, gravity relief ventilators and intakes, goosenecks, condensing units and elsewhere as indicated on the Drawings shall be furnished and installed under another Division of the specifications.
 2. Supporting curbs for rooftop HVAC units shall be furnished and installed by Division 23.
 3. Supporting framework for roof curbs shall be provided by another Division of the specifications.
- B. Floor Supports
1. Divisions 20 - 23 shall provide reinforced concrete bases (minimum 4") under all floor mounted equipment furnished under this contract except where shown otherwise on the Drawings.

3.14 ACCESS PANELS

- A. Where items such as valves, traps, specialties, or any piece of equipment or device requiring adjustment or service, are concealed in the construction, an access panel is to be provided to permit adjustment or service.
- B. Panels to be provided by others.
- C. Each trade to confer with other trades with respect to access panel locations, and wherever practical group valves, traps, dampers and other like items, in such a way as to be accessible from a single panel.
- D. Where items such as valves, traps, specialties, or any piece of equipment or device requiring adjustment or service, are concealed in the construction, an access panel is to be provided to permit adjustment or service.
- E. Panels to be furnished by Divisions 20 - 23 and installed by the General Contractor.

3.15 EARTHQUAKE PROTECTION

- A. Support suspended equipment and gas piping in accord with governing code to protect from earthquake damage.
- B. Support suspended HVAC ductwork and equipment in accord with SMACNA Standards and governing code to protect from earthquake damage.
- C. Flexible Expansion Loops:
 1. Install UL classified flexible expansion loop designed for seismic movement at pipe passing through or crossing building seismic joints.
 2. Flexible loops to impart no thrust loads to system support anchors or building structure.
 3. Locate loops at, or near, building seismic joint.
 4. Install a vertical support hanger, located within 4 pipe diameters, on each side of the flexible loop. Brace each hanger transversely and longitudinally braced in accord with local codes. Seismic bracing not to pass through building seismic joint and not to connect or tie together different sides or parts of building structure.
 5. Flexible Loops: Capable of movement in plus or minus X, Y, and Z planes.
 6. Install, inspect, and test flexible loop connection to piping in accord with current standards and governing codes.
- D. Inspections and tests necessary to comply with seismic code requirements are to be performed and documented as part of the Work.

3.16 FIRE RATED BARRIERS

- A. Divisions 20 - 23 is responsible for maintaining the integrity of all fire related barriers (walls, floors, etc.) penetrated by work installed under Divisions 20 - 23 of the specifications.
- B. The following procedures shall be used as dictated by project conditions:
 1. Penetration of floor slabs or concrete walls (poured or block) - sleeve or core drill floor or wall, and seal penetration between pipe or duct and sleeve with sealing system capable of passing a 3 hour test hour ASTM E814 (UL 1479).
 2. Penetration of sheetrock walls, cut opening in wall, install penetration and caulk with firestop sealant.

3.17 FIRE SAFETY PRECAUTIONS

- A. Cutting, welding, brazing or sweating operations carried on in the vicinity of, or accessible to combustible material, shall be adequately protected to make certain that a spark or hot slag does not reach the combustible material and start a fire.

- B. When it is necessary to do cutting, welding, brazing or sweating close to wood construction, in pipe shafts, or other locations where combustible materials cannot be removed or adequately protected, employ fireproof blankets and proper fire extinguishers. A helper shall be stationed nearby to guard against sparks and fire.
- C. Whenever combustible material has been exposed to molten metal or hot slag from welding or cutting operations, or splatter from electric arc, a guard shall be kept at the place of the work for at least one hour after completion to make sure that smoldering fires have not been started.

3.18 CONCRETE WORK

- A. For concrete work indicated or specified under Divisions 20 - 23, refer to concrete specifications under Division 3.

3.19 SIDEWALK, SOD AND LANDSCAPING REPLACEMENT

- A. This Contractor shall repair and replace all sidewalks, curbs, street or drive paving, sod and shrubbery disturbed during his work. Reconstruction shall be identical with the existing construction. Final surfaces shall be of the same elevation and shall match adjacent surfaces. Where public streets, walks, etc. are encountered, construction shall conform with City requirements.

END OF SECTION

SECTION 20 70 00 ELECTRICAL MOTORS AND WIRING

PART 1 - GENERAL

1.1 SUMMARY

- A. The General Provisions of the Contract, including Conditions of the Contract and Division 1 of the Specifications, apply to the work in this section.
- B. This section is hereby made a part of all other sections of Divisions 20 – 23 as fully as if repeated in each therein,
- C. Unless otherwise specified herein, magnetic starters, disconnects and power wiring shall be furnished and installed by Division 26.
- D. Control wiring shall be by Division 23 unless indicated on the Division 26 drawings.
- E. Divisions 20 - 23 shall furnish wiring diagrams and circuit data to aid in wiring of mechanical equipment.

1.2 QUALITY ASSURANCE

- A. Referenced Standards and Guidelines:
 - 1. Institute of Electrical and Electronic Engineers (IEEE)
 - a. IEEE 519-2014
 - 2. Underwriters Laboratories (as appropriate)
 - a. UL 508, 508A, 508C, UL 61800, 61800-5-1, 61800-5-2, UL 1995
 - 3. The Association of Electrical Equipment and Medical Imaging Manufacturers (NEMA)
 - a. NEMA ICS 7-2014, Adjustable Speed Drives
 - 4. International Electrotechnical Commission (IEC)
 - a. EN/IEC 61800
 - 5. National Electric Code (NEC)
 - a. NEC 430.120, Adjustable-Speed Drive Systems
 - 6. CSA Group
 - a. CSA C22.2 No. 274
 - 7. International Building Code (IBC)
 - a. IBC 2018 Seismic – referencing ASCE 7-16 and ICC AC-156
- B. Each item of equipment to have the manufacturer's name, address, model number and rating on a plate securely affixed in a conspicuous place.

1.3 SUBMITTALS

- A. Submit Manufacturer's descriptive data in accordance with Section 20 10 00 describing motors rated 1 HP or greater. Submittal data to be included with various items of motor driven equipment under Divisions 20 – 23.
- B. Submit Manufacturer's descriptive data for the variable frequency controllers.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Motors exposed to moisture to be completely dried out before connection and start-up, supplying trade responsible until Owner's acceptance.

PART 2 - PRODUCTS

2.1 MOTORS

- A. All motors conform to NEMA and bear the nameplate of manufacturer with current and operating characteristics noted thereon. All single phase motors shall be provided with built-in thermal overload protection.
- B. Motor characteristics shall be as follows unless noted otherwise.
 - 1. Motors 1/3 H.P. and smaller rated at 115 volt, single phase, 60 hertz.

2. Motors 1/2 H.P. and larger as follows:

<u>ELECTRICAL SERVICE</u>	<u>MOTOR RATING</u>
208-3-60	200-3-60
240-3-60	230-3-60
277-1-60	265-1-60
480-3-60	460-3-60

3. Refer to schedule on Drawings for motor sizes and electrical characteristics.

- C. Motors one HP and larger shall be classified as “premium efficiency”, and exceed the NEMA premium efficiency levels by a minimum of one full percentage point. Motors for emergency service only need not comply with the efficiency requirements. Examples are fire pump motors, jockey pump motors, dedicated smoke exhaust fan motors, stair pressurization fan motors.
- D. Motors which are to be controlled by a variable frequency drive shall be of a type that is compatible with the controller.

2.2 VARIABLE FREQUENCY CONTROLLER

- A. Furnish Variable Frequency Motor Controllers for air handling unit fans and/or circulating pumps in accordance with the schedule on the Drawings.
- B. Each unit shall be:
1. ABB programmable frequency AC motor control to provide variable speed control for motors.
 2. Provide control interface for remote static pressure sensor provided by Section 23 09 00.
- C. Controllers are to include LCD status indicator with 0 - 60 Hz frequency readout of operating condition. Terminal strips with linear 0 - 20 ma. output corresponding to 0 - 60 Hz are to be provided for EMS connection. Provide manual bypass with standard motor starter where unit serves single pumps or air handling unit fans. Unit shall be complete with a disconnect switch.
- D. Acceptable manufacturers shall be Danfoss, Yaskawa.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Protect motors from exposure to high humidity and precipitation prior to installation.
- B. Wiring of controls, equipment and accessories not factory wired, is to be done in accordance with Division 26 specifications.

3.2 VARIABLE FREQUENCY CONTROLLER

- A. Variable Frequency Controller is to be factory mounted in Rooftop equipment.
- B. Variable Frequency Controller shall be installed and wired by Division 26.
- C. Remote static pressure sensor and control installation shall be provided by Division 23 (Refer to Section 23 09 00).

END OF SECTION

SECTION 20 80 00 PAINTING AND IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes labor, materials, equipment, skills and related services necessary to furnish and install the painting and identification of Mechanical systems as indicated in the Contract Documents.
- B. Finish coat painting of Mechanical systems is to be done under a separate Division of the Specifications. This contractor shall touch-up factory painted Mechanical Equipment.

1.2 RELATED REQUIREMENTS

- A. The General Provisions of the Contract, including Conditions of the Contract and Division 1 of the Specifications, apply to the work in this section.
- B. This section is hereby made a part of all other sections of Divisions 20 – 23 as fully as if repeated in each therein.

1.3 SUBMITTALS

- A. Submit descriptive data in accordance with Section 15010 for the following:
 - 1. Valve identification list.
 - 2. Equipment identification list.

PART 2 - PRODUCTS

2.1 VALVE IDENTIFICATION

- A. Valves in piping systems to be identified with a brass tag, secured to valve with brass wire S-hook. Shut-off valves for heating terminal units and plumbing stops need not be tagged.
- B. Tags to be made of 19 gauge brass with stamped, black-filled characters.
- C. Tags to be not less than 1-1/2" size.
- D. Acceptable Manufacturers are Champion, Ready Made and Seton.

2.2 PIPE IDENTIFICATION

- A. Pipe identification labels shall be pressure sensitive labels and tape to meet OSHA and ANSI A13.1 codes. Labels shall be manufactured by Champion, Ready Made, W.H. Brady Company or Seton Name Plate Corporation.

2.3 EQUIPMENT IDENTIFICATION

- A. Black on white plastic laminated tags with 1/2" high capital lettering etched through the top layer of plastic to expose the white sublayer. Size to be appropriate for specific equipment label.
- B. Provide label behind sensor/thermostat covers to indicate unit to be controlled.
- C. For roof mounted HVAC units and exhaust fans, in addition to the laminated tags, paint equipment number on the units with a 6" high template using black enamel paint.

PART 3 - EXECUTION

3.1 VALVE IDENTIFICATION

- A. Provide four (4) copies of a typewritten list identifying numbered valves. Identification shall include valve number, service, location and area served.
- B. One (1) copy shall be framed under glass and installed where directed by Engineer.
- C. Three (3) copies shall be incorporated in maintenance manuals.

- D. Submit identification list for review prior to installation of piping.

3.2 PIPE IDENTIFICATION

- A. Pipe identification shall be accomplished by using pressure sensitive labels or by stenciling.
- B. Pressure sensitive labels shall include labeling of service, direction of flow and tape bands at each end of labels with approved colors.
- C. Identification of piping shall be accomplished by stenciling black letters on a yellow background. Letters to be stenciled using black stenciling paint and stenciling brushes. Stenciling of direction of flow shall be accomplished by stenciling a black arrow on a yellow background. Minimum height of letters shall be 1". The following abbreviations shall be used.
 - 1. Cold Water CW
 - 2. Hot Water HW
 - 3. Circulating Hot Water CHW
 - 4. Sanitary Sewer SANS
 - 5. Condensate Drain CD
 - 6. Rain Water Leader RWL
 - 7. Refrigeration Suction SUC
 - 8. Refrigeration Liquid LIQ
- D. Identification shall be provided for all exposed piping within the building and also in accessible concealed spaces, such as above lay-in ceilings and at access panels. Identification shall occur at the following minimum locations:
 - 1. At not more than 30' intervals on straight runs of pipes.
 - 2. Wherever a pipe turns 90 degrees.
 - 3. Wherever a pipe passes through a wall, on both sides.
 - 4. At other locations deemed necessary for ease of maintenance, e.g. access panels.

3.3 EQUIPMENT IDENTIFICATION

- A. Scheduled equipment (except floor drains, diffusers, plumbing fixtures) are to have equipment identification tags permanently affixed to equipment with mechanical fasteners (rivets, screws, bolts or other approved methods) in a prominent location. Tags are to be installed level and drawn tight to the equipment surface. Provide backing or back-up plates where required by the fastening devices. On pumps and similar small equipment, the label may be located on the wall adjacent to the equipment.
- B. Equipment labeling shall spell out the description of each piece of equipment ("Exhaust Fan No. 1 for EF-1 etc.) and the equipment performance data up to four lines maximum. Submit list of proposed labels for review by Architect/Engineer.
- C. 6" high equipment labeling used at rooftop equipment shall be painted in a location which is visible from the roof hatch. 6" lettering shall indicate equipment number only (1 for EF-1, etc.).

END OF SECTION

SECTION 22 07 00 PLUMBING INSULATION

PART 1 - SUMMARY

1.1 SUMMARY

- A. This Section includes labor, materials and equipment necessary to complete the thermal insulation for plumbing systems shown in the Contract Documents.

1.2 REFERENCES

- A. The General Provisions of the Contract including Conditions of the Contract and Division 1 of the specifications apply to the work in this Section.

1.3 QUALITY ASSURANCE

- A. Installation shall be by skilled workers regularly engaged in this type of work with successful experience in installations similar in size and type to the requirements of this Project.
- B. Installation shall be in accordance with National Commercial & Industrial Insulation Standards, published by Midwest Insulation Contractors Association (MICA).
- C. Insulation materials must be manufactured at facilities certified and registered with an approved registrar to conform with ISO 9000 Quality Standard.

1.4 SUBMITTALS

- A. Submit the following in accordance with Section 20 10 00.
 - 1. Manufacturers Literature: Materials description and application instructions.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the site in manufacturer's unopened cartons or packages, bearing a label clearly indicating that flame and smoke ratings do not exceed specified requirements.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Insulation shall carry the following composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to the insulation) fire and smoke hazard ratings (unless specifically excluded) tested in accordance with ASTM E84, NFPA 255 and UL 723.
 - 1. Flame Spread: 25 or less
 - 2. Smoke Developed: 50 or less
- B. Accessories, such as adhesives, mastics, cements, tapes, glass fabric and cloth for fittings shall have the same component ratings as specified above.
- C. Field Applied Jackets shall be Manville Zeston 2000, PVC plastic, 20 mil thickness, one piece, jacketing material. Provide connection tacks, adhesives and pressure sensitive matching tape.
- D. PVC insulated fitting covers/jackets shall not be used in return air ceiling plenum unless protected as required by Code and approved by local authorities.
- E. Piping exposed to the weather shall have an aluminum jacket, 0.016 inch thick sheet, embossed finish, with longitudinal slip joints and 2 inch laps, die shaped fitting covers with factory applied moisture barrier.

2.2 MANUFACTURERS

- A. Insulation Materials
 - 1. Armacell.
 - 2. IMCOA.

3. Johns Manville.
 4. Knauf.
 5. Nomaco K-Flex.
 6. Owens-Corning®.
 7. Trubro, Inc., Molded Vinyl Insulation.
 8. Unifrax.
- B. Adhesives, Cements and Accessories
1. Mon-Eco Industries, Inc., MEI®.
 2. Childers®.
 3. Ramco.
 4. 3M™, Minnesota Mining and Manufacturing.
 5. Saran™.

2.3 GLASS (FIBER, FIBRE) INSULATION: TYPE A

- A. External wrap heavy density resin bonded inorganic glass fiber insulation having factory-applied vapor barrier facing with an average thermal conductivity not exceeding 0.23 btu-inch/hour-ft²-deg F at a mean temperature of 75 deg F rated for 0 deg to 850 deg F operating temperature and jacket temperature limitation of minus 20 deg F to 150 deg F as follows:
1. FIBERGLAS™ SSL II® pipe insulation as manufactured by Owens Corning®: Jacketed with all-service, ASJ, vapor retarder and with factory applied DOUBLESURE® double pressure-sensitive longitudinal adhesive closure system and butt strips seals for a positive closure. Specification Compliance with ASTM C547, C585, and C1136. Thermal performance in accord with ASTM C 680.
 2. Owens Corning® “No Wrap” style pipe insulation designed for field jacketing with covering secured by wires or bands, and vapor sealed with mastic is an acceptable alternate.

2.4 FLEXIBLE ELASTOMERIC INSULATION: TYPE B

- A. Continuous Tube Insulation: Armacell “AP/Armaflex®” Elastomeric Thermal Insulation.

2.5 CLOSED CELL ELASTOMERIC INSULATION: TYPE C

- A. Closed Cell Insulation: Average thermal conductivity not exceeding 0.28 btu-inch/hour-ft²-deg F at a mean temperature of 75 deg F; rated for minus 40 deg F to 220 deg F, 6.0 pcf, flame spread rating not to exceed 25, smoke density rating not to exceed 50.

2.6 CLOSED-CELL POLYOLEFIN FOAM INSULATION: TYPE D

- A. Closed Cell Polyolefin Foam Insulation: Average thermal conductivity not exceeding 0.24 btu-inch/hour-ft²-deg F at a mean temperature of 75 deg F; rated for minus 324 deg F to 210 deg F, 1.5 pcf, flame spread rating not to exceed 25, smoke density rating not to exceed 50.

2.7 INSERTS AND SADDLES (SHIELDS)

- A. Inserts shall be calcium silicate insulation of equal thickness to the adjoining insulation and provided with a vapor barrier where required. Urethane inserts are acceptable for thicknesses less than 1".
1. Length: 2" longer than saddles (minimum).
 2. Circumference: 1/2 exterior insulation circumference.
- B. Shields shall be 16 gauge galvanized steel (for pipe sizes 4" and smaller) and 14 gauge (for pipe larger than 4").

Pipe Hanger Size	Shield Length
6" and smaller	12"
8" - 10"	18"
Over 12"	24"

PART 3 - EXECUTION

3.1 GENERAL

- A. Install insulation continuous through wall, floor and ceiling openings, and through wall sleeves.
- B. Insulation shall be applied on clean, dry surfaces.
- C. Insulation on cold surfaces where a vapor barrier is used shall extend full size through hangers and shall be protected at the hanger point by the use of inserts and saddles.
- D. All exposed insulated pipe, fittings and accessories within 8'-0" of finished floor shall be protected with a PVC jacket.
- E. Use insulation only for its intended purpose, for example, duct wrap used for rainwater conductors will be rejected.

3.2 DOMESTIC WATER PIPING

- A. Insulate domestic hot water, recirculating hot water, domestic cold water, and filtered cold water with Type A, Type C, or Type D insulation as follows:
 1. Type A: Open hinged sections of insulation, place over pipe, align and seal or jacket as required:
 - a. Type A insulation includes jacket and longitudinal lap with two adhesives separated by a release strip. Remove release strip to open insulation. After closing on pipe and aligning, rub adhesive strips firmly together to close and seal. A two-part butt strip seal completes the closure.
 - b. Finish Type A insulation designed for field-applied jacket with covering secured by wires or bands, and vapor seal where required. No staples are permitted.
 2. Install Type C insulation as recommended by manufacturer. Seal joints with recommended adhesive.
 3. Install Type D insulation as recommended by manufacturer. Seal joints with recommended adhesive.
- B. Finish fittings, valve bodies, and flanges for piping 4-inch and smaller with finishing cement to thickness of adjoining pipe insulation. Insulate piping over 4-inch and water meters with mitered pipe insulation segments secured with twine or 19 gage wire banding with one coat of finishing cement.
- C. When finishing cement is dry, cover with 4 oz. glass cloth jacket, Type GVB, and two coats of sizing.
- D. Install jacketing on exposed piping and fittings that are located between finished floor level and six feet above finished floor to protect insulation from damage in janitor closets and back room areas including night maintenance and water service room.
- E. (Pre-molded) covers are acceptable for fittings and valves in exposed areas only if approved by local authorities having jurisdiction. Secure covers over insulation and seal joints as recommended by manufacturer.
- F. Apply approved vapor retarder mastic compatible with PVC between pipe insulation and fitting cover, and on fitting cover throat overlap seam.
- G. For pipes running underground or in masonry walls, use 1/2-inch thick flexible elastomeric tube or closed-cell polyolefin foam insulation. Seal joints with adhesive as recommended by manufacturer.

3.3 RAINWATER CONDUCTORS

- A. Insulate horizontal rainwater conductors, not vertical conductors, and roof drain bodies with insulation type as listed on Piping Insulation Schedule.

3.4 PIPING INSULATION SCHEDULE

PIPING Type	Size	INSULATION	
		Type	Thickness
Domestic Hot Water Supply and Recirculating Hot Water	All	A	1"
		C	1"
		D	1"
Domestic Cold Water Raw Cold Water	All	A	1"
		C	3/4"
		D	1"
Filtered Cold Water	All	A	1"
		C	3/4"
		D	1"
Domestic Water under slab	All	B	1/2"
		C	1/2"
		D	1/2"
Domestic Water under slab	All	B	1/2"
		C	1/2"
		D	1/2"
Horizontal Rainwater Conductors (Insulate Vertical Conductors where noted on Drawings)	All	A	1"
		C	3/4"
		D	1"

3.5 INSERTS AND SADDLES (SHIELDS)

- A. Install inserts at hangers supporting insulated pipe. Extend vapor barrier over the insert and seal at insulation vapor barrier.
- B. Locate saddles beneath each insert, centered on the hanger.

END OF SECTION

SECTION 22 10 00 PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes labor, material, equipment and skills and related services necessary to furnish and install a complete plumbing system as indicated in the Contract Documents, including incidental work necessary to make it complete satisfactory and ready for operation.
- B. The work shall include, but not necessarily be limited to the following:
 - 1. Domestic hot and cold water system.
 - 2. Sanitary sewer drain, waste and vent piping system.
 - 3. Roof drainage system.
 - 4. Condensate drainage system.

1.2 REFERENCES AND RELATED SECTIONS

- A. The General Provisions of the Contract, including Conditions of the Contract and Division 1 of the Specifications apply to the work in this Section.
- B. Section 20 10 00 – Mechanical General Provisions.
- C. Section 20 50 00 – Basic Materials and Methods.
- D. Section 20 80 00 – Painting and Identification.
- E. Section 22 07 00 – Plumbing Insulation.
- F. Section 22 30 00 - Plumbing Equipment.
- G. Section 22 40 00 - Plumbing Fixtures.

1.3 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASME A112.6.3 - Floor and Trench Drains; 2019.
- C. ASME A112.6.4 - Roof, Deck, and Balcony Drains; 2008 (Reaffirmed 2012).
- D. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers; 2017.
- E. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent; 2009.
- F. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers; 2011.
- G. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2011 (Reaffirmed 2016).
- H. DIN 19580 - Drainage channels for vehicular and pedestrian areas - Durability, mass per unit area and evaluation of conformity; 2010.
- I. NSF 2 - Food Equipment; 2019.
- J. NSF 61 - Drinking Water System Components - Health Effects; 2019.
- K. NSF 372 - Drinking Water System Components - Lead Content; 2016.
- L. SPDI-WH 201 - Water Hammer Arresters; 2017.

1.4 SUBMITTALS

- A. Submit shop drawings and descriptive data in accordance with Section 20 10 00 for the following:
 - 1. Floor drains.
 - 2. Cleanouts.

3. Roof drains
 4. Water hammer arrestors
 5. Backflow prevention devices
 6. Grease interceptor
 7. Trench Drains
 8. Water Meter
- 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.
 - F. Sustainable Design Documentation: Submit appropriate evidence that materials used in potable water systems comply with the specified requirements.
 - G. Manufacturer's Qualification Statement.
 - H. Operation Data: Indicate frequency of treatment required for interceptors.
 - I. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
 - J. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, and water hammer arrestors.
 - K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. Extra Loose Keys for Outside Hose Bibbs: One.
 2. Extra Hose End Vacuum Breakers for Hose Bibbs: One.

1.5 QUALITY ASSURANCE

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

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 - PRODUCTS

2.1 DOMESTIC HOT AND COLD WATER SYSTEM PIPE AND FITTINGS:

- A. Below Grade:
 1. Type "K" soft annealed copper tubing with wrought copper solder fittings. 95-5 Solder.
 2. High density polyethylene tubing and fittings complying with requirements for Type II, Class C, Category 5, Grade 834 according to ASTM D1248 and have a recommended PPI designation of PE3408. Pipe shall be rated for working conditions of 160 PSI and have SDR 11 wall thickness.
- B. Above Grade:
 1. Type "L" hard drawn copper tubing with wrought copper solder fittings. 95-5 solder. T-Drill fittings or Copper Press Fittings may be used if permitted by local code authorities.
 2. Schedule 40 galvanized piping may be used for piping 2 1/2" and larger.
 3. If allowed by local code, Polyethylene (PEX) tubing and fittings is an acceptable method of installation for pipe 1-1/2-inches and smaller in diameter for above ground concealed installations only unless noted otherwise on Drawings.
 4. Grooved Mechanical Couplings
 - a. Gasket shall be Grade "P" Fluoroelastomer compound with red and blue color code designed for operating temperatures from 0 deg F to +180 deg F. Center-leg gasket with pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth. Reference shall always be made to the latest published Victaulic Selection Guide for Gaskets for proper gasket selection for the intended service.
 5. Verify compatibility of materials with local water conditions.

2.2 DRAIN, WASTE, AND VENT PIPING SYSTEM:

- A. Below Grade:
 - 1. Service weight cast iron soil pipe and fittings.
 - 2. No hub cast iron pipe and fittings may be used by request to the Engineer, including evidence that governing codes permit its use and including information and data on the proposed joint.
 - 3. Plastic pipe and fittings (if approved by governing codes).
 - a. Schedule 40 PVC.
 - b. Schedule 40 ABS.
 - 4. Verify compatibility of materials with local soil conditions.
- B. Above Grade:
 - 1. Galvanized steel pipe with:
 - a. Galvanized steel fittings.
 - b. Cast iron drainage fittings.
 - 2. Cast iron soil pipe, service weight or no hub cast iron pipe and fittings.
 - 3. Plastic pipe and fittings (where approved by governing codes).
 - a. Schedule 40 PVC.
 - b. Schedule 40 ABS.

2.3 ROOF DRAINAGE SYSTEM:

- A. Above Grade:
 - 1. Galvanized steel pipe with:
 - a. Galvanized steel fittings
 - b. Cast iron drainage fittings
 - 2. Cast iron soil pipe, service weight or no hub cast iron pipe and fittings.
 - 3. Plastic pipe and fittings (where approved by local code).
 - a. Schedule 40 PVC.
 - b. Schedule 40 ABS.
- B. Below Grade:
 - 1. Cast iron soil pipe, service weight.
 - 2. No hub cast iron pipe and fittings may be used by request to the Engineer including evidence that governing codes permit its use and including information and data on the proposed joint.
 - 3. Plastic Pipe and Fittings (If approved by governing codes).
 - a. Schedule 40 PVC.
 - b. Schedule 40 ABS.

2.4 FLOOR DRAINS

- A. Floor drains shall be heavy cast iron as scheduled and indicated in the Contract Documents.
 - 1. Acceptable manufacturers:
 - a. Josam
 - b. J.R. Smith
 - c. Zurn
 - d. Wade
 - e. Watts Drainage Products
- B. For each drain located above grade, provide a 36" x 36" Chloraloy, or acceptable substitute, membrane manufactured from chlorinated polyethylene (CPE) with a nominal thickness of 0.04" thickness. Sheet shall meet the requirements of ASTM D4068 and IPC/IAMPCO UPC File #3046.

2.5 CLEANOUTS

- A. Acceptable manufacturers:
 - 1. Josam
 - 2. J.R. Smith
 - 3. Zurn
 - 4. Wade
 - 5. Watts Drainage Products

- B. Finished Floor - Series 56000, Nikaloy Top
- C. Unfinished Floor - Series 56050 Cast Iron
- D. Wall Series 58600-15 Stainless Steel with vandal proof screws.
- E. Carpeted Floor - Series 56000-14 with Carpet marker.

2.6 ROOF DRAINS

- A. Roof drains shall be cast iron Josam Series 21500 as scheduled.
 - 1. Acceptable manufacturers:
 - a. Josam Series 21500
 - b. Mifab Series R1200-JD
 - c. Wade 3000
 - d. No other substitutions.
 - 2. Downspout nozzles shall be Josam Series 25010 with size as scheduled on the drawings.
 - a. Acceptable manufacturers:
 - 1) Josam
 - 2) Mifab
 - 3) J.R. Smith
 - 4) Zurn
 - 5) Wade
 - 6) Watts Drainage Products

2.7 WATER HAMMER ARRESTERS

- A. Provide engineered mechanical water hammer arresters at all flush valve fixture grouping and elsewhere as noted in the Contract Documents.
 - 1. Acceptable manufacturers:
 - a. Amtrol, Inc.
 - b. Sioux Chief
 - 2. For 1-11 Fixture units, Diatrol Model No. 536.
 - 3. For 12-32 Fixture units, use Diatrol Model No. 537.
 - 4. For 33-60 Fixture units, use Diatrol Model No. 538.
 - 5. For 61-113 Fixture units, use Diatrol Model No. 539.
 - 6. For 114-154 Fixture units, use Diatrol Model No. 540.
 - 7. For 155-330 Fixture units, use Diatrol Model No. 541.

2.8 BACKFLOW PREVENTION DEVICES

- A. Provide backflow preventers suitable for intended use and as required by governing code to prevent contamination/pollution of potable water distribution system.
- B. Acceptable Manufacturers:
 - 1. Ames.
 - 2. Conbraco.
 - 3. Febco.
 - 4. Flowmatic.
 - 5. Watts.
 - 6. Wilkens.
- C. Backflow Preventers:
 - 1. **ASSE 1012** - Double Check Valve with intermediate atmospheric vent (**DCV IAV**).
 - a. Equal to Watts Model 9D. Rated for 175 PSIG and backflow temperatures up to 250 deg F. Suitable for continuous pressure. Backflow preventer to have atmospheric vent with airgap fitting drain line piped to floor drain or janitor's sink.
 - b. Low Hazard; Backsiphonage or Backpressure.
 - 2. **ASSE 1013** - Reduced Pressure Zone backflow preventer (**RPZ**):
 - a. Equal to Watts Series 009. Rated for 175 PSIG and temperatures up to 180 deg F. Backflow preventer to have four test cocks and #1 and #2 shutoff valves. Provide air gap fitting piped to floor drain or mop sink.

- b. High or Low Hazard; Backsiphonage or Backpressure.
 - 3. **ASSE 1015** - Double Check Valve assembly (**DCV**):
 - a. Equal to Watts Series 007. Rated for 175 PSIG and temperatures up to 180 deg F.
 - b. Low Hazard; Backsiphonage or Backpressure.
 - 4. **ASSE 1022** – Backflow Preventer for Beverage Machines (including carbonated) (**BPBM**):
 - a. Equal to Watts Model SD-3. Rated for 150 PSIG and temperatures up to 140 deg F. Designed for beverage/carbonated water systems. All stainless-steel body and heavy-duty rubber parts. All rubber compounds shall comply with FDA food additive regulations.
 - b. Low Hazard; Backsiphonage or Backpressure.
- D. Vacuum Breakers:
 - 1. **ASSE 1001** - Atmospheric-type Vacuum Breaker (**AVB**):
 - a. Equal to Watts Series 288A. Rated for 150 PSIG and temperatures up to 210 deg F. Mount at high point of downstream piping according to manufacturer’s recommendation and local codes.
 - b. High or Low Hazard; Backsiphonage only.
 - 2. **ASSE 1020** - Pressure Vacuum Breaker (**PVB**):
 - a. Equal to Watts Model 800M4QT. Suitable for continuous pressure applications. Mount at high point of downstream piping according to manufacturer’s recommendation and local codes.
 - b. High or Low Hazard; Backsiphonage only.
 - 3. **ASSE 1052** – Hose Bibb Vacuum Breaker (**HBVB**):
 - a. Equal to Watts Model N9-CD. In-line field testable, dual check backflow preventer with atmospheric vent. Non-removable design. Temperature up to 180°F
 - b. High or Low Hazard; Backsiphonage or Low Head Backpressure
- E. Refer to the following tables for equipment and backflow prevention requirements:

Equipment	ASSE 1022- BPBM	ASSE 1013- RPZ	ASSE 1015- DCV	ASSE 1001- AVB	ASSE 1020- PVB
Carbonator	X				
Ice Machine	X				
Coffee Brewers	X				
Cappuccino	X				

2.9 THERMOSTATIC MIXING VALVE

- A. Thermostatic Mixing Valve for Multiple Plumbing Fixtures
 - 1. Thermostatic mixing shall be Powers Hydroguard Series 430, or acceptable substitute Watts or Lawler with rough brass finish complete with thermometer on the mixed water. Submittal shall include a graph indicating flow rate-pressure drop characteristics.
- B. Thermostatic Mixing Valve for Plumbing Fixtures:
 - 1. Acceptable Manufacturer: Watts, Lawler, Powers.
 - a. Watts series LFMMV-M1 for use at fixtures: ASSE 1017, ASSE 1069, ASSE 1070 and IAPMO cUPC listed, with locking adjustment cap and integral filter washers and check valves. Operating discharge temperature range of 80 deg F to 120 deg F. Maximum continuous inlet temperature of 200 deg F. Maximum pressure rating of 150 PSI.
- C. Thermostatic Mixing Valve for Individual Lavatories and Sinks:
 - 1. Acceptable Manufacturer: Watts, Lawler, Powers.
 - a. Watts series LFUSG-B-M2 for use at fixtures: ASSE 1070 and IAPMO cUPC listed, with locking adjustment nut and integral screens and check valves. Operating discharge temperature range of 80 deg F to 120 deg F. Maximum continuous inlet temperature of 180 deg F. Maximum pressure rating of 150 PSI.
- D. Thermostatic Mixing Valve for Plumbed Emergency Equipment:

1. Acceptable manufacturer: Haws, Watts, Lawler, Powers.
 - a. Laws Model 9201 EW thermostatic mixing valve that mixes hot and cold water to supply tempered water to emergency eyewash fixtures requiring flow up to 10 gpm and with features as follows:
 - b. Paraffin filled thermostatic mixing element.
 - c. Cold Water Bypass flow rate: 3.8 gpm.
 - d. 0.4 gpm hot water flow if cold supply fails.
 - e. Modular brass design with a one piece casting with internal check valves, oversized valve seats, valve binding, and a funnel design to improve temperature control with better mixing at low flow rates.
 - f. Lime and calcium resistant components throughout.
 - g. Outlet temperature factory setting: 85 deg F.
 - h. Maximum operating pressure: 125 psi.
 - i. Temperature adjustment range 60 – 90 deg F.
 - j. Min/max inlet hot water temperature: 120 deg/180 deg F.
 - k. Recommended inlet temperature: 140 deg F.
 - l. Min/max inlet cold water temperature: 40 deg/65 deg F.
 - m. Inlet and Outlet: 1/2- inch NPT(F).
 - n. Hot water inlet pressure must be within plus or minus 10 percent of cold inlet pressure.
2. Listings: CSA certified to perform according to ASSE 1071 standard and applicable sections of CSA B125.3.

2.10 GREASE INTERCEPTOR

- A. Grease interceptors shall be concrete gravity flow style grease interceptors.
 1. Acceptable manufacturers:
 - a. Jensen Precast
 - b. Approved alternates
 2. Be approved by the International Association of Plumbing and Mechanical Officials (IAPMO)
 3. Be installed to manufacturer's requirements in compliance with current local, state and federal requirements.
 4. Include traffic rated manholes over the inlet, outlet and baffle walls for purposes of access, inspection and cleaning.
 5. Include 24" diameter traffic rated round access covers.
 6. Include a 12" gap between bottom of grease interceptor to bottom of standpipes.
 7. Include pretest observation by applicable jurisdiction prior to backfilling.

2.11 WATER METER

- A. Badger Recordall Turbo Meter with cast bronze body with calibration by-pass. Meters as manufactured by Rockwell will be acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General
 1. Refer to Contract Documents for quantity, sizes, routing and location.
 2. Install in accordance with manufacturer's instructions.
- B. Domestic hot and cold water system
 1. Connect to line provided by Site Utility Contractor 5'-0" from building. Extend into building and provide water meter assembly as approved by local authorities.
 2. Provide a complete water distribution system within the building including connection to plumbing fixtures and equipment.
 3. Lines shall be graded where possible to facilitate drainage. Provide drain valves at bottoms of risers. Unnecessary traps in circulating lines shall be avoided.
 4. Where possible, fixtures supplied from overhead branch lines shall connect at bottom of mains and shall pitch down towards fixtures so that branch lines and/or mains may be drained through fixture. Branch lines shall be connected to the top of mains where branches serve only fixtures located on floor above branch lines.
 5. Piping Below Grade:
 - a. Use insulation to protect lines penetrating other construction.
 - b. Joints shall not be made below grade under concrete flooring.

6. Piping Above Grade:
 - a. Sweat solder joint and fittings.
 - b. Support piping at intervals per Section 20 50 00.
 - c. Install unions and shut off valves at plumbing fixtures, equipment, appliances, meters, branch lines off mainlines and before penetrating below grade. Flared connections are acceptable on soft copper lines and brass tubing in lieu of unions.
 - d. Install expansion off-sets in lines where required. Anchor piping at each end.
 7. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.
 8. Pipe relief from backflow preventer to nearest drain.
 9. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to flush valves.
 10. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch minimum, and minimum 18 inches long.
- C. Sanitary sewer drain, waste, vent piping and roof drainage system
1. Extend building sanitary sewer lines 5'-0" from exterior of building and connect to site utilities provided by others. Roof drainage piping shall discharge on grade.
 2. Drain, waste and roof drainage piping (where applicable) shall be properly pitched 1/4 inch per foot minimum for 2 inch pipe and smaller and 1/8 inch minimum for 3 inches and larger unless indicated otherwise. Piping shall not be sloped more than 1/2 inch per foot. Piping shall be properly supported so that it will not sag and form pockets.
 3. Vent piping (where applicable) shall be properly pitched 1/8 inch per foot minimum unless indicated otherwise. Piping shall not be sloped more than 1/2 inch per foot. Piping shall be properly supported so that it will not sag and form pockets.
 4. Grease waste piping (where applicable) shall be properly pitched 1/4 inch per foot minimum unless indicated otherwise. Piping shall not be sloped more than 1/2 inch per foot. Piping shall be properly supported so that it will not sag and form pockets.
 5. Joint between cast iron pipe and fittings shall be caulked with pitched oakum, thoroughly forced into joints with caulking tools. The joints shall then be filled with molten lead solidly caulked even with the hub top. If joints are made with Neoprene gaskets the Manufacturer's recommendations shall be carefully followed.
 6. Cast iron hubs at point of connection between underground and above ground soil waste and vent piping located in partition walls shall be installed in a manner such that hubs will be concealed by finish wall. Top of hubs shall be installed below finish floor when masonry partition wall thickness is insufficient to conceal hub and/or outside diameter of hub is greater than stud width.
 7. Roof extensions of waste and vent stacks shall be at least 2 inches in diameter or full size of the stack. The extension shall be of cast iron pipe from a point below roof to the terminal point above the roof. The extension shall be encased in a roof jacket approved by local code. The roof jacket shall be constructed with a roof flange of 16 ounce copper or sheet lead of not less than 4 pounds per square foot, suitable for roofing application under the General Construction work. Install in accordance to drawings and codes relating to distances from fresh air intakes.
 8. Elevations shall be verified with the site utility work prior to commencing work.
 9. Mount roof drainage piping as close to roof as possible.
 10. Connect roof drainage line to roof drains as indicated on the drawings.
 11. Secure flashing on roof drains and floor drains above grade by clamping into drain body to make a watertight, airtight, and durable connection.
 12. Provide 30" x 30" 4-pound lead flashing sheet for roof drains installed in built up roofs.
 13. Excavation and Backfilling:
 - a. Excavate as required to install piping to the depth shown on the Contract Documents or as required for proper operation.
 - b. Excavations shall be kept free of water during construction.
 - c. Before any backfilling is done, the Engineer and/or proper installation authorities shall test, examine and approve the installation of the work being buried. The excavation floor shall be trimmed true with uniform grade permitting piping and equipment to be installed and resting upon undisturbed earth. Over excavated areas are to be filled with free draining granular fill. Dirt under pipe hubs shall be removed so that the barrel of the pipe is resting upon firm soil.

