SPECIFICATIONS

Reading Terminal Market Capital Improvements - General Package
51 North 12th Street, Philadelphia, PA 19107

for the

Reading Terminal Market Corporation
51 North 12th Street, Philadelphia, PA 19107

Submitted By:

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Project No. 071274

Dated: 02/03/23

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SECTION 00 01 10
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PROCUREMENT AND CONTRACTING REQUIREMENTS

Part 1 The specification sections noted below are included in this submission of the specification manual. The indicated authors (firms) are listed as follows:

AIA	American Institute of Architects
GF	Gannett Fleming, Inc.
PCCA	Pennsylvania Convention Center
JJS	Joseph Jingoli and Son, Inc.
JM	J+M Engineering, Inc.
VTA	VITETTA, Architects and Engineers, Inc.

DIVISION 00 -- PROCUREMENT AND CONTRACTING REQUIREMENTS

SPECIFICATIONS

DIVISION 01 -- GENERAL REQUIREMENTS

END OF SECTION

SECTION 03 01 00
MAINTENANCE OF CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Repair of exposed structural, shrinkage, and settlement cracks.

B. Resurfacing of concrete slab surfaces having spalled areas and other damage or deterioration in excess of acceptable condition for preparation by fluid-applied finish flooring installer.

C. Area of Work: "Epoxy Floor Area" indicated on Drawing A102.

1.02 RELATED REQUIREMENTS

A. Section 09 67 00 - Fluid-Applied Flooring. Coordinate preparation requirements with work of this Section 03 01 00.

1.03 REFERENCE STANDARDS

A. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

B. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

1.04 SUBMITTALS

A. Product Data: Indicate product standards, physical and chemical characteristics, technical specifications, limitations, maintenance instructions, and general recommendations regarding each material.

B. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

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

B. Installer Qualifications: Company specializing in performing work of the type specified and with minimum of 3 years of documented experience.

1.06 MOCK-UP(S)

A. Test each type of maintenance procedure required on each type of existing construction, to determine the most appropriate procedures to use and as a record of expected results.

B. Crack Injection: Prepare one sample of each type of injection.

C. Horizontal Surface Repair: Total of 10 foot square area, demonstrating each type of repair.

D. Locate mock-up(s) where directed.

E. Re-work mock-up(s) until satisfactory to Design Professional.

F. Satisfactory mock-up(s) may remain as part of the work.

PART 2 PRODUCTS

2.01 CEMENTITIOUS PATCHING AND REPAIR MATERIALS

A. Manufacturers:
   1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
   2. Euclid Chemical Company: www.euclidchemical.com/#sle.
   3. Master Builders Solutions: www.master-builders-solutions.com/en-us/#sle.
   4. W. R. Meadows, Inc: www.wrmeadows.com/#sle.

B. Cementitious Resurfacing Mortar: One- or two-component, factory-mixed, polymer-modified cementitious mortar designed for continuous thin-coat application.
   1. In-place material resistant to freeze/thaw conditions.
   2. Mixed with water or latex type bonding agent in proportions as recommended by manufacturer.

3. Integral corrosion inhibitor.
4. Recommended Thickness: Feather edge to 1/4 inch.
5. Color: Gray.

C. Cementitious Repair Mortar, Trowel Grade: One- or two-component, factory-mixed, polymer-modified cementitious mortar.

2.02 EPOXY PATCHING AND REPAIR MATERIALS

A. Manufacturers:
1. Adhesives Technology Corporation: www.atcepoxy.com/#sle.
2. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
3. Chase Construction Products: www.chasecorp.com/#sle.
4. ChemCo Systems, Inc: www.chemcosystems.com/#sle.
5. Dayton Superior Corporation: www.daytonsuperior.com/#sle.
6. Euclid Chemical Company: www.euclidchemical.com/#sle.
7. Kaufman Products Inc.: www.kaufmanproducts.net/#sle.
8. Pecora: www.pecora.com/#sle.
9. SpecChem, LLC: www.specchemllc.com/#sle.
10. W. R. Meadows, Inc: www.wrmeadows.com/#sle.

B. Epoxy Injection Adhesive:
1. Manufacturers:
a. Euclid Chemical Company; DURAL FAST SET LV: www.euclidchemical.com/#sle.
b. W. R. Meadows, Inc; Rezi-Weld LV, Rezi-Weld LV State, Rezi-Weld (IP), or Rezi-Weld Gel Paste: www.wrmeadows.com/#sle.

C. Epoxy Bonding Adhesive: Non-sag, two-component, 100 percent solids; recommended by manufacturer for purpose and conditions under which used.
1. Non-Load-Bearing Applications: ASTM C881/C881M Type I, II, III, IV, or V, whichever is appropriate to application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Beginning of installation means acceptance of substrate.

3.02 PREPARATION

A. Prepare concrete surfaces to be repaired according to ICRI 310.2R, CSP 4.

3.03 CRACK REPAIR USING EPOXY ADHESIVE INJECTION

A. Repair exposed cracks.

B. Follow epoxy adhesive manufacturer's written installation instructions.

C. Provide temporary entry ports spaced to accomplish movement of fluids between ports; no deeper than the depth of the crack to be filled or port size diameter no greater than the thickness of the crack. Provide temporary seal at concrete surface to prevent leakage of adhesive.

D. Inject adhesive into ports under pressure using equipment appropriate for particular application.

E. Begin injection at lower entry port and continue until adhesive appears in adjacent entry port. Continue from port to port until entire crack is filled.

F. Remove temporary seal and excess adhesive.

G. Clean surfaces adjacent to repair and blend finish.

3.04 CONCRETE SURFACE REPAIR USING CEMENTITIOUS MATERIALS

A. Clean concrete surfaces, cracks, and joints of dirt, laitance, corrosion, and other contamination using method(s) specified above and allow to dry.

B. Follow bonding agent and repair mortar manufacturer's written installation instructions.

C. Apply coating of bonding agent to entire concrete surface to be repaired.

D. Fill voids with cementitious mortar flush with surface.

E. Apply repair mortar by steel trowel to a minimum thickness of 1/4 inch over entire surface, terminating at a vertical change in plane on all sides.

F. Trowel finish to match adjacent concrete surfaces.

G. Damp cure for four days.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items, including:
   1. Steel foreframe assembly for the new overhead rapid-coling door D01.

1.02 RELATED REQUIREMENTS

A. Section 08 23 33.13 - Overhead Rapid Coiling Doors: Design of steel foreframes.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

B. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

C. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

D. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.

E. AWS D1.1/D1.1M - Structural Welding Code - Steel.

F. AWS D1.2/D1.2M - Structural Welding Code - Aluminum.

G. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172.

H. SSPC-SP 2 - Hand Tool Cleaning.

1.04 SUBMITTALS

A. 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.

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

1.05 QUALITY ASSURANCE

A. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M and dated no more than 12 months before start of scheduled welding work.

B. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M, or better.

B. Plates: ASTM A283/A283M.

C. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

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. 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. Foreframe Assembly for Door 01 Overhead Rapid Coiling Door: Details as indicated on architectural drawings and further refined by the overhead rapid coiling door manufacturer and supplier.
   1. Shop Finish: None. Prepare fpr field finishing.

2.04 FINISHES - STEEL

A. Prepare surfaces to be primed in accordance with SSPC-SP2.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

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.
   1. Provide shims and other fillers as necessary between foreframes and existing construction to ensure tolerances are permanently maintained.

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 for field painting.

3.04 TOLERANCES

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

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

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Opening framing (foreframe and replacement trim) for new overhead rapid-coiling Door 02.

B. Preservative treated wood materials.

1.02 RELATED REQUIREMENTS

A. Section 08 23 33.13 - Overhead Rapid Coiling Doors: Design of wood foreframes.

1.03 REFERENCE STANDARDS

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

B. AWPA U1 - Use Category System: User Specification for Treated Wood.

C. PS 20 - American Softwood Lumber Standard.

D. SPIB (GR) - Standard Grading Rules.

1.04 SUBMITTALS

A. Product Data: Provide technical data on wood preservative materials.

1.05 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide 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.
   3. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

2.02 EXPOSED DIMENSION LUMBER

A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).

B. Sizes: Nominal sizes as indicated on drawings.

C. Surfacing: S4S.

D. Moisture Content: Kiln-dry or MC15.

2.03 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.
   2. Anchors: Types as appropriate for substrate to which the lumber is being attached and suitable for permanent bearing of imposed loads..

2.04 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

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

B. Preservative Treatment:
   1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative, Types CCA or MCA preferred over ACQ.
      a. Kiln dry lumber after treatment to maximum moisture content of 15 percent.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate installation of rough carpentry members with overhead rapid-coiling Door 02..

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

3.03 FRAMING INSTALLATION

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

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

C. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by overhead door manufacturer and supplier.

D. Provide shims and other fillers as necessary between foreframe members and existing supporting construction to ensure tolerances are permanently maintained and deformation of the lumber does not occur.

3.04 TOLERANCES

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

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

3.05 CLEANING

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

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

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

END OF SECTION

SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping of through-penetrations where new plumbing, HVAC and electrical utility service lines and ducts are installed through the following interior walls/partitions and elevated floors. Lines may include pipes (insulated or uninsulated), conduits, and cabling.
   1. Provide minimum 2-hour rated firestopping at penetrations through elevated floors that are indicated to be of fire-resistance rating greater than 1 hour.
   2. Provide minimum 1-hour rated firestopping at penetrations through all other elevated floors, both rated and unrated.
   3. Provide minimum 2-hour rated firestopping at penetrations through interior partitions that are indicated to be of fire-resistance rating greater than 1 hour.
   4. Provide minimum 1-hour rated firestopping at penetrations through all other interior partitions, both rated and unrated.

B. Firestopping of existing through-penetrations where existing utilities are abandoned or removed from fire-resistance rated walls/partitions and from existing floors, and where such penetrations are not patched to match the surrounding construction.

C. Prepare a comprehensive Schedule of Firestopping with a proposed firestopping assembly appropriate for each different penetrant and through-penetration condition.
   1. For through-penetration applications where Drawings show a basis-of-design firestopping system, include that system or a proposed equivalent on the Schedule of Firestopping.

1.02 RELATED REQUIREMENTS

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

1.03 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.

B. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems.

C. ITS (DIR) - Directory of Listed Products.

D. FM (AG) - FM Approval Guide.

E. UL (DIR) - Online Certifications Directory.

F. UL (FRD) - Fire Resistance Directory.

1.04 SUBMITTALS

A. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number proposed for use.

B. Product Data: Provide manufacturer's firestopping details corresponding to the proposed designs listed in the Schedule of Firestopping (prior paragraph) and data on product characteristics, performance ratings, and limitations.

C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

D. Manufacturer's qualification statement.

E. Installer's qualification statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company or personnel specializing in performing the work of this section and:
   1. Trained by manufacturer.
   2. Verification of minimum two years documented experience installing work of this type.

1.06 FIELD CONDITIONS

A. Field verify construction and materials used for existing interior partition and elevated floor assemblies. Include on Schedule of Firestopping.

B. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

C. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Firestopping Manufacturers:
   1. 3M Fire Protection Products: www.3m.com/firestop.
   2. Rectorseal, a CSW Industrials Company: www.metacaulk.com/#sle.
   3. Hilti, Inc: www.us.hilti.com/#sle.
   4. Nelson FireStop Products: www.nelsonfirestop.com.

2.02 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to or greater than the fire rating of penetrated assembly.
   1. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by Owner's designated representative and authorities having jurisdiction.

3.04 FIELD QUALITY CONTROL

A. Special Inspection Agency: Inspection agency employed and paid by Owner will examine penetration firestopping in accordance with ASTM E2174.

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

3.05 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 92 00
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 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.

1.03 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

C. ASTM C1193 - Standard Guide for Use of Joint Sealants.

D. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants.

E. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.

F. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.

G. SWRI (VAL) - SWR Institute Validated Products Directory.

1.04 SUBMITTALS

A. 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.
   5. Substrates for which use of primer is required.
   6. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
   7. Sample product warranty.
   8. Certification by manufacturer indicating that product complies with specification requirements.
   9. SWRI Validation: Provide currently available sealant product validations as listed by SWRI (VAL) for specified sealants.
   10. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
   11. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

B. Field Quality Control Plan: Submit at least two weeks prior to start of installation.

C. Field Quality Control Log: Submit filled-out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

D. Executed warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

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

D. Field Quality Control Plan:
   1. Visual inspection of entire length of sealant joints.
   2. Nondestructive field adhesion testing of sealant joints, except interior acrylic latex sealants.
      a. For each different sealant and substrate combination, allow for one test every 12 inches in the first 10 linear feet of joint and one test every 24 inches thereafter.
      b. If any failures occur in the first 10 linear feet, continue testing at 12 inches intervals at no extra cost to Owner.
   3. Field testing agency's qualifications.
   4. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.

E. Field Adhesion Test Procedures:
   1. Allow sealants to fully cure as recommended by manufacturer before testing.
   2. Have a copy of the test method document available during tests.
   3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
   4. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Design Professional.

F. Nondestructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Nondestructive Spot Method.
   1. Record results on Field Quality Control Log.

1.06 WARRANTY

A. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Exterior Joints: Seal open exterior joints at the following locations, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed.
      a. Joints between new overhead rapid-coiling door assemblies (Doors 01 & 02) and the steel or wood foreframe assemblies.
      b. Joints between the steel or wood foreframe assemblies of the new overhead doors and the underlying construction.
      c. Joints between new and existing wood trim in the opening of Door 02.
      d. Joints between new fiberglass door frame (Door B001) and the adjoining cement plaster casing beads and concrete sill.
      e. Perimieter joints between new louver and surrounding wall.
      f. Other exterior joints indicated.
   2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include the following items.

a. Joints between new overhead rapid-coiling door assemblies (Doors 01 & 02) and the steel or wood foreframe assemblies.
b. Joints between the steel or wood foreframe assemblies of the new overhead doors and the underlying construction.
c. Joints between new fiberglass door frame (Door B001) and the adjoining concrete masonry and concrete sill.
d. Isolation joints in the floor areas to receive new epoxy flooring, including joints where the floor meets the walls; around permanent fixtures, floor drains, and cleanouts; and existing expansion joints between sections of floor slab.
e. Other interior joints indicated.

B. Exterior Joints: Use nonsag nonstaining silicone sealant, unless otherwise indicated.

C. Interior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.
1. Floor Joints: Self-leveling polyurethane traffic-grade sealant.

2.02 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products with acceptable levels of volatile organic compound (VOC) content; see Section 01 61 16.

2.03 NONSAG JOINT SEALANTS

A. Nonstaining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
5. Color: To be selected by Design Professional from manufacturer's standard range.
6. Cure Type: Single-component, neutral moisture curing.
7. Service Temperature Range: Minus 20 to 180 degrees F.
8. Products:
a. Dow; DOWSIL 756 SMS Building Sealant: www.dow.com/#sle.
b. Momentive Performance Materials, Inc/GE Silicones; SCS9000 SilPruf NB - Non-Staining Silicone Weatherproofing Sealant: www.siliconeforbuilding.com/#sle.
c. Pecora Corporation; Pecora 864 NST (Non-Staining Technology): www.pecora.com/#sle.
d. Sika Corporation; Sikasil WS-295: www.usa.sika.com/#sle.
e. Tremco Commercial Sealants & Waterproofing; Spectrem 3: www.tremcosealants.com/#sle.
f. Or approved equal.

B. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
3. Color: As selected.
4. Service Temperature Range: Minus 40 to 180 degrees F.
5. Products:
a. Pecora Corporation; DynaTrol II: www.pecora.com/#sle.
b. Sherwin-Williams Company; Stampede-1/-TX Polyurethane Sealant: www.sherwin-williams.com/#sle.
c. Sika Corporation; Sikaflex-15 LM: www.usa.sika.com/#sle.
d. Or approved equal.

2.04 SELF-LEVELING JOINT SEALANTS

A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure; not expected to withstand

continuous water immersion .

1. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
2. Color: Color as selected.
3. Service Temperature Range: Minus 40 to 180 degrees F.
4. Products:
    a. Pecora Corporation; Urexpan NR200: www.pecora.com/#sle.
    b. Sherwin-Williams Company; Stampede 1SL Polyurethane Sealant: www.sherwin-williams.com/#sle.
    c. Sika Corporation; Sikaflex-1c SL: www.usa.sika.com/#sle.
    d. Or approved equal.

2.05 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
    1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
    2. 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.

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 the following, unless otherwise indicated:
    1. Width/depth ratio of 2:1.
    2. Neck dimension no greater than 1/3 of the joint width.
    3. Surface bond area on each side not less than 75 percent of joint width.

D. Install bond breaker backing tape where backer rod cannot be used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 FIELD QUALITY CONTROL

A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

B. Non-Destructive Adhesion Testing: If there are any failures in first 100 linear feet, notify Design Professional immediately.

C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

END OF SECTION

SECTION 079200.01 - EXTERIOR JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY - Exterior Doors & Storefront

A. Section Includes:

1. Nonstaining silicone joint sealants.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Joint sealants.
2. Joint-sealant backing materials.

B. Samples for Initial Selection: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.3 INFORMATIONAL SUBMITTALS

A. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

B. Field Quality-Control Reports: For field-adhesion-test reports, for each sealant application tested.

C. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Manufacturers' special warranties.

B. Installer's special warranties.

1.5 QUALITY ASSURANCE

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

B. Testing Agency Qualifications: Qualified in accordance with ASTM C1021 to conduct the testing indicated.

1.6 MOCKUPS

A. Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
3. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with masonry substrates.
4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each kind of sealant and joint substrate.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.

    a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.8 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.9 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

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

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

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

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain joint sealants from single manufacturer for each sealant type.

2.2 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested in accordance with ASTM C1248.

B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

1. Basis of Design – DowSil 795 Silicone Building sealant, a one-part medium modulus, neutral curing silicone sealant.

2.4 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Material acceptable to sealant manufacturer.

C. Cylindrical Sealant Backings: ASTM C1330, Type C, closed-cell material with a surface skin as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.5 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.

a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

a. Extent of Testing: Test completed and cured sealant joints as follows:

1) Perform 5 tests for each kind of sealant and joint substrate.

b. Test Method: Test joint sealants in accordance with Method A, Tail Procedure, in ASTM C1521.

1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

c. Inspect tested joints and report on the following:

1) Whether sealants filled joint cavities and are free of voids.
2) Whether sealant dimensions and configurations comply with specified requirements.
3) Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

d. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
e. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

2. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

C. Prepare test and inspection reports.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079200.01

SECTION 08 16 13
FIBERGLASS DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiberglass door.

B. Fiberglass door frames.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Perimeter joint sealant at door openings.

B. Section 08 71 00 - Door Hardware.

1.03 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.

B. ASTM D570 - Standard Test Method for Water Absorption of Plastics.

C. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

D. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.

E. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics.

F. ASTM D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between - 30 C and 30 C with a Vitreous Silica Dilatometer.

G. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

H. ASTM D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

I. ASTM D1761 - Standard Test Methods for Mechanical Fasteners in Wood and Wood-Based Materials.

J. ASTM D2344/D2344M - Standard Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates.

K. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.

L. ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

M. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

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

O. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

P. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

Q. NFRC 100 - Procedure for Determining Fenestration Product U-factors.

R. NFRC 400 - Procedure for Determining Fenestration Product Air Leakage.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Obtain hardware templates from hardware manufacturer prior to starting fabrication.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard door and frame technical data sheets and construction details. Include descriptions of materials, components, finishes, construction, fabrication, installation instructions, and anchor recommendations. Indicate test data results demonstrating doors comply with specified performance requirements.

B. Shop Drawings: Indicate layout and profiles; include assembly methods.
   1. Indicate product components, including hardware reinforcement locations and preparations, accessories, finish colors, patterns, and textures.
   2. Indicate tolerances, wall conditions, door and frame elevations, sections, dimensions and details of openings, materials, thicknesses, finishes, and location of door hardware by dimension; use same reference numbers indicated on drawings to identify details and openings.
   3. Identify factory, shop, and field assembly work.

C. Selection Samples: Submit two complete sets of color chips, illustrating manufacturer's available finishes and colors for the specified texture.

D. Door Corner Sample: Submit corner cross sections, 10 inches by 10 inches in size, illustrating construction, finish, color, and texture.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

G. Maintenance Data: Include instructions for maintenance and cleaning of doors and frames, including repair of minor scratches and damage.

H. Warranties: Submit manufacturer warranties and ensure that forms have been completed in Owner's name and registered with manufacturer; include detailed terms of warranty.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than ten years of documented and successful experience.
   1. Evidence of a documented complaint resolution quality management system.

B. Source of Materials: Door and frame components from the same manufacturer.

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

1.07 DELIVERY, STORAGE, AND HANDLING

A. Mark doors with door opening mark number, door type, color, and weight.

B. Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

C. Store materials in original packaging, under cover, protected from exposure to harmful weather conditions and from direct contact with water.
   1. Store at temperature and humidity conditions recommended by manufacturer.
   2. Do not use non-vented plastic or canvas shelters.
   3. Immediately remove wet wrappers.

D. Store in position recommended by manufacturer, elevated minimum 4 inches above grade, with minimum 1/4 inch space between doors.

1.08 FIELD CONDITIONS

A. Maintain temperature and humidity at manufacturer's recommended levels during and after installation of doors.

1.09 WARRANTY

A. Provide ten (10) year manufacturer warranty covering materials and workmanship of doors and frames, including excessive deflection and deterioration of finish or construction in excess of normal weathering.

B. Provide limited lifetime manufacturer warranty covering failure of corner joinery, core deterioration, and delamination or bubbling of door skin and corrosion of all-fiberglass products while the door is in its specified application in its original installation.

C. Provide three (3) year manufacturer warranty covering failure of factory-painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Pultruded Fiberglass Reinforced Plastic (FRP) Door Framing:
   1. Special-Lite, Inc; AF 150 Framing: www.special-lite.com/#sle.

B. Fiberglass Composite Doors:
   1. Special-Lite, Inc; AF-200: www.special-lite.com/#sle.

2.02 DOOR AND FRAME ASSEMBLIES

A. Door and Frame Assemblies: Factory-fabricated, prepared and machined for hardware.
   1. Operation: Manual.
   2. Screw-Holding Capacity: Tested to 890 pounds, minimum.
   3. Surface Burning Characteristics: Flame spread index (FSI) of 76 to 200, Class C, or better, and smoke developed index (SDI) of 450 or less, when tested in accordance with ASTM E84.
   4. Flammability: Self-extinguishing when tested in accordance with ASTM D635.
   5. Sizes: As indicated on drawings.
   6. Clearance Between Door and Frame: 1/8 inch, maximum.
   7. Clearance Between Bottom of Door and Finished Floor: 3/4 inch, maximum; not less than 1/4 inch clearance to threshold.
   8. Provide frame anchors that allow for variation in rough opening size; field cutting of doors or frames to fit is not permitted.

2.03 COMPONENTS

A. Doors: Fiberglass construction with reinforced core.
   1. Type: As indicated on drawings, including swinging doors.
   2. Thickness: 1-3/4 inch, nominal.
   3. Core Material: Expanded polystyrene foam (EPS), 2.0 pcf, mildew and rot resistant, sound and vibration dampening.
   4. Construction:
      a. Fiberglass face sheets, 0.090 inch thick, laminated to core; factory painted.
         1) Flame treat face sheets to promote durable, long lasting bond.
         2) Adhere face sheets to stiles, rails, and core using hot melt adhesive evenly coated across all surfaces to produce strong bond and prevent moisture absorption.
      b. Miter corners and secure with pultruded fiberglass corner clip chemically welded to stiles and rails. Mechanical fasteners to secure corner joints not acceptable.
   5. Face Sheet Texture: Smooth.
   6. Door Panel Configuration: Flush door.
   7. Subframe and Reinforcements: Pultruded fiberglass stiles and rails with integral channels for securing corner reinforcing clips.
   8. Waterproof Integrity: Provide factory fabricated edges and hardware preparations of fiberglass reinforced plastic (FRP); with joints and cutouts sealed.
   9. Hardware Preparations: Factory reinforce, machine, and prepare for door hardware including field installed items; provide solid blocking for each item; field cutting, drilling or tapping is not permitted; obtain manufacturer's hardware templates for preparation as necessary.
      a. Reinforcements: Solid high-density polyurethane shapes chemically welded to stiles, rails and/ or core. No metallic reinforcements.

B. Door Frames: Provide type in compliance with performance requirements specified for doors.
   1. Type: Knock-down type for field assembly.

2. Profiles: 5-3/4 inches deep, 2 inches wide at jambs, and 4 inches wide at headers.
3. Door Stop: 5/8 inch wide, by 2 inches deep.
4. Non-Fire-Rated:
   a. 1/4-inch thick fiberglass pultrusions with factory-painted finish.
5. Corner Joints: Mitered with concealed corner blocks or angles of same material as frame; joined with stainless steel screws; sealed watertight with silicone sealant.
6. Factory-Prepared Hardware Cut-outs: Provide continuous backing or mortar guards of same material as frame, with watertight seal.
7. Frame Anchors: Existing opening type, expansion anchors for masonry wall; stainless steel, Type 304 or 410; provide three anchors in each jamb for heights up to 84 inches with one additional anchor for each additional 24 inches in height.
8. Reinforcing: Provide manufacturer's standard reinforcing at hinge, strike, and closer locations.

2.04 PERFORMANCE REQUIREMENTS

A. Provide door assemblies that have been designed and fabricated in compliance with specified performance requirements.

B. Structural Performance: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E330/E330M, using 10 second duration of maximum load.

C. Thermal Transmittance: NFRC 100
   1. U-Factor 0.24 Btu/hr·ft²·deg F.

D. Air Leakage: NFRC 400, ASTM E283/E283M
   1. 0.02 cfm/sq ft 1.57 psf.
   2. 0.06 cfm/sq ft 6.24 psf.

E. Acoustical Performance: Sound Transmission Class (STC) of 30, minimum, when tested in accordance with ASTM E90.

F. Fiberglass Reinforced Plastic (FRP) Face Sheet Properties:
   1. Izod Impact Resistance: ASTM D256, 5 foot-pound force per inch of width, minimum, with notched izod.
   2. Tensile Strength at Break: ASTM D638, 6,000 psi, minimum.
   3. Tensile Modulus: ASTM D638, 0.4 x 10^6 psi.
   4. Water Absorption: ASTM D570, 0.16 percent, maximum, after 24 hours at 77 degrees F.
   5. Flexural Strength: ASTM D790, 14,000 psi, minimum.
   6. Flexural Modulus: ASTM D790, 0.4 x 10^6 psi.
   7. Barcol Hardness: ASTM D2583, minimum of 35 units.

G. Stiles and Rails: Fastener Withdrawal, ASTM D1761, 894 lbs. minimum.

H. Framing Properties:
   1. Tensile Strength at Break: ASTM D638, 15,900 psi, minimum.
   2. Tensile Modulus of Elasticity: ASTM D638, 1.58 x 10^6 psi.
   3. Maximum Compressive Strength: ASTM D695, 15,500 psi.
   4. Compressive Modulus of Elasticity: ASTM-D695, 6.7 x 10^5 psi.
   5. Flexural Strength: ASTM D790, 39,300 psi, minimum.
   6. Flexural Modulus: ASTM D790, 1.23 x 10^6 psi.
   7. Barcol Hardness: ASTM D2583, minimum of [57] units.
   8. Izod Impact: ASTM D256, 8.1 ft-lb/in.
   9. Specific Gravity: ASTM D792, 1.45 23 deg C.
   10. Density: ASTM D792, 1445.6 kg/m^3 23 deg C.
   11. Coefficient of Linear Expansion: ASTM D696, 1.26 x 10^{-5} in/in/deg F
   12. Short Beam Strength: ASTM D2344/D2344M, 3,980 psi.
   13. Fastener Withdrawal: ASTM D1761, 924 lbs.
   14. Percent Fiberglass: 60 .

2.05 FABRICATION

A. Complete factory cutting, fitting, forming, drilling, and grinding of metal before assembly.

B. Cut edges to be free of burs.

C. Maintain continuity of line and accurate relation of planes and angles.

D. Secure attachments and support at mechanical joints with hairline fit at contact surfaces.

E. Shop fabrication to be completed in accordance with manufactures process work instructions.

F. Quality control to be performed before leaving each department.

2.06 FINISHES

A. Painted: Two-part aliphatic polyurethane, low VOC, high solids, high build industrial coating.
   1. Thickness: Minimum 5 mils, 0.005 inch wet thickness.
   2. Color: As selected by Design Professional from manufacturer's standard line of colors.
   3. Impact Resistance, ASTM D2794: 140 in□lbs (direct), 50 in□lbs (reverse) 5 mils thickness.
   4. Taber Abrasion, 1 kg load, 1000 cycles, CS-17 wheel: 60.2 mg.
   5. Graffiti cleaning with Amerase with gloss retention: 100 cycles.
   6. Chemical Resistance: Excellent.
      a. Acidic.
      b. Alkaline.
      c. Salt Solutions.
      d. Seawater.
      e. Fresh Water.
      f. Petroleum Products.

2.07 HARDWARE

A. Door Hardware: See Section 08 71 00.

2.08 ACCESSORIES

A. Fasteners: Type 304 or 410 stainless steel, compatible with items being fastened.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify actual dimensions and other pertinent conditions of openings by field measurements before door and frame fabrication; show recorded measurements on shop drawings.

B. Do not begin installation until substrates have been properly prepared.

C. Notify Design Professional of unsatisfactory conditions before proceeding.

3.02 PREPARATION

A. Remove existing door, frame, and hardware, and dispose of all removed materials in accordance with local authorities having jurisdiction.
   1. Coordinate Door B01 work with partial removal and replair of adjacent exterior cement plaster finish.
   2. Remove existing perimeter joint sealants. Coordinate with Section 07 92 00.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Clean and prepare substrate in accordance with manufacturer's directions.

D. Protect adjacent work and finish surfaces from damage during installation.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions; do not penetrate frames with anchors.

B. Coordinate installation of door hardware with Section 08 71 00.

C. Set units plumb, level, and true-to-line, without warping or racking doors, and with specified clearances; anchor in place.

D. Install exterior doors to be weathertight in closed position.

E. Set thresholds in continuous bed of sealant.

F. In existing masonry wall opening, provide blocking subframe members and anchor frame with expansion anchors or similar anchor type approved by Architect.

G. Separate aluminum and other metal surfaces from sources of corrosion of electrolytic action at points of contact with other materials.

H. Repair or replace damaged installed products.
   1. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
   2. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's representative shall provide technical assistance and guidance for installation of doors.

3.05 ADJUSTING

A. Lubricate, test, and adjust doors to operate easily, free from warp, twist or distortion, and to fit watertight for entire perimeter.

B. Adjust hardware for smooth and quiet operation.

C. Adjust doors to fit snugly and close without sticking or binding.

3.06 CLEANING

A. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance.

B. Do not use harsh cleaning materials or methods that would damage finish.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion or final acceptance by Owner and Architect of fiberglass door work, whichever occurs first.

END OF SECTION

SECTION 08 33 23.13
OVERHEAD RAPID COILING DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Overhead high-speed coiling doors, operating hardware.

B. Wiring from electric circuit disconnect to operators to control stations.

C. Design of foreframe assemblies and their anchorages.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Steel foreframe materials and fabrication.

B. Section 06 10 00 - Rough Carpentry: Wood foreframe materials.

C. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

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.

B. DASMA 402 - Specification for High Performance Doors and Grilles.

C. DASMA 403 - Specification for High Speed Doors and Grilles.

D. ITS (DIR) - Directory of Listed Products.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

F. NEMA MG 1 - Motors and Generators.

G. NFPA 70 - National Electrical Code.

H. UL (DIR) - Online Certifications Directory.

I. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.04 SUBMITTALS

A. Product Data: Provide general construction, electrical equipment, and component connections and details.

B. Shop Drawings: Indicate pertinent dimensioning, anchorage design and methods, hardware locations, and installation details. Show steel and wood foreframe details, including wood trim replacement for Door 02.

C. Samples for Color Selection: Two sets of fabric curtain color samples, 6 by 3 inches minimum in size indicating available colors and finish textures.

D. Manufacturer's Installation Instructions: Indicate installation sequence and procedure details, and adjustment and alignment instructions.

E. Installer's qualification statement.

F. Maintenance Data: Indicate lubrication requirements and frequency, periodic adjustments required, and inspections.

G. Specimen warranties.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

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

C. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for purpose specified.

1.06 FIELD CONDITIONS

A. Existing Conditions: Field verify pertinent dimensions and conditions of each opening, including potential obstructions. Coordinate with new overhead door assemblies.

1.07 WARRANTY

A. Manufacturer Warranty: Provide five-year manufacturer warranty for three-ply multifilament polyester fabric curtain. Complete forms in Owner's name and register with manufacturer.

B. Manufacturer Warranty: Provide five-year manufacturer warranty for motor and gearbox. Complete forms in Owner's name and register with manufacturer.

C. Manufacturer Warranty: Provide two-year manufacturer warranty for other mechanical and electrical components. Complete forms in Owner's name and register with manufacturer.

D. Manufacturer Warranty: Provide lifetime manufacturer warranty for counterweights and tension springs. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Overhead Rapid Coiling Fabric Doors:
   1. Basis of Design: Dynaco; Model M2 Power: www.dynacodoor.us.
      a. Dealer: Just-Rite Equipment (formerly Overhead Door Company of Philadelphia), Bensalem, PA; telephone 215-352-4805; www.justriteequip.com.

2.02 DESIGN AND PERFORMANCE REQUIREMENTS

A. Adapt door assemblies to the physical limitations of the existing openings and the surrounding building features, HVAC systems, and plumbing systems without modification thereof other than as indicated. Conflicting existing air curtain heaters, wood guide rails, and electrical conduits, wiring, and devices are to be removed or relocated as indicated.

B. Performance Standards: DASMA 402 and DASMA 403 requirements for high performance doors.

C. Durability: Design doors to operate at a minimum of 300,000 cycles when properly selected, installed, operated, and maintained.