- d. Backfilling below grade shall be done with sand or gravel free from debris, perishable rubbish, large rocks, and other unsuitable material judged suitable for backfilling as approved by the testing firm, it may be used as fill.
 - e. Backfill material shall be carefully compacted until at least one foot of cover exists over the piping. The remainder of the backfill shall be a density in accordance with Specification Section 20 50 00.
 - f. Care shall be taken not to damage buried components during compaction.
- 14. 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.
- 15. Encase exterior cleanouts in concrete flush with grade.
- 16. Install floor cleanouts at elevation to accommodate finished floor.
- D. Plumbing fixtures: Install as indicated on drawings.
 - 1. Fixtures scheduled for handicapped, shall be mounted according to local requirements.
 - 2. Other fixtures shall be mounted as per Manufacturer's recommended mounting heights or as indicated in the Contract Documents.
- E. Water Heaters:
 - 1. Install pressure-temperature relief valve pipe to 1'-0" above floor drain.
 - 2. Install dielectric unions on hot and cold water connections to heater.
- F. Floor Drains: Install accurately where indicated in the Contract Documents.
 - 1. Install with top set level with finished floor, unless indicated otherwise.
 - 2. Trap and vent as required by code.
- G. Cleanouts: Install full size at the following locations:
 - 1. Base of waste stacks.
 - 2. Ninety degree turns in mains.
 - 3. Point where sewer leaves building.
 - 4. At connection of new waste and vent systems to existing systems where applicable to facilitate testing of new system.
 - 5. All other necessary points as indicated and required to permit easy system rodding:
 - a. Every 50 feet on lines 3" or less in size.
 - b. Every 100 feet on lines 4" or more in size.
- H. Water Hammer Arresters
 - 1. Install at the following locations:
 - a. On branch lines with quick closing valves.
 - b. As indicated on the Contract Documents.
 - 2. Install water hammer arrester in an upright position.
- I. Backflow prevention devices
 - 1. Backflow prevention devices shall be installed by a licensed and approved installation contractor in accordance with all State/Local requirements.
- J. Grease interceptor
 - 1. Install components in accordance with manufacturer's instructions and approved product data submittals.

3.2 FIELD QUALITY CONTROL

- A. Test pipe lines in partitions and concealed areas before they are concealed. Damage to materials or equipment because of leakage of piping during the guarantee period shall be paid for by this Contractor.
- B. Water supply pipes shall be tested at a pressure at least 10 PSIG higher than normal working pressure, but in no case shall any water pipe be tested at a pressure less than 125 psig for a period of 2 hours. Any leaks or imperfections developing during a test shall be remedied immediately.
- C. Waste, vent and sewer pipes shall be tested as required by State, City or Local ordinances, but not less than 5 psig air pressure for 15 minutes. Tests shall be made in the presence of the proper inspectors.
- D. Backflow Prevention Devices shall be tested in accordance with State/Local requirements.
- E. Tests shall be made at the expense of the Plumbing Contractor, and they shall furnish submittals in accordance with Section 20 10 00.

3.3 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Upon completion of the domestic water system, the contractor shall disinfect this system with chlorine before is placed in service. The amount of chlorine applied shall be such as to provide a dosage of 50-80 milligrams/liter. Following a period of not less than twenty four hours, or as required by codes, heavily chlorinated water shall be flushed from the system with clean water until the residual chlorine content is not greater than .02 milligrams per liter. Valves being disinfected shall be opened and closed several times during the period. Disinfection shall be repeated until piping meets state and local bacteriological test and is approved.

END OF SECTION

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SECTION 22 20 00 KITCHEN EQUIPMENT PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes labor, materials, equipment, skills and related services necessary to furnish and install the kitchen equipment plumbing as indicated in the Contract Documents.

1.2 REFERENCES

- A. The General Provisions of the Contract including conditions of the Contract and Division 1 of the specifications apply to work in this Section.

1.3 SUBMITTALS

- A. Submit shop drawings and descriptive data on accordance with Section 20 10 00.
- B. Submittal shall be in portfolio indicating kitchen equipment fixtures and trim with fixture number referenced to the numbers contained on the Kitchen Equipment Schedule.

PART 2 - PRODUCTS

2.1 FIXTURE SCHEDULE

- A. Furnish and install plumbing to kitchen equipment. Fixtures will be furnished and installed by kitchen equipment contractor. Provide required trim and accessories as noted for a complete installation. Install trim and accessories which are furnished by kitchen equipment contractor. Refer to schedule on Drawings and kitchen equipment Drawings, details and schedules for rough-in sizes and locations.

PART 3 - EXECUTION

3.1 KITCHEN EQUIPMENT PLUMBING

- A. Fixtures shall be properly connected, complete in every detail to soil, waste, vent and water pipes.
- B. Correctly faced inlets for fixtures shall be hung or supported with 5/16 brass bolts of sufficient length to securely fasten the fixture to the backing. Exposed heads of bolts for fixtures shall be chrome plated.
- C. Fixture wastes, shall be connected to waste lines with an iron ferrule and threaded pipe.
- D. Provide chrome plated angle supplies with stops in water supplies to units with exposed supplies. Where water supplies are concealed in accessible cabinetwork, the piping may be copper and the stops shall be wheel handle type.
- E. Refer to Kitchen Equipment Drawings for fixture locations and mounting heights.
- F. Indirect waste piping shall be rigidly supported above the floor.

END OF SECTION

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SECTION 22 30 00 PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes labor, material equipment, skills and related services necessary to furnish and install the plumbing equipment as indicated on the Contract Documents including incidental work necessary to make it complete, satisfactory and ready for operation.

1.2 REFERENCES

- A. The General Provisions of the Contract, including Conditions of the Contract and Division 1 of the Specifications apply to the work in this Section.

1.3 SUBMITTALS

- A. Submit shop drawings and descriptive data in accordance with Section 20 10 00 for the following.
 - 1. Water Heater.
 - 2. Relief Valves.
 - 3. Circulating Pump.
 - 4. Domestic Water Expansion Tank.

1.4 WARRANTY

- A. Provide three (3) years or longer written guarantee against leakage of water heater tank in addition to other guarantees required in the specifications.

1.5 QUALITY ASSURANCE

- A. Water heaters shall comply with the current efficiency requirements of ASHRAE/IES 90.1.

PART 2 - PRODUCTS

2.1 WATER HEATERS (ELECTRIC)

- A. Electric heater heaters shall be A.O. Smith, Lochinvar, Rheem, or State with capacity and size as scheduled.
- B. Units shall be glass lined construction, complete with fiberglass insulation with steel jacket, T&P relief valve (15 psig, hand test lever and FM approved) with discharge piped to floor.
- C. Safety and operating controls and valve shall be provided as required by governing codes and FMIA requirements. Units shall have thermostatically controlled, heating element(s).
- D. Units shall be UL approved with automatic overheating control.

2.2 TEMPERATURE & PRESSURE RELIEF VALVES

- A. Valves are to be tested under ANSI Z 21.22 with ratings as certified and listed by AGA.
- B. For water heaters under 100,000 BTUH input rating, use Watts No. 110XL, 3/4", 125 lb. setting.
- C. For gas or electric fired storage water heaters between 100,000 and 200,000 BTUH input rating, use Watts No. 40 or 140, 3/4", 125 lb. setting.
- D. For gas or electric fired storage water heaters between 200,000 and 700,000 BTUH input rating, use Watts No. 40 or 140, or N240 series, 1", 125 lb. setting.
- E. Acceptable manufacturers:
 - 1. Watts
 - 2. Conbraco

3. Crosby Valve and Gauge

2.3 DOMESTIC WATER EXPANSION TANK

- A. Acceptable Manufacturers:
 - 1. Amtrol
 - 2. Watts.
- B. Provide pre-charged hydro-pneumatic steel expansion tank constructed in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code, with all welds conforming to ASME Section IX. The tank shall be stamped with a maximum working pressure of 150 psi. All internal wetted parts must comply with FDA regulations and approvals and be suitable for potable water systems. An internal diaphragm shall be used to isolate air charge from water.
- C. Model number and size as indicated on plans.
- D. For in-line type tanks, suspend tank from structure as recommended by manufacturer. Coordinate with General Contractor.

2.4 CIRCULATING HOT WATER PUMP AND BALANCING DEVICES

- A. Smart Circulating hot water pump shall be all bronze unit with capacity as scheduled. Pump shall be complete with ECM motor and hydraulics better than ErP 2015 level. Design is based on Bell & Gossett ecocirc XLplus. System shall be complete with BMS BACnet compatible communication protocol.
- B. Acceptable manufacturers:
 - 1. Bell and Gossett
 - 2. Grundfos
 - 3. Taco
 - 4. Armstrong
- C. Provide Caleffi Thermosetter 116 Series recirculation thermal balancing valve.
 - 1. Valves ½-inch to 2-inch pipe size, NPT or sweat. Design pressure/temperature: 230 psig at 195 deg F. Model 1161_AC series thermal balancing with temperature gauge and check valve.
 - 2. Provide strainer and full-port isolation valves.
 - 3. Set at 140° F.
 - 4. Other acceptable manufacturer: Acorn Controls
- D. Balancing Devices
 - 1. Furnish and install balancing valves where indicated on the plans. CircuitSolver® shall be self-contained and fully automatic without additional piping or control mechanisms. Valve shall be a CircuitSolver® as manufactured by ThermOmegaTech®, Inc. CircuitSolver® shall regulate the flow of recirculated domestic hot water based on water temperature entering the valve regardless of system operating pressure. As the water temperature increases the valve proportionally closes dynamically adjusting flow to meet the specified temperature.
 - 2. CircuitSolver® body and all internal components shall be constructed of stainless steel with major components constructed of type 303 stainless steel. CircuitSolver® shall be rated to 200 PSIG maximum working pressure and 250°F (121°C) maximum working temperature. The thermal actuator inside the valve shall be spring loaded and self cleaning, delivering closing thrust sufficient to keep orifice opening free of scale deposits. All CircuitSolver® valve are NSF-61 certified for use in all domestic water systems. Installation of CircuitSolver® valve shall be made by qualified tradesmen in each domestic hot water return piping branch beyond last hot water device in that branch. Refer to the submittals above for additional specs.
- E. Balancing Devices – 140 F loop
 - 1. CircuitSolver® Model CSUAS -xx-140-CV1. “xx” denotes the device size.
 - 2. Strainer, check valve and full-port isolation valves.
 - 3. Valve is 90% closed at 140 (closing temperature) and fully open at 130 (10F below closing temperature).

PART 3 - EXECUTION

3.1 WATER HEATERS

- A. Install water heater(s) as indicated in the Contract Documents.
- B. Install temperature and pressure rated relief valve at each water heater and tank.
- C. Set water heater outlet temperature as indicated on the Drawings.

3.2 CIRCULATING HOT WATER PUMP

- A. Install circulating hot water pump as indicated.
- B. Install strap-on aquastat on hot water circulating line where indicated on the Drawings and in accord with manufacturer's recommendations. Aquastat to cycle circulating pump as return water temperature dictates. Pump shall go on at water temperature of 95°F and off at water temperature of 105°F (adjustable).
 - 1. Remove insulation from the pipe. Thoroughly scrape off scale, rust, or paint. Mount the controller using adjustable bracket furnished.
 - 2. Wiring shall be provided by Division 26.
- C. Install Circuit Setter® Calibrated Balance Valve on hot water circulating line where indicated on the Drawings and in accordance with manufacturer's recommendations.
 - 1. To retain calibrated accuracy, for pipe sizes ½-inch to 3-inch, maintain 3 pipe diameters minimum length of unrestricted straight pipe upstream and 1 pipe diameter minimum length downstream adjacent to the valve.
 - 2. Install balancing valve on hot water circulating line where indicated on the Drawings and in accordance with manufacturer's recommendations.
 - a. To retain calibrated accuracy, for pipe sizes ½-inch to 3-inch, maintain 3 pipe diameters minimum length of unrestricted straight pipe upstream and 1 pipe diameter minimum length downstream adjacent to the valve.

END OF SECTION

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SECTION 22 40 00 PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes labor, materials, equipment, skills and related services necessary to furnish and install the plumbing fixtures indicated on the Drawings and specified herein.

1.2 REFERENCES

- A. The General Provisions of the Contract Documents, including Conditions of the Contract and Division 1 of the Specifications apply to work in this Section.

1.3 SUBMITTALS

- A. Submit shop drawings and descriptive data in accordance with Section 20 10 00 for the following.
- B. Submittal shall be in portfolio form indicating plumbing fixtures and trim fixture number referenced to the numbers contained in the Contract Documents.

1.4 QUALITY ASSURANCE

- A. Vitreous ware fixtures shall be best quality, close grained and free from pores. Warped or imperfect fixtures will not be accepted. Surfaces coming into contact with walls, floors, or surface other fixtures shall be ground true.
- B. Fixtures shall be so designated and constructed such that parts are accessible for repairs when fixtures are in place. Manufacturer's trademark or name shall be located so that it will not be noticeable. Faucets, traps shall be chrome plated unless otherwise specified.
- C. Drinking water faucets shall meet NSF Standard 61, Section 9, Subsection 1-6. The product shall be manufactured from brass construction. Brass components which contact water within the faucet shall be from brass which contains no more than 3% lead by dry weight.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Fixture products shall be as scheduled on the Drawings, or acceptable substitute manufacturers.
 - 1. Vitreous china fixtures are to be white unless otherwise scheduled.
 - 2. Water closets are to have elongated bowls.
- B. Water Closets, Urinals, Vitreous China Sinks, Lavatories:
 - 1. American Standard
 - 2. Kohler
- C. Electric Water Coolers:
 - 1. Elkay
 - 2. Halsey-Taylor
 - 3. Oasis
- D. Mop Sinks:
 - 1. Fiat
 - 2. Mustee
- E. Wall Hydrants:
 - 1. Josam
 - 2. Woodford
- F. Flush Valves:
 - 1. Sloan
 - 2. Zurn.

- G. Trim/Faucets
 - 1. Chicago
 - 2. T&S Brass
 - 3. Grohe
- H. Fixture Carriers:
 - 1. Josam
 - 2. Zurn
 - 3. Watts Drainage Products
- I. Handicapped lavatory and P-Trap and angle valve assemblies shall be insulated with the fully molded, TRUEBRO, Handi Lav-Guard insulation kit, or acceptable substitute. Color shall be as selected by Architect.

PART 3 - EXECUTION

3.1 PLUMBING FIXTURES

- A. Fixtures shall be furnished, set in place and properly connected, complete in every detail to soil, waste, vent and water pipes. Fixtures shall be rigid, set plumb, level and true.
- B. Particular care shall be exercised in hanging fixtures, especially lavatories to assure rigidity and performance. This Contractor will be held responsible for the secure mounting of hangers and lavatories on the hangers, and any breakage resulting from improper installation on any fixture.
- C. Provide 17 gauge, chrome plated brass adjustable p-trap with cleanout on fixtures requiring traps. Traps for mop sink and service sink are to be cast iron.
- D. Fixture wastes, other than water closets and trap standard fixtures shall be connected to waste lines with an iron ferrule and threaded pipe. Connections to water closets and trap standard fixtures shall be made with cast iron floor flange with ring gasket and bolts for caulking into soil pipe. Closets and other trap standard floor connections joint shall be made tight without the use of putty. Fixtures shall be hung or supported with 5/16 brass bolts of sufficient length to securely fasten the fixture to the backing. Exposed heads of bolts for fixtures shall be chrome plated.
- E. Provide chrome plated angle supplies with loose key stops in water supplies to water closets, lavatories and sinks with exposed supplies. Where water supplies are concealed in accessible cabinetwork, the piping may be copper and the stops shall be wheel handle type.
- F. Caulk around plumbing fixtures with a white silicone sealant.
- G. Refer to Architectural Drawings for fixture locations and mounting heights.

END OF SECTION

SECTION 23 05 93
HVAC TESTING ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 SUMMARY

- A. **Section Includes:**
 - 1. Testing, adjusting, and balancing for the following heating, ventilating, and air conditioning systems:
 - a. Air handling equipment.
 - b. Air distribution systems.
 - c. Air exhaust systems.

1.2 SUBMITTALS

- A. Submit six (6) copies of air system testing and balancing report to Architect/Engineer.
- B. Name of Test and Balance Agency shall be submitted for approval to Architect/Consulting Engineer within 15 days after receipt of construction contract.

1.3 QUALITY ASSURANCE

- A. Testing and balancing shall be performed by an independent testing and balancing contractor who is a fully certified member of the Associated Air Balance Council or the National Environmental Balancing Bureau. The following balancing contractors are approved for this project.
 - 1. Mechanical Data Corporation.
 - 2. Bal-Tech.
 - 3. Systems Management
- B. Contractors bidding this Section of the Specifications are excluded from installing the work specified under Sections 23 21 00 and 23 30 00.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 AIR SYSTEM

- A. When the work has been completed, the Contractor shall balance the air deliveries from each unit in accordance with the recommendations of the diffuser manufacturer, setting fan speeds, dampers, controls and/or other volume control devices in such a manner as to produce the air volume deliveries indicated. Testing and balancing shall be accomplished by certified agency as specified elsewhere in this section of the specifications.
- B. The Contractor shall submit six (6) copies of a schedule to the Architect for approval containing the following information in tabular form:
 - 1. Room number or name.
 - 2. Grille register or diffuser type and size.
 - 3. Specified cfm.
 - 4. Actual cfm.
 - 5. Volume of air handled by each fan.
 - 6. Static pressure at inlet and outlet of each fan, coil and filter.
 - 7. Speed of fans and motors.
 - 8. Rated fan motor amperage.
 - 9. Actual fan motor amperage.

3.2 MECHANICAL EQUIPMENT

- A. Tests to the satisfaction of the Engineer shall also be conducted for satisfactory operation of equipment installed under Division 23 of the specifications, including packaged units, fans, motors, starters and drives.

- B. On completion of the initial start-up operation of the packaged units, the Testing and Balancing Agency shall test each unit for the actual performance versus the specified. The Report shall include, but not necessarily be limited to the following field observation and measurements:
- a. Each fan RPM, including condenser fans.
 - b. Motor amp, each phase for each unit. When a system uses variable amounts of outside air for cooling, reading shall be taken for both the maximum outdoor air condition and the minimum.
 - c. Static pressures at each fan suction and discharge. Take readings for both maximum outdoor air and minimum outdoor conditions where applicable.
 - d. CFM of main blower discharge. Take readings for both maximum outdoor air and minimum outdoor air condition.
 - e. Amperage on each compressor and condenser.
 - f. Compressor suction and discharge pressure.
 - g. Ambient D.B. and W.B. at the time of readings.
 - h. Return, mixed and discharge air temperature, during mechanical cooling, and during atmospheric cooling cycles.
 - i. Dehumidification system temperatures and dew points during unoccupied, minimum occupancy, and
 - 1) Process air stream
 - (a) Return air
 - (b) Outside air
 - (c) Mixed air entering desiccant wheel
 - (d) Discharge air from desiccant wheel
 - (e) Discharge air from post heat
 - (f) Process supply air
 - 2) Reactivation air stream
 - (a) Outside air conditions
 - (b) Entering reactivation heat conditions
 - (c) Leaving reactivation heat conditions.
 - (d) Entering desiccant dehumidification wheel condition
 - (e) Leaving desiccant dehumidification wheel condition
 - j. Remarks (if any).

3.3 BALANCING STANDARDS

- A. Air system testing, adjusting and balancing shall be performed by test and balance agency or division that specialized in to testing and balancing, heating, ventilation and air conditioning systems.
- B. Balancing is to be done in accordance with published agency guidelines and standards.
- C. Instruments used for testing and balancing of air systems must have been calibrated within a period of six months prior to balancing. Final test analysis reports shall include a letter of certification listing instrumentation used and last date of calibration.
- D. Services shall include one plan review prior to start of construction and one on-site inspection during the construction together with a report on recommended modifications and compliance with requirements of the specification.

END OF SECTION

SECTION 23 07 00 HVAC INSULATION

PART 1 - SUMMARY

1.1 SUMMARY

- A. This Section includes labor, materials and equipment necessary to complete the thermal and sound insulation for heating, ventilating and air conditioning piping and ductwork shown in the Contract Documents.

1.2 REFERENCES

- A. The General Provisions of the Contract including Conditions of the Contract and Division 1 of the specifications apply to the work in this Section.

1.3 QUALITY ASSURANCE

- A. Installation shall be by skilled workers regularly engaged in this type of work with successful experience in installations similar in size and type to the requirements of this Project.
- B. Installation shall be in accordance with National Commercial & Industrial Insulation Standards, published by Midwest Insulation Contractors Association (MICA).
- C. Insulation materials must be manufactured at facilities certified and registered with an approved registrar to conform with ISO 9000 Quality Standard.

1.4 SUBMITTALS

- A. Submit the following in accordance with Section 20 10 00.
 - 1. Manufacturers Literature: Materials description and application instructions.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the site in manufacturer's unopened cartons or packages, bearing a label clearly indicating that flame and smoke ratings do not exceed specified requirements. Duct liners shall be marked on the airstream surface as meeting NFPA 90A/B requirements.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Insulation shall carry the following composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to the insulation) fire and smoke hazard ratings (unless specifically excluded) tested in accordance with ASTM E84, NFPA 255 and UL 723.
 - 1. Flame Spread: 25 or less
 - 2. Smoke Developed: 50 or less
- B. Accessories, such as adhesives, mastics, cements, tapes, glass fabric and cloth for fittings shall have the same component ratings as specified above.
- C. PVC insulated fitting covers shall not be used in return air ceiling plenum unless protected as required by Code and approved by local authorities.
- D. Insulation products as manufactured by Manville, or acceptable substitutes as manufactured by Owens - Corning, Certain Teed, Knauf, or Armstrong.

2.2 PIPE INSULATION

- A. Type B - Closed Cell Insulation
 - 1. Materials

- a. Flexible closed cell elastomeric tubular or sheet insulation which conforms to minimum requirements specified by ASTM-C534. Material shall have a flame spread rating of 25 or less, a smoke development rating of 50 or less as tested in accord with ASTM-E84 for all thickness and water (vapor) transmission rate of 1 perm-inch or less as tested in accord with ASTM-E96. Acceptable manufacturers:
 - 1) Aeroflex Aerocel®.
 - 2) Armacell LLC.
 - 3) K-Flex USA.
- b. Pre-fabricated Insulation fittings by one of the following manufacturers subject to requirements of this Section:
 - 1) Armacell LLC, Armafit manufactured fittings.
 - 2) Aeroflex USA, AEROFIT manufactured fittings.
 - 3) K-Flex USA K-FIT manufactured fittings.
- 2. Accessories
 - a. Glue: A contact adhesive specifically formulated for bonding insulation materials which ensures a moisture resistant permanent bond between applied materials. Must form a non-flammable material when dried and is approved for use with insulation materials to be installed:
 - b. Acceptable manufacturers and products:
 - 1) Armaflex® 520 Adhesive.
 - 2) K-Flex® 620 Contact Adhesive-Black.
 - 3) K-Flex 320 Contact Adhesive-Amber.
 - c. Insulated pipe support systems in conjunction with Section 24 0529, shall be by one of the following:
 - 1) Insulation couplings as manufactured by Klo-Shure®.
 - 2) Armafix™ insulated inserts as manufactured by Cooper B-Line® Inc or ZSI Inc.
 - 3) Aerofix™ insulated inserts as manufactured by Aeroflex USA, Inc.
 - 4) K-Flex 360 Insulated Pipe Supports as manufactured by K-Flex USA.
 - d. Sealant:
 - 1) Acceptable manufacturer and product: Sealant - Sanitary silicone rubber sealant conforming to ASTM C 920, Type S, Grade NS, Class 25 Dow Corning® 786 Mildew Resistant Silicone Sealant or equal. VOC – 33 g/L.
- 3. Finishes
 - a. Protective Coatings:
 - 1) White PVC fitting covers and jacketing with vinyl adhesive for outdoor applications manufactured by Speedline Corporation, PH: 800-551-9759 or website www.speedlinepvc.com
 - 2) K-Flex WT Clad N/S (non-split) tube insulation with fully adhered PVC jacket and K-Flex pre-formed fittings.
- B. Piping exposed to the weather shall have an aluminum jacket, 0.016 inch thick sheet, embossed finish, with longitudinal slip joints and 2 inch laps, die shaped fitting covers with factory applied moisture barrier.

2.3 DUCT INSULATION

- A. Type C - Interior Duct Lining
 - 1. Ducts calling for thermal and/or acoustical lining shall be lined meeting ASTM C1071 with air surface coated with acrylic coating treated with EPA registered anti-microbial agent proven to resist microbial growth as determined by ASTM G21 and G22.
 - a. Rectangular Ducts: Johns Manville Permacote Linacoustic® RC-HP for 1" thickness and Manville Permacote Linacoustic® RC for other thicknesses, or acceptable substitute.
 - b. Round Ducts: Johns Manville Permacote Spiracoustic Plus, or acceptable substitute.
 - c. Noise Reduction Coefficient: 0.75 or higher based on "Type A mounting" and tested in accordance to ASTM C423.
 - d. Maximum Velocity: 6,000 FPM.
 - e. 'K' Value: ASTM C518, 0.23 Btu/hr/ft²/°F at 75F mean temperature.
 - f. Adhesive: meeting ASTM C916.
 - g. Fasteners: Duct liner galvanized steel pins, welded or mechanically fastened.
- B. Type D - Exterior Duct Insulation (Rigid)
 - 1. 3 lb. density fiberglass board with foil scrim kraft jacket, Manville 814 Spin Glass FSK, or equal. Thermal conductivity of .23 BTU/in. thickness per square foot per °F. per hour at mean temperature of 75 °F. Insulation shall meet ASTM C612.

2. JM Duramesh 20" x 20" glass fabric or 4 oz. canvas.
3. Foster's 30-36 Sealfast.

C. Type E - Exterior Duct Insulation (Duct Wrap)

1. Johns Manville Type 100 fiberglass duct wrap not less than 1.00 lb/cubic foot density. Thermal conductivity of .27 BTU/in. thickness per square foot per °F. per hour at mean temperature of 75 °F. Foil-Skrim-Kraft vapor barrier jacket. Insulation shall comply with ASTM C553. Compressed insulation installed R value as follows:
 - a. 1" thickness: R value 4.5
 - b. 1-1/2" thickness: R-value 6.0

2.4 INSERTS AND SADDLES (SHIELDS)

- A. Inserts shall be calcium silicate insulation of equal thickness to the adjoining insulation and provided with a vapor barrier where required. Urethane inserts are acceptable for thicknesses less than 1".
 1. Length: 2" longer than saddles (minimum).
 2. Circumference: 1/2 exterior insulation circumference.
- B. Shields shall be 16 gauge galvanized steel (for pipe sizes 4" and smaller) and 14 gauge (for pipe larger than 4").
 1. Length

Pipe Size	Length
Thru 6"	12"
8" thru 12"	16"
Over 12"	20"

PART 3 - EXECUTION

3.1 GENERAL

- A. Install insulation continuous through wall, floor and ceiling openings, and through wall sleeves except for runouts at connection to radiation.
- B. Insulation shall be applied on clean, dry surfaces.
- C. Insulation on cold surfaces where a vapor barrier is used shall extend full size through hangers and shall be protected at the hanger point by the use of inserts and saddles.
- D. All exposed insulated pipe, fittings and accessories within 8'-0" of finished floor shall be protected with a PVC jacket.
- E. Ductwork in the unconditioned attic shall be treated as outdoor ductwork. Refer to specification section 23 30 00.

3.2 TYPE B – CLOSED CELL PIPE INSULATION

- A. Insulation work shall be performed by trained installers regularly engaged in insulation trade.
- B. Cleanly and squarely cut all insulation joints. Do not tear insulation.
- C. Install piping insulation continuous through sleeves and penetrations (walls, partitions, roofs, ceilings, and floors).
- D. Completely seal seams, butts, and ends to retard moisture (vapor) from entering system. Glue joints with approved products. Do not tape insulation joints.
- E. Vapor stop exposed ends and every 12 feet by applying approved contact adhesive to outside surface of piping and inside surface of insulation, and secure to piping.
- F. Insulate fittings, flanges, and valves with same insulation thickness as adjacent piping.
- G. Cover elbows, "P" traps, and tees with prefabricated insulation fittings of mitered tubular sections, manufactured by an approved fabricator. Utilize three piece miters for each 90 degree change in direction.
- H. Insulate valves to a point just below seal cap or packing gland. Seal insulation to valve body with contact adhesive.
- I. Insulate refrigerant lines as described in insulation schedule.
 1. Glue seams to prevent condensation from forming.

2. Slide on insulation whenever possible and do not slice lengthwise unless unavoidable. (This statement applies only to act of physically applying insulation materials to sections of straight piping and does not contradict requirements for mitered insulation fittings.)
 3. Insulate valves and devices installed in lines with thickness described previously.
 4. Protect refrigerant piping insulation outdoors, from unit connection point to a point 6 inches inside of pipe box. Apply proper size PVC fitting covers and jacketing for insulated piping and seal in accord with manufacturers' instructions with solvent weld adhesive process for outdoor applications.
 5. Insulation shall be applied in strict accordance with local and state codes.
 6. If installation is found to be incomplete or unsatisfactory, installer will be required to re-insulate at their cost.
- J. Install piping and insulation in such a manner to ensure a properly functioning system. Reinstall any installation that is deemed unacceptable at installer's expense.
- K. Insulate evaporator coil condensate drain lines where exposed to unconditioned spaces.
- L. Type B – Closed Cell Pipe Insulation Schedule
1. Insulate piping in accordance with the following table:

Insulation Thickness For Pipe Sizes (Inches)							
Piping System Types	Fluid Temp. Range (°F)	Runouts ¹	1" & Less	1-1/4"-2"	2-1/2"-4"	5"-6"	8" & Larger
Condensate Drain	All	0.75	0.5	0.75	0.75	0.75	0.75
Refriger. Suction and Liquid	All	1.0	1.0	1.5	1.5	1.5	1.5

3.3 INSERTS AND SADDLES (SHIELDS)

- A. Install inserts at hangers supporting insulated pipe. Extend vapor barrier over the insert and seal at insulation vapor barrier.
- B. Locate saddles beneath each insert, centered on the hanger.

3.4 TYPE C - INTERIOR DUCT LINING (RECTANGULAR AND ROUND DUCTS)

- A. Duct liner shall be held in place by applying fire resistant adhesive over the entire metal surface then pressing insulation firmly in place. The mat faced surface shall face the air stream. Duct 18" wide and over shall have the duct liner additionally secured by welded pins and clips on not greater than 12" centers on top and side surfaces of the duct. Self adhering pins with clinch ends may be substituted for welded pins, when applied in accordance with manufacturers published instructions. Leading edges must be covered with metal nosing strip.
- B. Duct sizes shown on drawings are inside clear dimensions. Increase sheet metal dimensions to accommodate duct liner thickness.
- C. Ductwork exposed to the weather shall be made waterproof by sealing all seams with Hardcast tape, applied according to manufacturer's recommendations. As additional weather protection, apply one coat of aluminum paint to all of the tape.
- D. The following ducts shall be lined with thicknesses as listed. Entire lengths of ducts are intended to be insulated unless otherwise noted.
 1. Transfer air -- 1" thickness

3.5 TYPE D - EXTERIOR DUCT INSULATION (RIGID)

- A. Insulation shall be applied with edges tightly butted and impaled over welded pins and secured with clips. Pins shall be spaced to hold insulation securely in place but not over 18" center. Joints shall be sealed with FSK tape.
- B. Roll type aluminum corner bead shall be applied at all corners. Canvas or glass fabric shall be applied as finish over FSK embedding the fabric in a coat of adhesive. A finish brush coat of adhesive shall be applied over fabric.
- C. The following ducts shall be insulated externally.
 1. Outside air ductwork - 1 1/2" thickness (pool equipment room, mechanical room)
 2. Exposed exhaust air ductwork in mechanical room – 1-1/2" thickness

3.6 TYPE E - EXTERIOR DUCT INSULATION (DUCT WRAP)

- A. Insulate the following ducts with exterior duct insulation (duct wrap). Overlap facing and staple securely providing a tight-fitting vapor barrier installation.
 - 1. Concealed supply air ductwork – 1-1/2” thickness

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SECTION 23 30 00 HVAC AIR DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes labor, materials, equipment, skills and related services necessary to furnish and install the air distribution system as indicated in the Contract Documents.

1.2 REFERENCES

- A. The General Provisions of the Contract, including Conditions of the Contract and Division 1 of the Specifications apply to work in this Section.
- B. Refer to Section 23 07 00 - HVAC Insulation.

1.3 SUBMITTALS

- A. Submit shop drawings and descriptive data in accordance with Section 20 10 00 for the following:
 - 1. Low-Velocity sheet metal ductwork.
 - 2. Medium and high-pressure sheet metal ductwork.
 - 3. Flexible Air Duct
 - 4. Motorized Dampers
 - 5. Backdraft dampers.
- B. Submit detailed drawings of each built-up ventilating and air conditioning station including housing and foundation, equipment bases, electrical and mechanical services required. Drawing scale shall be 1/4 inch per foot or larger. Dimensions shall be based on equipment manufacturer's certified drawings.

1.4 QUALITY ASSURANCE

- A. Fans
 - 1. As a minimum, fans to be designed, fabricated and assembled in accordance with ASHRAE and AMCA Standards.
 - 2. Fans are to have metal identification plates indicating tag number, CFM, S.P., RPM, BHP, and other operating characteristics.
 - 3. Factory certified performance curves to be submitted.
 - 4. Manufacturer is to furnish complete decibel ratings for all 8 octave bands based on sound power level, and as further described in ASHRAE Guide.
- B. Air Outlets
 - 1. Outlets to be selected to provide throw and distribution required for their respective location without objectionable drafts.
 - 2. Maximum pressure drop through outlet to be 0.10 inches of water.
 - 3. Outlets to be selected and guaranteed by the manufacturer to handle the air quantity shown.
 - 4. Unless otherwise noted, outlets to be selected on the basis of maintaining a maximum sound level range of NC 30.
- C. Other equipment fabrication and installation to meet the requirements and recommendations of ASHRAE, and NFPA or the SMACNA Publication dated 1972, whichever is more stringent.

PART 2 - PRODUCTS

2.1 LOW VELOCITY DUCTWORK - SHEET METAL

- A. Ductwork material and construction shall be in accordance with the recommendations of the current edition of the SMACNA "HVAC Duct Construction Standards."
- B. Ductwork shall be constructed of the following gauges unless otherwise indicated.

<u>Duct Width - Inches</u>	<u>U.S. Standard Gauge</u>
0 to 12	#26
13 to 30	#24
31 to 54	#22
55 to 84	#20
Over 84	#18

- C. Ductwork exposed to weather shall be constructed of galvanized sheets specially prepared for painting. Manufacturer and type shall be Inland Steel Co. Paint-tile, or Youngstown Sheet & Tube Company Tufkote Bonderized.

2.2 MEDIUM AND HIGH-PRESSURE DUCTWORK - SHEETMETAL

- A. Fabricate and support in accordance with SMACNA High Pressure Duct Construction Standards and ASHRAE Handbooks except as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures required.

2.3 FLEXIBLE AIR DUCT

- A. Concealed, round duct connections to ceiling diffusers may be flexible insulated ducts, such as Owens-Corning Class 1 air duct, complying with NFPA No. 90A with a flame spread rating of 25 or less and a smoke developed rating not higher than 50.
- B. Acceptable manufacturers:
1. Owens-Corning
 2. Flexible Technologies
 3. Nailor Hart
 4. Geneflex

2.4 HANGERS, SUPPORTS AND ANCHORS

- A. Horizontal steel ductwork to be supported by hot dipped galvanized steel stock, or round steel rod of sizes specified. Round steel rods to be electrogalvanized all-thread rod. Hangers to be provided at both sides of flat sided ductwork for the full height of duct. Round ductwork to be provided with a band of the same size as the hanger to completely encircle the duct. Band to be secured to the hanger by means of a 3/8" bolt (min.).
- B. Hangers shall be constructed in accordance with the latest edition of SMACNA "HVAC Duct Construction Standards".

2.5 DAMPERS, SPLITTERS AND DEFLECTORS

- A. Provide manual dampers, splitters, and deflectors indicated and as required to balance the systems.
- B. Manual dampers and splitters in round or rectangular low pressure ductwork to be not less than 16 gauge galvanized sheet steel. Provide manual dampers with Vent Fabrics Co. No. 641 adjustment quadrant with fixing device. In high velocity air streams, provide manual dampers with Ventlock Co. No. 641 HVEL adjustment quadrant with fixing device. Provide splitters with No. 555 quadrant for bottom mounting or No. 690 for side mounting. Dampers to be provided with steel shafts and No. 609 end bearings. Provide splitters for each supply branch.
- C. For 20 inch diameter duct and larger, provide manual damper with Ventlock self locking regulator No. 644.
- D. Manual dampers in duct work larger than 2 square feet to be multi-blade volume dampers with maximum 8" blades.
- E. Wherever damper fixing or locking devices are not exposed or accessible through access panels, provide Vent Fabrics Co. No. 677 or Young No. 315 key operated regulators with prime coated adjustable covers.
- F. Similar products manufactured by Duro-Dyne or Cesco are acceptable.

2.6 ACCESS PANELS

- A. Access panels shall be provided at locations shown and at reheat coils, fire dampers, motorized dampers, control equipment, and at any location necessary for duct or equipment inspection or adjustment. Panels shall be fabricated of 18 gauge galvanized steel properly braced and stiffened and provided with Ventlok No. 100 series latches, hinges, and gasketing. Panels shall be 14" x 14" or 2" smaller than the duct for ducts under 14" in width or depth.

2.7 FLEXIBLE CONNECTIONS

- A. Provide fire resistive fabric material flexible connections between inlet and outlet of each fan and connection ductwork, and where ducts are crossing building expansion joints. The flexible connection shall be made of heavy glass fabric, double coated with neoprene similar to "Ventglas" for high pressure systems and "Ventfab" for low pressure systems as manufactured by Vent-fabrics, or approved equal. Materials shall be U.L. approved and shall have an adequate resistance to fire.

2.8 BELT DRIVES

- A. Drives to be selected for a minimum of 1.5 service factor based on motor brake horsepower and including unit factors for length of belt, effective sheave diameter and arc of contact correction.
- B. Adjustable drives to be provided for fans having motors of 10 H.P. or less. Sheaves to be selected to operate at mid-point of the fan curve to allow for adjustment in both directions. Fans having motors larger than 10 H.P. to be provided with fixed sheaves.
- C. It is the responsibility of the Contractor to see that fans deliver the design capacity at actual static pressures up to design static pressure. Fan sheaves to be replaced as necessary to obtain desired results.
- D. Sheaves to be dynamically and statically balanced and multiple belts to be machine matched in sets.
- E. Fan motors shafts, pulleys and sheaves to be provided with deep keyways and pulleys and sheaves to be properly keyed and secured in place. The use of only set screws for securing pulley or sheaves to shafts is not acceptable.
- F. Each belt drive shall be provided a NSC and OSHA approved belt guard. Guards to be constructed of No. 12 USS gauge, 3.4" diamond mesh wire screens, or equivalent, welded to 1" structural steel 1/8" thick angles frames and enclose all belts and sheaves. Tops and bottoms to be of substantial sheet metal not less than No. 18 USS gauge.
 - 1. Guard shall be secured to the driven machines or to foundations of floors by heavy structural angle supports and anchor bolts. Braces or supports secured to motors will not be permitted and braces and/or supports must not "bridge" the sound and vibration isolators.
 - 2. Guard shall be designed with adequate provision for movement of motor required to adjust belt tension. Means shall be provided to permit lubrication, use of speed counters, and other maintenance and testing operations with belt guard in place.