D. Rapid Coiling Doors Operation-Cycles Per Day Requirements: Minimum of 50, averaged on a yearly basis.

E. Wind Pressure Resistance: Minimum 21 psf.

2.03 RAPID COILING DOORS

A. Non-Fire-Rated Exterior High-Speed Coiling Fabric Doors: Reinforced, puncture-resistant, polymer-impregnated monofilament polyester curtain.
   1. Door Opening Speed: Variable, adjustable, up to 50 inches per second.
   2. Door Closing Speed: 30 inches per second.
   3. Flexibility: Provide curtain that is stiff in the horizontal direction and flexible in the vertical direction.
   4. Fabric Color: As selected by Architect from manufacturers standard colors.
   5. Side Frames: Reinforced side frames with structural galvanized steel outer guides, polyethylene inner guides and front and rear full-height weather seals. Provide factory-installed monitored light curtain sensor array.
   6. Side Frame Covers, Formed Sheet Metal: Galvanized steel.
   7. Hood: Provide accessible galvanized steel enclosure for each configuration; verify clearance is satisfactory for access and removal.
      a. For Door 01: Utilize Manufacturer's "Reduced Lintel Option" with hood configuration that has a smaller vertical dimension and greater horizontal projection from wall, to ensure adequate installation and operational clearance from existing duct.
      b. For Door 02: Manufacturer's standard hood configuration.
   8. Electric operation.
   9. Mounting: Surface mounted to inside face of wall at existing exterior coiling door opening.

2.04 COMPONENTS

A. Fabric Curtain Construction: Manufacturer's standard fabric for door type and model selected.
   1. Continuous Design: Curtain comprised of a single length of fabric.
   2. Soft Curtain Bottom for Fabric Curtains: Soft edge without hard, rigid, or stiff parts; designed to initially dislodge curtain from the tracks when an obstruction encountered in the vertical closing path exerts force of 12 pounds-force or more.
      a. Manufacturer's standard leading-edge bottom seal, replaceable without need for welding or tools.
   3. Weatherstripping for Exterior Doors: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.

B. Coiling Door Guide Construction: Continuous sheet metal, of profile to retain door in place with snap-on trim, mounting brackets of same metal.
   1. Galvanized Steel Sheet Guides: Minimum G90 coating, in compliance with ASTM A653/A653M.

C. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.

D. Fabric Tensioning System: Manufacturer's standard.

2.05 ELECTRIC OPERATION

A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
   1. Provide interlock switches on motor operated units.

B. Electric Operators: UL listed.
   1. Usage Classification: Heavy duty, rated up to 60 cycles per hour under constant load.
   2. Mounting: Side mounted.
   3. Motor Enclosure:
      a. Interior Coiling Doors: NEMA MG 1, Type 1; open drip proof.
   4. Motor Rating: 1 HP; continuous duty.
   5. Motor Voltage: 120 volts, single phase, 60 Hz.
   6. Variable-Frequency Motor Controller: Manufacturer's standard, complying with NEMA ICS, providing for soft start and stop.
   7. Controller Enclosure: NEMA 250, Type 4.
   8. Opening Speed: As indicated above in paragraph 2.03A.
      a. Provide independently controlled opening and closing speeds.
   9. Brake: Manufacturer's standard type, activated by motor controller.
   10. Manual override in case of power failure, utilizing wrench-operated mechanism built into operator.
   11. See Division 26 for electrical connections.

C. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated; enclose terminal lugs in terminal box sized to comply with NFPA 70.

D. Controls: Comply with UL 325. Same control set-up for both doors.
   1. Actuation Devices From Inside and Outside:
      a. Provide overhead-mounted proximity or motion sensors, one each side of door, with adjustable range, suitable for sensing forklifts and people.
   2. Provide programmable Inputs and Outputs in motor controller: Design to accommodate special control applications such as traffic lights, horns, actuation devices, timing sequences, and others.
      a. Include adjustable timer to close door after set period of time.
      b. Include adjustable programming for hours when door operates "automatically" and manual on-off override switch.
   3. Display Type: Self-diagnostic scrolling two-line fluorescent.
   4. Door Travel Limit Regulation: Self adjusting, not requiring use of tools.
   5. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.

a. Primary Protection Device: Provide monitored light curtain sensor array to sense obstructions in the opening while door is open or partially open.
b. Secondary Protection Device: Provide electric sensing edge with wireless edge kit along with continuous-constant control device.

E. Fabric Curtain Safety Edge: Located at bottom of curtain, full width, electro-mechanical sensitized type, with internal wireless transmitter signaling controller to stop and reverse door direction upon striking object.

2.06 ACCESSORIES

A. Foreframes:
1. Coordinate and oversee design and installation of steel and wood foreframes. See Section 05 50 00 - Metal Fabrications and 06 10 00 - Rough Carpentry for material requirements. See drawings for design intent.
2. Ensure connections are of appropriate type and strength and permanently secure to the indicated existing substrate construction.

B. Anchors: Use hot-dipped-galvanized or stainless steel anchors for attaching treated wood foreframe members to the existing structural substrates and for securing the overhead door guides and header assembly to the treated wood foreframe members.

C. Suitable permanent filler and weather closure materials at perimeter joints of foreframes, between foreframes and existing walls and between overhead door assemblies and foreframes.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION

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

B. Use anchorage devices to securely fasten assembly to foreframes, wall construction and building structure 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.

G. Install enclosure and perimeter trim.

3.03 TESTING AND ADJUSTING

A. Test operational modes of each door to ensure proper functions, including safety features.

B. Adjust operating assemblies for smooth and noiseless operation.

3.04 DEMONSTRATION AND TRAINING

A. Demonstrate full operational capabilities of doors to Owner-selected personnel, including adjustable controls and other features. Train Owner personnel in use and maintenance.

3.05 CLEANING

A. Clean installed components.

B. Remove unnecessary labels and visible markings.

END OF SECTION

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY - Exterior Doors & Storefront

A. Section Includes:

1. Aluminum-framed storefront systems.
2. Aluminum-framed entrance door systems.

B. Related Requirements:

1. Section 087111 "Door Hardware" for door hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
   a. Joinery, including concealed welds.
   b. Anchorage.
   c. Expansion provisions.
   d. Glazing.
   e. Flashing and drainage.
3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
4. Include point-to-point wiring diagrams showing the following:
   a. Power requirements for each electrically operated door hardware.
   b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:
1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For aluminum-framed entrances and storefronts.

B. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront. Include ASTM C1401 recommendations for post-installation-phase quality-control program.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Installers: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and that employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.

2. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

3. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.5 WARRANTY

A. Special Warranty: Manufacturer and/or Installer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures, including, but not limited to, excessive deflection.
      b. Noise or vibration created by wind and thermal and structural movements.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d. Water penetration through fixed glazing and framing areas.
      e. Failure of operating components.

   2. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
   b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: Five years from date of Substantial Completion.

C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
   1. Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Delta E units when tested in accordance with ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D 4214.
   c. Cracking, peeling, or chipping.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing, doors, sidelights, transoms, windows, spandrel panels and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

   a. Thermal stresses transferring to building structure.
   b. Glass breakage.
   c. Noise or vibration created by wind and thermal and structural movements.
   d. Loosening or weakening of fasteners, attachments, and other components.
   e. Failure of operating units.

B. Structural Loads

1. Wind Loads: Provide aluminum framed entrance on the door systems capable of withstanding wind load design pressures 100psf inward and 60 lbs psf outward. The design pressures are based on the 2018 IBC.

C. Deflection of Framing Members Supporting Glass: At design wind load, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m)].
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm).

D. Structural: Test in accordance with ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding [0.2] percent of span.
3. Test Durations: As required by design wind velocity, but not less than [10] seconds.

E. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft. (480 Pa).

F. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7 .

1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.6 at design displacement and 1.5 times the design displacement.

G. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor):

a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.57 Btu/sq. ft. x h x deg F (3.23 W/sq. m x K) as determined in accordance with NFRC 100.
b. Entrance Doors: U-factor of not more than 0.77 Btu/sq. ft. x h x deg F (4.37 W/sq. m x K) as determined in accordance with NFRC 100.

2. Air Leakage:

a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than [0.06 cfm/sq. ft. (0.30 L/s per sq. m)] at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa) when tested in accordance with ASTM E283.
b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. (5.08 L/s per sq. m) a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).

3. Condensation Resistance Factor (CRF):

a. Fixed Glazing and Framing Areas: CRF for the system of not less than 55 as determined in accordance with AAMA 1503.
b. Entrance Doors: CRF of not less than 57 as determined in accordance with AAMA 1503.

H. Blast Resistance:

1. Hazard Rating: Moderate Hazard in accordance with ASTM F2912, tested in accordance with ASTM F1642/F1642M.

I. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone [1] for basic protection.

1. Large-Missile Test: For glazing located within 30 feet (9.1 m)] of grade.

J. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

K. Structural-Sealant Joints:

1. Designed to carry gravity loads of glazing.

2.3 STOREFRONT SYSTEMS

A. Basis of Design is Kawneer 350 Heavy wall Swing Door medium stile modified, 3½ inch vertical face at sides and horizontal face at the head, paneline with exit device and 10 inch horizontal base, 1 ¾ to 2 inch medium depth, 3/16inch wall thickness for high traffic applications. The depth of the door will need to match the existing at the locations where the frames are to be maintained.

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: Thermally improved.
2. Glazing System: Retained mechanically with gaskets on two sides and structural sealant on two sides.
3. Glazing Plane: Front.
4. Finish: Superior-performance organic finish.
5. Fabrication Method: Field-fabricated stick system.
6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
7. Steel Reinforcement: As required by manufacturer or as shown in details.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Insulated Spandrel Panels:
1. Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.

a. Overall Panel Thickness:[1 inch (25.4 mm).

b. Exterior Skin: Aluminum.

1) Thickness: Manufacturer's standard for finish and texture indicated.
2) Finish: Match framing system.
3) Texture: Smooth.
4) Backing Sheet: 1/8-inch- (3.2-mm-) thick tempered hardboard.

c. Interior Skin: Aluminum.

1) Thickness: Manufacturer's standard for finish and texture indicated.
2) Finish: Matching storefront framing.
3) Texture: Smooth.
4) Backing Sheet: [1/8-inch- (3.2-mm-) thick tempered hardboard.

d. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1) Flame-Spread Index: 25 or less.
2) Smoke-Developed Index: 50 or less.

2.4 ENTRANCE DOOR SYSTEMS

A. Basis of Design is Kawneer 350 Heavy wall Swing Door medium stile modified, 3½ inch vertical face at sides and horizontal face at the head, paneline with exit device and 10 inch horizontal base, 1 ¾ , 3/16 inch wall thickness for high traffic applications.

B. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.

1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
2. Door Design: Medium stile; 3-1/2-inch (88.9-mm) nominal width.
3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

a. Provide nonremovable glazing stops on outside of door.

4. Finish: Match adjacent storefront framing finish.

2.5 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087111 "Door Hardware (Descriptive Specification) Section 087112 Power Door Operators.

B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door, to comply with requirements in this Section.

1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
3. Opening-Force Requirements:

a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N) to set the door in motion and not more than 15 lbf (67 N) to open the door to its minimum required width.
b. Accessible Doors: Not more than 5 lbf (22.2 N) to fully open door.

C. Designations: Requirements for design, grade, function, finish, quantity, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:

D. Pivot Hinges: BHMA A156.4, Grade 1.

E. Butt Hinges: BHMA A156.1, Grade 1, radius corner.

1. Nonremovable Pins: Provide setscrew in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.
2. Exterior Hinges: Stainless steel, with stainless steel pin.
3. Quantities:

a. For doors up to [87 inches (2210 mm)] high, provide four hinges per leaf.

F. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.

G. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.

H. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing in accordance with UL 305.

I. Cylinders:
1. As specified in Section 087111 "Door Hardware (Descriptive Specification)." BHMA A156.5, Grade 1.
a. Keying: Master key system. Permanently inscribe each key with a visual key control number and include notation "DO NOT DUPLICATE".

J. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

K. Operating Trim: BHMA A156.6.

L. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.

M. Concealed Overhead Holders and Stops: BHMA A156.8, Grade 1.

N. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

O. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.

2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

P. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

Q. Thresholds: BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch (12.7 mm).

2.6 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer. Comply with Section 088000 "Glazing."

D. Structural Glazing Sealants: ASTM C1184 chemically curing silicone formulation that is compatible with system components with which it comes in contact; specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in storefront system indicated.

1. Color: As selected by Architect from manufacturer's full range of colors.

E. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.

1. Color: Match structural sealant.

2.7 MATERIALS

A. Sheet and Plate: ASTM B209 (ASTM B209M).

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221 (ASTM B221M).

C. Structural Profiles: ASTM B308/B308M.

D. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.8 ACCESSORIES

A. Automatic Door Operators: Section 087113 "Power Door Operators.

B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system, fabricated from 300 series stainless steel.

C. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.

D. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials

E. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.9 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

F. Storefront Framing: Fabricate components for assembly using head-and-sill-receptor system with shear blocks at intermediate horizontal members.

G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At interior and exterior doors, provide compression weather stripping at fixed stops.

H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

I. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

J. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.10 ALUMINUM FINISHES

A. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF resin by weight in color coat.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Color and Gloss: As selected by Architect from manufacturer's full range of color and gloss.

2.11 SOURCE QUALITY CONTROL

A. Structural Sealant: Perform quality-control procedures complying with ASTM C1401 recommendations, including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.

I. Install joint filler behind sealant as recommended by sealant manufacturer.

J. Install components plumb and true in alignment with established lines and grades.

3.3 INSTALLATION OF OPERABLE UNITS

A. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

3.4 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 088000 "Glazing."

3.5 INSTALLATION OF STRUCTURAL GLAZING

A. Prepare surfaces that will contact structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

B. Set glazing into framing in accordance with sealant manufacturer and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.

C. Set glazing with proper orientation so that coatings face exterior or interior as specified.

D. Hold glazing in place using temporary retainers of type and spacing recommended by manufacturer, until structural sealant joint has cured.

E. Apply structural sealant to completely fill cavity, in accordance with sealant manufacturer and framing manufacturer's written instructions and in compliance with local codes.

F. Apply structural sealant at temperatures indicated by sealant manufacturer for type of sealant.

G. Allow structural sealant to cure in accordance with manufacturer's written instructions.

H. Clean and protect glass as indicated in Section 088000 "Glazing."

3.6 INSTALLATION OF WEATHERSEAL SEALANT

A. After structural sealant has completely cured, remove temporary retainers and insert backer rod between lites of glass as recommended by sealant manufacturer.

B. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.

3.7 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

A. Install entrance doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.

2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware in accordance with entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.8 ERECTION TOLERANCES

A. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
3. Alignment:

a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).

4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

3.9 MAINTENANCE SERVICE

A. Entrance Door Hardware Maintenance:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

2. Initial Maintenance Service: Beginning at Substantial Completion, provide [six] <Insert number> months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

END OF SECTION 084113

SECTION 08 71 00
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for fiberglass doors.

B. Thresholds.

C. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

A. Section 08 16 13 - Fiberglass Doors.

1.03 REFERENCE STANDARDS

A. BHMA (CPD) - Certified Products Directory.

B. BHMA A156.1 - Standard for Butts and Hinges.

C. BHMA A156.3 - Exit Devices.

D. BHMA A156.4 - Door Controls - Closers.

E. BHMA A156.7 - Template Hinge Dimensions.

F. BHMA A156.18 - Materials and Finishes.

G. BHMA A156.21 - Thresholds.

H. BHMA A156.22 - Standard for Gasketing.

I. BHMA A156.28 - Standard for Recommended Practices for Mechanical Keying Systems.

J. DHI (H&S) - Sequence and Format for the Hardware Schedule.

K. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.

L. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

M. NFPA 101 - Life Safety Code.

N. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives.

O. UL (DIR) - Online Certifications Directory.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

C. Keying Requirements Meeting:
   1. Schedule meeting at project site prior to Contractor occupancy.
   2. Attendance Required:
      a. Contractor.
      b. Owner.
      c. Installer's Architectural Hardware Consultant (AHC).
      d. Hardware Installer.
   3. Agenda:
      a. Establish keying requirements.
      b. Verify locksets and locking hardware are functionally correct for project requirements.
      c. Establish keying submittal schedule and update requirements.
   4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
      a. Key control system requirements.

5. Record minutes and distribute copies within two days after meeting to participants, with two copies to Design Professional, Owner, participants, and those affected by decisions made.
6. Deliver established keying requirements to manufacturers.

1.05 SUBMITTALS

A. 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.

B. 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.
   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.

C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

D. 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.

E. Installer's qualification statement.

F. Supplier's qualification statement.

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

1.06 QUALITY ASSURANCE

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

B. 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. Warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion.
   1. Closers: 20 years, minimum.
   2. Exit Devices: Three years, minimum.
   3. Cylinders: Three years, minimum.
   4. 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. Applicable provisions of NFPA 101.
   3. Listed and certified compliant with specified standards by BHMA (CPD).

D. 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. Provide machine screws for attachment to reinforced fiberglass doors and frames, in drilled and tapped holes.
      a. Self-drilling (Tek) type screws are not permitted.
   3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
   4. Fire-Rated Applications: Comply with NFPA 80.
      a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
      b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2.02 HINGES

A. Manufacturers:
   1. Basis of Design: Ives, an Allegion brand.
   2. McKinney; an Assa Abloy Group company: www.assaabloydss.com/#sle.
   3. Hager Companies: www.hagerco.com/#sle.
   4. Stanley, dormakaba Group: www.stanleyhardwarefordoors.com/#sle.

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. Provide hinges on every swinging door.
   3. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
   4. Provide ball-bearing hinges at each door with closer.
   5. Provide non-removable pins on exterior outswinging doors.
   6. Provide following quantity of butt hinges for each door:
      a. Doors From 60 inches High up to 90 inches High: Three hinges.

2.03 EXIT DEVICES

A. Manufacturers:
   1. Basis of Design: Von Duprin, an Allegion brand. No Substitution.

B. Exit Devices: Comply with BHMA A156.3, Grade 1.
   1. Provide exit devices properly sized for door width and height.
   2. Provide strike as recommended by manufacturer for application indicated.
   3. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.

C. Outside Trim: Pull with cylinder; stainless steel with finish as scheduled.

2.04 LOCK CYLINDERS

A. Manufacturers:
   1. Basis of Design: Schlage. No subsitution. Match Owner's existing standard.

B. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
   1. Provide cams and/or tailpieces as required for locking devices.

2.05 CLOSERS

A. Manufacturers; Surface Mounted:
   1. Basis of Design: LCN, an Allegion brand. No substitution.

B. Closers: Comply with BHMA A156.4, Grade 1.
   1. Type: As indicated in door hardware sets.
   2. Provide door closer on each exterior door.
   3. At outswinging exterior doors, mount closer on interior side of door.

2.06 KICK PLATES

A. Manufacturers:
   1. Basis of Design: Ives, an Allegion brand.
   2. Rockwood; an Assa Abloy Group company: www.assaabloydss.com/#sle.
   3. Trimco: www.trimcohardware.com/#sle.

B. Kick Plates: Provide along bottom edge of push and pull sides of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
   1. Size: 10 inch high by 2 inch less door width (LDW) on push side of door.

2.07 THRESHOLDS

A. Manufacturers:
   1. Basis of Design: Zero International, an Allegion brand.
   2. Pemko; an Assa Abloy Group company: www.assaabloydss.com/#sle.
   3. National Guard Products, Inc: www.ngpinc.com/#sle.
   4. Reese Enterprises, Inc: www.reeseusa.com/#sle.

B. Thresholds: Comply with BHMA A156.21.
   1. Provide threshold at each exterior door, unless otherwise indicated.
   2. Type: Flat surface.
   3. Material: Aluminum.
   4. Threshold Surface: Fluted horizontal grooves across full width.
   5. Field cut threshold to profile of frame and width of door sill for tight fit.
   6. Provide non-corroding fasteners at exterior locations.

2.08 WEATHERSTRIPPING AND GASKETING

A. Manufacturers:
   1. Basis of Design: Zero International, Inc., an Allegion brand.
   2. Pemko; an Assa Abloy Group company: www.assaabloydss.com/#sle.
   3. National Guard Products, Inc: www.ngpinc.com/#sle.
   4. Reese Enterprises, Inc: www.reeseusa.com/#sle.

B. Weatherstripping and Gasketing: Comply with BHMA A156.22.
   1. Head and Jamb Type: Self-adhesive.
   2. Door Sweep Type: Encased in retainer.
   3. Material: As scheduled.
   4. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
   5. Provide door bottom sweep on outside of each outswinging exterior door, unless otherwise indicated.

2.09 KEY CONTROL SYSTEMS

A. Key Control Systems: Comply with guidelines of BHMA A156.28. Coordinate with and utilize Owner's existing system.
   1. Key to existing keying system, including master or grandmaster system.
   2. Keys: Nickel silver.
   3. Supply keys in following quantities:
      a. 3 each Change keys for each keyed core.

4. Security Key Tags: For each keyed lock on project, provide one set of matching key tags for permanent attachment to one key of each set.
5. 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."

2.10 FINISHES

A. Finishes: Identified in Door Hardware Schedule.Complying with BHMA A156.18.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.

C. Install hardware for smoke and draft control doors in accordance with NFPA 105.

D. Use templates provided by hardware item manufacturer.

E. Do not install surface mounted items until application of finishes to substrate are fully completed.

F. 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 Fiberglass Doors and Frames: Install in compliance with DHI (LOCS) recommendations.

G. 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 FIELD QUALITY CONTROL

A. Provide an Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.04 ADJUSTING

A. Adjust hardware for smooth operation.

B. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.05 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.

3.06 PROTECTION

A. Protect finished Work.

B. Do not permit adjacent work to damage hardware or finish.

3.07 DOOR HARDWARE SCHEDULE

A. The hardware sets represent the design intent. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware, and missing items should be brought to the attention of the Architect for correction prior to receipt of bids.

Include appropriate additional hardware items or options not indicated in the hardware sets, as required for proper application and functionality.

B. Manufacturer Abbreviations:
1. IVS - Ives
2. LCN - LCN
3. VD - Von Duprin
4. SCH - Schlage
5. ZRO - Zero

C. Finish Abbreviations:
1. 630 - Satin stainless steel
2. 689 - Aluminum powder coat
3. A - Aluminum, mill finish
4. BK - Black

D. Hardware Sets:

S□□1.0				
Doors: B001				
3	Hinges	5BB1HW-SH-4.5x4.5-NRP	630	IVS
1	Surface Closer, Top Jamb Mounted (push side)	1460 - HD Arm - Aux Stop	689	LCN
1	Rim Exit Device	LD-98 x 299 strike	630	VD
1	Cylinder Pull Plate	VR914-NL	630	IVS
1	Schlage Cylinder	Coordinated w/ Owner's key system	630	SCH
2	Kick Plate	8400 10" high 4BE CSK	630	IVS
1 set	Gasketing	8144S (Head & Jambs)	BK	ZRO
1	Threshold	654	A	ZRO
1	Sweep	39	A	ZRO
Notes: Provide interior surface mounted door contact and reconnect to security system as directed by Owner.				

END OF SECTION

SECTION 087111 - EXTERIOR DOOR HARDWARE (DESCRIPTIVE SPECIFICATION)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial door hardware for the following:

a. Swinging doors.

2. Cylinders

3. Electrified door hardware.

B. Related Requirements:

1. Section 081113 "Hollow Metal Doors and Frames" for astragals provided as part of labeled fire-rated assemblies and for door silencers provided as part of hollow-metal frames.

1.2 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Conference participants shall include Installer's Architectural Hardware Consultant and Owner's security consultant.
2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system including, but not limited to, the following:

a. Flow of traffic and degree of security required.
b. Preliminary key system schematic diagram.
c. Requirements for key control system.
d. Requirements for access control.
e. Address for delivery of keys.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For electrified door hardware.

1. Include diagrams for power, signal, and control wiring.
2. Include details of interface of electrified door hardware and building safety and security systems.

C. Samples: For each exposed product in each finish specified, in manufacturer's standard size.

1. Tag Samples with full product description to coordinate Samples with door hardware schedule.

D. Samples for Verification: For each type of exposed product, in each finish specified.

1. Sample Size: Full-size units or minimum 2-by-4-inch (51-by-102-mm) Samples for sheet and 4-inch (102-mm) long Samples for other products.

a. Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

2. Tag Samples with full product description to coordinate Samples with door hardware schedule.

E. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
3. Content: Include the following information:

a. Identification number, location, hand, fire rating, size, and material of each door and frame.
b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
e. Fastenings and other installation information.
f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
g. Mounting locations for door hardware.
h. List of related door devices specified in other Sections for each door and frame.

F. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Architectural Hardware Consultant.

B. Product Certificates: For each type of electrified door hardware.

1. Certify that door hardware for use on each type and size of labeled fire-rated doors complies with listed fire-rated door assemblies.

C. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

D. Field quality-control reports.

E. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final door hardware and keying schedule.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Hardware: 2 spare sets (pair of doors) of exterior door hardware
2. Electrical Parts: 2 sets of electrical components for the doors.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC) and an Electrified Hardware Consultant (EHC), Architectural Openings Consultant (AOC).

1. Electrified Door Hardware Consultant Qualifications: A qualified Architectural Hardware Consultant who is experienced in providing consulting services for electrified door hardware installations.

C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

D. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." In addition to Owner, Construction Manager, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant and Owner's security consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Address for delivery of keys.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to electrified door hardware including, but not limited to, the following:

1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
2. Review sequence of operation for each type of electrified door hardware.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review required testing, inspecting, and certifying procedures.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.10 COORDINATION

A. Coordinate layout and installation of recessed pivots with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control system, security system, and/or building control system.

D. Existing Openings: Where new hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide for proper operation.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Two years from date of Substantial Completion unless otherwise indicated below:

    a. Electromagnetic Locks: Five years from date of Substantial Completion.
    b. Exit Devices: Three years from date of Substantial Completion.
    c. Manual Closers: 10 years from date of Substantial Completion.

1.12 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 PERFORMANCE REQUIREMENTS

A. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

C. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the USDOJ's "2010 ADA Standards for Accessible Design" and/or ICC A117.1.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
2. Comply with the following maximum opening-force requirements:
3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.

2.3 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and frames and fiberglass doors and frames.

1. Hager Companies
2. McKinney Products
3. Stanley Commercial Hardware

B. Antifriction-Bearing Hinges:

1. Mounting: Full mortise (butts).
2. Bearing Material: Manufacturer's standard antifriction bearing.
3. Grade 1 (heavy weight).
4. Base and Pin Metal:

    a. Exterior Hinges: Stainless steel with stainless steel pin – heavy duty.

5. Pins: Nonremovable.

    a. Outswinging Exterior Doors: Nonremovable.

6. Tips: Flat button.

7. Corners: Square 1/4-inch (6-mm) radius.

8. Fasteners: Machine screws for all doors and frames – installed into drilled and tapped holes

2.4 PIVOTS AND PIVOT HINGES

A. Manufacturers:

1. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
2. Hager Companies (HAG).
3. IVES Hardware; an Ingersoll-Rand Company (IVS).
4. McKinney Products Company; an ASSA ABLOY Group company (MCK).
5. Rixson Specialty Door Controls; an ASSA ABLOY Group company (RIX).
6. Stanley Commercial Hardware; Div. of The Stanley Works (STH).

2.5 MECHANICAL LOCKS AND LATCHES

A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).

B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

A. Electrified Locking Devices: BHMA A156.25.

B. Lock Trim:

1. Levers: Cast.
2. Escutcheons (Roses): Cast.
3. Dummy Trim: Match lever lock trim and escutcheons.

C. Lock Functions: As indicated in door hardware schedule.

D. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
2. Deadbolts: Minimum [1-inch (25-mm)] [1.25-inch (32-mm)] bolt throw.

E. Lock Trim:

1. Description: To match existing.
2. Levers: Cast.
   a. Construction: Solid, vandal resistant.

3. Escutcheons (Roses): Cast.
4. Dummy Trim: Match lever lock trim and escutcheons.

F. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Interconnected Locks and Latches: BHMA A156.12.
3. Strikes for Auxiliary Deadlocks: BHMA A156.5.
4. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
5. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.

G. Mortise Locks: BHMA A156.13; Operational Grade 1; stamped steel case with steel or brass parts; Series 1000.

1. Lockset Designs: Schlage L Series, 12A Design, to match existing. No Substitutions

2.6 MECHANICAL LOCKS AND LATCHES

A. Mortise Locks:

1. Manufacturers:

a. Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH). No Substitutions.

B. Interconnected Locks:

1. Manufacturers:

a. Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH). No Substitutions.

2.7 AUXILIARY LOCKS AND LATCHES

A. Auxiliary Locks:

1. Manufacturers:

a. Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH). No Substitutions.

2.8 ELECTRIC STRIKES

A. Electric Strikes: BHMA A156.31; Grade 1; with faceplate to suit lock and frame.
1. Alllegion/Schlage to match existing
2. Material: Steel or Stainless steel (exterior).
3. Mounting: Mortised.
4. Fire-Rated Door Assemblies: Use fail-secure electric strikes with fire-rated devices.

2.9 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

A. Automatic Flush Bolts: BHMA A156.3, Type 25; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge. Include wear plates.

1. Allegion

2. Door Controls International

3. Trimco.

2.10 DOOR BOLTS

A. Bolt Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Mortise Flush Bolts: Minimum 3/4-inch (19-mm) throw.

B. Dustproof Strikes: BHMA A156.16.

C. Manual Flush Bolts: Designed for mortising into door edge.

1. Manufacturers:

    a. Hager Companies (HAG).
    b. IVES Hardware; an Ingersoll-Rand Company (IVS).
    c. Rockwood Manufacturing Company (RM).

    d. Stanley Commercial Hardware; Div. of The Stanley Works (STH).
    e. Trimco (TBM).

D. Automatic and Self-Latching Flush Bolts: Designed for mortising into door edge.

1. Manufacturers:

    a. Hager Companies (HAG).
    b. IVES Hardware; an Ingersoll-Rand Company (IVS).
    c. Trimco (TBM).

2.11 EXIT DEVICES

A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).

B. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

C. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

D. Outside Trim: Pull with cylinder; material and finish to match locksets, unless otherwise indicated.

E. Manufacturer:

1. Von Duprin; an Ingersoll-Rand Company (VD). No Substitutions.

2.12 LOCK CYLINDERS

A. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. Number of Pins: Match Existing.
2. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.

3. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
4. Bored-Lock Type: Cylinders with tailpieces to suit locks.

B. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.

C. Construction Keying: Comply with the following:

1. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

a. Replace construction cores with permanent cores as indicated in Division 01 Section “Closeout Procedures.”

D. Manufacturer:

1. Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH). No Substitutions.

2.13 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference, and as follows:

1. Existing System: Master key or grand master key locks to Owner's existing system.

B. Keys: Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: "DO NOT DUPLICATE."

2. Quantity: In addition to one extra key blank for each lock, provide the following:

a. Cylinder Change Keys: Three.
b. Master Keys: Five.
c. Grand Master Keys: Five.
d. Great-Grand Master Keys: Five.

2.14 KEY CONTROL SYSTEM

A. Key Control Cabinet: Provide new metal cabinet with baked-enamel finish, to match existing cabinet; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders,

key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.

1. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

B. Cross-Index System: Match and expand existing index system. Set up by Installer.

2.15 ELECTRIC STRIKES

A. General: Use fail-secure electric strikes with fire-rated devices.

B. Manufacturers:

1. Adams Rite Manufacturing Co. (ARM).
2. Folger Adam Security Inc.; an ASSA ABLOY Group company (FAS).
3. Locknetics; an Ingersoll-Rand Company (LSE).
4. Von Duprin; an Ingersoll-Rand Company (VD).

2.16 CLOSERS

A. BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force

B. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

C. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.

D. Hold-Open Closers/Detectors: Coordinate and interface integral smoke detector and closer device with fire alarm system.

E. Flush Floor Plates: Provide finish cover plates for floor closers unless thresholds are indicated. Match door hardware finish, unless otherwise indicated.

F. Power-Assist Closers: As specified in Division 08 Section "Automatic Door Operators" for access doors for people with disabilities or where listed in the door hardware sets.

G. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

H. Surface Closers: Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.

1. Manufacturer:

a. LCN Closers; an Ingersoll-Rand Company (LCN). No Substitutions.

2.17 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel for exterior doors unless otherwise indicated.

B. Manufacturers:

1. Hager Companies (HAG).
2. IVES Hardware; an Ingersoll-Rand Company (IVS).
3. Rockwood Manufacturing Company (RM).
4. Trimco (TBM).

C. Flat Push Plates: With square corners and beveled edges; secured with exposed screws.

1. Thickness: 1/8 inch (3.2 mm).
2. Size: 4 inches wide by 16 inches high (102 mm wide by 406 mm high).

2.18 ACCESSORIES FOR PAIRS OF DOORS

A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release[; and with internal override].

B. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.

C. Flat Overlapping Astragals: BHMA A156.22; flat material to be the same as the doors surface mounted on face of door with screws; minimum 1/8 inch (3.2 mm) thick by 2 inches (51 mm) wide by full height of door.

2.19 PROTECTIVE TRIM UNITS

A. Size: 1-1/2 inches (38 mm) less than door width on push side and 1/2 inch (13 mm) less than door width on pull side, by height specified in door hardware sets.

B. Fasteners: Manufacturer's standard machine or self-tapping screws.

C. Metal Protective Trim Units:

1. Material: 0.050-inch- (1.3-mm-) thick stainless steel.
2. Manufacturers:

a. Hager Companies (HAG).
b. IVES Hardware; an Ingersoll-Rand Company (IVS).
c. Rockwood Manufacturing Company (RM).
d. Trimco (TBM).

2.20 STOPS AND HOLDERS

A. Stops and Bumpers: BMHA A156.16.

1. Provide floor stops for doors unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.

B. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch (13 mm); fabricated for drilled-in application to frame.

C. Manufacturers:

1. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
2. Hager Companies (HAG).
3. IVES Hardware; an Ingersoll-Rand Company (IVS).
4. Rockwood Manufacturing Company (RM).
5. Trimco (TBM).

2.21 DOOR GASKETING

A. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

B. Air Leakage: Not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

C. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.

1. Provide smoke-labeled gasketing on 20-minute-rated doors and on smoke-labeled doors.

D. Fire-Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1. Test Pressure: Test at atmospheric pressure. After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches (1016 mm) or less above the sill.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Gasketing Materials: ASTM D 2000 and AAMA 701/702.

G. Manufacturers:

1. Hager Companies (HAG).
2. National Guard Products (NGP).
3. Reese Enterprises (RE).
4. Zero International (ZRO).

2.22 THRESHOLDS

A. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

1. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.

B. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch (13 mm) high.

C. Manufacturers:

1. National Guard Products (NGP).
2. Reese Enterprises (RE).
3. Zero International (ZRO).

2.23 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially

recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Fire-Rated Applications:

    a. Steel Through Bolts: For the following unless door blocking is provided:

        1) Surface hinges to doors.
        2) Closers to doors and frames.
        3) Surface-mounted exit devices.

2. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
3. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.24 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

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

3.2 PREPARATION

A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames in accordance with ANSI/SDI A250.6.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule, but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).

E. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner.
2. Furnish permanent cores to Owner for installation.

F. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated. Verify location with Architect.

1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.

G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

H. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

K. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.7 DEMONSTRATION

A. Engage Installer to train Owner's maintenance personnel to adjust, operate, and maintain door hardware.

3.8 DOOR HARDWARE SCHEDULE

Reading Terminal Market Doors

Hardware Set A -Exterior Pair of Doors - Door Opening 001 – 1 pair of doors.
3 pairs of heavy duty hinges McKinney T4A3386, 4 ½ X 4 ½ inch
2 Surface Closer – LCN 9553
2 Exit Device – Von Duprin 98/99 heavy duty push pads, concealed vertical rods with 990TP Panic Device Trim and cylinder, 1 set dummy trim
2 horizontal bars on each door in front of lower glass panels – Rockwood Push Bar with base plate
2 sets Sill Gasketing NGP 200NA-36”
2 sets Perimeter Gasketing – NGP PF 180-120”
Threshold – width of door opening
Door Silencer – Rockwood 608-RKW

Hardware Set B -Exterior Pair of Doors - Door Opening 002 – 1 pair of doors.
3 pairs of heavy duty hinges McKinney T4A3386, 4 ½ X 4 ½ inch
2 Surface Closer – LCN 9553
2 Exit Device – Von Duprin 98/99 heavy duty push pads, concealed vertical rods with 990TP Panic Device Trim and cylinder, 1 set dummy trim
Door to have automatic hardware added to provide ADA access – push plate mounted on interior and exterior.
2 horizontal bars on each door in front of lower glass panels – Rockwood Push Bar with base plate
2 sets Sill Gasketing NGP 200NA-36”
2 sets Perimeter Gasketing – NGP PF 180-120”
Threshold – width of door opening
Door Silencer – Rockwood 608-RKW

Hardware Set C -Exterior Pair of Doors - Door Opening 003 – 1 pair of doors.
3 pairs of heavy duty hinges McKinney T4A3386, 4 ½ X 4 ½ inch
2 Surface Closer – LCN 9553
2 Exit Device – Von Duprin 98/99 heavy duty push pads, concealed vertical rods with 990TP Panic Device Trim and cylinder, 1 set dummy trim
2 horizontal bars on each door in front of lower glass panels – Rockwood Push Bar with base plate
2 sets Sill Gasketing NGP 200NA-36”
2 sets Perimeter Gasketing – NGP PF 180-120”
Threshold – width of door opening
Door Silencer – Rockwood 608-RKW

Hardware Set D -Exterior Pair of Doors Door Opening 004 and 005 - 2 single and 1 pair of doors at each .
6 pairs of heavy duty hinges McKinney T4A3386, 4 ½ X 4 ½ inch
4 Surface Closer – LCN 9553
4 Exit Device – Von Duprin 98/99 heavy duty push pads, concealed vertical rods with 990TP Panic Device Trim and cylinder, 1 set dummy trim
2 horizontal bars on each door in front of lower glass panels – Rockwood Push Bar with base plate – 8 total
4 sets Sill Gasketing NGP 200NA-36”

4 sets Perimeter Gasketing – NGP PF 180-120”
4 Thresholds – width of door openings
Door Silencer – Rockwood 608-RKW

Hardware Set E -Exterior Pair of Doors Door Opening 006 – 2 single and 1 pair of doors .
6 pairs of heavy duty hinges McKinney T4A3386, 4 ½ X 4 ½ inch
4 Surface Closer – LCN 9553
4 2 Exit Device – Von Duprin 98/99 heavy duty push pads, concealed vertical rods with 990TP Panic Device Trim and cylinder, 1 set dummy trim
2 horizontal bars on each door in front of lower glass panels – Rockwood Push Bar with base plate
One Door at Opening 006 to have automatic hardware added to provide ADA access – push plate mounted on interior and exterior.
4 sets Sill Gasketing NGP 200NA-36”
4 sets Perimeter Gasketing – NGP PF 180-120”
4 Thresholds – width of door opening
Door Silencer – Rockwood 608-RKW

Hardware Set F -Exterior Pair of Doors - Door 007 and Door 010 – single door.
1 ½ pairs of heavy duty hinges McKinney T4A3386, 4 ½ X 4 ½ inch
1 Surface Closer – LCN 9553
1 Exit Device – Von Duprin 98/99 heavy duty push pads, concealed vertical rods with 990TP Panic Device Trim and cylinder, 1 set dummy trim
2 horizontal bars on each door in front of lower glass panels – Rockwood Push Bar with base plate
1 sets Sill Gasketing NGP 200NA-36”
1 sets Perimeter Gasketing – NGP PF 180-120”
Threshold – width of door opening
Door Silencer – Rockwood 608-RKW

Hardware Set G -Exterior Pair of Doors - Door 008 2 single doors.
3 pairs of heavy duty hinges McKinney T4A3386, 4 ½ X 4 ½ inch
2 Surface Closer – LCN 9553
2 2 Exit Device – Von Duprin 98/99 heavy duty push pads, concealed vertical rods with 990TP Panic Device Trim and cylinder, 1 set dummy trim
2 horizontal bars on each door in front of lower glass panels – Rockwood Push Bar with base plate
2 sets Sill Gasketing NGP 200NA-36”
2 sets Perimeter Gasketing – NGP PF 180-120”
Threshold – width of door opening
Door Silencer – Rockwood 608-RKW

Hardware Set H -Exterior Pair of Doors - Door 009 – 2 single doors.
3 pairs of heavy duty hinges McKinney T4A3386, 4 ½ X 4 ½ inch
2 Surface Closer – LCN 9553
2 2 Exit Device – Von Duprin 98/99 heavy duty push pads, concealed vertical rods with 990TP Panic Device Trim and cylinder, 1 set dummy trim

One Door at Opening 009 to have automatic hardware added to provide ADA access – push plate mounted on interior and exterior.
2 horizontal bars on each door in front of lower glass panels – Rockwood Push Bar with base plate
2 sets Sill Gasketing NGP 200NA-36”
2 sets Perimeter Gasketing – NGP PF 180-120”
Threshold – width of door opening
Door Silencer – Rockwood 608-RKW

END OF SECTION 087111

SECTION 087113 - POWER DOOR OPERATORS

PART 1 - GENERAL

1.1 SUMMARY - Exterior Doors & Storefront

A. Section Includes:

1. Low-energy door operators for swinging doors.

1.2 DEFINITIONS

A. AAADM: American Association of Automatic Door Manufacturers.

B. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.

C. Safety Device: A control that, to avoid injury, prevents a door from opening or closing.

D. For automatic door terminology, see BHMA A156.10 and BHMA A156.19 for definitions of terms.

1.3 COORDINATION

A. Coordinate sizes and locations of recesses in concrete floors for recessed control mats that control power door operators. Concrete, reinforcement, and formwork requirements are specified elsewhere.

B. Templates: Distribute for doors, frames, and other work specified to be factory prepared and reinforced for installing power door operators.

C. Coordinate hardware for doors with operators to ensure proper size, thickness, hand, function, and finish.

D. Electrical System Roughing-in: Coordinate layout and installation of power door operators with connections to the following:

1. Power supplies.
2. Access-control system.
3. Remote activation devices.
4. Remote monitoring systems.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for power door operators.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For power door operators.

1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
2. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Indicate locations of activation and safety devices.
4. Include diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified, manufacturer's standard size.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of power door operator. For each operator for fire-rated door assemblies, certify that operator is listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for use on types and sizes of labeled fire doors required.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For power door operators, safety devices, and control systems, to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation and maintenance of units required for this Project and who employs a Certified Inspector.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

B. Certified Inspector Qualifications: Certified by AAADM.

1.9 WARRANTY

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A. Special Warranty: Manufacturer agrees to repair or replace components of power door operators that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty or sporadic operation of power door operator, including controls.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain power door operators, including activation and safety devices, from Norton- Assa Abloy. The selected product shall be the 6021/D6021 models low energy power operator, heavy duty unit.

2.2 POWER DOOR OPERATORS, GENERAL

A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated; and in accordance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.

1. Wind Load: Provide door operators on exterior doors that will open and close doors and maintain them in fully closed position when subjected to wind load of 90 mph..

B. Electromechanical Operating System: Self-contained unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, connections for power and activation- and safety-device wiring, and manual operation, including spring closing when power is off.

C. Hinges: See Section 087111 "Door Hardware (Descriptive Specification)"] for hinge type for each door that door operator shall accommodate.

D. Cover for Surface-Mounted Operators: Fabricated from 0.125-inch- (3.2-mm-) thick, extruded or formed aluminum; continuous over full width of operator-controlled door opening, with enclosed end caps, provision for maintenance access, and fasteners concealed when door is in closed position.

E. Brackets and Reinforcements: Fabricated from aluminum with nonstaining, nonferrous shims for aligning system components..

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 LOW-ENERGY DOOR OPERATORS FOR SWINGING DOORS

A. Standard: BHMA A156.19.

B. Performance Requirements:

1. Opening Force if Power Fails: Not more than 15 lbf (67 N) required to release latch if provided, not more than 30 lbf (133 N) required to manually set door in motion, and not more than 15 lbf (67 N) required to fully open door.
2. Entrapment-Prevention Force: Not more than 15 lbf (67 N) required to prevent stopped door from closing or opening.

C. Configuration, Pair: Operator to control pair of swinging doors.

1. Traffic Pattern: Two way.
2. Operator Mounting: Surface.

D. Operation: Power opening and power-assisted spring closing. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.19. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.

E. Operating System: Electromechanical.

F. Microprocessor Control Unit: Solid-state controller.

G. Features:

1. Adjustable opening speed.
2. Adjustable opening force.
3. Adjustable backcheck.
4. Adjustable hold-open time from zero to 30 seconds.
5. Adjustable time delay.
6. Adjustable acceleration.
7. Obstruction recycle.
8. On-off/hold-open switch to control electric power to operator; key operated].

H. Activation Device: Key switch on each side of door to activate door operator.

I. Exposed Finish: Finish matching door hardware.

2.4 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Extrusions: ASTM B221 (ASTM B221M).
2. Sheet: ASTM B209 (ASTM B209M).

B. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.5 CONTROLS

A. General: Provide controls, including activation and safety devices, in accordance with BHMA standards; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.

B. Motion Sensors: Self-contained, K-band-frequency, microwave-scanner units; fully enclosed in plastic housing; adjustable to provide detection field sizes and functions required by BHMA A156.10.

1. Provide capability for switching between bidirectional and unidirectional detection.
2. For one-way traffic, sensor on egress side shall not be active when doors are fully closed.

C. Presence Sensors: Self-contained, active-infrared scanner units; adjustable to provide detection field sizes and functions required by BHMA A156.10. Sensors shall remain active at all times.

D. Photoelectric Beams: Pulsed infrared, sender-receiver assembly for recessed mounting. Beams shall not be active when doors are fully closed.

E. Key Switch: Recess-mounted, door control switch with key-controlled actuator; enclosed in 2-by-4-inch (50-by-100-mm) junction box. Provide faceplate engraved with text indicating switch functions.

1. Faceplate Material: Stainless steel as selected by Architect from manufacturer's full range.
2. Functions: On-off, momentary contact.
3. Mounting: As indicated on Drawings, recess mounted.] [Recess mounted, semiflush in wall] [Recess mounted in door jamb] [Surface mounted on wall] [Surface mounted on post].

F. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.6 FABRICATION

A. Factory fabricate power door operators to comply with indicated standards.

B. Form aluminum shapes before finishing.

C. Fabricate exterior components to drain condensation and water-passing joints within operator enclosure to the exterior.

D. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match operator.

2.7 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary, protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, [AA-M12C22A41, Class I, 0.018 mm] [AA-M12C22A31, Class II, 0.010 mm] or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame preparation and reinforcements, and other conditions affecting performance of power door operators.

B. Examine roughing-in for electrical systems to verify actual locations of power connections before power door operator installation.

C. Examine roughing-in for compressed-air piping systems to verify actual locations of piping connections before power door operator installation.

D. Verify that full-height finger guards are installed at each door with pivot hinges, where door has a clearance at hinge side greater than 1/4 inch (6 mm) and less than 3/4 inch (19 mm) with door in any position.

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

3.2 INSTALLATION, GENERAL

A. Install power door operators in accordance with manufacturer's written instructions and cited BHMA standard for type of door operation and direction of pedestrian travel, including signage, controls, wiring, remote power units if any, and connection to building's power supply.

1. Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion.
2. Install operators true in alignment with established lines and door geometry without warp or rack. Anchor securely in place.

B. Controls: Install activation and safety devices in accordance with manufacturer's written instructions and cited BHMA standard for operator type and direction of pedestrian travel. Connect control wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Access-Control System: Connect operators to access-control system as specified in Section 281500 "Access Control Hardware Devices."

D. Signage: Apply on both sides of each door as required by cited BHMA standard for type of door operator and direction of pedestrian travel.

3.3 ADJUSTING

A. Adjust power door operators to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.

1. Adjust operators on exterior doors for tight closure.

B. After completing installation of power door operators, inspect exposed finishes on doors and operators. Repair damaged finish to match original finish.

C. Readjust power door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).

3.4 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of power door operator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Engage a Certified Inspector to perform safety inspection after each adjustment or repair and at end of maintenance period. Furnish completed inspection reports to Owner.
2. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain power door operators.

END OF SECTION 087113

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY - Exterior Doors & Strorefront

A. Section Includes:

1. Glass products.
2. Laminated glass.
3. Glazing sealants.
4. Glazing tapes.
5. Miscellaneous glazing materials.

B. Related Requirements:
1. Section 083115 "Steel Doors."

1.2 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

C. IBC: International Building Code.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of ; 12 inches (300 mm) square.
   1. Laminated glass/tempered glass assembly.

C. Glazing Accessory Samples: For sealants and, in 12-inch (300-mm) lengths. Install sealant Samples between two strips of material representative in color of adjoining framing system.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer of fabricated glass units.

B. Product Certificates: For glass.

C. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.

   1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

D. Preconstruction adhesion and compatibility test report.

E. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved by primary glass manufacturer.

B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F (4.4 deg C).

1.10 WARRANTY

A. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Heat-Soaked Tempered Glass: Manufacturer agrees to replace heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent (3/1000) within specified warranty period. Coverage for any other cause is excluded.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glass: Obtain glass from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:

1. Design Wind Pressures: Determine design wind pressures applicable to Project in accordance with ASCE/SEI7.
   a. Basic Wind Speed: 100 mph (44 m/s).
   b. Importance Factor: 1.0.
   c. Exposure Category: B.
2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.

3. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.

C. Windborne-Debris-Impact Resistance: Exterior glazing shall pass ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone [2] for basic protection.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: ["Laminated Glazing Reference Manual" and]"Glazing Manual."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: [6 mm] <Insert thickness designation>.

D. Strength: Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear).

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.5 LAMINATED GLASS

A. Windborne-Debris-Impact-Resistant Laminated Glass: Comply with the following requirements
   1. Construction: Laminate glass with polyvinyl butyral interlayer reinforced with polyethylene terephthalate film or ionoplast interlayer to comply with interlayer manufacturer's written instructions.
   2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
   3. Interlayer Color: Clear unless otherwise indicated.

2.6 GLAZING SEALANTS

A. General:

   1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
   3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors].

B. Neutral-Curing Silicone Glazing Sealant, Class 50: Complying with ASTM C920, Type S, Grade NS, Use NT.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

   1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:

   1. EPDM with Shore A durometer hardness of 85, plus or minus 5.

2. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:

1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
2. Type recommended in writing by sealant or glass manufacturer.

E. Edge Blocks:

1. EPDM blocks with Shore A durometer hardness per manufacturer's written instructions.
2. Type recommended in writing by sealant or glass manufacturer.

2.9 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch- (3-mm-) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.6 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.7 LAMINATED GLASS SCHEDULE

A. Clear Laminated Glass Type : Two plies of fully tempered float glass.

1. Basis-of-Design Product: Oldcastle fully tempered, laminated glass shall be the basis of design.
2. Minimum Thickness of Each Glass Ply: 6 mm.
3. Interlayer Thickness: 0.030 inch (0.76 mm).

END OF SECTION 088000

SECTION 09 24 00
CEMENT PLASTERING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal of existing exterior cement plaster finish and and replacement with new cement plaster finish to facilitate replacement of exterior Door B01. Intent is to closely match the existing cement plaster color and smooth texture.

1.02 REFERENCE STANDARDS

A. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

B. ASTM C91/C91M - Standard Specification for Masonry Cement.

C. ASTM C150/C150M - Standard Specification for Portland Cement.

D. ASTM C897 - Standard Specification for Aggregate for Job-Mixed Portland Cement-Based Plasters.

E. ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster.

F. ASTM C932 - Standard Specification for Surface-Applied Bonding Compounds for Exterior Plastering.

G. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster.

1.03 SUBMITTALS

A. Product Data: Provide data on plaster materials and trim accessories.

B. Installer's Qualification Statement.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.05 FIELD CONDITIONS

A. Exterior Plaster Work: Do not apply plaster when substrate or ambient air temperature is 40 degrees F or lower, or when temperature is expected to drop below 40 degrees F within 48 hours of application.

PART 2 PRODUCTS

2.01 CEMENT PLASTER APPLICATIONS

A. Solid Plaster Base: Concrete masonry.
   1. Plaster Type: Jobsite mixed plaster.
   2. Number of Coats: Three.
   3. First Coat: Apply to a nominal thickness of 1/4 inch.
   4. Second Coat: Apply to a nominal thickness of 1/4 inch.
   5. Finish Coat: Apply to a nominal thickness of 1/8 inch.

2.02 JOBSITE MIXED CEMENT PLASTER

A. Materials:
   1. Portland Cement: ASTM C150/C150M, Type I.
      a. Finish Coat: Gray color.
   2. Masonry Cement: ASTM C91/C91M, Type N.
   3. Sand: Clean, well graded, and complying with ASTM C897.
   4. Water: Clean, fresh, potable, and free of mineral or organic matter that could adversely affect plaster.
   5. Admixture: Air entrainment type.

B. Plaster Mixes: Proportioned in accordance with ASTM C926; parts by volume.

1. First Coat Over High Absorption Solid Base:
    a. Plaster Mix "CM": One part Portland cement, and one part Type N masonry cement.
    b. Minimum 2-1/2 parts and maximum 4 parts sand, per total volume of cementitious materials.
2. Second Coat: Same mixture as first coat, except minimum 3 parts and maximum 5 parts sand.
3. Finish Coat:
    a. Plaster Mix "FCM": One part Portland cement, and one part Type N masonry cement.
    b. Minimum 1-1/2 parts and maximum 3 parts sand, per total volume of cementitious materials.

2.03 ACCESSORIES

A. Finishing Accessories: ASTM C1063; galvanizd steel sheet ASTM A924/A924M G90 or galvanized steel wire, unless noted otherwise.
    1. Types: As detailed or required for finished appearance, including but not necessarily limited to base screed and casing bead.

B. Bonding Compound: If existing concrete masonry substrate is found to have insufficient absorption for proper bonding of plaster base coat, provide type recommended for bonding plaster to solid surfaces, complying with ASTM C932.

PART 3 EXECUTION

3.01 DEMOLITION

A. Coordinate with removal and replacement of Door B01.

B. Remove existing cement plaster, including trim, reinforcement, and other components from the vertical wall plane immediately surrounding the exterior of Door B01, down to the masonry substrate.

3.02 EXAMINATION

A. Verify existing substrate and adjoining conditions are acceptable prior to starting the new work.
    1. Evaluate absorption capability of the existing concrete masonry substrate. Adjust mix type accordingly.

B. Verify masonry joints are reasonably flush and surfaces are ready to receive work of this section, and that there are no existing bituminous or water repellent coatings on masonry surfaces.

3.03 PREPARATION

A. Dampen masonry surfaces to reduce excessive suction.

B. If necessary, roughen concrete masonry surfaces and apply bonding compound in accordance with manufacturer's written installation instructions.

C. Roughen approximately 2-inch wide area of existing-to-remain cement plaster finishes on adjoining .

3.04 MIXING

A. Mix only as much plaster as can be used prior to initial set.

B. Mix materials dry, to uniform color and consistency, before adding water.

C. Add air entrainment admixtures to each coat to provide 5 to 7 percent air entrainment.

D. Do not retemper mixes after initial set has occurred.

E. Protect mixtures from frost or freezing temperatures, contamination, and excessive evaporation.

3.05 APPLICATION

A. Install base screed and casing beads. Casing bead to overlap new door frame by 1/2 inch.

B. Apply plaster in accordance with manufacturer's written instructions and comply with ASTM C926.

C. Base Coats:
   1. Follow guidelines in ASTM C926 for moist curing base coats and application of subsequent coats.

D. Finish Coats:
   1. Cement Plaster:
      a. Apply with sufficient material and pressure to ensure complete coverage of base to specified thickness.
      b. Apply surface texture while mix is still workable.
      c. Float to a consistent finish matching existing.
      d. Blend finish into adjoining return wall and soffit surface finishes.

END OF SECTION

SECTION 09 67 00
FLUID-APPLIED FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fluid-applied epoxy flooring, including preparation of existing concrete floor slab substrate.

1.02 RELATED REQUIREMENTS

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

B. Section 03 10 00 - Maintenance of Concrete: Crack repair. Repair and preparation of concrete floor surfaces having spalled areas and other damage or deterioration in excess of acceptable condition for preparation by fluid-applied finish flooring installer.

C. Section 07 92 00 - Joint Sealants: Sealing joints between fluid-applied flooring and adjacent construction and fixtures.

1.03 REFERENCE STANDARDS

A. ASTM C579 - Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.

B. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.

C. ASTM D4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.

D. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.

E. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

F. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

G. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

H. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

1.04 SUBMITTALS

A. Product Data: Provide data on specified products, describing flooring system, physical and performance characteristics; sizes, patterns and colors available.

B. Samples for Color Selection: Submit two sample sets, with actual system samples minimum 2 by 3 inch in size illustrating manufacturer's standard color range.

C. Samples for Initial Texture Selection: Submit two identical sets of 5 samples each of actual system finish applied to solid substrates showing the range of textures available. Color does not have to match selected system color. Obtain initial texture selection prior to construction of mock-up.

D. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

E. Mock-Up Report: Submit adhesion test results and documentation of mock-up evaluations.

F. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and application rate for each coat.

G. Manufacturer's Qualification Statement.

H. Applicator's Qualification Statement, including certificates signed by manufacturer stating that installers comply with specified qualification requirements.

I. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section.
   1. Minimum five years of documented experience.
   2. Installers shall be trained and approved by manufacturer.

C. Pre-installation Conference: Conduct conference at Project site before work and mockups begin.

1.06 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Construct mock-up(s) of fluid applied flooring to verify color selection and serve as basis for evaluation of adhesion, texture, workmanship, cleanability, and slip-resistance.
   1. Number of Mock-Ups to be Prepared: One, minimum.
   2. Use same materials and methods for use in the work. Provide finish color and texture initially selected from sample sets.
   3. Locate where directed.
   4. Minimum Size: 48 inches by 48 inches.

C. Test adhesion in accordance with flooring manufacturer's recommended method. Submit results in a test report. If unsatisfactory adhesion is found, provide remedial recommendations.

D. Obtain approval of mock-up by Design Professional and Owner before proceeding with work.
   1. Schedule review by Owner to test mock-up surface texture for satisfactory slip-resistance and ease of cleaning. If results are unsatisfactory, review sample sets with Owner, adjust aggregate load accordingly, prepare a second mock-up, and have Owner re-evaluate. Repeat until approved.
   2. Document and submit results of evaluations, with photographs, and final approval, in a report. Note any unforeseen issues and steps taken to remedy.

E. Approved mock-up may remain as part of the work. Remove or refinish unapproved mock-ups.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store resin materials in a dry, secure area.

B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.08 FIELD CONDITIONS

A. Maintain minimum temperature in storage area of 55 degrees F.

B. Store materials in area of installation for minimum period of 24 hours prior to installation.

C. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

D. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fluid-Applied Flooring:
   1. Basis of Design: Sherwin-Williams High-Performance Flooring; www.sherwin-williams.com/resin-flooring/#sle.
   2. Substitutions of proposed equivalent flooring systems will be considered from the following manufacturers. See Section 01 60 00 - Product Requirements.
      a. Crossfield Products Corp: www.crossfieldproducts.com/#sle.
      b. Key Resin Company: www.keyresin.com/#sle.
      c. Master Builders Solutions: www.master-builders-solutions.com/en-us/#sle

d. PPG Flooring: www.ppgpaints.com/#sle and www.ppgpmc.com/home.aspx/#sle.

2.02 FLUID-APPLIED FLOORING SYSTEMS

A. Fluid-Applied Flooring: Epoxy resin-based, two component, thermosetting. Abrasion-, impact- and chemical-resistant, high-performance, monolithic floor surfacing designed to produce a seamless floor.
   1. Basis of Design System: Sherwin-Williams Resuflor Screed TG46 TX.
   2. Total System Thickness: 3/16 to 1/4 inch.
   3. Primer: Resuprime 3579 applied at 250 sq. ft. / gal.
   4. Base (Mortar) Coat: Resuflor 3561 with 5115 aggregate applied at published system guide coverage rates to achieve the required thickness; color as selected.
   5. Broadcast Bonding Coat: Resuflor 3746 applied at 100 sq. ft. / gal and broadcast with 5310-8 20-40 mesh to excess rate of 0.5 lbs / 1,000 sq. ft.
   6. Grout Coat: Resuflor 3746 applied at 100 sq. ft. / gal; color as selected.
   7. Top (Seal) Coat: Resuflor 3746 applied at 100 sq. ft. / gal; color as selected.
   8. Provide slip-resistant finish.
   9. VOC Content of Resinous Flooring: 100 g/L maximum when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   10. Critical Radiant Flux: Minimum of 0.45 watts/sq cm, when tested in accordance with ASTM E648.
   11. Tensile Strength: 6,000 psi, when tested in accordance with ASTM D638.
   12. Compressive Strength: 15,000 psi, when tested in accordance with ASTM C579 .
   13. Abrasion Resistance: Maximum weight loss of 90 mg/1000 cycles, when tested in accordance with ASTM D4060, CS-17.
   14. Color: Selected by Design Professional from manufacturer's standard range.

2.03 ACCESSORIES

A. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.

B. Primer: Type recommended by fluid-applied flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Coordinate examination of existing floor conditions and scope of floor slab repairs with Installer for Section 03 01 00 - Maintenance of Concrete.

B. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work 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. Test as Follows:
      a. Alkalinity (pH): ASTM F710.
      b. Internal Relative Humidity: ASTM F2170.
      c. Moisture Vapor Emission: ASTM F1869.
   2. 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 and that all other work affecting the floor has been completed.

F. No "waiver of responsibility" for incomplete, inadequate or defective underlaying and adjoining work, surfaces and conditions will be considered, unless notice of such unsatisfactory conditions has been submitted and agreed to in writing before Work begins. Commencement of Work constitutes acceptance of surfaces.

3.02 PREPARATION

A. Comply with recommendations of Sherwin-Williams Surface Preparation Form G-1.

B. Remove all surface contamination, loose or weakly adherent particles, laitance, grease, oil, curing compounds, paint, dust and debris by blast track method or approved mechanical means (acid etch not allowed). If surface is questionable try a test patch.

C. Prepare concrete surfaces and create minimum surface profile according to ICRI 310.2R, CSP 4-6, including abrasive blasting.

D. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.

E. At perimeter of floor drains and cleanouts, grind surface of adjoining concrete to provide a 4 to 6 inch wide sloping border that will result in the adjoining finish floor surface being flush to the drain or cleanout surface and eliminate abrupt vertical transitions. Rout 1/4-inch wide by 1/4-inch deep isolation joint in the concrete immediately adjacent to the floor drains and cleanouts, to receive joint sealant after completion of epoxy floor finish.

F. Prepare existing isolation and expansion joints that will receive joint sealant upon completion of floor finish.

G. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.

H. Vacuum clean substrate.

I. 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, to achieve specified total system thickness.

C. Finish to smooth, slip-resistant level surface.

D. After flooring has fully cured, clean out isolation joints where flooring meets walls, permanent fixtures, floor drains, cleanouts, etc. and install joint sealant. See Section 07 92 00 - Joint Sealants.

3.04 CLEANING AND PROTECTION

A. Upon completion of the floor finish, clean up and remove from the premises surplus materials, tools, appliances, empty cans, cartons and rubbish resulting from the Work. Clean off all spattering and drippings, and all resulting stains.

B. Prohibit traffic on floor finish for 48 hours after installation.

C. Barricade area to protect flooring until fully cured.

END OF SECTION

SECTION 09 91 13
EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish the following surfaces exposed to view prior to installation of rapid-coiling overhead doors .:
   1. New steel foreframe, welds and fasteners at new rapid-opening overhead Door 01.
   2. New wood foreframe and adjoining wood trim at new rapid-opening overhead Door 02.

1.02 RELATED REQUIREMENTS

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

1.03 REFERENCE STANDARDS

A. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials.

B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.

C. SSPC-SP 1 - Solvent Cleaning.

D. SSPC-SP 6 - Commercial Blast Cleaning.

1.04 SUBMITTALS

A. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

B. Samples: Submit two paper chip samples, 2 x 4 inch in size illustrating range of colors available for each surface finishing product scheduled.

C. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

1.05 QUALITY ASSURANCE

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

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
   4. Supply each paint material in quantity required to complete entire project's work from a single production run.
   5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content: Comply with Section 01 61 16.

C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Design Professional from the manufacturer's full line.

D. Colors: To be selected from manufacturer's full range of available colors.
   1. Selection to be made by Design Professional after award of contract.

2.03 PAINT SYSTEMS - EXTERIOR

A. Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including primed wood and primed metal.
   1. Two top coats and one coat primer.
   2. Top Coat(s): Exterior Light Industrial Coating, Water Based.
      a. Products:
         1) Behr Premium Interior/Exterior Direct-To-Metal Paint Semi-Gloss [No. 3200]. (MPI #163)
         2) PPG Paints Pitt-Tech Plus DTM Industrial Enamel, 4216 HP Series, Semi-Gloss.
         3) Sherwin-Williams Pro Industrial Multi-Surface Acrylic, Semi-Gloss.
   3. Primer: As specified under "PRIMERS" below.

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
   1. Rust-Inhibitive Water Based Primer for Steel.
      a. Products:
         1) Behr Premium Plus Interior/Exterior Multi-Surface Primer and Sealer [No. 436]. (MPI #107)
         2) PPG Paints Pitt-Tech Plus DTM Industrial Primer, 4020 PF Series.
         3) Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer. (MPI #107)
   2. Latex Primer for Exterior Wood.
      a. Products:
         1) Behr Premium Plus Interior/Exterior Multi-Surface Primer and Sealer [No. 436]. (MPI #6)

2) PPG Paints Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer, 17-921XI Series. (MPI #6)
3) Sherwin-Williams Exterior Latex Primer, B42W8041. (MPI #6)

2.05 ACCESSORY MATERIALS

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

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
2. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Ferrous Metal:
1. Solvent clean according to SSPC-SP 1.
2. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

G. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

3.03 APPLICATION

A. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

A. Owner will provide field inspection.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 22 05 17
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.

B. Pipe sleeve-seals.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Piping identification.

C. Section 22 07 19 - Plumbing Piping Insulation.

1.03 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.

1.04 SUBMITTALS

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified this section.
   1. Minimum three years experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Manufacturers:
   1. Flexicraft Industries; Pipe Wall Sleeve: www.flexicraft.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.

C. Pipe Passing Through Below Grade Exterior Walls:
   1. Zinc coated or cast iron pipe.
   2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

D. Pipe Sleeve Sizing:

E. Uninsulated Pipes: Size sleeves two pipe sizes larger than pipe passing through, or size sleeves for a minimum of 1/2-inch clearance between inside of sleeve and outside diameter of pipe passing through.

F. Wall Seal Sleeve: Size sleeves to accommodate the pipe plus the hydrostatic Wall Seal.

G. Insulated Pipes: Size sleeves for a minimum of 1/2-inch clearance between inside of sleeve and outside diameter of insulation covering on pipes passing through.

H. Sleeve Length:

I. Wall and Partitions: Equal to total thickness of wall or partitions and terminated flush with finished surfaces.

J. Floors: Equal to total depth of floor construction including finish and extending a minimum of one inch above floor level.

K. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Partitions, and Beam Flanges: 1 inch greater than external pipe diameter.
   3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

2.02 PIPE-SLEEVE SEALS

A. Manufacturers:
   1. Advance Products & Systems, LLC; Innerlynx: www.apsonline.com/#sle.
   2. Flexicraft Industries; PipeSeal: www.flexicraft.com/#sle.
   3. Garlock; Link-Seal: www.garlock.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Modular Mechanical Sleeve-Seal:
   1. Elastomer-based interlocking links continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
   2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
   3. Size and select seal component materials in accordance with service requirements.
   4. Service Requirements:
      a. Corrosion resistant.
   5. Glass-reinforced plastic pressure end plates.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
   1. Underground Piping: Caulk pipe sleeve watertight with mechanically expandable chloroprene inserts with bitumen sealed metal components.
   2. Aboveground Piping:
      a. Pack solid using mineral fiber complying with ASTM C592.
      b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
   3. All Rated Openings: Caulk tight with fire stopping material complying with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.
   4. Caulk exterior wall sleeves watertight with mechanically expandable chloroprene inserts with mastic-sealed components.

E. Manufactured Sleeve-Seal Systems:
   1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
   2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
   3. Locate piping in center of sleeve or penetration.

4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a water-tight seal.
6. Install in accordance with manufacturer's recommendations.

F. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.03 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prefabricated trapeze-framed systems.

B. Pipe hangers.

C. Pipe supports, guides, shields, and saddles.

D. Anchors and fasteners.

1.02 RELATED REQUIREMENTS

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

B. Section 05 50 00 - Metal Fabrications.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

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

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.

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

I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

M. FM (AG) - FM Approval Guide.

N. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

O. UL (DIR) - Online Certifications Directory.

P. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.

4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Design Professional of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

B. Installer's Qualifications: Include evidence of compliance with specified requirements.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of plumbing work.

B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.