2.9 ROUND DUCTWORK

- A. General
 - 1. All round supply, return and exhaust ductwork shall be SPIROsafe® as manufactured by Lindab, Inc (800) 797-7476 or acceptable substitute as manufactured by Sheet Metal Connectors. The duct system shall consist of fittings that are factory fitted with a sealing gasket and spiral duct which, when installed according to the manufacturer's instructions, will seal the duct joints without the use of duct sealer.
 - 2. The contractor may, at his option, convert any or all rectangular ductwork to round provided that the project space limitations are properly addressed and that the overall system design static pressure not be exceeded.
- B. Materials
 - 1. Unless otherwise noted, all duct and fittings shall be a minimum of G-60 galvanized steel in accordance with ASTM A-653 and A-924.
 - 2. When specified on contract documents, stainless steel type 304 or type 316 in accordance with ASTM A-240 shall be provided.
- C. Construction

1. Unless otherwise noted or required by Code, duct and fittings shall be constructed per SMACNA's Duct Construction Standards (+10 in W.G.) shown in the following table:

Diameter (inches)	Galvanized Spiral Duct	Galvanized Fittings
3 - 14	26	24
16 - 26	24	22
28 - 36	22	20
38 - 50	20	20

D. Fittings:

1. All fitting ends shall come factory equipped with a double lipped, U-profile, EPDM rubber gasket. Gasket shall be manufactured to gauge and flexibility so as to insure that system will meet all of the performance criteria set forth in the manufacturer's literature. Gasket shall be classified by Underwriter's Laboratories to conform to ASTM E84-91a and NFPA 90A flame spread and smoke developed ratings of 25/50.
2. All fitting ends shall be calibrated to manufacturer's published dimensional tolerance standard and associated spiral duct.
3. All fitting ends from 3" to 24" Diameter shall have rolled over edges for added strength and rigidity.
4. All elbows from 3" to 12" Diameter shall be 2 piece die stamped and continuously stitch welded. All elbows 14" Diameter and larger shall be standing seam gorelock construction and internally sealed.
5. The radius of all 90° and 45° elbows shall be 1.5 times the elbow diameter, unless otherwise noted on the contract documents to be 1.0 times the elbow diameter. The radius of all 15°, 30° and 60° elbows shall be 1.0 times the elbow diameter.
6. All fittings that are of either spot welded or button punched construction shall be internally sealed. When contract documents require divided flow fittings, only full body fittings will be accepted. The use of duct taps is unacceptable except for retrofit installations.
7. All volume dampers shall be SPIROsafe type DRU, DSU or DTU or approved equal. Damper shall be fitting sized to slip into spiral duct. Damper shall have the following features:
 - a. Locking quadrant with blade position indicator
 - b. 2" sheet metal insulation stand-off
 - c. Integral shaft/blade assembly
 - d. Shaft mounted, load bearing bushings
 - e. Gasketed shaft penetrations to minimize leakage

E. Spiral Duct:

1. Spiral duct shall be calibrated to manufacturer's published dimensional tolerance standard.
2. All spiral duct 14" Diameter and larger shall be corrugated for added strength and rigidity.
3. Spiral seam slippage shall be prevented by means of a flat seam and a mechanically formed indentation evenly spaced along the spiral seam.

F. Performance

1. Duct system performance shall meet SMACNA's Leakage Class 3 requirements at the system design static pressure as indicated on the contract documents not to exceed -20 in W.G. or +12 in W.G.

G. Exposed ductwork intended to be painted shall be Paint-Grip.

2.10 MOTORIZED DAMPERS

A. Motorized Dampers

1. Furnish Arrow Series 1770 opposed blade dampers of size indicated on the Drawings. Units shall be complete with the following:
 - a. Frames: 4" wide 16 gauge galvanized hot shaped channel.
 - b. Blades: Maximum spacing 6", 16 gauge, 48" maximum length.
 - c. Linkage: Type ES-92 formed brackets of 1/8" steel.
 - d. Bearings: Oilite bronze.
 - e. Axles: 1/2" diameter cadmium plated steel extendable 6" beyond frame.
 - f. Seals: Blade and jamb of polyurethane.
 - g. Motors: Heavy duty 120 volt with spring return.
2. Acceptable manufacturers:

- a. Arrow
 - b. Greenheck
 - c. Pottorff
 - d. Ruskin
 - e. Louvers & Dampers, Inc.
3. Outside air/exhaust dampers to outside are to be low leak type: No more than 6 CFM/S.F. leakage at 4" w.c. static pressure, with operator exerting 6 in - lbs. of torque.
- B. Insulated Motorized Dampers
1. Dampers shall be TAMCO Series 9000 Thermally Insulated Damper, as manufactured by T. A. Morrison & Co., Inc. (Tel: 1-800-561-3449, USA & Canada), or acceptable substitute as manufactured by Ruskin or Greenheck
 2. Extruded aluminum (6063-T5) damper frame shall not be less than 0.080" (2.03 mm) in thickness. Damper frame shall be 4" (101.6 mm) deep x 1" (25.4 mm), with duct mounting flanges on both sides of frame. Damper frame shall have a 2" (50.8 mm) mounting flange on the rear of the damper, when installed as Extended Rear Flange install type. Frame to be assembled using zinc-plated steel mounting fasteners. Welded frames shall not be acceptable.
 3. Blades shall be maximum 6.4" (162.6 mm) deep extruded aluminum (6063-T5) air-foil profiles with a minimum wall thickness of 0.06" (1.52mm). Blades shall be internally insulated with expanded polyurethane foam and shall be thermally broken. Complete blade shall have an insulating factor of R-2.29 and a temperature index of 55 (tested to AAMA 1502.7 Test Method).
 4. Blade seals shall be extruded EPDM, secured in an integral slot within the aluminum blade extrusions and shall be mechanically fastened to prevent shrinkage and movement over the life of the damper. Adhesive or clip-on type blade seals will not be approved.
 5. Frame seals shall be extruded silicone, secured in an integral slot within the aluminum frame extrusions and shall be mechanically fastened to prevent shrinkage and movement over the life of the damper. Metallic compression type jamb seals will not be approved.
 6. Bearings shall be a dual bearing system composed of a Celcon inner bearing (fixed around a 7/16" (11.11 mm) aluminum hexagon blade pivot pin), rotating within a polycarbonate outer bearing inserted in the frame. Single axle bearing, rotating in an extruded or punched hole shall not be acceptable.
 7. Hexagonal control shaft shall be 7/16" (11.11 mm). It shall have an adjustable length and shall be an integral part of the blade axle. A field-applied control shaft shall not be acceptable. All parts shall be zinc-plated steel.
 8. Linkage hardware shall be aluminum and corrosion-resistant zinc-plated steel, installed in the frame side, out of the airstream, and accessible after installation. Linkage hardware shall be complete with cup-point trunnion screws to prevent linkage slippage. Linkage that consists of metal rubbing metal will not be approved.
 9. Dampers shall be designed for operation in temperatures ranging from -40°F (-40°C) to 212°F (100°C).
 10. Dampers shall be AMCA rated for Leakage Class 1A at 1 in w.g. (0.25 kPa) static pressure differential. Standard air leakage data to be certified under the AMCA Certified Ratings Program.
 11. Dampers shall be custom made to required size, with blade stops not exceeding 1¼" (31.7 mm) in height.
 12. Dampers shall be opposed blade action or parallel blade action as indicated on the Drawings.
 13. Field supplied intermediate structural support is required to resist applied pressure loads for dampers that consist of two or more sections in both height and width. (See TAMCO Aluminum Damper Installation Guidelines.)

PART 3 - EXECUTION

3.1 LOW VELOCITY DUCTWORK - SHEET METAL

- A. Sheet metal ducts shall be erected in a first-class and workmanlike manner, true to the dimensions indicated, unless otherwise approved, straight and smooth on the inside with neatly finished airtight joints. The ducts shall be securely anchored to the building in an approved manner and shall be so installed as to be completely free from vibration under all conditions of operation. The ducts shall be properly braced and reinforced with steel angles or other structural members made in the direction of the flow. The angles and sheet metal used shall be galvanized iron except as hereinafter specified. Connections to diffusers and registers shall be absolutely airtight.
- B. Ducts and fittings shall be fabricated, reinforced and installed in accordance with the latest issue of SMACNA "HVAC Duct Construction Standards".

- C. Ducts up to 30 inches shall have locked seams, and ducts 31 inches and wider and shall have standing seams with separate cleat mitering at the corner. Additional bracing where necessary shall be used and may be ordered by the Engineer wherever in his opinion such additional bracing is required. All panels over 12" wide or deep shall be cross-broken for strength.
- D. Fresh air, exhaust air or relief air ducts entering or leaving the building and passing over finished ceilings shall be soldered absolutely watertight for a developed horizontal distance of 15' from the wall or roof opening unless a special water-collecting connection is detailed at the wall or roof opening.
- E. Ductwork shall be run as high as possible in rooms to maintain proper headroom. Whenever possible, ducts shall be run close to beams or floor slabs above and where two or more ducts cross each other, they must be arranged in such a manner as to maintain the greatest possible clearance underneath. This Contractor shall not cover any electrical outlets. This Contractor shall consult with the other trades to avoid interference with piping runs, etc. This Contractor shall inform the Architect/Engineer before proceeding with concealed ductwork that will require a ceiling be lowered or shaft to be increased in size, etc. Should it be found impractical to install duct of the exact size given, a duct of different shape, but having the same resistance shall be installed.
- F. Elbows shall be made with an inside radius the same dimensions as the width of the duct where space permits unless otherwise shown on the Drawings. If the space requirements are not large enough for this type of elbow, the Contractor may reduce the inside radius to 1/2 the width of the duct. No elbows will be permitted which are constructed with an inside radius less than 1/2 the width of the duct. In this case, the Contractor shall furnish and install double walled turning vanes with an air foil section. Typical details of the vanes shall be submitted to the Architect/Engineer for approval unless the vanes are a standard manufactured product.
- G. Tee connections shall be made with a radius tap-in unless noted on the drawings to be otherwise. The branch ducts shall be increased in size by 1/2 at all square tap-ins and generally reduced to the branch size.
- H. Ductwork Dimensions: Duct dimensions indicated are inside dimensions for the net free area. If ducts are lined, the duct dimensions are dimensions for the net free area inside the lining and the outer or overall dimensions of the actual ducts shall be increased accordingly to accommodate the duct lining specified. Refer to Section 15250 for information on duct lining.
- I. Sides including bottom and top of ducts and plenums shall be constructed of sheet metal and no portion of the building construction, such as walls or slabs, shall be used as part of any duct or plenum, unless called for on the Drawings or otherwise specified.
- J. Flashing: Wherever ducts or pipes penetrate the roof, outerwalls or water proofing of any kind, base flashing and necessary counterflashing shall be furnished and installed by Division 15.
- K. Transverse and longitudinal joints shall be sealed with a silicone sealant.

3.2 FLEXIBLE AIR DUCT

- A. The flexible duct shall be capable of maintaining the shape required by job conditions without subsequent sagging or droop. Ducts shall be supported with 2" wide straps, 3 feet on center or by wire from grommets, factory installed for the purpose. Duct shall be installed in the shortest direct distance (8 ft. maximum) between components with a maximum of only one 90 degree turn in a runout. Duct connections to collars shall be made airtight and fastened in accordance with the duct manufacturer's recommendations, using a nylon or metal draw band. Two wraps of an approved duct tape over the vapor barrier to complete the airtight seal shall be required.

3.3 HANGERS, SUPPORTS AND ANCHORS

- A. Ductwork shall be supported with hangers in accordance with the latest issue of SMACNA "HVAC Duct Construction Standards".
- B. Hangers shall be attached to structural members. Ductwork or equipment shall not be supported from steel roof deck. Furnish and install additional steel supports required for hanging duct, fans, units, etc.
- C. Vertical ducts shall be supported by structural member at each floor.
- D. Fastenings and hardware for galvanized ductwork and sheet metal work shall be cadmium plated and screws, bolts, fastenings, etc., shall not penetrate into duct.

- E. Hangers shall be galvanized strap hangers, bolted to the angle stiffeners or secured to the sides of the duct, adequately supported from the building structure with bolts, anchors, inserts and/or clamps, as the condition requires.
- F. Stays on vertical lines of ducts shall consist of galvanized steel straps anchored to the building structure at such points as are necessary for properly supporting them and maintaining alignment.
- G. Ductwork shall be adequately side-braced to prevent swaying.
- H. Provide seismic restraints for all suspended ductwork with the exception of the following:
 - 1. Rectangular ductwork less than six square feet in cross sectional area.
 - 2. Round ductwork less than 28 inches in diameter.
 - 3. Ductwork suspended by hangers less than 12 inches or less in length from the top of the duct to the bottom of the support for the hanger.

3.4 DAMPERS, SPLITTERS AND DEFLECTORS

- A. Manual volume dampers shall be installed in each branch low pressure supply, return and exhaust duct. Splitters or extractors may be used in lieu of manual volume dampers for small branches, where so indicated.
- B. Dampers shall be stiffened where necessary to prevent noise. Dampers causing noise shall be replaced with new one or additional stiffeners added so as to eliminate the noise.

3.5 ACCESS PANELS

- A. Coordinate the location of duct access panels and equipment access doors with other trades in order that the wall or ceiling access door may correspond with the service location for valve, damper and unit.

3.6 DUCT SLEEVES

- A. This Contractor shall be responsible for coordinating the location and size with other trades of openings for ductwork that pass through walls, floors, or partitions.

3.7 INSTRUMENT OPENINGS

- A. Suitable openings shall be cut in the ductwork at 6" O.C. vertical and horizontal side of discharge duct and appropriate locations for the insertion of 3/8" Pitot tubes and similar air measuring instruments. Such openings shall be equipped with removable tight fitting caps. Coordinate with air balancing engineer prior to completion of Project.

3.8 EXPOSED ROUND DUCTWORK

- A. Spirally wound ductwork shall be joined together to be made airtight per manufacturer's recommendations.
- B. Spirally wound seams shall be aligned at transverse joints to create an appearance of a continuous spiral seam for entire length of run.
- C. Seams shall be sealed with a silicone sealant.

3.9 MOTORIZED DAMPERS

- A. Install motorized dampers as indicated in the Contract Documents.

END OF SECTION

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SECTION 23 34 23 HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes labor, materials, equipment, skills and related services necessary to furnish and install the power ventilators indicated in the Contract Documents.

1.2 REFERENCES

- A. The General Provisions of the Contract, including Conditions of the Contract and Division 1 of the Specifications apply to the work in this Section.
- B. Refer to Division 7 for roof curb installation.

1.3 SUBMITTALS

- A. Submit shop drawings and descriptive data in accordance with Section 20 10 00 for the following.
 - 1. Power roof ventilators.

1.4 QUALITY ASSURANCE

- A. Units to be AMCA Certified Rating Seal and to be tested and rated for sound in AMCA Sones in accordance with AMCA Standard Test Code. Sone ratings to be submitted.
- B. Units to be Underwriter's Laboratories approved.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Greenheck
 - 2. Loren Cook
 - 3. Penn
 - 4. Twin City Fan
- B. Acceptable Thermostat Manufacturers:
 - 1. Honeywell
 - 2. Johnson
 - 3. Staeffa.

2.2 ELECTRICAL

- A. Motor starters for power ventilators are to be provided under Division 26.
- B. Unit disconnects for power ventilators are to be provided under this Section.
- C. Electronically Commutated Motor
 - 1. Motor enclosures: Open type
 - 2. Motor to be a DC electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start and 3 phase induction type motors.
 - 3. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.
 - 4. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.
 - 5. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal.
 - 6. Motor shall be a minimum of 85% efficient at all speeds.

2.3 POWER ROOF VENTILATORS

- A. Power roof exhauster to have aluminum airfoil centrifugal backward curved wheels mounted in aluminum housings. Weatherproof electrical disconnect switch to be mounted within housing. Fans to be provided with 1/2" woven mesh aluminum or plastic coated steel bird screens and motorized damper.
- B. Belt driven units are to have motors isolated from air stream, mounted on vibration isolators and provided with belt tension adjustment capability.
- C. Direct drive fans are to have motors totally enclosed or isolated from the air stream.
- D. Furnish prefabricated, preinsulated roof curbs for each power roof ventilator.
- E. Provide variable speed controllers for units where scheduled.

PART 3 - EXECUTION

3.1 POWER VENTILATORS

- A. Install power roof ventilators on pre-fabricated curbs furnished with units. Roof curb installation is under Division 7.
- B. Time delay switch and reverse acting thermostat shall be installed and wired by Division 26.
- C. Damper wiring and control is to be provided by the Division 23 Contractor in accordance with the requirements of the Division 26 Specifications.

END OF SECTION

SECTION 23 37 13 DIFFUSERS, REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes labor, materials, equipment, skills and related services necessary to furnish and install the air terminal units as indicated in the Contract Documents.

1.2 REFERENCES

- A. The General Provisions of the Contract, including Conditions of the Contract and Division 1 of the Specifications apply to the work in this Section.
- B. Section 23 30 00 is hereby made a part of the Section.
- C. Standards
 - 1. ASHRAE Standard 70 – Method of Testing the Performance of Air Outlets and Inlets (2006)

1.3 SUBMITTALS

- A. Submit shop drawings and descriptive data in accordance with Section 20 10 00 for the following.
 - 1. Grilles, Registers and Diffusers.

PART 2 - PRODUCTS

2.1 GRILLES, REGISTERS AND DIFFUSERS

- A. Acceptable manufacturers:
 - 1. Titus
 - 2. Tuttle & Bailey
 - 3. Price
 - 4. Nailer
- B. Supply registers shall have individually adjustable vertical or horizontal double deflection bars with a key operated opposed blade volume control damper.
- C. At points indicated on the Drawings furnish and install individually adjustable deflecting vanes that will control air volume and deflect supply air for even distribution through branch duct, a supply grille, register or diffuser.
- D. Grilles, registers and diffusers located in acoustical tile ceilings shall have a baked-on white enamel finish.
- E. Grilles, registers and diffusers located on exposed ductwork or on walls shall be finished with a prime coat finish. Natural aluminum registers mounted on exposed ductwork may be left with a natural finish.
- F. Rectangular to round adaptors shall be provided where required.
- G. Provide a manufactured metal plaster frame for grilles or registers installed in plastered walls.

PART 3 - EXECUTION

3.1 GRILLES, REGISTERS AND DIFFUSERS

- A. Grilles, registers, and diffusers shall be fitted with gaskets, drawn tight to the surface and securely fastened to eliminate gaps and dirt streaking. Ducts behind grilles, registers, and diffusers shall be rigidly fastened and extra screws shall be added if necessary to draw the grilles, registers and diffusers tight to the surface.

END OF SECTION

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SECTION 23 81 00 PACKAGED AIR CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes labor, material, equipment, skills and related services necessary to furnish and install the packaged air conditioners indicated on the Drawings and specified herein.
- B. The work shall include the following:
 - 1. Split system air conditioning unit, air cooled.

1.2 REFERENCES

- A. The General Provisions of the Contract, including Conditions of the Contract and Division 1 of the Specifications apply to the work in this Section.
- B. Section 23 30 00 is hereby made a part of this Section.

1.3 SUBMITTALS

- A. Submit shop drawings and descriptive data in accordance with Section 20 10 00 for the following:
 - 1. Split system air conditioning unit, air cooled.

PART 2 - PRODUCTS

2.1 SPLIT SYSTEM AIR CONDITIONING UNIT- AIR COOLED

- A. Furnish and install the split system air conditioning unit as indicated on the Drawings and specified herein. Unit shall be manufactured by Mitsubishi, or acceptable substitute as manufactured by Carrier, Samsung, Panasonic, or LG.
- B. Indoor Unit
 - 1. General:
 - a. Indoor, direct expansion, wall mounted fan coil. Unit shall be complete with cooling coil, fan, fan motor, piping connectors, electrical controls, microprocessor control system, and integral temperature sensing. Unit shall be furnished with integral wall mounting bracket and mounting hardware.
 - 2. Unit Cabinet:
 - a. Cabinet discharge and inlet grilles shall be attractively styled, high impact polystyrene. Cabinet shall be fully insulated for improved thermal and acoustic performance.
 - 3. Fans:
 - a. Fan shall be tangential direct drive blower type with air intake at the top of the unit and discharge at the bottom front. Automatic, motor--driven vertical air sweep shall be provided standard. Automatic motor driven horizontal air sweep shall be provided standard on sizes 030 and 036.
 - b. Air sweep operation shall be user selectable. The vertical sweep may be adjusted (using the remote control) and the horizontal air direction may be set manually on unit sizes 018 and 024.
 - 4. Coil:
 - a. Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion and specially coated for enhanced wetability. A drip pan under the coil shall have two drain connections for hose attachment, on either the left or right hand side, to remove condensate. Condensate pan shall have internal trap.
 - 5. Motors:
 - a. Motors shall be open drip proof, permanently lubricated ball bearing with inherent overload protection. Fan motors shall be 3 speed.
 - 6. Controls:
 - a. Controls shall consist of a microprocessor based control system which shall control space temperature, determine optimum fan speed, and run self-diagnostics. The temperature control range shall be from 62°F to 84°F.
 - b. User interface with the unit shall be accomplished through the standard wireless remote control.

7. The unit shall have the following functions as a minimum:
 - a. An automatic restart after power failure at the same operating conditions as at failure.
 - b. A timer function to provide a minimum 24 hour timer cycle for system Auto Start/Stop.
 - c. Temperature sensing controls shall sense return air temperature.
 - d. Indoor coil freeze protection.
 - e. Automatic vertical air sweep control to provide on or off activation of air sweep louvers. Automatic horizontal air sweep is available on sizes 030 and 036.
 - f. Dehumidification mode shall provide increased latent removal capability by modulating system operation and setpoint temperature.
 - g. Fan only operation to provide room air circulation when no cooling is required.
 - h. Diagnostics shall provide continuous checks of unit operation and warn of possible malfunctions. Error messages shall be displayed at the unit.
 - i. Fan speed control shall be user selectable: high, medium, low, or microprocessor controlled automatic operation during all operating modes.
 - j. Automatic heating-to-cooling changeover in heat pump mode. Control shall include dead band to prevent rapid mode cycling between heating and cooling.
 8. Filters:
 - a. Unit shall have filter track with factory supplied cleanable filters.
 9. Electrical Requirements:
 - a. Indoor units shall be 208/230-1-60 and require their own power supply. Only control wiring shall run between the indoor and outdoor units.
 10. Operating Characteristics:
 - a. When matched with the appropriate outdoor section, shall have a minimum listed SEER (seasonal energy efficiency ratio) of 13 at ARI conditions, and a minimum HSPF of 7.7.
 11. Refrigerant Lines:
 - a. Units shall have pre-insulated refrigerant line sets that can be oriented to connect from the left, right or back of unit. Refrigerant lines need to be insulated. Refer to Section 23 07 00 for insulation requirements. Verify required length of line sets with field conditions.
- C. Outdoor Unit
1. General:
 - a. Factory assembled, single piece, air-cooled outdoor unit.
 - b. Contained within the unit enclosure shall be all factory wiring, piping, controls, and the compressor.
 2. Unit Cabinet:
 - a. Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a baked--enamel finish on inside and outside.
 - b. Unit access panels shall be removable with minimal screws and shall provide full access to the compressor, fan, and control components.
 - c. Outdoor compartment shall be isolated and have an acoustic lining to assure quiet operation.
 - d. Compressor compartment shall be isolated to allow performing diagnostics while the system is running.
 3. Fans:
 - a. Outdoor fans shall be direct--drive propeller type, and shall discharge air horizontally. Fans shall blow air through the outdoor coil.
 - b. Outdoor fan motors shall be totally--enclosed, single phase motors with class B insulation and permanently lubricated bearings. Motor shall be protected by internal thermal overload protection.
 - c. Shaft shall have inherent corrosion resistance.
 - d. Fan blades shall be metallic and shall be statically and dynamically balanced.
 - e. Outdoor fan openings shall be equipped with PVC coated metal protective grille over fan.
 4. Compressor:
 - a. Compressor shall be fully hermetic scroll type.
 - b. Compressor shall be equipped with oil system, operating oil charge, and motor. Internal overloads shall protect the compressor from over temperature and over current.
 - c. Motor shall be NEMA rated class F, suitable for operation in a refrigerant atmosphere.
 - d. Compressor assembly shall be installed on rubber vibration isolators.
 - e. Compressors shall be available in single-phase.
 5. Outdoor Coil:
 - a. Coil shall be constructed of aluminum fins mechanically bonded to seamless copper tubes, which are cleaned, dehydrated, and sealed.

6. Refrigeration Components:
 - a. Refrigerant circuit components shall include brass external liquid line service valve with service gage port connections, suction line service valve with service gage connection port, service gage port connections on compressor suction and discharge lines with Schrader type fittings with brass caps, accumulator, reversing valve.
7. Controls and Safeties: Operating controls and safeties shall be factory selected, assembled, and tested. The minimum control functions shall include the following:
 - a. Controls:
 - 1) A time delay control sequence is provided standard through the fan coil board.
 - 2) Automatic outdoor fan motor protection.
 - b. Safeties:
 - 1) Diagnostics provided by matched indoor unit.
 - 2) Compressor motor current and temperature overload protection.
 - 3) Outdoor fan failure protection (High Pressure Switch).
 - 4) Low pressure protection.
 - 5) Fusible plug to vent refrigerant safely in case of a fire.
8. Electrical Requirements:
 - a. All sizes shall operate on single-phase, 60 Hz power at 208/230V.
 - b. Unit control voltage to the indoor fan coil shall be 24 VDC.
 - c. All power and control wiring must be installed per NEC and all local electrical codes.
9. Refrigerant Line Lengths:
 - a. The unit shall be capable of 200 feet maximum piping, a maximum lift (fan coil above) of 65 feet and a maximum drop (fan coil below) of 150 feet.
 - b. Provide pre-charged line sets to accommodate the total length of refrigerant piping required for the installation.
 - c. Accessories will be required to achieve these lengths. Furnish a liquid line solenoid valve for each unit.
10. Special Features requiring field installation.
 - a. Low Ambient Kit: Control shall regulate fan motor cycles in response to saturated condensing temperature of the unit. The control shall be capable of maintaining a condensing temperature of $100^{\circ}\text{F} \pm 10^{\circ}\text{F}$ with outdoor temperatures to -20°F . Installation of kit shall not require changing the outdoor fan motor.
 - b. Crankcase Heater
 - c. Wind baffle

PART 3 - EXECUTION

3.1 SPLIT SYSTEM AIR CONDITIONING UNIT - AIR COOLED

- A. Install indoor unit where indicated on the Drawings. Extend condensate drain line from unit to exterior of building where shown on Drawings.
- B. Outdoor unit shall be installed on roof on curb provided by Division 7.
- C. Install pre-charged refrigerant tubing from indoor unit to outdoor unit as indicated on the Drawings. Provide heavy gauge metal guards around vertical sections and anchor securely to wall.
- D. The General Provisions of the Contract, including Conditions of the Contract and Division 1 of the Specifications apply to work in this Section.

3.2 TESTING AND START-UP

- A. Provide check, test and start-up for the air conditioners.
- B. Provide instructions to the Owner's designated operating personnel.
- C. Refer to Section 20 10 00 for additional information.

END OF SECTION

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SECTION 23 82 39 UNIT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes labor, materials, equipment, skills and related services necessary to furnish and install the unit heaters indicated in the Contract Documents.

1.2 REFERENCES

- A. The General Provisions of the Contract, including Conditions of the Contract and Division 1 of the Specifications apply to the work in this Section.

1.3 SUBMITTALS

- A. Submit shop drawings and descriptive data in accordance with Section 20 10 00 for the following.
 - 1. Cabinet Unit Heaters
 - 2. Horizontal Unit Heaters

PART 2 - PRODUCTS

2.1 ELECTRIC UNIT HEATERS

- A. Acceptable manufacturers
 - 1. Berko
 - 2. Q'Mark
 - 3. Markel
 - 4. Sentinel
- B. Q'Mark, Type "MUH" or equivalent type by other acceptable manufacturers with the following features:
 - 1. Heavy gauge die-formed steel housing.
 - 2. Pull through air flow design.
 - 3. Completely enclosed fan motors, not requiring oiling.
 - 4. Aluminum finned, copper clad steel sheath heating element.
 - 5. Control transformer.
 - 6. Automatic reset linear thermal cut-out, capillary type, providing protection over entire length of heating element.
 - 7. Fan delay, allowing heat up and cool down of heating element prior to fan start-up and shut-down.
 - 8. Unit shall be UL listed.
 - 9. Provide individually adjustable discharge louvers.
- C. Provide return air or remote thermostat as indicated on drawings.
- D. Provide voltage and wattage as indicated on the Drawings.

PART 3 - EXECUTION

3.1 ELECTRIC UNIT HEATERS

- A. Install electric heaters as recommended by manufacturer and as shown on Drawings.
- B. Install electric unit heaters from ceiling supports using manufacturer's brackets.
- C. Mount electric unit heater with unit bottom a minimum of 8 feet above finished floor
- D. Install thermostat for unit control.

END OF SECTION

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SECTION 26 00 01 - GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The General Provisions of the Contract, including Conditions of the Contract (Division 00 70 00), and General Requirements (Division 01 00 00) of the Specifications, apply to the work in Division 26, 27, and 28.
- B. This Section is hereby made a part of all other Sections of Division 26, 27, and 28 as fully as if repeated in each therein.

1.2 DESCRIPTION

- A. Definitions: The terms listed below are defined as follows only when used in Division 26, 27, and 28.
 - 1. Work: labor and materials of the Contractor and/or Sub-contractor.
 - 2. Furnish: obtain, coordinate, submit the necessary drawings, deliver to the job site in new condition and guarantee.
 - 3. Install: receive at the job site, unload, store, set in place, connect, place in operation and guarantee.
 - 4. Provide: furnish and install.
 - 5. Connect: bring service to the equipment and make final attachment including necessary switches, outlets, etc.
 - 6. Conduit: includes, in addition to conduit, all fittings, pull boxes, hangers, and other supports and accessories related to such conduit.
 - 7. Concealed: hidden from sight in chases, furred spaces, shafts, hung ceilings, embedded in construction, in crawl spaces or buried.
 - 8. Exposed: not installed underground nor concealed as defined above.
 - 9. The building structure or building structural members consist of steel columns, steel beams, steel joists (top chord and at panel points), concrete walls and concrete block walls. Metal decking, joist bridging and bottom chords of bar joists shall not be construed as building structure nor as a building structural member for the purpose of support.
- B. Provide Electrical work, which is finished work, tested and ready for operation.
 - 1. Apparatus, appliances, material or work not indicated or any incidental accessories necessary to make the work complete and ready for operation, even though not specified nor shown on the drawings, are to be provided.
 - 2. Should there be any discrepancies or a question of intent, refer the matter to the Architect/Engineer for decision before ordering equipment or materials and before starting any related work.
 - 3. Where work connects to that of another trade, or to wiring or equipment in place, take measurements in the field to make connecting work come true and line up with the item being connected.
 - 4. Where work specified under other Divisions of the Specifications connects to equipment, which is a part of Division 26, provide proper connection(s) to such equipment.

1.3 QUALITY ASSURANCE

- A. Workmanship
 - 1. All workmanship shall be first class in every respect and shall be performed only by skilled mechanics.
- B. Codes and Standards
 - 1. Materials and workmanship to comply with applicable codes. As a minimum, codes include; all State and Federal laws, local ordinances, utility company regulations and requirements and recommendations of the following.
 - a. State and Local Building codes
 - b. State Industrial Commission Regulations
 - c. State and Local Fire Codes and Regulations
 - d. National Electric Code
 - e. State and Local Electrical Codes
 - f. Occupational Safety and Health Administration Regulations.
 - 2. If these specifications with accompanying drawings are in any way at variance with these codes, the above cited codes shall govern and the Contractor shall make this installation accordingly, except where the drawings or specifications call for a higher quality of work than required by the Code.

3. These Standards shall be used where referenced by the following abbreviations:

AIA:	American Insurance Association
AIA:	American Institute of Architects
ANSI:	American National Standards Institute
APA:	APA – The Engineered Wood Association
ASTM:	American Society of Testing and Materials
EPA:	Environmental Protection Agency
FM:	Factory Mutual Insurance Association
IEEE:	Institute of Electrical and Electronic Engineers
IES:	Illuminating Engineering Society of North America
NBS:	National Bureau of Standards
NECA:	National Electrical Contractors Association
NEMA:	National Electrical Manufacturers Association
NFPA:	National Fire Protection Association
NSC:	National Safety Council
UL:	Underwriter's Laboratories

1.4 SUBMITTALS

- A. Shop Drawings and Samples: Submit in accordance with the General Conditions and Division 01. Refer to individual sections of Division 26, 27, and 28 for supplementary requirements.
- B. All Shop Drawings shall be marked in a way that makes it clear what equipment or materials is being provided. Unmarked Shop Drawings may be returned to Contractor for resubmission.
- C. If Shop Drawings are returned to Contractor as 'Rejected' or 'Revised and Resubmit' three (3) times, the Engineer may choose to charge an Additional Service for further review.
- D. Shop Drawings and other pertinent information shall be submitted and reviewed before equipment is purchased or before fabrication or erection of materials is started.
- E. The Contractor shall check drawings relative to capacity, arrangement and physical dimensions and shall mark the drawings approved prior to submitting for their final review.

1.5 APPROVAL OF MATERIALS

- A. Refer to General conditions and Division 01 for approval requirements.
- B. To obtain approval to use unspecified equipment, bidding contractors shall submit written requests to the Engineer at least ten days prior to bid date. Requests shall clearly describe the equipment for which approval is being requested. Include all data necessary to demonstrate that equipment capacities, features and performance are equivalent to the specific equipment and include a cost comparison between specified equipment and equipment for which approval is being requested. If the equipment is acceptable the Engineer shall approve it in an Addendum.
- C. Where approved substitutes are used, the Contractor assumes responsibility for physical dimensions and other resulting changes. This responsibility extends to include extra work required by other trades as result of the substitution.
- D. Substituted equipment which requires additional costs by other trades in its application shall have such costs borne by the contractor furnishing the equipment.

- E. If substitution of materials occur after Bid is awarded, the Contractor shall provide a submittal for approval to the Engineer. Requests shall clearly describe the equipment for which approval is being requested. Include all data necessary to demonstrate that equipment capacities, features and performance are equivalent to the specific equipment and include a cost comparison between specified equipment and equipment for which approval is being requested. If the equipment is acceptable the Engineer shall approve it in an Addendum or other appropriate manner.

1.6 PERMITS, LICENSES AND FEES

- A. The Contractor shall secure all permits and licenses, both temporary and permanent required for their work. The Contractor shall pay all fees and expenses required for the permits and licenses.
- B. The Contractor shall make all arrangements with each utility company and pay all service charges associated with new services or modifications to existing services.
- C. The Contractor shall request inspections as required by regulating agencies and/or regulations. The Contractor shall pay all charges for inspections.
- D. Contractor shall furnish the Owner with a certificate of final inspection and approval by enforcement authorities.

1.7 INSPECTION OF SITE

- A. Prior to submitting a proposal on the work contemplated, bidder shall examine the site of the proposed work and thoroughly familiarize himself with existing conditions and limitations affecting the performance of their work. No extra compensation will be allowed because of misunderstanding as to the amount of work involved nor bidder's failure to verify existing conditions which they could have discovered or reasonably anticipated prior to bidding. Contractor shall be responsible for any additional cutting, patching, before mounting or installation modifications, etc., not called out on the drawings but required for the successful completion of the job. This includes any additional work required due to any existing jobsite condition (i.e., the construction of walls, ceiling spaces, clearances, available voltages, mounting requirements, existing equipment coordination, hazardous materials, etc.) that the contractor had an opportunity to determine in the pre-bid walk-through and could have reasonably determined before the bid by visual inspection or by asking the engineer or owner. No additional money shall be awarded for additional work incurred caused by existing jobsite conditions which could have been verified by the contractor prior to bid. In addition, no additional money shall be awarded for failure to properly coordinate with other trades.

1.8 PLAN INTERPRETATION

- A. The plans are diagrammatic and indicate the arrangement of systems and equipment unless indicated otherwise by dimensions or detail plans of 1/4" = 1'-0" scale or larger. Refer to dimensioned plans for exact locations of building elements. However, field measurements take precedence over dimensioned plans. Report any differences discovered between electrical plans and the plans for other divisions. The installation of all systems and equipment is subject to clarification as indicated in reviewed shop drawings.
- B. Equipment outlines shown on detailed plans of 1/4" = 1'-0" scale or larger and/or dimensions indicated on the plans are limiting dimensions. Do not install any equipment that exceeds the equipment outlines shown or reduces indicated clearances.

1.9 SYSTEMS CONTENT

- A. Provide all materials required for complete and operable systems as specified within. Omissions of specific reference to incidental parts required for complete systems shall not be construed as a release from furnishing such parts.

1.10 CORRELATION OF WORK

- A. Consult the drawings and specifications of Mechanical and other trades for correlating information and lay out work so that it will co-ordinate with other trades. Verify dimensions and conditions (i.e. finished ceiling heights, footing and foundation elevations, beam depths, etc.) with the Architectural and Structural drawings. If conflicts occur such that resolution is not possible by the affected trades on the job, the Architect/Engineer shall be notified so that the proper changes can be made to avoid extra cost to the Owner.

- B. Where work must be replaced due to the failure of the Contractor to verify the conditions existing on the job, such replacement must be accomplished at no cost to the Owner. This shall apply to shop fabricated work as well as to work fabricated in place.
- C. Throughout the course of the work, minor changes and adjustments to the installation may be requested by the Engineer. The Contractor shall make adjustments without additional cost to the Owner, where such adjustments are necessary to the proper installation and operation within the intent of the Contract Documents. This does not include work already completed.
- D. Equipment outlines shown on detail plans of 1/4" = 1'-0" scale or larger and/or dimensions indicated on the plans are limiting dimensions. Do not install any equipment that exceeds the equipment outlines shown or reduces indicated clearances.

1.11 CORRECTIVE PERIOD

- A. The Contractor shall guarantee and maintain the stability of work and materials and keep same in perfect repair and condition for the period of one (1) year after the Date of Substantial Completion of the Project.
- B. Defects of any kind due to faulty work or materials appearing during the above-mentioned period must be immediately made good by the Contractor at their own expense to the entire satisfaction of the Owner and Architect and Engineer. Such reconstruction and repairs shall include damage to the finish or the building resulting from the original defect or repairs thereto.
- C. This guarantee shall not apply to injuries occurring after final acceptance and due to wind, fire, violence, abuse or carelessness or other Contractors or their employees or the agents of the Owner.
- D. This guarantee shall not apply where other guarantees for different lengths of time are specifically called for.

1.12 START-UP SYSTEMS AND OPERATING INSTRUCTIONS

- A. The Owner's designated operating personnel shall be fully instructed by the Contractor in the operation of each type of operating equipment and electrical system at the time it is put into service. A statement from the Owner shall be obtained to the effect that their designated personnel have been instructed.
- B. Each Contractor shall submit to the Engineer two (2) Maintenance and Operating manuals. These manuals shall be submitted in portfolio form neatly edited with similar equipment grouped, tabbed and indexed. Materials shall be printed or typewritten. Each manual shall contain the following:
 1. Shop drawings, approved manufacturer's bulletins, and other appropriate data from specific manufacturer and other sources relating to the approved care, maintenance, and operating instructions required of each piece of equipment furnished and/or installed. Shop drawings, manufacturer's bulletin, and other data shall be appropriate marked to reflect the "as-built" condition.
 2. List of electrical equipment together with the equipment manufacturer, local representative and local distributor and installing contractor. The list shall be arranged in neat columnar form with current telephone numbers and address provided for listed representatives and distributors.
 3. Test reports.

1.13 LIGHTING REBATE SCHEME:

- A. It is the intention to apply the Utility lighting rebate scheme to the project.
- B. The Electrical Contractor shall secure on behalf of the Owner the maximum rebate. This shall include all negotiations, providing substantiation where required, and making all necessary arrangements on behalf of the Owner.

1.14 RECORD DRAWINGS

- A. Provide record drawings in accordance with the requirements of the General Conditions and Division 1.

1.15 CONSTRUCTION LIGHTING & POWER SYSTEM – NEW BLDG

- A. Furnish, install, and maintain a construction lighting and power system, as directed herein, for the use of all trades. As soon as a motive to proceed is issued, arrange with the power company for a 100 ampere, 120/240-volt, single phase, and three wire service.