C. 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 [_____]. Include consideration for vibration, equipment operation, and shock loads where applicable.

D. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.

E. Materials for Metal Fabricated Supports: Comply with Section 05 50 00.
1. Zinc-Plated Steel: Electroplated in accordance with ASTM B633 unless stated otherwise.
2. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.

F. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.
1. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.

2.02 PIPE HANGERS

A. Swivel Ring Hangers, Adjustable:
1. Manufacturers:
a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
b. Substitutions: See Section 01 60 00 - Product Requirements.
2. MSS SP-58 type 10, epoxy-painted, zinc-colored.
3. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
4. FM (AG) and UL (DIR) listed for specific pipe size runs and loads.

B. Clevis Hangers, Adjustable:
   1. Manufacturers:
      a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Copper Tube: MSS SP-58 type 1, epoxy-plated copper.

2.03 PIPE CLAMPS

A. Riser Clamps:
   1. Manufacturers:
      a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   2. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
   3. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
   4. UL (DIR) listed: Pipe sizes 1/2 to 8 inch.

2.04 PIPE SUPPORTS, GUIDES, SHIELDS, AND SADDLES

A. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.

B. Pipe Shields for Insulated Piping:
   1. Manufacturers:
      a. Anvil International: www.anvilintl.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   2. MSS SP-58 type 40, ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
   3. General Construction and Requirements:
      a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
      b. Shields Material: UV-resistant polypropylene with glass fill.
      c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
      d. Service Temperature: Minus 40 to 178 degrees F.
      e. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

C. Pipe Supports:
   1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
   2. Liquid Temperatures Up to 122 degrees F:
      a. Overhead Support: MSS SP-58 types 1, 3 through 12 clamps.
      b. Support From Below: MSS SP-58 types 35 through 38.

D. Pipe Supports, Thermal Insulated:
   1. General Requirements:
      a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
      b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
      c. Provide pipe supports for 1/2 to 30 inch iron pipes.
      d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by 360 degree, PVC jacketing.
   2. PVC Jacket:
      a. Pipe insulation protection shields to be provided with ball bearing hinge and locking seam.
      b. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
      c. Minimum Thickness: 60 mil, 0.06 inch.

E. Copper Pipe Supports:
   1. Manufacturers:
      a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 ANCHORS AND FASTENERS

A. Manufacturers - Mechanical Anchors:
   1. FNW; 7502: www.fnw.com/#sle.
   2. Hilti, Inc: www.us.hilti.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

C. Concrete: Use expansion anchors or screw anchors.

D. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.

E. Preset Concrete Inserts: Continuous metal strut channel and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
   1. Channel Material: Use galvanized steel.
   2. Manufacturer: Same as manufacturer of metal strut channel framing system.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

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

B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

C. Unless specifically indicated or approved by Design Professional, do not provide support from suspended ceiling support system or ceiling grid.

D. Unless specifically indicated or approved by Design Professional, do not provide support from roof deck.

E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

F. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

G. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

I. Secure fasteners according to manufacturer's recommended torque settings.

J. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe markers.

E. Underground warning tape.

1.02 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Identification painting.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.04 SUBMITTALS

A. Schedules:
1. Submit plumbing component identification schedule listing equipment, piping, and valves.
2. Detail proposed component identification data in terms of of wording, symbols, letter size, and color coding to be applied to corresponding product.
3. Valve Data Format: Include id-number, location, function, and model number.

B. Product Data: Provide manufacturers catalog literature for each product required.

C. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

D. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

A. Nameplates:
1. Water heaters, mixing valves, backflow preventers and other heat transfer products.
2. Heat-trace Control panels.
3. Pumps and control panels.

B. Tags:
1. Piping: 3/4 inch diameter and smaller.
2. Manually operated valves
3. Automated control valves.

C. Stencil: Not permitted.

D. Pipe Markers: 3/4 inch diameter and larger.

2.02 NAMEPLATES

A. Manufacturers:
1. Brimar Industries, Inc: www.pipemarker.com/#sle.
2. Seton Identification Products: www.seton.com/#sle.
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: Laminated piece with up to three lines of text.
1. Letter Color: White.
2. Letter Height: 1/4 inch.
3. Background Color: Red.

2.03 TAGS

A. Manufacturers:
1. Brady Corporation: www.bradycorp.com/#sle.

2. Brimar Industries, Inc: www.pipemarker.com/#sle.
3. Seton Identification Products: www.seton.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Metal: Brass, 19 gauge 1-1/2 inch in diameter with smooth edges, blank, smooth edges, and corrosion-resistant ball chain. Up to three lines of text.

C. Valve Tag Chart: Typewritten 12-point letter size list in anodized aluminum frame.

D. Piping: 3/4 inch diameter and smaller. Include corrosion resistant chain. Identify service, flow direction, and pressure.

2.04 STENCILS

2.05 PIPE MARKERS

A. Manufacturers:
1. Brady Corporation: www.bradycorp.com/#sle.
2. Brimar Industries, Inc: www.pipemarker.com/#sle.
3. Seton Identification Products: www.seton.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Comply with ASME A13.1.

C. Flexible Marker: Factory fabricated, semi-rigid, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid conveyed.

D. Flexible Tape Marker: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.

E. Identification Scheme, ASME A13.1:
1. Primary: External Pipe Diameter, Uninsulated or Insulated.
a. 3/4 to 1-1/4 inches: Use 8 inch field-length with 1/2 inch text height.
b. 1-1/2 to 2 inches: Use 8 inch field-length with 3/4 inch text height.
c. 2-1/2 to 6 inches: Use 12 inch field-length with 1-1/4 inch text height.
d. 8 to 10 inches: Use 24 inch field-length with 2-1/2 inch text height.
e. Over 10 inches: Use 32 inch field-length with 3-1/2 inch text height.
2. Secondary: Color scheme per fluid service.
a. Water; Potable, Sanitary, Heat-Traced Grease Waste, Storm Drain Other, Sanitary Vent, Grease Waste Vent: White text on green background.

2.06 UNDERGROUND WARNING TAPE

A. Manufacturers:
1. Brady Corporation: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

C. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil, 0.004 inch.

D. Legend: Type of service, continuously repeated over full length of tape.

E. Color:
1. Tape for Buried Grease Piping: Black text on red background.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive identification products.

3.02 INSTALLATION

A. Install flexible nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags in clear view and align with axis of piping

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe marker around pipe in accordance with manufacturer's instructions.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

F. Apply ASME A13.1 Pipe Marking Rules:
   1. Place pipe marker adjacent to changes in direction.
   2. Place pipe marker adjacent each valve port and flange end.
   3. Place pipe marker at both sides of floor and wall penetrations.
   4. Place pipe marker every 25 to 50 feet interval of straight run.

END OF SECTION

SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cellular glass insulation.

B. Flexible elastomeric cellular insulation.

C. Glass fiber insulation.

D. Jacketing and accessories.

E. Prefabricated Fitting Covers

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.

C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.

E. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.

F. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum [_____] years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER INSULATION

A. Manufacturers:
   1. Johns Manville Corporation; Micro_Lok AP 2000: www.jm.com/#sle.
   2. CertainTeed Corporation: www.certainteed.com/#sle.
   3. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.ocbuildingspec.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. K Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm inch.

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

E. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.03 INSULATED FITTING COVERS

A. Manufacturers (Insulated Fitting Covers):
   1. Johns Manville Corporation; Zeston 2000
   2. Substitutions: See Section01 60 00-Product Requirements.

B. Insulated Fitting Covers: Insulate fittings and valve bodies with a factory made pre-molded one-piece polyvinyl chloride (PVC) insulated cover. PVC cover self-extinguishing fire-rating not to exceed a flame spread of 25 and a fuel contribution rating of 0 when tested in accordance with ASTM E 84. Insulation inserts manufactured of noncombustible glass fiber with a K factor of .28 at 75 degrees F. mean temperature.

2.04 CELLULAR GLASS INSULATION

A. Insulation: ASTM C552, Type II, Grade 6.
   1. K Value: 0.35 at 100 degrees F.
   2. Service Temperature Range: From 250 degrees F to 800 degrees F.
   3. Water Vapor Permeability: 0.005 perm inch maximum per inch.
   4. Water Absorption: 0.5 percent by volume, maximum.

2.05 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
   1. Aeroflex USA, Inc; Aerocel Stay-Seal with Protape (SSPT): www.aeroflexusa.com/#sle.
   2. Armacell LLC; AP Armaflex: www.armacell.us/#sle.
   3. K-Flex USA LLC; Insul-Tube: www.kflexusa.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Flexible Insulation (For Pipe Sizes 1/2 in. Thru 5 in.) TYPE 1: Expanded, closed cell, elastomeric structure or unicellular polyolefin foam insulation manufactured to meet requirements of ASTM C 534, Type I, in pre-slit or un-slit tubing form.
   1. Basic Physical Properties:
      a. Density: 5 to 6 pounds per cubic foot.
      b. Thermal Conductivity: 0.28 BTUH or less per sq. ft. per degree per inch at 75 degrees F. mean temperature when tested according to ASTM C 177.
      c. Water Vapor Permeability: 0.10 perm-inch or less when tested according to ASTM E 96.

d. Fire Rating: not exceeding 25 Flame Spread and 50 Smoke Developed when tested according to ASTM E 84.
e. Temperature Limits: -40 degrees F. to 220 degrees F.

2. Provide insulation manufacturer's companion joint making/sealing adhesive to make permanent insulation joints.
3. Fitting Insulation (Flexible): Insulate fittings and valve bodies with sleeves of same insulation thickness used on adjacent piping and having an inside diameter large enough to fit over the insulation on adjacent piping.

C. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 220 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

2.06 JACKETING AND ACCESSORIES

A. PVC Plastic.
1. Manufacturers:
a. Johns Manville Corporation: www.jm.com/#sle.
b. Substitutions: See Section 01 60 00 - Product Requirements.
2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
a. Minimum Service Temperature: 0 degrees F.
b. Maximum Service Temperature: 150 degrees F.
c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
d. Thickness: 10 mil, 0.010 inch.
e. Connections: Tacks, pressure sensitive color matching vinyl tape or perma-weld solvent weld adhesive: As recommended by insulation material manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Glass fiber insulated pipes conveying fluids below ambient temperature:
1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

E. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

F. Glass fiber insulated pipes conveying fluids above ambient temperature:
1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

G. Inserts and Shields:

1. Application: Piping 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.

H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 07 84 00.

I. Heat Traced Piping: Insulate fittings and joints with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with PVC jacket with seams located on bottom side of horizontal piping.

3.03 SCHEDULES

A. Plumbing Systems:
1. Domestic Cold Water Supply:
   a. Glass Fiber Insulation:
      1) Pipe Size Range: 2-inch and smaller.
      2) Thickness: 1/2".
   b. Cellular Foam Insulation
      1) Pipe Size Range: 2-inch and smaller.
      2) Thickness: 1/2".
2. Domestic Hot Water Supply:
   a. Glass Fiber Insulation:
      1) Pipe Size Range: 2-inch and smaller.
      2) Thickness: 1".
   b. Cellular Glass Insulation:
      1) Pipe Size Range: 2-inch and smaller.
      2) Thickness: 1".
3. Domestic Hot Water Recirculation:
   a. Glass Fiber Insulation:
      1) Pipe Size Range: All sizes.
      2) Thickness: 1 inch.
4. Tempered Domestic Water Supply:
   a. Glass Fiber Insulation:
      1) Pipe Size Range: 2-inch and smaller.
      2) Thickness: 1".
5. Grease Waste:
   a. Glass Fiber Insulation:
      1) Pipe Size Range: 2-inch and smaller.
      2) Thickness: 1".
   b. Cellular Glass Insulation:
      1) Pipe Size Range: 2-inch and smaller.
      2) Thickness: 1".

END OF SECTION

SECTION 22 10 05
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary waste piping, above grade.
B. Grease waste piping, buried within 5 feet of the building.
C. Domestic water piping, above grade.
D. Pipe flanges, unions, and couplings.
E. Pipe hangers and supports.
F. Pipe sleeve-seal systems.
G. Ball valves.
H. Balancing valves.
I. Strainers.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.
B. Section 08 31 00 - Access Doors and Panels.
C. Section 09 91 23 - Interior Painting.
D. Section 22 05 16 - Expansion Fittings and Loops for Plumbing Piping.
E. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.
F. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
G. Section 22 07 19 - Plumbing Piping Insulation.
H. Section 31 23 16 - Excavation.
I. Section 31 23 16.13 - Trenching.
J. Section 31 23 23 - Fill.
K. Section 33 01 10.58 - Disinfection of Water Utility Piping Systems.

1.03 REFERENCE STANDARDS

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
C. ASME B31.9 - Building Services Piping.
D. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators.
E. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
F. ASTM B32 - Standard Specification for Solder Metal.
G. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
H. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
I. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric).
J. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.
K. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.
L. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

M. ASTM C1277 - Standard Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.

N. ASTM C1540 - Standard Specification for Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.

O. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings.

P. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

Q. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

R. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

S. FM 1680 - Approval Standard for Couplings Used in Hubless Cast Iron Systems for Drain, Waste or Vent, Sewer, Rainwater or Storm Drain Systems Above and Below Ground, Industrial/ Commercial and Residential.

T. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements.

U. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.

V. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

W. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

X. NSF 61 - Drinking Water System Components - Health Effects.

Y. NSF 372 - Drinking Water System Components - Lead Content.

Z. UL (DIR) - Online Certifications Directory.

AA. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

B. Welders' Certificates: Submit certification of welders' compliance with ASME BPVC-IX.

C. Sustainable Design Documentation: For soldered copper joints, submit installer's certification that the specified installation method and materials were used.

D. Project Record Documents: Record actual locations of valves.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements for additional provisions.
   2. Valve Repacking Kits: One for each type and size of valve.

1.05 QUALITY ASSURANCE

A. For drinking water service, provide valves and components complying with NSF 61.

B. Provide all components in the drinking water system to comply with the Federal “Reduction of Lead in Drinking Water Act” – 2011.

C. Flush piping systems with faucet aerators and shower heads removed. Install faucet aerators and shower heads at the time of the final disinfection.

D. Perform final disinfection within 2 weeks of the building or space being occupied.

E. Perform work in accordance with applicable codes.

F. Valves: Manufacturer's name and pressure rating marked on valve body.

G. Cast Iron Soil Pipe Markings: All cast iron soil pipe shall be clearly marked with the manufacturer’s name, country of origin, registered trademark of manufacturing site, eight-digit date code, pipe diameter and length, relevant ASTM standard and registered trademark of the

third-party certifier. Third party certifier shall be accredited by ANSI.

H. Material Test Reports: Upon request suppliers of cast iron soil pipe shall be able to supply material tests reports in accordance with the relevant ASTM standard and shall include testing and analysis on: radioactivity, dimensional characteristics, tensile strength and chemical/metallurgical content. Suppliers shall also supply MSDS sheets on all coatings.

I. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

J. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

K. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.06 WARRANTY

A. Epoxy coated cast iron pipe shall be warranted for 10-years.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.08 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, valves, pipe specialties and solder and flux, that comply with NSF 61 and NSF 372 for maximum lead content.

B. Label pipe and fittings.

2.02 SANITARY, WASTE AND VENT PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74, CISPI 301; hubless, service weight.
   1. Fittings: ASTM Cast iron.
   2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. Cast Iron Pipe: ASTM A74, CISPI 301, ANSI/NSF 61 service weight, bell and spigot.
   1. Fittings: ASTM A74, CISPI 301, ANSI/NSF 61; Cast iron.
   2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.
   3. Joint Lubricant: designed for use in making compression joints and formulated to impart no chemical attack to the gasket.

C. Cast Iron Pipe: ASTM A74, CISPI 301, ANSI/NSF 61; hubless, service weight.
   1. Fittings: CISPI 301, ANSI/NSF 61; Cast iron.
   2. Joints: CISPI 310, ASTM C564; neoprene gaskets and Type 301 stainless steel clamp, Type 305 stainless steel screws, Type 3401 stainless steel corrugated shield, 1 ½” to 4” pipe diameter, 2 1/8” wide clamp with 2 straps, 5” and 6” pipe diameter 3” wide clamp with 4 straps.
   3. Hubless Coupling Manufacturers:
      a. New Age Casting
      b. Anaco
      c. Substitutions: See section 01 60 00 - Product Requirements

2.03 GREASE WASTE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74, CISPI 301, ANSI/NSF 61; service weight, bell and spigot.
   1. Fittings: ASTM A74, CISPI 301, ANSI/NSF 61; Cast iron.

2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.
3. Joint Lubricant: designed for use in making compression joints and formulated to impart no chemical attack to the gasket.

B. Cast Iron Pipe: CISPI 301, ANSI/NSF 61; hubless.
1. Fittings: ASTM A74, CISPI 301, ANSI/NSF 61; Cast iron, hubless.
2. Joints: CISPI 310, ASTM C564; neoprene gasket and Type 301 stainless steel clamp, Type 305 stainless steel screws and Type 301 stainless steel corrugated shield, 0.0075 thick Type 301 stainless steel corrugated shield. 1 ½" to 4" pipe diameter, 2 1/8" wide clamp with 2 straps, 5" and 6" pipe diameter 3" wide clamp with 4 straps.
3. Hubless Coupling Manufacturers:
a. New Age Casting
b. Anaco
c. Substitutions: See section 01 60 00 - Product Requirements

2.04 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B).
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B32, lead-free, alloy Sn95 solder.
3. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.
a. Manufacturers:
1) Anvil International: www.anvilintl.com/#sle.
2) Apollo Valves: www.apollovalves.com/#sle.
3) Viega LLC: www.viega.us/#sle.
4) Substitutions: See Section 01 60 00 - Product Requirements.

2.05 PIPE FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 inch and Under:
1. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

B. No-Hub Couplings:
1. Testing: In accordance with ASTM C1277 and CISPI 310.
2. Gasket Material: Neoprene complying with ASTM C564.
3. Band Material: Stainless steel.
4. Eyelet Material: Stainless steel.
5. Manufacturers:
a. MIFAB, Inc; MI-QHUB: www.mifab.com/#sle.
b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Shielded, Heavy Duty No-Hub Couplings:
1. Testing: In accordance with ASTM C1540 and FM 1680.
2. Gasket Material: Neoprene complying with ASTM C564.
3. Band Material: Stainless steel.
4. Eyelet Material: Stainless steel.

2.06 PIPE HANGERS AND SUPPORTS

A. See Section 22 05 29 for additional requirements.

B. Provide hangers and supports that comply with MSS SP-58.
1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
3. Trapeze Hangers: Welded steel channel frames attached to structure.
4. Vertical Pipe Support: Steel riser clamp.

C. Plumbing Piping - Water:

1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
2. Hangers for Cold Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
3. Hangers for Hot Pipe Sizes 2 to 4 inch: Carbon steel, adjustable, clevis.
4. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
1. Concrete Wedge Expansion Anchors: Comply with ICC-ES AC193.
2. Masonry Wedge Expansion Anchors: Comply with ICC-ES AC01.
3. Concrete Screw Type Anchors: Comply with ICC-ES AC193.
4. Masonry Screw Type Anchors: Comply with ICC-ES AC106.
5. Concrete Adhesive Type Anchors: Comply with ICC-ES AC308.
6. Other Types: As required.

2.07 PIPE SLEEVE-SEAL SYSTEMS

A. Manufacturers:
1. Garlock, a company of Enpro Industries, Inc: www.garlock.com.
2. The Metraflex Company; MetraSeal: www.metraflex.com/#sle.
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Modular Mechanical Seals:
1. Elastomer-based interlocking links continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
3. Size and select seal component materials in accordance to service requirements.
4. Service Requirements:
   a. Underground, buried, and wet conditions.
   b. Fire Resistant: 1 hour, UL (DIR) approved.
5. Glass reinforced plastic pressure end plates.

2.08 BALL VALVES

A. Manufacturers:
1. Apollo Valves; Model 70LF-100-03 or 70LF-200-03: www.apollovalves.com/#sle.
2. Nibco, Inc: www.nibco.com/#sle.
3. Viega LLC: www.viega.us/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Construction, 4 inch and Smaller: MSS SP-110, ANSI/NSF 61;Class 150, 400 psi CWP, bronze body, 304 stainless steel or chrome plated brass ball, full port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with vinyl grip, solder or threaded ends with union.

2.09 BALL VALVES (EMERGENCY FIXTURES)

A. Manufacturers:
1. Apollo Valves; Model 70LF-100-03-27 or 70LF-200-03-27: www.apollovalves.com/#sle.
2. Nibco, Inc: www.nibco.com/#sle.
3. Viega LLC: www.viega.us/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Construction, 4 inch and Smaller: MSS SP-110, ANSI/NSF 61; Class 150, 400 psi CWP, bronze body, 304 stainless steel or chrome plated brass ball, full port, teflon seats and stuffing box ring, blow-out proof stem, lock-open, lever handle with vinyl grip, solder or threaded ends with union.

2.10 BALANCING VALVES

A. Manufacturers:
1. ITT Bell & Gossett: www.bellgossett.com/#sle.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Calibration: Control flow within five percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

2.11 VACUUM BREAKERS

A. Acceptable Manufacturers (Vacuum Breakers):
   1. Watts Regulator Company, Model 8A.
   2. Wilkins
   3. Substitutions: Section 01 60 00 - Product Requirements.

B. Vacuum Breakers: ASSE 1011/ANSI A112.1.3; LEAD FREE brass body, non- removable, stainless steel internal working parts, rubber diaphragm and disc.

2.12 STRAINERS

A. Manufacturers:
   1. Armstrong International, Inc: www.armstronginternational.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Size 1/2 inch to 3 inch:
   1. Class 150, threaded forged bronze Y-pattern body, stainless steel perforated mesh screen with cap, and rated for 150 psi, 250 deg F WOG service.

C. Size 2 inch and Smaller:
   1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
   2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with unions.

D. Interferences: Layout piping systems to compensate for structural interferences, to preserve headroom, and not to interfere with openings, passageways and equipment. Do not install piping with joints and fittings over motors, switchboards, panels, or similar electrical apparatus.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Clean piping prior to and following the installation, prepare for painting. Keep open ends of piping and pipe attachment openings on equipment capped or plugged until actual connections.

E. Install piping to maintain headroom, conserve space, and not interfere with use of space.

F. Group piping whenever practical at common elevations.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 22 05 16.

H. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

I. Provide access where valves and fittings are not exposed.
   1. Coordinate size and location of access doors with Section 08 31 00.

J. Excavate in accordance with Section 31 23 16.

K. Backfill in accordance with Section 31 23 23.

L. Install bell and spigot pipe with bell end upstream.

M. Install valves with stems upright or horizontal, not inverted.

N. Install water piping to ASME B31.9.

O. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

P. Sleeve pipes passing through partitions, walls, and floors.

Q. Inserts:

R. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9.
2. Support horizontal piping as indicated.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping.
9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
    a. Painting of interior plumbing systems and components is specified in Section 09 91 23.
10. Support cast iron drainage piping at every joint.

S. Pipe Sleeve-Seal Systems:
1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a watertight seal.
6. Install in accordance with manufacturer's recommendations.

3.04 PIPE JOINING

A. General Requirements: Exercise care when making pipe joints and make joints in accordance with the pipe material manufacturer's recommendations and the following additional requirements.
1. In each instance of pipe joining, those portions of pipes involved must be absolutely clean just prior to assembly.
2. If a joint is extremely difficult to assemble or is not completely sealed, disassemble the joint and correct the difficulty if possible. Remake the joint using new materials when necessary.

B. Copper Tubing and Pipe Joints: Cut tubing and piping ends square, deburr and ream to size of original bore.
1. Solder: Prior to sweating, clean ends of pipe and fitting surfaces involved in the joint, to bright metal without marring surfaces. Finished joints shall show no evidence of hard-temper due to over-heating, no evidence of improper solder draw, and excess solder must be removed.

3.05 INSTALLATION - BURIED PIPING

A. Buried Piping: Perform earthwork including trenching for buried pipe runs as specified in Section 02324.

B. Keep trenches dewatered until pipe joints have been made and concrete bedding and blocking, if any, have hardened. Under no circumstances lay pipe in water or on sub grade containing frost.

C. Rest each section of pipe on pipe bedding for the full length of its barrel, with recesses excavated for pipe bells so joints can easily be made. Backfill recesses with bedding material immediately following pipe joining operations.

D. Lay pipe proceeding upgrade true to line and grades given. Lay bell and spigot pipe with bell end upgrade.

E. Take up and relay pipe that is not laid true to required alignment or grade and/or has its joints disturbed after installation. No deviations from the required line and grade permitted, except with approval of the Engineer.

3.06 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.07 CLEANING

A. Division 01 – General Requirements: Requirements for cleaning.

B. Flush all existing domestic water piping that will remain for new construction, prior to the installation of any new piping. Perform water tests to verify piping is cleaned. Submit water quality tests to the Engineer or the Construction Manager.

C. Flush all new piping prior to disinfection.

D. Perform a final flush of the piping systems and equipment within 3 weeks of owner's occupancy. Remove all faucet aerators prior to final flush.

3.08 FIELD TESTS AND INSPECTIONS

A. Verify and inspect systems according to requirements by the Authority Having Jurisdiction. In the absence of specific test and inspection procedures proceed as indicated below.

B. Domestic Water Systems:
   1. Perform hydrostatic testing for leakage prior to system disinfection.
   2. Test Preparation: Close each fixture valve or disconnect and cap each connected fixture.
   3. General:
      a. Fill the system with water and raise static head to 10 psi above service pressure. Minimum static head of 50 to 150 psi. As an exception, certain codes allow a maximum static pressure of 80 psi.

C. Test Results: Document and certify successful results, otherwise repair, document, and retest.

3.09 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system in accordance with Section 33 01 10.58.

B. Verify all faucet aerators, shower heads, equipment strainers and filter cartridges are removed prior to disinfection.

C. Perform a final disinfection of the piping system, fixtures and equipment within 2 weeks of the owner's occupancy. Strainer screens, faucet aerators, shower heads should be removed from the system prior to the disinfection.

3.10 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe Size: 1/2 inch to 1-1/4 inch:
         1) Maximum Hanger Spacing: 6.5 ft.

2) Hanger Rod Diameter: 3/8 inches.

b. Pipe Size: 1-1/2 inch to 2 inch:
   1) Maximum Hanger Spacing: 10 ft.
   2) Hanger Rod Diameter: 3/8 inch.
c. Pipe Size: 2-1/2 inch to 3 inch:
   1) Maximum Hanger Spacing: 10 ft.
   2) Hanger Rod Diameter: 1/2 inch.
d. Pipe Size: 4 inch to 6 inch:
   1) Maximum Hanger Spacing: 10 ft.
   2) Hanger Rod Diameter: 5/8 inch.
e. Pipe Size: 8 inch to 12 inch:
   1) Maximum hanger spacing: 14 ft.
   2) Hanger Rod Diameter: 7/8 inch.
f. Pipe Size: 14 inch and Over:
   1) Maximum Hanger Spacing: 20 ft.
   2) Hanger Rod Diameter: 1 inch.

END OF SECTION

SECTION 22 10 06
PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Floor Drains.

B. Trench Drains

C. Cleanouts.

D. Hose bibbs.

E. Hydrants.

F. Hose Stations.

G. Mixing valves.

H. Floor drain trap seals.

1.02 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping.

B. Section 22 45 00 - Emergency Plumbing Fixtures.

1.03 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor and Trench Drains.

B. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers.

C. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent.

D. ASSE 1015 - Performance Requirements for Double Check Backflow Prevention Assemblies.

E. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance.

F. NSF 61 - Drinking Water System Components - Health Effects.

G. NSF 372 - Drinking Water System Components - Lead Content.

1.04 SUBMITTALS

A. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

B. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

C. Manufacturer's qualification statement.

D. Operation Data: Indicate frequency of treatment required for interceptors.

E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements for additional provisions.
   2. Extra Loose Keys for Outside Hose Bibbs: One.

1.05 QUALITY ASSURANCE

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

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 FLOOR DRAINS

A. Manufacturers:
   1. Zurn Industries, LLC: www.zurn.com/#sle.
   2. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
   3. Josam Company: www.josam.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Floor Drain (FD-1):
   1. ASME A112.6.3; lacquered cast iron, body with bottom outlet, seepage pan and combination membrane flashing clamp and frame with integral trap primer and plug.ble drainage flange, laquered cast iron, round, medium-duty strainer, sediment bucket. Zurn Model; Z550-Y

C. Trench Drains (TD-1 & TD-2):
   1. Frame and Grate System, Zurn Z712, of length indicated, with 12-inch wide reveal and 8-1/2-inch clear opening. Mechanically lock into the concrete surround every 12 inches. Provide with P12-DGE 12-inch wide reveal Ductile Iron Slotted Grates with 63/64-inch wide slots and 1-1/2-inch bearing depth that lock down to frame. At trash compacter area, provide two 24-inch long Z712-DC solid ductile iron covers in lieu of grates, one each centered under the trash compacter rollers. Ductile Iron grates shall conform to ASTM specification A536-84, Grade 80-55-06 and be rated class C per the DIN EN1433 top load classifications. Grate to have an open area of 86.7 sq. in per ft. The 1/4-inch thick Heavy-Duty Carbon Steel Frame Assembly shall conform to ASTM specification A36 with 12 4-inch long concrete anchors per 120 inch length, with a powder coated finish. Grate lockdown bars are to be integral to the frame.

2.03 PIPE TRAPS

A. Pipe Traps: Deep seal, laquered coated cast iron body with bronze cleanout plug.

B. Acceptable Manufacturers:
   1. Zurn Industries, Inc.; Model Z1000
   2. Josam Manufacturing Co.
   3. Jay R. Smith Co
   4. Substitutions: Section 01 60 00 - Product Requirements.

2.04 CLEANOUTS

A. Manufacturers:
   1. Zurn Industries, LLC: www.zurn.com/#sle.
   2. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
   3. Josam Company: www.josam.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Interior Finished Floor Areas: Heavy duty, adjustable, coated cast iron body with gas and watertight bronze tapered threaded plug, round scoriated cast iron secured top; Model Z-1400-BP.

C. Cleanout Ferrule: Heavy duty, adjustable, coated cast iron body, bronze tapered threaded plug; Model Z-1449-BP.

2.05 HOSE BIBBS

A. Manufacturers:
   1. Woodford Mfg. Co.; Model 26 with 37HF-BR
   2. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
   3. Zurn Industries, LLC: www.zurn.com/#sle.

4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Interior Hose Bibbs:
1. Hose Bibb (Interior): ASSE 1052; Field testable, double check backflow protected solid brass body, rough brass finish, angle pattern, metal wheel handle, EPDM packing, replaceable “O” ring seat, adjustable brass packing nut, sweat or threaded inlet, standard 3/4 inch male hose end outlet.

2.06 HYDRANTS

A. Manufacturers:
1. Zurn Industries, LLC: www.zurn.com/#sle.
2. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Wall Hydrants:
1. Non-freeze Hydrant: ASSE 1019; Encased, non-freeze, 3/4 [1-inch] hose end outlet, combination hot and cold water, bronze casing, all bronze interior parts, non-turning operating rods with closure valves, replaceable bronze seat and seat washer, nickel bronze box and hinged cover with operating key lock and “water” cast on cover, 3/4" vacuum breaker; Model Z-1325-VB.handwheel

2.07 VACUUM BREAKERS

A. Manufacturers (Vacuum Breakers):
1. Watts Regulator Company, Model 8A.
2. Wilkins
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Vacuum Breakers: ASSE 1011/ANSI A112.1.3; LEAD FREE brass body, non-removable, stainless steel internal working parts, rubber diaphragm and disc.

2.08 HOSE STATIONS

A. Manufacturers:
1. Strahman Washdown Equipment, Model M-159-TG with M-70
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Hose Station: Hot and Cold water system, wall mountd, stainless steel hose rack and fittings, dial-type outlet thermometer, internal blending chamber, bronze body construction, bronze inlet ball valves, 3/4" hose end connection.

C. Nozzle: Bronze construction, replaceable rubber covers (Red), whole hand handle grip, stainless steel seat design, 200 degrees F. maximum water temperature and 150-psi maximum operating pressure, variable spray.

2.09 MIXING VALVES

A. Thermostatic Mixing Valves:
1. Manufacturers:
a. Leonard Valve Company; Model LV-981A-LF-IT-BDT-LWS: www.leonardvalve.com/#sle.
b. Apollo Valve Company
c. Substitutions: See Section 01 60 00 - Product Requirements.
2. Single Valve, (3/4” inlets and 3/4”outlet), ASSE 1017; 2.5 – 28 gpm flow, 125 psi maximum pressure, 200°F maximum water temperature, LEAD FREE bronze construction with rough bronze chrome plated finish, locking temperature regulating handle, copper encapsulated thermostat assembly, integral combination check stops with strainers on inlets, outlet ball valve with dial thermometer, inlet thermometers, integral wall support, lead-free bronze and stainless steel internal parts, factory assembled and tested.

B. Thermostatic Mixing Valves (Emergency Fixtures):
1. Manufacturers:
a. Leonard Valve Company; Model TA-300-LF: www.leonardvalve.com/#sle.
b. Apollo Valve Company

c. Substitutions: See Section01 60 00-Product Requirements.

2. Single Valve: ASSE Standard 1071, ANSI Z 358.1; 2.0-7.0 gpm flow rate, (1/2” inlets and outlet); on failure of hot water supply the internal cold water by-pass delivers cold water to the emergency fixture, minimum of 4 gpm @ 30 psi., on the failure of cold water supply the hot water is shut-down, 140°F minimum hot water supply, 30 psi minimum hot and cold water supply pressure, 125 psi working pressure, factory assembled and tested, adjustable high temperature limit stop set for 90°F, locking temperature regulator set for 85°F., LEAD FREE bronze construction with rough bronze finish; bronze, brass and stainless steel internal parts, solid bi-metal element, integral wall support, color coded dial outlet thermometer, angle check-stops on inlets.

2.10 FLOOR DRAIN TRAP SEALS

A. Manufacturers:
   1. MIFAB, Inc; MI-GARD: www.mifab.com/#sle.
   2. SureSeal Manufacturing
   3. ProVent Systems

B. Description: Push-fit EPDM or silicone fitting with a one-way membrane.

PART 3 EXECUTION

3.01 PREPARATION

A. Field Measurement: The Drawings are in general indicative of the Work, with symbols and notations for clarity. However, the Drawings are not an exact representation of all conditions involved, therefore, layout piping to suit actual field measurements.
   1. No extra compensation will be made for Work due to difference between indicated and actual dimensions.
   2. Submit to the Engineer for approval, details of proposed departures necessitated by field conditions or other causes.

B. Interferences: Layout piping systems to compensate for structural interferences, to preserve headroom, and not to interfere with openings, passageways and equipment. Do not install piping with joints and fittings over motors, switchboards, panels, or similar electrical apparatus.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. 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.

F. Pipe relief from backflow preventer to nearest drain.

3.03 DISINFECTION OF DOMESTIC WATER SYSTEMS

A. Disinfect water distribution piping system in accordance with Section 02516.

END OF SECTION

SECTION 22 45 00
EMERGENCY PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Eye/face wash equipment.

B. Emergency-fixture water-tempering valves.

1.02 REFERENCE STANDARDS

A. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment.

B. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.03 SUBMITTALS

A. Product Data: Manufacturer's catalog sheets for fixtures, fittings, accessories, and supplies.

B. Field Test Reports: Plumbing fixture operational tests.

PART 2 PRODUCTS

2.01 EYE/FACE WASH EQUIPMENT

A. Manufacturers:
   1. Guardian Equipment; G1750BC with AP285-205: www.gesafety.com/#sle.
   2. Bradley Corporation: www.bradleycorp.com/#sle.
   3. Haws Corporation: www.hawsco.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. ANSI Z358.1, wall mounted, stainless steel cover and bowl. dual eye/face-spray head assembly. integral flow control and filters,

C. Pipe and Fittings Material: PVC.

D. Valve: Full flow, chrome plated stay-open ball valve with PTFE seals, quick to open thru wide-handle manual hand operator.

E. Drain: Built-into the bowl assembly with 1-1/4 inch female outlet.

F. Accessories:
   1. Bowl Cover: Valve-operated stainless steel hinged assembly.
   2. Signage: ANSI Z535.2, emergency eye/face wash safety equipment.
   3. Cast aluminum powder coated finish wall bracket.
   4. Flow Switch: 1/2" IPS double pole, double throw waterproof flow switch, mounted in horizontal position.
   5. Alarms: NEMA 250, Type 1 audio-visual station with amber colored, weatherproof lamp and weatherproof horn with output sound adjustment screw, pre-set at 100 db. at 10 ft.,

2.02 EMERGENCY-FIXTURE WATER-TEMPERING VALVES

A. Manufacturers:
   1. Bradley Corporation: www.bradleycorp.com/#sle.
   2. Guardian Equipment: www.gesafety.com/#sle.
   3. Haws Corporation: www.hawsco.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Tepid Water Temperature: Set to 85 degrees F.

C. Valve Assembly: Thermostatic mixing (blending) type made of lead-free cast brass body with integral built-in cold water bypass (fail safe), color marked dual-scale outlet temperature gauge, integral inlet check valve, integral inlet strainer, locking-type regulator, and mounting bracket.

D. Cabinet: 16 gauge, 0.0598 inch stainless steel, surface-mounted with keyed lock.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that fixtures and accessories are of the correct type and size prior to installation.

B. Verify that deck, wall and floor finishes are prepared and ready for fixture installation.

3.02 INSTALLATION

A. Install fixtures and fittings in accordance with the manufacturer's instructions.

B. Adjust water flow rates to comply with manufacturer's rating of the fixture.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Operational Tests: Upon completion and sterilization of plumbing systems, conduct operating tests to demonstrate satisfactory, functional, and operating efficiency.

3.04 CLEANING

A. Thoroughly clean plumbing fixtures and equipment.

3.05 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Repair or replace products damaged before Date of Substantial Completion.

3.06 SCHEDULES

A. Fixture Heights: Install fixtures to heights above finished floor as indicated.
   1. Emergency Eye and Face Wash:
      a. Standard: 38 inches to receptor rim.

END OF SECTION

SECTION 23 01 30.51
HVAC AIR-DISTRIBUTION SYSTEM CLEANING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cleaning of HVAC duct system, equipment, and related components.

1.02 RELATED REQUIREMENTS

A. Section 01 40 00 - Quality Requirements: Additional requirements for testing and inspection agencies.

1.03 DEFINITIONS

A. HVAC System: For purposes of this section, the surfaces to be cleaned include all existing interior surfaces of the heating, air-conditioning and ventilation system from the points where the air enters the system to the points where the air is discharged from the system; see NADCA ACR for more details.

1.04 REFERENCE STANDARDS

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

B. NADCA ACR - The NADCA Standard for Assessment, Cleaning, and Restoration of HVAC System.

C. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors.

D. UL 181A - Closure Systems for Use with Rigid Air Ducts.

PART 2 PRODUCTS

2.01 TOOLS AND EQUIPMENT

A. Vacuum Devices and Other Tools: Exceptionally clean, in good working order, and sealed when brought into the facility.

B. Vacuum Devices That Exhaust Air Inside Building, Including Hand-Held and Wet Vacuums: Equipped with HEPA filtration with 99.97 percent collection efficiency for minimum 0.3-micron size particles and DOP test number.

C. Vacuum Devices That Exhaust Air Outside Building, Including Truck- and Trailer-Mounted Types: Equipped with particulate collection including adequate filtration to contain debris removed from the HVAC system; exhausted in manner that prevents contaminant re-entry to building; compliant with applicable regulations as to outdoor environmental contamination.

2.02 SURFACE TREATMENTS

A. Anti-Microbial Materials: EPA registered specifically for use on non-porous HVAC system surfaces and applied per manufacturer's instructions.

B. Surface Coating for Fibrous Glass Materials: Water-based, zero VOC; flame spread index less that 25, smoke developed index less than 450, Class A, when tested in accordance with ASTM E84.

PART 3 EXECUTION

3.01 PROJECT CONDITIONS

A. Comply with applicable federal, state, and local requirements.

B. Perform cleaning, inspection, and remediation in accordance with the recommendations of NADCA "Assessment, Cleaning and Restoration of HVAC Systems" (ACR) and as specified herein.

C. Where NADCA ACR uses the terms "recommended", "highly recommended", or "ideally" in regard to a certain procedure or activity, do that unless it is clearly inapplicable to the project.

D. Obtain Owner's approval of proposed temporary locations for large equipment.

E. Designate a decontamination area and obtain Owner's approval.

F. If unforeseen mold or other biological contamination is encountered, notify Design Professional immediately, identifying areas affected and extent and type of contamination.

3.02 EXAMINATION

A. Inspect the system as required to determine appropriate methods, tools, equipment, and protection.

B. Start of cleaning work constitutes acceptance of existing conditions.

C. When concealed spaces are later made accessible, examine and document interior conditions prior to beginning cleaning.

D. Document all instances of mold growth, rodent droppings, other biological hazards, and damaged system components.

3.03 PREPARATION

A. When cleaning work might adversely affect life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with authorities having jurisdiction.

B. Ensure that electrical components that might be adversely affected by cleaning are de-energized, locked out, and protected prior to beginning work.

C. Air-Volume Control Devices: Mark the original position of dampers and other air-directional mechanical devices inside the HVAC system prior to starting cleaning.

D. Access to Concealed Spaces: Use existing service openings and make additional service openings as required to accomplish cleaning and inspection.
   1. Do not cut openings in non-HVAC components without obtaining the prior approval of Owner.
   2. Make new openings in HVAC components in accordance with NADCA Standard 05; do not compromise the structural integrity of the system.
   3. Do not cut service openings into flexible duct; disconnect at ends for cleaning and inspection.

E. Ceiling Tile: Lay-in ceiling tile may be removed to gain access to HVAC systems during the cleaning process; protect tile from damage and reinstall upon completion; replace damaged tile.

3.04 CLEANING

A. Use any cleaning method recommended by NADCA ACR unless otherwise specified; do not use methods prohibited by NADCA ACR, or that will damage HVAC components or other work, or that will significantly alter the integrity of the system.

B. Obtain Owner's approval before using wet cleaning methods; ensure that drainage is adequate before beginning.

C. Ducts: Mechanically clean all portions of ducts.

D. Hoses, Cables, and Extension Rods: Clean using suitable sanitary damp wipes at the time they are being removed or withdrawn from their normal position.

E. Registers, Diffusers, and Grilles: When removing, take care to prevent containment exposure due to accumulated debris.

F. Collect debris removed during cleaning; ensure that debris is not dispersed outside the HVAC system during the cleaning process.

G. Store contaminated tools and equipment in polyethylene bags until cleaned in the designated decontamination area.

3.05 REPAIR

A. Repair openings cut in the ventilation system so that they do not significantly alter the airflow or adversely impact the facility's indoor air quality.

B. At insulated ducts and components, accomplish repairs in such a manner as to achieve the equivalent thermal value.

C. Reseal new openings in accordance with NADCA Standard 05.

D. Reseal rigid fiber glass duct systems using closure techniques that comply with UL 181 or UL 181A.

E. When new openings are intended to be capable of being re-opened in the future, clearly mark them and report their locations to Owner in project report documents.

3.06 FIELD QUALITY CONTROL

A. Ensure that the following field quality control activities are completed prior to application of any treatments or coatings and prior to returning HVAC system to normal operation.

B. Visually inspect all portions of the cleaned components; if not visibly clean as defined in NADCA ACR, re-clean and reinspect.

C. Notify Design Professional when cleaned components are ready for inspection.

D. When directed, re-clean components until they pass.

E. Submit evidence that all portions of the system required to be cleaned have been cleaned satisfactorily.

3.07 ANTI-MICROBIAL TREATMENT

A. When directed, apply anti-microbial treatment to internal surfaces.

B. Apply anti-microbial agent after removal of surface deposits and debris.

C. Apply anti-microbial treatments and coatings in strict accordance with the manufacturer's written recommendations and EPA registration listing.

D. Spray coatings directly onto interior ductwork surfaces; do not "fog" into air stream.

3.08 ADJUSTING

A. After satisfactory completion of field quality control activities, restore adjustable devices to original settings, including, but not limited to, dampers, air directional devices, valves, fuses, and circuit breakers.

3.09 WASTE MANAGEMENT

A. Double-bag waste and debris in 6 mil, 0.006 inch thick polyethylene plastic bags.

B. Dispose of debris off-site in accordance with applicable federal, state and local requirements.

END OF SECTION

SECTION 23 05 23
GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ball valves.

1.02 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch.

B. ASME B31.9 - Building Services Piping.

C. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators.

D. MSS SP-45 - Drain and Bypass Connections.

1.03 SUBMITTALS

1.04 QUALITY ASSURANCE

A. Manufacturer:
   1. Obtain valves for each valve type from single manufacturer.
   2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
   2. Protect valve parts exposed to piped medium against rust and corrosion.
   3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.

B. Use the following precautions during storage:
   1. Maintain valve end protection and protect flanges and specialties from dirt.
      a. Provide temporary inlet and outlet caps.
      b. Maintain caps in place until installation.
   2. Store valves in shipping containers and maintain in place until installation.
      a. Store valves indoors in dry environment.
      b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).

B. Provide the following valves for the applications if not indicated on drawings:
   1. Throttling (Hydronic): Butterfly, Ball, Globe, and Angle.

C. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.

D. Condenser Water Valves:
   1. Size 2 inch and Smaller, Brass and Bronze Valves:
      a. Threaded ends.

E. Heating Hot Water Valves:
   1. Size 2 inch and Smaller, Brass and Bronze Valves:
      a. Threaded ends.
   2. Size 2-1/2 inch and Larger, Iron Valves:
      a. 2-1/2 inch to 4 inch: Threaded ends.

2.02 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:
   1. Hand Lever: Quarter-turn valves 6 inch and smaller.

D. Valves in Insulated Piping: Provide 2 inch stem extensions and the following features:
   1. Memory Stops: Fully adjustable after insulation is installed.

E. Valve-End Connections:
   1. Threaded End Valves: ASME B1.20.1.

F. General ASME Compliance:
   1. Building Services Piping Valves: ASME B31.9.

G. Valve Bypass and Drain Connections: MSS SP-45.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

END OF SECTION

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components.

1.02 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

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

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

1.03 SUBMITTALS

1.04 QUALITY ASSURANCE

A. Comply with applicable building code.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of [_____]. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Prefabricated Trapeze-Framed Metal Strut Systems:
   1. Strut Channel or Bracket Material:
      a. Indoor Dry Locations: Use galvanized steel.
   2. Accessories: Provide bracket covers, cable basket clips, cable tray clips, clamps, conduit clamps, fire-retarding brackets, j-hooks, protectors, and vibration dampeners.

C. Hanger Rods:
   1. Threaded zinc-plated steel unless otherwise indicated.
   2. Minimum Size, Unless Otherwise Indicated or Required:
      a. Equipment Supports: 1/2 inch diameter.

D. Anchors and Fasteners:
   1. Manufacturers - Mechanical Anchors:
   2. Manufacturers - Powder-Actuated Fastening Systems:
   3. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
   4. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.01 INSTALLATION

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

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

D. Unless specifically indicated or approved by Design Professional, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Design Professional, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Secure fasteners according to manufacturer's recommended torque settings.

I. Remove temporary supports.

END OF SECTION

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Adhesive-backed duct markers.

D. Pipe markers.

1.02 REFERENCE STANDARDS

A. ASTM D709 - Standard Specification for Laminated Thermosetting Materials.

1.03 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

E. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Ductwork: Nameplates.

B. Piping: Tags.

C. Small-sized Equipment: Tags.

2.02 NAMEPLATES

A. Manufacturers:
   1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com/#sle.
   2. Brimar Industries, Inc: www.pipemarker.com/#sle.
   3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
   4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   5. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.

B. Letter Color: White.

C. Letter Height: 1/4 inch.

D. Background Color: Black.

E. Plastic: Comply with ASTM D709.

2.03 TAGS

A. Manufacturers:
   1. Advanced Graphic Engraving: www.advancedgraphicengraving.com/#sle.
   2. Brady Corporation: www.bradycorp.com/#sle.
   3. Brimar Industries, Inc: www.pipemarker.com/#sle.
   4. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
   5. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   6. Seton Identification Products, a Tricor Company: www.seton.com/#sle.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

2.04 ADHESIVE-BACKED DUCT MARKERS

A. Manufacturers:

1. Brimar Industries, Inc: www.pipemarker.com/#sle.
2. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.

B. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch; printed with UV and chemical resistant inks.

C. Style: Individual Label with block text and flow arrows.

D. Supply Air Color: Blue/White.

E. Return Air Color: Green/White

2.05 PIPE MARKERS

A. Manufacturers:
1. Brady Corporation: www.bradycorp.com/#sle.
2. Brimar Industries, Inc: www.pipemarker.com/#sle.
3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
5. Seton Identification Products, a Tricor Company: www.seton.com/#sle.

B. Color: Comply with ASME A13.1.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

D. Install ductwork markers on both sides of equipment (supply air and return air).

E. Use tags on piping 3/4 inch diameter and smaller.
1. Identify service, flow direction, and pressure.
2. Install in clear view and align with axis of piping.
3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic systems.

1.02 REFERENCE STANDARDS

A. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems.

B. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing.

1.03 SUBMITTALS

A. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit to Design Professional.
   2. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   3. Include certification that the plan developer has reviewed Contract Documents, the equipment and systems, and the control system with the Design Professional and other installers to sufficiently understand the design intent for each system.
   4. Include at least the following in the plan:
      a. Preface: An explanation of the intended use of the control system.
      b. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      d. Identification and types of measurement instruments to be used and their most recent calibration date.
      e. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      f. Final test report forms to be used.
      g. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
      h. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Revise TAB plan to reflect actual procedures and submit as part of final report.
   2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Design Professional and for inclusion in operating and maintenance manuals.
   3. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
   4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.

6. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
7. Include the following on the title page of each report:
   a. Name of Testing, Adjusting, and Balancing Agency.
   b. Address of Testing, Adjusting, and Balancing Agency.
   c. Telephone number of Testing, Adjusting, and Balancing Agency.
   d. Project name.
   e. Project location.
   f. Project Design Professional.
   g. Project Engineer.
   h. Project Contractor.
   i. Project altitude.
   j. Report date.

E. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. SMACNA (TAB).

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
      b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
      c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.

D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Air coil fins are cleaned and combed.
   8. Access doors are closed and duct end caps are in place.
   9. Air outlets are installed and connected.
   10. Duct system leakage is minimized.
   11. Hydronic systems are flushed, filled, and vented.
   12. Proper strainer baskets are clean and in place.
   13. Service and balance valves are open.

3.03 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.

1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Design Professional to facilitate spot checks during testing.

C. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
1. Running log of events and issues.
2. Discrepancies, deficient or uncompleted work by others.
3. Contract interpretation requests.
4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

H. Check and adjust systems approximately six months after final acceptance and submit report.

3.06 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

3.07 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.08 SCOPE

A. Test, adjust, and balance the following:
   1. Unit Heaters.
   2. Water Source Heat Pumps.

3.09 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer.
   2. Model/Frame.
   3. HP/BHP.
   4. Phase, voltage, amperage; nameplate, actual, no load.
   5. RPM.
   6. Service factor.
   7. Starter size, rating, heater elements.
   8. Sheave Make/Size/Bore.

B. V-Belt Drives:
   1. Identification/location.
   2. Required driven RPM.
   3. Driven sheave, diameter and RPM.
   4. Belt, size and quantity.
   5. Motor sheave diameter and RPM.
   6. Center to center distance, maximum, minimum, and actual.

C. Cooling Coils:
   1. Identification/number.
   2. Location.
   3. Service.
   4. Manufacturer.
   5. Air flow, design and actual.
   6. Entering air DB temperature, design and actual.
   7. Entering air WB temperature, design and actual.
   8. Leaving air DB temperature, design and actual.
   9. Leaving air WB temperature, design and actual.
   10. Water flow, design and actual.
   11. Water pressure drop, design and actual.
   12. Entering water temperature, design and actual.
   13. Leaving water temperature, design and actual.
   14. Saturated suction temperature, design and actual.
   15. Air pressure drop, design and actual.

D. Heating Coils:
   1. Identification/number.
   2. Location.

3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Water flow, design and actual.
7. Water pressure drop, design and actual.
8. Entering water temperature, design and actual.
9. Leaving water temperature, design and actual.
10. Entering air temperature, design and actual.
11. Leaving air temperature, design and actual.
12. Air pressure drop, design and actual.

E. Air Moving Equipment:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.
7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.
12. Sheave Make/Size/Bore.
13. Number of Belts/Make/Size.
14. Fan RPM.

F. Duct Traverses:
1. System zone/branch.
2. Duct size.
3. Area.
4. Design velocity.
5. Design air flow.
6. Test velocity.
7. Test air flow.
8. Duct static pressure.
9. Air temperature.
10. Air correction factor.

END OF SECTION

SECTION 23 07 13
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

1.02 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

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

D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

E. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:
   1. Johns Manville: www.jm.com/#sle.
   2. JP Lamborn Co; Thermal Sleeve MT: www.jpflex.com/#sle.
   3. Knauf Insulation; Atmosphere Duct Wrap: www.knaufinsulation.com/#sle.
   4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. K value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 1,200 degrees F.
   3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure-sensitive tape.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with PVC jacket..

END OF SECTION

SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Flexible removable and reusable blanket insulation.

C. Jacketing and accessories.

1.02 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

C. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.

D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.

E. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

G. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.06 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, RIGID

A. Manufacturers:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Knauf Insulation; Earthwool 1000 Degree Pipe Insulation: www.knaufinsulation.com/#sle.
   4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.ocbuildingspec.com/#sle.
   5. Owens Corning Corporation; VaporWick Pipe Insulation: www.ocbuildingspec.com/#sle.

B. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
   1. K Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 650 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive: Compatible with insulation.

F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

G. Fibrous Glass Fabric:
   1. Cloth: Untreated; 9 oz/sq yd weight.
   2. Blanket: 1.0 pcf density.

2.03 JACKETING AND ACCESSORIES

A. PVC Plastic.
   1. Manufacturers:
      a. Johns Manville Corporation: www.jm.com/#sle.
   2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil, 0.010 inch.
      e. Connections: Brush on welding adhesive.
   3. Covering Adhesive Mastic: Compatible with insulation.

B. Aluminum Jacket:
   1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
   2. Thickness: 0.016 inch sheet.
   3. Finish: Smooth.
   4. Joining: Longitudinal slip joints and 2 inch laps.
   5. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
   6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulated Pipes Conveying Fluids Below Ambient Temperature:
   1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

D. Glass Fiber Insulated Pipes Conveying Fluids Below Ambient Temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.

2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

E. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

F. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

G. Glass Fiber Insulated Pipes Conveying Fluids Above Ambient Temperature:
1. Provide standard jackets, with or without vapor barrier, factory-applied, or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

H. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

END OF SECTION

SECTION 23 08 00
COMMISSIONING OF HVAC

PART 1 GENERAL

1.01 SUMMARY

A. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

B. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.

C. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
   1. Unit Heaters (4 Total)
   2. Water Source Heat Pumps (4 Total)
   3. Special Ventilation:
      a. Specialty fans.
   4. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

D. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02 SUBMITTALS

A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. Draft Prefunctional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:
   1. System name.
   2. List of devices.
   3. Step-by-step procedures for testing each controller after installation, including:
      a. Process of verifying proper hardware and wiring installation.
      b. Process of downloading programs to local controllers and verifying that they are addressed correctly.
      c. Process of performing operational checks of each controlled component.
      d. Plan and process for calibrating valve and damper actuators and all sensors.
      e. Description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.
   4. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when a sensor or controller has “passed” and is operating within the contract parameters.
   5. Description of the instrumentation required for testing.
   6. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the Commissioning Authority and TAB contractor for this determination.

C. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.

D. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
   1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other

features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.

2. Full as-built set of control drawings.
3. Full as-built sequence of operations for each piece of equipment.
4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
    a. Floor.
    b. Room number.
    c. Room name.
    d. Air handler unit ID.
    e. Reference drawing number.
    f. Air terminal unit tag ID.
    g. Heating and/or cooling valve tag ID.
    h. Minimum air flow rate.
    i. Maximum air flow rate.
5. Full print out of all schedules and set points after testing and acceptance of the system.
6. Full as-built print out of software program.
7. Electronic copy on disk of the entire program for this facility.
8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
10. Control equipment component submittals, parts lists, etc.
11. Warranty requirements.
12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
    a. Sequences of operation.
    b. Control drawings.
    c. Points lists.
    d. Controller and/or module data.
    e. Thermostats and timers.
    f. Sensors and DP switches.
    g. Valves and valve actuators.
    h. Dampers and damper actuators.
    i. Program setups (software program printouts).

E. Training Manuals:
    1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

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

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 EXECUTION

3.01 PREPARATION

A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the Commissioning Authority.

C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.

D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.

E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.

F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

G. Provide temperature and pressure taps in accordance with Contract Documents.

3.02 INSPECTING AND TESTING - GENERAL

A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.

B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.

C. Provide two-way radios for use during the testing.

D. Valve/Damper Stroke Setup and Check:
   1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
   2. Set pump/fan to normal operating mode.
   3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
   4. Command valve/damper open; verify position is full open and adjust output signal as required.
   5. Command valve/damper to a few intermediate positions.
   6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

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

F. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.03 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of HVAC.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.

D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.

E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.

F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.04 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.

D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
   1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to Owner.
   2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.

E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.
   1. Setpoint changing features and functions.
   2. Sensor calibrations.

G. Demonstrate to the Commissioning Authority:
   1. That all specified functions and features are set up, debugged and fully operable.
   2. That scheduling features are fully functional and setup, including holidays.
   3. That all graphic screens and value readouts are completed.
   4. Correct date and time setting in central computer.
   5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.
   6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.
   7. Power failure and battery backup and power-up restart functions.
   8. Global commands features.
   9. Security and access codes.
   10. Occupant over-rides (manual, telephone, key, keypad, etc.).
   11. O&M schedules and alarms.
   12. Occupancy sensors and controls.
   13. All control strategies and sequences not tested during controlled equipment testing.

H. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to

Owner.

3.05 OPERATION AND MAINTENANCE MANUALS

A. Add design intent documentation furnished by Design Professional to manuals prior to submission to Owner.

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

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

3.06 DEMONSTRATION AND TRAINING

A. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

B. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.

C. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide the following minimum durations of training:

D. TAB Review: Instruct Owner's personnel for minimum 1 hour, after completion of TAB, on the following:
   1. Review final TAB report, explaining the layout and meanings of each data type.
   2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
   3. Identify and discuss any duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
   4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
   5. Other salient information that may be useful for facility operations, relative to TAB.

E. Provide the services of manufacturer representatives to assist instructors where necessary.

F. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION

SECTION 23 21 13
HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hydronic system requirements.

B. Heating water piping, above grade.

C. Condenser water piping, above grade.

D. Pipe hangers and supports.

E. Unions, flanges, mechanical couplings, and dielectric connections.

F. Valves:
   1. Ball valves.
   2. Butterfly valves.
   3. Check valves.
   4. Pressure independent temperature control valves and balancing valves.

G. Flow controls.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators.

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

D. ASME B31.9 - Building Services Piping.

E. ASTM A536 - Standard Specification for Ductile Iron Castings.

F. ASTM B32 - Standard Specification for Solder Metal.

G. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

H. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric).

I. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

J. AWWA C606 - Grooved and Shouldered Joints.

K. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

1.04 SUBMITTALS

A. Product Data:
   1. Include data on pipe materials, pipe fittings, valves, and accessories.
   2. Provide manufacturers catalog information.
   3. Indicate valve data and ratings.

B. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

C. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum 3 years of experience.

C. Date stamp all castings used for coupling housings, fittings, valve bodies, etc. for quality assurance and traceability.

D. Coupling Manufacturer:
   1. Perform on-site training by factory-trained representative to the Contractor's field personnel in the proper use of grooving tools and installation of grooved joint products.
   2. Periodic job site visits by factory-trained representative to ensure best practices in grooved joint installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers, and supports as required, as indicated, and as follows:
   1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
   2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
   3. Grooved mechanical joints may be used in accessible locations only.
      a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Design Professional.
      b. Use rigid joints unless otherwise indicated.
   4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

D. Valves: Provide valves where indicated:
   1. Provide drain valves where indicated, and if not indicated, provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch ball valves with cap; pipe to nearest floor drain.
   2. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.
   3. For throttling, bypass, or manual flow control services, use globe, ball, or butterfly valves.
   4. For throttling and isolation service in condenser water systems, use only butterfly valves.
   5. In heating water or condenser water systems, butterfly valves may be used interchangeably with gate and globe valves.
   6. For shut-off and to isolate parts of systems or vertical risers, use gate, ball, or butterfly valves.
   7. For throttling service, use plug cocks. Use non-lubricated plug cocks only when shut-off or isolating valves are also provided.

E. Welding Materials and Procedures: Comply with ASME BPVC-IX.

2.02 CONDENSER WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn; using one of the following joint types:

1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
   a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
2. Grooved Joints: AWWA C606 grooved tube, fittings of same material, and copper-tube-dimension mechanical couplings.
3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
4. Mechanical Press Sealed Fittings: Double pressed type complying with ASME B16.22, utilizing EPDM, nontoxic synthetic rubber sealing elements.

2.03 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

B. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge-shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

2.04 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe of 2 Inches and Less:
   1. Ferrous Piping: 150 psi brass or malleable iron, threaded.
   2. Copper Pipe: Bronze, soldered joints.

B. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
   1. Dimensions and Testing: In accordance with AWWA C606.
   2. Mechanical Couplings: Comply with ASTM F1476.
   3. Housing Material: Ductile iron, galvanized complying with ASTM A536.
   4. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
   5. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
   6. When pipe is field grooved, provide coupling manufacturer's grooving tools.
   7. Manufacturers:
      a. Grinnell Products: www.grinnell.com/#sle.
      b. Victaulic Company: www.victaulic.com/#sle.

2.05 FLOW CONTROLS

A. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.

B. Calibration: Control flow within 10 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, minimum pressure 2 psi.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare piping connections to equipment using jointing system specified.

E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

F. After completion, fill, clean, and treat systems.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner, parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and to avoid interference with use of space.
D. Group piping whenever practical at common elevations.
E. Slope piping and arrange to drain at low points.

END OF SECTION

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ducts.

1.02 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

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

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

D. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements.

E. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements.

F. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements.

G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

H. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.

1.03 SUBMITTALS

A. Product Data: Provide data for duct materials.

B. Shop Drawings: Indicate duct fitting types, gauges, sizes, welds, and configuration.

C. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.

B. Provide metal duct unless otherwise indicated. Fibrous glass duct can be substituted at the Contractor's option.

C. Duct Shape and Material in accordance with Allowed Static Pressure Range:
   1. Rectangular: Plus or minus 1/2 in-wc of galvanized steel.

D. Duct Sealing and Leakage in accordance with Static Pressure Class:
   1. Duct Pressure Class and Material for Common Mechanical Ventilation Applications:
      a. Supply Air: 1/2 in-wc pressure class, galvanized steel.
      b. General Exhaust Air: 1/2 in-wc pressure class, galvanized steel.
      c. Heating or Combustion Air: 1/2 in-wc pressure class, galvanized steel.

E. Duct Fabrication Requirements:
   1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
   2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
   3. Construct tee's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.
   4. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
   5. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

6. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.
7. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.02 METAL DUCTS

A. Material Requirements:
   1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Connectors, Fittings, Sealants, and Miscellaneous:
   1. Fittings: Manufacture with solid inner wall of perforated galvanized steel.
   2. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
      a. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
      b. VOC Content: Not more than 250 g/L, excluding water.
      c. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
      d. For Use with Flexible Ducts: UL labeled.
      e. Manufacturers:
         1) Carlisle HVAC Products; Hardcast Versa-Grip 181 Water Based Fiber Reinforced Duct Sealant: www.carlislehvac.com/#sle.
         2) Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
   3. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.
   4. Hanger Fasteners: Attach hangers to structure using appropriate fasteners as follows:
      a. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
      b. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
      c. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
      d. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
      e. Other Types: As required.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install products following the manufacturer's instructions.

C. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

D. Duct sizes indicated are inside precise dimensions. For lined ducts, maintain sizes inside lining.

E. Provide openings in ductwork as indicated to accommodate thermometers and controllers. Provide pilot tube openings as indicated for testing of systems, complete with metal can with spring device or screw to insure against air leakage. For openings, insulate ductwork and install insulation material inside a metal ring.

F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

G. Use double nuts and lock washers on threaded rod supports.

END OF SECTION

SECTION 23 34 23
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Inline centrifugal fans and blowers.

1.02 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program.

B. AMCA 99 - Standards Handbook.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.

E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

G. UL 705 - Power Ventilators.

1.03 SUBMITTALS

A. Product Data: Provide data on fans and accessories, including fan curves with specified operating point plotted, power, rpm, sound power levels at rated capacity, and electrical characteristics and connection requirements.

B. Manufacturer's Instructions: Indicate installation instructions.

C. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carnes, a division of Carnes Company Inc: www.carnes.com/#sle.

B. Greenheck Fan Corporation: www.greenheck.com/#sle.

C. Loren Cook Company: www.lorencook.com/#sle.

D. PennBarry, Division of Air System Components: www.pennbarry.com/#sle.

E. Twin City Fan & Blower: www.tcf.com/#sle.

F. US DRAFT CO..

2.02 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: Comply with AMCA 204.

B. Performance Ratings: Comply with AMCA 210, bearing certified rating seal.

C. Sound Ratings: Comply with AMCA 301, tested to AMCA 300, bearing certified sound ratings seal.

D. Fabrication: Comply with AMCA 99.

E. UL Compliance: UL 705, listed, labeled, designed, manufactured, and tested.

F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

G. Furnish NEMA 12 disconnect switch for interior fans and NEMA 3X disconnect switch for exterior fans.

2.03 INLINE CENTRIFUGAL FANS AND BLOWERS

A. Centrifugal Fan Unit: V-belt or direct driven, with galvanized steel housing lined with acoustic insulation, resiliently-mounted motor, gravity backdraft damper in discharge.

B. Backward Inclined Blower:
   1. Adjustable belt-driven, resiliently-mounted electrically-commutated motor, heavy duty ball bearings, powder-coated steel housing for outdoor service, and removable service panels.
   2. Service Temperature: Minus 65 to 250 degrees F.
   3. Accessories: Provide external vibration isolator spring, filter section, and MERV- 8 filters, and disconnect switch.

C. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm gets reached with sheaves set at mid-position; fan shaft with self-aligning prelubricated ball bearings.

D. Controls: Interlock combustion air supply fan with combustion equipment.

2.04 COMBUSTION AIR CONTROL PANEL

A. Manufacturers:
   1. US DRAFT CO.: V200
   2. Or approved equal.

B. Compliance:
   1. UL378 & UL508 listed.

C. Warranty: 2 years.

D. Construction: NEMA 1 control panel with LCD screen and user interface for control of combustion air supply fan with input from up to 4 combustion air equipment units.

E. Output: Interlock with ECM motor of combustion air supply fan.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Hung Fans:
   1. Install fans with resilient mountings and flexible electrical leads.
   2. Install flexible connections specified between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

C. Provide sheaves required for final air balance.

D. Provide backdraft dampers on outlet from fans.

END OF SECTION

SECTION 23 81 46
WATER-SOURCE UNITARY HEAT PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Horizontal/vertical WSHP.

1.02 RELATED REQUIREMENTS

A. Section 23 21 13 - Hydronic Piping.

B. Section 23 31 00 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

B. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

C. ASHRAE Std 13256-1 - Water-Source Heat Pumps - Testing and Rating for Performance - Part 1: Water-to-Air and Brine-to-Air Heat Pumps.

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

E. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

F. UL 508 - Industrial Control Equipment.

G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

H. UL 1995 - Heating and Cooling Equipment.

1.04 SUBMITTALS

A. Product Data: Provide drawings indicating dimensions, rough-in connections, and electrical characteristics and connection requirements.

B. Manufacturer's Instructions: Include assembly instructions, support details, connection requirements, and start-up instructions.

C. Operation and Maintenance Data: Provide maintenance data, parts lists, controls, and accessories. Include trouble-shooting guide.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 WARRANTY

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

PART 2 PRODUCTS

2.01 GENERAL HEAT PUMP FABRICATION REQUIREMENTS

A. Energy Efficiency: ASHRAE Std 90.1 I-P EER and COP ratings, minimum.

B. ASHRAE Std 13256-1, factory-assembled unit including safety-controls, accessories, filters, piping, cables, wires, and precharged with R-410A refrigerant prior to testing.