- B. Materials furnished by the Electrical Contractor for the system shall remain their property and shall be removed when there is no longer any need for temporary light and power or when so ordered by the Architect.
- C. Furnish, install and maintain the service terminal pole, metering equipment (except that switch, overhead service to the building and a construction lighting and power distribution system within the building as hereinafter specified).
- D. The power company's connect-and-disconnect charges shall be paid by the Electrical Contractor.
- E. Provide and maintain lighting and receptacle outlets throughout the construction area in accordance with the following:
 - 1. Lighting at the rate of one third watt per square foot with at least one outlet per room.
 - 2. One (1) duplex receptacle per 2500 square feet of area.
 - 3. All receptacles shall have ground fault protection.
- F. Install the lighting and receptacle outlets throughout all areas in an arrangement acceptable to the Architect and to the other trades. Connect maximum of three (3) duplex receptacles to one (1) 20A receptacle circuit.
- G. Overload protection for circuits and equipment of the temporary light and power system shall comply with the applicable codes relating to permanent work. Panelboards and other protective equipment shall be furnished and installed as required.

PART 2 - PRODUCTS (DOES NOT APPLY)

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

- A. Store and protect products to be installed or turned over to Owner.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect products from dirt, water, construction debris, and traffic.

3.2 CLEAN UP

- A. Contractor shall at all times keep the premises free from accumulation of waste material or rubbish caused by their employees or work. Upon completion of the work they shall remove their rubbish, tools, scaffolding, and surplus materials from and about the building, and shall leave their work areas "broom clean" or its equivalent. Electrical equipment shall be cleaned with temporary identification removed. In case of dispute the Owner will remove the rubbish and charge the cost to the Contractor.
- B. After tests have been made and accepted, the Electrical Contractor shall go over the whole job and clean light fixtures, panels and other equipment installed by him, leaving the entire plant in a clean and complete working order.

3.3 PAINTING

- A. Refinish all electrical equipment damaged during shipping and/or installation to its original condition. Remove all rust; prime, and paint per manufacturer's recommendations for finish equal to original.

3.4 MOUNTING HEIGHTS

- A. Coordinate mounting heights, spacing and overall appearance at locations where (2) or more devices are located in the same area.

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SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Single conductor building wire.
- B. Metal-clad cable.
- C. Variable-frequency drive cable.
- D. Wiring connectors.
- E. Electrical tape.
- F. Heat shrink tubing.
- G. Oxide inhibiting compound.
- H. Wire pulling lubricant.
- I. Cable ties.
- J. Firestop sleeves.

1.2 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping.
- B. Section 26 00 01 - General Provisions.
- C. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
- D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 21 00 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conductors.
- F. Section 31 23 16 - Excavation.
- G. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.
- H. Section 31 23 23 - Fill: Bedding and backfilling.

1.3 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 D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape.
- F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes.
- G. FS A-A-59544 - Cable and Wire, Electrical (Power, Fixed Installation); Federal Specification.
- H. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- I. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.

- J. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.
- K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.
- M. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- N. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.
- O. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
- P. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.
- Q. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.
- R. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.4 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.

1.5 SUBMITTALS

- A. Submit material list in accordance with Section 26 00 01, describing all material furnished under Part 2 of this Section of the Specifications.
- 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. Sustainable Design Documentation: Submit manufacturer's product data on conductor and cable showing compliance with specified lead content requirements.
- D. Field Quality Control Test Reports.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.
- G. 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 Manufactured Wiring Systems Cable Assemblies: One of each configuration, 6 feet (2000 mm) length.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- 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.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.8 FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F (-10 degrees C), unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 - PRODUCTS

2.1 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
 - 1. Exceptions:
 - a. Use variable-frequency drive cable for connection between variable-frequency motor controllers and associated motors.
- C. Metal-clad cable is permitted only as follows:
 - 1. Where not otherwise restricted, may be used:
 - a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
 - 1) Maximum Length: 6 feet (1.8 m).
 - b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
 - 1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.
 - 2. In addition to other applicable restrictions, may not be used:
 - a. Unless approved by Owner.
 - b. Where not approved for use by the authority having jurisdiction.
 - c. Where exposed to view.
 - d. Where exposed to damage.
 - e. For damp, wet, or corrosive locations, unless provided with a PVC jacket listed as suitable for those locations.
 - f. For isolated ground circuits, unless provided with an additional isolated/insulated grounding conductor.
 - g. For patient care areas of health care facilities requiring redundant grounding.

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.

SELECT PARAGRAPH BELOW IF PROJECT IS LEED V4 HEALTHCARE Provide new conductors and cables manufactured not more than one year prior to installation.

- D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- E. Comply with NEMA WC 70.
- F. Comply with FS A-A-59544 where applicable.
- G. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- H. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- I. Conductors for Grounding and Bonding: Also comply with Section 26 0526.
- J. Conductors and Cables Installed Where Exposed to Direct Rays of Sun: Listed and labeled as sunlight resistant.

- K. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.
- L. Conductor Material:
 - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
 - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
 - 3. Tinned Copper Conductors: Comply with ASTM B33.
- M. Minimum Conductor Size:
 - 1. Branch Circuits: #12 AWG.
 - a. Exceptions:
 - 1) 20 A, 120 V circuits longer than 75 feet (23 m): #10 AWG, for voltage drop.
 - 2) 20 A, 120 V circuits longer than 150 feet (46 m): #8 AWG, for voltage drop.
 - 3) 20 A, 277 V circuits longer than 150 feet (46 m): #10 AWG, for voltage drop.
 - 2. Control Circuits: #14 AWG.
- N. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- O. Conductor Color Coding:
 - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 - 2. Color Coding Method: Integrally colored insulation.
 - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
 - 3. Color Code:
 - a. 480Y/277 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - 4) Neutral/Grounded: Gray.
 - b. 208Y/120 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.
 - c. Equipment Ground, All Systems: Green.
 - d. Isolated Ground, All Systems: Green with yellow stripe.
 - e. Travelers for 3-Way and 4-Way Switching: Pink.
 - f. For control circuits, comply with manufacturer's recommended color code.

2.3 SINGLE CONDUCTOR BUILDING WIRE

- A. Manufacturers:
 - 1. Copper Building Wire:
 - a. Cerro Wire LLC.
 - b. Encore Wire Corporation.
 - c. General Cable Technologies Corporation.
 - d. Service Wire Co.
 - e. Southwire Company.
 - f. Substitutions: Approved substitute.
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
 - 1. Feeders and Branch Circuits:
 - a. #10 AWG and Smaller: Solid.
 - b. #8 AWG and Larger: Stranded.
 - 2. Control Circuits: Stranded.

- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
 - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
 - a. #4 AWG and Larger: Type XHHW-2.
 - b. Installed Underground: Type XHHW-2.
 - c. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.

2.4 METAL-CLAD CABLE

- A. Manufacturers:
 - 1. AFC Cable Systems Inc.
 - 2. Encore Wire Corporation.
 - 3. Service Wire Co.
 - 4. Southwire Company.
 - 5. Substitutions: Approved substitute.
- B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.
- C. Conductor Stranding:
 - 1. #10 AWG and Smaller: Solid.
 - 2. #8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
- F. Provide oversized neutral conductors where indicated or required.
- G. Provide dedicated neutral conductor for each phase conductor where indicated or required.
- H. Grounding: Full-size integral equipment grounding conductor.
 - 1. Provide additional isolated/insulated grounding conductor where indicated or required.
- I. Armor: Steel, interlocked tape.
- J. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

2.5 VARIABLE-FREQUENCY DRIVE CABLE

- A. Manufacturers:
 - 1. Service Wire Co.
 - 2. Substitutions: Approved substitute.
- B. Description: Flexible motor supply cable listed and labeled as complying with UL 2277 in accordance with NFPA 79; specifically designed for use with variable frequency drives and associated nonlinear power distortions.
- C. Conductor Stranding: Stranded.
- D. Insulation Voltage Rating: 1000 V.
- E. Insulation: Use only thermoset insulation types; thermoplastic insulation types are not permitted.
- F. Grounding: Full-size integral equipment grounding conductor or symmetrical arrangement of multiple conductors of equivalent size.
- G. Provide metallic shielding.
- H. Jacket: PVC or Chlorinated Polyethylene (CPE).

2.6 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

- B. Connectors for Grounding and Bonding: Comply with Section 26 05 26.
- C. Wiring Connectors for Splices and Taps:
 - 1. Copper Conductors #8 AWG and Smaller: Use twist-on insulated spring connectors.
 - 2. Copper Conductors #6 AWG and Larger: Use mechanical connectors or compression connectors.
- D. Wiring Connectors for Terminations:
 - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
 - 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
 - 3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
 - 4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
 - 5. Copper Conductors #8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
 - 6. Stranded Conductors #10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
 - 7. Conductors for Control Circuits: Use crimped terminals for all connections.
- E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.
- G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F (105 degrees C) for standard applications and 302 degrees F (150 degrees C) for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
 - 1. Manufacturers:
 - a. 3M.
 - b. Ideal Industries, Inc.
 - c. NSI Industries LLC.
 - d. Substitutions: Approved substitute.
- H. Mechanical Connectors: Provide bolted type or set-screw type.
 - 1. Manufacturers:
 - a. Burndy LLC.
 - b. IlSCO.
 - c. Thomas & Betts Corporation.
 - d. Substitutions: Approved substitute.
- I. Compression Connectors: Provide circumferential type or hex type crimp configuration.
 - 1. Manufacturers:
 - a. Burndy LLC.
 - b. IlSCO.
 - c. Thomas & Betts Corporation.
 - d. Substitutions: Approved substitute.
- J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
 - 1. Manufacturers:
 - a. Burndy LLC.
 - b. IlSCO.
 - c. Thomas & Betts Corporation.
 - d. Substitutions: Approved substitute.

2.7 ACCESSORIES

- A. Electrical Tape:
 - 1. Manufacturers:
 - a. 3M.
 - b. Plymouth Rubber Europa.

- c. Substitutions: Approved substitute.
 - 2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
 - 3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
 - 4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil (0.76 mm); suitable for continuous temperature environment up to 194 degrees F (90 degrees C) and short-term 266 degrees F (130 degrees C) overload service.
 - 5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil (3.2 mm); suitable for continuous temperature environment up to 176 degrees F (80 degrees C).
 - 6. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil (0.18 mm); suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
 - 7. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil (2.3 mm).
- B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
- 1. Manufacturers:
 - a. 3M.
 - b. Burndy LLC.
 - c. Thomas & Betts Corporation.
 - d. Substitutions: Approved substitute.
- C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
- 1. Manufacturers:
 - a. Burndy LLC.
 - b. Ideal Industries, Inc.
 - c. IlSCO.
 - d. Substitutions: Approved substitute.
- D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
- 1. Manufacturers:
 - a. 3M.
 - b. American Polywater Corporation.
 - c. Ideal Industries, Inc.
 - d. Substitutions: Approved substitute.
- E. Cable Ties: Material and tensile strength rating suitable for application.
- 1. Manufacturers:
 - a. Burndy LLC.
 - b. Substitutions: Approved substitute.
- F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.
- 1. Products:
 - a. Menzies Metal Products; Electrical Roof Stack and Cap.
 - b. Menzies Metal Products; Electrical Retro Box.
 - c. Substitutions: Approved substitute.
- G. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
- 1. Products:
 - a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built.
 - b. Substitutions: Approved substitute.

PART 3 - EXECUTION

3.1 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.

3.2 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3 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 (3.0 m) 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.
 - d. Maximum number of conductors in raceways and boxes shall conform to the latest edition of the NEC with the following exception: Do not fill 1/2" conduit to more than 25% fill.
 - 8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is permitted where not otherwise prohibited, except for the following:
 - a. Branch circuits fed from ground fault circuit interrupter (GFCI) circuit breakers.
 - b. Branch circuits fed from feed-through protection of GFI receptacles.
 - c. Branch circuits with dimming controls.
 - d. Branch circuits with isolated grounding conductor.
 - 9. Provide oversized neutral/grounded conductors where indicated and as specified below.
 - a. Provide 200 percent rated neutral for feeders fed from K-rated transformers.
 - b. Provide 200 percent rated neutral for feeders serving panelboards with 200 percent rated neutral bus.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install metal-clad cable (Type MC) in accordance with NECA 120.
- E. Installation in Raceway:
 - 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 - 2. Pull all conductors and cables together into raceway at same time.
 - 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 - 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- F. Exposed Cable Installation (only where specifically permitted):

1. Route cables parallel or perpendicular to building structural members and surfaces.
 2. Protect cables from physical damage.
- G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- H. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
 2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.
- I. Terminate cables using suitable fittings.
1. Metal-Clad Cable (Type MC):
 - a. Use listed fittings.
 - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
- J. 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 (300 mm) of slack at each outlet.
- L. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet (1.5 m) 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 contaminants. Do not use wire brush on plated connector surfaces.
 5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- 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 un-spliced 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 8400.
- 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.

3.4 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 required for all conductors. The resistance test for parallel conductors listed as optional is not required.
 - 1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
- D. Correct deficiencies and replace damaged or defective conductors and cables.

3.5 BALANCING LOADS

- A. When connecting single phase circuits and equipment to a three-phase system, distribute the loads among the phases to achieve an approximately balanced loading of the three-phase system.

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Ground rod electrodes.
- F. Chemically-enhanced ground electrodes.
- G. Ground enhancement material.

1.2 RELATED REQUIREMENTS

- A. Section 26 00 01 – General Provisions
- B. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
- C. Section 26 05 53 – Identification for Electrical Systems
- D. Section 26 20 20 – Service Entrance
- E. Section 26 22 13 – Dry Type Transformers
- F. Section 26 24 13 – Switchboards
- G. Section 26 24 16 – Panelboards
- H. Section 26 51 00 – Lighting
- I. Section 33 79 00 – Site Grounding.

1.3 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 (NEC)
- F. UL 467 - Grounding and Bonding Equipment

1.4 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.

1.5 SUBMITTALS

- A. Submit material list in accordance with Section 26 00 01, describing all material furnished under Part 2 of this Section of the Specifications.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
- C. Shop Drawings:
 - 1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Field quality control test reports.
- F. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.6 QUALITY

- A. Comply with requirements of the NEC.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

- A. Do not use products for applications other than as permitted by the NEC and product listing.
- B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- C. Where conductor size is not indicated, size to comply with the NEC but not less than applicable minimum size requirements specified.
- D. Grounding Electrode System:
 - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
 - a. Provide continuous grounding electrode conductors without splice or joint.
 - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
 - 2. Metal Underground Water Pipe(s):
 - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet (3.0 m) at an accessible location not more than 5 feet (1.5 m) from the point of entrance to the building.
 - b. Provide bonding jumper(s) around insulating joints/pipes 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 the NEC.
 - 4. Concrete-Encased Electrode:

- a. Provide connection to concrete-encased electrode consisting of not less than 20 feet (6.0 m) of either steel reinforcing bars or bare copper conductor not smaller than #4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with the NEC.
 5. Ground Rod Electrode(s):
 - a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
 - b. Space electrodes not less than 10 feet (3.0 m) from each other and any other ground electrode.
 - c. Where location is not indicated, locate electrode(s) at least 5 feet (1.5 m) outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
 - d. Provide ground enhancement material around electrode where indicated.
 6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
 7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in the NEC. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
 - a. Ground Bar Size: 1/4 by 2 by 12 inches (6 by 50 by 300 mm) unless otherwise indicated or required.
 - b. 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 (450 mm) above finished floor unless otherwise indicated.
 8. Ground Riser: Provide common grounding electrode conductor not less than #3/0 AWG for tap connections to multiple separately derived systems as permitted in the NEC.
- E. 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.
- F. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:
1. Provide grounding electrode system for each separate building or structure.
 2. Provide equipment grounding conductor routed with supply conductors.
 3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
 4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.
- G. Separately Derived System Grounding:
1. Separately derived systems include, but are not limited to:
 - a. Transformers (except autotransformers such as buck-boost transformers).
 - b. Uninterruptible power supplies (UPS), when configured as separately derived systems.
 2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
 3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
 4. Where common grounding electrode conductor ground riser is used for tap connections to multiple separately derived systems, provide bonding jumper to connect the metal building frame and metal water piping in the area served by the derived system to the common grounding electrode conductor.
 5. Outdoor Source: Where the source of the separately derived system is located outside the building or structure supplied, provide connection to grounding electrode at source in accordance with the NEC.
 6. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
 7. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.

- 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 the NEC.
 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 the NEC.
 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 the NEC. This includes, but is not limited to:
 - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
 - b. Metal gas piping.
 - c. Metal process piping.
 8. Provide bonding for interior metal air ducts.
 9. Provide bonding for metal building frame.
 10. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.
- 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 the NEC.
 2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
 - a. Bonding Jumper Size: #6 AWG, unless otherwise indicated or required.
 - b. Raceway Size: 3/4-inch (21 mm) trade size unless otherwise indicated or required.
 - c. Ground Bar Size: 1/4 by 2 by 12 inches (6 by 50 by 300 mm) unless otherwise indicated or required.
 - d. Ground Bar Mounting Height: 18 inches (450 mm) above finished floor unless otherwise indicated.
- J. Pole-Mounted Luminaires: Also comply with Section 26 51 00.
- K. Cash Register System Grounding
1. Establish ground at the distribution transformer as follows:
 - a. Provide a connection to the building steel, and
 - b. Provide a ground rod.
 2. Provide "grounding electrode conductors" in non-metallic conduit. Provide welded connections.
 - a. Acceptable manufacturer: Cadweld type GR or VS

2.2 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
 2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 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).
 2. Factory Prefabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gauge of specified conductors.
- 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.
 - a. Exceptions:
 - 1) Use exothermic welded connections for connections to metal building frame.
 4. Manufacturers - Mechanical and Compression Connectors:
 - a. Advanced Lightning Technology (ALT)
 - b. Burndy LLC
 - c. Harger Lightning & Grounding
 - d. Thomas & Betts Corporation
 - e. Approved substitute.
 5. Manufacturers - Exothermic Welded Connections:
 - a. Burndy LLC
 - b. Cadweld, a brand of Erico International Corporation
 - c. thermOweld, subsidiary of Continental Industries
 - d. Approved substitute.
- D. Ground Bars:
1. Description: Copper, rectangular ground bars with mounting brackets and insulators.
 2. Size: As indicated.
 3. Holes for Connections: As indicated or as required for connections to be made.
 4. Manufacturers:
 - a. Advanced Lightning Technology (ALT)
 - b. Erico International Corporation
 - c. Harger Lightning & Grounding
 - d. thermOweld, subsidiary of Continental Industries
 - e. Approved substitute.
- E. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
 2. Material: Copper-bonded (copper-clad) steel.
 3. Size: 5/8-inch (19 mm) diameter by 10 feet (3.0 m) length, unless otherwise indicated.
 4. Where rod lengths of greater than 10 feet (3.0 m) are indicated or otherwise required, sectionalized ground rods may be used.
 5. Manufacturers:
 - a. Advanced Lightning Technology (ALT)
 - b. Erico International Corporation
 - c. Galvan Industries, Inc
 - d. Harger Lightning & Grounding
 - e. Approved substitute.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.

- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45-degree angle, or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with the NEC or provide ground plates.
 - 1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches (150 mm) below finished grade.
 - 2. Indoor Installations: Unless otherwise indicated, install with 4 inches (100 mm) of top of rod exposed.
- D. Make grounding and bonding connections using specified connectors.
 - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 - 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- E. Identify grounding and bonding system components in accordance with Section 26 05 53.

3.3 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

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.2 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Section 05 50 00 - Metal Fabrications.
- C. Section 26 00 01 - General Provisions
- D. Section 26 05 33 - Conduit for Electrical Systems.
- E. Section 26 05 33 - Boxes for Electrical Systems.
- F. Section 26 51 00 - Lighting.

1.3 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. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- F. MFMA-4 - Metal Framing Standards Publication.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- H. NFPA 70 - National Electrical Code (NEC).
- I. NFPA 101 - Life Safety Code.
- J. UL 5B - Strut-Type Channel Raceways and Fittings.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.5 SUBMITTALS

- A. Submit material list in accordance with Section 26 00 01, describing all material furnished under Part 2 of this Section of the Specifications.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.
- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
- D. Derating Calculations for Fiberglass Channel (Strut) Framing Systems: Indicate load ratings adjusted for applicable service conditions.
- E. 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.
- F. Installer's Qualification Statement: Include evidence of compliance with specified requirements.
- G. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 QUALITY ASSURANCE

- A. Comply with the NEC.
- B. Comply with applicable building code.
- C. Installer Qualifications for Field-Welding: As specified in Section 05 50 00.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
 - 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 - 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 5.0. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 4. Do not use products for applications other than as permitted by the NEC and product listing.
 - 5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
 - 6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
 - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Materials for Metal Fabricated Supports: Comply with Section 05 50 00.
- C. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
 - 1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.

2. Conduit Clamps: Bolted type unless otherwise indicated.
 3. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation.
 - b. Erico International Corporation.
 - c. HoldRite, a brand of Reliance Worldwide Corporation.
 - d. O-Z/Gedney, a brand of Emerson Electric Co.
 - e. Thomas & Betts Corporation.
 - f. Substitutions: Approved substitute.
- D. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
1. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation.
 - b. Erico International Corporation.
 - c. HoldRite, a brand of Reliance Worldwide Corporation.
 - d. O-Z/Gedney, a brand of Emerson Electric Co.
 - e. Thomas & Betts Corporation.
 - f. Substitutions: Approved substitute.
- E. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Comply with MFMA-4.
 2. Channel (Strut) Used as Raceway (only where specifically indicated): Listed and labeled as complying with UL 5B.
 3. 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.
 4. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch (2.66 mm).
 5. Minimum Channel Dimensions: 1-5/8-inch (41 mm) width by 13/16-inch (21 mm) height.
 6. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation.
 - b. Thomas & Betts Corporation.
 - c. Unistrut, a brand of Atkore International Inc.
 - d. Substitutions: Approved substitute.
 - e. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
- F. Fiberglass Channel (Strut) Framing Systems: Factory-fabricated continuous-slot fiberglass channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Channel Material: Use polyester resin or vinyl ester resin.
 2. Minimum Channel Dimensions: 1-5/8-inch (41 mm) width by 1-inch (25 mm) height.
 3. 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.
 4. Manufacturers:
 - a. Enduro Composites.
 - b. Substitutions: Approved substitute.
 - c. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
- G. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: 1/2-inch (13 mm) diameter.
 - b. Busway Supports: 1/2-inch (13 mm) diameter.
 - c. Single Conduit up to 1-inch (27 mm) trade size: 1/4-inch (6 mm) diameter.
 - d. Single Conduit larger than 1-inch (27 mm) trade size: 3/8-inch (10 mm) diameter.
 - e. Trapeze Support for Multiple Conduits: 3/8-inch (10 mm) diameter.
 - f. Outlet Boxes: 1/4-inch (6 mm) diameter.
 - g. Luminaires: 1/4-inch (6 mm) diameter.

- H. Non-Penetrating Rooftop Supports for Low-Slope Roofs: Steel pedestals with thermoplastic or rubber 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.
 - 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 (150 mm) under supported component to top of roofing.
 - 4. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation.
 - b. Erico International Corporation.
 - c. PHP Systems/Design.
 - d. Unistrut, a brand of Atkore International Inc.
 - e. Substitutions: Approved substitute.
- I. Anchors and Fasteners:
 - 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
 - 2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
 - 3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
 - 4. Hollow Masonry: Use toggle bolts.
 - 5. Hollow Stud Walls: Use toggle bolts.
 - 6. Steel: Use beam 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. 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. Minimum Channel Thickness: Steel sheet, 12-gauge, 0.1046 inch (2.66 mm) minimum base metal thickness.
 - d. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
 - 11. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.
 - 12. Manufacturers - Mechanical Anchors:
 - a. Hilti, Inc.
 - b. ITW Red Head, a division of Illinois Tool Works, Inc.
 - c. Powers Fasteners, Inc.
 - d. Simpson Strong-Tie Company Inc.
 - e. Substitutions: Approved substitute.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with 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. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- H. Field-Welding (where approved by Architect): Comply with Section 05 50 00.
- I. Equipment Support and Attachment:
 - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 03 30 00.
 - 5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- J. Conduit Support and Attachment: Also comply with Section 26 05 33.
- K. Box Support and Attachment: Also comply with Section 26 05 33.
- L. Interior Luminaire Support and Attachment: Also comply with Section 26 51 00.
- M. Exterior Luminaire Support and Attachment: Also comply with Section 26 56 00.
- N. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
- O. Secure fasteners according to manufacturer's recommended torque settings.
- P. Remove temporary supports.
- Q. Identify independent electrical component support wires above accessible ceilings (only where specifically indicated or permitted) with color distinguishable from ceiling support wires in accordance with the NEC.

3.3 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

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SECTION 26 05 33 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED WORK

- A. Section 03 30 00 – Cast-in-Place Concrete
- B. Section 08 31 00 – Access Doors and Panels
- C. Section 26 00 01 – General Provisions
- D. Section 26 05 19 – Conductors and Cable
- E. Section 26 27 26 – Wiring Devices
- F. Section 26 05 29 – Hangers and Supports for Electrical Systems
- G. Section 26 05 53 – Identification for Electrical Systems: Identification products and requirements
- H. Section 26 27 26 – Wiring Devices

1.2 REFERENCES

- A. ANSI C80.1 – Electrical Rigid Steel Conduit (ERSC)
- B. ANSI C80.3 – Electrical Metallic Tubing – Steel (EMT-S)
- C. ANSI C80.5 – Electrical Rigid Metal Conduit – Aluminum (ERMC-A)
- D. ANSI/NEMA FB 1 – Fittings, Cast Metal Boxes, and Conduit bodies for Conduit, Electrical Metallic Tubing, and Cable
- E. NEMA RN-1 - Polyvinyl Chloride (PVC) Externally-Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
- F. NEMA TC 2 – Electrical Polyvinyl Chloride (PVC) Conduit
- G. NEMA TC 3 – Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing
- H. UL – Building Materials Directory
- I. UL 1242 – Intermediate Metallic Conduit – Steel
- J. UL 6A – Electrical Rigid Metal Conduit – Aluminum, Red Brass, and Stainless Steel
- K. UL 514D – Cover Plates for Flush-Mounted Wiring Devices
- L. UL 5 – Surface Metal Raceways and Fittings
- M. NEMA OS 1 – Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
- N. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum)
- O. NFPA 70 – National Electrical Code (NEC)

1.3 SUBMITTALS

- A. Submit material list in accordance with Section 26 00 01, describing all material furnished under Part 2 of this Section of the Specifications.

1.4 QUALITY

- A. Provide new, first quality material for all products specified. No material shall be reused unless indicated or approved by the Engineer.

PART 2 - PRODUCTS

2.1 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
 - 1. Under Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
 - 2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
 - 3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit, intermediate metallic 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 where emerging from underground.
 - 5. Where rigid polyvinyl (PVC) conduit larger than 2-inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
 - 6. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
 - 7. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches (100 mm) 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: Not permitted.
 - 3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit, 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 where emerging from concrete.
 - 5. Where electrical metallic tubing (EMT) emerges from concrete into salt air, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches (100 mm) on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.
- E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).
- I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
 - 1. Locations subject to physical damage include, but are not limited to:
 - a. Where exposed below 8 feet (2.4 m), except within electrical and communication rooms or closets.
 - b. Where exposed below 20 feet (6.1 m) in warehouse areas.

- K. Exposed, Exterior: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit.
- L. Concealed, Exterior, Not Embedded in Concrete or in Contact with Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- M. Corrosive Locations Above Ground: Use PVC-coated galvanized steel rigid metal conduit, or aluminum rigid metal conduit.
 - 1. Corrosive locations include, but are not limited to:
 - a. Cooling towers.
- N. Hazardous (Classified) Locations: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), aluminum rigid metal conduit, or PVC-coated galvanized steel rigid metal conduit.
- O. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
 - 1. Maximum Length: 6 feet (1.8 m).
- P. Connections to Vibrating Equipment:
 - 1. Dry Locations: Use flexible metal conduit.
 - 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
 - 3. Maximum Length: 6 feet (1.8 m) unless otherwise indicated.
 - 4. Vibrating equipment includes, but is not limited to:
 - a. Transformers.
 - b. Motors.
- Q. Fished in Existing Walls, Where Necessary: Use flexible metal conduit.

2.2 CONDUIT REQUIREMENTS

- A. Electrical Service Conduits: Also comply with Section 26 21 00.
- B. Communications Systems Conduits: Also comply with Section 27 05 28.
- C. Fittings for Grounding and Bonding: Also comply with Section 26 05 26.
- D. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- E. Provide products listed, classified, and labeled as suitable for the purpose intended.
- F. Minimum Conduit Size, Unless Otherwise Indicated:
 - 1. Branch Circuits: 1/2-inch (16 mm) trade size.
 - 2. Branch Circuit Homeruns: 3/4-inch (21 mm) trade size.
 - 3. Control Circuits: 1/2-inch (16 mm) trade size.
 - 4. Flexible Connections to Luminaires: 1/2-inch (16 mm) trade size.
 - 5. Underground, Interior: 3/4-inch (21 mm) trade size.
 - 6. Underground, Exterior: 1-inch (27 mm) trade size.
- G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 - 1. Allied Tube & Conduit, a division of Atkore International.
 - 2. Nucor Tubular Products.
 - 3. Western Tube, a division of Zekelman Industries.
 - 4. Wheatland Tube, a division of Zekelman Industries.
 - 5. Substitutions: Approved substitute.
- 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

- b. O-Z/Gedney, a brand of Emerson Electric Co
 - c. Thomas & Betts Corporation
 - d. Approved substitute.
- 2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
- 3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
- 4. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
- 5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.4 ALUMINUM RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 - 1. Allied Tube & Conduit, a division of Atkore International.
 - 2. Nucor Tubular Products.
 - 3. Western Tube, a division of Zekelman Industries.
 - 4. Wheatland Tube, a division of Zekelman Industries.
 - 5. Substitutions: Approved substitute.
- B. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.
- C. Fittings:
 - 1. Manufacturers:
 - a. Bridgeport Fittings Inc
 - b. O-Z/Gedney, a brand of Emerson Electric Co
 - c. Thomas & Betts Corporation
 - d. Approved substitute.
 - 2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
 - 4. Material: Use aluminum.
 - 5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.5 INTERMEDIATE METAL CONDUIT (IMC)

- A. Manufacturers:
 - 1. Allied Tube & Conduit, a division of Atkore International.
 - 2. Nucor Tubular Products.
 - 3. Western Tube, a division of Zekelman Industries.
 - 4. Wheatland Tube, a division of Zekelman Industries.
 - 5. Substitutions: Approved substitute.
- 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 Inc
 - b. O-Z/Gedney, a brand of Emerson Electric Co
 - c. Thomas & Betts Corporation
 - d. Approved substitute.
 - 2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.

4. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.6 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 1. Thomas & Betts Corporation
 2. Robroy Industries
 3. Approved substitute.
- 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 (1.02 mm).
- D. Interior Coating: Urethane, minimum thickness of 2 mil (0.05 mm).
- E. PVC-Coated Fittings:
 1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
 2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
 3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
 4. Material: Use steel or malleable iron.
 5. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil (1.02 mm).
 6. Interior Coating: Urethane, minimum thickness of 2 mil (0.05 mm).
- F. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil (0.38 mm).

2.7 FLEXIBLE METAL CONDUIT (FMC)

- A. Manufacturers:
 1. AFC Cable Systems, Inc.
 2. Electri-Flex Company
 3. International Metal Hose
 4. Approved substitute.
- 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 to be used.
- C. Fittings:
 1. Manufacturers:
 - a. Bridgeport Fittings Inc.
 - b. O-Z/Gedney, a brand of Emerson Electric Co.
 - c. Thomas & Betts Corporation
 - d. Approved substitute.
 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 3. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.

2.8 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Manufacturers:
 1. AFC Cable Systems, Inc.
 2. Electri-Flex Company
 3. International Metal Hose
 4. Approved substitute.
- B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

- C. Fittings:
 - 1. Manufacturers:
 - a. Bridgeport Fittings Inc.
 - b. O-Z/Gedney, a brand of Emerson Electric Co.
 - c. Thomas & Betts Corporation
 - d. Approved substitute.
 - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 3. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.

2.9 ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
 - 1. Allied Tube & Conduit, a division of Atkore International.
 - 2. Nucor Tubular Products.
 - 3. Western Tube, a division of Zekelman Industries.
 - 4. Wheatland Tube, a division of Zekelman Industries.
 - 5. Substitutions: Approved substitute.
- B. Description: NFPA 70, Type EMT 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 Inc.
 - b. O-Z/Gedney, a brand of Emerson Electric Co.
 - c. Thomas & Betts Corporation
 - d. Approved substitute.
 - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 3. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
 - 4. Connectors and Couplings: Use compression (gland) or set-screw type.
 - a. Do not use indenter type connectors and couplings.
 - b. Do not use set-screw 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.

2.10 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Manufacturers:
 - 1. Cantex Inc.
 - 2. Carlon, a brand of Thomas & Betts Corporation
 - 3. JM Eagle
 - 4. Approved substitute.
- 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.

2.11 ACCESSORIES

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil (0.51 mm).
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force (890 N).
- E. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.
- F. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig. Suitable for the conduits to be installed.
- G. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
 - 1. Products:
 - a. Menzies Metal Products; Electrical Roof Stack and Cap
 - b. Menzies Metal Products; Electrical Retro Box
 - c. Approved substitute.
- H. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.
 - 1. Manufacturers:
 - a. Quickflash Weatherproofing Products, Inc.
 - b. Approved substitute.
- I. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
 - 1. Products:
 - a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built
 - b. Approved substitute.

2.12 RACEWAY REQUIREMENTS

- A. Provide all components, fittings, supports, and accessories required for a complete raceway system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

2.13 SURFACE RACEWAY SYSTEMS

- A. Manufacturers:
 - 1. Hubbell Incorporated
 - 2. Wiremold, a brand of Legrand North America, Inc.
 - 3. MonoSystems, Inc.
 - 4. Approved substitute.
- B. Surface Metal Raceway (Small):
 - 1. Listed and labeled as complying with UL 5.
 - 2. Provide surface metal raceway for power, lighting, and systems services as indicated on the Drawings.
 - 3. Installation shall be complete with all necessary fittings to form a complete system. Installation shall conform to Article 352 of the NEC.
 - 4. Raceway shall consist of a Factory Assembly designed to accommodate pulling wires into the raceway.
- C. Surface Metal Raceway (Large):
 - 1. Listed and labeled as complying with UL 5.
 - 2. Base section shall be a minimum of 18 gauge; cover section shall be a minimum of 20 gauge.
 - 3. Raceway shall be 4-3/4 inches high. Raceway shall be divided into two compartments where indicated on the Drawings.
 - 4. Single Compartment Raceway shall be 2-3/4 inches high.
 - 5. Raceway shall consist of a Factory Assembly designed to accommodate pulling wires into the raceway.
- D. Multioutlet Assemblies
 - 1. Listed and labeled as complying with UL 111.
 - 2. Provide multi-outlet assembly consisting of two-piece steel raceway with regularly spaced pre-wired receptacles.

3. Multi-outlet assembly shall be two circuit except as indicated on the Drawings. Outlet shall be spaced 12 inches on center.
4. Color shall be "gray" except as indicated on the Drawings.
5. Feed all multi-outlet assembly with a direct conduit connection. Space conduit connector per manufacturer's directions to provide necessary wire clearance.

E. Metal Channel (Strut) Used as Raceway: Comply with Section 26 05 29.

2.14 WIREWAYS

- A. Manufacturers:
 1. Cooper B-Line, a division of Cooper Industries
 2. Hoffman, a brand of Pentair Technical Products
 3. Schneider Electric; Square D Products
 4. Enduro Composites
 5. Approved substitute.
- B. Description: Lay-in wireways and wiring troughs with removable covers; listed and labeled as complying with UL 870.
- C. Wireway Type, Unless Otherwise Indicated:
 1. Indoor Clean, Dry Locations: NEMA 250, Type 1, painted steel with screw-cover.
 2. Outdoor Locations: NEMA 250, Type 3R, painted steel with screw-cover; include provision for padlocking.
- D. Finish for Painted Steel Wireways: Manufacturer's standard grey unless otherwise indicated.
- E. Wireways shall be provided without knockouts.
- F. Minimum Wireway Size: 4 by 4 inches (100 by 100 mm) unless otherwise indicated.
- G. Where wireway size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.15 FIRESTOPPING

- A. Seal all openings around conduit or other electrical work penetrating fire and smoke rated partitions, floors, and ceilings.
- B. Firestop material shall comply with UL 1479, NEC 300-21, and NEC 800-3(c).
- C. Acceptable Manufacturers:
 1. 3M
 2. Nelson
 3. Approved substitute

2.16 BOXES

- A. General Requirements:
 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
 3. Provide products listed, classified, and labeled as suitable for the purpose intended.
 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
 5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:
 1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
 2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.

3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
 4. Use cast aluminum boxes where aluminum rigid metal conduit is used.
 5. Use nonmetallic boxes where exposed rigid PVC conduit is used.
 6. Use suitable concrete type boxes where flush-mounted in concrete.
 7. Use suitable masonry type boxes where flush-mounted in masonry walls.
 8. Use raised covers suitable for the type of wall construction and device configuration where required.
 9. Use shallow boxes where required by the type of wall construction.
 10. Do not use "through-wall" boxes designed for access from both sides of wall.
 11. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
 12. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
 13. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
 14. 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.
 15. Boxes for Ganged Devices: Use multi-gang boxes of single-piece construction. Do not use field-connected gang-able boxes unless specifically indicated or permitted.
 16. 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 05 28.
 - c. Communications Systems Outlets: 4-inch square by 2-1/8-inch (100 by 54 mm) trade size.
 - d. Ceiling Outlets: 4 inch octagonal or square by 1-1/2-inch-deep (100 by 38 mm) trade size.
 17. Wall Plates: Comply with Section 26 27 26.
 18. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation
 - b. Hubbell Incorporated; Bell Products
 - c. Hubbell Incorporated; RACO Products
 - d. O-Z/Gedney, a brand of Emerson Electric Co
 - e. Thomas & Betts Corporation.
 - f. Approved substitute
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
 2. NEMA 250 Environment Type, Unless Otherwise Indicated:
 - 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 (1,650 cu cm):
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
 - b. Boxes 6 square feet (0.56 sq m) and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
 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
 - b. Hoffman, a brand of Pentair Technical Products
 - c. Hubbell Incorporated; Wiegmann Products
 - d. Approved substitute
- D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gang-able boxes may be used.
1. Manufacturers:
 - a. Hubbell Incorporated
 - b. Approved substitute

- E. Boxes for Hazardous (Classified) Locations: Listed and labeled as complying with UL 1203 and NFPA 70 for the classification of the installed location.
 - 1. Manufacturers:
 - a. Appleton, a brand of Emerson Electric Co
 - b. Cooper Crouse-Hinds, a division of Eaton Corporation
 - c. Hubbell Incorporated; Killark Products
 - d. Approved substitute

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive equipment.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 CONDUIT INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.
- E. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- F. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.
- G. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- H. 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 all conduits unless specifically indicated to be exposed.
 - 4. Conduits in the following areas may be exposed, unless otherwise indicated:
 - a. Electrical rooms.
 - b. Mechanical equipment rooms.
 - c. Within joists in areas with no ceiling.
 - 5. Unless otherwise approved, do not route conduits exposed:
 - 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 the shortest possible manner unless otherwise indicated. Route all 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 the equivalent of four 90-degree bends between pull points.
 - 9. Arrange conduit to provide no more than 150 feet (46 m) between pull points.
 - 10. Route conduits above water and drain piping where possible.
 - 11. Route all exposed conduit in a neat, workmanlike manner parallel to the building lines, tight to the wall and ceiling surfaces, and firmly support with conduit clamps or hangers.
 - 12. Do not route conduits in columns except to feed column mounted devices.
 - 13. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
 - 14. Maintain minimum clearance of 6 inches (150 mm) between conduits and piping for other systems.
 - 15. Maintain minimum clearance of 12 inches (300 mm) between conduits and hot surfaces. This includes, but is not limited to:

- a. Heaters.
 - b. Hot water piping.
 - c. Flues.
- 16. Group parallel conduits in the same area together on a common rack.
- I. Conduit Support:
 - 1. Secure and support conduits 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. See Paragraph 26 00 01.1.2 for definition of "building structure".
 - 3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
 - 4. Use conduit strap to support single surface-mounted conduit.
 - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
 - 5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
 - 6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
 - 7. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
 - 8. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
 - 9. Use of spring steel conduit clips for support of conduits is not permitted.
 - a. Support of electrical metallic tubing (EMT) up to 1-inch (27 mm) trade size concealed above accessible ceilings and within hollow stud walls.
 - 10. Use of wire for support of conduits is not permitted.
 - a. For securing conduits to studs in hollow stud walls.
 - b. For suspending conduits supported by spring steel conduit clips (only where specifically indicated or permitted).
 - 11. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the most stringent requirements.
- J. 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 liquid tight 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 a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
 - 7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
 - 8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
- K. 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. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
 - 6. Provide suitable modular seal where conduits penetrate exterior wall below grade.
 - 7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.