C. Include marked terminal strip to interface field-mounted components, accessories, and thermostat.

D. Comply with UL 1995; place service and caution labels on unit.

E. Cabinet Assembly:
   1. Construct of zinc-coated, heavy-gauge, galvanized steel with exposed edges rounded.
   2. Finish: Factory apply electrostatic powder paint or baked enamel finish. Coordinate with Design Professional for specific color finish requirements of console units or other units installed within occupied spaces.

3. Provide access panels for inspection, cleaning, and servicing of refrigerant, controls, condensate drain pan, coil, and blower.
4. Furnish 1-inch or 3-inch duct flange on open-discharge selections.
5. Interior Insulation: Minimum 1/2 inch thick, dual density, bonded glass fiber.
6. Provide flame spread of less than 25, and smoke developed classification of less than 50 in compliance with ASTM E84 and UL 723.
7. Sound and Noise Suppression:
    a. Mechanical Rooms: 18 gauge, 0.05 inch, minimum.
    b. Occupied Spaces: 16 gauge, 0.06 inch, minimum.
    c. Compressor enclosure lined with 1/2 inch thick insulation.
    d. Include vibration isolation between compressor and heat exchanger.
    e. Include length-wise, unit base stiffeners.
    f. Foam gasket sealant around compressor and end panel perimeter.

F. Blower Section:
1. Draw-through, centrifugal fan, constructed of corrosion-resistant, galvanized material and designed for efficient, quiet operation.
2. Factory program for both soft start and constant flow output over static pressure range.
3. Provide preinstalled neutral wire protection when required to support specified fan type.
4. Motor to include thermal overload protection, quick disconnect plug, and permanently lubricated bearings.
5. Variable Speed Control: Configure controller to maintain adjustable flow setpoint for modulating or speed-switched units.
6. Fan Turndown: Design control features to allow fan speed reduction to adjustable 50 percent of its capacity when the zone set point temperature is satisfied or when unit runs in fan-only mode.

G. Evaporator Section:
1. Internally finned, aluminum or copper tubes mechanically bonded to configured aluminum plate fin, corrosion inhibitor coated as indicated.
2. Refrigerant Coil Distributor Assembly: Orifice style with round copper distributor tubes.
3. Thermostatic Expansion Valve: Factory select and install for wide control range.
4. Factory leak test to minimum 450 psi and pressure test to minimum 600 psi.
5. Tubes: Size tubes consistent with coil capacity. Fabricate suction header from rounded copper pipe.
6. Completely evacuate air and charge with proper column of refrigerant prior to shipment.
7. Drain Pan:
    a. Construct of ABS plastic, HDPE, stainless steel, or other corrosion-resistant material and flame rated in accordance with UL 94 when using polymers.
    b. Slope on two planes to pitch condensate to drain connection.
    c. Float Switch: UL 508, rated for protection against condensate overflow, controller connected.

H. Compressor Section:
1. Provide rubber mounting devices located underneath compressor mounting base.
2. Safety Interlocked Devices:
    a. Thermal overload protection.
    b. High pressure switch for protection against excessive discharge pressure.
    c. Low pressure safety for protection against loss of refrigerant charge.
    d. Compressor lockout.

I. Refrigerant Tubing Lines:
1. Tubing made of copper with service pressure ports on high- and low-pressure sides.
2. Free from contaminants and conditions such as drilling fragments, dirt, and oil.
3. Include drier, thermal expansion valve, and other related components.
4. Freeze Protection: 30 degrees F, thermistor based.
5. Insulation: Evaporator and heat exchanger sides; minimum 3/8 inch thick elastomeric insulation.

J. Refrigerant Load Control:
   1. Hot-Gas Bypass: Provide to increase heat transfer efficiency at low temperatures.
   2. Hot-Gas Reheat Coil:
      a. Humidity Control: Upgrade thermostat to include humidity sensor tied to unit controller for integral dehumidification control.
      b. Coil Assembly: Aluminum or copper tubes mechanically expanded into evenly spaced aluminum fins.
      c. Coil Testing: Proof test at minimum of 1.5 times maximum operating pressure, then leak test at maximum operating pressure.
   3. Hot-Water Generator:
      a. Secondary coil or heat exchanger, reversing valve, and accessories.
      b. Storage: Interconnect to existing water heater or external storage tanks.

K. Water-to-Refrigerant Heat Exchanger:
   1. Coaxial Type: Provide aluminum or copper tube and fins.
   2. Brazed-Plate Type: Stainless steel, with bidirectional liquid line filter drier.
   3. Insulate heat exchanger, water lines, and refrigerant suction lines for prevention of condensation at temperatures below 60 degrees F.
   4. Provide rubber isolation to heat exchanging device for enhanced sound attenuation.
   5. Freeze Protection: 35 degrees F by thermistor sensing.
   6. Minimum Working Pressure: 400 psi water side, 600 psi DX side.
   7. End Connections: Copper NPT. Provide flow shut-off ball valves.
   8. Accessories:
      a. Strainer, PT test plug, and flow regulator.
      b. Unit-controlled, return-water-side solenoid valve.

L. Waterside Economizer Section:
   1. Thermostat-controlled, metered, prepiped return air coil with 3-way valve assembly, and flow switch, tied and coordinated by unit controller.
   2. Provide assembly factory-installed or shipped loose for field installation as indicated.
   3. Performance Requirements: As indicated on drawings.
   4. Air-to-Water Hydronic Coil:
      a. Aluminum or copper tubes and aluminum plate fin combination.
      b. Accessible, cleanable, dual sloped, noncorrosive drain pan.
      c. Leak test at maximum operating pressure.
      d. Factory proof test at minimum 1.5 times maximum operating pressure.
   5. Modulating or position-adjusted control valve to engage and control coil at listed EWT.

M. Filter Section:
   1. ASHRAE Std 52.2, 1" thick throw-away minimum efficiency reported value or MERV listing.
   2. Filter Box: Provide field-installed return duct-mounted filter housing with side access.

N. Electrical:
   1. Provide factory-installed phase loss safety device for 3-phase units.
   2. Configure unit for single point connection, include terminal for field-installed components.
   3. Include separate holes and knockouts with plastic ferrules for respective electrical and controls wiring.

O. Unit Controls:
   1. DDC:
      a. Tested to monitor and handle sequencing functions and other operational modes using field-mounted thermostat and other sensors.
      b. Coordination and Sequencing:
         1) Internal Devices: Include compressors, blower, sensors, switches, valves, safeties, other components.
         2) Field-Installed Devices: Solenoid valves, thermostat, EWT sensors, LWT sensors, load-pump contact, source pump contact, and other devices required

for operation.
3) Safeties: At minimum include anti-short-cycle compressor protection, condensate overflow, refrigerant high pressure, refrigerant low pressure, loss-of-charge, loss-of-water flow, refrigerant freeze protection, and freezestat.

2. Thermostat:
   a. Field mounted and wired, tied into prewired control-interface terminals.
   b. Smart Thermostat:
      1) BAS- or BMS-linked programmable thermostat.
   c. Programmable Thermostat:
      1) Electro-mechanical type with key- or pushbutton-operated display.
      2) Programmable occupied/unoccupied weekly and holiday schedule.
   d. Nonprogrammable Thermostat:
      1) Electro-mechanical type with key- or pushbutton-operated display.
      2) User-configurable, precoded options aligned with equipment functions.
   e. Thermostat: Single-gang-box-mounted platinum or thermistor.
      1) Local Interface to Include:
         (a) Filter maintenance indicating status.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Suspended Units: Suspend from structure with threaded steel rods and 0.25 inch minimum static deflection rubber-in-shear vibration isolators and seismic restraints.

C. Ductwork:
   1. Provide as indicated on drawings; see Sections 23 31 00 and 23 33 00.
   2. Connections to Existing Systems: Obtain approval before interrupting service; notify Design Professional in writing at least 15 calendar days prior to start pending connections.

3.02 CONNECTIONS

A. Connect supply/return piping from heat pump to appropriate water source piping; see Section 23 21 13. Complete end connections with unions and shut-off valves.

3.03 SYSTEM STARTUP

A. Prepare and start equipment and systems in accordance with manufacturers' instructions and recommendations.

B. Adjust for proper operation within manufacturer's published tolerances.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

3.05 CLOSEOUT ACTIVITIES

A. Demonstrate proper operation of equipment to the designated representative of the Owner.

B. Demonstration: Demonstrate operation of system to Owner personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Conduct walking tour of project.
   3. Briefly describe function, operation, and maintenance of each component.

C. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's training personnel.
   4. Location: At project site.

END OF SECTION

SECTION 23 82 00
CONVECTION HEATING AND COOLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hydronic unit heaters.

1.02 REFERENCE STANDARDS

A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.

1.03 SUBMITTALS

A. Product Data: Provide typical catalog of information including arrangements.

B. Shop Drawings:
   1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
   2. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.

C. Certificates: Certify that coils are tested and rated in accordance with AHRI 410.

D. Manufacturer's Instructions: Indicate installation instructions and recommendations.

E. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.

F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

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

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 HYDRONIC UNIT HEATERS

A. Manufacturers:
   1. Modine Manufacturing Company: www.modineHVAC.com/#sle.
   2. Sterling Hydronics, a Mestek Company: www.sterlingheat.com/#sle.
   3. Trane Technologies, PLC: www.trane.com/#sle.

B. Coils: Seamless copper tubing, silver brazed to steel headers, and with evenly spaced aluminum fins mechanically bonded to tubing.

C. Perform factory run test under normal operating conditions, water, and steam flow rates.

D. Casing: Minimum 18 gauge, 0.0478 inch thick sheet steel casing with threaded pipe connections for hanger rods for horizontal models and minimum 18 gauge, 0.0478 inch thick sheet steel top and bottom plates for vertical projection models.

E. Finish: Factory applied baked primer coat.

F. Fan: Direct drive propeller type, statically and dynamically balanced, with OSHA fan guard; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.

G. Air Outlet: Adjustable pattern diffuser on vertical projection models and two- or four- way louvers on horizontal projection models.

H. Control: Local solid state disconnect switch with electropneumatic thermostat.

I. Electrical Characteristics:
   1. Provide with single point power connection, factory-installed and wired disconnect switch, and control power trasnformer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are suitable for installation.

3.02 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Do not damage equipment or finishes.

C. Unit Heaters:
   1. Hang from building structure, with pipe hangers anchored to building, not from piping or electrical conduit.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Provide manufacturer's field representative to test, inspect, instruct, and observe.

3.04 CLEANING

A. After construction and painting is completed, clean exposed surfaces of units.

END OF SECTION

SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Electrical equipment coordination and installation
   2. Sleeves for raceways and cables
   3. Sleeve seals
   4. Common electrical installation requirements
   5. Supporting devices for electrical components
   6. Cutting and patching for electrical construction
   7. Touchup painting

1.02 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. Provide: Furnish and install.

C. Directed: Directed by the A/E.

D. Indicated: Indicated in the Contract Documents.

E. Concealed: Hidden from normal sight. Includes items in shafts, pipe and duct spaces and above ceilings.

F. Exposed: Not concealed. Work within equipment rooms and all visible (normal sight) work shall be considered “exposed”.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

C. Electrical System Studies.

1.04 QUALITY ASSURANCE

A. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

1.05 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping and conduit installed at required slope.
   4. So that connecting raceways, cables and wireways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
   1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

D. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

E. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent, are tested to demonstrate successful interoperability.

1.06 GENERAL REQUIREMENTS

A. Nothing contained in these "SPECIFICATIONS" or shown on the "DRAWINGS" shall be so constructed as to conflict with any local, municipal, or State laws or regulations governing the installation of electric or other work specified herein, and all such ordinances and regulations, including the National Electrical Code, are hereby incorporated and made a part of these specifications. All such requirements shall be satisfied by the Contractor and at no additional cost to the Owner.

B. Due to the small scale of drawings, it is not possible to indicate all conduits, conductors, boxes, fittings, switches, and similar parts which may be required. The contractor shall investigate the structural and finish conditions affecting the work and arrange all work accordingly furnishing such parts and equipment as may be required to meet building conditions.

C. Contractor shall lay out work from dimensions of architectural and structural drawings and actual dimensions of equipment being installed. Layouts in congested areas should not be scaled from mechanical or electrical drawings.

D. The Drawings are indicative of the character and scope of the work and are not intended to show all the details.

E. The actual location of all wiring, outlets, and equipment shall be determined at the site.

F. The Drawings shall be carefully checked, to ensure that all equipment, as shown, will operate satisfactorily in the space allotted to it.

G. Generally, major equipment of the system is located on the floor plans and the interconnecting conduit and wiring are indicated on the diagrams or called for in the Specifications.

1.07 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with all applicable requirements of NFPA 70, National Electrical Code.

C. Testing Agency: Use a NETA accredited electrical testing agency, or approved equal, that is accredited for the region in which the Contract work is performed. Refer to Section 26 0563.

1.08 REGULATIONS

A. All electrical work, equipment and material furnished or installed under this contract shall conform to the requirements of latest applicable codes and any other Governmental or Local Authorities having jurisdiction and all rules and regulations of the Utility Company involved. Nothing mentioned in the specifications or indicated on the drawings shall be construed to conflict with the mentioned codes, ordinances, and regulations.

B. All materials furnished, and all work installed, shall comply with the latest issue of the codes, rules, regulations, and recommendations of the following bodies, unless otherwise noted:
   1. American National Standards Institute (ANSI)
   2. American Society of Testing and Materials (ASTM)
   3. International Building Code (IBC)
   4. International Energy Conservation Code (IECC)
   5. Insulated Power Cable Engineers Associate (IPCEA)
   6. Insulated Cable Engineers Associate (ICEA), formerly IPCEA.
   7. Illuminating Engineering Society (IES)
   8. Institute of Electrical and Electronic Engineers (IEEE)
   9. National Electrical Code (NEC)
   10. National Electrical Manufacturers Association (NEMA)
   11. National Fire Protection Association (NFPA)
   12. National Electrical Safety Code (NESC)

13. National Electrical Contractors Association (NECA)
14. Occupational Safety and Health Agency (OSHA)
15. Underwriters Laboratories, Inc. (UL)
16. City or Local Code(s)
17. Pennsylvania Department of Labor and Industry (L&I)
18. Pennsylvania Department of Health (DoH)
19. National Board of Fire Underwriters
20. Americans with Disabilities Act (ADA)
21. City of Philadelphia Electrical Code
22. Other codes, as applicable

1.09 ELECTRICAL SYSTEM STUDIES

A. Prepare and submit a Short Circuit, Arc-Flash, and Protective Device Coordination Study as specified in this Article.
   1. Immediately after award of the Contract, collect all data needed to perform calculations for the studies.
      a. Obtain, in writing, electrical utility source information and any other information required from the utility to perform the necessary studies directly from the serving utility.
      b. The Owner will provide, as available, information about the portions of the facility's existing electrical system affected by the work performed under this Contract.
         1) The Owner will provide copies of the latest revision of the existing facility record drawings to the Contractor for use in defining existing equipment load requirements.
         2) Base the contribution of motors on actual motor loads as indicated on the equipment list, system one-line diagrams, and panel schedules.
         3) If the information provided is insufficient to perform the studies or represents unknown ratings of existing equipment, investigate and obtain the information required.
            (a) Employ qualified technicians to obtain the necessary data.
      c. Obtain data for new equipment directly from suppliers and other contractors working on the project.
   2. Once the data needed is obtained, perform a preliminary computerized Short Circuit, Arc-Flash, and Protective Device Coordination Study, complete with initial calculations.
      a. At least two full calendar weeks prior to submitting Shop Drawings for equipment included the respective studies, submit the preliminary studies and corresponding computer printouts and annotated one-line distribution diagram to the Engineer for review and comment.
      b. After the Engineer provides his comments, submit four copies of the revised and corrected preliminary studies.
   3. Include the following types of information common to each study:
      a. Calculations and tabulations.
         1) Ensure that the calculations in the Short Circuit, Arc-Flash, and Protective Device Coordination Study are sufficient to ascertain interrupting and/or withstand ratings of the equipment.
            (a) Identify items of distribution system equipment that are not rated for the available fault current and provide corrective recommendations for consideration.
      b. Data on the computer programs used to perform calculations and tabulations.
      c. An appendix to each report that includes the information obtained from outside entities, agencies, electrical manufacturers, the serving utility company, field inspections, and other field sources such as the following:
         1) Copies of letters.
         2) Photographic records.
         3) Nameplate tracings.
         4) Actual data sources from which the data and information was obtained.

B. Final Project Report:
   1. After the Engineer accepts the revised and corrected preliminary studies, prepare a report summarizing the results of the individual studies; and submit this Final Project Report to the Engineer for acceptance and approval.
      a. Include the following sections in the Final Project Report:
         1) Description.
         2) Purpose.
         3) Basis and scope of the study.
         4) A single line diagram of that portion of the power system that is included within the scope of the study.
         5) Computerized time versus current coordination graphs and corresponding printouts for protective devices.
            (a) Include the feeder cable damage curves associated with the items being coordinated in these graphs.
            (b) Include the ANSI/NEMA MG 1 damage points for the motors in the system and the ANSI/IEEE C57.12.00 mechanical and electrical damage points on the curves.
         6) Tabulations of the relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
         7) Harmonic data at Points-of-Common-Coupling (PCC).
      b. Submit ten bound copies of the Final Project Report for review and approval and two copies of record drawings showing the existing facility as it was before the work of this Contract was performed.
      c. Once the Final Project Report has been approved, forward one additional bound final copy of the report to the Owner.

C. Short Circuit, Arc-Flash, and Protective Device Coordination Study:
   1. Prepare the Short Circuit, Arc-Flash, and Protective Device Coordination Study under the supervision of a Professional Engineer, licensed in the Commonwealth of Pennsylvania, or have a NETA certified electrical testing laboratory employing technicians certified according to ANSI/NETA ETT prepare it.
      a. Perform the short circuit portion of the Study in accordance with ANSI/IEEE C37.10, ANSI/IEEE C37.13, ANSI/IEEE 141, ANSI/IEEE 242, and ANSI/IEEE 399.
         1) Calculate short circuit momentary duty values and interrupting duty values on the basis of the following short circuit conditions at every distribution transformer, secondary and primary terminal at every bus in every switchboard, motor control center, distribution panelboard, branch circuit panelboard and at terminals of utilization equipment whether it be Electrical, Process, HVAC, Plumbing or Instrumentation that is either 480V or 208V, 3-phase and rated 15 Amps or higher. Include:
            (a) Single line to ground fault.
            (b) Bolted three-phase line to ground fault.
            (c) Double line (line to line) to ground fault.
      b. Perform the arc flash portion of the Study for the electrical distribution equipment in accordance with NFPA 70E and ANSI/IEEE 1584.
         1) Perform the analysis under worst-case arc-flash conditions; and if applicable, describe in the final report how these conditions differ from worst-case bolted fault conditions.
         2) Provide the following items for each circuit and arc location analyzed:
            (a) Printed hardcopy of calculations performed.
            (b) Arcing fault magnitude.
            (c) Device clearing time.
            (d) Duration of arc.
            (e) Arc flash boundary distances.
            (f) Working distance.
            (g) Arc flash incident energy.

(h) Hazard risk category.
(i) Personal-protective equipment classes.
(j) Arc flash warning labels as specified in Section 26 05 23.
(k) Recommendations and potential options for arc flash energy reduction to reduce the Incident Energy levels where they are calculated to be over the 40 cal/cm2.
(l) Maintenance procedures/guidelines in accordance with the requirements of NFPA 70E for the Owner.

c. Coordinate protective devices with systems and equipment by providing the necessary calculations and logic decisions required to select or to check the selection of power fuse ratings, ratios and characteristics of associated current transformers, and breaker trip characteristics and settings and distribution system fuses.
1) Provide coordination plots for phase and ground protective devices on a system basis.
(a) Adhere to National Electrical Code restrictions and maintain proper coordination.
(b) Provide a sufficient number of separate curves to clearly indicate the coordination achieved.
2) Computer-generate time-current characteristics of the specified protective devices on log-log scale plots.
(a) Include complete titles, the respective one-line diagram and identifying legends, associated relays or fuse characteristics, significant motor starting characteristics, complete operating bands of low voltage circuit breaker trip curves and fuses.
(b) Indicate the types of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, transformer magnetizing inrush, through-fault current duration per ANSI/IEEE C57.12.59, dry-type transformers withstand, cable thermal overcurrent withstand limits, symmetrical fault currents and motor full load current, locked-rotor current, and magnetizing inrush in the coordination plots.
3) Provide the selection and settings of the protective devices separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios and connection, manufacturer and type, range of adjustment, and recommended settings.
(a) Use the information from the Study to obtain optimum device protective and coordination performance.

2. In addition to the information common to the studies as listed in Subparagraph 1.11 A 3, include the following information specific to short circuit, arc-flash, and protective device coordination distortion only in the Short Circuit, Arc-Flash, and Protective Device Coordination Study:
a. Complete short circuit and protective device coordination studies, including coordination plots, for the following electrical distribution systems serving the entire facility:
1) Utility (primary) voltage service
2) Low voltage service/distribution system.
3) Low voltage 208Y/120 volts, 3 phase, 4 wire distribution systems.
b. Power company supply and network characteristics, including the following:
1) The base quantities selected.
2) Source impedance data and impedance diagrams.
3) One-line diagrams.
4) Calculation methods and tabulations.
(a) Include short circuit tabulations of the fault impedance, X to R ratios, asymmetry factors, KVA, symmetrical and asymmetrical fault currents, and all multiplying factors.
5) Conclusions and recommendations.
c. Motor starting characteristics for motors 50 HP and above.

d. Provide sufficient information in the study to ensure adequate protection of the cables, transformers, and other equipment; to indicate proper coordination between fuses and circuit breakers; and to determine areas of the system in which additional coordination may be required.

3. Submit Short Circuit, Arc-Flash, and Protective Device Coordination Study information with the equipment submittals for review by the Engineer.

1.10 PERMITS AND INSPECTIONS

A. Give all necessary notices and obtain all required permits. Pay all fees and other costs, including utility connections or extensions in connection with the work. File all necessary plans, prepare all documents, and obtain all necessary approvals of all governmental agencies having jurisdiction. Obtain all required certifications of inspection and deliver same to the Architect.

1.11 RECORD DRAWINGS

A. The Contractor shall keep accurate records of all deviations in work as actually installed from work indicated. One complete set of Contract Documents shall be available at the construction site for indicating said deviations. The Contractor shall indicate routing of all feeders, junction boxes and the like.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 Articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

B. Coordinate sleeve selection and application with selection and application of firestopping. Use UL listed materials as shown in a UL listed detail for the configuration of the penetration. Submit UL detail showing materials used.

2.03 MATERIALS AND EQUIPMENT

A. All materials and equipment furnished for the project shall be new and of first quality, produced by manufacturers of recognized reputation for each line of material or equipment. The fact that materials or equipment offered are recently developed and untried may be sufficient justification for their rejection. All materials, fittings, devices, and equipment shall be those approved by the Underwriters Laboratories, Inc., and if of the class for which the Underwriters Laboratories, Inc., provides label service, they shall bear such labels.

B. Where there is more than one item of equipment furnished under this Contract, the Contractor shall furnish equipment of the same type and from the same manufacturer. In no case shall the Contractor furnish similar types of equipment from different manufacturers. One manufacturer shall furnish all similar types of equipment.

2.04 TOUCHUP PAINT

A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 EXECUTION

3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give right of way to raceways and piping systems installed at a required slope.

F. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

3.02 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables or wireways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section, "Firestopping."

C. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

D. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches above finished floor level.

H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require a different clearance.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

K. Sleeves shall be provided by the Contractor for the installation of conduit, etc. The sleeves shall be carefully located in advance of the construction of walls and floors where new construction is involved. Provide all cutting and patching necessary to set sleeves which are not placed prior to construction. All cutting and patching necessary to set sleeves which are not placed prior to construction shall be the responsibility of the trade providing the sleeves.

L. Sleeves shall be provided for all conduit, etc. passing through concrete, masonry, plaster and gypsum wallboard construction

M. Fasten sleeves securely in the construction so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster or other materials being forced into space between conduits, etc., and sleeve during construction.

N. Sleeves required in existing concrete or masonry walls shall be set and secured with mortar grout and fast drying bitumastic sealant.

O. Where conduit motion due to expansion and contraction will occur, provide sleeves of sufficient diameter, or permit free movement of conduit. Check construction to determine proper length for various locations; make actual lengths to suit the following:
   1. Terminate sleeves flush with walls, partitions, and ceilings.
   2. Terminate sleeves 2 inches above finished floor in equipment rooms or Wet Locations.
   3. In all other areas, terminate sleeves 1/2-inch above finished floors.

3.03 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.04 FIELD QUALITY CONTROL

A. Inspect installed sleeve and sleeve-seal installations and associated firestopping for damage and faulty work.

3.05 WORKMANSHIP

A. Each subcontractor shall furnish the services of an experienced superintendent who shall be constantly in charge of the installation of the work.

B. The quality of the workmanship required for each trade in the execution of its work shall be the finest and highest obtainable in that trade working with the materials specified. Workmanship shall be satisfactory to the Architect and his decision as to the acceptable quality is final.

3.06 WATERPROOFING

A. Under no circumstances shall any waterproofing be damaged or penetrated. Should conditions arise which indicate such necessity, notify the Architect. Penetrations required by this Contract shall be made watertight.

3.07 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.08 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work, including the following:
   1. Raceways
   2. Supporting devices for electrical components
   3. Electricity-metering components
   4. Concrete bases
   5. Cutting and patching for electrical construction
   6. Touchup painting

3.09 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touch up paint: Paint materials and application requirements are specified in Division 09 Section, "Painting."
   1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
   2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
   3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.10 CLEANING AND PROTECTION

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

C. Conduit and Equipment to be painted: Clean all conduits exposed to view in completed structure by removing plaster and dirt. Remove grease, oil, and similar material from conduit and equipment by wiping with clean rags and suitable solvents in preparation for paint.

D. All Items with Factory Finish: Remove cement, plaster, grease and oil, and leave all surfaces, including cracks and corners, clean and polish. Touch up any scratched or bare spots to match finish. The Architect may approve factory finish as prime coat. See “Painting” Section.

E. Electrical equipment and materials exposed to public and in finished areas shall be finish-painted after installation to coordinate with surrounding walls. Surfaces shall be thoroughly cleaned for receiving paint. Paint color coordination shall be as directed, and on adjacent surfaces to insure proper matching of quality and color with surrounding areas.

F. All electrical apparatus and equipment in equipment rooms shall be provided with a factory finish coat. All panels in public spaces, corridors, etc. shall be provided with a factory prime coat and field finish painted to match surrounding finishes.

G. Site Cleaning: Remove from site all packing cartons, scrap materials, and other rubbish relating to electrical installation.

3.11 MECHANICAL EQUIPMENT WIRING

A. Furnish and install all conduit and power wiring to all safety switches, motor starters, start/stop switches, HOA switches, and thermal switches, and make final power connections to all mechanical equipment.

B. Provide all safety switches, motor starters, start/stop switches to mechanical equipment as indicated on the Contract Drawings.

C. All safety disconnect switches, shall be installed by the Electrical Contractor.

D. All control wiring shall be the responsibility of the respective Contractor supplying the equipment.

END OF SECTION

SECTION 26 05 05
SELECTIVE ELECTRICAL DEMOLITION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: The work specified in this Section consists of material for demolition and salvaging existing electrical systems, wiring, raceways, supports, equipment, and minor repair of underlying structure.

B. Related Sections:
   1. Division 01 – General Requirements

1.02 REFERENCES

A. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code (NEC)

1.03 SUBMITTALS

A. Submit demolition plan.

1.04 COORDINATION AND SEQUENCING

A. Coordinate all power outages with Owner.

B. Perform demolition in a manner not to delay or interfere with other operations of work in the Project and operations of the Owner.

1.05 SCHEDULING

A. Schedule all work with the Owner through the Owner's designated representative. Start no work in an area until a schedule has been prepared, submitted and approved.

B. Coordinate the work schedule with the Owner, Engineer, and other Contractors. Coordinate the work so not to interfere or conflict with the performance of work by the Owner and the Owner's tenants.

1.06 PROJECT/SITE CONDITIONS

A. Care shall be used so as not to impede the ongoing operations of the Owner.

B. Demolition work, as specified herein, is not intended to be performed as a wrecking operation but as work relative to the performance of the various construction operations of the Project.

C. Existing Conditions:
   1. Demolition information shown or otherwise indicated on the Drawings is based on visual field examination and existing record documents. While the information provided is believed to be correct, no assurance is implied relative to its total completeness or accuracy. Report discrepancies to Construction Manager for disposition of the Engineer before disturbing existing installations.
   2. The Contractor hereby distinctly agrees that neither the Construction Manager, the Engineer nor the Owner is responsible for the correctness or sufficiency of the information given and after his own Site Investigation:
      a. That he must have no claim for delay or extra compensation or damage on account of the information given; and
      b. That he must have no claim for relief from any obligation or responsibility under the Contract with respect to the above stated stipulations.

D. Protection: Exercise care during demolition work to confine demolition operations to the areas as indicated on the Drawings. The physical means and methods used for protection are at the Contractor's option. However, the Contractor will be completely responsible for replacement and restitution work, of whatever nature, at no expense to the Owner.
   1. Additionally, if public safety is endangered during the progress of the demolition work, provide adequate protective measures to protect the public and/or Owner personnel.
   2. Conform signs, signals and barricades to requirements of Federal, State and local laws, rules, regulations, precautions, orders and decrees.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Basic Electrical Materials: Those products such as conduit, raceway, wire and cable, support devices, fasteners, and control devices as required for work of this Section are specified in other Sections.

B. Equipment along with machinery and apparatus, motorized or otherwise, used to perform the demolition may be chosen at the Contractor's discretion. However, the chosen equipment shall perform the work within the limits of the Contract requirements.

C. Patching Materials: Patching materials shall match, as nearly as practical, the existing material for each surface being patched.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify that measurements and existing circuiting arrangements are as shown on Drawings.

B. Equipment, machinery and apparatus, motorized or otherwise, used to perform the demolition work may be used as chosen at the Contractor's discretion, but which will perform the work within the limits of the Contract requirements.

C. Verify that abandoned wiring and electrical equipment serve only the abandoned facility.

3.02 DEMOLITION

A. General: The means and methods of performing electrical demolition and removal operations are the sole responsibility of the Contractor, except as otherwise specified. However, equipment used, and methods of demolition and removal will be subject to approval of the Construction Manager and the Engineer.
   1. Remove, relocate and extend existing installations to accommodate new construction as indicated and/or as required.
   2. Remove exposed abandoned conduit systems, including abandoned conduit systems above accessible ceiling systems.
   3. Remove wiring in abandoned conduit systems to source of power supply.
   4. Maintain access to existing electrical installations, which remain active. Modify installations and provide access panels or plates as appropriate.
   5. Extend existing installations using materials and methods compatible with existing electrical installations, and as specified in other Sections of these Specifications.

B. System De-activation: Prior to demolition and removal work, de-activate existing electrical systems as indicated.

C. Use means and methods for permanent disconnection, which render the remaining electrical systems and apparatus in conformity with NFPA 70.

D. Provide temporary wiring and connections as required to maintain existing systems in service during construction. Remove same when no longer required.
   1. Conform temporary wiring to the requirements of NEC Article 305, General Requirements.

E. Remove all wiring from disconnected circuits, feeders, and equipment unless otherwise specified or indicated. Remove all exposed raceways and related supports. Cut all exposed raceways flush with floor and plug.

F. Coordinate electrical power outages with requirements in Section 26 0500.

G. General: The means and methods of performing electrical demolition and removal operations are the sole responsibility of the Contractor except as otherwise specified. Use equipment and methods that do not damage items to remain or salvaged and areas adjacent to demolition operations. Use methods that do not interfere with Owner’s operations and which do not cause excessive dust. Remove debris as it accumulates.

H. Cutting: Perform cutting work of existing structure materials by such methods as will prevent extensive damage beyond the immediate area of cutting.

I. Debris Removal: Dispose of demolition debris off site in a lawful manner. Containerize or otherwise store debris as work is in progress.

J. Patching: After demolition and removal work is performed patch the existing structure as required to match surrounding finish and appearance including the appropriate surface decoration.

K. Salvage: The Owner shall have the right to claim as salvage any items and materials removed under the work of this Section. Should such right of salvage be exercised by the Owner, move and neatly store removed items on the site in a location agreeable to the Owner and in a manner approved by the Engineer.

END OF SECTION

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Requirements for furnishing, installing, connecting, energizing, testing, cleaning, and protecting low voltage cable, shielded cable, and accessories.

B. Related Sections:
   1. Section 26 0500 – Common Work Results for Electrical
   2. Section 26 0526 – Grounding and Bonding for Electrical Systems
   3. Section 26 0553 – Identification for Electrical Systems
   4. Section 26 0533 – Raceways and Boxes for Electrical Systems
   5. Section 26 0563 – Acceptance Electrical Testing

1.02 REFERENCES

A. American Society for Testing Materials (ASTM):
   1. ASTM B 8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

B. Institute of Electrical and Electronic Engineers (IEEE):
   1. IEEE 1202 - Standard for Flame-Propagation Testing of Wire and Cables

C. National Electrical Manufacturer's Association (NEMA):
   1. NEMA WC 26/EEMAC 201 - Binational Wire and Cable Packaging Standard
   2. ANSI/NEMA WC 57 - Standard for Control, Thermocouple Extension, and Instrumentation Cables

D. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code (NEC)

E. Underwriter's Laboratories, Inc. (UL):
   1. UL 13 - Standard for Power-Limited Circuit Cables
   2. UL 1581 - Reference Standard for Electrical Wires, Cables, and Flexible Cords
   3. UL 1685 - Standard for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

F. Insulated Cable Engineers Association (ICEA):
   1. ICEA T-29-520 - Vertical Cable Tray Flame Test @ 210,000 BTU

1.03 DESIGN REQUIREMENTS

A. Conductors in Raceway and Conduit Systems:
   1. Provide conduit systems for installing wiring that is outside of equipment.
   2. Except for raceway or conduit for control wires or where otherwise indicated on the Contract Drawings, design raceway and conduit systems so that the maximum number of low-voltage current carrying conductors (per NFPA 70, Article 310) in each raceway or conduit does not exceed three, plus a ground.

B. Cable Tension Design Requirements:
   1. Design conduit runs so that the tension limits set by the wire and cable manufacturers will not be exceeded.
      a. Provide additional pulling points as required to limit the tension to acceptable levels.

C. Product Data and Catalog Cuts:
   1. Submit low-voltage ground, power, and control wiring product data as listed below for the products provided as the Work of this Section; and clearly indicate the usage of each product on the data submitted.
      a. Wires and cables.
      b. Lugs.
      c. Connectors.

d. Tapes.
e. Pulling lubricant.
f. Tools used to crimp connectors.

D. Use of Trade Names:
1. The use of trade names within the Contract Documents is intended to establish the basis of design and to illustrate the constructability and level of quality required.
a. The use of trade names is not intended to exclude other manufacturers whose products are equivalent to those named, subject to compliance with Contract requirements.

1.04 SUBMITTALS

A. Submit the following information to the Engineer for approval in accordance with the requirements of General Conditions:
1. Product Data:
a. Wires and cables
b. Lugs
c. Connectors
d. Tape
e. Pulling lubricant
2. Samples:
a. Wire samples
3. Quality Assurance/Control Submittals:
a. Certificates:
1) Testing agency/quality verification
b. Manufacturer's Instructions:
1) Cable manufacturer's recommendations
c. Qualification Statements:
1) Documented experience of the installing firm
2) Qualifications of the licensed electricians supervising the Work

1.05 QUALITY ASSURANCE

A. Qualifications:
1. Installer Qualifications:
a. To install the Work of this Section, employ the services of a firm specializing in installing wire, cable, and accessories, and that has a minimum of 3 years experience doing so.
1) Submit the documented experience of the firm installing the wire, cable, and accessories.
b. To supervise installation of the Work of this Section, employ licensed electricians.
1) Submit the qualifications of the licensed electricians supervising the Work of this Section.

B. Regulatory Requirements:
1. Perform the Work of this Section in accordance with the requirements specified in NFPA 70, and to all other applicable state, local, and national governing codes and regulatory requirements.

C. Certifications:
1. Provide products that are listed and labeled by Underwriters Laboratory, approved by Factory Mutual, or certified as meeting the standards of UL by the Electrical Testing Laboratory (ETL) for the location installed in, and the application intended, unless products meeting the requirements of these testing laboratories are not available or unless standards do not exist for the products.
a. Provide copper conductors listed and labeled by UL for all wiring.
2. Submit evidence of testing agency/quality verification, listing, and labeling for each product with the submitted product data either by providing a printed mark on the data or by attaching a separate listing card.

a. For items without such evidence, submit a written statement from the product manufacturer that indicates why it does not have quality assurance verification.

1.06 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
1. Imprint insulated conductors with the date of manufacture, the wire type, and the manufacturer.
2. Package wire and cable in conformance with the requirements of NEMA WC 26/ EEMAC 201.
3. Protect items from damage during delivery, handling, and installation.
a. Comply with the cable manufacturer's recommendations for inspection, handling, storage, temperature conditioning, bending and training limits, pulling limits, and calculation parameters for installing cable.
b. Submit the cable manufacturer's recommendations for inspection, handling, storage, temperature conditioning, bending and training limits, pulling limits, and calculation parameters for installing cable

B. Acceptance at Site:
1. Wire and cable manufactured more than 12 months before delivery to the Site is unacceptable for use under this Contract, and will be rejected.

C. Storage and Protection:
1. Store products indoors on blocking or pallets.
2. Protect items from damage during storage.

PART 2 PRODUCTS

2.01 LOW VOLTAGE CONDUCTORS

A. Conductor Design Requirements:
1. Provide conductors of proper size and ampacity ratings based on Article 310 of NFPA 70.
a. Provide copper conductors that have 98 percent conductivity.
b. Unless otherwise indicated on the Contract Drawings, at a minimum provide conductors of the following American Wire Gauge (AWG) sizes:
1) For power and branch feeder circuits: 12 AWG.
(a) For power and branch feeders, provide solid copper low-voltage conductors for sizes up to and including 10 AWG; provide stranded copper low-voltage conductors for 8 AWG and larger sizes.
2) For control circuits: 14 AWG.
3) For alarm and status circuits: 14 AWG.

B. Insulation Design Requirements:
1. Provide low voltage ground, power, and control wiring having the proper insulation types as follows:
a. For wiring that is wholly in dry indoor locations: dual-rated Type THHN/THWN.
b. For ground wires: THW may be used at the Contractor's option.
2. Color Coding of Wires:
a. Insulation shall be color coded in accordance with requirements of Section 26 05 53.
3. Available Manufacturers:
a. Continental Wire & Cable Company
b. SouthWire
c. General Cable
d. CME Wire & Cable Inc.
e. Or Approved Equal

2.02 ACCESSORIES

A. Cable Pulling Lubrication and Lubricant:
1. Lubricant shall provide reduced tension on all types of cable jackets, dry to a thin lubricating film that retains its lubricity for an extended period and won't cement in the cables.

2. The cable pulling lubricant shall produce a low coefficient of friction on a wide variety of cable jacket materials. The lubricant shall be UL listed. It shall be easy to handle and adhere well to the cable. Where appropriate, it shall also be tested and approved for use with CSPE (chlorosulfonated polyethylene) fire-retardant cable jackets where these materials are utilized.
3. The lubricant shall be UL or CSA Listed and Labeled and shall pass the IEEE 1210, Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable. It shall pass physical compatibility tests on LLDPE, XLPE, CPE, and PVC cable jacket or sheath materials. It shall not stress crack polyethylene per ASTM Standard 1693. There shall be no significant changes in the conductive properties of XLPE and EPR semi-conducting compounds when the lubricant's effect on volume resistivity is tested according to IEEE Standard 1210.
4. Lubricant to be specification-grade type that does not promote flame propagation when used with fire-retardant cables and systems, is harmless to humans, environmentally safe, and compatible with all common cable jacket materials
5. The lubricant shall contain no waxes, greases, silicones, or polyalkylene glycol oils or waxes. The lubricant shall have less than a 6.0% solids residue after drying for 24 hours at 105°C.
6. Where CPE insulated wire and/or cable is rated for Low Smoke / Zero Halogen type, only Polywater Type LZ shall be utilized.
7. Specific lubricants for fiber-optic and other special cable installations shall be determined by the cable / lubricant manufaturers and the Contractor shall provide submittal information, including MSDS documentation and other information verifying suitability of products and general specification compliance as outlined herein.
8. Available Manufacturers:
    a. PolyWater - DynaBlue
    b. 3M - Type WL
    c. Greenlee - Type GEL

B. Grounding Braid:
1. Provide conformable, all-metal (tinned copper wires), corrosion resistant, woven grounding braid having a high current-carrying capacity approximately that of 6 AWG wire, such as.
2. Available Manufacturers:
    a. 3M, Scotch, Scotch® 25 Electrical Grounding Braid,
    b. Plymouth
    c. Permacel
    d. Or Approved equal

C. Tapes:
1. Vinyl Insulating Tape:
    a. Provide UL-listed flexible polyvinyl chloride (PVC) backed insulating tape with a pressure sensitive adhesive, such as black Scotch® 33+ Vinyl Electrical Tape, that is resistant to abrasion, acids, alkalis, and copper corrosion; resistant to, hot, cold and wet weather; and resistant to damage from UV sunlight exposure.
2. Available Manufacturers:
    a. 3M, Scotch
    b. Plymouth
    c. Permacel
    d. Or Approved equal

D. Wire and Cable Connections:
1. Grounding Connectors:
    a. Provide grounding connectors conforming to the requirements of Section 26 05 26 Grounding and Bonding for Electrical Systems.
2. Connectors for Service Wires and Cables, and for Wires and Cables Larger Than Number 6:
    a. Split Bolt Connectors or Compression Type Connectors:

1) Provide UL-listed split bolt connectors or compression type connectors for making parallel or butt splices of stranded copper wire.
2) Use companion preformed plastic insulating covers or tape insulation conforming to NFPA 70 (NEC) requirements.

b. Mechanical compression connectors:
1) Provide mechanical compression connectors that are capable of connecting single or multiple conductors, and of being installed with one wrench.
(a) Type: Compact, two-hole mechanical compression connectors having two clamping bolts.
(1) Connector Body: Provide a high copper bronze or brass alloy body.
(2) Bolts: Provide brass or bronze bolts; plated steel screws are unacceptable.
(3) Fasteners: Provide silicon-bronze fasteners for bolting connectors to connections.

c. Crimped Compression Connectors:
1) Provide two-hole crimped compression type connectors fabricated from high conductivity, seamless, electrolytic wrought copper, electrolytically tin-plated, and color coded to match the dies.
2) Provide crimped compression type connectors with adequate area to conduct the electrical current.
3) To crimp connectors, provide crimping tools from the same manufacturer that manufactured the connectors.

3. Control Wiring Connections:
a. For control wiring connections at terminal boards, provide crimped nylon-insulated ring terminals.
b. For control wiring splices, provide nylon insulated butt splices with insulation grips.
c. For joining more than two control wires, provide junction boxes with terminal boards.

4. Connectors for Other Conductors:
a. Any of the applicable types listed for larger wire may be provided.
b. Screw Terminal Connections:
1) For making terminal connections of stranded copper wire to screw terminals, provide nylon insulated crimped compression terminals with copper barrel on the wire.
2) For making terminal connections of solid copper wire to screw terminals, provide screw lock connectors.

c. Wire Nuts:
1) For making splices of copper wire, provide pre-insulated, UL-listed, solderless connectors of the spring-lock or compression type that can be installed by hand or using tools.
2) For site lighting, wire nuts used in underground or below grade locations is prohibited. There only permitted use for site lighting is within a pole base.

d. Available Manufacturers:
1) Thomas & Betts Corp.
2) Tyco Electronics, AMP Inc.
3) Ilsco Corp.
4) FCI-Burndy® Products
5) Or Approved equal

PART 3 EXECUTION

3.01 INSTALLERS

A. Install the work of this Section only under the supervision of licensed electricians.

3.02 EXAMINATION

A. Inspect all conduits, junction boxes, electrical vaults, and handholes to verify that they are clean, that they do not have burrs, that conduits are properly aligned, and that they are complete.

1. Ensure that on all conduits without threaded hubs, two locknuts are installed.
2. Ensure that in all conduits with wires larger than No. 10, bushings are installed.
3. Ensure that grounding bushings and fittings are installed at all places specified in Section 26 0526, “Grounding and Bonding”.
4. Verify that proper sized boxes are installed.

B. Verify that boxes and conduit fittings conform to the bending requirements specified in Article 314 of NFPA 70 (NEC).

3.03 PREPARATION

A. Verify that pulling calculations have been made and are available for long conduit runs and pulls as indicated in this Section.

B. Do not begin installing wiring until other work which might cause damage to the wires, cables, or conduits has been completed.
1. Correct deficiencies in conduits, junction boxes, and raceways that have been discovered by the inspection required in Paragraph 3.02.A.

C. Prepare conduits to receive wire and cable.
1. Swab the conduits with a nylon brush and steel mandrel.
2. Pre-lubricate the conduits for which the pulling tension calculations are based on a coefficient of friction less than that of a dry conduit.

D. Verify that a means of controlling the pulling tension on the wire or cable is installed on the mechanical assist devices furnished for pulling cable.

E. Take the necessary precautions to prevent water, dirt, or other foreign material from accumulating in the conduits during the execution of wiring work.

3.04 INSTALLATION

A. Low Voltage Ground, Power, and Control Wiring:
1. Install Type CL2P, FPLP, or CMP cable as required by the application in accordance with the requirements of NFPA 70 (NEC).
   a. For low voltage wiring concealed from view, only install wiring in the accessible locations permitted by the Contract Drawings.
2. Neutral Conductors:
   a. For each single-phase and each multi-phase feeder, provide separate neutrals.
   b. For branch circuits, except at three-phase, wye-connected panelboards, provide separate neutral conductors.
      1) For three-phase, wye-connected panelboards, a common, or “shared”, neutral from three (3) adjacent single-pole circuit breakers, or from the poles of the same multi-pole circuit breaker, may be provided unless otherwise specified.
         (a) Do not utilize shared neutrals for receptacle circuits.
         (b) Do not utilize shared neutrals for control circuits or circuits serving electronic equipment.
         (c) Do not utilize shared neutrals for circuits serving LED lighting fixtures.
   c. Size each neutral conductor the same as the largest phase conductor.
3. Equipment Ground Conductors:
   a. Provide a green equipment ground conductor with all runs.
      1) Provide equipment ground conductor wire type as specified in Section 26 0526, Grounding and Bonding.

B. Pulling Cable:
1. Establish a feed-in located at the highest elevation of the run, and pull cables down grade using flexible cable feeds to convey cables into raceways through the feed-in point opening.
   a. Furnish quadrant blocks located properly along the cable run.
   b. Limit cable pulling tensions to the maximum pulling tensions recommended by the cable manufacturer.

1) Measure the cable pulling tension on all runs pulled with mechanical assistance and for all cable runs where calculations are required to be submitted by using a dynameter.
2) Remove cables subjected to excessive bending and tension and that are cracked or have damaged or nicked outer jackets from the Site, and replace these cables with new undamaged cables.
   (a) If pulling tension is exceeding during pulling, remove the affected cables and mark them as not to be reused.

c. Lubricate cables with lubricants during pulling.

C. Terminating Cable:
1. Terminate cable using materials and methods indicated or specified herein, or in accordance with the written instructions of the cable manufacturer or termination kit manufacturer.
   a. For equipment connections, provide split bolt or compression type connectors, mechanical compression connectors, or crimped compression type connectors as specified and approved by the equipment manufacturer; for all other types of connections provide connectors of one of the types specified:
2. Protect insulated power and lighting cable terminations from accidental contact, deterioration of coverings, and moisture by using proper terminating devices and materials.

D. Splicing Wire and Cable:
1. All new conductors shall be continuous from end to end without splices, except where indicated on the drawings or with the special written permission of the Engineer on a case-by-case basis where the Contractor can demonstrate that installation without splices is not practical.
2. If permitted as noted above, splice cables in accessible locations.
3. Within outlet or junction boxes, make wire and cable splices that conform to the requirements of NFPA 70 (NEC).
   a. Install these outlet or junction boxes in accessible locations.

E. Wiring Identification:
1. Color code all wires and cables as indicated in Section 26 0553.
2. Identify all power wiring by circuit and panelboard numbers.
3. Identify all control wiring with wire numbers.
4. Provide additional electrical identification of cabling and wiring as specified in Section 26 0553, “Identification for Electrical Systems”.

F. Refer to Section 26 0500 for requirements for measuring and recording of conductor lengths.

3.05 FIELD QUALITY CONTROL

A. Site Tests:
1. Prior to energizing wire and cable, field test wires and cables as specified in Section 26 0563, “Acceptance Electrical Testing”.

B. Verify that control wiring wire numbers correspond to the numbers indicated in the record drawings.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For testing agency and testing agencies field supervisor.

C. Field quality-control test reports.

1.03 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
   1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 PRODUCTS

2.01 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:
   1. Solid Conductors: ASTM B 3
   2. Stranded Conductors: ASTM B 8
   3. Tinned Conductors: ASTM B 33
   4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter
   5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor
   6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick
   7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick

2.02 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
   1. Pipe Connectors: Clamp type, sized for pipe.

C. Clamps and Non-Welded Connectors:
   1. Provide bronze or brass clamps and connectors that are UL Listed for use below grade
   2. All bolts and other materials shall be bronze or brass; plated-steel screws or other hardware are unacceptable
   3. Provide bolts, nuts, lock-washers, and similar hardware designed not to damage ground wire.

PART 3 EXECUTION

3.01 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
   1. Feeders and branch circuits
   2. Receptacle circuits
   3. Single-phase motor and appliance branch circuits
   4. Three-phase motor and appliance branch circuits
   5. Flexible raceway runs

3.02 INSTALLATION

A. General:
   1. Layout the electrical work to suit actual field conditions and in accordance with accepted industry standard practice
   2. Verify existing conditions are as expected and ready for installation of grounding materials prior to commencement of the installation
      a. Perform field measurements to discover offsets and fitting requirements
      b. Locate on-site utilities and other obstructions in the area of work and verify that interferences will not occur.
   3. Clean paint, grease, and other such insulating materials from contact points of grounds
   4. After inspection by Owner's Representative, and prior to backfilling the excavation, apply protective coating compound to all grounding connections located underground.
      a. Coatings shall be allowed to cure for the minimum required time period, as recommended by the coating manufacturer, prior to backfilling of the excavation.

B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
   2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

B. Perform the following tests and inspections and prepare test reports:
   1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

C. Report measured ground resistances that exceed the following values:
   1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.

D. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify the Engineer promptly, and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 28
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Requirements for furnishing, installing, cleaning, and protecting hanger and support systems for electrical wiring, conduit boxes, and equipment.

B. Related Section:
   1. Section 26 0500 – Common Work Results for Electrical

1.02 REFERENCES

A. American Iron and Steel Institute (AISI):
   1. AISI Standard Steels (Handbook)

B. American Society for Testing Materials (ASTM):
   1. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel
   2. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated - Welded and Seamless
   3. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   4. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   5. ASTM A 283/A 283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
   6. ASTM A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi, Minimum Tensile Strength
   7. ASTM A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
   8. ASTM A 563 - Standard Specification for Carbon and Alloy Steel Nuts
   9. ASTM A 575 - Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
   10. ASTM A 576 - Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality
   11. ASTM A 635/A 635M - Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot-Rolled
   12. ASTM A 1011/A 1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
   13. ASTM B 633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
   14. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials

C. American Welding Society (AWS):
   1. AWS D1.1/D1.1M - Structural Welding Code - Steel

D. National Electrical Manufacturers Association (NEMA):
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts maximum)

E. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code (NEC)
   2. NFPA 258 - Standard Research Test Method for Determining Smoke Generation of Solid Materials

F. Society of Automotive Engineers International (SAE):
   1. SAE J 429 - Mechanical and Material Requirements for Externally Threaded Fasteners

G. The Society for Protective Coatings (SSPC):
   1. SSPC Painting Manual:

a. SSPC-SP 2 - Hand Tool Cleaning
b. SSPC-Paint 15 - Paint Specification No. 15, Steel Joist Shop Paint, Type I, Red Oxide Paint, Type II, Asphalt Coating
c. SSPC-Paint 20 - Paint Specification No. 20, Zinc-Rich Primers (Type I, "Inorganic," and type II, "Organic")

H. Underwriters Laboratory, Inc. (UL):
1. UL 568 - Nonmetallic Cable Tray Systems
2. UL 635 - Standard for Insulating Bushings
3. UL 870 - Standard for Wireways, Auxilliary Gutters, and Associated Fittings
4. UL 884 - Standard for Underfloor Raceways and Fittings
5. UL 1479 - Standard for Fire Tests of Through-Penetration Firestops
6. UL 2239 - Hardware for the Support of Conduit, Tubing, and Cable

I. U. S. General Services Administration (GSA)
1. Federal Specifications:
a. A-A-1922A - Shield, Expansion (Caulking Anchors, Single Lead)
b. FF-S-107C (2) - Screws, Tapping and Drive

1.03 SUBMITTALS

A. Submit the following information to the Engineer for approval in accordance with the requirements of Supplementary Conditions SC-19 Shop Drawings/Samples, and Section 26 0500, Basic Electrical Materials and Methods:
1. Product Data:
a. Provide product data and catalog cuts for the products provided under this Section.
2. Shop Drawings:
a. Provide Shop Drawings for equipment backboards and support structures not directly fastened to walls.
b. Provide Shop Drawings of hanging supports for conduit.
3. Quality Assurance/Control Submittals:
a. Design Data:
1) Provide structural calculations for the following items:
(a) Equipment backboards and support structures not directly fastened to the walls.
(b) Hanging supports for conduit.
2) Detailed drawings of proposed departures from the original design.
b. Certificates:
1) Testing Agency/Quality Verification:
(a) With the product data for electrical hangers and supports, provide evidence of quality verification, listing, and labeling by the Electrical Testing Agency (ETA); either by a printed mark on the data, or by a separate listing card.
(b) If an item does not have ETA quality assurance verification, provide a written quality assurance verification statement from the product manufacturer indicating why the item does not have the specified quality assurance verification.
(1) Such quality assurance verification statements are subject to approval by the Owner and the Engineer.
2) Manufacturers' Certificate of Compliance.
c. Qualification Statements:
1) Manufacturers' qualifications.

1.04 QUALITY ASSURANCE

A. Qualifications;
1. Electrical Testing Agency (ETA) Qualifications:
a. Use the Electrical Testing Agency (ETA) qualified as specified in Section 26 05 00, Common Work Results for Electrical.

2. Manufacturers' Qualifications:
    a. Provide electrical support framing made by manufacturers that have been manufacturing support framing for a minimum of 5 years, and who carefully controls their operations to ensure that excellent product engineering, quality, safety, and reliability are achieved.
    b. Submit the manufacturer's qualifications to the Engineer for approval.

B. Certifications:
1. Electrical Testing Laboratory (ETL) Certification:
    a. Provide products that are listed and labeled by Underwriters Laboratory, Inc. (UL) or certified as meeting the standards of UL by the Electrical Testing Laboratory (ETL) unless products meeting the requirements of these testing laboratories are not readily available or unless standards do not exist for the products.
2. Manufacturers Certificate of Compliance:
    a. Submit a manufacturer's Certificate of Compliance certifying that both the galvanizing and the products meet the requirements of the ASTM standards.

1.05 DELIVERY, STORAGE AND HANDLING

A. Packaging, Shipping, Handling, and Unloading:
1. Deliver, store, and handle the hangers and supports in accordance with Section 26 05 00 Common Work Results for Electrical, and as specified herein.
2. Deliver material to Site in the original factory packaging.

B. Storage and Protection:
1. Shelter and store the components under cover and supported off the ground and floors on blocking.

PART 2 PRODUCTS

2.01 MATERIALS

A. Carbon Steel Shapes:
1. Provide shapes of the sizes specified and as indicated on the Contract Drawings:
2. Provide steel shapes complying with the following material specifications for the type of steel shape listed:
    a. Steel Sections: ASTM A36/A 36M
    b. Steel Tubing: ASTM A 500, Grade B
    c. Plates: ASTM A 283/A 283M
    d. Sheets: ASTM A 1011/A 1011M
    e. Pipe: ASTM A 53/A 53M, Grade B, Schedule 40, hot-dipped, zinc-coated

B. Welding materials:
1. Provide welding materials complying with the requirements of AWS D1.1/D1.1M for the type of material being welded.

2.02 MANUFACTURED UNITS

A. Metal U-Channel Electrical Support Framing Systems and Fittings:
1. Carbon Steel U-Channel Support Framing Systems:
    a. Provide 1-5/8-inch nominal size U-channel supports fabricated from 12-gauge carbon steel electrolytically galvanized with a zinc-coating thickness commensurate with Service Condition SC 1 (mild) in conformance with the requirements of ASTM B 633.
        1) For Type II ASTM B 633 galvanized finishes, fabricate the framing from steel complying with the requirements for Grade 33 specified in ASTM A 1011/A 1011M.
        2) For Type III ASTM B 633 galvanized finishes, fabricate the framing from steel complying with the requirements of ASTM A 575, ASTM A 576, ASTM A 635/A 635M, or ASTM A 36/A 36M.
    b. Where combination members are required, spot-weld the members on 3-inch centers.

c. Provide 1-3/8-inch or larger depths, except where supports are mounted directly to walls 13/16-inch or larger depths may be provided.
d. Provide metal framing systems and fittings for metal framing systems from a single manufacturer.
e. Manufacturers:
1) Unistrut Corporation, Unistrut® Metal Framing System, www.unistrut.com.
2) Thomas & Betts, Kindorf®, http://elec-cat.tnb.com.
3) Cooper B-Line®, Inc., www.b-line.com.
4) Power-Strut, www.power-strut.com.
5) Approved Equal.

B. Conduit Supports:
1. Malleable Iron Conduit Supports:
a. Provide one-hole style galvanized malleable iron fasteners with pipe straps similar to those as manufactured by Thomas & Betts.
b. Provide support devices consisting of threaded rods, channel supports, and conduit straps/fasteners.
2. Stamped Steel Conduit Supports:
a. Provide one-hole style galvanized stamped steel fasteners with pipe straps similar to those as manufactured by Thomas & Betts.
b. Provide support devices consisting of threaded rods, channel supports, and conduit straps/fasteners.
3. Manufacturers:
a. Thomas & Betts, http://www-public.tnb.com/contractor/docs/superstrut.pdf.
b. Approved equal

C. Cable Supports:
1. Provide voltage rated cable supports fabricated from hot-dip galvanized malleable iron with a threaded collar.
2. Provide tapered wedging cable plugs fabricated from hard fiber, impregnated hardwood, or canvas bakelite for the cable supports.
3. Manufacturers:
a. EGS Electrical Group, O-Z/Gedney, Inc., Type "M"
b. Approved equal

D. Bolts, Nuts, and Washers:
1. For bolts, nuts, and washers smaller than 1/4-inch trade size, provide 316 stainless steel fasteners complying with the requirements of ASTM A 325.
2. For fastening galvanized components, provide stainless steel bolts, nuts, and washers galvanized in accordance with the requirements of ASTM A 325.

E. Anchors and Fasteners:
1. Drive (Deep-Pitch) Screws:
a. Provide Type 316 stainless steel self-tapping type drive (deep-pitch) screws that comply with the requirements of FF-S-107C (2).
2. Drilled-In Anchors and Fasteners:
a. Provide drilled-in anchors and fasteners that comply with the requirements of FF-S-107C (2).
b. Masonry Anchors:
1) Provide masonry anchors designed to accept both machine bolts and threaded rods as fasteners.
(a) Provide SAE J 429 Grade 2 machine bolt fasteners fabricated from AISI Type 316 stainless steel.
(b) Provide nuts and washers conforming to the requirements of ASTM A 563.
2) Provide masonry anchors consisting of an expansion shield and expander nut contained inside the shield.
(a) Expander Nuts:

(1) Fabricate square expander nuts with their sides tapered inward from the bottom to the top.
(2) Design the expander nuts to simultaneously climb the bolt or rod thread and expand the shield as soon as the threaded expander nut reaches and bears against the shield bottom when being tightened.

(b) Expansion Shields:
(1) Provide expansion shield bodies consisting of four legs, the inside of each tapered toward the shield bottom, or nut end.
(2) The end of one leg shall be elongated and turned across shield bottom. Outer surface of shield body shall be ribbed for grip-action.

3) Masonry Anchor Material:
(a) Provide die cast Zamac No. 3 zinc alloy having a minimum tensile strength of 43,000 psi.

4) Manufacturers:
(a) U.S.E. Diamond, Inc., FORWAY System, , www.mktfastening.com

c. Concrete Anchors:
1) Carbon Steel Anchor/Fastener:
(a) Provide UL listed one-piece studs (bolts) with integral expansion wedges, nuts, and washers.
(b) Provide carbon steel anchor/fasteners complying with the physical requirements specified in FF-S-325 for Group II, Type 4, Class 1.

2) Stainless Steel Anchor/Fastener:
(a) Provide one-piece AISI Type 303 or 304 stainless steel studs (bolts) with integral expansion wedges, AISI Type 316 stainless steel nuts, and AISI Type 316 stainless steel washers.
(b) Provide stainless steel anchor/fasteners complying with the physical requirements of FF-S-325 for Group II, Type 4, Class 1.

3) Acceptable Manufacturers:
(a) U.S.E. Diamond, Inc.; SUP-R-STUD, www.mktfastening.com
(b) Hilti Fastening Systems; KWIK-BOLT, hilti.com.
(c) Molly Fastener Group; PARABOL
(d) Phillips; RED HEAD Wedge-Anchor, www.phillipsfastener.com.

3. Hammer drive-type explosive charge drive-type anchors and fastener systems are unacceptable.
4. Lead shields, plastic-inserts, fiber-inserts, and drilled-in plastic sleeve/nail drive systems are unacceptable.

2.03 FABRICATION

A. Fit and shop assemble items in the largest sections practical for delivery to the Site.

2.04 FINISHES

A. Prime paint non-galvanized steel items.
1. Prepare surfaces to be primed in accordance with the requirements of SSPC-SP 2.
a. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
2. Prime Painting: Apply one coat of primer.

B. Galvanizing items specified above as galvanized.
1. Galvanize the items after fabrication in accordance with the requirements of ASTM A 123/A 123M.
2. Provide a minimum galvanized coating of 1.25 ounces per square foott (380 grams per square meter).

C. Touch-Up Primer:
1. For un-galvanized metal surfaces: Provide primer complying with the requirements of SSPC-Paint 15 for Type I, Red Iron Oxide.

2. For galvanized surfaces: Provide primer complying with the requirements of SSPC-Paint 20 for Type I, Inorganic Zinc-Rich Primer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Field Measurement:
   1. Although the Contract Drawings are generally indicative of the Work, take field measurements to verify actual conditions.
      a. Due to the small scale of the Contract Drawings it is not possible to indicate all offsets, fittings, and apparatus required or the minor structural obstructions that may be encountered during the Work.
   2. Carefully investigate the structural and finish conditions, and other construction work, at the Site which may affect the work of this Section.

3.02 PREPARATION

A. After carefully investigating structural and finish conditions and other in-place construction work, produce detailed Shop Drawings showing proposed departures from the original design due to field conditions or other causes.
   1. Layout the electrical work according to accepted standard electrical trade practice to suit actual field measurements.
   2. Arrange the electrical work to consider existing conditions and to preserve access to other equipment, rooms, areas, and similar features of the construction.
   3. Show equipment backboards and support structures not directly fastened to the walls on the Shop Drawings.
   4. Indicate the location and details of conflicting utility construction and slopes on the Shop Drawings.
   5. Submit the Shop Drawings to the Engineer for approval prior to performing the Work of this Section.

B. Obtain roughing-in dimensions of electrically operated equipment, including equipment being installed by both electrical and other construction trades.
   1. Set conduit and boxes only after receiving approved dimensions and checking such equipment locations.
   2. Arrange electrical Work accordingly and furnish such fittings and apparatus as required to accommodate such conditions and to preserve access to other equipment, rooms, areas, and similar spaces.

3.03 INSTALLATION

A. Install electrical Work in conformance to the requirements of NFPA 70 for wiring methods general requirements, and to other applicable Articles of the NEC governing methods of wiring.

B. Installing Anchors and Fasteners:
   1. For anchoring or fastening applications in masonry and hollow-core precast concrete structural elements, provide masonry anchors as specified herein.
   2. For anchoring or fastening applications in cast-in-place concrete and solid precast concrete structural elements, provide concrete anchors as specified herein.
   3. Threaded Bolts:
      a. Draw threaded bolted connections up tight using 316 stainless steel lock washers to prevent the bolt or nut from loosening.
   4. Drilled-In Expansion Anchors:
      a. Install expansion anchors in strict accordance with manufacturer's instructions and the following.
         1) Drill holes to the required diameter and depth in accordance with anchor manufacturer's instructions for the size of anchor being installed.
         2) Minimum Embedment:
            (a) Embed expansion anchors to four and one-half bolt diameters minimum unless otherwise indicated on the Contract Drawings.

C. Installation of U-Channel Support Framing Systems: per Table 26 0528-1 below:

Table 26 0528-1 U-Channel Support Framing Selection		
Condition 1	**Condition 2**	**Type**
Aboveground	Interior Dry Locations	Carbon steel

D. Installing Conduit Supports:
   1. For interior locations, provide stamped steel conduit supports.

E. Panelboard/Enclosure Feed Risers:
   1. Furnish and install cable supports in feeder risers as required by the underwriters.

F. Field Fabrication:
   1. Fabricated Items:
      a. Fabricate backboards, backboard supports, equipment supports, conduit supports, and the other items as detailed on the Contract Drawings.
         1) Hot-dip galvanize mild-steel fabrications in accordance with the requirements of ASTM A 153/A 153M.
      b. Supply components required for the anchorage of fabrications.
         1) Except where specifically noted otherwise, fabricate anchors and related components from the same material as the fabrication and apply the same finish.
   2. Tightly fit and secure joints.
      a. Make exposed joints butt tight, flush, and hairline.
      b. Weld fabricated assemblies in accordance with AWS D1.1/D1.1M.
         1) Continuously seal joined members using intermittent welds and plastic filler.
         2) Dress welds smooth and free of sharp edges and corners.
      c. Grind exposed joints flush and smooth with the adjacent finish surface.
   3. Ease exposed edges to a small uniform radius.
      a. Cut all backboard corners to a 1-inch radius.
   4. For the attachment of work and for bolted connections, accurately drill or punch holes for the fasteners as required.
      a. Burned holes are unacceptable.
      b. Provide holes no more than 3/32-inch larger than the fasteners.
   5. Exposed Mechanical Fastenings:
      a. Except where specifically noted otherwise in the Contract Documents, provide flush countersunk screws or bolts; unobtrusively located, and consistent with the design of the component.
   6. 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).

END OF SECTION

SECTION 26 05 33
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:
   1. Division 26 Section "Wiring Devices" for devices installed in boxes.

1.02 DEFINITIONS

A. FMC: Flexible metal conduit.

B. RGS: Rigid galvanized steel conduit.

C. LFMC: Liquidtight flexible metal conduit.

1.03 SUBMITTALS

A. Product Data: For raceways and fittings, hinged-cover enclosures, and cabinets.

B. Shop Drawings: Show fabrication and installation details of components for raceways, fittings, boxes, enclosures, and cabinets.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.05 COORDINATION

A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.02 METAL CONDUIT AND TUBING

A. Available Manufacturers:
   1. AFC Cable Systems, Inc.
   2. Alflex Inc.
   3. Anamet Electrical, Inc.; Anaconda Metal Hose
   4. Electri-Flex Co.
   5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
   6. LTV Steel Tubular Products Company
   7. Manhattan/CDT/Cole-Flex
   8. O-Z Gedney; Unit of General Signal
   9. Wheatland Tube Co.
   10. Or Approved Equal

B. Rigid Galvanized Steel Conduit: ANSI C80.1.

C. FMC: Zinc-coated steel.

D. LFMC: Flexible steel conduit with PVC jacket.

E. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.03 BOXES, ENCLOSURES, AND CABINETS

A. Available Manufacturers:
   1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
   2. Emerson/General Signal; Appleton Electric Company
   3. Erickson Electrical Equipment Co.
   4. Hoffman
   5. Hubbell, Inc.; Killark Electric Manufacturing Co.
   6. O-Z/Gedney; Unit of General Signal
   7. RACO; Division of Hubbell, Inc.
   8. Robroy Industries, Inc.; Enclosure Division
   9. Scott Fetzer Co.; Adalet-PLM Division
   10. Spring City Electrical Manufacturing Co.
   11. Thomas & Betts Corporation
   12. Walker Systems, Inc.; Wiremold Company (The)
   13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

F. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.04 FACTORY FINISHES

A. Finish: For surface raceway, wireway, enclosure, or cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.

PART 3 EXECUTION

3.01 RACEWAY APPLICATION

A. Indoors:
   1. Exposed: Rigid galvanized steel.
      a. All feeder conduits shall be RGS.
   2. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations, including the Boiler room and Sub-Basement.
   3. Damp or Wet Locations: Rigid galvanized steel conduit.
   4. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
      a. Damp or Wet Locations: NEMA 250, Type 3R.