8. 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. Include proposed locations of penetrations and methods for sealing with submittals.
 9. Provide metal escutcheon plates for conduit penetrations exposed to public view.
 10. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in this Section and in Section 07 84 00.
- L. Underground Installation:
1. Provide trenching and backfilling in accordance with Section 31 23 16.13.
 2. Provide trenching and backfilling in accordance with Section 31 23 16 and Section 31 23 23.
 3. Minimum Cover, Unless Otherwise Indicated or Required:
 - a. Underground, Exterior: 24 inches (610 mm).
 - b. Under Slab on Grade: 12 inches (300 mm) to bottom of slab.
 4. Provide underground warning tape in accordance with Section 26 05 53 along entire conduit length for service entrance where not concrete-encased.
- M. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Include proposed conduit arrangement with submittals.
 2. Maximum Conduit Size: 1 inch (27 mm) unless otherwise approved.
 3. Minimum Conduit Spacing: verify with Structural Engineer.
 4. Install conduits within middle one third of slab thickness.
 5. Secure conduits to prevent floating or movement during pouring of concrete.
- N. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 03 30 00 with minimum concrete cover of 3 inches (76 mm) on all sides unless otherwise indicated.
- O. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with NFPA 70.

PROVIDE IF SPECIAL PURPOSE OUTLETS ARE REQUIRED.

- P. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
 3. Where calculated in accordance with NFPA 70 for reinforced thermosetting resin conduit (RTRC) conduit installed above ground to compensate for thermal expansion and contraction.
 4. Where conduits are subject to earth movement by settlement or frost.
- Q. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
 2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
 3. Where conduits penetrate coolers or freezers.
- R. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches (300 mm) at each end.
- S. Provide grounding and bonding in accordance with Section 26 05 26.

3.3 DISTRIBUTION FEEDERS

- A. Provide all conduit and wire necessary to complete the distribution feeder circuits as shown on the drawings. Size all raceways as required by the National Electrical Code with oversized conduits as indicated.
- B. Provide pull and junction boxes as required by the National Electrical Code and located to be accessible after completion of the project.

- C. Overhead feeder conduits shall be rigid metal conduit or intermediate metal conduit. Overhead conduits may be electrical metallic tubing above finished ceiling areas.
- D. Underground feeder conduits shall be rigid steel or rigid PVC. Provide insulated grounding conductor sized per NEC when PVC conduit is used.

3.4 BRANCH CIRCUITS

- A. Branch circuit wire shall be encased in a continuous raceway. Size all raceway as required by the National Electrical Code with oversize conduits as indicated. Minimum branch circuit homerun conduit size: 3/4". Minimum conduit size 1/2", unless indicated otherwise. The raceway shall be EMT with the following exceptions:
 - 1. Rigid steel conduit shall be used in the following instances:
 - a. Where exposed to physical damage
 - b. Stub-ups one (1) inch or less in diameter
 - c. Exposed drops one (1) inch or less in diameter
 - 2. Rigid steel, IMC or rigid PVC shall be used in the following instances:
 - a. Exterior
 - b. Underground
 - c. Embedded in concrete
 - 3. Flexible metal conduit or cable shall be used in the following instances:
 - a. Connection to utilization equipment in dry locations
 - b. Motor and transformer connections
 - c. In inaccessible locations

3.5 SURFACE RACEWAY INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install raceways plumb and level.
- D. Arrange wireways and associated raceway connections to comply with NFPA 70, including but not limited to requirements for deflected conductors and wireways used as pull boxes. Increase size of wireway where necessary.
- E. Secure and support raceways in accordance with Section 26 05 29 at intervals complying with NFPA 70 and manufacturer's requirements.
 - 1. Anchor raceway every 18 inches and not over six (6) inches from lead end.
- F. Close unused raceway openings.
- G. Provide grounding and bonding in accordance with Section 26 05 26.
 - 1. Provide a separate ground conductor in each section of raceway and bund to conduit system in and approved manner.
- H. No surface mounted raceway shall be allowed in food service areas. Boxes and conduit shall be recessed.
- I. Identify raceways in accordance with Section 26 05 53.

3.6 EXCAVATION AND BACKFILLING

- A. All excavation and backfilling required to complete the installation of the electrical system shall be the responsibility of this Contractor. The work shall be done in a manner to conform with the provisions of Section 31 23 00 Earthwork of these specifications.
- B. Bed all conduit and structures on a 6-inch thick compacted layer of granular material. Should unsatisfactory soil conditions be discovered, the Engineer/Architect will inspect the excavation and determine the necessary additional support required.
- C. Backfill around conduit and structures by hand using coarse sand, pit run gravel or the native material if it is similar to the above. Remove all large stones, frozen lumps, perishable rubbish, and tramp metal. Carefully compact this material in 6-inch layers to a depth of 8 inches above the conduit, cable, or duct.

- D. Replace all existing surface improvements (i.e. street pavement, curbs, sidewalks, finish sodding, etc.) removed or damaged in the course of the work unless such improvements are to be reconstructed under the general contract. Make all necessary arrangements to perform such repairs, pay all costs in connection therewith and include them in the bid.

3.7 CUTTING AND PATCHING

- A. Do all cutting and patching of building materials as required for the installation of the work. No structural members shall be cut without the written approval of the Engineer/Architect and any such cutting shall be done in a manner satisfactory to the Engineer/Architect.
- B. All patching of or repair of damage to work in place shall be done in a neat and workmanlike manner with the approval of the Engineer/Architect. The Contractor whose operations require cutting of work in place, or who cause damage which entails repairs of such work, shall employ mechanics of the particular trade whose work must be cut or which is damaged, and shall pay all costs of such patching or repair.
- C. All holes through pre-cast concrete shall be drilled.
- D. Contractor shall be responsible for any additional cutting, patching, mounting/installation modifications, etc., not called out on the drawings but required for the successful completion of the job. This would include additional work required due to any existing jobsite condition (i.e., the construction of walls, ceiling spaces, clearances, available voltages, mounting requirements, existing equipment coordination, hazardous materials, etc.) that the contractor had an opportunity to determine in the pre-bid walk-through and could have reasonably determined before the bid by visual inspection or by asking the engineer or owner. No additional money shall be awarded for additional work incurred caused by existing jobsite conditions which could have been verified by the contractor prior to bid. In addition, no additional money shall be awarded for failure to properly coordinate with other trades.

3.8 SLEEVES

- A. Set all sleeves true to line, grade and position and plumb or level after concrete is poured. Correct any deviation from proper position.
- B. Schedule 40 pipe sleeves shall have at least three (3) concrete anchors.
- C. Provide galvanized steel tube sleeve 1 1/2 inches larger than the outside diameter of conduit. Sleeve shall have wall thickness of 0.061 inches.
- D. Where conduit pass through exterior concrete walls below grade, caulk both sides with oakum and lead wool or otherwise adequately waterproof the openings around the conduit.
- E. Caulk spaces between pipe and floor sleeves inside the building with a waterproof caulking material. Spaces between pipe and exterior partition sleeves shall be caulked with glass fiber insulation.
- F. Where conduits pass through the roof furnish sealable penetration pockets compatible with the building roofing system. Pockets to be turned over to the General Contractor.
- G. Seal all sleeves or raceway penetrations of smoke or fire rated walls or floors with intumescent type fire barriers, 3M or approved equal.

3.9 BOX INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- E. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- F. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- G. Box Locations:

1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 31 00 as required where approved by the Architect.
 2. Unless dimensioned, box locations indicated are approximate.
 3. Locate boxes as required for devices installed under other sections or by others.
 - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 27 26.
 - b. Communications Systems Outlets: Comply with Section 27 05 28.
 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 (150 mm) 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 (610 mm) horizontal separation.
 9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
 - a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
 - b. Do not install flush-mounted boxes with area larger than 16 square inches (0.0103 sq m) or such that the total aggregate area of openings exceeds 100 square inches (0.0645 sq m) for any 100 square feet (9.29 sq m) of wall area.
 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.
 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.
- H. 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 except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
 3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
 4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.
- I. Install boxes plumb and level.
- J. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.
 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.
- K. Floor-Mounted Cabinets: Mount on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 03 30 00.
- L. Install boxes as required to preserve insulation integrity.
- M. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- N. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

- O. Close unused box openings.
- P. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- Q. Provide grounding and bonding in accordance with Section 26 05 26.
- R. Identify boxes in accordance with Section 26 05 53.
- S. Position outlet boxes to locate luminaires as shown on reflected ceiling plan (RCP).

3.10 MOUNTING HEIGHTS

- A. Coordinate mounting heights, spacing and overall appearance at locations where two (2) or more devices are in the same area.

3.11 IDENTIFICATION

- A. Use marking pen to label all feeder junction and pull boxes; communications systems junction and pull boxes; all junction boxes, pull boxes, and raceways installed for future use.
- B. Provide engraved cover plates where indicated on the Drawings.

END OF SECTION

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Underground warning tape.
- F. Floor marking tape.
- G. Warning signs and labels.

1.2 RELATED SECTIONS

- A. Section 09 91 13 - Exterior Painting.
- B. Section 09 91 23 - Interior Painting.
- C. Section 26 01 00 - General Provisions.
- D. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
- E. Section 26 05 73 - Power System Studies.
- F. Section 26 27 26 - Wiring Devices.

1.3 REFERENCES

- 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 (NEC)
- D. NFPA 70E – Standard for Electrical Safety in the Workplace
- E. UL 969 - Marking and Labeling Systems

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
- B. Sequencing:
 - 1. Do not 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.

1.5 SUBMITTALS

- A. Submit material list in accordance with Section 26 00 01, describing all material furnished under Part 2 of this Section of the Specifications.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
- C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.
- D. Samples:

1. Identification Nameplates: One of each type and color specified.
 2. Warning Signs and Labels: One of each type and legend specified.
- E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.6 QUALITY

- A. Comply with requirements of the NEC.

1.7 FIELD CONDITIONS

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 - PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

- A. Identification for Equipment:
1. Use identification nameplate or identification label to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Switchboards:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Use identification nameplate to identify main overcurrent protective device.
 - 5) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
 - b. Panelboards:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Identify main overcurrent protective device. Use identification nameplate 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. Do not identify spares and spaces.
 - c. Transformers:
 - 1) Identify kVA rating.
 - 2) Identify voltage and phase for primary and secondary.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Identify load(s) served. Include location when not within sight of equipment.
 - d. Enclosed switches, circuit breakers, and motor controllers:
 - 1) Identify voltage and phase.
 - 2) Identify power source and circuit number. Include location when not within sight of equipment.
 - 3) Identify load(s) served. Include location when not within sight of equipment.
 - e. Time Switches:
 - 1) Identify load(s) served and associated circuits controlled. Include location.
 - f. 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.
 - g. 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 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 or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.
 7. Use identification label or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
 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.
 9. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.
 10. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" or approved equivalent.
- B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
 2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
 3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
 - a. At each source and load connection.
 - b. Within boxes when more than one circuit is present.
 - c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
 - d. In cable tray, at maximum intervals of 20 feet (6.1 m).
 4. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
 5. 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 (6.1 m).
 2. Use voltage markers or color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet (6.1 m).
 - a. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches (76 mm) wide.
 - 1) Field-Painting: Comply with Section 09 9123 and 09 91 13.
 - 2) Vinyl Color Coding Electrical Tape: Comply with Section 26 05 19.
 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 identification labels, handwritten text using indelible marker, or 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 (6.1 m).
- 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 voltage markers or 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, use only identification labels.
 - 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. Wiring Device and Coverplate Finishes: Comply with Section 26 27 26.
 - 2. Factory Pre-Marked Coverplate: Comply with Section 26 27 26.
 - 3. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
 - a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.
 - 4. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.
 - 5. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.
- G. Identification for Luminaires:
 - 1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

2.2 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
 - 1. Manufacturers:
 - a. Brimar Industries, Inc
 - b. Kolbi Pipe Marker Co
 - c. Seton Identification Products
 - d. Substitutions: Approved substitute.
 - 2. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.
 - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
 - 3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch (1.6 mm); engraved text.
 - a. Exception: Provide minimum thickness of 1/8 inch (3 mm) when any dimension is greater than 4 inches (100 mm).
 - 4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
 - 5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
 - 6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.
- B. Identification Labels:
 - 1. Manufacturers:
 - a. Brady Corporation
 - b. Brother International Corporation
 - c. Panduit Corp
 - d. Substitutions: Approved substitute.
 - 2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
 - a. Use only for indoor locations.
 - 3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
 - 1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
 - 2. Legend:
 - a. System designation where applicable:

- b. Equipment designation or other approved description.
 - c. Other information as indicated.
- 3. Text: All capitalized unless otherwise indicated.
- 4. Minimum Text Height:
 - a. System Designation: 1 inch (25 mm).
 - b. Equipment Designation: 1/2 inch (13 mm).
 - c. Other Information: 1/4 inch (6 mm).
 - d. Exception: Provide minimum text height of 1 inch (25 mm) for equipment located more than 10 feet (3.0 m) above floor or working platform.
- 5. Color:
 - a. Normal Power System: White text on black background.
- D. Format for General Information and Operating Instructions:
 - 1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
 - 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height: 1/4 inch (6 mm).
 - 5. Color: Black text on white background unless otherwise indicated.
- E. Format for Caution and Warning Messages:
 - 1. Minimum Size: 2 inches (51 mm) by 4 inches (100 mm).
 - 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height: 1/2 inch (13 mm).
 - 5. Color: Black text on yellow background unless otherwise indicated.
- F. Format for Receptacle Identification:
 - 1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
 - 2. Legend: Power source and circuit number or other designation indicated.
 - 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 mm).
 - 5. Color: Black text on clear background.
- G. Format for Control Device Identification:
 - 1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
 - 2. Legend: Load controlled or other designation indicated.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height: 3/16 inch (5 mm).
 - 5. Color: Black text on clear background.

2.3 WIRE AND CABLE MARKERS

- A. Manufacturers:
 - 1. Brady Corporation
 - 2. HellermannTyton
 - 3. Panduit Corp
 - 4. Substitutions: Approved substitute.
- B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
- C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- D. Legend: Power source and circuit number or other designation indicated.
- E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
 - 1. Do not use handwritten text.

- F. Minimum Text Height: 1/8 inch (3 mm).
- G. Color: Black text on white background unless otherwise indicated.

2.4 VOLTAGE MARKERS

- A. Manufacturers:
 - 1. Brady Corporation
 - 2. Brimar Industries, Inc
 - 3. Seton Identification Products
 - 4. Substitutions: Approved substitute.
- 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 (29 by 110 mm).
 - 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 (29 by 110 mm).
 - 4. Markers for Junction Boxes: 1/2 by 2-1/4 inches (13 by 57 mm).
- E. Legend:
 - 1. Markers for Voltage Identification: Highest voltage present.
 - 2. Markers for System Identification:
 - a. Other Systems: Type of service.
- F. Color: Black text on orange background unless otherwise indicated.

2.5 UNDERGROUND WARNING TAPE

- A. Manufacturers:
 - 1. Brady Corporation
 - 2. Brimar Industries
 - 3. Seton Identification Products
 - 4. Substitutions: Approved substitute
- B. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
 - 1. Exception: Use foil-backed detectable type tape where required by serving utility or where directed by Owner.
- C. Non-detectable Type Tape: 6 inches (152 mm) wide, with minimum thickness of 4 mil (0.1 mm).
- D. Foil-backed Detectable Type Tape: 3 inches (76 mm) wide, with minimum thickness of 5 mil (0.1 mm), unless otherwise required for proper detection.
- E. Legend: Type of service, continuously repeated over full length of tape.
- F. Color:
 - 1. Tape for Buried Power Lines: Black text on red background.
 - 2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.6 FLOOR MARKING TAPE

- A. Manufacturers:
 - 1. Brady Corporation
 - 2. Brimar Industries, Inc
 - 3. Seton Identification Products
 - 4. Substitutions: Approved substitute.
- B. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlamine, 3 inches (76 mm) wide, with alternating black and white stripes.

2.7 WARNING SIGNS AND LABELS

- A. Manufacturers:
 - 1. Brimar Industries, Inc
 - 2. Clarion Safety Systems, LLC
 - 3. Seton Identification Products
 - 4. Substitutions: Approved substitute.
- B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- C. Warning Signs:
 - 1. Materials:
 - a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
 - b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
 - 2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
 - 3. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.
- D. Warning Labels:
 - 1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
 - 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 (51 mm by 102 mm) unless otherwise indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
 - 1. Surface-Mounted Equipment: Enclosure front.
 - 2. Flush-Mounted Equipment: Inside of equipment door.
 - 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
 - 4. Elevated Equipment: Legible from the floor or working platform.
 - 5. Branch Devices: Adjacent to device.
 - 6. Interior Components: Legible from the point of access.
 - 7. Conduits: Legible from the floor.
 - 8. Boxes: Outside face of cover.
 - 9. Conductors and Cables: Legible from the point of access.
 - 10. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
 - 1. Do not use adhesives on exterior surfaces except where substrate cannot be penetrated.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches (75 mm) below finished grade.
- G. Secure rigid signs using stainless steel screws.
- H. Mark all handwritten text, where permitted, to be neat and legible.

3.3 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

SECTION 26 05 73 - POWER SYSTEM STUDIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Short-circuit study.
- B. Protective device coordination study.
- C. Arc flash and shock risk assessment.
 - 1. Includes arc flash hazard warning labels.
- D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.2 RELATED REQUIREMENTS

- A. Section 26 01 00 - General Provisions
- B. Section 26 05 53 - Identification for Electrical Systems.
- C. Section 26 21 00 - Low-Voltage Electrical Service Entrance.
- D. Section 26 24 13 - Switchboards.
- E. Section 26 24 16 - Panelboards.
- F. Section 26 28 13 - Fuses.
- G. Section 26 28 16 - Disconnect Switches.
- H. Section 26 29 13 - Enclosed Controllers.

1.3 REFERENCE STANDARDS

- A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.
- B. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
- C. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis.
- D. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems.
- E. IEEE 1584 - IEEE Guide for Performing Arc Flash Hazard Calculations.
- F. NEMA MG 1 - Motors and Generators.
- G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.
- H. NFPA 70 - National Electrical Code (NEC).
- I. NFPA 70E - Standard for Electrical Safety in the Workplace.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
 - 2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Pre-Study Meeting: Conduct meeting with Owner to discuss system operating modes and conditions to be considered in studies.

- C. 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).
- D. Scheduling:
 1. Arrange access to existing facility for data collection with Owner.
 2. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.

1.5 SUBMITTALS

- A. Submit material list in accordance with Section 26 00 01, describing all material furnished under Part 2 of this Section of the Specifications.
- B. Study preparer's qualifications.
- C. Field testing agency's qualifications.
- D. Study reports, stamped or sealed and signed by study preparer.
- E. 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. Include characteristic time-current trip curves for protective devices.
 2. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
 3. Include documentation of listed series ratings upon request.
 4. 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.
- F. Arc Flash Hazard Warning Label Samples: One of each type and legend specified.
- G. Site-specific arc flash hazard warning labels.
- H. Field quality control reports.
- I. Certification that field adjustable protective devices have been set in accordance with requirements of studies.
- J. 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.

1.6 POWER SYSTEM STUDIES

- A. Scope of Studies:
 1. Perform analysis of new 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 the NEC.
 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 Utility Company.
 - 2) Utility Company: See Section 26 21 00 for Utility Company contact information.
 - b. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 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.
- 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. Protective Device Coordination Study:
 1. Comply with applicable portions of IEEE 242 and IEEE 399.
 2. Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
 3. Analyze protective devices and associated settings for suitable margins between time-current curves to achieve full selective coordination while providing adequate protection for equipment and conductors.
- F. 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.
 - a. Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584, provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.
 - b. For single-phase systems, study preparer to perform calculations assuming three-phase system in accordance with IEEE 1584 using single phase bolted fault current, yielding conservative results.
 3. For equipment with main devices mounted in separate compartmentalized sections, perform calculations on both the line and load side of the main device.
 4. 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).
- G. 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. Protective Device Coordination Study:
- a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
 - b. For each graph include (where applicable):
 - 1) Partial single-line diagram identifying the portion of the system illustrated.
 - 2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.
 - 3) Conductors: Damage curves.
 - 4) Transformers: Inrush points and damage curves.
 - 5) Generators: Full load current, overload curves, decrement curves, and short circuit withstand points.
 - 6) Motors: Full load current, starting curves, and damage curves.
 - c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
 - 1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
 - 2) Include ground fault pickup and delay.
 - 3) Include fuse ratings.
 - d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.
4. 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.
 - c. Include recommendations for reducing the incident energy at locations where the calculated maximum incident energy exceeds 8 calories per sq. cm.

1.7 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 the preparation of studies of similar type and complexity using specified computer software.
 - 1. Study preparer may be employed by the manufacturer of the electrical distribution equipment.
 - 2. Study preparer may be employed by field testing agency.
- B. Field Testing Agency Qualifications: Independent testing organization specializing in testing, analysis, and maintenance of electrical systems with minimum five years experience; NETA Accredited Company.
 - 1. Field Supervisor: Certified electrical testing technician; NETA ETT Level III.

- C. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.
 - 1. Acceptable Software Products:
 - a. EasyPower LLC.
 - b. ETAP/Operation Technology, Inc.
 - c. Power Analytics Corporation.
 - d. SKM Systems Analysis, Inc.
 - e. Substitutions: Approved substitute.

PART 2 - PRODUCTS

2.1 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. Minimum Size: 4 by 6 inches (100 by 150 mm).
 - 3. 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 orange header that reads "WARNING" unless otherwise indicated.
 - b. Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.
 - c. 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.
 - 5) Limited approach boundary.
 - 6) Restricted approach boundary.
 - 7) Equipment identification.
 - 8) Date calculations were performed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install arc flash warning labels in accordance with Section 26 05 53.

3.2 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.

3.3 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. Provide minimum of eight hours of training.
3. Instructor: Representative of entity performing study.
4. Location: At project site.

END OF SECTION

SECTION 26 05 83 - WIRING CONNECTIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Electrical connections to equipment.

1.2 RELATED REQUIREMENTS

- A. Section 26 00 01 – General Provisions
- B. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
- C. Section 26 05 33 – Raceways and Boxes
- D. Section 26 27 26 – Wiring Devices
- E. Section 26 28 16 – Disconnect Switches
- F. Section 26 29 13 – Enclosed Controllers

1.3 REFERENCE STANDARDS

- A. NEMA WD 1 – General Color Requirements for Wiring Devices
- B. NEMA WD 6 – Wiring Devices - Dimensional Specifications
- C. NFPA 70 – National Electrical Code (NEC)

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
 - 2. Determine connection locations and requirements.
- B. Sequencing:
 - 1. Install rough-in of electrical connections before installation of equipment is required.
 - 2. Make electrical connections before required start-up of equipment.

1.5 SUBMITTALS

- A. Submit material list in accordance with Section 26 00 01, describing all material furnished under Part 2 of this Section of the Specifications.
- B. Product Data: Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.
- 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.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of the NEC.
- 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.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
 - 1. Colors: Comply with NEMA WD 1.
 - 2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
 - 3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
- B. Disconnect Switches: As specified in Section 26 28 16 and in individual equipment sections.
- C. Wiring Devices: As specified in Section 26 27 26.
- D. Raceways and Boxes: As specified in Section 26 05 33.
- E. Wire and Cable: As specified in Section 26 05 19.
- F. Wire Connectors
 - 1. Acceptable Manufacturers:
 - a. AMP Distributor Industries.
 - b. Ideal Industries.
 - c. 3M Company.
 - 2. Conical spring type with plastic or nylon insulating outer shell, color coded to denote wire size, for conductor sizes #14 through #10 AWG.
 - 3. Butt compression style insulating crimp splices for conductors smaller than #14 AWG.
- G. Connectors, Splices & Taps
 - 1. Acceptable Manufacturers:
 - a. AMP Distributor Industries.
 - b. OZ Gedney.
 - c. ILSCO.
 - d. Burndy.
 - 2. Compression or setscrew type, insulating cover for use on conductors #8 AWG and smaller.
 - 3. Compression type or split bolt connectors with insulating covers for conductors #6 AWG and larger.
- H. Lugs
 - 1. Acceptable Manufacturers:
 - a. ILSCO.
 - b. Teledyne Penn-Union.
 - c. Burndy Corporation.
 - 2. Compression Type: Seamless, one-piece, copper; size for conductor applied to.
 - 3. Connections to Set Screw Lugs: Pin type compression fittings for use on conductors #2 AWG and larger with barrels filled with conductive paste.
- I. Crimp-On Terminals
 - 1. Acceptable Manufacturers:
 - a. AMP Distributor Industries.
 - b. 3M Company.
 - c. Thomas-Betts.
 - 2. Crimp on insulated for conductors ranging from #14 through #10 AWG, flanged fork or ring tongue style.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 INSTALLATION

- A. Bus Connection: Use compression lugs, bolt to bus bars using cap screws, lock washers and nuts of material electrically compatible with bus, for connections to switchboard and main distribution panelboards only.
- B. Set Screw Lug Connection: Install pin type compression fitting of similar construction as compression lugs.
- C. Use crimping tool supplied by manufacturer of connector to install on conductor. Do not remove conductor strands or over-size terminators. Apply insulating tape over exposed conductor surfaces to 150% of the conductor insulating material.
- D. Strip conductor insulation as prescribed by the manufacturer of the terminator. Use conductive paste where required for dissimilar materials or as recommended by the manufacturer.
- E. Tighten connections to ensure maximum surface contact between terminals.

3.3 MOTOR CONNECTIONS

- A. Use crimp-on connectors for motor terminations from stranded conductors and where terminal lugs are not provided at connection point. Use ring-tongue terminals wherever possible

3.4 EQUIPMENT CONNECTIONS

- A. Make final connection to all equipment indicated on the Drawings except those items explicitly noted.
- B. Coordinate with equipment installers prior to completing rough-in and to making connection.
- C. Where equipment is indicated as "Future", provide conduit and conductors to the outlet indicated on the Drawings. Provide receptacle where indicated.

END OF SECTION

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SECTION 26 09 23 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Occupancy sensors.
- B. Outdoor photo controls.
- C. Lighting contactors.
- D. Accessories.

1.2 RELATED REQUIREMENTS

- A. Section 26 01 00 - General Provisions
- 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 33 - Raceways and Boxes.
- E. Section 26 05 53 - Identification for Electrical Systems.
- F. Section 26 05 73 - Power System Studies.
- G. Section 26 27 26 - Wiring Devices.
- H. Section 26 28 13 - Fuses.
- I. Section 26 29 13 - Enclosed Controllers.
- J. Section 26 51 00 - Lighting.

1.3 REFERENCE STANDARDS

- A. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing.
- B. ANSI C136.24 - American National Standard for Roadway and Area Lighting Equipment - Nonlocking (Button) Type Photocontrols.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- D. NECA 130 - Standard for Installing and Maintaining Wiring Devices.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- F. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts.
- G. NFPA 70 - National Electrical Code (NEC).
- H. UL 773 - Plug-in, Locking Type Photocontrols for Use with Area Lighting.
- I. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control.
- J. UL 916 - Energy Management Equipment.
- K. UL 917 - Clock-Operated Switches.
- L. UL 1472 - Solid-State Dimming Controls.
- M. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules.
- N. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters.

1.4 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. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
- B. Sequencing:
 - 1. Do not install lighting control devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

- A. Submit material list in accordance with Section 26 00 01, describing all material furnished under Part 2 of this Section of the Specifications.
- B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
 - 1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.
- C. Shop Drawings:
 - 1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.
- D. Field Quality Control Reports.
- E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. Operation and Maintenance Data: Include detailed information on device programming and setup.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
- H. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of the NEC.
- 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.

1.7 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.

1.8 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide five (5) year manufacturer warranty for all occupancy sensors.

- C. Provide five (5) year manufacturer warranty for utility grade locking receptacle-mounted outdoor photo controls.
- D. Provide two (2) year manufacturer warranty for all daylighting controls.

PART 2 - PRODUCTS

2.1 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.
- C. Products for Switching of Electronic Ballasts/Drivers: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

2.2 OCCUPANCY SENSORS

- A. Manufacturers:
 - 1. Hubbell Incorporated.
 - 2. Lutron Electronics Company, Inc.
 - 3. Sensor Switch Inc.
 - 4. WattStopper.
 - 5. Substitutions: Approved substitute.
 - 6. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.
- B. All Occupancy Sensors:
 - 1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
 - 2. Sensor Technology:
 - a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
 - b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
 - c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
 - d. Passive Infrared/Acoustic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and audible sound sensing 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. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
 - 7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
 - 8. Sensitivity: Field adjustable.
 - 9. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
 - 10. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above the selected level.
 - 11. 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.
 - 12. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.
 - 13. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.

14. Where wired sensors are indicated, wireless sensors are acceptable provided that all components and wiring modifications necessary for proper operation are included.

C. Wall Switch Occupancy Sensors:

1. All Wall Switch Occupancy Sensors:
 - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
 - b. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.
 - c. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
 - d. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
 - e. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
 - f. Provide selectable audible alert to notify occupant of impending load turn-off.
 - g. Finish: Match finishes specified for wiring devices in Section 26 27 26, unless otherwise indicated.
 - h. Provide vandal resistant lenses for passive infrared (PIR) and dual technology wall switch occupancy sensors where indicated.
2. Passive Infrared (PIR) Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet (83.6 sq m).
 - a. Products:
 - 1) Lutron Maestro Series.
 - 2) Substitutions: Approved substitute.
3. Ultrasonic Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 400 square feet (37.2 sq m).
4. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet (83.6 sq m).
 - a. Products:
 - 1) Lutron Maestro Series.
 - 2) Substitutions: Approved substitute.

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.
 - c. Provide field selectable setting for disabling LED motion detector visual indicator.
 - d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
 - e. Finish: White unless otherwise indicated.
2. Passive Infrared (PIR) Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet (41.8 square meters) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.
 - 1) Products:
 - (a) Lutron LOS-CIR Series.
 - (b) Lutron Radio Powr Savr Wireless Sensors.
 - (c) Substitutions: Approved substitute.
 - b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet (111.5 sq m) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.
 - 1) Products:
 - (a) Lutron LOS-CIR Series.
 - (b) Substitutions: Approved substitute.
3. Ultrasonic Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within an area of 500 square feet (46.5 sq m) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.
 - 1) Products:
 - (a) Lutron LOS-CUS Series.

- (b) Substitutions: Approved substitute.
 - b. Medium Range Sensors: Capable of detecting motion within an area of 1,000 square feet (92.9 sq m) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.
 - 1) Products:
 - (a) Lutron LOS-CUS Series.
 - (b) Substitutions: Approved substitute.
 - c. Extended Range Sensors: Capable of detecting motion within an area of 2,000 square feet (185.8 sq m) at a mounting height of 9 feet (2.7 m).
 - 1) Products:
 - (a) Lutron LOS-CUS Series.
 - (b) Substitutions: Approved substitute.
4. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
- a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet (41.8 sq m) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.
 - 1) Products:
 - (a) Lutron LOS-CDT Series.
 - (b) Substitutions: Approved substitute.
 - b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet (111.5 sq m) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.
 - 1) Products:
 - (a) Lutron LOS-CDT Series.
 - (b) Substitutions: Approved substitute.
5. Passive Infrared/Acoustic Dual Technology Ceiling Mounted Occupancy Sensors:
- a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet (41.8 sq m) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.
 - 1) Products:
 - (a) Substitutions: Approved substitute.
 - b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet (111.5 sq m) at a mounting height of 9 feet (2.7 m).
 - 1) Products:
 - (a) Substitutions: Approved substitute.
- E. Directional Occupancy Sensors:
- 1. All Directional Occupancy Sensors: Designed for wall or ceiling mounting, with integral swivel for field adjustment of motion detection coverage.
 - a. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
 - b. Provide field selectable setting for disabling LED motion detector visual indicator.
 - c. Finish: White unless otherwise indicated.
 - 2. Passive Infrared (PIR) Directional Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within a distance of 40 feet (12 m) at a mounting height of 10 feet (3.1 m).
 - 1) Products:
 - (a) Lutron LOS-WIR Series.
 - (b) Lutron Radio Powr Savr Wireless Sensors.
 - (c) Substitutions: Approved substitute.
 - b. Long Range Sensors: Capable of detecting motion within a distance of 80 feet (24 m) at a mounting height of 10 feet (3.1 m).
 - 1) Products:
 - (a) Lutron Radio Powr Savr Wireless Sensors.
 - (b) Substitutions: Approved substitute.
 - c. High Bay Sensors: Capable of detecting motion within a distance of 50 feet (15 m) at a mounting height of 30 feet (9.1 m).
 - 1) Products:
 - (a) Substitutions: Approved substitute.
 - 3. Passive Infrared/Ultrasonic Dual Technology Directional Occupancy Sensors: Capable of detecting motion within a distance of 40 feet (12 m) at a mounting height of 10 feet (3.1 m).
 - a. Products:

- 1) Lutron LOS-WDT Series.
 - (a) Substitutions: Approved substitute.
- F. Luminaire Mounted Occupancy Sensors: Designed for direct luminaire installation and control, suitable for use with specified luminaires.
 1. LED High Bay Luminaire Mounted Occupancy Sensors: Passive infrared (PIR) type with a field of view of 360 degrees unless otherwise indicated.
 - a. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.
 - b. Finish: White unless otherwise indicated.
 - c. Circular Coverage Sensors: Capable of detecting motion within a distance of 40 feet (12 m) at a mounting height of 20 feet (6.1 m).
 - d. Linear Aisle Coverage Sensors: Capable of detecting motion within an area of 20 feet wide by 60 feet long (6.1 m wide by 18 m long) at a mounting height of 40 feet (12 m).
 - e. Accessories:
 - 1) Provide mounting bracket for lowering occupancy sensor such that luminaire does not block sensor field of view where required.
- G. 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 VAC.
 4. Load Rating: As required to control the load indicated on drawings.
- H. Accessories:
 1. Provide heavy duty coated steel wire protective guards compatible with specified occupancy sensors where indicated.
 1. Provide lockable enclosure; environmental type per NEMA 250 as specified for the following installation locations:

2.3 OUTDOOR PHOTO CONTROLS

- A. Manufacturers:
 1. Intermatic, Inc.
 2. Tork, a division of NSI Industries LLC.
 3. Substitutions: Approved substitute.
 4. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.
- B. Stem-Mounted Outdoor Photo Controls:
 1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
 2. Housing: Weatherproof, impact resistant polycarbonate.
 3. Photo Sensor: Cadmium sulfide.
 4. Provide external sliding shield for field adjustment of light level activation.
 5. Light Level Activation: 1 to 5 footcandles (10.8 to 53.8 lux) turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
 6. Voltage: As required to control the load indicated on the drawings.
 7. Failure Mode: Fails to the on position.
 8. Load Rating: As required to control the load indicated on the drawings.
 9. Provide accessory wall-mounting bracket where indicated or as required to complete installation.
- C. Locking Receptacle-Mounted Outdoor Photo Controls
 1. Description: Plug-in locking type photo control unit complying with ANSI C136.10 for mounting on a compatible receptacle, listed and labeled as complying with UL 773.
 2. Housing: Weatherproof, impact resistant UV stabilized polypropylene, color to be selected.
 3. Photo Sensor: Cadmium sulfide.
 4. Light Level Activation: 1 to 3 footcandles (10.8 to 32.3 lux) turn-on and 1.5 to 1 turn-off to turn-on ratio with instant turn-on and delayed turn-off.

5. Voltage: As required to control the load indicated on the drawings.
 6. Failure Mode: Fails to the on position.
 7. Load Rating: As required to control the load indicated on the drawings.
 8. Surge Protection: 160 joule metal oxide varistor.
 9. Provide the following accessories where indicated or as required to complete installation:
 - a. Receptacle: Complying with ANSI C136.10.
 - b. Mounting Bracket.
 - c. Shorting Cap: Suitable for replacing locking photo control to complete circuit.
- D. Button Type Outdoor Photo Controls
1. Description: Direct-wired photo control unit complying with ANSI C136.24 with weatherproof gasketed wall plate where required or indicated, listed and labeled as complying with UL 773A.
 2. Housing: Weather resistant polycarbonate.
 3. Photo Sensor: Cadmium sulfide.
 4. Light Level Activation: 1 to 3 footcandles (10.8 to 32.3 lux) turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
 5. Voltage: As required to control the load indicated on the drawings.
 6. Failure Mode: Fails to the on position.
 7. Load Rating: As required to control the load indicated on the drawings.

2.4 LIGHTING CONTACTORS

- A. Manufacturers:
1. ABB/GE.
 2. Eaton Corporation.
 3. Rockwell Automation Inc; Allen-Bradley Products.
 4. Schneider Electric; Square D Products.
 5. Siemens Industry, Inc.
 6. Substitutions: Approved substitute.
- B. Description: Magnetic lighting contactors complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; noncombination type unless otherwise indicated; ratings, configurations and features as indicated on the drawings.
- C. Combination Contactors: NEMA ICS 2, Class A combination controllers with magnetic contactor(s) and externally operable disconnect.
1. Disconnects: Circuit breaker or disconnect switch type as indicated..
 - a. Disconnect Switches: Fusible type unless otherwise indicated.
 - b. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
 - c. Provide auxiliary interlock for disconnection of external control power sources where applicable.
- D. Short Circuit Current Rating:
1. Provide contactors with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- E. Enclosures:
1. Comply with NEMA ICS 6.
 2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1 or Type 12.
 - b. Outdoor Locations: Type 3R or Type 4.
 3. Finish: Manufacturer's standard unless otherwise indicated.

2.5 ACCESSORIES

- A. Auxiliary Contacts:
1. Comply with NEMA ICS 5.

2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each lighting contactor, minimum.
- B. Pilot Devices:
1. Comply with NEMA ICS 5; heavy-duty type.
 2. Nominal Size: 30 mm.
 3. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
 4. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
 5. Indicating Lights: Push-to-test type unless otherwise indicated.
 6. Provide LED lamp source for indicating lights and illuminated devices.
- C. Control and Timing Relays:
1. Comply with NEMA ICS 5.
 2. Provide number and type of relays indicated or required to perform necessary functions.
 3. Timing Relays: Electronic or pneumatic as indicated.
 - a. Adjustable Timing Range: As indicated on drawings.
- D. Fire-Rated Device Enclosures:
1. Manufacturers:
 - a. Fire Rated Product Specialties Corp.
 - b. Substitutions: Approved substitute.
 2. Provide as required to preserve fire resistance rating of building elements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with the NEC.
- 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.

3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

- A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Install lighting control relays furnished under Section 25 36 26
- C. Coordinate locations of outlet boxes provided under Section 26 05 33 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 (1.2 m) above finished floor.

2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
 3. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches (80 mm) from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
- D. Install lighting control devices in accordance with manufacturer's instructions.
 - E. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
 - F. Install lighting control devices plumb, level, and held securely in place.
 - G. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 05 26.
 - H. Provide required supports in accordance with Section 26 05 29.
 - I. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
 - J. Identify lighting control devices in accordance with Section 26 05 53.
 - K. Occupancy Sensor Locations:
 1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
 2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet (1.2 m) from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.
 - L. 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.
 - M. 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.
 - N. Combination Enclosed Lighting Contactors:
 1. Except where indicated to be mounted adjacent to the equipment they supply, mount lighting contactors such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.
 2. Provide fuses complying with Section 26 08 13 for fusible switches as indicated.
 - O. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.
 - P. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.
 - Q. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.
 - R. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.
 - S. Where indicated or required, provide cabinet or enclosure in accordance with Section 26 05 33 for mounting of lighting control device system components.

3.4 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. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.5 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.
- C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.
- D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.
- E. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect.

3.6 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.7 COMMISSIONING

- A. See Section 01 91 13 - General Commissioning Requirements for commissioning requirements.

3.8 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 lighting control devices to Architect, and correct deficiencies or make adjustments as directed.
- D. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Provide minimum of two hours of training.
 - 3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
 - 4. Location: At project site.

END OF SECTION

SECTION 26 09 43 - NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- A. Section 26 01 00 - General Provisions.
- B. Section 26 05 53 - Identification for Electrical Systems.
- C. Section 26 27 26 - Wiring Devices.
- D. Section 26 51 00 - Interior Lighting.

1.2 REFERENCE STANDARDS

- A. ANSI/ESD S20.20 - Standard for the Development of an Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices).
- B. ASTM D4674 - Standard Practice for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Office Environments.
- C. CSA C22.2 No. 223 - Power Supplies with Extra-low-voltage Class 2 Outputs.
- D. IEC 60669-2-1 - Switches for Household and Similar Fixed Electrical Installations - Part 2-1: Particular Requirements - Electronic Switches.
- E. IEC 60929 - AC and/or DC-Supplied Electronic Control Gear for Tubular Fluorescent Lamps - Performance Requirements.
- F. IEC 61000-4-2 - Electromagnetic Compatibility (EMC) - Part 4-2: Testing and Measurement Techniques - Electrostatic Discharge Immunity Test.
- G. IEC 61000-4-5 - Electromagnetic Compatibility (EMC) - Part 4-5: Testing and Measurement Techniques - Surge Immunity Test.
- H. IEC 61347-2-3 - Lamp Control Gear - Part 2-3: Particular Requirements for A.C. and/or D.C. Supplied Electronic Control Gear for Fluorescent Lamps.
- I. IEEE 1789 - IEEE Recommended Practice for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers.
- J. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits.
- K. ISO 9001 - Quality management systems -- Requirements.
- L. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- M. NECA 130 - Standard for Installing and Maintaining Wiring Devices.
- N. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts.
- O. NEMA WD 1 - General Color Requirements for Wiring Devices.
- P. NFPA 70 - National Electrical Code (NEC).
- Q. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
- R. UL 508A - UL Standard for Safety Industrial Control Panels.
- S. UL 924 - Emergency Lighting and Power Equipment.

- T. UL 1310 - Class 2 Power Units.
- U. UL 1472 - Solid-State Dimming Controls.
- V. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of sensors and wall controls with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate the placement of wall controls with actual installed door swings.
 - 3. Coordinate the placement of daylight sensors 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.
 - 4. Where motorized window treatments are to be controlled by the lighting control system provided under this section, coordinate the work with other trades to provide compatible products.
 - 5. Coordinate the work to provide luminaires and lamps compatible with the lighting controls to be installed.
 - 6. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.
- B. Pre-Wire Meeting: Conduct on-site meeting with lighting control system manufacturer prior to commencing work as part of manufacturer's standard startup services. Manufacturer to review with installer:
 - 1. Low voltage wiring requirements.
 - 2. Separation of power and low voltage/data wiring.
 - 3. Wire labeling.
 - 4. Lighting management hub locations and installation.
 - 5. Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "DIGITAL-NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS", sensor locations to be reviewed in accordance with layout provided by Lighting Control Manufacturer. Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.
 - 6. Control locations.
 - 7. Computer jack locations.
 - 8. Load circuit wiring.
 - 9. Network wiring requirements.
 - 10. Connections to other equipment and other Lutron equipment.
 - 11. Installer responsibilities.
 - 12. Power panel locations.
- C. Sequencing:
 - 1. Do not install sensors and wall controls until final surface finishes and painting are complete.

1.4 SUBMITTALS

- A. Submit material list in accordance with Section 26 00 01, describing all material furnished under Part 2 of this Section of the Specifications.
- B. Design Documents: Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "DIGITAL-NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS", Lighting Control Manufacturer to provide plans indicating occupancy/vacancy and/or daylight sensor locations.
- C. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
 - 1. Occupancy/Vacancy Sensors: Include detailed basic motion detection coverage range diagrams.
- D. Shop Drawings:
 - 1. Provide schematic system riser diagram indicating component interconnections. Include requirements for interface with other systems.

2. Provide detailed sequence of operations describing system functions.
- E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. System Performance-Verification Documentation: Include as part of the base bid additional costs for manufacturer's enhanced documentation detailing start-up performance-verification procedures and functional tests performed along with test results.
- G. Project Record Documents: Record actual installed locations and settings for lighting control system components.
- H. Operation and Maintenance Data: Include detailed information on lighting control system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
- I. Warranty: Submit sample of manufacturer's Warranty or Enhanced Warranty as specified in Part 1 under "WARRANTY". Submit documentation of final execution completed in Owner's name and registered with manufacturer.
- J. Software: One copy of software provided under this section.

1.5 QUALITY ASSURANCE

- A. Conform to requirements of the NEC.
- B. Manufacturer Qualifications:
 1. Company with not less than ten years of experience manufacturing lighting control systems of similar complexity to specified system.
 2. Registered to ISO 9001, including in-house engineering for product design activities.
 3. Qualified to supply specified products and to honor claims against product presented in accordance with warranty.
- C. Maintenance Contractor Qualifications: Manufacturer's authorized service representative.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.7 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.
 1. System Requirements, Unless Otherwise Indicated:
 - a. Ambient Temperature:
 - 1) Lighting Control System Components, Except Those Listed Below: Between 32 and 104 degrees F (0 and 40 degrees C).
 - 2) Lighting Management System Computer: Between 50 and 90 degrees F (10 and 35 degrees C).
 - 3) Fluorescent Electronic Dimming Ballasts: Between 50 and 140 degrees F (10 and 60 degrees C).
 - b. Relative Humidity: Less than 90 percent, non-condensing.

1.8 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Manufacturer's Standard Warranty, With Manufacturer Start-Up:
 1. Manufacturer Lighting Control System Components, Except Lighting Management System Computer, Ballasts/Drivers and Ballast Modules:
 - a. First Two Years:
 - 1) 100 percent replacement parts coverage, 100 percent manufacturer labor coverage to troubleshoot and diagnose a lighting issue.
 - 2) First-available on-site or remote response time.

- 3) Remote diagnostics for applicable systems.
- b. Telephone Technical Support: Available 24 hours per day, 7 days per week, excluding manufacturer holidays.
2. Ballasts/Drivers and Ballast Modules: Five (5) years 100 percent parts coverage, no manufacturer labor coverage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Manufacturer: Acuity Brands Lighting, Inc.
 1. Basis of Design System: Acuity Controls Fresco Controller
- B. Substitutions: Approved substitute.
 1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by Architect a minimum of 10 working days prior to the bid date and must be made available to all bidders. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.
 2. Any proposed substitutions to be reviewed by Architect at Contractor's expense at a rate of \$200 per hour.
 3. By using pre-approved substitutions, Contractor accepts responsibility and associated costs for all required modifications to related equipment and wiring. Provide complete engineered shop drawings (including power wiring) with deviations from the original design highlighted in an alternate color for review and approval by Architect prior to rough-in.
- C. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2.2 SYSTEM COMPLIANCE

- A. System components shall comply with UL 916 and UL 924 standards where applicable.
- B. System components shall comply with CFR Title 47, Part 15 standards where applicable.
- C. All equipment shall be installed and connected in compliance with NFPA 70.

2.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. System Architecture
 1. System shall have an architecture that is based upon three main concepts: (a) networkable intelligent lighting control devices, (b) standalone lighting control zones using distributed intelligence, (c) optional system backbone for remote, time based and global operation between control zones.
 - a. Intelligent lighting control devices shall have individually addressable network communication capability and consist of one or more basic lighting control components: occupancy sensor, photocell sensor, relay, dimming output, contact closure input, analog 0-10V input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure shall be permissible so as to minimize overall device count of system.
 - b. Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices and shall be capable of providing automatic control from sensors (occupancy and/or photocell) and manual control from local wall stations without requiring connection to a higher level system backbone; this capability is referred to as "distributed intelligence."
 - c. System must be capable of interfacing directly with networked luminaires such that either low voltage network cabling or wireless RF communication is used to interconnect networked luminaires with control components such as sensors, switches and system backbone (see Control Zone Characteristics sections for each type of network connection, wired or wireless).
 2. The system shall be capable of providing individually addressable switching and dimming control of the following: networked luminaires, control zones to include multiple switch legs or circuits, and relay and dimming outputs from centralized panels to provide design flexibility appropriate with sequence of operations required in each project area or typical space type. A single platform shall be used for both indoor and outdoor lighting controls.

3. Lighting control zones shall be capable of being networked with a higher level system backbone to provide time based control, remote control from inputs and/or systems external to the control zone, and remote configuration and monitoring through a software.
 4. System shall be capable of “out of box” sequence of operation for each control zone. Standard sequence is:
 - a. All switches control all fixtures in a zone
 - b. All occupancy sensors automatically control all fixtures in the control zone with a default timeout.
- B. Wired Networked Control Zone Characteristics
1. Following proper installation and provision of power, all networked devices connected together with low voltage network cable shall automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g., software application, handheld remote, pushbutton). The “out of box” default sequence of operation is intended to provide typical sequence of operation so as to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.
 2. System shall be able to automatically discover all connected devices without requiring any provisioning of system or zone addresses.
 3. The following types of wired networked control devices shall be provided for egress and/or emergency light fixtures:
 - a. Low-Voltage power sensing: These devices shall automatically provide 100% light level upon detection of loss of power sensed via the low voltage network cable connection.
 - b. UL924 Listed Line-Voltage power sensing: These devices shall be listed as emergency relays under the UL924 standard, and shall automatically close the load control relay(s) and provide 100% light output upon detection of loss of power sensed via line voltage connections.
 - c. Emergency egress devices shall be provided and UL labeled by the lighting control manufacturer.
- C. System Integration Capabilities
1. The system shall be able to interface with third party building management systems (BMS) to support two-way communication using the industry standard BACnet/IP or BACnet MS/TP protocols. The following system integration capabilities shall be available via BACnet/IP and BACnet MS/TP protocols:

2.4 SYSTEM SOFTWARE INTERFACES

- A. Management Interface
1. System shall provide a web-based management interface that provides remote system control, live status monitoring, and configuration capabilities of lighting control settings and schedules.
 2. Management interface must be compatible with industry-standard web browser clients, including, but not limited to, Microsoft Internet Explorer®, Apple Safari®, Google Chrome®, Mozilla Firefox®.
 3. All system software updates must be available for automatic download and installation via the internet.
- B. Historical Database and Analytics Interface
1. System shall provide a browser-based trending and monitoring interface that stores historical data for all occupancy/daylight sensors and lighting loads. Additionally, the system shall optionally upload that data to a cloud based server.
- C. Visualization Interfaces
1. System shall provide an optional web-based visualization interface that displays a graphical floorplan. System data, to include status of occupancy sensors, daylight sensors and light output shall be overlaid to the floorplan to provide a graphical status page.
- D. Portable Programming Interface for Standalone Control Zones
1. Portable handheld application interface for standalone control zones shall be provided for systems that allows configuration of lighting control settings.
 2. Programming capabilities through the application shall include, but not be limited to, the following:

- a. Switch/occupancy/photosensor group configuration
- b. Manual/automatic on modes
- c. Turn-on dim level
- d. Occupancy sensor time delays
- e. Dual technology occupancy sensors sensitivity
- f. Photosensor calibration adjustment and auto-setpoint
- g. Trim level settings

2.5 SYSTEM BACKBONE AND SYSTEM INTEGRATION EQUIPMENT

A. System Controller

1. Product Series: Fresco FCS Architectural Lighting Controller
2. System Controller shall be multi-tasking, real-time digital control processor consisting of modular hardware with plug-in enclosed processors, communication controllers, and power supplies.
3. System Controller shall perform the following functions:
 - a. Time-based control of downstream wired and wireless network devices.
 - b. Facilitation of global network switch communication between different system controllers.
 - c. Linking into an Ethernet network.
 - d. Integration with Building Management Systems (BMS) and Heating, Ventilation and Air Conditioning (HVAC) equipment.
 - e. Connection to various software interfaces, including management interface, historical database and analytics interface, visualization interface, and personal control applications.
4. System Controller shall have an integral web server to support configuration, diagnostics and hosting of software interfaces.
5. Device shall be capable of communicating with software interfaces via LAN connection.
6. Device shall automatically detect all networked devices connected to it, including those connected to wired communication bridges.
7. Device shall have a standard and astronomical internal time clock.

B. Wired Networked Relay and Dimming Panel

1. Product Series: nLight ARP Relay Panel
2. Relay and dimming panel(s) shall be capable of providing the required amount of relay capacity, as required per panel schedules shown on drawings, with an equal number of individual 0-10V dimming outputs.
3. Standard relays used shall have the following required properties:
 - a. Configurable in the field to operate with normally closed or normally open behavior.
 - b. Provides visual status of current state and manual override control of each relay.
 - c. Be individually programmable
4. 0-10 dimming outputs shall support a minimum of 100mA sink current per output.
5. Panel shall be UL924 listed for control of emergency lighting circuits.
6. Panel shall provide a contact closure input that acts as a panel override to activate the normally configured state of all relays (i.e., normally open or normally closed) in the panel.
7. Shall communicate with an nLight network of up to 128 digital devices per nLight control zone.
8. All relays shall include local manual override lever.
9. All relays shall be individually programmable.
10. Shall supply 24VDC auxiliary power and nLight network bus power (40mA per RJ45 port)
11. UL924 panel listing for Switching Emergency Circuits.

12. Shall have optional field installed voltage barriers for normal/emergency use or mixed voltage use.
13. Shall be remotely configurable or upgradeable.

2.6 WIRED NETWORKED DEVICES

A. Wired Networked Wall Switches, Dimmers, Scene Controllers

1. Wall switches & dimmers shall support the following device options:
 - a. Number of control zones: 1, 2 or 4
 - b. Control Types Supported: On/Off or On/Off/Dimming
2. Scene controllers shall support the following device options:
 - a. Number of scenes: 1, 2 or 4
 - b. Control Types Supported:
 - 1) On/Off or On/Off/Dimming
 - 2) Preset Level Scene Type
 - 3) Reprogramming of other devices within daisy-chained zone so as to implement user selected lighting scene
 - 4) Selecting a lighting profile to be run by the system's upstream controller so as to implement a selected lighting profile across multiple zones

B. Wired Networked Auxiliary Input / Output (I/O) Devices

1. Auxiliary Input/Output Devices shall be specified as an input or output device with the following options:
 - a. Contact closure input
 - 1) Input shall be programmable to support maintained or momentary inputs that can activate local or global scenes and profiles, ramp light level up or down, or toggle lights on/off.
 - b. 0-10V analog input
 - 1) Input shall be programmable to function as a daylight sensor.
 - c. RS-232/RS-485 digital input
 - 1) Input supports activation of up to 4 local or global scenes and profiles, and on/off/dimming control of up to 16 local control zones.
 - d. 0-10V dimming control output, capable of sinking a minimum of 20mA of current
 - 1) Output shall be programmable to support all standard sequence of operations supported by system.

C. Wired Networked Occupancy and Photosensors

1. Sensors shall utilize passive infrared (PIR) or passive dual technology (PDT) to detect both major and minor motion as defined by NEMA WD-7 standard.
2. Sensing technologies that are acoustically passive, meaning they do not transmit sound waves of any frequency do not require additional commissioning. Ultrasonic or Microwave based sensing technologies may require commissioning due to the active nature of their technology, if factory required.
3. Sensor programming parameter shall be available and configurable remotely from the software and locally via the device.
4. Sensor mounting type shall match project design requirements as shown on plans.
 - a. Sensors shall have optional features for photosensor/daylight override, dimming control, and low temperature/high humidity operation.
5. The system shall support the following types of photocell-based control:
 - a. On/Off: The control zone is automatically turned off if the photocell reading exceeds the defined setpoint and automatically turned on if the photocell reading is below the defined setpoint. A time delay or adaptive setpoint adjustable behavior may be used to prevent the system from exhibiting nuisance on/off switching.

- b. Continuous Dimming: The control zone automatically adjusts its dimming output in response to photocell readings, such that a minimum light level consisting of both electric light and daylight sources is maintained at the task. The photocell response shall be configurable to adjust the photocell setpoint and dimming rates.
- D. Wired Networked Wall Switch Sensors
 - 1. Wall switches sensors shall support the following device options:
 - a. User Input Control Types Supported: On/Off or On/Off/Dimming
 - b. Occupancy Sensing Technology: PIR only or Dual Tech
 - c. Daylight Sensing Option: Inhibit Photosensor
- E. Wired Networked Embedded Sensors
 - 1. Embedded sensors shall support the following device options:
 - a. Occupancy Sensing technology: PIR only or Dual Tech
 - b. Daylight Sensing Option: Occupancy only, Daylight only, or combination Occupancy/Daylight sensor
- F. Distributed System Power, Switching and Dimming Controls
 - 1. Devices shall incorporate one optional Class 1 relay, optional 0-10 VDC dimming output, and contribute low voltage Class 2 power to the rest of the system.
 - 2. Device programming parameters shall be available and configurable remotely from the software and locally via the device push-button.
 - 3. Device shall be plenum rated.
 - 4. Devices shall be UL Listed for load and load type as specified on the plans.
- G. Wired Networked Luminaires
 - 1. Networked luminaire shall have a factory installed mechanically integrated control device and carry a UL Listing as required.
 - 2. Networked LED luminaire shall provide low voltage power to other networked control devices.
 - 3. System shall be able to maintain constant lumen output over the specified life of the LED luminaire (also called lumen compensation) by automatically varying the dimming control signal to account for lumen depreciation.
 - 4. System shall be able to provide control of network luminaire intensity, in addition to correlated color temperature of specific LED luminaires.
 - 5. Controls manufacturer is responsible for primary troubleshooting and tech support of complete fixture.

PART 3 - EXECUTION

3.1 PHOTOCELL(S)

- A. Install photocell(s) per manufacturer's recommendations.
- B. Locate photocell above the roof with the sensor pointed to the north.
- C. Provide Intermatic #FF2H manual timer rotary override switch with plate for each photocell indicated on the plans. Wire switch in parallel with photocell contacts. Mount switch adjacent to low voltage control panel(s) associated with photocell and label "Photocell Manual Override".

3.2 LOW VOLTAGE LIGHTING CONTROL

- A. Install lighting control panel as indicated on the Drawings.
- B. Data cable shall be CAT-5 or greater with RJ-45 connectors.
- C. Label all low voltage switch wires to identify which relay(s) and switch(es) control associated room.

- D. Stub 3/4" empty EMT conduit from each switch outlet box to above lay-in ceiling and cap with an insulating type brushing.
- E. All controllers shall be tied into the control software and network system.
- F. Contractor shall provide a data / internet network connection for troubleshooting. Contractor shall not assume that a network connection will be provided by the owner for programming and commissioning.

3.3 OCCUPANCY SENSORS

- A. Locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations.
 - 1. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate occupancy habits of single or multiple occupants at any location within the room(s).
 - 2. The locations and quantities of sensors shown on the drawings are diagrammatic, use tables, installation conditions, and manufacturer's recommendations to finalize locations.
 - 3. Install additional sensors if required to properly and completely cover the respective room.
- B. Provide, at the site, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem-solving diagnosis of the occupancy sensing devices and systems. Provide sign-off sheet in O&M Manuals indicating date, and personnel trained, with Owner's signature.
- C. Sensor time delays
 - 1. Adjust time delay to 10 minutes except as indicated otherwise.
 - 2. Adjust time delay to 16 minutes for non-partitioned employee restrooms.

3.4 INSTALLATION PROCEDURES AND VERIFICATION

- A. The successful bidder shall review all required installation and pre-startup procedures with the manufacturer's representative through pre-construction meetings.
- B. The successful bidder shall install and connect the networked lighting control system components according to the manufacturer's installation instructions, wiring diagrams, the project submittals and plans specifications.
- C. The successful bidder shall be responsible for testing of all low voltage network cable included in the bid. Bidder is responsible for verification of the following minimum parameters:
 - 1. Wire Map (continuity, pin termination, shorts and open connections, etc.)
 - 2. Length
 - 3. Insertion Loss

3.5 COORDINATION WITH OWNER'S IT NETWORK INFRASTRUCTURE

- A. The successful bidder is required to coordinate with the owner's representative to secure all required network connections to the owner's IT network infrastructure.
- B. The bidder shall provide to the owner's representative all network infrastructure requirements of the networked lighting control system.
- C. The bidder shall provide to the manufacturer's representative all necessary contacts pertaining to the owner's IT infrastructure, to ensure that the system is properly connected and started up.

3.6 DOCUMENTATION AND DELIVERABLES

- A. The installing contractor shall be responsible for documenting installed location of all networked devices, including networked luminaires. This includes responsibility to provide as-built plan drawing showing device address barcodes corresponding to locations of installed equipment.
- B. The installing contractor is also responsible for the following additional documentation to the manufacturer's representative if visualization / graphical floorplan software is provided as part of bid package:

- C. As-Built floor plan drawings showing daisy-chain wired network control zones outlined, in addition to device address locations required above. All documentation shall remain legible when reproducing/scanning drawing files for electronic submission.
- D. As-Built electrical lighting drawings (reflected ceiling plan) in PDF and CAD format. Architectural floor plans shall be based on as-built conditions.
 - 1. CAD files shall have layers already turned on/off as desired to be shown in the graphical floorplan background images. The following CAD elements are recommended to be hidden to produce an ideal background graphical image:
 - Titleblock
 - Text- Inclusive of room names and numbers, fixture tags and drawings notes
 - Fixture wiring and homeruns
 - Control devices
 - Hatching or poché of light fixtures or architectural elements
 - 2. CAD files shall be of AutoCAD 2013 or earlier. Revit file overall floor plan views shall be exported to AutoCAD 2013.

3.7 IDENTIFICATION

- A. Provide "nameplates" as specified in Section 26 05 53, for all contactors and time switches. Label contactors and time switches to indicate load served (e.g. canopy lights, store sign).
- B. Provide identification for all control switches. Provide engraved device plates for controls located in finished spaces.

3.8 OWNER SCHEDULING AND TUNING

- A. Provide a lighting control scheduling and tuning session with the Owner. Meet with Owner on site to adjust building to Owner parameters. Provide training to Owner on proper operation of the system, including making changes to programming. Provide a minimum of 16 hours of tuning and training.

3.9 SYSTEM STARTUP

- A. Upon completion of the installation, verify adjustments and sensor placement to ensure a trouble-free occupancy-based lighting control system.
- B. Upon completion of installation by the installer, including completion of all required verification and documentation required by the manufacturer, the system shall be started up and programmed by an authorized representative of the manufacturer.
 - 1. Low voltage network cable testing shall be performed prior to system startup.
- C. System start-up and programming shall include:
 - 1. Verifying operational communication to all system devices.
 - 2. Programming the network devices into functional control zones to meet the required sequence of operation.
 - 3. Programming and verifying all sequence of operations.
 - 4. Customization of owner's software interfaces and applications.
- D. Initial start-up and programming is to occur on-site. Additional programming may occur on-site or remotely over the Internet as necessary

3.10 COMMISSIONING

- A. Lighting control system shall be commissioned by a Certified Testing Company that is National Electrical Testing Association certified and shall not be associated with the manufacturer of equipment or systems under test.
- B. Subcontractor shall provide all test equipment necessary to fulfill requirements. Test equipment shall have been calibrated within one (1) year of its use on the project.
- C. Subcontractor shall review design documents, shop drawings, and O & M manuals and manufacturer recommended installation and testing procedures.

- D. Subcontractor shall monitor installation to ensure the equipment, configuration, and quality of construction meets the design requirements, approved submittals, and shop drawings.
- E. The Subcontractor shall train facility staff on proper operation of the lighting control system.
- F. The test procedures shall contain step-by-step procedures with expected responses.
- G. Testing Requirements
 - 1. Verify functionality and compliance with the design intent. Verify proper operation of all control strategies, energy efficiency, and self-diagnostics features. Test every step in every written sequence and other significant modes, sequences, and operational features not mentioned in written sequences, including startup, normal operation, shutdown, scheduled on and off, unoccupied and manual modes, overrides, lockouts, and power failure.
 - 2. Verify performance of all components and control system components, including all interlocks and interactions with other equipment and systems.
 - 3. Verify time of day schedules.
 - 4. Verify all energy saving control strategies.
 - 5. Verify proper startup and shutdown procedures, including power failure.
 - 6. Test all occupancy and vacancy sensors for sensor sensitivity and time to OFF function and ensure that sensor location is proper and won't be tripped inadvertently.

3.11 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.12 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:
 - 1. On-Site Performance-Verification Walkthrough: Include as part of the base bid additional costs for lighting control manufacturer to provide on-site demonstration of system functionality to commissioning agent.
- D. Training:
 - 1. Include services of manufacturer's authorized Service Representative to perform on-site training of Owner's personnel on operation, adjustment, and maintenance of lighting control system as part of standard system start-up services.
 - a. Include training on software to be provided:
 - 1) Configuration software used to make system programming and configuration changes.
 - 2) Control and monitor.
 - 3) Energy savings display software.
 - 4) Personal web-based control software.
 - 2. Customer-Site Solution Training Visit: Include as part of the base bid additional costs for Lighting Control Manufacturer to provide one day(s) of additional on-site system training.

3.13 PROTECTION

- A. Protect installed products from subsequent construction operations.

3.14 MAINTENANCE

- A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
- B. Software Maintenance Agreement: Include as part of the base bid additional costs for manufacturer to provide quarterly compatibility testing results for PC-based lighting control software and new patches issued for Microsoft Operating System, Database, and Browser tools.

1. If new Microsoft patches create a software conflict, manufacturer to provide lighting control software patches to ensure continued operation.
- C. System Optimization Visit: Include as part of the base bid additional costs for Lighting Control System Manufacturer to visit site six months after system start-up to evaluate system usage and discuss opportunities to make efficiency improvements that will fit with the current use of the facility.

END OF SECTION

SECTION 26 21 00 - LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Permanent underground service entrance.
 - 2. Service entrance conduit, wire and equipment.
 - 3. Installation and connection of Utility furnished metering equipment.
 - 4. Coordination with Utility.
 - 5. Transformer Connection Cabinet.
 - 6. Grounding of service transformer pad.

1.2 RELATED SECTIONS

- A. Section 25 36 13 – Integrated Automation Power Meters
- B. Section 26 00 01 – General Provisions
- C. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables.
- D. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
- E. Section 26 05 29 – Hangers and Supports for Electrical Systems.
- F. Section 26 05 33.13 – Conduit for Electrical Systems.
- G. Section 26 05 33.23 – Surface Raceways for Electrical Systems.
- H. Section 26 05 53 – Identification for Electrical Systems.
- I. Section 26 24 13 – Switchboards.
 - 1. Includes utility metering transformer compartment.
- J. Section 26 24 16 – Panelboards.
- K. Section 26 28 16.16 – Enclosed Switches.
- L. Section 26 43 00 – Surge Protective Devices.
- M. Section 31 23 16 – Excavation.
- N. Section 31 23 16.13 – Trenching.
- O. Section 31 23 23 – Fill.

1.3 PRICE AND PAYMENT PROCEDURES

- A. Allowances:
 - 1. Owners shall pay all usage fees.

1.4 DEFINITIONS

- A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.

1.5 REFERENCE STANDARDS

- A. IEEE C2 - National Electrical Safety Code.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- C. NFPA 70 - National Electrical Code (NEC).

1.6 ADMINISTRATIVE REQUIREMENTS

- A. No later than two weeks following date of the Agreement, notify Utility Company of anticipated date of service.
- B. Coordination:
 - 1. Verify the following with Utility Company representative:
 - a. Utility Company requirements, including division of responsibility.
 - b. Exact location and details of utility point of connection.
 - c. Utility easement requirements.
 - d. Utility Company charges associated with providing service.
 - 2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
 - 3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- C. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.
- D. Utility Company charges associated with providing permanent service to be paid by Owner.
- E. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.
- F. Scheduling:
 - 1. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.
 - 2. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.7 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 26 00 01.
 - 1. Submit first to the utility company, then submit results of utility company review with shop drawings to engineer.
- B. Utility Company letter of availability for providing electrical service to project.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, outline and support point dimensions, finishes, weights, service condition requirements, and installed features.
- D. Shop Drawings: Include dimensioned plan views and sections indicating locations and arrangement of Utility Company and service entrance equipment, metering provisions, required clearances, and proposed service routing.
 - 1. Obtain Utility company approval of shop drawings prior to submittal.
- E. Drawings prepared by Utility Company.
- F. Project Record Documents: Record actual locations of equipment and installed service routing.

1.8 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. IEEE C2 (National Electrical Safety Code).
 - 2. NFPA 70 (National Electrical Code).
 - 3. The requirements of the Utility Company.
 - 4. The requirements of the local authorities having jurisdiction.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Products: Listed, classified, and labeled as suitable for the purpose intended.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Store products indoors in a clean, dry space having a uniform temperature to prevent condensation (including outdoor rated products which are not weatherproof until completely and properly installed). Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle products carefully to avoid damage to internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.1 ELECTRICAL SERVICE REQUIREMENTS

- A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.
- B. Electrical Service Characteristics: As indicated on drawings.
- C. Electrical Service Characteristics:
 - 1. Service Type: Underground.
 - 2. System Voltage: 277/480-volt, three-phase, four-wire, 60 Hertz.
 - 3. Service Size: 600A.
- D. Utility Company: Georgia Power.
 - 1. Point of Contact: Savannah Watson.
 - 2. Phone: (912) 677-9620.
 - 3. Email: savwatso@southernco.com.
- E. Division of Responsibility:
 - 1. Pad-Mounted Utility Transformers:
 - a. Transformer Pads: Furnished and installed by Contractor per Utility Company requirements.
 - b. Transformers: Furnished and installed by Utility Company.
 - c. Transformer Grounding Provisions: Furnished and installed by Contractor per Utility Company requirements.
 - d. Transformer Protective Bollards: Furnished and installed by Contractor per Utility Company requirements.
 - e. Primary:
 - 1) Trenching and Backfilling: Provided by Contractor.
 - 2) Conduits: Furnished and installed by Contractor.
 - 3) Conductors: Furnished and installed by Utility Company.
 - f. Secondary:
 - 1) Trenching and Backfilling: Provided by Contractor.
 - 2) Conduits: Furnished and installed by Contractor.
 - 3) Conductors: Furnished and installed by Contractor (Service Point at transformer).
 - 2. Terminations at Service Point: Provided by Utility Company.
 - 3. Metering Provisions:
 - a. Meter Bases: Furnished and installed by Contractor per Utility Company requirements.
 - b. Metering Transformer Cabinets: Furnished and installed by Contractor per Utility Company requirements.
 - c. Metering Transformers: Furnished by Utility Company, installed by Contractor.
 - d. Conduits Between Metering Transformers and Meters: Furnished and installed by Contractor per Utility Company requirements.
 - e. Wiring Between Metering Transformers and Meters: Furnished and installed by Utility Company.
 - f. Communications Conduits for Meters: Furnished and installed by Contractor per Utility Company requirements.
- F. Products Furnished by Contractor: Comply with Utility Company requirements.

2.2 METERING EQUIPMENT

- A. Current transformers - Provided by Utility, installed by contractor. See Drawings.
- B. Meter - Provided by Utility. Verify if meter is provided with pulsed output for remote metering.
- C. Provide weatherproof transition transformer connection cabinet, fully bussed with lugs for connection to secondary conductors and conductors to the transformer.
- D. Provide concrete pad for connection cabinet integral with the transformer pad.
- E. Paint cabinet to match the utility company transformer.
- F. Acceptable Manufacturers:
 - 1. AMP.
 - 2. EMI.
 - 3. States Electric.
 - 4. Approved substitute

2.3 CURRENT TRANSFORMER CABINET

- A. Cabinets shall be American Midwest Power, Inc. CT Series or approved substitute.
- B. Cabinet shall be NEMA type 3R suitable for wall mounting. Cabinet shall be formed of galvanized sheet steel. The enclosure shall be painted to match the building flashing. Verify color with Architect.
- C. Bussing shall be electrical grade aluminum (max. 750 A/sq. in.) or copper (max 1000 A/sq. in.). Bus bars shall be supported on plastic insulators and shall have provision for Utility Company's current transformers.
- D. Cabinet shall be sized to the service entrance conductors. Provide Cabinet with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 0573.
- E. Short circuit rating shall be a minimum of 65,000 amperes RMS. Cabinet shall be UL listed and meet power company requirements.
- F. Acceptable Manufacturers:
 - 1. AMP.
 - 2. EMI.
 - 3. States Electric.
 - 4. Approved substitute

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

- A. Verify and mark locations of existing underground utilities.

3.3 SERVICE

- A. Make arrangements with the Utility to obtain permanent electric service to the project.
- B. The transformer and primary shall be provided by the Utility.
- C. The transformer pad shall be provided by the Electrical Contractor.

3.4 GROUNDING

- A. Transformer Ground – Provided by Electrical Contractor.
- B. System Ground – Provided by Electrical Contractor in conformance with the requirements of Section 26 05 26 – Secondary Grounding

3.5 SERVICE CONDUCTORS

- A. Underground service: Provide the service feeder in conduit from the Utility transformer or cable termination cabinet to the building service equipment.
- B. Feeder cables shall be Type THHN or THWN.

3.6 SERVICE CONDUIT

- A. Feeder conduits shall be rigid steel or Schedule 80 PVC. PVC shall be concrete encased.

3.7 INSTALLATION

- A. Install products in accordance with manufacturer's instructions and Utility Company requirements.
 - 1. Install service entrance conduits from Utility's pad-mounted transformer to building service entrance equipment. Provide service entrance conductors from service entrance equipment to service transformer secondary. Service transformer secondary connections are by Utility.
- B. Perform work in accordance with NECA 1.
- C. Arrange equipment to provide minimum clearances and required maintenance access.
- D. Provide required trenching and backfilling in accordance with Section 31 23 16 and Section 31 23 23.
- E. Construct cast-in-place concrete pads for utility equipment in accordance with Utility Company requirements and Section 03 30 00.
- F. Provide required protective bollards in accordance with Utility Company requirements.
- G. Provide required support and attachment components in accordance with Section 26 05 29.
- H. Provide grounding and bonding for service entrance equipment in accordance with Section 26 05 26.
- I. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 26 05 53.

3.8 PROTECTION

- A. Protect installed equipment from subsequent construction operations.

3.9 IDENTIFICATION

- A. Provide "nameplates" as specified in Section 26 05 53 for all service equipment. Label as indicated on the Drawings.

END OF SECTION

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SECTION 26 22 13

LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. Section 03 30 00 – Cast-in-Place Concrete
- B. Section 26 00 01 – General Provisions
- C. Section 26 05 26 – Secondary Grounding
- D. Section 26 05 29 – Supports for Electrical Systems
- E. Section 26 05 33 – Raceways and Boxes
- F. Section 26 05 53 – Identification for Electrical Systems
- G. Section 26 24 16 – Panelboards

1.2 REFERENCES

- A. 10 CFR 431, Subpart K - Energy Efficiency Program for Certain Commercial and Industrial Equipment - Distribution Transformers
- B. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers
- C. IEEE C57.96 - IEEE Standard Guide for Loading Dry-Type Distribution and Power Transformers
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction
- E. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers
- F. NEMA ST 20 - Dry-Type Transformers for General Applications
- G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
- H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems
- I. NFPA 70 - National Electrical Code
- J. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers

1.3 ADMINISTRATIVE REQUIREMENTS

- A. 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.
- B. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
- C. Coordinate the work with placement of supports, anchors, etc. required for mounting.
- D. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
- E. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.4 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.

1. Vibration Isolators: Include attachment method and rated load and deflection.
 2. K-factor Rated Transformers: Include K-factor ratings.
 3. Shielded Transformers: Include shielding method and noise attenuation performance.
- C. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.
 - D. Source Quality Control Test Reports: Include reports for tests designated in NEMA ST 20 as design and routine tests.
 - E. Field Quality Control Test Reports.
 - F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
 - G. Maintenance Data: Include recommended maintenance procedures and intervals.
 - H. Project Record Documents: Record actual locations of transformers.

1.5 QUALITY

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.6 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 in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

1.7 FIELD CONDITIONS

- A. Ambient Temperature: Do not exceed the following maximum temperatures during and after installation of transformers.
 1. Greater than 10 kVA: 104 degrees F (40 degrees C) maximum.
 2. Less than 10 kVA: 77 degrees F (25 degrees C) maximum.

PART 2 - PRODUCTS

2.1 TRANSFORMERS – GENERAL REQUIREMENTS

- A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.
- B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
 1. Altitude: Less than 3,300 feet (1,000 meters).
 2. Ambient Temperature:
 - a. Greater than 10 kVA: Not exceeding 104 degrees F (40 degrees C).
 - b. Less than 10 kVA: Not exceeding 77 degrees F (25 degrees C).
- C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.
- D. Transformer core and coil shall be isolated from the enclosure using vibration - absorbing mounts.

2.2 GENERAL PURPOSE TRANSFORMERS

- A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.
- B. Primary Voltage: 480 volts delta, 3-phase.
- C. Secondary Voltage: 208Y/120 volts, 3-phase.
- D. Insulation System and Allowable Average Winding Temperature Rise:
 - 1. Less than 15 kVA: Class 180 degrees C insulation system with 115 degrees C average winding temperature rise.
 - 2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.
- E. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.
- F. Winding Taps:
 - 1. Less than 3 kVA: None.
 - 2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.
 - 3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
 - 4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.
- G. Energy Efficiency: Comply with 10 CFR 431, Subpart K.
- H. The sound rating shall not exceed the following levels:
 - 1. 0 to 9 KVA: 40 Db
 - 2. 10 to 50 KVA: 45 Db
 - 3. 51 to 150 or Greater: 50 Db
- I. Mounting Provisions:
 - 1. Less than 15 kVA: Suitable for wall mounting.
 - 2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
 - 3. Larger than 75 kVA: Suitable for floor mounting.
- J. Transformer Enclosure: Comply with NEMA ST 20.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor clean, dry locations: Type 2.
 - b. Outdoor locations: Type 3R.
 - 2. Construction: Steel.
 - a. Less than 15 kVA: Totally enclosed, non-ventilated.
 - b. 15 kVA and Larger: Ventilated.
 - 3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
 - 4. Provide lifting eyes or brackets.
- K. Accessories:
 - 1. Mounting Brackets: Provide manufacturer's standard brackets.
 - 2. Weathershield Kits: Provide for ventilated transformers installed outdoors to provide a listed NEMA 250, type 3R assembly.
 - 3. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.

2.3 K-FACTOR TRANSFORMERS RATED FOR NONLINEAR LOADS

- A. Description: Self-cooled, two winding transformers listed and labeled as complying with [UL 1561](#), and designed to supply nonlinear loads to the degree designated by the UL defined K-factor; ratings as indicated on the drawings.
- B. Primary Voltage: 480 volts delta, 3-phase.
- C. Secondary Voltage: 208Y/120 volts, 3-phase.

- D. K-factor Rating: K-4, or higher.
- E. Insulation System and Allowable Average Winding Temperature Rise: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.
- F. Coil Conductors: Continuous aluminum windings with terminations brazed or welded. Individually insulate secondary conductors and arrange to minimize hysteresis and eddy current losses at harmonic frequencies. Size secondary neutral conductor at twice the secondary phase conductor ampacity.
- G. Winding Taps: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
- H. Neutral Bus: Sized to accommodate twice the rated secondary current.
- I. Energy Efficiency: Comply with [10 CFR 431, Subpart K](#).
- J. The sound rating shall not exceed the following levels:
 - 1. 15 to 50 KVA, 45 decibels.
 - 2. 51 to 150 KVA or greater, 50 decibels.
- K. Mounting Provisions:
 - 1. Up to 75 kVA: Suitable for wall, floor, or trapeze mounting.
 - 2. Larger than 75 kVA: Suitable for floor mounting.
- L. Electrostatic Shield: Provide grounded copper electrostatic shield between primary and secondary windings to attenuate electrical noise.
- M. Transformer Enclosure: Comply with [NEMA ST 20](#).
 - 1. Environment Type per [NEMA 250](#): Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor clean, dry locations: Type 2.
 - b. Outdoor locations: Type 3R.
 - 2. Construction: Steel, ventilated.
 - 3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
 - 4. Provide lifting eyes or brackets.
- N. Accessories:
 - 1. Mounting Brackets: Provide manufacturer's standard brackets.
 - 2. Weathershield Kits: Provide for ventilated transformers installed outdoors to provide a listed NEMA 250, type 3R assembly.
 - 3. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.
- O. Acceptable Manufacturers:
 - 1. Square D
 - 2. General Electric
 - 3. Cutler-Hammer
 - 4. Siemens

2.4 CONDUCTOR TERMINATIONS

- A. For all transformers, provide terminations marked as being suitable for 60/75 degrees C or 75 degrees C wire per UL.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.
- C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.

3.2 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install transformers in accordance with NECA 409 and IEEE C57.94.
- D. Use flexible conduit, under the provisions of Section 26 05 33.13, two (2) feet (600 mm) minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
- E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.
- F. Install transformers plumb and level.
- G. Transformer Support:
 - 1. Provide required support and attachment in accordance with Section 26 05 29, where not furnished by transformer manufacturer.
 - 2. Provide required vibration isolation and/or seismic controls in accordance with Section 26 05 48.
 - 3. Use integral transformer flanges, accessory brackets furnished by manufacturer, or field-fabricated supports to support wall-mounted transformers.
 - 4. Unless otherwise indicated, mount floor-mounted transformers on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 03 30 00.
 - 5. Use trapeze hangers assembled from threaded rods and metal channel (strut) to support suspended transformers. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- H. Provide grounding and bonding in accordance with Section 26 05 26.
- I. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.
- J. Where not factory-installed, install lugs sized as required for termination of conductors as indicated.
- K. Where furnished as a separate accessory, install transformer weathershield per manufacturer's instructions.
- L. Identify transformers in accordance with Section 26 05 53.

3.3 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 Sections 7.2.1.1 and 7.2.1.2. Tests and inspections listed as optional are not required.
 - 1. 167 kVA single phase, 500 kVA three phase and smaller:
 - a. Perform turns ratio tests at all tap positions.

3.4 ADJUSTING

- A. Measure primary and secondary voltages and make appropriate tap adjustments.
- B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

- A. Clean dirt and debris from transformer components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

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SECTION 26 24 13 - SWITCHBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.
- B. Overcurrent protective devices for switchboards.

1.2 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete
- 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 53 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 05 73 - Power System Studies
- F. Section 26 21 00 - Low-Voltage Electrical Service Entrance.
- G. Section 26 43 00 - Surge Protective Devices.

1.3 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service
- B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction
- D. NECA 400 - Standard for Installing and Maintaining Switchboards
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
- F. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum)
- G. NEMA PB 2 - Deadfront Distribution Switchboards
- H. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less
- I. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems
- J. NFPA 70 - National Electrical Code (NEC)
- K. UL 98 - Enclosed and Dead-Front Switches
- L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures
- M. UL 869A - Reference Standard for Service Equipment
- N. UL 891 - Switchboards
- O. UL 1053 - Ground-Fault Sensing and Relaying Equipment

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by the NEC.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.

5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Service Entrance Switchboards:
 1. Coordinate with Utility Company to provide switchboards with suitable provisions for electrical service.
 2. Coordinate with Owner to arrange for Utility Company required access to equipment for installation and maintenance.
 3. See Section 26 21 00 for Utility Company contact information and additional requirements.
 4. Obtain Utility Company approval of switchboard prior to fabrication.
 5. Preinstallation Meeting: Convene one week prior to commencing work of this section to review requirements with Utility Company representative.
 6. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.5 SUBMITTALS

- A. Submit material list in accordance with Section 26 00 01, describing all material furnished under Part 2 of this Section of the Specifications.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.
 1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
- C. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
 1. Include dimensioned plan and elevation views of switchboards and adjacent equipment with all required clearances indicated.
 2. Include wiring diagrams showing all factory and field connections.
 3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
 4. Include documentation demonstrating selective coordination upon request.
 5. Identify mounting conditions required for equipment seismic qualification.
- D. Manufacturer's equipment seismic qualification certification.
- E. Service Entrance Switchboards: Include documentation of Utility Company approval of switchboard.
- F. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 2 as production (routine) tests.
- G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- H. Field Quality Control Test Reports.
- I. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.
- J. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- K. 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. Enclosure Keys: Two of each different key.
 3. Electronic Trip Circuit Breakers: Provide one portable test set.
 4. Drawout Devices:
 - a. Handles Necessary for Racking of Devices: One for each electrical room containing switchgear with drawout devices.
 - b. Lifting Yokes: One of each different yoke required, for each electrical room containing drawout devices.
 - c. Portable Lifting Devices: One for each electrical room containing switchboards with drawout devices and no integral top rail-mounted lifting device.
 - d. Removable Covers: One for blocking each different opening size when device is temporarily removed from its compartment.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of the NEC.
- 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.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.
- B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.
- C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

- A. Maintain field conditions within required service conditions during and after installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Switchboards - Acceptable Manufacturers:
 - 1. Schneider Electric; Square D Products
 - 2. Eaton Corporation
 - 3. ABB/GE
 - 4. Siemens Industry, Inc.
 - 5. Approved substitute.
- 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.
- C. Source Limitations: Furnish switchboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 SWITCHBOARDS

- A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.
- D. Front-Connected Switchboards:
 - 1. Main Device(s): Individually mounted.
 - 2. Feeder Devices: Panel/group mounted.
 - 3. Arrangement: Front accessible only (not rear accessible), rear aligned.
 - 4. Gutter Access: Bolted covers.

- E. Service Entrance Switchboards:
 - 1. Listed and labeled as suitable for use as service equipment according to UL 869A.
 - 2. For solidly grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
 - 3. Comply with Utility Company requirements for electrical service.
- F. Service Conditions:
 - 1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
 - a. Altitude: Less than 6,600 feet (2,000 m).
 - b. Ambient Temperature:
 - 1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
- G. Short Circuit Current Rating:
 - 1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 0573.
 - 2. Minimum Rating: 65,000 rms symmetrical amperes.
 - 3. Label equipment utilizing series ratings as required by NFPA 70.
- H. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- I. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.
- J. Bussing: Sized in accordance with UL 891 temperature rise requirements.
 - 1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
 - 2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
 - 3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
 - 4. Phase and Neutral Bus Material: Tin-plated aluminum.
 - 5. Ground Bus Material:
 - a. Copper
 - b. Aluminum
- K. Conductor Terminations: Suitable for use with the conductors to be installed.
 - 1. Line Conductor Terminations:
 - a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - b. Main and Neutral Lug Type: Mechanical.
 - 2. Load Conductor Terminations:
 - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - b. Lug Type:
 - 1) Provide mechanical lugs unless otherwise indicated.
- L. Enclosures:
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
 - 2. Finish: Manufacturer's standard unless otherwise indicated.
- M. Future Provisions:
 - 1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware, and all other required provisions.
 - 2. Equip distribution sections with full height vertical bussing to accommodate maximum utilization of space for devices.

- N. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 43 00, list switchboards as a complete assembly including surge protective device.
- O. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
 - 1. Where overcurrent protective devices equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
- P. Arc Flash Energy-Reducing Maintenance Switching: For circuit breakers rated 1200A or higher, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.
- Q. Instrument Transformers:
 - 1. Comply with IEEE C57.13.
 - 2. Select suitable ratio, burden, and accuracy as required for connected devices.
 - 3. Current Transformers: Connect secondaries to shorting terminal blocks.
 - 4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

2.3 OVERCURRENT PROTECTIVE DEVICES

- A. Circuit Breakers:
 - 1. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - 2. Molded Case Circuit Breakers:
 - a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 - 1) Provide thermal magnetic circuit breakers unless otherwise indicated.
 - 2) Provide electronic trip circuit breakers where indicated.
 - b. Minimum Interrupting Capacity:
 - 1) 14,000 rms symmetrical amperes at 480 VAC.
 - c. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
 - 1) Provide interchangeable trip units where indicated.
 - d. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
 - 1) Provide for branch devices rated over 100 amperes and more.
 - 2) Provide the following field-adjustable trip response settings:
 - (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
 - (b) Long time delay.
 - (c) Short time pickup and delay.
 - (d) Instantaneous pickup.
 - (e) Ground fault pickup and delay where ground fault protection is indicated.
 - 3) Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
 - 4) Provide communication capability where indicated: Compatible with system indicated.
 - e. Provide the following circuit breaker types where indicated:
 - 1) 100 Percent Rated Circuit Breakers: Listed for application within the switchboard where installed at 100 percent of the continuous current rating.
 - 2) Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
 - f. Provide the following features and accessories where indicated or where required to complete installation:
 - 1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
 - 2) Pad-Lock Provision: For locking circuit breaker handle in OFF position.

- 3) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
- 4) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
- 5) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

2.4 SOURCE QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Factory test switchboards according to NEMA PB 2, including the following production (routine) tests on each switchboard assembly or component:
 1. Dielectric tests.
 2. Mechanical operation tests.
 3. Grounding of instrument transformer cases test.
 4. Electrical operation and control wiring tests, including polarity and sequence tests.
 5. Ground-fault sensing equipment test.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive switchboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.
- C. Arrange equipment to provide required clearances and maintenance access.
- D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch (10 mm) between switchboard and wall.
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Install switchboards plumb and level.
- G. Unless otherwise indicated, mount switchboards on properly sized 4 inch (100 mm) high concrete pad constructed in accordance with Section 03 30 00.
- H. Provide grounding and bonding in accordance with Section 26 05 26.
- I. Install all field-installed devices, components, and accessories.
- J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- K. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed in accordance with Section 26 05 73.
- L. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- M. Provide filler plates to cover unused spaces in switchboards.
- N. Identify switchboards in accordance with Section 26 05 53.

- O. Prior to turning the project over to the Owner adjust the trip setting on the main breaker to the following settings. (Note the following values are based on the Square D Micrologic Trip Unit Functions)
 - 1. Adjustable long-time ampere rating 1.0 times plug ampere rating.
 - 2. Adjustable long-time delay 18 seconds at 6 times rating
 - 3. Adjustable short time pickup 8 times plug ampere setting.
 - 4. Adjustable short time delay 32, I₂t out
 - 5. Adjustable instantaneous pickup OFF

3.3 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
 - 1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.
- 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. Test shunt trips to verify proper operation.
- F. Correct deficiencies and replace damaged or defective switchboards or associated components.
- G. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.4 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of switchboard covers and doors.

3.5 BALANCING LOADS

- A. When connecting loads to a switchboard, distribute the loads on the phases to achieve an approximately balanced loading. Measure the steady state load currents each phase and rearrange circuits if there is greater than a 10% difference between phases.
- B. Measure the current on each phase after the current loads are balanced. Record the measured values on the project record drawings.

3.6 CLEANING

- A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.
- B. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.
- C. Repair scratched or marred surfaces to match original factory finish.

3.7 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: Train Owner's personnel on operation, adjustment, and maintenance of switchboard and associated devices.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Provide minimum of two hours of training.
 - 3. Instructor: Manufacturer's authorized representative.
 - 4. Location: At project site.

3.8 PROTECTION

- A. Protect installed switchboards from subsequent construction operations.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Lighting and appliance panelboards

1.2 RELATED SECTIONS

- 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 53 - Identification for Electrical Systems
- D. Section 26 05 73 - Power System Studies
- E. Section 26 43 00 - Surge Protective Devices

1.3 REFERENCES

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction
- C. NECA 407 - Standard for Installing and Maintaining Panelboards
- D. NEMA 250 - 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; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations
- K. UL 67 - Panelboards
- L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures
- M. UL 943 - Ground-Fault Circuit-Interrupters
- N. UL 1053 - Ground-Fault Sensing and Relaying Equipment

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by the NEC.
 - 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.

1.5 SUBMITTALS

- A. Submit shop drawings and product data for equipment and component devices under provisions of Section 26 00 01.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
 - 1. Include characteristic trip curves for each type and rating of overcurrent protective device.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
 - 1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
 - 2. Include wiring diagrams showing all factory and field connections.
 - 3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
 - 4. Include documentation of listed series ratings upon request.
 - 5. Identify mounting conditions required for equipment seismic qualification.
- D. Manufacturer's equipment seismic qualification certification.
- E. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.
- F. Field Quality Control Test Reports.
- G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- H. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
- I. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Panelboard Keys: Two of each different key.
 - 3. See Section 26 28 13 for requirements for spare fuses and spare fuse cabinets.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- 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.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

- A. Maintain ambient temperature within the following limits during and after installation of panelboards:

26 2416 - 2
NR 25050

Anchor Park Concession and Team Room Facilities
Panelboards

1. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Schneider Electric; Square D Products
- B. ABB/GE
- C. Eaton Corporation
- D. Siemens Industry, Inc.
- E. Approved substitute.
- F. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 PANELBOARDS - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 1. Altitude: Less than 6,600 feet (2,000 m).
 2. Ambient Temperature:
 - a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
- C. Short Circuit Current Rating:
 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.
- D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
 2. Provide 200 percent rated neutral bus and lugs where indicated, where oversized neutral conductors are provided, or where panelboards are fed from K-rated transformers.
 3. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
 4. Provide separate isolated/insulated ground bus where indicated or where isolated grounding conductors are provided.
- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, and the NEC.
 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R.
 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 - b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
 - c. Provide removable end walls for NEMA Type 1 enclosures.
 - d. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.
 3. Fronts:

- a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
 - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
 - c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
- 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware, and all other required provisions.
- J. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 43 00, list and label panelboards as a complete assembly including surge protective device.
- K. Panelboard Contactors: Where panelboard contactors are indicated, provide electrically operated, mechanically held magnetic contactor complying with NEMA ICS 2.
 - 1. Ampere Rating: Not less than ampere rating of panelboard bus.
 - 2. Short Circuit Current Rating: Not less than the panelboard short circuit current rating.
 - 3. Coil Voltage: As required for connection to control system indicated.
- L. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
 - 1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
 - 2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
 - a. Use zero sequence ground fault detection method unless otherwise indicated.
 - b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
 - c. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.
- M. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- N. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.
- O. Load centers are not acceptable.
- P. Provide the following features and accessories where indicated or where required to complete installation:
 - 1. Feed-through lugs.
 - 2. Sub-feed lugs.
 - a. Copper

2.3 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. Products:
 - 1. Acceptable manufacturers for panelboards rated for a maximum of 240 volts:
 - a. Eaton/Cutler Hammer, POW-R-LINE 2a
 - b. Siemens Type S1
 - c. Square D Type NQOD
 - d. General Electric Type AQ
 - 2. Approved substitute.
- C. Conductor Terminations:
 - 1. For all circuit breakers, fused switches, panelboards, etc., provide terminations marked as being suitable for 60/75 degrees C or 75 degrees C wire per UL Construction Materials Directory.
 - 2. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 3. Main and Neutral Lug Type: Mechanical.

- D. Bussing:
 - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
 - 2. Phase and Neutral Bus Material:
 - a. Copper
 - b. Tin-plated aluminum.
 - 3. Ground Bus Material: Copper.
- E. Circuit Breakers:
 - 1. Thermal magnetic bolt-on type unless otherwise indicated.
 - 2. Provide multipole breakers where required.
 - 3. Handle ties are not acceptable.
- F. Provide all panelboards with proper lugs and connections and space for cable size indicated on the Drawings.
- G. Provide a minimum of 50 circuits breaker handle “lock-ons” for each type of panelboard (480 volt and 240 volt).
- H. Enclosures:
 - 1. Provide surface-mounted or flush-mounted enclosures as indicated.
 - 2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 - 3. Provide clear plastic circuit directory holder mounted on inside of door.
- I. Provide column-width panelboards with accessory column-width cable trough and pullbox where indicated.

2.4 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.
 - 2) 14,000 rms symmetrical amperes at 480 VAC.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - 3. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. Provide compression lugs where indicated.
 - c. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
 - a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 100 amperes and larger.
 - b. Provide interchangeable trip units where indicated.
 - 5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
 - a. Provide the following field-adjustable trip response settings:
 - 1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
 - 2) Long time delay.
 - 3) Short time pickup and delay.
 - 4) Instantaneous pickup.
 - 5) Ground fault pickup and delay where ground fault protection is indicated.
 - b. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
 - c. Provide communication capability where indicated: Compatible with system indicated.
 - 6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
 - 7. Provide the following circuit breaker types where indicated:

- a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
 - b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
 - c. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
 - d. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
- 8. Do not use tandem circuit breakers.
 - 9. Do not use handle ties in lieu of multi-pole circuit breakers.
 - 10. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
 - 11. Provide the following features and accessories where indicated or where required to complete installation:
 - a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
 - b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.
 - c. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
 - d. Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
 - e. Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

2.5 SOURCE QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Factory test panelboards according to NEMA PB 1.

PART 3 - EXECUTION

3.1 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.

3.2 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, NEMA PB 1.1, and the NEC.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and the NEC.
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Install panelboards plumb.
- G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor or working platform.
- I. Mount floor-mounted power distribution panelboards on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 03 30 00.
- J. Provide grounding and bonding in accordance with Section 26 05 26.

1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only.
- K. Install all field-installed branch devices, components, and accessories.
- L. Provide fuses complying with Section 26 05 13 for fusible switches as indicated.
- M. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- N. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by the NEC.
- O. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 05 73.
- P. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- Q. Provide filler plates to cover unused spaces in panelboards.
- R. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
 1. Communications equipment circuits.
 2. Intrusion detection and access control system circuits.
 3. Video surveillance system circuits.
- S. Identify panelboards in accordance with Section 26 05 53.

3.3 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. Test GFCI circuit breakers to verify proper operation.
- D. Test shunt trips to verify proper operation.
- E. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.
- F. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.4 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.
- C. Load Balancing:
 1. For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.
 2. When connecting loads to a distribution panel, distribute the loads on the phases to achieve an approximately balanced loading. Measure the steady state load currents at each panelboard feeder and rearrange circuits if there is greater than a 10% difference between phases.
- D. Measure the current on each leg at each panelboard after the current loads are balanced. Record the measured values on the project record drawings.

3.5 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.

3.6 IDENTIFICATION

- A. Provide "nameplates" as specified in Section 26 05 53 for all panelboards. Label as indicated on the Drawings.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. Section 26 00 01 – General Provisions
- B. Section 26 05 19 – Conductors and Cable
- C. Section 26 05 26 – Secondary Grounding
- D. Section 26 05 33 – Raceways and Boxes
- E. Section 26 05 53 – Identification for Electrical Systems
- F. Section 26 05 83 – Wiring Connections.
- G. Section 26 09 23 – Lighting Control Devices
- H. Section 26 29 13 – Motor Starters

1.2 REFERENCES

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for.
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General 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 (NEC).
- 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.
- L. UL 1310 - Class 2 Power Units.
- M. UL 1449 - Standard for Surge Protective Devices.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
 - 3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
 - 4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
 - 5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
- B. Sequencing:
 - 1. Do not install wiring devices until final surface finishes and painting are complete.

1.4 SUBMITTALS

- A. Submit material list in accordance with Section 26 00 01, describing all material furnished under Part 2 of this Section of the Specifications.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
- 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. Operation and Maintenance Data:
 - 1. GFCI Receptacles: Include information on status indicators.
- F. Project Record Documents: Record actual installed locations of wiring devices.
- G. 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 Wall Plates: One of each style, size, and finish.

1.5 QUALITY ASSURANCE

- A. Comply with requirements of the NEC.
- 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. Products: Listed, classified, and labeled as suitable for the purpose intended.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 - PRODUCTS

2.1 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 (1.8 m) of sinks.
- E. Provide GFCI protection for receptacles installed in kitchens.
- F. Provide GFCI circuit breaker ONLY for standard receptacles serving electric water coolers / drinking fountains. (Coordinate receptacle locations with mechanical contractor prior to rough-in.)
- G. Unless noted otherwise, do not use combination switch/receptacle devices.

2.2 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices, Unless Otherwise Indicated: Gray with Stainless Steel wall plate.
- C. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.

- D. Wiring Devices Installed in Wet or Damp Locations: White with specified weatherproof cover.

2.3 WALL SWITCHES

- A. Manufacturers:
1. Hubbell Incorporated
 2. Leviton Manufacturing Company, Inc
 3. Pass & Seymour, a brand of Legrand North America, Inc
 4. Accepted substitute.
- B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.4 RECEPTACLES

- A. Manufacturers:
1. Hubbell Incorporated;
 2. Leviton Manufacturing Company, Inc; CR20-? (finish).
 3. Lutron Electronics Company, Inc; Designer Style.
 4. Pass & Seymour, a brand of Legrand North America, Inc;
 5. Approved substitute.
 6. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wall plates by the same manufacturer in locations indicated.
- B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 2. NEMA configurations specified are according to NEMA WD 6.
- C. Convenience Receptacles:
1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
 2. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
 3. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
 4. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
- 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.
 - a. Provide test and reset buttons of same color as device.
 2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
 3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
 4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.

5. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

2.5 WALL PLATES

- A. Manufacturers:
 1. Hubbell Incorporated
 2. Leviton Manufacturing Company, Inc
 3. Lutron Electronics Company, Inc
 4. Pass & Seymour, a brand of Legrand North America, Inc
 5. Approved substitute.
 6. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wall plates by the same manufacturer in locations indicated.
- B. Wall Plates: Comply with UL 514D.
 1. Configuration: One-piece cover as required for quantity and types of corresponding wiring devices.
 2. Size: Standard.
 3. Screws: Metal with slotted heads finished to match wall plate finish.
- C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.
- D. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
- E. Aluminum Wall Plates: Smooth satin finish, clear anodized, factory-coated to inhibit oxidation.
- F. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.
- G. Pre-marked Wall Plates: Factory labeled as indicated; hot stamped for nylon wall plates and engraved for metal wall plates.
- H. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, or Lexan, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.
- I. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, or Lexan, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.
- J. Weatherproof boots: Yellow rubber, with overlapping design to seal out water and dirt. Rubber boot shall keep weatherproof seal intact when plug is used with wall mounted receptacles.

2.6 HAZARDOUS AREAS

- A. All wiring, devices, outlets, and lighting fixtures in hazardous areas shall be installed in accordance with NEC requirements for that classification of hazardous locations. All devices and equipment shall be listed for use in this type of location.
- B. Where it is necessary to install sealing fittings accessible from rooms or areas which are finished, a flush wall or ceiling outlet box is to be installed and the conduit to be sealed run straight through the box with the sealing fitting occurring within the outlet box. The box shall then be covered with blank plate.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

- F. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 05 33 as required for installation of wiring devices provided under this section.
 - 1. Mounting Heights: Unless otherwise indicated, as follows:
 - a. Wall Switches: 48 inches (1200 mm) above finished floor.
 - b. Receptacles: 18 inches (450 mm) above finished floor or 6 inches (150 mm) above counter.
 - 2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
 - 3. Where multiple receptacles or wall switches are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
 - 4. Locate wall switches on strike side of door with edge of wall plate 3 inches (80 mm) from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
 - 5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Where required, connect wiring devices using pigtails not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.
- F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- I. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.
- J. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- K. Install wall switches with OFF position down.
- L. Install vertically mounted receptacles with grounding pole on bottom and horizontally mounted receptacles with grounding pole on right.
- M. 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.
- N. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- O. Identify wiring devices in accordance with Section 26 05 53.

3.4 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.

3.5 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.6 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 28 13 - FUSES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fuses.

1.2 RELATED REQUIREMENTS

- A. Section 26 00 01 - General Provisions
- B. Section 26 05 53 - Identification for Electrical Systems.
- C. Section 26 05 73 - Power System Studies.
- D. Section 26 28 16 - Enclosed Switches: Fusible switches.
- E. Section 26 29 13 - Enclosed Controllers: Fusible switches.

1.3 REFERENCE STANDARDS

- A. NEMA FU 1 - Low Voltage Cartridge Fuses.
- B. NFPA 70 - National Electrical Code (NEC).
- C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements.
- D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses.
- E. UL 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses.
- F. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses.
- G. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses.
- H. UL 248-15 - Low-Voltage Fuses - Part 15: Class T Fuses.

1.4 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.
 - b. Fusible Switches for Enclosed Motor Controllers: See Section 26 29 13.
 - 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.

1.5 SUBMITTALS

- A. Submit material list in accordance with Section 26 00 01, describing all material furnished under Part 2 of this Section of the Specifications.
- B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.
- 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 Fuses: One set(s) of three for each type and size installed.
 - 3. Fuse Pullers: One set(s) compatible with each type and size installed.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of the NEC.

- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 TIME-CURRENT DATA

- A. Submit "time-current data" with shop drawings for main switchboard overcurrent device, all distribution fuses, and all ground-fault interrupters. The Engineer shall indicate the proper trip settings on the shop drawings during review. The Contractor shall be responsible for adjusting "trip settings" as indicated by the Engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Bussmann, a division of Eaton Corporation.
- B. Littelfuse, Inc.
- C. Mersen.
- D. Approved substitute.

2.2 APPLICATIONS

- A. Feeders:
 - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
 - 2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.
- B. General Purpose Branch Circuits: Class RK1, time-delay.
- C. Individual Motor Branch Circuits: Class RK1, time-delay.
- D. In-Line Protection for Pole-Mounted Luminaires: Class CC, time-delay.
- E. Primary Protection for Control Transformers: Class CC, time-delay.

2.3 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:
 - a. Products (Bussmann used as reference):
 - 1) LPN-RK.
 - 2) LPS-RK.
 - 3) Approved substitute.
- H. Class J Fuses: Comply with UL 248-8.
 - 1. Class J, Time-Delay Fuses:
 - a. Products (Bussmann used as reference):
 - 1) LPJ.
 - 2) Approved substitute.

- I. Class L Fuses: Comply with UL 248-10.
 - 1. Class L, Time-Delay Fuses:
 - a. Products (Bussmann used as reference):
 - 1) KRP-C.
 - 2) Approved substitute.
- J. Class CC Fuses: Comply with UL 248-4.
 - 1. Class CC, Time-Delay Fuses:
 - 2. Class CC, Fast-Acting, Non-Time-Delay Fuses:
- K. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- L. Provide the following accessories where indicated or where required to complete installation:
 - 1. Fuse Holders: Compatible with indicated fuses.
 - 2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

PART 3 - EXECUTION

3.1 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.

3.2 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

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SECTION 26 28 16 - DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. Section 26 00 01 – General Provisions
- 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 53 - Identification for Electrical Systems.
- E. Section 26 05 73 - Power System Studies.
- F. Section 26 28 13 - Fuses.
- G. Section 26 29 13 - Enclosed Controllers.

1.2 REFERENCES

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum).
- E. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.
- F. NFPA 70 - National Electrical Code (NEC).
- G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.
- H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.
- I. UL 98 - Enclosed and Dead-Front Switches.
- J. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
- K. UL 869A - Reference Standard for Service Equipment.
- L. UL 943 - Ground-Fault Circuit-Interruption.
- M. UL 1053 - Ground-Fault Sensing and Relaying Equipment.

1.3 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 the NEC.
 - 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.

1.4 SUBMITTALS

- A. Submit product data (product drawings and descriptive data) in accordance with Section 26 00 01, Paragraph 1.4 "Submittals" describing all material furnished under Part 2 of this Section of the Specifications.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

- C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
 - 1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
 - 2. Include wiring diagrams showing all factory and field connections.
 - 3. Identify mounting conditions required for equipment seismic qualification.
- D. Manufacturer's equipment seismic qualification certification.
- E. Field Quality Control Test Reports.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- G. Project Record Documents: Record actual locations of enclosed switches.
- H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. See Section 26 28 13 for requirements for spare fuses and spare fuse cabinets.

1.5 QUALITY ASSURANCE

- A. Comply with requirements of the NEC.
- 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.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.7 FIELD CONDITIONS

- A. Maintain ambient temperature between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C) during and after installation of enclosed switches.

1.8 TIME-CURRENT DATA

- A. Submit "time-current data" with shop drawings for all overcurrent devices. The Engineer shall indicate the proper trip settings on the shop drawings during review. The Contractor shall be responsible for adjusting "trip settings" as indicated by the Engineer.

PART 2 - EQUIPMENT

2.1 MANUFACTURERS

- A. Schneider Electric; Square D Products.
- B. Allen-Bradley
- C. Eaton Corporation.
- D. ABB/GE.

- E. Siemens Industry, Inc.
- F. Approved substitute.
- G. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 ENCLOSED SAFETY SWITCHES

- A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet (2,000 m).
 - 2. Ambient Temperature: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).
- D. Horsepower Rating: Suitable for connected load.
- E. Voltage Rating: Suitable for circuit voltage.
- F. Short Circuit Current Rating:
 - 1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.
 - 2. Minimum Ratings:
 - a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.
 - b. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
 - c. Double Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.
- G. Provide with switch blade contact position that is visible when the cover is open.
- H. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
 - 1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
- I. Conductor Terminations: Suitable for use with the conductors to be installed.
- J. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.
- K. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- L. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R.
 - 2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
- M. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- N. Heavy Duty Switches:
 - 1. Comply with NEMA KS 1.
 - 2. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. Provide compression lugs where indicated.
 - c. 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.
 - a. Provide means for locking handle in the ON position where indicated.
- O. Provide the following features and accessories where indicated or where required to complete installation:
 1. Hubs: As required for environment type; sized to accept conduits to be installed.
 2. Integral fuse pullers.
 3. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.
 4. Viewing Window: Positioned over switch blades for visual confirmation of contact position with door closed.
 5. Interlocked Receptacle: Integral pre-wired three phase, three wire, grounded type receptacle interlocked with switch mechanism to prevent insertion or removal of plug with switch in the ON position and to prevent switch from being placed in the ON position without matching plug inserted. Provide receptacle configuration as required to accept plug as indicated on the drawings.

PART 3 - EXECUTION

3.2 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.

3.3 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 the NEC.
- D. Provide required support and attachment in accordance with Section 26 05 29.
- E. Install enclosed switches plumb.
- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.
- G. Provide grounding and bonding in accordance with Section 26 05 26.
- H. Install fuses complying with Section 26 28 13 for fusible switches as indicated or as required by equipment manufacturer's recommendations.
- I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- J. Identify enclosed switches in accordance with Section 26 05 53.

3.4 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.

3.5 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.6 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.

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SECTION 26 29 13 - MOTOR STARTERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Enclosed NEMA controllers for low-voltage (600 V and less) applications:
 - 1. Magnetic motor starters.
 - 2. General purpose contactors.
 - 3. Manual motor starters.
 - 4. Motor-starting switches without overload protection.
- B. Overcurrent protective devices for motor controllers, including overload relays.
- C. Control accessories:
 - 1. Auxiliary contacts.
 - 2. Pilot devices.
 - 3. Control and timing relays.
 - 4. Control power transformers.
 - 5. Control terminal blocks.

1.2 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 53 – Identification for Electrical Systems.
- D. Section 26 05 73 – Power System Studies.
- E. Section 26 28 13 – Fuses.

1.3 REFERENCE STANDARDS

- A. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.
- E. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
- F. NEMA ICS 6 - Industrial Control and Systems: Enclosures.
- G. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum).
- H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.
- I. NFPA 70 - National Electrical Code (NEC).
- J. UL 98 - Enclosed and Dead-Front Switches.
- K. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
- L. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules.
- M. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by the NEC.

2. Coordinate the work to provide motor controllers and associated overload relays suitable for use with the actual motors to be installed.
3. Coordinate the work to provide controllers and associated wiring suitable for interface with control devices to be installed.
4. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
5. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
6. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

- A. Submit shop drawings and product data under the provisions of Section 26 00 01.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.
 1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
- C. Shop Drawings: Indicate dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
 1. Include dimensioned plan and elevation views of enclosed controllers and adjacent equipment with all required clearances indicated.
 2. Include wiring diagrams showing all factory and field connections.
 3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
 4. Include documentation of listed series ratings upon request.
 5. Include documentation demonstrating selective coordination upon request.
 6. Identify mounting conditions required for equipment seismic qualification.
- 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. Field Quality Control Test Reports.
- F. Project Record Documents: Record actual installed locations of controllers and final equipment settings.
 1. Include nameplate data of actual installed motors and associated overload relay selections and settings.
 2. Motor Circuit Protectors: Include magnetic instantaneous trip settings.
- G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- 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. See Section 26 28 13 for requirements for spare fuses.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of the NEC.
- 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.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

- A. Maintain field conditions within required service conditions during and after installation.

PART 2 - EQUIPMENT

2.1 MANUFACTURERS

- A. ABB/GE.
- B. Eaton Corporation.
- C. Rockwell Automation, Inc; Allen-Bradley Products.
- D. Schneider Electric; Square D Products.
- E. Siemens Industry, Inc.
- F. Substitutions: Approved Substitute.
- G. Source Limitations: Furnish enclosed motor controllers and associated components produced by a single manufacturer and obtained from a single supplier.
 - 1. Motor-starting switches without overload protection may be produced by the same manufacturer as the wiring devices used for this project.

2.2 ENCLOSED CONTROLLERS

- A. Provide enclosed controller assemblies consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Enclosed controllers complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; ratings, configurations and features as indicated on the drawings.
- D. Service Conditions:
 - 1. Provide controllers and associated components suitable for operation under the following service conditions without derating:
 - a. Altitude:
 - 1) Class 1 Km Equipment (devices utilizing power semiconductors, e.g. variable frequency controllers): Less than 3,300 feet (1,000 m).
 - 2) Class 2 Km Equipment (electromagnetic and manual devices): Less than 6,600 feet (2,000 m).
 - b. Ambient Temperature: Between 32 degrees F (0 degrees C) and 104 degrees F (40 degrees C).
- E. Short Circuit Current Rating:
 - 1. Provide controllers 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. Label equipment utilizing series ratings as required by the NEC.
- F. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. Enclosures:
 - 1. Comply with NEMA ICS 6.
 - 2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1 or Type 12.
 - b. Outdoor Locations: Type 3R or Type 4.
 - c. Hazardous (Classified) Locations: Type 7/9, as required for the classification of the installed location.
 - 3. Finish: Manufacturer's standard unless otherwise indicated.
- I. Instrument Transformers:
 - 1. Comply with IEEE C57.13.
 - 2. Select suitable ratio, burden, and accuracy as required for connected devices.

3. Current Transformers: Connect secondaries to shorting terminal blocks.
 4. Potential Transformers: Include primary and secondary fuses with disconnecting means.
- J. Magnetic Motor Starters: Combination type unless otherwise indicated.
1. Combination Magnetic Motor Starters: NEMA ICS 2, Class A combination motor controllers with magnetic contactor(s), externally operable disconnect and overload relay(s).
 2. Noncombination Magnetic Motor Starters: NEMA ICS 2, Class A noncombination motor controllers with magnetic contactor(s) and overload relay(s).
 3. Configuration: Full-voltage non-reversing unless otherwise indicated.
 4. Minimum Starter Size: NEMA Size 0.
 5. Use of non-standard starter sizes smaller than specified standard NEMA sizes is not permitted.
 6. Disconnects: Circuit breaker or disconnect switch type as indicated.
 - a. Circuit Breakers: Motor circuit protectors (magnetic-only) unless otherwise indicated or required.
 - b. Disconnect Switches: Fusible type unless otherwise indicated.
 - c. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
 - d. Provide auxiliary interlock for disconnection of external control power sources where applicable.
 7. Overload Relays: Bimetallic thermal type unless otherwise indicated.
 8. Pilot Devices Required:
 - a. Furnish local pilot devices for each unit as specified below unless otherwise indicated on drawings.
 - b. Single-Speed, Non-Reversing Starters:
 - 1) Pushbuttons: START-STOP.
 - 2) Selector Switches: HAND/OFF/AUTO.
 - 3) Indicating Lights: Red ON, Green OFF.
 - c. Single-Speed, Reversing Starters:
 - 1) Pushbuttons: FOR-REV-STOP.
 - 2) Selector Switches: FOR/OFF/REV.
 - 3) Indicating Lights: Red FOR, Red REV, Green OFF.
 - d. Two-Speed Starters:
 - 1) Pushbuttons: FAST-OFF-SLOW.
 - 2) Selector Switches: SLOW/OFF/FAST.
 - 3) Indicating Lights: Red FAST, Red SLOW, Green OFF.
- K. General Purpose Contactors: Combination type unless otherwise indicated.
1. Combination Contactors: NEMA ICS 2, Class A combination controllers with magnetic contactor(s) and externally operable disconnect, but without integral overload relay(s).
 2. Noncombination Contactors: NEMA ICS 2, Class A noncombination motor controllers with magnetic contactor(s), but without integral overload relay(s).
 3. Configuration: Full-voltage non-reversing unless otherwise indicated.
 4. Minimum Contactor Size: NEMA Size 0.
 5. Use of non-standard contactor sizes smaller than specified standard NEMA sizes is not permitted.
 6. Disconnects: Circuit breaker or disconnect switch type as indicated.
 - a. Circuit Breakers: Thermal magnetic unless otherwise indicated or required.
 - b. Disconnect Switches: Fusible type unless otherwise indicated.
 - c. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
 - d. Provide auxiliary interlock for disconnection of external control power sources where applicable.
 7. Pilot Devices Required:
 - a. Furnish local pilot devices for each unit as specified below unless otherwise indicated on drawings.
 - b. Contactors for motor applications where overload protection is provided separately or where motor contains integral thermal protectors to be provided with pilot devices as specified for magnetic motor starters above.
- L. Manual Motor Starters:
1. Description: NEMA ICS 2, Class A manually-operated motor controllers with overload relay(s).
 2. Configuration: Non-reversing unless otherwise indicated.
 3. Fractional-Horsepower Manual Motor Starters:
 - a. Furnish with toggle operator.

- b. Overload Relays: Bimetallic or melting alloy thermal type.
- c. Provide means for locking operator in the OFF position.
- d. Furnish Red ON indicating light where not within sight of equipment.
- 4. Integral-Horsepower Manual Motor Starters:
 - a. Furnish with toggle or pushbutton operator.
 - b. Overload Relays: Bimetallic or melting alloy thermal type.
 - c. Provide means for locking operator in the OFF position.
 - d. Furnish Red ON indicating light where not within sight of equipment.
 - e. Provide auxiliary contact where indicated; normally open (NO) or normally closed (NC) as indicated or as required.
- M. Motor-Starting Switches: Horsepower-rated switches without overload protection; toggle operator.

2.3 OVERCURRENT PROTECTIVE DEVICES

- A. Overload Relays:
 - 1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
 - 2. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
 - 3. Trip-free operation.
 - 4. Visible trip indication.
 - 5. Resettable.
 - a. Employ manual reset unless otherwise indicated.
 - b. Employ automatic reset or remote reset where indicated.
 - c. Do not employ automatic reset with two-wire control.
 - 6. Bimetallic Thermal Overload Relays:
 - a. Provide ambient temperature compensation.
 - b. Interchangeable current elements/heaters.
 - c. Adjustable trip; plus/minus 10 percent of nominal, minimum.
 - d. Designed for quicker trip response under phase loss condition.
 - e. Trip test function.
 - f. Provide isolated alarm contact where indicated.
 - 7. Melting Alloy Thermal Overload Relays:
 - a. Interchangeable current elements/heaters.
 - b. Provide isolated alarm contact where indicated.
 - 8. Solid-State Overload Relays:
 - a. Selectable inverse-time trip class rating; available ratings of Class 10, 20, and 30, minimum.
 - b. Adjustable full load current.
 - c. Phase loss protection.
 - d. Phase imbalance protection.
 - e. Ground fault protection.
 - f. Ambient temperature insensitive.
 - g. Thermal memory.
 - h. Repeat Trip Accuracy: Plus/minus 2 percent, minimum.
 - i. Trip test function.
 - j. Provide isolated alarm contact.
 - k. Provide communication capability where indicated: Compatible with system indicated.
 - l. Other Acceptable Product(s):
- B. Fusible Disconnect Switches:
 - 1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
 - 2. Fuse Clips: As required to accept indicated fuses.
 - a. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
 - 3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

C. Circuit Breakers:

1. Interrupting Capacity (not applicable to motor circuit protectors):
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - c. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.
2. Motor Circuit Protectors:
 - a. Description: Instantaneous-trip circuit breakers furnished with magnetic instantaneous tripping elements for short circuit protection, but not with thermal inverse time tripping elements for overload protection; UL 489 recognized only for use as part of a listed combination motor controller with overload protection; ratings, configurations, and features as indicated on the drawings.
 - b. Provide field-adjustable magnetic instantaneous trip setting.
 - c. Provide the following features and accessories where indicated or where required to complete installation:
 - 1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
 - 2) Pad-Lock Provision: For locking circuit breaker handle in OFF position.
 - 3) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
 - 4) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
 - 5) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.
3. Molded Case Circuit Breakers:
 - a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.
 - 1) Provide thermal magnetic circuit breakers unless otherwise indicated.
 - 2) Provide electronic trip circuit breakers where indicated.
 - b. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
 - 1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
 - 2) Provide interchangeable trip units where indicated.
 - c. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
 - 1) Provide the following field-adjustable trip response settings:
 - (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
 - (b) Long time delay.
 - (c) Short time pickup and delay.
 - (d) Instantaneous pickup.
 - (e) Ground fault pickup and delay where ground fault protection is indicated.
 - d. Provide the following features and accessories where indicated or where required to complete installation:
 - 1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
 - 2) Pad-Lock Provision: For locking circuit breaker handle in OFF position.
 - 3) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
 - 4) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
 - 5) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

2.4 CONTROL ACCESSORIES

A. Auxiliary Contacts:

1. Comply with NEMA ICS 5.
2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each magnetic motor starter, minimum.

B. Pilot Devices:

1. Comply with NEMA ICS 5; heavy-duty type.
 2. Nominal Size: 30 mm.
 3. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
 4. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
 5. Indicating Lights: Push-to-test type unless otherwise indicated.
 6. Provide LED lamp source for indicating lights and illuminated devices.
- C. Control and Timing Relays:
1. Comply with NEMA ICS 5.
 2. Provide number and type of relays indicated or required to perform necessary functions.
 3. Timing Relays: Electronic or pneumatic as indicated.
 - a. Adjustable Timing Range: As indicated on drawings.
 4. Multi-Speed Motor Starters: Employ accelerating relays, decelerating relays, and compelling relays where indicated.
 5. Accelerating Relays: Starts motor at low speed and then accelerates automatically through definite time intervals for each successive speed until selected speed is attained.
 6. Decelerating Relays: Allows motor to decelerate automatically through definite time intervals for each successive speed until selected speed is attained.
 7. Compelling Relays: Requires motor to start at low speed before a higher speed can be selected.
- D. Control Power Transformers:
1. Size to accommodate burden of contactor coil(s) and all connected auxiliary devices, plus _____ VA spare capacity.
 2. Include primary and secondary fuses.
- E. Control Terminal Blocks: Include 25 percent spare terminals.

2.5 VARIABLE FREQUENCY DRIVES

- A. Provide Variable Frequency Motor Drives for equipment as indicated on the Drawings. Drives shall be enclosed in a NEMA 1 enclosure unless noted otherwise. The equipment shall have a SCCRE of 65,000 amps.
- B. All VFDs shall have the following standard features.
1. The same customer interface, including digital display, and keypad, shall be provided regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.
 2. The keypad shall include Hand-Off-Auto selections and manual speed control. There shall be fault reset and "Help" buttons on the keypad. The Help button shall include "on-line" assistance for programming and troubleshooting.
 3. VFDs through 200 HP shall have internal chokes (reactors) providing 5% impedance.
 4. The input current rating of the VFD shall not be greater than the output current rating.
 5. The VFD shall provide a programmable loss-of-load (broken belt / broken coupling) Form-C relay output. The drive shall be programmable to signal the loss-of-load condition via a keypad warning, Form-C relay output, and / or over the serial communications bus.
- C. All VFDs to have the following adjustments:
1. Motor overload protection shall be provided in both drive and bypass modes.
 2. Run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, input contact closure, time-clock control, or serial communications), the VFD shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. (The closed end-switch is wired to a VFD digital input and allows VFD motor operation.)
 3. Programmable time delay for VFD start and a keypad indication that this time delay is active. A Form C relay output provides a contact closure to signal the VAV boxes open. (This will allow VAV boxes to be driven open before the motor operates)
 4. Fireman's override input. The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands), except customer defined safety run interlocks, and force the motor to run at a preset speed or in a separate PID mode.

- D. Serial Communications
 - 1. The VFD shall have an EIA-485 port as standard. The standard protocols shall be Modbus, Johnson Controls N2, Siemens Building Technologies FLN, and BACnet. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority (i.e. BTL Listing for BACnet).
- E. All VFD's shall include EMI/RFI filters. (The onboard filters shall allow the VFD assembly to be CE Marked and the VFD shall meet product standard EN 61800-3 for the First Environment restricted level (Category C2))
- F. Bypasses shall be furnished and mounted by the drive manufacturer as indicated on the Drawings. All VFD with bypass configurations shall be UL Listed
 - 1. A complete factory wired and tested bypass system consisting of a door interlocked, padlockable circuit breaker, output contactor, bypass contactor, and fast acting VFD input fuses
 - 2. The bypass shall maintain positive contactor control through the voltage tolerance window of nominal voltage +30%, -35%. Designs that will not allow input single phase operation in the VFD mode are not acceptable. (This feature is designed to avoid contactor coil failure during brown out / low line conditions and allow for input single phase operation when in the VFD mode.)
 - 3. Motor protection from single phase power conditions - the bypass system must be able to detect a single-phase input power condition while running in bypass, disengage the motor in a controlled fashion, and give a single-phase input power indication.
 - 4. The bypass system shall be designed for stand-alone operation and shall be completely functional in both Hand and Automatic modes even if the VFD has been removed from the system for repair / replacement. Serial communications shall remain functional even with the VFD removed.
 - 5. Serial communications – the bypass shall be capable of being monitored and / or controlled via serial communications. On-board communications protocols shall include ModBus RTU; Johnson Controls N2; Siemens Building Technologies FLN (P1); and BACnet MS/TP.
 - 6. The user shall be able to select the text to be displayed on the keypad when an external safety opens. Example text display indications include "FireStat", "FreezStat", "Over pressure" and "Low suction". The user shall also be able to determine which of the four (4) safety contacts is open over the serial communications connection.
- G. Environmental operating conditions: -15 to 40 degrees C (5 to 104 degrees F) continuous. Altitude 0 to 3300 feet above sea level, less than 95%, non-condensing All circuit boards shall be coated to protect against corrosion.
- H. Acceptable manufacturers:
 - 1. Toshiba
 - 2. Hitachi
 - 3. Square D
 - 4. ABB

2.6 SOFT START STARTERS

- A. Operating Characteristics:
 - 1. Torque Control System
 - 2. Voltage Ramp
 - 3. Current Ramp
 - 4. Current % Limit: 200-500%
 - 5. Torque % Limit: 10-100%
 - 6. Acceleration Ramp time: 1-60 sec.
 - 7. Deceleration Ramp time: 0.5-60 sec.
 - 8. Free wheel stop
- B. Provide with fusible switch disconnect in common enclosure.
 - 1. Phase Failure Protection: Protection shall include phase loss (single phasing), low voltage (any or all phases), and phase sequence reversal.
- C. Control
 - 1. HAND-OFF-AUTO selector switch, spring return to "OFF" from "HAND" position.
 - 2. Provide for three wire (START-STOP) control from remote pushbuttons.
 - 3. Indicator Lights: Red Green pilot light on cover, illuminated while motor is running.
- D. Acceptable Manufacturers:
 - 1. Square D Altistart 58

2. Or acceptable substitute from Allen Bradley or Cutler Hammer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that ratings of enclosed controllers are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed controllers.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install controllers in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and the NEC.
- 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 controllers plumb and level.
- G. Provide grounding and bonding in accordance with Section 26 05 26.
- H. Install all field-installed devices, components, and accessories.
- I. Provide fuses complying with Section 26 28 13 for fusible switches as indicated.
- J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- K. Set field-adjustable controllers and associated components according to installed motor requirements, in accordance with manufacturer's recommendations and NFPA 70.
- L. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed in accordance with Section 26 05 73.
- M. Identify enclosed controllers in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's reports with submittals.
- C. Correct deficiencies and replace damaged or defective enclosed controllers or associated components.
- D. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.4 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

- A. Clean dirt and debris from controller enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

3.6 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 controllers to Owner, and correct deficiencies or make adjustments as directed.
- D. Training: Train Owner's personnel on operation, adjustment, and maintenance of enclosed controllers and associated devices.

3.7 PROTECTION

- A. Protect installed enclosed controllers from subsequent construction operations.

END OF SECTION

SECTION 26 43 00 - SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Surge protective devices for service entrance locations.
- B. Surge protective devices for distribution locations.
- C. Surge protective devices for branch panelboard locations.

1.2 RELATED REQUIREMENTS

- A. Section 26 00 01 – General Provisions
- B. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
- C. Section 26 23 00 – Low-Voltage Switchgear.
- D. Section 26 24 13 – Switchboards.
- E. Section 26 24 16 – Panelboards.
- F. Section 26 27 26 – Wiring Devices.

1.3 ABBREVIATIONS AND ACRONYMS

- A. EMI/RFI: Electromagnetic Interference/Radio Frequency Interference.
- B. SPD: Surge Protective Device.

1.4 REFERENCE STANDARDS

- A. MIL-STD-220 - Method of Insertion Loss Measurement.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.
- E. NFPA 70 - National Electrical Code (NEC).
- F. UL 1283 - Standard for Electromagnetic Interference Filters.
- G. UL 1449 - Standard for Surge Protective Devices.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to ordering equipment.

1.6 SUBMITTALS

- A. Submit material list in accordance with Section 26 00 01, describing all material furnished under Part 2 of this Section of the Specifications.
- B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.
 - 1. SPDs with EMI/RFI filter: Include noise attenuation performance.

- C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.
- D. Certificates: Manufacturer's documentation of listing for compliance with the following standards:
 - 1. UL 1449.
 - 2. UL 1283 (for Type 2 SPDs).
- E. Field Quality Control Test Reports.
- F. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.
- H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- I. Project Record Documents: Record actual connections and locations of surge protective devices.

1.7 QUALITY ASSURANCE

- A. Comply with requirements of the NEC.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.8 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.9 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Manufacturer's Warranty: Provide minimum five-year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.
- C. Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Surge Suppression, LLC (SSI).
- B. Field-installed, Externally Mounted Surge Protective Devices - Other Acceptable Manufacturers:
 - 1. ABB/GE.
 - 2. Advanced Protection Technologies, Inc (APT).
 - 3. Current Technology; a brand of Thomas & Betts Power Solutions.
 - 4. Schneider Electric; Square D Brand Surgellogic Products.
 - 5. Surge Suppression, LLC (SSI).
 - 6. Approved substitute.
- C. Factory-installed, Internally Mounted Surge Protective Devices:

1. Same as manufacturer of equipment containing surge protective device, to provide a complete listed assembly including SPD.
- D. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.
- E. Source Limitations: Furnish surge protective devices produced by a single manufacturer and obtained from a single supplier.

2.2 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

- A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.
- B. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.
- C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.
- D. Protected Modes:
 1. Wye Systems: L-N, L-G, N-G, L-L.
 2. Single Split Phase Systems: L-N, L-G, N-G, L-L.
- E. UL 1449 Voltage Protection Ratings (VPRs):
 1. Equivalent to basis of design.
 2. 208Y/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.
 3. 480Y/277V System Voltage: Not more than 1,500 V for L-N, L-G, and N-G modes and 2,000 V for L-L mode.
- F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.
- G. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 1. Indoor clean, dry locations: Type 1.
 2. Outdoor locations: Type 3R.
- H. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:
 1. Provide surface-mounted SPD where mounted in non-public areas or adjacent to surface-mounted equipment.
 2. Provide flush-mounted SPD where mounted in public areas or adjacent to flush-mounted equipment.
- I. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.
 1. Switchboards: See Section 26 24 13.
 2. Panelboards: See Section 26 24 16.

2.3 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

- A. Surge Protective Device - Basis of Design: Surge Suppression, LLC (SSI); SpecPRO Series; Model SSMA8 (80 kA/phase, Type 2, I-n = 10 kA).
 1. Voltage: As indicated on drawings.
 2. Features: Seven modes of protection; component-level thermal fusing; internal circuit board-mounted overcurrent fusing; 200 kAIC SCCR; 15-year warranty.
 3. Include the following options:
 - a. AC10 - Basic internal audible alarm with dry relay contacts.
 - b. AC11 - Advanced internal audible alarm with on, off, and test with dry relay contacts.
 - c. C - Form C dry relay contacts.
 - d. LP - Remote LED indicators in individual NEMA 4X housings.
 - e. S6 - Surge counter with reset button.

- f. D1 - NEMA 1, 2, 3, 3S, 4X, and 12 composite enclosure with integral non-fused disconnect switch, with external handle
 - g. D3 - NEMA 1, 2, 3, 3S, 4X, and 12 composite enclosure with integral non-fused disconnect switch, without external handle
 - h. D5 - NEMA 1, 2, 3, 3S, 4X, and 12 composite enclosure with integral non-fused disconnect switch, with external handle
 - i. D6 - NEMA 1, 2, 3, 3S, 4X, and 12 composite enclosure with integral non-fused disconnect switch, without external handle
 - j. M - NEMA 12 steel enclosure.
 - k. W - NEMA 4 steel enclosure.
 - l. X - NEMA 4X composite enclosure, box-in-box.
 - m. X1 - NEMA 4X composite enclosure with clear lid, box-in-box.
 - n. X2 - NEMA 1, 2, 3, 3S, 4, 4X, and 12 composite enclosure.
 - o. X3 - NEMA 1, 2, 3, 3S, 4, 4X, and 12 composite enclosure, 10 by 8 by 4 inches (25 by 20 by 10 cm).
 - p. XS - NEMA 4X stainless steel enclosure.
 - q. P - Flush mount plate.
 - r. N - Without N-G tracking circuit.
- B. Products - Field-installed, Externally Mounted Surge Protective Devices:
- 1. Surge Suppression, LLC (SSI) SpecPRO Series; SSM/CSM (80 kA per phase).

2.4 SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

- A. Surge Protective Device - Basis of Design: Surge Suppression, LLC (SSI); SpecPRO Series; Model SSMA8 (80 kA/phase, Type 2, I-n = 10 kA); www.surgesuppression.com/#sle.
- 1. Voltage: As indicated on drawings.
 - 2. Features: Seven modes of protection; component-level thermal fusing; internal circuit board-mounted overcurrent fusing; 200 kAIC SCCR; 15-year warranty.
 - 3. Include the following options:
 - a. AC10 - Basic internal audible alarm with dry relay contacts.
 - b. AC11 - Advanced internal audible alarm with on, off, and test with dry relay contacts.
 - c. C - Form C dry relay contacts.
 - d. LP - Remote LED indicators in individual NEMA 4X housings.
 - e. S6 - Surge counter with reset button.
 - f. D1 - NEMA 1, 2, 3, 3S, 4X, and 12 composite enclosure with integral non-fused disconnect switch, with external handle
 - g. D3 - NEMA 1, 2, 3, 3S, 4X, and 12 composite enclosure with integral non-fused disconnect switch, without external handle
 - h. D5 - NEMA 1, 2, 3, 3S, 4X, and 12 composite enclosure with integral non-fused disconnect switch, with external handle
 - i. D6 - NEMA 1, 2, 3, 3S, 4X, and 12 composite enclosure with integral non-fused disconnect switch, without external handle
 - j. M - NEMA 12 steel enclosure.
 - k. W - NEMA 4 steel enclosure.
 - l. X - NEMA 4X composite enclosure, box-in-box.
 - m. X1 - NEMA 4X composite enclosure with clear lid, box-in-box.
 - n. X2 - NEMA 1, 2, 3, 3S, 4, 4X, and 12 composite enclosure.
 - o. X3 - NEMA 1, 2, 3, 3S, 4, 4X, and 12 composite enclosure, 10 by 8 by 4 inches (25 by 20 by 10 cm).
 - p. XS - NEMA 4X stainless steel enclosure.
 - q. P - Flush mount plate.
 - r. N - Without N-G tracking circuit.
- B. Products - Field-installed, Externally Mounted Surge Protective Devices:
- 1. Surge Suppression, LLC (SSI) SpecPRO Series; SSM/CSM (80 kA per phase).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.
- C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.
- D. Verify system grounding and bonding is in accordance with Section 26 0526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.
- E. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.
- F. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.
- G. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 0526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.
- H. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

3.3 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 7.19.1.
- D. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

3.4 CLEANING

- A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

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SECTION 26 51 00 - LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Interior luminaires.
- B. Exterior luminaires.
- C. Emergency lighting units.
- D. Exit signs.
- E. Ballasts and drivers.
- F. Lamps.
- G. Poles and accessories.
- H. Accessories.

1.2 RELATED REQUIREMENTS

- A. Section 26 01 00 - General Provisions
- 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 33 - Boxes for Electrical Systems.
- E. Section 26 05 53 - Identification for Electrical Systems.
- F. Section 26 09 19 - Enclosed Contactors.
- G. Section 26 09 23 - Lighting Control Devices.
- H. Section 26 27 26 - Wiring Devices.
- I. Section 26 28 13 - Fuses.

1.3 UNIT PRICES

- A. See Section 01 22 00 - Unit Prices, for additional unit price requirements.
- B. Exterior Lighting Unit:
 - 1. Basis of Measurement: Each.
 - 2. Basis of Payment: Includes concrete foundation, pole, and luminaire(s) with lamps and accessories.

1.4 REFERENCE STANDARDS

- A. 47 CFR 15 - Radio Frequency Devices.
- B. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signal.
- C. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code).
- D. IEEE C2 - National Electrical Safety Code.
- E. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits.
- F. IES LM-63 - IESNA Standard File Format for Electronic Transfer of Photometric Data and Related Information.
- G. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products.

- H. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules.
- I. NECA 1 - Standard for Good Workmanship in Electrical Construction.
- J. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems.
- K. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems.
- L. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts.
- M. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility.
- N. NFPA 70 - National Electrical Code (NEC).
- O. NFPA 101 - Life Safety Code.
- P. UL 844 - Luminaires for Use in Hazardous (Classified) Locations.
- Q. UL 924 - Emergency Lighting and Power Equipment.
- R. UL 1598 - Luminaires.
- S. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products.

1.5 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 placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
 - 3. 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.
 - 4. Coordinate the placement of exit signs with furniture, equipment, signage, or other potential obstructions to visibility 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.

1.6 SUBMITTALS

- A. Submit material list in accordance with Section 26 00 01, describing all material furnished under Part 2 of this Section of the Specifications.
- 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.
 - 3. Provide structural calculations for each pole proposed for substitution.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), 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. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.
 - 3. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.

- D. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.
- E. Samples:
 - 1. Provide one sample(s) of each luminaire proposed for substitution upon request.
 - 2. Provide one sample(s) of each product finish illustrating color and texture upon request.
- F. Certificates for Dimming Drivers: Manufacturer's documentation of compatibility with dimming controls to be installed.
- G. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.
- H. Field quality control reports.
 - 1. Include test report indicating measured illumination levels.
- I. 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, and starting of product.
- J. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- K. 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 Fuses: Five percent of total quantity installed for each type, but not less than two of each type.
 - 4. Touch-Up Paint: Two (2) gallons (8 liters), to match color of pole finish.
- L. Project Record Documents:
 - 1. Record actual connections and locations of luminaires and any associated remote components.
 - 2. Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.7 QUALITY ASSURANCE

- A. Comply with requirements of the NEC.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.8 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 501 (exterior 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.

1.9 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide three (3) year manufacturer warranty for LED luminaires, including drivers.
- C. Provide five (5) year pro-rata warranty for batteries for emergency lighting units.
- D. Provide ten-year pro-rata warranty for batteries for self-powered exit signs.

PART 2 - PRODUCTS

2.1 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. Substitutions: Approved substitutes.

2.2 LUMINAIRES

- A. Manufacturers:
 - 1. As shown on the luminaire schedule on the drawings.
 - 2. Substitutions: Approved substitute.
- B. Provide products that comply with requirements of the NEC.
- C. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- D. Provide products listed, classified, and labeled as suitable for the purpose intended.
- E. Provide products complying with Federal Energy Management Program (FEMP) requirements.
- F. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, drivers, reflectors, lenses, housings, and other components required to position, energize, and protect the lamp and distribute the light.
- G. 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.
- H. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- I. Recessed Luminaires:
 - 1. Ceiling Compatibility: Comply with NEMA LE 4.
 - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
 - 3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
- J. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.
- K. LED Luminaires:
 - 1. Components: UL 8750 recognized or listed as applicable.
 - 2. Tested in accordance with IES LM-79 and IES LM-80.
 - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
- L. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.
- M. Exposed Exterior Hardware: Stainless steel.

2.3 EMERGENCY LIGHTING UNITS

- A. Manufacturers:
 - 1. As shown on the luminaire schedule on the drawings.
 - 2. Substitutions: Appropriate substitute.
- B. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
- C. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

- D. Battery:
 - 1. Sealed maintenance-free lead calcium unless otherwise indicated.
 - 2. Size battery to supply all connected lamps, including emergency remote heads where indicated.
- E. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
- F. Provide low-voltage disconnect to prevent battery damage from deep discharge.
- G. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.
- H. Where indicated, provide units with integral time delay to maintain emergency illumination for 15 minutes after restoration of normal power source.
- I. Accessories:
 - 1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
 - 2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
 - 3. Provide compatible accessory wire guards where indicated.
 - 4. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

2.4 EXIT SIGNS

- A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
 - 1. Number of Faces: Single- or double-face as indicated or as required for installed location.
 - 2. Directional Arrows: As indicated or as required for installed location.
- B. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.
 - 1. Manufacturers:
 - a. As shown on the luminaire schedule on the drawings.
 - b. Substitutions: Approved substitute.
 - 2. Self-Powered Exit Signs:
 - a. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
 - b. Battery: Sealed, maintenance-free, nickel cadmium unless otherwise indicated.
 - c. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
 - d. Provide low-voltage disconnect to prevent battery damage from deep discharge.
 - e. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.
- C. Accessories:
 - 1. Provide compatible accessory high-impact polycarbonate vandal shields where indicated.
 - 2. Provide compatible accessory wire guards where indicated.

2.5 BALLASTS AND DRIVERS

- A. Manufacturers:
 - 1. As shown on the luminaire schedule on the drawings
 - 2. Substitutions: Approved substitute.
 - 3. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by a single manufacturer.
 - 4. 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. Drivers - General Requirements:
 - 1. Minimum Efficiency/Efficacy: Provide drivers complying with all current applicable federal and state efficiency/efficacy standards.

2. Electronic Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.
- C. Dimmable LED Drivers:
 1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
 2. Control Compatibility: Fully compatible with the dimming controls to be installed.
 - a. Wall Dimmers: See Section 26 27 26.
 3. Product(s):
 - a. As shown on the luminaire schedule on the drawings

2.6 POLES

- A. Manufacturers:
 1. As shown on the luminaire schedule on the drawings.
 2. Substitutions: Approved substitute.
- B. All Poles:
 1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
 2. Structural Design Criteria:
 - a. Comply with AASHTO LTS.
 3. Material: Steel, unless otherwise indicated.
 4. Shape: Square straight, unless otherwise indicated.
 5. Finish: Match luminaire finish, unless otherwise indicated.
 6. Mounting Height: As shown on the luminaire schedule on the drawings.
 7. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.
 8. Unless otherwise indicated, provide with the following features/accessories:
 - a. Top cap.
 - b. Handhole.
 - c. Anchor bolts with leveling nuts or leveling shims.
 - d. Anchor base cover.
 - e. Provision for pole-mounted weatherproof GFI receptacle where indicated.
 - f. Brackets.
 - g. Hinged base.
 - h. Pole-top tenon.
- C. Metal Poles: Provide ground lug, accessible from handhole or transformer base.

2.7 ACCESSORIES

- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2-inch size, factory finished to match luminaire or field-painted as directed.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4-inch size, field-painted as directed.
- C. Fire-Rated Luminaire Enclosures:
 1. Manufacturers:
 - a. Fire Rated Product Specialties Corp.
 - b. Specialty Products & Insulation (SPI); SafeLite.
 - c. Substitutions: Approved substitute.
 2. Provide as required to preserve fire resistance rating of building elements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with the NEC.
- C. Verify that suitable support frames are installed where required.

- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 05 33 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), NECA 501 (exterior lighting) and NECA 502 (industrial lighting).
- 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. 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 gage, 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.
- H. Recessed Luminaires:
 - 1. Install trims tight to mounting surface with no visible light leakage.
 - 2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
 - 3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
- I. Suspended Luminaires:
 - 1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
 - 2. Install using the suspension method indicated, with support lengths and accessories 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 (1.2 m) between supports.
 - 4. Install canopies tight to mounting surface.
 - 5. Unless otherwise indicated, support pendants from swivel hangers.
- J. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- K. Pole-Mounted Luminaires:
 - 1. Maintain the following minimum clearances:
 - a. Comply with IEEE C2.
 - b. Comply with utility company requirements.
 - 2. Foundation-Mounted Poles:
 - a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 03 30 00.
 - 1) Install anchor bolts plumb per template furnished by pole manufacturer.
 - 2) Position conduits to enter pole shaft.

- b. Install foundations plumb.
 - c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
 - d. Tighten anchor bolt nuts to manufacturer's recommended torque.
 - e. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.
 - f. Install anchor base covers or anchor bolt covers as indicated.
- 3. Embedded Poles: Install poles plumb as indicated.
- 4. Grounding:
 - a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
 - b. Provide supplementary ground rod electrode as specified in Section 26 05 26 at each pole bonded to grounding system as indicated.
- 5. Install separate service conductors, #12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.
- 6. Install non-breakaway in-line fuse holders and fuses complying with Section 26 28 13 in pole handhole or transformer base for each ungrounded conductor.
- 7. Install weather resistant GFI duplex receptacle with weatherproof cover as specified in Section 26 27 26 in designated poles.
- L. Install accessories furnished with each luminaire.
- M. Bond products and metal accessories to branch circuit equipment grounding conductor.
- N. Emergency Lighting Units:
 - 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
 - 2. Install lock-on device on branch circuit breaker serving units.
- O. Exit Signs:
 - 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
 - 2. Install lock-on device on branch circuit breaker serving units.
- P. Identify luminaires connected to emergency power system in accordance with Section 26 05 53.
- Q. Install lamps in each luminaire.
- R. 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.

3.4 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.
- F. Measure exterior illumination levels at night with calibrated meters to verify compliance with performance requirements. Record test results in written report to be included with submittals.

3.5 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.
- B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

- C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.
- D. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Architect.

3.6 CLEANING

- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 501 (exterior lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

- A. 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.

3.8 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

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SECTION 26 60 00 - ELECTRICAL HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Electric Unit Heaters
 - 2. Temperature Controls

1.2 REFERENCES

- A. NEC, "National Electric Code", NFPA-70.
- B. UL, "Building Materials Directory".

1.3 SUBMITTALS

- A. Submit shop drawings and operating instructions and manuals in accordance with Section 26 00 01.

PART 2 - PRODUCTS

2.1 ELECTRIC UNIT HEATERS

- A. Markel, Type "3320" or equivalent type by other acceptable manufacturers with the following features:
 - 1. Heavy gauge die-formed steel housing.
 - 2. Pull through air flow design.
 - 3. Completely enclosed fan motors, not requiring oiling.
 - 4. Aluminum finned, copper clad steel sheath heating element.
 - 5. Control transformer.
 - 6. Automatic reset linear thermal cut-out, capillary type, providing protection over entire length of heating element.
 - 7. Fan delay, allowing heat up and cool down of heating element prior to fan start-up and shut-down.
 - 8. Unit shall be UL listed.
 - 9. Provide individually adjustable discharge louvers.
 - 10. Provide voltage and wattage as indicated on the Drawings.
- B. Acceptable manufacturers:
 - 1. Berko
 - 2. Q'Mark
 - 3. Markel
 - 4. Sentinel

2.2 TEMPERATURE CONTROLS

- A. Adjustable Thermostats – Line Voltage
 - 1. Provide heavy-duty, line voltage thermostats as indicated on the Drawings. Units shall be DPST and shall have positive 'OFF'. Units shall have locking cover and scale range of 45 to 75 degrees F. Contacts rated 16 amps at 120-volt and 18 amps at 277-volt.
 - 2. Acceptable manufacturers:
 - a. Berko #M612W
 - b. Markel #TW 147
 - c. Approved substitute
- B. Adjustable Thermostats – Low Voltage
 - 1. Provide low voltage thermostats as indicated on the Drawings. Units shall have a scale range of 40 to 90 degrees F. Contacts rated pilot duty.
 - 2. Acceptable manufacturers:
 - a. Berko #T8775A1009
 - b. Approved substitute
- C. Non-adjustable thermostats

1. Provide line voltage (120-volt) thermostat as indicated on the Drawings. Units shall have a hermetically sealed mercury actuator preset for 68 degrees F. and a locking cover.
2. Acceptable manufacturers:
 - a. Accustat LV120-A-H1

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install electric heaters as recommended by manufacturer and as shown on Drawings.

3.2 ELECTRIC UNIT HEATERS

- A. Install electric unit heaters from ceiling supports using manufacturer's brackets.
- B. Mount electric unit heater with unit bottom a minimum of 8 feet above finished floor
- C. Install thermostat for unit control.

3.3 INSTRUCTION OF OWNER

- A. Fully instruct Owner's personnel as to proper operation of equipment.

END OF SECTION

SECTION 26 70 00 - ELECTRIC HAND DRYERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Electric hand dryers

1.2 REFERENCES

- A. NEC, "National Electric Code", NFPA 70.
- B. UL, "Building Materials Directory".

1.3 SUBMITTALS

- A. Submit shop drawings and operating instructions and manuals in accordance with Section 26 00 01.

PART 2 - PRODUCTS

2.1 ELECTRIC HAND DRYERS (900 WATTS)

- A. Electrical Characteristics: Entire unit internally grounded and connected to system ground, designed for operation on 120-volt, 7.5 amps, 60 Hz, single-phase, two-wire circuitry.
 - 1. Heating Elements: 900 watts, protected by automatic resetting thermostat which opens when airflow is cut off and closes when air flow is resumed.
 - 2. Motor: Universal type, 5/8 HP, 20,000 RPM with resilient mounting, sealed and lubricated ball bearings, and protected by a properly sized UL Class G fuse or thermal overload.
- B. Fan: Delivering at least 16,000 linear feet per minute at air outlet.
- C. Switch: Hand Dryer Control assembly activated by a proximity, fully automatic, infrared optical sensor located next to the air outlet. The dryer shall operate as long as hands are under the air outlet. There is a 35-second lockout feature if hands are not removed.
- D. Cover: One-piece tamperproof heavy duty die-cast zinc alloy. Bright chrome finish.
- E. Include manufacturer's wall box where recessed installation is required.
- F. Manufacturer:
 - 1. Excel XL-C-XXX-1.1 NZ
 - 2. World #L-970
 - 3. Approved substitute

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install surface mounted.
- B. Install dryers as recommended by manufacturer.
- C. Install dryers at junction boxes indicated with mounting heights as indicated. When no mounting height is indicated, install at height recommended by manufacturer for each specific area and type of use.

3.2 WARRANTY

- A. The hand dryer shall be guaranteed to be free from defects for a period of five (5) years. Warranty shall include factory performed labor as well as the repair or exchange

END OF SECTION

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SECTION 27 05 28 - LOW VOLTAGE RACEWAY SYSTEM - COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Telephone/Data/TV Systems: Electrical Contractor is to furnish and install service entrance conduits, conduit stubs from each outlet to an accessible ceiling space, conduit sleeves through walls and floors, as indicated on the Drawings and as further described in the Specifications.

1.2 RELATED SECTIONS

- A. Section 26 00 01 – General Provisions
- B. Section 26 05 29 – Supports for Electrical Systems
- C. Section 26 05 33 – Raceway and Boxes
- D. Section 26 27 26 – Wiring Devices

1.3 SUBMITTALS

- A. Submit shop drawings and descriptive data in accordance with Section 26 00 01, Paragraph 1.04 "Submittals" describing all material furnished under Part 2 of this Section of the Specifications.

PART 2 - PRODUCTS

2.1 RACEWAY

- A. Conduit and Outlet Boxes: Refer to Section 26 05 33.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to General Provisions of this Section and the Drawings.
- B. Provide the conduits, boxes and equipment mounting board required for the low voltage systems as indicated on the Drawings and specified herein.
- C. Telephone/Data/TV outlets shall consist of the following:
 - 1. 5" square box with cable management posts. Provide single device mud ring.
 - 2. Blank coverplate.
 - 3. 1" empty EMT conduit stubbed up from box to space above lay-in ceiling (or 10'-0" for areas without ceiling) and capped with insulating type bushing.
- D. Telephone equipment mounting board shall be 4' x 8' x 5/8" plywood board (unless noted otherwise on the Drawings) painted with two (2) coats enamel paint.
- E. Provide a duplex receptacle (on a separate circuit) adjacent to the telephone equipment mounting board.
- F. Provide empty 3" PVC conduit from main telephone backboard to property line except as indicated on the Drawings. Provide routing as indicated on the Drawings.
- G. Provide one (1) #6 AWG conductor in 1/2" PVC conduit from junction box at equipment mounting board to building electrical service grounding point and ground. Provide 15'-0" slack at terminal board.
- H. Provide a pull line in all empty conduits.

END OF SECTION

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SECTION 28 05 28 - LOW VOLTAGE RACEWAY SYSTEM - SECURITY

PART 1 - GENERAL

1.1 SUMMARY

- A. Security: Electrical Contractor is to furnish and install service entrance conduits, conduit stubs from each outlet to an accessible ceiling space, conduit sleeves through walls and floors, as indicated on the Drawings and as further described in the Specifications.

1.2 RELATED SECTIONS

- A. Section 26 00 01 – General Provisions
- B. Section 26 05 29 – Supports for Electrical Systems
- C. Section 26 05 33 – Raceway and Boxes

PART 2 - PRODUCTS

2.1 RACEWAY

- A. Conduit and Outlet Boxes: Refer to Section 26 05 33.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to General Provisions of this Section and the Drawings.
- B. Provide the conduits, boxes and equipment mounting board(s) as indicated on the Drawings and specified herein.
- C. Security outlets shall consist of the following:
 - 1. Two gang box with single device mudring. In masonry wall a two-gang masonry box with two gang plate shall be provided
 - 2. Blank coverplate.
 - 3. 3/4" empty EMT conduit stubbed up from box to space above lay-in ceiling (or 10'-0" for areas without ceiling) and capped with insulating type bushing.
- D. Provide a pull line in all conduits.

END OF SECTION

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SECTION 31 2316 - EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Excavating for building volume below grade, footings, slabs-on-grade, and utilities within the building.
- B. Section 31 2323 - Fill: Fill materials, backfilling, and compacting.
- C. Section 33 4100 - Subdrainage: Filter aggregate and filter fabric for foundation drainage systems.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench mark and intended elevations for the work are as indicated.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities that remain and protect from damage.
- C. Grade top perimeter of excavation to prevent surface water from draining into excavation. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by Architect.

3.03 EXCAVATING

- A. Excavate to accommodate new structures and construction operations.
 - 1. Excavate to the specified elevations.
 - 2. Excavate to the length and width required to safely install, adjust, and remove any forms, bracing, or supports necessary for the installation of the work.
- B. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Provide temporary means and methods, as required, to remove all water from excavations until directed by Architect. Remove and replace soils deemed suitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.04 FILLING AND BACKFILLING

- A. Do not fill or backfill until all debris, water, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from excavation.
- B. See Section 31 2323 for fill, backfill, and compaction requirements at general excavations.

3.05 REPAIR

- A. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31 2323.

3.06 CLEANING

- A. Remove excavated material that is unsuitable for re-use from site.
- B. Remove excess excavated material from site.

3.07 PROTECTION

- A. Divert surface flow from rains or water discharges from the excavation.
- B. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
- C. Protect open excavations from rainfall, runoff, freezing groundwater, or excessive drying so as to maintain foundation subgrade in satisfactory, undisturbed condition.
- D. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
- E. Keep excavations free of standing water and completely free of water during concrete placement.

SECTION 31 2323 - FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Filling, backfilling, and compacting for building volume below grade, footings, slabs-on-grade, paving, and utilities within the building.
- B. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.02 RELATED REQUIREMENTS

- A. Section 31 0519 - Geosynthetics for Earthwork.
- B. Section 31 2316 - Excavation: Removal and handling of soil to be re-used.

1.03 REFERENCE STANDARDS

- A. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2017, with Editorial Revision (2020).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used, including manufactured fill.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where indicated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. Provide soil materials for fill and backfill in gradations and compactions as indicated in the geotechnical report.
- B. Sand- Fill Type Clean Granular Fill: Natural river or bank sand; free of silt, clay, loam, friable or soluble materials, and organic matter.
 - 1. At the final 6" fill below concrete floor slabs and as noted otherwise on the Drawings.
 - 2. Grade in accordance with ASTM D2487 Group Symbol SP, unless noted otherwise in geotechnical report.

2.02 SOURCE QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench marks and intended elevations for the Work are as indicated.
- B. Identify required lines, levels, contours, and datum locations.
- C. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.
- D. Verify structural ability of unsupported walls to support imposed loads by the fill.
- E. Verify areas to be filled are not compromised with surface or ground water.

3.02 PREPARATION

- A. Scarify and proof roll subgrade surface to a depth of 6 inches (150 mm) to identify soft spots.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with controlled density.
- C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

- A. Fill to contours and elevations indicated using unfrozen materials.
- B. Fill up to subgrade elevations unless otherwise indicated.
- C. Employ a placement method that does not disturb or damage other work.
- D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.
- G. Slope grade away from building minimum 2 inches in 10 feet (50 mm in 3 m), unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- H. Correct areas that are over-excavated in accordance with geotechnical report.
- I. Reshape and re-compact fills subjected to vehicular traffic.
- J. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the Architect. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.04 FILL AT SPECIFIC LOCATIONS

- A. Use general fill unless otherwise specified or indicated.
- B. Over Subdrainage Piping at Foundation Perimeter and Under Slabs:
 - 1. Drainage fill and geotextile: Section 31 0519.
 - 2. Cover drainage fill with Pea Gravel.
 - 3. Compact to 95 percent of maximum dry density.

3.05 TOLERANCES

- A. Top Surface of General Filling: Plus or minus 1 inch (25 mm) from required elevations.

3.06 CLEANING

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

SECTION 31 3116 - TERMITE CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Chemical soil treatment.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Termite / vapor barrier placement under concrete slab-on-grade.

1.03 REFERENCE STANDARDS

- A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; 2019.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.
- C. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements.
- D. Test Reports: Indicate regulatory agency approval reports when required.
- E. Certificate of compliance from authority having jurisdiction indicating approval of toxicants.
- F. Manufacturer's Instructions: Indicate caution requirement.
- G. Record and document moisture content of soil before application.
- H. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three (3) years of documented experience.
- I. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing this type of work and:
 - 1. Having minimum of three (3) years documented experience.
 - 2. Approved by manufacturer of treatment materials.
 - 3. Licensed in the State in which the Project is located.

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year installer's warranty against damage to building caused by termites.
 - 1. Include coverage for repairs to building and to contents damaged due to building damage. Repair damage and, if required, re-treat.

PART 2 PRODUCTS

2.01 CHEMICAL SOIL TREATMENT

- A. Toxicant Chemical: EPA Title 7, United States Code, 136 through 136y approved; synthetically color dyed to permit visual identification of treated soil.
- B. Diluent: Recommended by toxicant manufacturer.
- C. Manufacturers:

1. Bayer Environmental Science Corp: www.backedbybayer.com/pest-management/#sle. Bayer Environmental Science Corp: www.backedbybayer.com/pest-management/#sle. Bayer Environmental Science Corp: www.backedbybayer.com/pest-management/#sle.
 2. FMC Professional Solutions: www.fmcprosolutions.com/#sle.
 3. Syngenta Professional Products: www.syngentaprofessionalproducts.com/#sle.
- D. Mixes: Mix toxicant to manufacturer's instructions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.
- B. Verify final grading is complete.

3.02 APPLICATION - CHEMICAL TREATMENT

- A. Comply with requirements of U.S. EPA and applicable state and local codes.
- B. Spray apply toxicant in accordance with manufacturer's instructions.
- C. Apply toxicant at following locations:
 1. Under Slabs-on-Grade.
 2. At Both Sides of Foundation Surface.
 3. Soil Within 10 feet (3 m) of Building Perimeter For a Depth of 2 feet (0.61 m).
- D. Under slabs, apply toxicant immediately prior to installation of vapor barrier.
- E. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.
- F. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.
- G. Re-treat disturbed treated soil with same toxicant as original treatment.
- H. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 PROTECTION

- A. Do not permit soil grading over treated work.
- B. Protect sheet materials from damage after completed installation. Repair damage with manufacturer's recommended products and according to the manufacturer's written instructions.

END OF SECTION