B. Minimum Raceway Size: 3/4-inch trade size.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.
   1. Rigid Galvanized Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.02 INSTALLATION

A. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

B. Complete raceway installation before starting conductor installation.

C. Install temporary closures to prevent foreign matter from entering raceways.

D. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.

E. Make bends and offsets so inside diameter is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

F. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
   1. Run parallel or banked raceways together on common supports.
   2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

G. Join raceways with fittings designed and approved for that purpose and make joints tight.
   1. Use insulating bushings to protect conductors.

H. Terminations:
   1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
   2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

I. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

J. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

K. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed and semi recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations, including the Boiler room and Sub-Basement. Install separate ground conductor across flexible connections.

L. Grounding Conductors in Raceways: Install a separate, green, ground conductor in all raceways.

M. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

N. Fire stopping: Use UL listed materials as shown in a UL listed detail for the configuration of the penetration. Submit UL detail showing materials used.

3.03 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to paint finishes with matching touchup coating recommended by manufacturer.

3.04 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Identification for raceways
   2. Identification for conductors and control cable
   3. Warning labels and signs
   4. Equipment identification labels/signs
   5. Miscellaneous identification products

B. THE EXTENT OF ELECTRICAL IDENTIFICATION IS INDICATED BY DRAWINGS.

2.01 SUBMITTALS

A. Product Data: Submit manufacturer's product specifications and installation instructions for each identification material and device required. Include data substantiating that materials comply with requirements.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

2.02 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and ANSI C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.145.

D. UL Compliance: Comply with applicable portions of UL safety standards pertaining to electrical marking and labeling identification systems.

E. NEC Compliance: Comply with NEC as applicable to installation of identifying labels and markers for wiring and equipment.

2.03 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

3.01 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering identification products which may be incorporated in the work include, but are not limited to, the following:
   1. Almetek Industries, Inc.
   2. W.H. Brady Co.
   3. Cole-Flex Corp.
   4. Griffolyn Co.
   5. Ideal Industries, Inc.
   6. LEM Products, Inc.
   7. National Band and Tag Co.

8. Radar Engineers Div., EPIC Corp.
9. Seton Nameplate Co.
10. Tesa Corp.

3.02 ELECTRICAL IDENTIFICATION MATERIALS

A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.

B. Cable/Conductor Identification Bands: Provide manufacturer's standard aluminum wrap-around cable/conductor markers, of size required for proper application, and numbered to show circuit identification, or provide manufacturer's standard vinyl-cloth self-adhesive cable/conductor markers of wrap-around type; either pre-numbered, plastic-coated type or write-on type with clear plastic self-adhesive cover flap; numbered to show circuit identification.

C. Plasticized Tags: Provide manufacturer's standard pre-printed or partially pre-printed accident-prevention and operational tags, of plasticized card stock with matte finish suitable for writing, approximately 3-1/4" x 5-5/8", with brass grommets and wire fasteners, and with appropriate pre-printed wording including large-size primary wording (as examples: DANGER, CAUTION, DO NOT OPERATE).

D. Self-Adhesive Plastic Signs: Provide manufacturer's standard, self-adhesive or pressure-sensitive, pre-printed, flexible vinyl signs for operational instructions or warnings; of sizes suitable for application areas and adequate for visibility, with proper wording for each application (as examples: 208 VOLTS, EXHAUST FAN, RECTIFIER). Unless otherwise indicated or required by governing regulations, provide orange signs with black lettering.

E. Engraved Plastic-Laminate Signs: Provide engraving stock melamine plastic laminate signs, complying with FS L-P-387, in sizes and thicknesses indicated, engraved with engraver's standard letter style of sizes and wording indicated, black and white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

F. Thickness: 1/16", for units up to 20 sq. in. or 8" length; 1/8" for larger units.

G. Fasteners: Self-tapping stainless-steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

3.03 LETTERING AND GRAPHICS:

A. General: Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of electrical systems and equipment.

3.04 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

C. Warning label and sign shall include, but are not limited to, the following legends:
   1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

3.05 ARC FLASH WARNING LABELS

A. Arc Flash Warning Labels shall be prepared in accordance with NFPA 70, NFPA 70E, IEEE-1584 latest editions and ANSI Z535.
   a. Minimum label size shall be 4" x 6" as provided by Duralabel or Brady with applicable header information identifying both warning and danger based upon the findings.

b. Minimum information to be included on the Arc Flash label shall consist of the following:
   1) Prefaced electrical warning including universal symbol identification, approved safety color, and preface description noting that arc and shock hazard are present. Note where dual labeling is provided/required with the use of arc flash reduction maintenance settings within the equipment, such labels shall be uniquely identified by a different label safety color I, as approved by the Owner. Consult the Owner for acceptable color schemes to be used for the equipment.
   2) Statement noting that personnel protective equipment (PPE) requirements are required. Also clearly identify all equipment as “Dangerous” where work on energized equipment is otherwise prohibited and/or where no safe PPE protection so exists.
   3) Calculated arc flash hazard boundary, in inches.
   4) Calculated arc flash hazard at 18 inches, in calories/cm2.
   5) Arc flash hazard risk category, including descriptive summary of required PPE items necessary for entry into energized equipment.
   6) Voltage classification and description of conditions present for shock hazard.
   7) Insulated glove classification rating, as required for contact conditions and measurements.
   8) Limited approach boundary, in inches.
   9) Restricted approach boundary, in inches.
   10) Prohibited approach boundary, in inches.
   11) Available short circuit current.
   12) Unique equipment locator identification, corresponding to applicable device abbreviation identifiers utilized for the electrical system study / one-line diagram prepared by Contractor as specified in Section 26 0500.
   13) Name, address & phone number of the responsible engineer, engineering company or agency contracted to perform the analysis. Also include the preparer’s name, where prepared by a subcontract to the named company or agency contracted to perform the analysis report.
   14) Respective contract (job) number for the analysis report.
   15) Preparation date of the issued/approved Arc Flash Study (analysis) supporting the equipment labeling, as installed.
   16) Suffix cautionary warning that “Changes in equipment settings or system configuration will invalidate the calculated values and PPE requirements.”

3.06 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16-inch thick for signs up to 20 sq. in. and 1/8-inch thick for larger sizes.
   1. Engraved legend with black letters on white face.
   2. Punched or drilled for mechanical fasteners.
   3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

3.07 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

B. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

3.08 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
   1. Minimum Width: 3/16 inch.
   2. Tensile Strength: 50 lb, minimum.
   3. Temperature Range: Minus 40 to plus 185 deg F.
   4. Color: Black, except where used for color-coding.

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 EXECUTION

4.01 APPLICATION

A. Accessible Raceways, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with orange self-adhesive vinyl label.

B. Accessible Raceways, Over 600 Volts: Identify the voltage carried in conduit or raceway by providing voltage labeling markers on all accessible raceways, or by other means as approved or directed by the owner.

C. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands: Revise list below to suit Project.
   1. Control Wiring: Green and red.

D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.

E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.

F. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
   1. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

G. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
   1. Labeling Instructions:
      a. Indoor Equipment: Adhesive film label with clear protective overlay. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high.
      b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
      c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   2. Equipment to Be Labeled:
      a. Panelboards, electrical cabinets, and enclosures
      b. Access doors and panels for concealed electrical items
      c. Disconnect switches
      d. Enclosed circuit breakers

H. Arc Flash Warning Labels: For each arc location or circuit analyzed as part of the Arc Flash Study required by Section 26 0500, furnish and install an Arc Flash Warning label.

4.02 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
   1. Color shall be factory applied.
   2. Colors for 208/120-V Circuits:
      a. Phase A: Black
      b. Phase B: Red
      c. Phase C: Blue
   3. Colors for 480/277-V Circuits:
      a. Phase A: Brown
      b. Phase B: Orange
      c. Phase C: Yellow

H. Color-Coding for Phase and Voltage Level Identification, Over 600 Volts: Conform to requirements of the Local Electric Utility Company.

I. Painted Identification: Prepare surface and apply paint according to Division 09, “Painting” Section(s). END OF SECTION

END OF SECTION

SECTION 26 05 63
ACCEPTANCE ELECTRICAL TESTING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: The work specified in this Section consists of materials to performance test electrical systems and equipment.
   1. Items Supplied Under This Section:
      a. Electrical System Testing
      b. Thermographic Testing
      c. Ground System Testing
      d. Equipment Testing
      e. Test Procedure
      f. Test Report

B. Related Sections:
   1. Division 01 – General Requirements
   2. Division 26 Sections, As Applicable

1.02 REFERENCES

A. Applicable Documents and Testing Requirements of:
   1. America National Standards Institute (ANSI): as applicable, including:
      a. ANSI C2 - National Electrical Safety Code
      b. ANSI Z244.1 - American National Standards for Personnel Protection.
   2. National Electrical Manufacturer's Association (NEMA): as applicable, including:
      a. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
   3. American Society for Testing and Materials (ASTM), as applicable.
   4. Institute of Electrical and Electronics Engineers (IEEE), as applicable.
   5. National Fire Protection Association (NFPA), as applicable, including:
      a. NFPA 70 - National Electrical Code (NEC)
      b. NFPA 70E - Electrical Safety Requirements for Employee Workplaces.
   6. Insulated Cable Engineer's Association (ICEA), as applicable.
   7. State and Local Codes and Ordinances as applicable.
   8. Occupational Safety and Health Administration (OSHA), as applicable, including:
      a. Title 29 - Parts 1907, 1910 and 1936.
   9. InterNational Electrical Testing Association (NETA) as applicable, including:
      a. ATS-2021 - Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems
      b. MTS-2019 - Maintenance Testing Specifications for Electric Power Distribution Equipment and Systems.

1.03 SUBMITTALS

A. Submit documentation as required by this Section of the Contract to the Design Engineer in strict accordance with the provisions of Section 26 05 00 for review, comments and subsequent approval.

B. Submission to include the following:
   1. Field inspection report as required for each item of material and/or equipment outlined herein.

C. Test Reports:
   1. Each test report prepared by the respective testing firm(s) comply, where applicable, to all stipulations specified in Section 26 0500 for Operation, Maintenance and Installation Manuals with reference to preparation, paper requirements, indexing and binders. Include in each test report the following:
      a. Summary of project

b. Description of equipment tested
c. Description of test
d. Test results
e. Conclusions and recommendations
f. Appendix, including appropriate test forms
g. Identification of test equipment used
h. Signature of responsible test organization authority
i. Furnish five copies of each completed report to the Design Electrical Engineer no later than 30 days after completion of each test. Assemble and certify the testing firm each final test report, which must be submitted to the Design Engineer for review, comments and subsequent approval.

1.04 QUALITY ASSURANCE

A. Qualifications of Testing Laboratory: Select an independent nationally recognized testing laboratory that is independent from electrical contractor that either is a member of The International Electrical Testing Association or meets the following qualifications:
   1. Is nationally recognized as an electrical testing laboratory.
   2. Has been regularly engaged in the testing of electrical systems and equipment for at least 2 years.
   3. Is independent from the electrical contractor, the Owner, the Engineer and all other contractors on the job.
   4. Has at least one Professional Engineer on staff that is licensed in the State where the project site is located.
   5. Derives more than 75 percent of its income from electrical testing.
   6. Owns or leases sufficient calibrated equipment to do the testing required.
   7. Has a means to trace all test instrument calibration to The National Institute of Standards and Technology.

B. Membership in the International Electrical Testing Association (NETA) shall be considered evidence of meeting items A. 1. through and including A. 5

C. Testing shall be done under the supervision of a technician certified by International Electrical Testing Association or by technicians that are both certified by the National Society of Professional Engineers and experienced in electrical testing with 5 years of testing experience.

D. The testing laboratory shall supervise or perform all testing of equipment and oversee setting of all circuit breakers and calibration of all instruments.

E. The testing firm used must be approved by the Engineer.

F. Include the cost of such tests in the Contractors Bid Price for the applicable bid item.

1.05 GENERAL REQUIREMENTS

A. Field Inspection:
   1. This Contractor is responsible for a complete inspection of all equipment, prior to testing and energizing to ascertain that it is free from any damage, scratches, or missing components and that all power connections are correct, and that they are tight in conformance with recommended standard practice. The inspection is to also include a check of control wiring, terminal connections and all bolts and nuts.
   2. Perform field inspection by this Contractor during a time when the Field Engineer and the Design Engineer are present to witness each inspection and its performance.
   3. Correct any deficiencies found during the inspection by this Contractor prior to the energizing and testing of the equipment.

1.06 SCHEDULING

A. Schedule all testing with work of other contractors to ensure an orderly sequence of startup and completion of work.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 ELECTRICAL INSPECTIONS AND TESTS

A. Perform, supervise, and furnish all test equipment needed to perform tests and provide safety measures, procedures and equipment required for each test.

B. Schedule all testing with the Construction Manager (CM). Perform testing in the presence of the CM, except when the CM approves in writing the conducting of a specific test without being present.

C. Notify all involved parties including the Construction Manager prior to tests, advising them of the test to be performed and the scheduled date and time.

D. Coordinate the tests with others involved.

E. Prepare written test procedures and forms used in the test reports and submit for approval prior to commencement of testing.

F. Include in each test report the following information:
   1. Job title
   2. Date of test
   3. Equipment, system or cable identification
   4. Type of test
   5. Description of test instrument and date of latest calibration
   6. Section of specification defining test along with description of test and evaluations as reported by the testing company
   7. Test results (correct all readings at 20 degrees C)
   8. Signature of person supervising test
   9. Signature of Contractor
   10. Space for Construction Manager’s signature.

G. Refer to individual tests and inspections hereinafter specified for any additional or specified requirements.

H. Test Instrument Calibration:
   1. The testing firm is to have a calibration program, which assures that all applicable test instrumentation are maintained within rated accuracy.
   2. The accuracy is to be directly traceable to The National Institute of Standards and Technology.
   3. Instruments are to be calibrated in accordance with the following frequency schedule.
      a. Analog - 6 months maximum
      b. Digital - 12 months maximum
      c. 12 months
      d. 12 months
   4. Make dated calibration labels visible on all test equipment.
   5. Keep records up-to-date, which show date and results of instruments calibrated or tested.
   6. Maintain an up-to-date instrument calibration instruction and procedure for each test instrument.
   7. Calibrating standard is to be of higher accuracy than that of the instrument tested.

I. Safety and Precautions:
   1. Safety practices are to include, but are not limited to, the following requirements:
      a. Occupational Safety and Health Act of 1970-OSHA
      b. Accident Prevention Manual for Industrial Operations, National Safety Council, Chapter 4
      c. Applicable State and Local safety operating procedures
      d. IETA Safety/Accident Prevention Program
      e. Owner's safety practices

f. National Fire Protection Association - NFPA 70E
g. ANSI Z244.1 American National Standards for Personnel Protection

2. Perform all tests with apparatus de-energized except where otherwise specifically required.
3. The testing firm is to have a designated safety representative on the project to supervise all testing operations with respect to safety.

3.02 TESTING TO BE PERFORMED BY CONTRACTOR

A. The Contractor is required to obtain copies of NETA ATS-2017 and MTS-2015, and to keep at least one copy of each at the project site, to use as reference for testing requirements.

B. Continuity Test: Make test for continuity and correctness of wiring and identification on all conductors installed.

C. Wire and Cable:
1. Test all wires and cables sized No. 2 and larger in accordance with NETA ATS-2017.
2. Perform visual, mechanical, and electrical tests on all No. 4 and No. 6 power cables that operate at voltages exceeding 150 volts to ground in accordance with NETA ATS-2017.
3. Perform visual, mechanical, and electrical tests on all other wires and cables in accordance with NETA ATS-2017.
4. Replace any wires which have been damaged.
5. Correct causes of all readings which do not meet the acceptable minimum insulation readings are as stated in NETA ATS-2017. Exceed the nominal expected temperatures for the actual load.
6. Retest items requiring correction.

D. Surge Protective Devices (SPDs):
1. Visually and mechanically inspect the SPD unit and connections.
2. Use an AC voltmeter to check all voltages and ensure that normal operating voltages of the power system match the voltage rating on the SPD nameplate.
3. Check LED status indicators on the display panels and suppression modules to confirm normal status.
4. Press the alarm test button to confirm the audible alarm and LED.
5. Operate the alarm silence switch to confirm proper operation.

E. Ground Fault Circuit Interrupter (GFCI) Receptacles:
1. Test all GFCI receptacles as specified in Section 26 2726.

3.03 TESTING TO BE PERFORMED BY THE TESTING LABORATORY

A. The Contractor shall select, hire and pay an independent, nationally recognized electrical testing laboratory to perform all testing specified in this Article. Obtain Owner’s approval of the testing laboratory and the testing laboratory’s proposed test procedure prior to commencement of any tests.

B. Set all adjustments for all overcurrent protection devices in accordance with the protection and coordination study required by Section 26 0500.

C. Visually and mechanically inspect and electrically test items of equipment (as listed and required hereinafter) using the procedures of NETA ATS-2017. When a test for a particular item is not called out in ATS, test using the procedures in NETA MTS-2015.

D. Thermographic Inspection:
1. Perform thermographic inspection of the electrical equipment and installations, provided under this Project and as listed below, in accordance with NETA ATS-2017, and these Specifications. The following equipment is to be scanned:
a. all ratings
b. 50-Ampere and larger
c. 10 kVA and larger
d. 100 amp and larger
2. Provide report including the following items:
a. Items scanned

b. Whether item passed or failed
c. All items in NETA ATS-2017
d. The probable cause
e. Severity of defect
f. Recommended corrective measures
g. Video recording of test.

3. Scan using an infrared camera with video scanner output to a display screen with a range of at least 1 degree C to 75 degrees C with an accuracy of 0.1 degree C and with the following equipment:
   a. One 7 degree telephoto lens
   b. One 20 degree wide angle lens
   c. One 40 degree extra-wide angle lens
4. Record output of camera during testing onto a DVD or store digital images of each piece of equipment inspected onto a CD as a record of the temperature variations. Record either by order or by digital imprinting the actual equipment being scanned. Turn off recordings during inactive periods or edit DVD to eliminate dead periods.
5. Display data on a monitor capable of providing both a gray step mode and color monitor. These capabilities allow distinct temperature levels to be shown in black and white and color on the thermogram.
6. Submit three copies of report and two copies of the DVD or CD.
7. Include DVD or CD of thermographs of the defective equipment and installations. Also include in report.
8. Submit both copies of the report to the Engineer who will make the determination of corrective measurements.

E. Low Voltage Molded Case Circuit Breaker Tests:
   1. Visually and mechanically inspect and electrically test all low voltage circuit breakers in frame sizes rated 100-amperes or more in accordance with NETA ATS-2017.
   2. Acceptable values are as stated in NETA ATS-2017.

F. Low Voltage Panelboard Tests:
   1. Visually and mechanically inspect and electrically test all low voltage panelboards furnished under this Project in accordance with NETA ATS-2017.
   2. Acceptable values are as stated in NETA ATS-2017.
   3. Test all components as specified in this Section.

G. Dry Type Transformer Tests:
   1. Visually and mechanically inspect and electrically test low voltage dry-type transformers in accordance with NETA ATS-2017.
   2. Acceptable test values are as stated in NETA ATS-2017.

3.04 CORRECTION OF DEFICIENCIES

A. Report all unacceptable values immediately. Correct all deficiencies found in work of this contract and separately report deficiencies in work of items of other contracts.
   1. Retest items requiring correction. Correct or have corrected any remaining deficiencies and retest until work is acceptable.

3.05 RETESTING

A. After equipment has been in service for a period of nine months repeat the following tests:
   1. Thermographic testing. Correct all causes of readings above the nominal expected reading for the load encountered.

END OF SECTION

SECTION 26 22 00
LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: The work specified in this Section consists of material for furnishing, installing, connecting, energizing, testing, cleaning and protecting transformers.

B. Related Section:
1. Section 26 05 00 - Common Work Results for Electrical.
2. Section 26 05 26 - Grounding and Bonding for Electrical Systems
3. Section 26 05 63 – Acceptance Testing of Electrical Systems
4. Section 26 05 33.13 – Conduits for Electrical Systems.

1.02 REFERENCES

A. Institute of Electrical And Electronic Engineers/American National Standards Institute (IEEE/ANSI):
1. General Requirements for Dry-type Distribution and
   a. Power Transformers.
2. Guide for Dry-type Transformer Through-Fault
   a. Current Duration.
3. Terminal Markings and Connections for Power and
   a. Distribution Transformers.
4. Standard Terminology for Power and Distribution
   a. Transformers.
5. Test Code for Power and Distribution
   a. Transformers.
6. Recommended Practice for Installation,
   a. Application, Operation, and Maintenance of Dry-Type General Purpose Distribution and Power Transformers.
7. Guide for Loading Dry-Type Distribution and
   a. Power Transformers.

B. National Electric Manufacturer's Association (NEMA):
1. Dry Type Transformers for General Applications.
2. Transformers, Regulators, and Reactors.

C. Underwriter’s Laboratory, Inc. (UL):
1. Transformers, Dry-Type General Purpose and
   a. Power.

D. National Fire Protection Association (NFPA):
1. National Electrical Code (NEC).

1.03 DEFINITIONS

A. Definitions of terms are as indicated in NFPA 70, IEEE/ANSI C57.12.80 and NEMA ST 20 unless otherwise indicated, noted or specified.

1.04 SYSTEM DESCRIPTION

A. Design Criteria:
1. Provide transformers with ratings as indicated.
2. Provide transformers designed for the following conditions:
   a. 40 degrees C. maximum ambient temperature.
   b. -20 degrees C. minimum ambient.
   c. 1,000 feet (300m) above sea-level.
   d. Indoors unless otherwise indicated or specified.

B. Provide transformers for connecting to the following systems with nominal voltages and operating ranges as specified in IEEE/ANSI C84.1:

1. 480Volt, 3-phase, 3-wire, grounded or ungrounded.

C. Provide transformers for supplying the following systems with nominal voltages and operating ranges as specified in IEEE/ANSI C84.1
   1. 208/120 Volt, 3-phase, 4-wire, grounded wye.

D. Provide transformers for connecting to systems with a let-through fault capability up to the limits of IEEE/ANSI C57.12.59.

1.05 SUBMITTALS

A. Testing Agency/Quality Verification: Provide with all product data evidence of testing agency/quality verification, listing, and labeling either by printed mark on the data or by a separate listing card. Provide from product manufacturers a written statement indicating why an item does not have a quality assurance verification. Such statements are subject to the approval of the Engineer.

B. Product Data:
   1. List of transformers and accessories to be furnished and installed.
   2. Catalog cuts of all transformers and accessories.

C. Shop Drawings: Provide shop drawings for the following:
   1. Complete outline drawing, showing overall length, width, and height and including ratings of equipment, impedance, and installation restrictions.

D. Submit Operation and Maintenance Manual.

1.06 QUALITY ASSURANCE

A. Provide products that are listed and labeled by Underwriters Laboratory, approved by Factory Mutual, or certified as meeting the standards of UL by the Electrical Testing Laboratory unless products meeting the requirements of these testing laboratories are not readily available or unless standards do not exist for the products. Provide products that are listed and labeled or approved as stated above for the location installed in and listed and labeled or approved as indicated and specified for the applications the items are intended for.

B. Conform all work to NFPA 70, National Electrical Code.

C. Install work under supervision of skilled licensed electricians.

PART 2 PRODUCTS

2.01 SECONDARY TRANSFORMERS

A. Provide transformers of the general purpose, indoor, double-wound, ventilated, dry-type designed and tested in accordance with NEMA Standard ST 20 and ANSI Standard C57.12.01, Underwriter's Laboratories Standard UL-1561, and ANSI C57.12.91 of capacities and mounting arrangements, (floor or wall) as indicated on the Drawings. Provide wall-mounted transformers with the wall bracket that is adequate for the supporting weight.

B. Design transformers for continuous operation at rated KVA, 24 hours a day, 365 days a year, with normal life expectancy as defined in ANSI/IEEE C57.96. Provide a transformer which will make this performance obtainable without exceeding 150 degree C. average temperature rise by resistance or 180 degree C. hot spot temperature rise in a 40 degree C. maximum ambient and 30 degree C. average ambient. Do not exceed 220 degree C as the maximum coil hot spot temperature.

C. Provide proven 220 degree C. insulation systems.

D. Wind the coils with [copper] [aluminum], which has insulated, proven, high temperature resistant, 220 degree C. materials.

E. Use all materials in the transformer that are flame retardant and do not support combustion as defined in ASTM Standard Test Method D635.

F. Totally immerse the transformer in an insulating varnish, which will maintain superior bond strength, high dielectric strength, and outstanding power factors at temperatures associated with the 220 degree C. system as a final insulation treatment. After immersion, cure the varnish at normal operating temperatures for such a period of time as to assure complete curing of the

varnish and scourging of volatiles in the varnish solvent.

G. Construct transformers with core materials of a high quality, low loss nature as to minimize exciting current, no-load losses, and interlaminar vibrations.

H. The core and coil assembly shall be installed on vibration-absorbing pads.

I. Transformer average sound levels shall not exceed the following ANSI and NEMA levels for self-cooled ratings:
   1. 9 kVA 40 db
   2. 50 kVA 45 db
   3. 150 kVA 50 db
   4. 300 kVA 55 db
   5. 500 kVA 60 db
   6. 700 kVA 62 db
   7. 1000 kVA 64 db
   8. 65 db

J. Design the core-coil assembly and mechanically brace to withstand short circuit tests as defined in ANSI C57.12.91 by the use of full scale testing. The coil construction and mechanical bracing members shall be such as to prevent mechanical degradation of the insulation structures during short circuit.

K. Provide single phase transformers 2 KVA and below without taps. Provide 3 KVA and 5 KVA with 2-2 ½ percent above nominal full capacity (ANFC) and 2-2 ½ percent below nominal full capacity (BNFC) taps. Provide 7-1/2 KVA and above with 2-2 ½ percent ANFC and 4-2 ½ percent BNFC taps.

L. Provide three phase transformers with 2-2 ½ percent ANFC and 4-2 ½ percent BNFC taps.

M. Provide transformer with enclosures removable front and back panels, and must have screened or grilled ventilation openings designed to prevent accidental access to electrified parts.

N. The following factory tests shall be made on all transformers:
   1. Ratio tests at the rated voltage connection and at all tap connections.
   2. Polarity and phase relation tests on the rated voltage connection.
   3. Applied potential tests.
   4. Induced potential tests.
   5. No-load and excitation current at rated voltage on the rated voltage connection.

O. Transformers shall be low loss type with minimum efficiencies per NEMA TP-1 when operated at 35% of full load capacity.

P. Acceptable Manufacturers:
   1. Square D Company
   2. Eaton Electric
   3. General Electric
   4. Siemens Industry for LV Power Distribution
   5. Or Approved Equal

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, connect, and interconnect products where indicated, and in accordance with NEMA Standards, manufacturer's printed installation instructions, and this Section. Make connections in a manner, which will insure electrical continuity and operability of the products.

B. Protect the equipment against foreign matter and moisture during installation.

C. Install a 3-foot (1m) length of liquid-tight flexible metal conduit between transformer and fixed conduit system in accordance with Section 26 05 33.13. Make power conductor connections in accordance with manufacturer's drawings, and as indicated on the Drawings.

D. Ground in accordance with Section 26 05 26. Provide ground bond for enclosure and neutral, minimum size #6 AWG to nearest structural steel and nearest water pipes to conform with

Section 26 05 26 and the NEC.

3.02 FIELD QUALITY CONTROL

A. Dry out dry type transformers before they are energized.

B. Check transformer for tightness of external structural members and mechanical joints in order to minimize audible sound levels. Check the ground connections.

C. Test as specified in Section 26 05 63.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Lighting and appliance branch-circuit panelboards.

1.02 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.
   1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
      a. Enclosure types and details for types other than NEMA 250, Type 1
      b. Bus configuration, current, and voltage ratings
      c. Short-circuit current rating of panelboards and overcurrent protective devices
      d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
   2. Wiring Diagrams: Power, signal, and control wiring.

C. Qualification Data: For testing agency.

D. Field quality-control test reports including the following:
   1. Test procedures used
   2. Test results that comply with requirements
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section “Operation and Maintenance Data," include the following:
   1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
   2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.03 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Section "Products."

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.04 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
   1. Ambient Temperature: Not exceeding 122 deg F (50 deg C)
   2. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

   1. Notify Construction Manager/Owner no fewer than fourteen (14) days in advance of proposed interruption of electrical service
   2. Do not proceed with interruption of electrical service without Construction Manager's/Owner's written permission.

1.05 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.06 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Keys: Four (4) spares for each type of panelboard cabinet lock
      a. All panelboards furnished under this Project shall be keyed alike, using Corbin lock as basis of design as specified hereinafter.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
      a. Eaton Corporation; Cutler-Hammer Products
      b. General Electric Co.; Electrical Distribution & Protection Division
      c. Siemens Energy & Automation, Inc.
      d. Square D Company.

2.02 MANUFACTURED UNITS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces.

B. Enclosures: Flush- and surface-mounted cabinets; NEMA PB 1, Type 12 or as otherwise required.
   1. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box
   2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover
   3. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat
   4. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.

C. Phase and Ground Buses:
   1. Material: Hard-drawn copper, 98 percent conductivity
   2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

D. Conductor Connectors: Suitable for use with conductor material.

1. Main and Neutral Lugs: Compression type
2. Ground Lugs and Bus Configured Terminators: Compression type.

E. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.03 PANELBOARD SHORT-CIRCUIT RATING

A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Main Overcurrent Protective Devices (where required): Circuit breaker, thermal-magnetic type or as indicated on the Drawings.

B. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, thermal-magnetic type; replaceable without disturbing adjacent units.

C. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike using Corbin lock as basis of design.

2.05 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: UL 489, with series-connected rating to meet available fault currents.
   1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
   1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
   2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

2.06 ACCESSORY COMPONENTS AND FEATURES

A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Fungus Proofing: Permanent fungicidal treatment for panelboard interior, including overcurrent protective devices and other components.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mount top of trim 74 inches above finished floor, unless otherwise indicated or required.

C. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

D. Install overcurrent protective devices.
   1. Set field-adjustable circuit-breaker trip ranges, as applicable.

E. Install filler plates in unused spaces.

F. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

3.02 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section 26 053.

B. Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.03 CONNECTIONS

A. Ground equipment according to Section 26 0526.

B. Connect wiring according to Section 26 0519.

3.04 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

B. Perform the following field tests and inspections and prepare test reports:
   1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
   1. Measure as directed during period of normal system loading.
   2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
   3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
   4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.05 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION

SECTION 26 28 16
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following individually mounted, enclosed switches:
   1. Fusible switches
   2. Non-fusible switches
   3. Enclosures

1.02 DEFINITIONS

A. HD: Heavy duty.

B. SPDT: Single pole, double throw.

1.03 SUBMITTALS

A. Product Data: For each type of enclosed switch, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
   1. Enclosure types and details for types other than NEMA 250, Type 1
   2. Current and voltage ratings
   3. Short-circuit current rating
   4. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Qualification Data: For testing agency.

D. Field quality-control test reports including the following:
   1. Test procedures used
   2. Test results that comply with requirements
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements

E. Operation and Maintenance Data: For enclosed switches to include in emergency, operation, and maintenance manuals. In addition to items specified in Section "Closeout Procedures," include the following:
   1. Manufacturer's written instructions for testing and adjusting enclosed switches
   2. Time-current curves, including selectable ranges for each type fuse

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
   1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
   1. Ambient Temperature: Not exceeding 122 deg F (50 deg C).
   2. Altitude: Not exceeding 6600 feet.

1.06 COORDINATION

A. Coordinate layout and installation of switches, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.07 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Spare Fuses:
      a. Control-Power Fuses: 3 of each type installed
      b. Fuses for Fusible Switches: 3 of each type installed

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 FUSIBLE AND NON-FUSIBLE SWITCHES

A. Available Manufacturers:
   1. Eaton Corporation; Cutler-Hammer Products
   2. General Electric Co.; Electrical Distribution & Control Division
   3. Siemens Energy & Automation, Inc.
   4. Square D/Group Schneider

B. Fusible Switch, 600A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
   2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
   3. Auxiliary Contact Kit: Where indicated on the Drawings, furnish switches with an auxiliary set of contacts, arranged to mimic or follow the position of the main switch and open before the switch blades open.

2.03 ENCLOSURES

A. Provide enclosures sized to contain the safety switches, fuses, and all other required items.
   1. Provide an interlock that prevents opening the enclosure door when the switch is in the “ON” position.
      a. Provide an interlock defeater, which requires a common hand-tool to operate.
   2. Provide a copper ground-bus or ground stud rated for 100 percent of capacity.

B. Provide each enclosure with an external operator that positively indicates the “ON”, “OFF”, and “TRIPPED” positions of the switch.

C. Provide the capability to pad-lock the switch in the “ON” and the “OFF” positions by using three padlocks.

D. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Indoor, Dry Locations: NEMA 250, Type 12
2. Outdoor Locations: NEMA 250, Type 3R
3. Other Wet or Damp Indoor Locations: NEMA 250, Type 3R

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches for compliance with installation tolerances and other conditions affecting performance.

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

3.02 INSTALLATION

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches.

B. Mount individual wall-mounting switches with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Electrical Identification."

B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Electrical Identification."

3.04 FIELD QUALITY CONTROL

A. Prepare for acceptance testing as follows:
   1. Inspect mechanical and electrical connections
   2. Verify switch and relay type and labeling verification
   3. Verify rating of installed fuses
   4. Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer's certification

B. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:
   1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
   3. Infrared Scanning:
      a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch. Open or remove doors or panels so connections are accessible to portable scanner.
      b. Follow-Up Infrared Scanning: Perform an additional follow-up infrared scan of each unit 11 months after date of Substantial Completion.
      c. Instruments, Equipment and Reports:
         1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
         2) Prepare a certified report that identifies enclosed switches included and describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

3.05 CLEANING

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION