PROJECT MANUAL AND SPECIFICATIONS
FOR

24th Street
Detroit, MI

Crown Enterprises, LLC

Building Renovation
2220 24th Street
Detroit, MI 48216

January 31, 2025
Issue for Permit

Project Design Team:

ARCHITECT OF RECORD
FormSurfaces Design Group
10913 Marcello Lane, Whitmore Lake, MI 48189

MEP ENGINEER
Unified Building Systems
75 N. Main St. Suite 221
Mt. Clemens, MI 48043

CIVIL ENGINEER
Angle Design and Engineering, LLC
6200 Shaefer Road, Ste. 100, Dearborn, MI 48126

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SECTION 01 10 00

SUMMARY OF WORK

PART 1- GENERAL

1.1 SCOPE OF WORK

The building is a partial interior renovation of 4,787 square feet of an existing 28,759 square foot building located at 2220 24th Street, Detroit, Michigan. It is to be used as a truck repair garage, including open areas for the parking of semi-trailers (per code 50-10-107.38) and/or motor vehicle services, minor (per code 50-10-106.25), but will not be open to the general public. The building will be a single story mixed-use occupancy, with S-1 storage and B business use and will have fire suppression.

1.2 GENERAL DESCRIPTION

A. Interior renovation of building in Detroit, MI.

1.3 WORK BY OWNER

A. The following work is to be performed by a separate contract, as noted, and not included in this scope of work. The Construction Manager/General Contractor will coordinate and schedule separate contracts and provide associated work as indicated in the Drawings and Specifications:
    a. City building plan review and permits, systems development, and utility fees.
    b. Site preparation.
    c. Asbestos and existing contaminated soil removal, if applicable.
    d. Appliances not specifically identified and specified in these drawings and specifications.
    e. Furniture and Equipment not specified.
    f. Interior and exterior signage including any exterior building mounted sign and it's associated materials and support structure.

1.4 AWARD

A. The owner will award the work for the above within 30 days of bid due date. The contractor will commence work with 15 days of the award. The start and completion dates are critical for the scheduling and coordination of work with other related work and trades. These milestone dates are to be coordinated and confirmed with the Construction Manager/General Contractor prior to award and documented as part of the award agreement. No delay in the completion dates will be acceptable and may result in liquidated damages.

1.5 SUB-CONTRACTORS

A. The subcontractors shall carefully examine the site prior to Bidding, taking note of existing site conditions, locations of approaches to the site, and shall compare findings with Drawings and Specification requirements. Report any discrepancies to the Architect for clarification or modification.

1.6 PREMIUM TIME WORK

A. Premium time work is defined as afternoon shift, night shift or weekend work. Premium time work must be coordinated with and approved in advance and in writing by the Owner. It may include, but not limited to:

1. Work activities that cause excessive noise, vibration or other nuisances that disturbs work in or access to the neighboring buildings.

1.7 COORDINATION

A. The successful contractor/vendor will need to coordinate activities, including but not limited to scheduling, demolition, salvage, new construction and staging with Hercules Concrete, Crown Enterprises. The area of work will be unoccupied during construction.

B. The successful contractor/vendor will need to coordinate laydown and staging areas with the Owner.

1.8 CONTRACTOR USE OF PREMISES

A. Limit use of the site and premises to allow:
   a. Owner access and use for Work by Owner.
   b. Work by Others (there may be other contracts underway during this project and Work by Owner.

B. Time Restrictions: Work may be performed during the hours of 7:00 AM to 6:00 PM Monday through Friday. Notify Owner for work to be performed during hours other than those noted.

C. Emergency Building Exists During Construction: Exists and routes to be maintained in a fully functional condition.

1.9 WORK SEQUENCE

A. Perform work in phases to accommodate Owner's occupancy requirements during the construction period, coordinate construction schedule and operations with the Construction Manager/General Contractor.

1.10 OWNER OCCUPANCY

   a. The Owner may utilize the building area of work during construction as a construction office to stage and phase construction activities.

   b. Cooperate with the Owner to minimize conflict and to facilitate Owner's activities and goals.

END OF SECTION

SECTION 01 60 10

SUBSTITUTION REQUEST PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Transportation and handling.

C. Storage and protection.

D. Product options.

E. Substitutions.

1.2 RELATED SECTIONS

A. Section 01 60 13 - Substitution Request Form

1.3 PRODUCTS

A. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents and Owner.

B. Provide interchangeable components of the same manufacturer, for components being replaced.

1.4 TRANSPORTATION AND HANDLING

A. Transport and handle products in accordance with manufacturer’s instructions.

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

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement and damage.

1.5 STORAGE AND PROTECTION

A. Store and protect products in accordance with manufacturer’s instructions, with seals and labels intact and legible.

B. Store sensitive products in weather-tight, climate controlled enclosures.

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

D. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

E. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation, mold formation or potential degradation of product.

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

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

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

1.6 PRODUCT OPTIONS

A. Products specified by reference standards or by description only: Any product meeting those standards or description.

B. Products specified by naming one or more manufacturer's products or manufacturer's named and meeting specifications: No options or substitutions are allowed.

C. Products specified by naming one or more manufacturers with a provision for substitutions: Submit a request for substitution using the form provided in Section 01 60 13 – Substitution Form.

1.7 SUBSTITUTIONS

A. During Bid: Bidding instruction specifies that the Architect will consider written requests for substitutions, received at least 7 days prior or Bid Date. Requests received after that date will not be considered.

B. Substitutions After Contract Award: The Owner may consider Contractor's for substitution when extensive revisions to the Contract Documents are not required, when the proposed changes are on keeping with the Contract Documents, when the request is timely, fully documented, and properly submitted and when one or ore of the following conditions is satisfied, all as judged by the Architect. Otherwise, requests will be returned without action except to record non-compliance with these requirements.

a. Where the request is directly related to a clause allowing "substitutions per Section – 01 60 10 or similar language in the Contract Documents.
b. Where the specified product or methods cannot be provided within the contract time. However, the request will not be considered if the product or methods can not be provided within the contract time. However, the request will not be considered if the product or method cannot be provided as a result of the Contractor's failure to pursue the work promptly or coordinate the various activities properly.
c. Where the specified product or method cannot receive necessary approval by governing authority or insurance regulation, and the requested substitution can be

approved.

d. Where a substantial advantage is offered the Owner, in terms of cost, time, energy conservation, or other considerations of merits after deducting offsetting responsibilities the Owner may be required to bear.
e. When the specified product or method cannot be provided in a manner which is compatible with other materials of the work, and where the Contractor certifies that the substitution will overcome the incompatibility.
f. When the specified product or method cannot be properly coordinated with other materials in the work, and where the Contractor certifies that the substitution can be properly coordinated.
g. When the specified product or method cannot receive a warranty as required by the Contract Documents and where the Contractor certifies that the proposed substitution will receive the required warranty.
h. Where specified products become unavailable, or discontinued through no fault of the Contractor.

C. Work Related Submittals: Contractor's receipt of Architect's reviewed and accepted shop drawings, product data, and/or samples which relate to work not complying with requirement of the contract documents, does not constitute acceptable or valid (nor approval of) request for a substitution thereof. It does not relieve the contractor of the responsibility to meet the requirements of the contract documents.

D. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

E. A request constitutes a representation that the Bidder or Contractor:

a. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
b. Will provide the same or better warranty for substitution as for the specified product.
c. Will coordinate installation and make changes to other work, which may be required for the work to be complete with no additional cost to the Owner.
d. Waives claims for additional costs or time extension, which may subsequently become apparent.
e. Will reimburse Owner and Architect/Engineer for review or redesign services associated with re-approval by authorities.

F. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

G. Substitution Submittal Procedure:

a. Submit request on form in Section 01 60 13 – Substitution Request Form or CSI Substitution Request Form.
b. Use one form for each product requested.
c. Submit 2 copies of each request for Substitution for consideration.
d. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. THE BURDEN OF PROOF IS ON THE PROPOSER.
e. Bidders are not to rely on approvals made in any other manner than Addenda or

returned written responses.

f. Submit request in PDF format via e-mail.
g. The Architect/Engineer will notify Contractor, in writing, of decision to accept or reject request.

PART 2 PRODUCTS - Not Applicable To This Section

PART 3 EXECUTION - Not Applicable To This Section

END OF SECTION

SECTION 01 60 13

SUBSTITUTION REQUEST FORM

PART 1 GENERAL

1.1 IDENTIFICATION

A. Request Number:_____

B. Contractor:_____

C. Subcontractor:_____

1.2 REQUEST

A. We hereby submit for consideration the following product in place of the specified product for this project:

1. Specified Product Specification Section / Reference Drawing(s):

_____

2. Proposed Substitution:

_____

3. Manufacturer:

_____

4. Location:

_____

5. Product Website URL:

_____

6. Phone:

_____

7. Time Used:

_____

8. Identify the Difference between Proposed Substitution and Specified Product (All substitutions and exceptions must be listed, omission of this information and acceptance of materials otherwise submitted will not relieve the obligation for the contractor to meet design as drawn and specified.):

_____

_____

1.3 INFORMATION

A. Attach complete information: cut sheets, data sheets, laboratory testing, Drawings and/or Specifications changes, which the proposed substitution will require for its proper installation.

1.4 SUBMISSION

A. Submit with request all necessary samples and substantiating data to establish equivalent quality and performance to the specified product. Clearly mark manufacturer's literature to indicate equivalent performance.

1.5 AFFIRMATION

A. Does the substitution affect dimensions shown on the drawings? ___Yes ___No
If yes, clearly indicate how:

_____

_____

B. Does the substitution request result in a (credit____) (add____) (no charge___) to the base contract amount?

1. If Credit/Add, How Much: (-/+)_____

C. Will the Undersigned pay for all additional costs resulting from the proposed substitution including the Architect's and Consultant's additional services? ____Yes ___No
If no, fully explain: _____

_____

D. What effect does the substitution have on the other subcontracts or trades?

_____

_____

E. What effect does the substitution request have on the construction schedule?

_____

_____

F. Are manufacturer's warranties for the proposed and specified product the same?
___Yes ___No
If no, explain or provide attachment_____

_____

G. Reason for substitution request: _____

_____

H. Identify the advantages of the substitution to the Owner/Project:

_____

I. Itemized comparison of specified product(s) and proposed substitution:

_____

_____

I. Accurate cost data comparing proposed substitution with specified product:

_____

_____

J. Differences of maintenance services and sources:

_____

_____

J. Manufacturer's guarantees of proposed and specified items are:
___Same ___Different

_____

1.6 AFFIRMATION DOCUMENTATION

A. Submit executed affidavit from Product Manufacturer.

B. Additionally, submit Testing Laboratory Certificate.

C. Contractor is specifically bound by the General Conditions in addition to those of this Section.

1.7 ARCHITECT'S ACTION

A. Refer to Applied Review Stamp with Annotations for Approved, Approved as Noted (conditional approval), Not approved, Revise and Resubmit.

END OF SECTION

SECTION 02 41 03

SELECTIVE DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. Provide demolition activities with the scope as per specifications and drawings.

B. Fully demolish all abandoned utilities within the scope of work area.

1.2 SUBMITTALS

A. Schedule: Submit for approval selective demolition schedule, including schedule and methods for capping utilities to be abandoned and maintaining existing utility service.

1.3 QUALITY ASSURANCE

A. Codes and Regulations: Comply with governing codes and regulations. Use experienced workers.

1.4 PROJECT CONDITIONS

A. Occupancy: Immediate areas of work will not be occupied during selective demolition. People may occupy the adjacent Kitchen during demolition and construction activities.

B. Existing Conditions: No responsibility for buildings and structures to be demolished will be assumed by the Owner.

PART 2 PRODUCTS

2.1 DEMOLITION APPLICATIONS

A. Selective Interior Demolition:
1. Application: Selective demolition of interior partitions, systems, and building components designated to be removed.
   a. Demolition of designated areas of mechanical and plumbing items.
   b. Notification to Owner of schedule of shut-off of utilities which serve occupied spaces.
   c. Disconnection, capping, and removal of utilities.
   d. Pollution control during building demolition, including noise control.
   e. Removal and legal disposal of materials.
2. Protection: Existing items and areas to remain and adjacent construction.
3. Salvage: Designated items.
4. Utilities: Interruption, capping or removal as applicable.
5. Hazardous Materials: None known to be present.

PART 3 EXECUTION

3.1 SELECTIVE DEMOLITION

A. Demolition Operations: Do not damage building structure, assemblies, elements and improvements indicated to remain. Items of salvage value, not included on schedule of

salvage items to be returned to Owner, shall be removed from structure. Storage or sale of items at project site is prohibited.

B. Utilities: Locate, identify, disconnect, and seal or cap off utilities in buildings to be demolished.

C. Shoring and Bracing: Provide and maintain interior and exterior shoring and bracing.

D. Occupied Spaces: Do not close or obstruct egress paths, streets, walks, drives or other occupied or used spaces or facilities without the written permission of the Owner and the authorities having jurisdiction. Do not interrupt utilities serving occupied or used facilities without the written permission of the Owner and authorities having jurisdiction. If necessary, provide temporary utilities.

E. Operations: Cease operations if public safety or remaining structures are endangered. Perform temporary corrective measures until operations can be continued properly.

F. Security: Provide adequate protection against accidental trespassing. Secure project after work hours.

G. Restoration: Restore finishes of patched areas.

3.2 SCHEDULE

A. Items for Protection During Demolition and Construction: (The following are samples only)
   1. Adjacent existing building structures.

B. Items to be Salvaged for Reinstallation:
   1. As identified on drawings.

C. Utilities Requiring Interruption, Capping, or Removal:
   1. Electric.
   2. Heat.
   3. Water.
   4. Gas.
   5. Sewerage.

END OF SELECTIVE DEMOLITION

SECTION 04 22 00

UNIT MASONRY ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete Block.
B. Mortar and Grout.
C. Reinforcement and Anchorage.
D. Accessories.

1.2 RELATED SECTIONS

A. Section 03 11 16- Cast-In-Place Concrete
B. Section 05 50 00- Metal Fabrications (Steel Lintels)
D. Section 07 92 00- Joint Sealers

1.4 PERFORMANCE REQUIREMENTS

A. Building Code Compliance:
   1. Michigan Building Code 2015

B. Provide unit masonry that develops the following net-area compressive strengths (fm) at 28 days. Determine compressive strength of masonry from net-area compressive strengths of masonry units and mortar types according to ASTM C 1314.

C. Provide unit masonry that develops the following net-area compressive strengths (fm) at 28 days.
   1. For Concrete Unit Masonry: f'm=1500 psi

1.5 SUBMITTALS

A. See Division 1 - General Requirements for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar.

C. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

E. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
   1. Each type of masonry unit required.
      a. Include size-variation data for block, verifying that actual range of sizes falls within specified tolerances.
      b. Include test results, measurements, and calculations establishing net-area compressive strength of masonry units.
      c. Include test results indicating initial rate of adsorption.
   2. Mortar complying with property requirements of ASTM C 270.
   3. Grout mixes complying with compressive strength requirements of ASTM C 476. Include description of type and proportions of grout ingredients.

D. Samples: Submit two representative samples of each material specified indicating

visual characteristics and finish. Include range samples if variation of finish is anticipated.

F. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

1.6 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/ASCE 5/TMS 402 and ACI 530.1/ASCE 6/TMS 602, except where exceeded by requirements of the contract documents.

B. Fire Rated Assemblies: Conform to MBC 2015 for applicable requirements for fire rated masonry construction.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1093 to conduct the testing indicated, as documented according to ASTM E 548.

F. Preconstruction Testing Service: Engage a qualified Independent Testing Agency to perform the following preconstruction testing:
1. Concrete Masonry Unit Test: For each concrete masonry unit indicated, per ASTM C 140.
2. Prism Test: For each type of wall construction indicated, per ASTM C 1314
3. Mortar Test: For mortar properties per ASTM C 270.
4. Grout Test: For compressive strength per ASTM C 1019.

G. Mock-Ups: Provide mock-up as required to demonstrate quality of workmanship.
1. Include each type of masonry construction.
2. Include a sealant filled joint in mock-up.

H. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

1.8 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section.

B. Conduct pre-installation meeting at project site to comply with requirements in Division 1 General Requirements Section "Project Meetings".

1.9 DELIVERY, STORAGE, AND HANDLING

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

B. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

1. Protect Type I concrete masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

1.10 PROJECT CONDITIONS

A. Cold Weather Requirements: When ambient temperature is below 40 degrees Fahrenheit, implement cold weather procedures. Comply with ACI 530.1/ASCE 6/TMS 602 Specification requirements. Provide approved admixtures only.

B. Hot Weather Requirements: When ambient temperatures during construction or during the protection period are greater than 100 degrees Fahrenheit, or greater than 90 degrees Fahrenheit with a wind velocity greater than 8 miles per hour, comply with ACE 530.1/ASCE 6/ TMS 602 Specification requirements. Provide approved admixtures only.

C. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

D. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

PART 2 PRODUCTS

2.1 MATERIALS

A. Concrete Masonry Units (CMU): Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 x 8 inches and nominal depth as indicated on the drawings.
   2. Load-Bearing Units: ASTM C 90.
      a. Both hollow and solid block, as indicated.
      b. Type I - Moisture-controlled; medium weight.
      c. Exposed faces: Manufacturer's standard color.
   3. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1500 psi.
   4. Weight Classification: Medium weight, unless otherwise indicated.
   5. Fire Rated: As indicated and by wall types on Drawings.
      a. ASTM E 119.

2.2 MORTAR AND GROUT MATERIALS

A. Acceptable Manufacturers: Custom Building Products; Hohmann & Barnard, Inc.; LATICRETE International, Inc.; Quikrete Companies; SPEC MIX, Inc.

B. Masonry Cement: ASTM C 91, Type S.

C. Portland Cement: ASTM C 150, Type I; color as required to produce approved color sample.

1. Hydrated Lime: ASTM C 207, Type S.
2. Mortar Aggregate: ASTM C 144, except for joints less than 1/4 inch thick use aggregate graded with 100% passing No. 16 sieve.
3. Grout Aggregate: ASTM C 404.

D. Pigments for Colored Mortar: Iron or chromium oxides with demonstrated stability and colorfastness. ASTM C979.
   1. Colors: As required to match Architect's color samples.

E. Water: Clean and potable.

F. Accelerating Admixture: Nonchloride type for use in cold weather.

G. Moisture-Resistant Admixture: Water repellent compound designed to reduce capillarity.

H. Do not use calcium chloride in mortar or grout.

2.4 REINFORCEMENT AND ANCHORAGE

A. Acceptable Manufacturers: Products meeting specified requirements, as manufactured by Dur-O-Wall, Heckman, Hohmann Barnard, or National Wire Products.

B. Reinforcing Steel: Masonry Joint Reinforcement, General: ASTM A951
   a. Interior Walls: Mill galvanized, ASTM 641 (0.10 oz. per ft.), carbon steel.
   b. Exterior Walls: Hot dipped galvanized, ASTM A153 Class B-2 (1.5 oz. per sq. ft.), carbon steel.
   c. Wire Size for Veneer Ties: W2.8 or 0.1875 in. diameter (3/16")
   d. Wire Size for Side and Cross Rods: W1.7 or 0.148 in. diameter (9 ga.)

C. Single Wythe Joint Reinforcement: Truss type; ASTM A 82 steel wire, hot dip galvanized after fabrication to ASTM A 153/A 153M, Class B; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.

D. Strap Anchors: Z-type bent steel shape, 28 x 1-1/2 inch size x 0.250 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B-2.
   1. Manufacturers:
      a. Heckmann Model 272 (Z-Type).
      b. Dur-O-Wal, Inc. Model 301 Z.

E. CMU (Single Wythe) Flashing System: System of CMU cell flashing pans and interlocking CMU web covers mad from high-density polyethylene incorporating chemical stabilizers that prevent UV degradation. Cell flashing pans have integral weep spouts that are design to be built into mortar bed joints and weep collected moisture to the exterior of CMU walls and that extend into the cell to prevent clogging with mortar.
   a. Mortar Net US, Ltd; Block-Flash.

2.6 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
   1. Manufacturers:
      a. Hohmann & Barnard, Inc. Model #RS Series.

b. Williams Products Model Slot Seal Standard 2015-3.
c. Dur-O-Wal, Inc. Model D/A 2001.

B. Joint Filler: Closed cell neoprene; oversized 50 percent to joint width; self expanding; 1/2 inch wide, unless indicated otherwise
1. Manufacturers:
a. Hohmann & Barnard, Inc. Model #NS.
b. Williams Products Inc. Model Type NN1.

C. Fiberglass Mesh: 1/4 inch square monofilament screen fabricated from high strength non-corrosive polypropylene polymers, width of masonry.

E. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.187 inch steel wire, hot-dip galvanized after fabrication.

2.7 MASONRY CLEANERS

A. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

B. Job-Mixed Detergent Solution: Solution of 1/2 cup dry measure tetrasodium polyphosphate and 1/2 cup dry measure laundry detergent dissolved in 1 gal. of water.

2.8 LINTELS

A. Install lintels over openings.
1. Provide built-in-place masonry lintels. Use specially formed bond beam units with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.

B. Schedule: As indicated on drawings.

C. Install reinforced unit masonry lintels over openings where lintels are not scheduled.
1. Openings to 42 inches: Place two, No. 4 reinforcing bars 1 inch from bottom of unit.
2. Openings from 42 inches to 78 inches: Place two, No. 5 reinforcing bars 1 inch (25 mm) from bottom of unit.
3. Openings over 78 inches: Reinforce openings as detailed on drawings.
4. Do not splice reinforcing bars.
5. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
6. Place and consolidate grout fill without displacing reinforcing.
7. Allow masonry lintels to attain specified strength before removing temporary supports.

D. Maintain minimum 8 inch bearing on each side of opening, unless indicated otherwise.

2.9 MORTAR AND GROUT MIXES

A. Mortar for Unit Masonry: ASTM C 270, using the Proportion Specification.
1. Masonry below grade and in contact with earth: Type S.
2. Exterior, load-bearing masonry: Type S.

3. Interior, load-bearing masonry: Type S.
4. Non load-bearing masonry: Type N.

B. Colored Mortar: ASTM C979, Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

C. Grout: ASTM C 476. Consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

D. Mixing: Use mechanical batch mixer and comply with referenced standards.

2.10 SOURCE QUALITY CONTROL

A. Engage a qualified Independent Testing Agency to perform source quality-control testing indicated below:
1. Payment for these services will be made by Contractor.
2. Retesting of materials failing to meet specified requirements done at Contractor's expense.

B. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.

C. Mortar Tests: Test each type of mortar in accordance with ASTM C 780, testing with same frequency as masonry samples.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.2 INSTALLATION - GENERAL

A. Comply with PCA Recommended Practices for Laying Concrete Block, Brick Institute of America BIA Tech Notes, and NCMA TEK Bulletins.

B. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.

C. Build chases and recesses to accommodate items specified in this section and in other sections of the specifications.

D. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.

E. Sawcut units when required. Maintain uniform joint width. Provide full bed, head and collar joints except at weep holes.

F Expansion Joints to be installed where indicated. Build in compressible joint fillers where required. Sealant and backer rod as specified.

G. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures to match the existing.

H. Bond Pattern: Match drawings.

I. Install lintels and accessories in masonry construction.

J. Coordinate installation of flashings.

K. Comply with applicable codes and regulations for spacing of ties and horizontal reinforcing.

L. Provide expansion and control joints in accordance with BIA and NCMA recommendations.

M. Clean concrete masonry by dry brushing, NCMA TEK No. 28.

N. Infill areas to be toothed in.

3.3 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.4 COURSING

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

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
1. Bond: Running, unless indicated otherwise.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: Concave.

3.5 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed and toothed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar as work progresses.

E. Interlock intersections and external corners.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

H. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

I. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

J. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler and sealant. Provide mineral wool filler with flexible and sprayable firestopping where rated walls indicated or required by code.

3.6 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY

A. Install horizontal joint reinforcement at spacing indicated on drawings.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Reinforce joint corners and intersections with strap anchors 16 inches on center or prefabricated "L" or "T" horizontal joint reinforcement.

3.7 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
   1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
   2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.
   3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.10 GROUTED COMPONENTS

A. Reinforced Bond Beams: As scheduled or with two, No 5 bars minimum.

B. Lap splices 48 bar diameters or a minimum 24 inches.

C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

D. Place and consolidate grout fill without displacing reinforcing.

E. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

3.11 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.
   1. Construct formwork to conform to shape, line, and dimensions shown. Make it sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
   2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements of ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
   1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.12 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control and expansion joints.

B. Form control joint with pre-formed rubber control joints or with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.

C. Size control joint in accordance with Section 07900 for sealant performance.

D. Form expansion joint as detailed.

3.13 BUILT-IN WORK

A. As work progresses, install built-in metal door frames, glazed frames, window frames, and anchor bolts, and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
   1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

D. Grout cores for three courses 24 inches under bearing plates, beams, lintels, and similar items, unless noted otherwise.

E. Do not build into masonry construction organic materials that are subject to deterioration.

3.14 TOLERANCES

A. Maximum Variation from Alignment of Columns and Pilasters: 1/4 inch.

B. Maximum Variation from Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.

G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.15 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.16 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Division 1 - General Requirements for testing.

B. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C 140.

C. Mortar Tests: Test each type of mortar in accordance with ASTM C 780, testing with same frequency as masonry samples.

3.17 CLEANING

A. Remove excess mortar and mortar smears as work progresses.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.18 PROTECTION OF FINISHED WORK

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

END OF UNIT MASONRY ASSEMBLIES

SECTION 06 64 00

PLASTIC (FIBER REINFORCED PLASTIC) PANELING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Fiberglass reinforced plastic (FRP) paneling for wall and ceiling surfaces, including trim accessories.

B. Related Sections: Section(s) related to this section include:

1. Section 07 90 00 – Joint Sealers

1.2 REFERENCES

A. General: Standards listed by reference form a part of this specification section. Standards listed are identified by issuing authority, abbreviation, designation number, title or other designation. Standards subsequently referenced in this Section are referred to by issuing authority abbreviation and standard designation.

B. ASTM International:

1. ASTM D256 – Standard Test Methods For Determining the Izod Pendulum Impact Resistance of Plastics.
2. ASTM D570 – Standard Test Method For Water Absorption of Plastics.
3. ASTM D638 – Standard Test Method For Tensile Properties of Plastics.
4. ASTM D2583 – Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
5. ASTM D5319 – Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
6. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meetings: Conduct preinstallation meeting to clarify Project requirements, substrate conditions, manufacturer’s installation instructions and manufacturer’s warranty requirements.

1.4 SUBMITTALS

A. Product Technical Data: For each type of product required.

B. Shop Drawings: Showing layout, profiles and product components, including anchorage, accessories, finish colors, patterns and textures. Indicate location and dimension of joints and fastener attachment.

C. Samples: Selection and verification samples for finishes, colors and textures. Submit two samples of each type of panel, trim and fastener.

D. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics, criteria and physical requirements.

E. Test and Evaluation Reports: Showing compliance with specified performance characteristics and physical properties.

F. Manufacturer's Instructions: Manufacturer's Installation Guide for FRP #6876.

G. Qualifications Statements: For manufacturer and installer.

H. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For installed products including maintenance methods and precautions against cleaning materials and methods detrimental to finishes and performance.

B. Warranty: Warranty documents required in this section.

1.6 MAINTENANCE MATERIAL

A. Extra Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 01 Closeout Submittals Section.

1. Quantity: Furnish quantity of units equal to 5 percent of amount installed.
2. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra materials.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Provider of advanced installer training.

B. Installer Qualifications:

1. At least five years experience in the installation of fiberglass reinforced plastic panels.
2. Experience on at least five projects of similar size, type and complexity as this Project.
3. Employer of workers for this Project who are competent in techniques required by manufacturer for installation indicated.

C. Mock-Ups: Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner and Architect approval and acceptance of finish color, texture, pattern, trim, fasteners and quality of installation.

2. Maintenance: Maintain mock-up during construction for quality comparison. Remove and legally dispose of mock-up when no longer required.
3. Incorporation: Mock-up may be incorporated into final construction upon Owner approval.

D. Surface-Burning Characteristics: Determined by testing identical products according to ASTM E84 by a testing agency acceptable to authorities having jurisdiction.

1. Flame-Spread Index: 25, Class A
2. Smoke-Developed Index: 450 or less.

1.8 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Package sheets on skids or pallets for shipment to project site.

B. Storage and Handling: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer. Store panels in a dry indoor location at Project site. Remove any foreign matter from face of panel by using a soft bristle brush, avoiding abrasive action.

1.9 PROJECT CONDITIONS

A. Ambient Conditions:

1. Do not begin installation until building is enclosed, permanent heating and cooling equipment is in operation, and residual moisture from plaster, concrete or terrazzo work has dissipated.
2. During installation, and within 48 hours prior to installation, maintain ambient temperature and relative humidity within limits required by type of panel adhesive used and recommendation of panel adhesive manufacturer.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace FRP panels that fail within specified warranty period.

1. Failures shall include, but not be limited to substantial defects in material and workmanship, rotting, rusting, corrosion, development of structural surface cracks, or requiring painting or refinishing.
2. Warranty Period: One year from date of Substantial Completion.

PART 2 PRODUCTS

2.1 FIBERGLASS REINFORCED PLASTIC (FRP) PANELS

A. General: Fiberglass reinforced plastic panels complying with ASTM D5319.

1. Low-Emitting Materials: Comply with testing and product requirements of California Department of Health Services standards for Volatile Organic Emissions.

B. Basis of Design Product: Subject to compliance with requirements provide Crane Composites, Inc.; Innovative Finishes DESIGNS Wall Panel IPSA DESIGNS Class A Fiberglass Reinforced Plastic (FRP) Panels

1. Acceptable Manufacturers: Kal-Lite, Marlite, Nudo

D. Product Options:

1. Color: White
2. Surface Finish: Smooth.
3. Nominal Thickness: 0.075 inch (1.9 mm).

4. Wall Panel Size: as noted on drawings.

E. Performance Criteria (Class A Panels):

1. Flexural Strength: 12,000 psi (124 Mpa), ASTM D790.
2. Tensile Strength: 7,000 psi (48 Mpa), ASTM D638.
3. Barcol Hardness: 35, ASTM D2583.
4. Impact Strength (IZOD): 8 ft-lb/sq in (0.43 J/mm) ASTM D256, showing no visible damage on finish side.
5. Water Absorption: 0.16 percent in 24 hours at 77 deg F (25 deg C), ASTM D570.

2.2 ACCESSORIES

A. Moldings: PVC Pattern-matched to panel.

B. Panel Adhesive: As recommended by panel manufacturer for the required substrates.

1. Adhesive shall have a VOC content of 50 g/L or less.

2.3 SOURCE QUALITY CONTROL

A. Obtain fiberglass reinforced panels, moldings and other accessories from a single manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. General: Comply with manufacturer’s product data, including product technical bulletins, and installation instructions in product catalogs and product packaging.

B. Verify that substrates previously installed under other sections are acceptable for product installation in accordance with FRP manufacturer’s instructions.

1. Examine substrate surfaces to determine that corners are plumb and straight, that surfaces are smooth, sound and uniform, that nails or screw fasteners are countersunk, and that joints and cracks are filled flush and smooth with adjoining surfaces.
2. Do not begin panel installation until substrate surfaces are in satisfactory condition.

3.2 PREPARATION

A. Clean substrates to remove substances that could impair bond of adhesive, including oil, grease, dirt, dust or other contamination.

B. Condition panels by unpacking and placing in installation space no less than 24 hours before installation.

C. Lay out paneling before beginning installation. Locate panel joints to provide equal panel widths at ends of walls and so that trimmed panels at corners are not less than 12 inches (300 mm) wide.

3.3 INSTALLATION

A. General: Comply with panel manufacturer's Installation.

B. Cut and drill panels, finished face down, with carbide tipped saw blades or drill bits, or cut with snips.

C. Install panels with manufacturer's recommended gap for panel field and corner joints.

1. Pre-drill fastener holes in panels, 1/8 inch (3.2 mm) greater in diameter than fastener.
2. Install panels in a full spread of adhesive. For trowel type and application of adhesive, follow adhesive manufacturer's recommendations.

D. Install trim accessories with adhesive and nails or staples. Do not fasten through panels.

E. Sealant:

1. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.
2. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths.

3.4 FIELD QUALITY CONTROL

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A. Manufacturer's Field Services: If requested by Owner, provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.5 CLEANING

A. Remove temporary coverings and protection of adjacent work areas.

B. Repair or replace any installed products that have been damaged.

C. Clean installed panels in accordance with manufacturer's instructions prior to Owner's acceptance.

D. Remove and lawfully dispose of construction debris from project site.

3.6 PROTECTION

A. Protect installed product and finish surfaces from damage during construction.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Stainless steel metal flashings, counterflashings and fabricated sheet metal items.

B. Stainless steel prefabricated pipe, angle, conduit, tube, beam flashing and scuppers.

C. Stainless steel reglets and accessories.

D. Pipe mounting pedestal.

1.02 RELATED SECTIONS

A. Section 07 90 00 - Joint Sealers

1.03 REFERENCES

A. ASTM B 32 - Standard Specification for Solder Metal; 2000.

B. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2000.

C. ASTM B 209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2000.

D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austeric Stainless Steel Sheet, Strap, Plate and Flat Bar, 2000.

E. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2000.

F. SMACNA (ASMM) - Architectural Sheet Metal Manual; Sheet Metal and Air Conditioning Contractors' National Association; 1993, Fifth Edition.

1.04 SUBMITTALS

A. See Division 1, General Requirements for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, prefinished and prefabricated gutters and downspouts and installation details.

C. Samples: Submit two samples 6x6 inch (152 x 152 mm) in size illustrating metal finish color.

D. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA Architectural Sheet Metal Manual requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

1.06 PRE-INSTALLATION CONFERENCE

A. Convene one week before starting work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials which may cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Stainless Steel: ASTM A666 Type 304, soft temper, 0.015 inch (0.4mm) thick, smooth No. 4 finish.

B. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability of alloy and temper designated below:
   1. Anodized Aluminum Sheet: ASTM B 209 (ASTM B 209M), 3003-H14, with a minimum thickness of 0.050 inch (1.2 mm).
   2. Extruded Aluminum: ASTM B 221 (ASTM B 221M), alloy 6063-T52, with a minimum thickness of 0.080 inch (2.0 mm) for primary legs of extrusions that are anodized, unless otherwise indicated.

2.02 ACCESSORIES

A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers.

B. Primer: Zinc chromate type.

C. Protective Backing Paint: Zinc chromate alkyd.

D. Sealant: Type specified in Section 07900.

E. Plastic Cement: ASTM D 4586, Type I.

F. Reglets: Surface mounted type, stainless steel; face and ends covered with plastic tape.

G. Conduit, angle, pipe, tube and Flashing: Prefabricated 26 ga., type 304, 2B stainless steel meeting ASTM A-240; flashing by S.B.C Industries, No. Miami, Fla.(1-800-228-2580).
   1. Provide "D" Series Split units for penetrations already connected and "S" Series to slip over top of unconnected penetrations.
   2. Provide accessories as recommended by manufacture including close cell foam tape and single part urethane sealant.

H. Solder: ASTM B 32; Sn50 (50/50) type.

2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Fabricate cleats of same material as sheet, minimum 0.125 inches (6 mm) wide, interlocking with sheet.

C. Form pieces in longest possible lengths.

D. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.

E. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

F. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.

G. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing membrane. Return and brake edges.

2.04 PREMANUFACTURED AND PREFINISHED COPINGS

A. Coping: Provide copings fabricated anodized aluminum sheet minimum 0.034 inch (0.7 mm) thick, in shapes and sizes indicated, with shop fabricated and welded corners and FM 90 approved. Include anchor plates formed from at least 0.028-inch (0.7 mm) thick, galvanized steel sheets; cleats or other attachment devices; concealed splice plates. and trim and other accessories required for complete installation with no exposed fasteners.

B. Aluminum Finishes
   1. General Comply with Aluminum Association’s (AA) “Designation System for Aluminum Finishes” for finish designations and application recommendations.
   2. Class I, Color Anodic Finish: AA-C22A42/A44 (Chemical Finish: etched, medium matte: Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 606.1 or AAMA 608.1.
      Color: As approved by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

3.03 INSTALLATION

A. Install premanufactured items complying with manufacturer's recommendations. Coordinate with installation of substrates to receive work. Perform work properly that combined elements are waterproof and weather tight.

B. Insert flashings into reglets to form tight fit. Secure in place with lead wedges. Pack remaining spaces with lead wool. Seal flashings into reglets with sealant.

C. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.

D. Apply plastic cement compound between metal flashings and felt flashings.

E. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

F. Seal metal joints watertight.

G. Solder metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

H. Install prefabricated pipe, conduit, angle, and tube flashing, as recommended by manufacturer, with no less than 9 inches (228 mm) high and of proper diameter to provide 1/8 inch (3mm) - 1/4 inch (6mm) maximum clearance from flashed item. Counterflash 5 inches (127 mm) high with diameter 1/2 inch (9mm) larger than flashed item. Seal cover and slope outward and downward at 30 degrees from horizontal plane with inside diameter equal to item flashed. Shop solder all seams.

3.04 FIELD QUALITY CONTROL

A. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Hollow metal doors.

B. Hollow metal pressed frames.

1.2 RELATED SECTIONS

A. Section 09 21 16 – Gypsum Board Assemblies

B. Section 08 71 00 - Door Hardware

1.3 REFERENCES

A. American National Standards Institute (ANSI):
1. ANSI A250.8 - Recommended Specification for Standard Steel Doors and Frames

B. American Society for Testing and Materials (ASTM):
1. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM D 1621 - Standard Test Method for Compressive Properties Of Rigid Cellular Plastics.
3. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
4. ASTM E 152 - Methods of Fire Tests of Door Assemblies.

C. National Fire Protection Association (NFPA).

D. National Association of Architectural Metal Manufacturers (NAAMM):
1. HMMA-860 - Guide Specifications for Hollow Metal Doors and Frames.

E. Steel Door Institute (SDI):
1. SDI-100 - Recommended Specifications for Standard Steel Doors and Frames
2. SDI-111 - Recommended Selection and Usage Guide for Standard Steel Doors, Frames and Accessories.
3. SDI-113 - Standard Practice for Determining the Steady State Thermal Transmittance of Steel Door and Frame Assemblies.
4. SDI-250.4 – Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings.

F. ADA Standards for Accessible Design

G. ANSI A 117.1 – Accessible and Usable Buildings and Facilities

H. MI Building Code (MBC) 2015.

1.4 SUBMITTALS

F. Product Data: Submit catalog cuts or other data indicating details of construction, gauges of metals, dimensions, hardware preparation, core, label compliance, profiles and specifications for shop priming.

G. Shop Drawings: Submit shop drawings showing fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.

H. Provide schedule of doors and frames using same reference numbers for details and openings as those indicated on drawings.

I. Indicate coordination of glazing frames and stops with glass and glazing requirements.

J. Templates: Secure templates from finish hardware supplier for specified hardware and mounting locations.

K. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall have five years experience manufacturing and fabricating products of similar type and scope as those specified in this section.

B. Installer Qualifications: Installer shall have five years experience manufacturing and fabricating products of similar type and scope as those specified in this section.

C. Provide doors and frames meeting the requirements of ANSI A250.8 (ANSI/SDI-100).

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Provide packaging such as cardboard corner guards or other means to protect surfaces of hollow metal doors. Provide temporary spreader bars fastened to the bottom of each welded frame.

B. Inspection: Inspect doors and frames upon delivery. Minor damage may be repaired provided finish items are equal to new work and acceptable to the Architect; otherwise remove and replace damaged items as directed.

C. Storage: Store doors and frames on platforms under cover. Store doors and frames in dry storage spaces with adequate ventilation, free from dust, and which permits easy access for inspection and handing. Avoid using non-vented plastic or canvas shelters that create a humidity chamber. To promote air circulation, provide a 1/4 inch (6 mm) space between doors. Mark or tag each door and frame with the appropriate opening identification symbol.

1.6 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer:
1. Door Components Inc.
2. Ceco Door Products.
3. Curries.
4. Pioneer Industries.
5. Steelcraft.

2.2 DOOR CONSTRUCTION

A. General: Fabricate doors in accordance with ANSI A250.8 (SDI-100) or HMMA-860 (NAAMM).

B. Internal Construction: Fabricate doors with any of the internal construction methods specified herein and in accordance with ANSI A250.8 (SDI-100) except as specified below.
1. Fire Rated Doors: Fabricate to the requirements of ÅSTM E 152 for the hourly ratings indicated. Fabricate labeled fire resistive doors at stairwells with mineral fiberboard composite core that will provide the specified maximum transmitted temperature end point.

C. Glazing: Provide glazed openings with steel glazing stops. Stops shall be non-removable on exterior or corridor side of door. All glazing in doors shall be safety glazing.

D. Clearances: Provide doors and frames with clearances in accordance with SDI-100.

2.3 FINISH

A. Factory Primer: After fabrication, clean and spray coat all exposed surfaces of doors and frames with a rust inhibitive prime paint, of even consistency to provide a uniformly finished surface ready to receive finish paint.

B. Finish field painting is specified in Section 09 91 00.

2.4 DOORS

A. Honeycomb Core Doors (Interior):
1. Description: Economical, impact resistant, for interior or exterior usage with 1 inch (25 mm) hexcells for maximum strength, rigidity and flatness.
2. Honeycomb Cells: 1 inch (25 mm) honeycomb cells permanently bonded to both face sheets. Impact resistance - 45 PSI crushing strength of honeycomb.
3. Compliance: SDI-100.
4. Fire Rating: As noted in door schedule.
5. R Factor: 2.4.
6. U Factor: 0.41.
7. Material: 20-gauge A60 galvanealed steel, standard duty.
8. Material Compliance: ÅSTM A 653.
9. Top and Bottom Channels: 18-gauge top and bottom inverted channels spot welded to face sheets.
10. Construction: Standard, continuously welded vertical edges (seamless).
11. Hardware Reinforcement:
    a. Closers: 14 gauge.
    b. Locks: 12 gauge.
    c. Hinges: 7 gauge, 3/16 inch.
12. Finish: Rust inhibitive prime coat ANSI/SDI 250.10.

13. Door Thickness: Standard, 1-3/4 inches (44.5 mm).
14. Interior Door Undercut: Standard ¾ inch maximum from finished floor.
15. Integral Louver/Lite Configuration: As per drawings and door schedule.
16. Fire Rating: As per drawings and door schedule.

B. Doors, Polystyrene Core (Exterior):

1. Description: Polystyrene core permanently bonded to face sheets, for interior or exterior usage.
2. Compliance: SDI-100.
3. Core Density: 1 lb.
4. Compressive Strength: 33-38 PSI, ASTM D 1621.
5. R Factor: 7.07.
6. U Factor: 0.14.
7. Material: 18-gauge A60 galvanealed steel.
8. Material Compliance: ASTM A 653.
9. Construction: Continuously welded vertical edges (seamless).
10. Hardware Reinforcement:
    a. Closers: 12 gauge.
    b. Locks: 10 gauge.
    c. Hinges: 7 gauge, 3/16 inch.
11. Finish: Rust inhibitive prime coat ANSI/SDI 250.10.
12. Door Thickness: 2 inches.
13. Interior Door Undercut: Standard ¾ inch maximum from finished floor.
14. Integral Louver/Lite Configuration: As per drawings and door schedule.

2.5 FRAMES

A. Fabricate frames in accordance with SDI-100 except as modified herein. Provide metal frames for doors, transoms, sidelites, borrowed lites and other openings, of types and styles indicated and scheduled. Conceal fastenings, unless otherwise indicated.

1. Frames to have mitered corners, continuously welded, with welds ground smooth. Provide stops a minimum of 5/8 inch (16 mm) deep.

B. Door Frames:

1. Frame Profiles: As per drawings and door schedule.
2. Frame Elevations: As per drawings and door schedule.
3. Frame Type: Standard.
4. Frame Type: 12 gauge.
5. Frame Type: Welded Frames.

C. Anchors: Provide floor anchor and wall anchors welded into each jamb member; 16 gauge minimum. Loose anchors are not acceptable.

1. Compliance: Wall anchors shall comply with SDI 111, of the type indicated for the specific wall conditions. Head anchors welded into head member as recommended by frame manufacturer. Anchors.
2. Anchoring System: A1 Standard strap anchor.

D. Mullions and Transom Bars: Provide closed or tubular mullions and transom bars where indicated. Fasten mullions and transom bars at crossings and to jambs by butt welding. Reinforce joints between frame members with concealed clip angles or sleeves of same metal and thickness as frame.

PART 3 EXECUTION

3.1 EXAMINATION

A. Inspect conditions of substrate and other conditions which may affect installation of signage.

B. Do not begin installation until substrates are within manufacturer's specified tolerances and have been prepared in accordance with manufacturer's instructions.

C. If substrate preparation is the responsibility of another installer, do not proceed with installation. Notify Architect of unsatisfactory preparation immediately.

D. Commencement of work is deemed as acceptance of installation conditions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Set frames accurately in position and plumb, align and brace them securely until permanent anchors are set. Anchor the bottom of frames securely to floors with expansion bolts or with powder-driven fasteners.

C. Build in or secure wall anchors to adjoining construction as indicated or required by adjoining construction. Where frames require ceiling struts or other structural overhead bracing, anchor such struts securely above, as required. Fill frames solid with Portland cement grout where indicated or required by fire rating of opening. Remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

D. Install fire rated doors and frames, including hardware and operational characteristics, in accordance with the requirements of the listing agency, NFPA-80, and manufacturers recommendations.

E. Doors and finish hardware shall operate smoothly, quietly, and free from bind.

3.3 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 08 33 00

INSULATED ROLLING STEEL DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Rolling Steel Doors.

1.2 RELATED SECTIONS

A. Section 05500 - Metal Fabrications: Support framing and framed opening.
B. Section 06200 - Finish Carpentry: Wood jamb and head trim.
C. Section 08710 - Door Hardware: Product Requirements for cylinder core and keys.
D. Section 09900 - Painting: Field applied finish.

1.3 REFERENCES

A. ANSI/DASMA 108 - American National Standards Institute Standard Method For Testing Sectional Garage Doors And Rolling Doors: Determination Of Structural Performance Under Uniform Static Air Pressure Difference.
B. ANSI/DASMA 203 - American National Standards Institute Specifications for non-rated fire rolling doors published by Door & Access Systems Manufacturers Association International.
C. ASTM A 123 - Zinc hot-dipped galvanized] coatings on iron and steel products.
D. ASTM A 229 - Steel wire, oil-tempered for mechanical springs.
E. ASTM A 653 - Steel sheet, zinc-coated galvanized by the hot-dipped process, commercial quality.
F. ASTM E 330 - Structural performance of exterior windows, curtain walls, and doors by uniform static air pressure difference.
G. ASTM E 413 - Classification for Rating Sound Insulation

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Include detailed plans, elevations, details of framing members, anchoring methods, required clearances, hardware, and accessories. Include relationship with adjacent construction.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) long, representing actual product, color, and patterns.

F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

G. Closeout Submittals: Provide manufacturer’s maintenance instructions that include recommendations for periodic checking, adjustment and lubrication of components.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience in the fabrication and installation of security closures.

B. Installer Qualifications: Installer Qualifications: Company specializing in performing Work of this section with minimum three years and an authorized installer.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.

1.6 DELIVERY, STORAGE AND HANDLING

A. Store products in manufacturer's unopened packaging with seals and labels intact until ready for installation.

B. Store materials off the ground in a dry, warm, ventilated weathertight location.

1.7 SEQUENCING

A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.

B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 WARRANTY

A. Provide rolling steel springless high cycle doors with limited 3 Year, 500,000 cycle Warranty on all door systems materials and workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Asta Door Corporation, Model 624

B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 INSULATED ROLLING SERVICE DOORS

A. Asta Door Corporation. Model 424
   1. Refer to drawings for dimensions.
   2. Curtain: composed of interlocking roll-formed slats.
      a. Slat Profiles/Material:
         1) 24 gauge (front) galvanized steel cold roll formed into continuous lengths.
         2) 24 gauge (back) galvanized steel cold roll formed into continuous lengths.
      b. Vision Slats, in one slat at approx. 5ft. aff.
      c. Finish:
         1) Galvanized steel A653:
            (a) Baked Epoxy Primer
            (b) Baked Polyester Topcoat, color selection from maufacturer’s standards.
   3. Bottom Bar: Consists of two equal angles, 12 ga. minimum thickness, to stiffen curtain with vinyl astragal. Angle shall be:
      a. Steel factory painted black.
   4. Guides: Three-piece structural angle guide assembly forming a slot to retain curtains in guides.
      a. Angles min thickness 3/16”
      b. Fabricated of:
         1) Steel factory painted black.
         2) Steel with powder coat, to match curtain.
      c. Provide with high usage guide wear strips.
      d. Provide with integral windlock bars when size or wind loading requires.
      e. Removable bottom bar stops.
      f. Weather Seal: non-coil side to be vinyl weather seal.

5. Brackets: Design to provide support for springless counterbalance pipe at each end. Fabricate of steel plates, with permanently sealed ball bearings. Brackets shall be black painted steel. Thickness shall be:
    a. 1/4 inch minimum.
6. Barrel Assembly:
    a. Barrel: Steel Pipe of diameter and wall thickness to restrict maximum deflection to 0.03” per foot of door width.
    b. Springs: Oil tempered, grease packed helical torsion type design to cycle 25,000 times. Springs are to be mounted on a cold rolled steel inner shaft.
    c. End Bearing: Self lubricating ball bearings or oil impregnated bronze bushings.
7. Hood: Hood to enclose curtain coil and counterbalance mechanism. Hood fabricated of sheet metal, flanged at top for attachment to header and flanged at bottom to provide longitudinal stiffness.
    a. Fabricate of:
        1) Minimum 24-gauge galvanized steel.
    b. Hood Finish:
        1) Galvanized steel:
            (a) Baked epoxy primer.
            (a) Baked polyester top coat
        2) 8” PVC baffle to be riveted to inside of hood
    c. Reinforcing: to be 1/4” thick steel brackets for doors over 16’ wide.
8. Operation:
    a. Drive: roller chains and sprockets
    b. Hand Chain: galvanized machine link. Pull not to exceed 35 lbs.
    c. Hand Chain Lock: Lockable bracket, mounted to guide angle, suitable for padlocking.
9. Windload Design:
    a. Design and size components to withstand loads caused by pressure and suction of wind acting normal to plane of wall as calculated in accordance with MBC 2015 and based on wind speeds of 115mph, reference Structural Drawings.
10. Mounting:
    a. Steel jambs.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

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

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install door complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports in accordance with final shop drawings, manufacturers instructions, and as specified herein.

C. Fit, align and adjust rolling door assemblies level and plumb for smooth operation.

D. Upon completion of final installation, lubricate, test and adjust doors to operate easily, free from warp, twist or distortion and fitting for entire perimeter.

3.4 ADJUSTING

A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.

B. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.5 CLEANING

A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.

B. Remove labels and visible markings.

C. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 08 34 00

DRAFT CURTAINS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire protective vertical fixed fabric smoke draft curtains, one hour rating.

1.2 REFERENCES

A. American National standards Institute (ANSI):
   1. ANSI/ASTM E119 - Standard Tests Methods for Fire Tests of Building Construction and Materials.

B. International Building Code (IBC):
   1. IBC 715.4 C - Fire Door and Shutter Assemblies.

C. ICC Evaluation Services
   1. ICC-ES AC77 - Acceptance Criteria for Smoke-Containment Systems Used with Fire-Resistive Doors and Frames.

D. ASTM International (ASTM):
   1. ASTM A240/240M - Standard Specification for Heat Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.
   2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials. Calculated smoke developed (CSD) of 2, a smoke developed index (SDI) of 0, and a calculated flame spread (CFS) of 0.
   3. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C.

E. National Fire Protection Association (NFPA):
   1. NFPA 3 - Recommended Practice for Commissioning of Fire Protection and Life Safety Systems.
   2. NFPA 70 - National Electrical Code.
   3. NFPA 72 - National Fire Alarm Code.
   4. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
   5. NFPA 92B - Standard for Smoke Management Systems in Malls, Atria, and Large Spaces.
   6. NFPA 101 - Life Safety Code.
   7. NFPA 105 - Recommended Practice for the Installation of Smoke-Control Door Assemblies.
   8. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

F. Underwriters Laboratory (UL):

1. UL 10B - Standard for Fire Tests of Door Assemblies.
2. UL 10C - Standards for Positive Pressure Fire Door Assemblies.
3. UL 10D - Standard for Fire Tests of Fire Protective Curtain Assemblies.
4. UL 263 - Fire Tests of Building Construction and Material.
5. UL 555 - Standard for Fire Dampers.
6. UL 864 - Standard for Control Units and Accessories for Fire Alarm Systems.
7. UL 1784 - Standard for Safety of Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Manufacturer's printed fabrication and installation details and instructions, showing required preparation and installation procedures.
      a. Operating clearances.
      b. Requirements for supporting smoke curtains, track, and equipment.
      c. Locations of equipment components, switches, motors and controls.
      d. Differentiation between manufacturer-installed and field-installed wiring.
   2. Installation methods.
   3. Cleaning operation and maintenance instructions.
   4. Manufacturer's warranty.
   5. Documentation of recycled content.

B. Verification Samples: For each type of fabric from dye lot to be used for the Work, with specified treatments applied, showing complete pattern and texture repeat, if any. Mark top and face of fabric.
   1. Sample Size: Not less than 36 inches (900 mm) square.

C. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.

1.4 QUALITY ASSURANCE

A. Manufacturer shall maintain a quality control program for follow up service in accordance with ICC-ES Acceptance Criteria 77.

B. Installer Qualifications: Minimum 5 years installing similar assemblies.
   1. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
   2. Installers work has resulted in applications with a record of successful in-service performance.
   3. Certified to ISO 9001 1994 for the design, manufacture, installation and commissioning of Automatic Fire Protective Smoke Barriers and Partitions.

C. Pre-installation Meeting: Conduct pre-installation meeting on-site two weeks prior to commencement of installation.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards.

B. Deliver and store assembly materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact. Protect from damage.

1.6 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard warranty document executed by authorized company official.
   1. Warranty one year on motors, motor control circuits (MCC) and group control panels (GCP) from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: U.S. Smoke and Fire, Akon Curtains, and Door Systems Inc.

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 – Substitution Request Procedures.

2.2 FIRE PROTECTIVE VERTICAL FIXED FABRIC SMOKE DRAFT CURTAINS, ONE HOUR RATING

A. Basis of Design: SD60 Fixed Fabric Draft Smoke Curtains, as manufactured by U.S. Smoke and Fire, one hour fire rating.
   1. Fire protective smoke curtain system composed of tightly woven glass-fiber fabric fixed to the ceiling structure providing smoke draft control in large open spaces.
   2. Standards Compliance:
      a. ANSI/ASTM E119.
      b. ASTM E84.
      c. ASTM E136.
      d. California Department of Forestry and Fire Protection and Office of the State Fire Marshal: Listed.
      e. NFPA 105.
      f. NFPA 701.
      g. UL 10B.
      h. UL 10C.
      i. UL 10D.
   3. Performance Requirements:
      a. One hour fire and smoke rating, (UL 10D/ANSI/ASTM E119) time temperature curves.
      b. Fabric Area Density: Greater than or equal to 0.00077 lbs per sq in (540 grams per sq m) for temperature less than or equal to 1832 degrees F (1000 degrees C) for a period of 1 hr.
      c. Fabric Tensile Strength: Panama weave fabric, greater than or equal to 0.00059 lbs per sq in (415 grams per sq m) glass cloth.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

A. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.
   1. Examine areas and conditions for compliance with requirements; inserts, clips, supporting members, blocking, supports, installation tolerances, clearances, and other conditions affecting the Work.
   2. Verify rough and clear openings and the dimensions of other construction by field measurements before installation and indicate measurements on shop drawings.
   3. Verify capacity of each track and rigging component to support loads.

B. Do not proceed with installation until substrates have been properly prepared and deviations from manufacturer's recommended tolerances are corrected. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Commencement of installation constitutes acceptance of conditions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's written instructions and recommendations as applicable to specified application.

B. Install products in strict accordance with manufacturer's instructions, and approved submittals.

3.3 FIELD QUALITY CONTROL

A. Fire Alarm Testing: Smoke curtain is to deploy upon a signal from fire alarm in an emergency.

B. Deployment Verification: Conducted in the presence of the authority having jurisdiction per NFPA guidelines.

C. Training: Engage a factory-authorized service representative to train Owner's Personnel to rig, adjust, operate, and maintain automatic smoke curtains.

D. Annual Adjustment, Maintenance and Preventative Maintenance Service: Engage a U.S. Care factory authorized service representative to test, adjust and maintain system once per annum required per NFPA 3 and NFPA 80. Any system that does not undergo the required preventative maintenance over a twelve month period shall void the testing laboratory label on the assembly. No contractor nor end user shall attempt any service of the system. Such action shall void the testing laboratory label on the assembly. All maintenance must be done by a U.S. Care factory certified technician.

END OF SECTION

SECTION 08 41 00

ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Provide storefront doors, hardware and components for a complete assembly.

B. Related Sections include the following:
1. Section 07 90 00 - Joint Sealers
2. Section 08 71 00 – Door Hardware
3. Section 08 80 00 - Glazing

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

C. Warranty: Submit manufacturer's standard warranty. Include labor and materials to repair or replace defective materials.
1. Warranty Period: 2 years.

D. Operation and Maintenance Data: Submit manufacturer's operation and maintenance data, including operating instructions, list of spare parts and maintenance schedule.

E. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

1.3 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Hardware shall comply with ABAAS requirements for handle and pull force.

C. Comply with ICC ANSI 117.1 2017.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance Requirements:

1. Comply with requirements of NAFS.

2. ASTM E1996 Large Missile Test.
3. Based on Michigan Building Code; 2015 Edition
    a. Climate zone design loads. Refer to Structural drawings for loads.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aluminum Storefront:
1. Aluminum Members: ASTM B 209, ASTM B 221, ASTM B 429.
2. Steel Reinforcement: ASTM A 36, ASTM A 1008, and ASTM A 1011.
3. Door Style:
    a. Full Glass Lite: Medium stile and rail doors.
    b. Half Glass Lite: Medium stile and rail doors.
4. Storefront Style: Aluminum header and base, butt glazed vertical joints.
5. Glazing Color: Clear glass.
6. Closers: Surface
7. Interior Aluminum Finish: Bronze anodized.

B. Manufacturers:
1. Interior System Basis of Design: Kawneer 450 (4 ½" deep)
2. Acceptable Manufacturers: Subject to compliance with the requirements
    a. Oldcastle
    b. U.S. Aluminum
    c. Vistawall Architectural Products
    d. Kawneer
    e. Gensteel
    f. Masonite
    g. Therma-Tru

2.2 Thermal Requirements

A. Framing systems shall accommodate expansion and contraction movement due to surface temperature differentials of 180F without causing buckling, stress on glass, failure of joint seals, excessive stress on structural elements, reduction of performance, or other detrimental effects.
B. Ensure doors function normally within limits of specified temperature range.

2.3 Performance Requirements:

A. Doors- Exterior
1. Based on Michigan Building Code; 2015 Edition, design loads.

B. Framing
1. Based on Michigan Building Code; 2015 Edition, design loads.
2. Deflection: Maximum calculated deflection of any framing member in direction normal to plane of wall when subjected to specified design pressures for spans up to and including 13'-6" (4.11m) shall be limited to [L/175] of its clear span and for spans greater than 13'-6" (4.11m) deflection shall be limited to [L/240] of its clear span + 1/4"

(6.35mm), except that maximum deflection of members supporting plaster surfaces shall not exceed 1/360 of its span.

PART 3 EXECUTION

3.1 INSTALLATION

A. Take field measurements before fabrication where possible; do not delay job progress.

B. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

C. Anchor securely in place; install plumb, level and in true alignment. Isolate dissimilar materials to prevent corrosion.

D. Coordinate with glass and glazing work; install hardware and adjust for smooth, proper operation.

E. Clean and protect completed system; repair damage.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 GENERAL

1.1 SUMMARY

A. Provide door hardware.

B. Related Sections include the following:

1. Section 08 11 13 - Hollow Metal Doors and Frames

2. Section 08 41 00 – Entrances and Storefronts

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

C. Submit for approval hardware schedule proposed for use based on Owner's requirements.

D. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

1.3 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Hardware for Fire-Rated Openings: NFPA 80, and local requirements.

C. Materials and Application: ANSI A156 series standards.

PART 2 PRODUCTS

2.1 MATERIALS

A. Door Hardware:

1. Manufacturers: Accurate Metal Weather Strip Co., Inc.; Acorn Mfg. Co.; DORMA Architectural Hardware; LCN Closers, Div. of Ingersoll Rand; Norton Door Controls, (An ASSA ABLOY Group company); PDQ Mfg.; Tempo Hardware, Inc.; PDQ Mfg.; Schlage Lock Co., Div. of Ingersoll Rand; Von Duprin, Div. of Ingersoll Rand; Yale Locks and Hardware; Zero International, Inc..

2. Quality Level: Heavy duty commercial.
3. Locksets and Latchsets: Mortise type.
4. Lock Cylinders: Interchangeable.
5. Keying: Owner's requirements.
6. Hinges and Butts: Full-mortise type at interior, with nonremovable pins at exterior doors.
7. Closers, Door Control, and Exit Devices: Barrier-free.
8. Pivots: Offset or center-hung type.
9. Push/Pull Units: Through-bolted type.
10. Hardware Finishes: Satin stainless finish on exposed surfaces.
11. Auxiliary Materials:
    a. Door Trim Units: Kickplates, edge trim, viewers and related trim.
    b. Stops and overhead door holders.
    c. Weatherstripping and thresholds.
    d. Knox box for fire emergency keys.
12.

PART 3 EXECUTION

3.1 INSTALLATION

A. Follow guidelines of DHI 'Recommended Locations for Builder's Hardware and hardware manufacturers' instructions.

B. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

C. Adjust operation, clean and protect.

3.2 SCHEDULE

A. Hardware:
    1. All hardware to be mid grade in quality
    2. All hardware to be 26-D finish (brushed)
    3. Cores to be construction cores final keying will be by owner
    4. Basic function per opening is addressed on door schedule

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Provide glass and glazing as shown on the drawings.

B. Related Sections include the following:

1.Section 08 11 13- Hollow Metal Door and Door Frames

2.Section 08 41 00 - Entrances and Storefronts

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Safety glazing certification reports. Glass of type required for this project must be a certified safety glazing product listed with the Safety Glazing Certification Council by firm.

C. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

D. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

E. Warranty: Submit manufacturer's standard warranty. Include labor and materials to repair or replace defective materials.
1. Tempered and Insulated Glass: Manufacturer's 10-year warranty.

F. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

1.3 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, for wired glass, ANSI Z97.1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council.

C. Insulating Glass Certification Program: If specified as and detailed as such, provide insulating glass units permanently marked either on spacers or at least one component lite of units with appropriate certification label of inspection and testing agency indicated: Insulating Glass Certification Council (IGCC)

D. Glazing Publications:
1. GANA Publications: GANA's Guide to Architectural Glass.
2. GANA Publications: GANA's Laminated Glazing Reference Manual.

F. Glass standards:

1. ASTM specification C1048 for heat treated flat glass.
2. ASTM specification C1036 for flat glass.
3. ASTM specification C1172 for laminated flat glass.
4. ASTM specification E1300 for determining the minimum thickness and type of glass required to resist a specific load.
5. ASTM specification E2190 for insulating glass unit performance and evaluation.

G. Single-Source Responsibility:
1. Manufacturers: Provide each type of glass and primary sealant/gasket from a single manufacturer with not less than five years successful experience in the production of materials similar to those required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Glass and Glazing:
1. All new glass and glazing shall meet the 2015 Michigan Building Code.
2. Manufacturers: Guardian Glass, PPG Industries, or Viracon
3. Auxiliary Materials: as required by the storefront manufacturer to provide a complete storefront assembly.
   a. Compression gaskets.
   b. Elastomeric glazing sealants.
   c. Preformed glazing tapes.
   d. Glazing gaskets.
   e. Setting blocks, spacers, and compressible filler rods.
4. Privacy film: applied to conference rooms and offices
   a. 50% opacity, white
   b. Floor to 30" aff

2.2 GLASS SCHEDULE

A. Glass and Glazing:
1. Clear, Insulated, Laminated Glazing
   a. Location: Exterior doors, curtainwall and windows
   b. Glazing:
      i. Solarban 70 (2nd surface) + Clear
      ii. Total Thickness: 1"
      iii. U value 0.28
      iv. SGHC: 0.27
      v. Manufacturer: Vitro Architectural Glass- Solarban 70, or approved equal

2. Clear Tempered Glazing:
   a. Location: Interior doors, sidelights and transomsSolarban

i. Lite: 6 mm clear tempered glass
ii. Manufacturer: Guardian Glass or approved equal.

3. Clear Glazing:
   a. Location: Interior windows
      i. Lite: 6 mm clear glass
      ii. Manufacturer: Guardian Glass or approved equal.

PART 3 - EXECUTION

3.1 GLAZING

A. General: Comply with written instructions of manufacturers of glass, sealant, gasket, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

1. Glazing channel dimensions, as indicated on drawings, shall provide necessary bite on glass, minimum edge and face clearance, and adequate sealant thicknesses, with reasonable tolerances.

2. Protect glass edges from damage during handling and installation. Remove damaged glass from project site and legally dispose of off project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance.

B. Follow industry best practices, published guidelines of the Glass Association of North America, and applicable manufacturer’s recommendations for proper tape, gasket, sealant, and lock-strip glazing.

3.2 INSTALLATION

A. Inspect framing and report unsatisfactory conditions in writing.

B. Comply with GANA "Glazing Manual" and manufacturer’s instructions and recommendations. Use manufacturer's recommended spacers, blocks, primers, sealers, gaskets and accessories.

C. Install glass with uniformity of pattern, draw, bow and roller marks.

D. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove non-permanent labels, and clean surface.

E. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come in contact with glass, remove them immediately as recommended by the glass manufacturer.

F. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

G. Wash glass on both exposed surfaces in each area of project not more than four days

before date scheduled for inspections that establish date of substantial completion. Wash glass as recommended by glass manufacturer.

END OF SECTION

SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

A. Provide gypsum board assemblies.

1.2 RELATED SECTIONS

A. Section 07 20 00 - Insulation
B. Section 07 90 00 - Joint Sealers: Perimeter sealant and backup materials.
C. Section 09 22 16 – Non-structural Metal Framing: non-structural metal framing for gypsum board assemblies.
D. Section 09 91 00 – Paints

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

1.4 QUALITY ASSURANCE

A. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Tolerances: Not more than 1/16-inch difference in true plane at joints between adjacent boards before finishing. After finishing, joints shall be not be visible. Not more than 1/8 inch in 10 feet deviation from true plane, plumb, level and proper relation to adjacent surfaces in finished work.

C. Performance: Comply with governing codes and regulations. Meet the requirements of the 2015 Michigan Building Code.

PART 2 PRODUCTS

2.1 MATERIALS

A. Gypsum Board: Regular, moisture-resistant and fire-rated types as required.
   1. Manufacturers:
      a. CertainTeed Gypsum, Inc.
      b. Lafarge North America Inc.
      c. Temple-Inland Forest Products Corp.
      d. Gypsum Products.
      e. USG Corporation
   2. Application: Interior walls, partitions, and ceilings with tape and joint compound finish.

3. Application: Insulation in gypsum board assemblies.
4. Material Standard: ASTM C1396.
5. Type: Board for tape and joint compound finish.
   a. Type: Regular, moisture-resistant and fire-rated types as required.
   b. Typical Thickness: 5/8 inch.
6. Joint Treatment: ASTM C474 and ASTM C840, 3-coat system, paper or fiberglass tape.
7. Auxiliary Materials:
   a. Cornerbead, edge trim and control joints.
   b. Drywall Control Joint, Surface mounted control joint with removable tape for use in wall or ceiling applications.
      1) Dimensions: 2-1/4 inch (57 mm) wide, with groove 1/4 inch wide and 1/2 inch deep.
   c. Casing bead, termination or edge dividers at dissimilar materials.
   d. Gypsum board screws, ASTM C 1002.
   e. Mineral fiber sound attenuation blankets.

PART 3 EXECUTION

3.1 INSTALLATION

A. Steel Framing: Install steel framing in compliance with ASTM C 754. Install with tolerances necessary to produce substrate for gypsum board assemblies with tolerances specified. Include wall reinforcing for casework, wall cabinets, wall mounted shelving, drying racks and water purifier.

B. Tape and Joint Compound: Install gypsum board for tape and 3-coat joint compound finish in compliance with ASTM C 840 and GA 216, Level 4 finish. Install gypsum board assemblies true, plumb, level and in proper relation to adjacent surfaces.

C. Install boards vertically. Do not allow butt-to-butt joints and joints that do not fall over framing members.

D. Where new partitions meet existing construction, remove existing cornerbeads to provide a smooth transition.

E. Provide insulation full height and thickness in partitions where required.

F. Provide siliconized acrylic sealant at both faces at top and bottom runner tracks, wall perimeters, openings, expansion and control joints.

G. Install trim in strict compliance with manufacturer's instructions and recommendations.

H. Repair surface defects. Leave ready for finish painting or wall treatment.

END OF SECTION

SECTION 09 22 16

NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.1 SUMMARY

A. Provide non-structural metal framing for gypsum board assemblies.

1.2 RELATED SECTIONS

A. Section 07 90 00 - Joint Sealers

B. Section 09 21 16 - Gypsum Board Assemblies

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

1.4 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Tolerances: Not more than 1/8 inch in 10 feet deviation from true plane, plumb, level and proper relation to adjacent surfaces in finished work.

C. Fire Resistance for Fire-Rated Assemblies: ASTM E 119.

D. Performance: Fire, structural, and seismic performance meeting requirements of building code and local authorities.

PART 2 PRODUCTS

2.1 MATERIALS

A. Steel Framing for Walls and Partitions:
   1. Manufacturers: Clark Dietrich, Cemco, Marino-ware and MBA Metal Framing.
   2. Material Standard: ASTM C645.
      a. Galvanized where noted.
   3. Stud Thickness: 20 gauge (.0329 inch).
   4. Stud Depth, Typical: As per partition type detail.
   5. Furring Channel Thickness: 20 gauge (.0329 inch).
   6. Auxiliary Framing Components: Furring brackets, resilient furring channels, Z-furring members, and non-corrosive fasteners.

B. Steel Framing for Suspended and Furred Ceilings:

1. Manufacturers: Clark Dietrich, Cemco, Marino-ware and MBA Metal Framing.
2. Material Standard: ASTM C645.
   a. Galvanized where noted.
3. Attachment: Standard.
4. Attachment: Resilient.
5. Stud Thickness: 20 gauge (.0329 inch).
6. Accessories: Furring channels, hangers and inserts.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide fire-rated systems where indicated and where required by authorities having jurisdiction.

B. Where new partitions meet existing construction, remove existing cornerbeads to provide a smooth transition.

C. Provide acoustical sealant at both faces at top and bottom runner tracks, wall perimeters, openings, expansion and control joints.

END OF SECTION

SECTION 09 30 00

TILE

PART 1 GENERAL

1.1 SUMMARY

A. Provide tile, tile work and related accessories. Extent of tile work is shown on drawings and schedules.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.
1. Include manufacturers full range of color and finish options if additional selection is required.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

1.3 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Tile: ANSI A 137.1.

C. Regulations: Compliance with VOC and environmental regulations.

1. Products shall meet ANSI A138.1 Green Squared American National Standard Specifications for Sustainable Ceramic Tiles, Glass Tiles and Tile Installation Materials and the California Department of Public Health’s Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers.

D. Tile Setting Materials: ANSI A 118 series standard specifications.

E. Tile Installation: ANSI 108 series standard specifications and Tile Council of America, Handbook for Ceramic Tile Installation.

F. Provide tile that conforms with the Dynamic Coefficient of Friction (DCOF) as follows:

1. Interior Walking Surfaces- Ceramic Tile DCOF AcuTest value of 0.42 when wet.

G. Mock-Ups: Provide mock-up as required to demonstrate quality of workmanship.

H. Accessibility Requirements: Comply with requirements applicable in the jurisdiction of the project, including but not limited to ADA and ICC/ANSI A117.1 requirement as applicable.

PART 2 PRODUCTS

2.1 MATERIALS

A. Tile:
1. Refer to Finish Legend in the Drawings for Tile selections.
2. Application: Interior floor tile over existing concrete slab and interior wall tile of existing walls. Contractor shall inspect all existing substrates to receive new tile and report any conditions requiring repair to the owner.
3. Type: Wall, base and floor tile including field, patterns, prefabricated metal movement joints and edge trim/transitions in restrooms.
4. Auxiliary Materials: Edge guards, adhesives, cements and fasteners, leveling compound.

B. Single Source Responsibility for Tile Installation Materials- Obtain all tile installation materials from one manufacturer.

C. Setting Materials:
1. Manufacturers: Laticrete International, Inc.; MAPEI Corp. ; Custom Building Products
2. Mortar setting bed.
   a. ANSI A118.4
   b. Polymer-Modified thick mortar bed.
3. Thin-set mortar.
   a. Polymer-Modified cement thinset mortar.
   b. Epoxy thinset mortar (wet locations).
4. Self-Leveling Underlayment.
5. Grout.
   a. Polymer-Modified Portland Cement Grout (floor and wall, except wet locations), ANSI A118.7
   b. Epoxy Grout (wet floor locations), ANSI A118.3
6. Waterproofing and Crack Isolation Membrane under tile.
   a. ANSI A 118.10 and 118.12.
   b. Design Standard: Hydroban by Laticrete International
7. Silicone Joint sealant.
8. Stone thresholds.
9. Control Joint Movement Strips.
   a. Provide thermal plastic removable rubber insert movement zone. Match floor tile joint width.
10. Tile Cleaner, specific to type, finish and applications as recommended by manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with Tile Council of America and ANSI Standard Specifications for Installation for substrate and installation required. Comply with manufacturer's instructions and recommendations.

B. Install waterproofing and crack isolation membrane in accordance with manufacturer's instructions and recommendations.

C. Lay tile in grid pattern with alignment grids. Layout tile to provide uniform joint widths

and to minimize cutting; do not use less than 1/2 tile units.

D. Provide sealant joints where recommended by TCA and approved by Architect.

E. Grout and cure, clean and protect.

3.2 SCHEDULE

A. Tile Schedule:
1. Toilet Room Walls: Glazed ceramic tile over tile backer board with polymer-modified cement thinset mortar and polymer-modified portland cement grout.
2. Toilet Room Floors: Glazed porcelain floor tile over existing concrete slab with epoxy thinset mortar and epoxy grout.
3. Schedule of tile selections with description, color and finish in drawing's material legend.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SUMMARY

A. Provide acoustical ceilings and suspension systems.

B. Related Sections include the following:

1. Section 09 21 16 - Gypsum Board Assemblies

1.2 SYSTEM DESCRIPTION

A. Continuous/Wall-to-Wall.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

1. Minimum 6 inch x 6 inch samples of specified acoustical panel.

2. 8 inch long samples of exposed wall molding and suspension system, including main runner.

3. 4 foot cross tees.

D. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

2. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire

3. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process

4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

5. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

6. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels

7. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

8. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials

9. ASTM E 119 Standard Test Methods for Fire Tests of Building Construction and Material

A. Fire Guard Products

1. ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint

2. ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems

3. ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum

4. ASTM E 1264 Classification for Acoustical Ceiling Products

B. 2015 Michigan Building Code

C. ASHRAE Standard 62.1-2004, Ventilation for Acceptable Indoor Air Quality

D. NFPA 70 National Electrical Code

E. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures

1.4 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Performance: Fire, structural, and seismic performance meeting requirements of building code and local authorities.

1. NRC of not less than 0.90 in accordance with ASTM C423.

2. Light Reflectance Value: Minimum 0.85 (white)

3. Content: Minimum 50% Recycled Content

C. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

1. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

2. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 Classification.

3. Fire Resistance: As follows tested per ASTM E119 and listed in the appropriate floor or roof design in the Underwriters Laboratories Fire Resistance Directory

D. Coordination of Work: Coordinate acoustical ceiling work with installers of related work

including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, and electrical systems.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.6 PROJECT CONDITIONS

A. Space Enclosure:

Standard Ceilings: Do not install interior ceilings until space is enclosed and weatherproof; wet work in place is completed and nominally dry; work above ceilings is complete; and ambient conditions of temperature and humidity are continuously maintained at values near those intended for final occupancy. Building areas to receive ceilings shall be free of construction dust and debris.

1.7 WARRANTY

A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:

1. Acoustical Panels: Sagging and warping.

2. Grid System: Rusting and manufacturer's defects.

B. Warranty Period:

1. Acoustical panels: Ten (10) years from date of substantial completion.

2. Suspension: Ten (10) years from date of substantial completion.

3. Ceiling System: Thirty (30) years from date of substantial completion.

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.8 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.

1. Acoustical Ceiling Units: Furnish quality of full-size units equal to 2,0 percent of amount installed.

2. Exposed Suspension System Components: Furnish quantity of each exposed suspension

component equal to 2.0 percent of amount installed.

PART 1 PRODUCTS

1.3 MATERIALS

A. Mineral Fiber Acoustical Ceilings:

B. Location: (ACT-1)

1. Basis of Design Manufacturer: USG, Radar
    a. Composition: Mineral Fiber
    b. Color: White
    c. Texture: Lightly textured, nondirectional
    d. Size: 2x4
    e. Edge Profile: Square
    f. Noise Reduction Coefficient(NRC): ASTM C 423; Classified with UL label on product carton 0.75
    g. Ceiling Attenuation Class (CAC) : ASTM C 1414; Classified with UL label on product carton 35
    h. Flame Spread: ASTM E 1264; Class A (UL)
    i. Light Reflectance (LR) White Panel: ASTM E 1477; 0.83
2. Auxiliary Materials
    a. Components: Main beams and cross tees, base metal and end detail, fabricated from commercial quality hot dipped galvanized steel complying with ASTM A 653. Main beams and cross tees are double-web steel construction with type exposed flange design. Exposed surfaces chemically cleansed, capping prefinished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.
        i. Structural Classification: ASTM C 635 Heavy Duty duty
        ii. Color: White
        iii. Basis of Design: USG DX/DXL
            a) Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
            b) Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft annealed, with a yield stress load of at least time three design load, but not less than 12 gauge.
3. Accessories: Edge Moldings and Trim:
    a. Drywall Transition Molding
    b. Vector/Concealed Hold Down Clip – use within 20 ft of exterior doors

PART 2 EXECUTION

2.1 PREPARATION

A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

2.2 INSTALLATION

A. Follow manufacturer installation instructions. Coordinate installation with location of mechanical and electrical work to ensure proper locations and anchorage.

B. Level ceiling to within 1/8 inch in 10 feet in both directions. Scribe and cut panels to fit accurately. Measure and layout to avoid less than half panel units.

C. Install suspension system and panels in accordance with the manufacturer's instructions, and in compliance with ASTM C 636 and with the authorities having jurisdiction.

D. Suspend main beam from overhead construction with hanger wires spaced 4-0 on center along the length of the main runner. Install hanger wires plumb and straight.

E. Install wall moldings at intersection of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect or install corner caps.

F. For reveal edge panels: Cut and reveal or rabbet edges of ceiling panels at border areas and vertical surfaces.

G. Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.

2.3 ADJUSTING AND CLEANING

A. Replace damaged and broken panels.

B. Adjust, clean, and touch-up all system components.

C. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove any ceiling products that cannot be successfully cleaned and or repaired. Replace with attic stock or new product to eliminate evidence of damage.

END OF SECTION

SECTION 09 65 13

RESILIENT BASE AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Provide resilient wall base and accessories.

B. Related Sections include the following:

1. Section 03 30 00 - Cast-in Place Concrete

2. Section 09 21 16 - Gypsum Board Assemblies

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

C. Submit extra stock equal to 2% of total used.

D. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

1.3 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Performance: Fire performance meeting requirements of building code and local authorities.

C. Accessibility Requirements: Comply with requirements applicable in the jurisdiction of the project, including but not limited to ADA and ICC/ANSI A117.1 requirement as applicable.

PART 2 PRODUCTS

2.1 MATERIALS

A. Resilient Wall Base:
1. Basis of Design Manufacturer: Roppe
2. Standard:
   a. ASTM E 84/NFPA 255 (Flame/Smoke) – Class A.
   b. ASTM E 648/NFPA 253 (Critical Radiant Flux) – Class I.
3. Type: TPR rubber compound
4. Group: 700 Series
5. Style: Cove.
6. Height: 4 inches.

7. Toe: Standard Toe

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's instructions and recommendations. Install in proper relation to adjacent work.

B. Install base and accessories to minimize joints. Install base with joints as far from corners as practical.

C. Install flush and smooth to wall surface to prevent ripples and gaps.

D. Clean, polish, and protect.

END OF SECTION

SECTION 09 91 00

PAINTS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on interior substrates.

B. Related Sections include the following:
1. Section 04 22 00 – Unit Masonry Assemblies
2. Section 08 11 13 - Hollow Metal Door and Door Frames
3. Section 09 21 16 - Gypsum Board Assemblies

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

1. Include manufacturers full range of color and finish options if additional selection is required.

C. Extra Stock: Submit 1 unopened gallons of each paint and color used in the project.

D. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

1.3 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Regulations: Compliance with VOC and environmental regulations.

PART 2 PRODUCTS

2.1 MATERIALS

A. Painting – Walls and Ceiling: interior wall and ceiling surfaces.
1. Manufacturers:
a. Sherwin Williams.
b. Pratt & Lambert.
c. Benjamin Moore.
d. ICI Paint Stores.

e. PPG Architectural Finishes.

2. Primary Coating Type: Low VOC water-based epoxy paints.
3. Gypsum Board Walls in Rooms and Corridors:
   a. Paint Systems: Primer plus two finish coats.
   b. Finish: Water-based epoxy paint with an eggshell finish, except toilet rooms, and storage rooms to be satin finish.
   c. Color: Refer to architectural plans and finish schedule for locations.
4. Masonry Walls:
   a. Paint Systems: Primer with void filler plus two finish coats.
   b. Finish: Latex enamel paint with an eggshell finish.
   c. Color: Refer to architectural plans and finish schedule for locations.

B. Painting – Interior Hollow Metal Doors and Door Frames:
1. Manufacturers:
   a. Sherwin Williams.
   b. Pratt & Lambert.
   c. Benjamin Moore.
   d. ICI Paint Stores.
   e. PPG Architectural Finishes.
2. Primary Paint Systems: Rust-inhibiting primer plus two finish coats, sprayed application.
3. Finish: Alkyd based enamel paints with a satin finish.
   a. Color: Refer to architectural plans and finish schedule for locations.

C. Fire Rated Assemblies: New and Existing.
1. Paint “ONE HOUR RATED in stencil form with letters not less than 1.5” in height and the color red on a white or existing light contrasting background 12” below ceiling/floor deck every 10 feet of continuous wall surface and not less than once in each room adjoining the wall.

PART 3 EXECUTION

3.1 INSTALLATION

A. Inspect surfaces, report unsatisfactory conditions in writing; beginning work means acceptance of substrate.

B. Comply with manufacturer's instructions and recommendations for preparation, priming and coating work. Coordinate with work of other sections.

C. At existing areas to be repainted, remove blistered or peeling paint to sound substrates. Remove chalk deposits and mildew and wash all surfaces with mild detergent. Perform related minor preparation including caulk and glazing compounds. Spot prime bare areas before priming and painting as specified.

D. Re-coat or remove and replace work which does not match or shows loss of adhesion. Clean up, touch up and protect work.

END OF PAINTS

SECTION 10 14 00

INTERIOR SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Plastic interior panel signs.
   1. Room Identification.
   2. Restroom.
   3. Exit.

1.2 RELATED SECTIONS

A. Section 06 20 00 - Finish Carpentry.

1.3 REFERENCES

A. ANSI 117.1 - For Buildings and Facilities.

B. ASTM International (ASTM):
   1. ASTM D149 - Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies.
   2. ASTM D150 - Standard Test Methods for AC Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulation.
   3. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
   4. ASTM D542 - Standard Test Method for Index of Refraction of Transparent Organic Plastics.
   5. ASTM D570 - Standard Test Method for Water Absorption of Plastics.
   6. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
   7. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
   8. ASTM D648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
   9. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics.
   10. ASTM D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C with a Vitreous Silica Dilatometer.
   11. ASTM D732 - Standard Test Method for Shear Strength of Plastics by Punch Tool.
   12. ASTM D785 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials.
   13. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
   14. ASTM D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
   15. ASTM D1003 - Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics.
   16. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics.
   17. ASTM D2843 - Standard Test Method for Density of Smoke from the Burning or

Decomposition of Plastics.

18. ASTM D3418 - Standard Test Method for Transition Temperatures and Enthalpies of Fusion and Crystallization of Polymers by Differential Scanning Calorimetry.
19. ASTM D3763 - Standard Test Method for High Speed Puncture Properties of Plastics Using Load and Displacement Sensors.
20. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
21. ASTM E2072-04 - Standard Specification for Photoluminescent (Phosphorescent) Safety Marketing.
22. ASTM E2073-02 - Standard Test Method for Photopic Luminance of Photo Luminescent (Phosphorescent) Markings.

C. Underwriters Laboratories (UL):
1. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.
2. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Detail drawings showing sizes, lettering and graphics, construction details of each type of sign and mounting details with appropriate fasteners for specific project substrates.

D. Manufacturer's Installation Instructions: Printed installation instructions for each signage system.

E. Message List: Signage report indicating signage location, text, and sign type.

F. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and available pictograms, characters, and Braille indications.

G. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and typical pictograms, characters, and Braille indications.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum two years documented experience in work of this Section.

B. Installer Qualifications: Minimum two years documented experience in work of this Section.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
1. Furnish signs designated by Architect.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in unopened factory packaging.

B. Inspect materials at delivery to verify there are no defects or damage.

C. Store products in manufacturer's original packaging until ready for installation in climate controlled location away from direct sunlight.

D. Store and dispose of solvent-based materials, and materials used with solvent-based materials in accordance with requirements of local authorities having jurisdiction.

1.7 PROJECT CONDITIONS

A. Install products in an interior climate controlled environment.

B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Nova Polymers Inc., Acorn Sign Graphics,
   a. AdLight Group, ASI Iowa, Bell Company, Boyd Sign Systems, Cab Signs, Cadwell Signs, Graphic Components, InPro Corporation, Kroy Sign Systems, Neiman & Company, Park Place Sign Systems Inc, Sign Pro, Signtech,

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 PERFORMANCE REQUIREMENTS

A. Provide photopolymer signage that conforms to the requirements of all regulatory agencies holding jurisdiction.

B. Provide glow in the dark, photo luminescent material that complies with applicable provisions of ASTM E 2073-02 and DIN 67510. Photo luminescent material must have up to eight hours of luminance.

C. Requirements:
   1. Comply with all applicable provisions of the 2010 ADA Standard for Accessible Design.
   2. Character Proportion: Letters and numbers on signs must have a width-to-height ratio between 3:5 and 1:1 and a stroke width-to-height ratio between 1:5 and 1:10.
   3. Color Contrast: Characters and symbols must contrast with their background - either light characters on a dark background or dark characters on a light background.
   4. Raised Characters or Symbols: Letters and numbers on signs must be raised 1/32 in (0.8 mm) minimum and be sans serif characters. Raised characters or symbols must be at least 5/8 in (16 mm) high but no higher than 2 in (50 mm). Symbols or pictograms on signs must be raised 1/32 in (0.8 mm) minimum.
   5. Symbols of Accessibility: Accessible facilities required to be identified must use the international symbol of accessibility.
   6. Braille: Grade II with accompanying text.

D. Fire Performance Characteristics:

1. Provide photopolymer signage with surface burning characteristics that consist of a flame spread of 75 and a smoke development of 120 when tested in accordance with UL 723 (ASTM E 84).
2. Self-Extinguishing: Provide photopolymer signage with a CC1 classification for .060 in thick material when tested in accordance with the procedures in ASTM D 635, Standard Test Method for Rate of Burning and/or Extent and Time of Burning Plastics in a Horizontal Position.
3. Vertical Burn: Provide photopolymer material that is classified as 94V-2 for material .118 in thick or greater and 94HB for material .118 in thick or less when tested in accordance with UL 94, Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.
4. Self-Ignition Temperature: Provide photopolymer material that has a self-ignition temperature of 800 degrees F (427 degrees C) when tested in accordance with ASTM D 1929.

E. Novacryl PETG: Polyethylene terephthalate glycol. A thermoplastic polyester with high chemical resistance, and fomability.
1. ADA Compliant.
2. NSF: Listed.
3. FDA: Conforms to food contact regulations.
4. Physical Properties:
    a. Specific Gravity per ASTM D792: 1.27.
    b. Optical Refractive Index per ASTM D542: 1.57.
    c. Light Trans - Total per ASTM D1003: 86 percent.
    d. Light Trans - Haze per ASTM D1003: 1 percent.
    e. Water Absorption by weight per ASTM D570: 0.2 percent.
5. Mechanical Properties:
    a. Tensile Strength per ASTM D638: 7,700 psi.
    b. Tensile Modulus of Elasticity per ASTM D790: 320,300 psi.
    c. Flexural Strength per ASTM D790: 11,200 psi.
    d. Flexural Modulus of Elasticity per ASTM D790: 10,000 psi.
    e. Izod Impact Strength Molded - Milled Notch per ASTM D256: 1.7 Ft-lb per inch Notch.
    f. Rockwell Hardness per ASTM D785: R-115.
    g. Drop Dart Impact per ASTM D3763: 22 ft-lbs.
    h. Shear Strength per ASTM D732: 9,000 psi.
    i. Compressive Strength per ASTM D695: 8,000 psi.
6. Thermal Properties:
    a. Deflection Temperature at 264 psi ASTM D648: 157 degrees F.
    b. Deflection Temperature at 66 psi ASTM D648: 164 degrees F.
    c. Coefficient of Thermal Expansion ASTM D696: 3.8x10 Inches per inch per degrees F.
    d. Flammability (Burning Rate) ASTM D635: 0.06 Inches per minute.
    e. Flammability UL 94: HB.
    f. Smoke Density Rating ASTM D2843: 53.8 percent.
    g. Self-Ignition Temp ASTM D1929: 880 degrees F.
    h. Flame Spread Index ASTM E84: 85.
    i. Smoke Development Index ASTM D84: 450.
    j. Glass Transition Temperature ASTM D3418: 178 degrees F.
7. Electrical Properties:
    a. Dielectric Constant at 1KHz ASTM D150: 2.6.
    b. Dielectric Constant at 1MHz ASTM D150: 2.4.
    c. Dielectric Strength ASTM D149: 410 Volts per mil.

2.3 SIGNAGE - GENERAL

A. It is the intent of these specifications to establish a sign standard for the Owner including but not limited to, wall-mounted directional signs, primary room identification, restrooms, conference rooms and all code compliant Braille signage.

B. Comply with all applicable provisions of the ANSI 117.1 2019, and 2010 ADA Standard for Accessible Design codes that apply to the State and Local jurisdiction of the project.

C. If required text and graphics are not indicated in specification or on drawings, obtain Owner's instructions as to text and graphics prior to preparation of shop drawings.

D. Typography: See Drawings. Copy shall be a clean and accurate reproduction of typeface(s) specified. Upper and lower case and all caps as indicated in Sign Type drawings and Signage Schedule. Letter spacing to be set by manufacturer.

E. Arrows, symbols, and pictograms will be provided in style, sizes, colors and spacing as indicated in drawings for each sign system.

F. Braille:
1. Grade 1 Braille.
2. Grade 2 Braille.
3. California Braille.

G. Design:
1. Text/Graphics Placement: As indicated on contract drawings.
2. Font: Arial.

2.4 INTERIOR SIGNAGE

A. Panel Material: Novacryl PT Series Photopolymer
1. Composition: 0.032 inch (0.8 mm) thick moisture resistant, non-glare interior nylon photopolymer on ultraviolet resistant clear NOVACRYL PETG sign base, single piece construction. Laminated photopolymers, added-on characters, and engraved characters are not acceptable.
2. Sustainable Certification: Minimum 40 percent pre-consumer recycled content.
3. Base thickness: 0.020 inch (0.5 mm) Gloss NOVACRYL PETG.
4. Type and Color: To be selected from manufacturer's full color range by Architect.
5. Size: See Signage Elevations.
6. Surface burning characteristics: Flame spread/smoke developed rating less than 75/120, tested to ASTM E 84 and UL 723.
7. Rate of burning: Tested to ASTM D 635 at nominal 0.060 inch (1.5 mm) thickness with resulting Classification CC1.
8. Vertical burning: Tested to UL 94, classified as 94V-2 in thickness of 0.118 inch (3.0 mm) or greater and 94HB in thicknesses less than 0.118 inch (3.0 mm).
9. Self-ignition temperature: 800 degrees F (427 degrees C), tested to ASTM D 1929.

2.5 ACCESSORIES

A. Adhesive:
1. Type recommended by sign manufacturer.
2. Maximum volatile organic compound (VOC) content: 70 grams per liter.

B. Tape: Double sided, waterproof, pressure sensitive.

2.6 FABRICATION

A. Fabricate panel material in accordance with manufacturer's instructions and approved shop drawings.

B. Fabricate signs by photo polymer process using film negatives to produce characters and graphics in contrasting color, raised. Refer to Signage Schedule.

C. Pictograms: Refer to Signage Elevations.

D. Provide Braille Grade indications for each character.

E. Frames:
1. Miter corners; fit to hairline joint.
2. Secure frame to sign with adhesive.

F. Changeable Slide Inserts: Clear NOVACRYL PETG sheet cover with slot behind for insertion of changeable slide strip, removed from side.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

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

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 10 21 00

TOILET PARTITIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Phenolic Toilet partitions.

B. Phenolic Urinal screens.

1.2 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry, coordination with blocking in walls to secure panels, wall posts and stiles.

B. Section 09 30 00 - Tile, coordination with layout and installation.

C. Section 10 28 00 - Toilet Accessories, for accessories.

1.3 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

B. Shop Drawings: Submit manufacturer's shop drawings for each product specified, including the following:
1. Plans, elevations, details of construction and attachment to adjacent construction.
2. Show anchorage locations and accessory items.
3. Verify dimensions with field measurements prior to final production of toilet compartments.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 10 year experience manufacturing similar products.

B. Installer Qualifications: Minimum 2 year experience installing similar products.

C. Single Source Requirements: To the greatest extent possible provide products from a single manufacturer.

D. Accessibility Requirements: Comply with requirements applicable in the jurisdiction of the

project, including but not limited to ADA and ICC/ANSI A117.1 requirement as applicable.

1.5 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to starting work of this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Handling: Handle materials to avoid damage.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.8 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard 25 year limited warranty for panels, doors, and stiles against breakage, corrosion, delamination, and defects in factory workmanship. Manufacturer's standard 1 year guarantee against defects in material and workmanship for stainless steel door hardware and mounting brackets.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
1. American Sanitary Partition Corp.
2. Bobrick
3. Bradley
4. General Partitions

B. Basis of Design: ASI Global
1. Color: Graphite Grafix 3020

2.2 PHENOLIC CORE TOILET PARTITIONS

A. Partition Construction:
1. Toilet Partition Type: PH-FS - Phenolic Core, Floor Stile.
2. Panels, Stiles and Doors: Solid phenolic core decorative plastic laminate with multiple resin-impregnated kraft paper and surface sheets fused at high temperature and pressure; the edges being finished and polished; black core.
a. Panel Thickness: No less than 1/2 inch (13mm) thick.
b. Stile Thickness: No less than 3/4 inch (19mm) thick.

c. Door Thickness: No less than 3/4 inch (19mm) thick.

B. Materials:
1. Panels: Solid phenolic core decorative plastic laminate with multiple resin-impregnated kraft paper and surface sheets fused at high temperature and pressure; the edges being finished and polished; black core.
   a. Panel Thickness: 1/2 inch (13mm) Phenolic Core.
2. Doors: Solid phenolic core decorative plastic laminate with multiple resin-impregnated kraft paper and surface sheets fused at high temperature and pressure; the edges being finished and polished; black core.
   a. Door Thickness: 3/4 inch (19mm) Phenolic Core.
3. Stiles: Solid phenolic core decorative plastic laminate with multiple resin-impregnated kraft paper and surface sheets fused at high temperature and pressure; the edges being finished and polished; black core.
   a. Stile Thickness: 3/4 inch (19mm) Phenolic Core.
4. Headrail: 6063-T5 Aluminum; etched and anodized.

C. Fittings:
1. Wall Brackets:
   a. Stirrup Brackets: Stainless Steel; #304 with a #4 finish; adjustable to keep panels and stiles clear from walls.
   b. Full Height Continuous Brackets: Stainless Steel; #304 with a #4 finish; adjustable to keep panels and stiles clear from walls.
   c. Full Height Continuous Aluminum: 6063-T5 Aluminum; etched and anodized and adjustable to keep panels and stiles clear from walls.
2. Stile Cover Bases: Stainless Steel: #304 with a #4 finish; 3 inches (76mm) high.
3. Panel Brackets:
   a. Full height Continuous Stainless Steel; #304 with a #4 finish; "U" brackets, adjustable to keep panels clear from pilasters.
   b. Full Height Continuous Aluminum: 6063-T5 Aluminum; etched and anodized and adjustable to keep panels clear from stiles.

D. Hardware:
1. Door Hardware: Vault Ball Bearing Hinge
   a. Fastening Hardware: Stainless Steel; #304 with a #4 finish.
   b. Top Hinge: Heavy Duty "Bank Vault" type, die-cast #304 stainless steel with a #4 finish; wrap-around pilaster and door mounting, through bolted.
   c. Bottom Hinge: Same as top hinge, with gravity-type cam permitting adjustment to any desired angle of the door when not latched.
2. Door Hardware: Piano Hinge
   a. Hinges: Full Height Continuous Piano Hinge; #304 stainless steel with a #4 finish, surface mounted, through bolted with screws of same material and finish.
   b. Fastening Hardware: Stainless Steel; #304 with a #4 finish.
3. Slide Latch: Stainless Steel; #304 with a #4 finish. Through bolted with one-way theft proof screws of the same material and finish.
4. Combination Bumper Coat Hook: Stainless Steel; #304 with a #4 finish.
5. Keepers: Stainless Steel; #304 with a #4 finish. Through bolted with one-way theft proof screws of the same material and finish.
6. Keepers: Full Height Continuous 6063 T5 etched and anodized aluminum.
7. Coat Hooks: Stainless Steel; #304 with a #4 finish.

2.3 PHENOLIC CORE URINAL SCREENS

A. Urinal Screen- Wall Hung
1. Panel Shell: Solid phenolic core decorative plastic laminate with multiple resin-impregnated kraft paper and surface sheets fused at high temperature and pressure; the edges being finished and polished; black core.
2. Panel Thickness: 1/2 inch (13mm).
3. Panel Width: 18 inches (457mm).
4. Panel Width: 24 inches (610mm).
5. Panel Height: 48 inches (1219mm).
6. Wall supported:
a. Attached with three (3) stainless steel wall brackets.
b. Attached with full height continuous stainless steel bracket.

PART 3 PRODUCTS

3.1 PREPARATION

A. Prepare substrates including but not limited to blocking and supports in walls and ceilings at points of attachment using methods recommended by the manufacturer for achieving the best result for the substrates under the project conditions.
1. Inspect areas scheduled to receive compartments for correct dimensions, plumbness of walls, and soundness of surfaces that would affect installation of mounting brackets.
2. Verify spacing of plumbing fixtures to assure compatibility with installation of compartments.

B. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

C. Do not proceed with installation until substrates have been properly prepared with blocking and supports in walls and ceilings at points of attachment and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

3.2 INSTALLATION

A. Install products in strict compliance with manufacturer's written instructions and recommendations, including the following:
1. Verify blocking and supports in walls and ceilings has been installed properly at points of attachment.
2. Verify location does not interfere with door swings or use of fixtures.
3. Use fasteners and anchors suitable for substrate and project conditions
4. Install units rigid, straight, plumb, and level.
5. Conceal evidence of drilling, cutting, and fitting to room finish.
6. Test for proper operation.

3.3 ADJUSTING, CLEANING AND PROTECTION

A. Adjust hardware for proper operation after installation. Set hinge cam on in-swinging

doors to hold doors open when unlatched. Set hinge cam on out-swinging doors to hold unlatched doors in closed position.

B. Touch-up, repair or replace damaged products.

C. Clean exposed surfaces hardware, and fittings.

D. Clean Phenolic Core Partitions:
   1. Wipe laminate with a clean damp cloth or sponge using a mild soap, detergent, or general purpose cleaner.
   2. Do not use abrasive cleaners or powders, or abrasive scouring pads.

END OF SECTION

SECTION 10 28 00

TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Toilet room accessories.
   a. Grab bars.
   b. Mirror
   c. Hand Dryer
   d. Soap Dispenser
   e. Toilet Tissue Dispenser
   f. Sanitary Disposal Unit

1.2 RELATED SECTIONS

A. Section 06 20 00 - Finish Carpentry

B. Section 10 21 00 - Toilet Partitions

1.3 REFERENCES

A. ASTM International (ASTM):

1. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
3. ASTM A 1008/A 1008M- Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
4. ASTM B 456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
5. ASTM C 1503 - Standard Specification for Silvered Flat Glass Mirror.
6. ASTM F 446 - Standard Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area.

B. American National Standards Institute (ANSI):
1. ANSI A 117.1 – Accessible and Usable Buildings and Facilities

1.4 ACTION SUBMITTALS

A. Product Data: For each product:

1. Manufacturer's product data sheets indicating operating characteristics, materials and finishes. Mark each sheet with product designation.
2. Mounting requirements and rough-in dimensions.

1.5 INFORMATION SUBMITTALS

A. Sample warranty.

B. Operation, care and cleaning instructions.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

1.6 MAINTENANCE SUBMITTALS

A. Furnish indicated spare parts that are packaged with identifying labels listing associated products.

B. Operation and Maintenance data.

1.7 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

B. Manufacturer Qualifications: Approved manufacturer listed in this section, with minimum five years of experience in the manufacture of product types. Manufacturers seeking approval must submit the following:

1. Product data, including test data from qualified independent testing agency indicating compliance with requirements.
2. Samples of each component of product specified.
3. List of successful installations of similar products available for evaluation by Architect.
4. Submit substitution request not less than 15 days prior to bid date.

C. Accessibility Requirements: Comply with requirements applicable in the jurisdiction of the project, including but not limited to ADA and ICC/ANSI A117.1 requirement as applicable.

1.8 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage or frame corrosion defects within specified warranty period.

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Bradley Corporation.
2. Bobrick.
3. American Specialties, Inc.

2.2 MATERIALS

A. Stainless Steel: ASTM A 666 Type 304 (18-8); satin finish exposed surfaces unless otherwise indicated.

B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS, manufacturer's standard thickness.

C. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating, manufacturer's standard thickness.

D. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

E. Fasteners:

1. Exposed: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant.
2. Concealed: Galvanized steel.

F. Chrome Plating: ASTM B 456, Service Condition Number SC 2, moderate service.

G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.3 TOILET ACCESSORIES

A. Fixed Grab Bars:
1. Basis of Design, Fixed Grab Bar: Bradley Corp., Model 817 series 1-1/2 inch (38 mm) diameter**.**
2. Application: At each water closet, unless otherwise indicated.
3. Mounting: Exposed flanges, horizontally mounted
4. Material: Stainless steel, 0.05 inch (1.27 mm) thick.
5. Length: 18", 36" and 42"
6. Finish: Safety grip.

B. Mirror Unit:
1. Basis of Design: Bradley Corp, Model B-1556
2. Size and Application: 18" x 30" Frameless
3. Mounting: Surface mounted
4. Mirror:
   a. Channel Framed, Stainless steel finish
   b. 1/4 inch (6 mm) thick, float glass, triple silvered, electro-copper plated with baked enamel finish, all edges protected by neoprene tubing.

C. Hand Dryer:
1. Basis of Design: Dyson Airblade
2. Electric Hand Dryer
   a. Energy Per Use: Not greater than 3.7 Wh
3. Mounting: Surface mounted

4. Finish: Stainless Steel
5. Accessories: Stainless Steel Wall Guard

D. Soap Dispenser :
1. Basis of Design: Bradley Corp., Model 6362-68.
2. Application: At each lavatory, unless otherwise indicated.
3. Housing: Satin stainless steel, 6” spout
4. Operation: Stainless steel manual pump.
5. Mounting: Lavatory Mounted.
6. Soap Capacity: 32 ounces**.**

E. Toilet Tissue Enclosed Roll Dispenser, Surface Mount:
1. Basis of Design: Bradley Corp., Model 5402.
2. Application: At each water closet, unless otherwise indicated.
3. Capacity: Single roll plus spare roll.
4. Material: Satin finish stainless steel, with polymer spindles.
5. Roll Access: Enclosed.
6. Delivery: Non-controlled.
7. Mounting: Surface Mounted.
8. Service Access: Vandal resistant lock.

F. Sanitary Disposal Unit
1. Basis of Design: Bradley Corp., 4722-15. Stainless steel construction, with satin finish. 1.5 gallon waste container. Push flap door. Vandal resistant.
2. Application: Where indicated.
3. Mounting: Surface mounted.
4. Receptacle: Removable, with vandal-proof lock, capacity 1.5 gal (5.7 L).
5. Finish: Stainless steel satin**.**

2.4 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Assemble fixtures and associated fittings and trim in accordance with manufacturer's instructions.

B. Install supports attached to building structure for equipment requiring supports.

C. Grab Bars: Install grab bars to withstand downward force of not less than 250 lbf (1112 N) per ASTM F 446.

D. Install equipment level, plumb, and firmly in place in accordance with manufacturer's rough-in drawings.

3.2 CLEANING AND PROTECTION

A. Repair or replace defective work, including damaged equipment and components.

B. Clean unit surfaces, and leave in ready-to-use condition.

C. Turn over keys, tools, maintenance instructions, and maintenance stock to Owner.

3.3 TESTING AND ADJUSTING

A. Test each piece of equipment provided with moving parts to assure proper operation, freedom of movement, and alignment.

B. Repair or replace malfunctioning equipment, or equipment with parts that bind or are misaligned.

END OF SECTION

SECTION 10522

FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Portable fire extinguishers
2. Cabinets for portable fire extinguishers

B. Related Sections include the following

1. Section 09 21 16 - Gypsum Board Assemblies

2. Section 09 91 00 - Paints

1.02 REFERENCES

A. American Disability Act (ADA), ANSI A 117.1 2017– Accessible and Usable Buildings and Facilities
B. American Society for Testing and Materials (ASTM)
A1008/A1008M Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
C1036 Standard Specification for Flat Glass
E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops
C. Federal Standard (FED-STD)
FED-STD-795 Uniform Federal Accessibility Standards (UFAS)
D. National Fire Protection Association (NFPA)
NFPA 10 Portable Fire Extinguishers
E. Michigan Building Code (MBC) - 2015
F. International Fire Code (IFC)

1.03 SUBMITTALS

A. Submit brochure and product data.

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

1.04 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10.

B. Fire Extinguishers: Listed and labeled by Underwriter’s Laboratory (UL) or Factory Mutual (FM) for type, rating, and classification.

C. Accessibility Requirements: Comply with requirements applicable in the jurisdiction of the project, including but not limited to ADA and ICC/ANSI A117.1 requirement as applicable.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. 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. J.L. Industries, Inc. a division of Activar Construction Products Group
   2. Larsen's Manufacturing Co.
   3. Potter Roemer LLC
   4. Kidde Residential and Commercial Divison, subsidiary of Kidde plc.

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A1008/A1008M, commercial quality, stretcher leveled, temper rolled.

2.03 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.

   1. Product: A 10-lb, multi-purpose, UL listed, dry chemical fire extinguisher with a minimum rating of Class A-B-C and AK.

B. Mounting Brackets: Manufacturer's standard steel bracket, designed to secure extinguisher, of sizes required for types and capacities of fire extinguisher indicated, with plated or baked-enamel finish.

C. Fire extinguishers installed outside shall be located in approved weather-tight fire extinguisher cabinets.

2.04 FIRE EXTINGUISHER CABINETS

A. General: Unless specified otherwise on construction drawings, provide fire extinguisher cabinet of type, size, and rating as indicated below, or equivalent.

   1. Semi-recessed mounted as indicated on drawings.

B. Cabinet Size: The minimum inside box dimensions shall be 24"H x 9½W x 6"D for SNL Type I and Type III fire extinguishers, and 27"H x 12"W x 8"D for SNL Type II fire extinguishers.

C. Cabinet Construction: Provide manufacturer's standard box, with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.

D. Fire-Rated Cabinets: Listed and labeled to meet requirements of ASTM E814 for fire-resistance rating of wall where it is installed. Construct fire-rated cabinets with double walls fabricated from 0.0478-inch (1.2-mm) thick, cold-rolled steel sheet lined with minimum 5/8-inch (16-mm) thick, fire-barrier material. Provide factory drilled mounting holes.
   1. Cabinet Metal: Enameled-steel sheet.
      a. Provide FX option where located in rated walls.

   2. Shelf: Same metal and finish as cabinet.

E. Cabinet Mounting: Suitable for the following:

1. Semirecessed: Cabinet box partially recessed in walls of shallow depth to suit style of trim indicated.

F. Cabinet Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded and ground smooth.

G. Cabinet Trim Material: Steel sheet.

H. Door Material: Steel sheet.

I. Door Glazing: Clear Float Glass, ASTM C1036, Type 1, Class 1

J. Door Style: Vertical side glass panel with frame.

K. Door Construction: Provide a minimum ½-inch (13 mm) thick door frames.

L. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide recessed door pull and friction latch. Provide continuous-type hinge permitting door to open 180 degrees.

M. Cabinet and Door Finishes: Provide manufacturer's standard baked-enamel paint for the exterior and interior of the cabinet and doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets are to be installed. Verify that rough openings for cabinets are correctly sized and located.

B. Examine fire extinguishers for proper charging and tagging. Remove and replace damaged, defective, or undercharged units.

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

3.02 INSTALLATION OF FIRE EXTINGUISHERS

A. Comply with manufacturer's written instructions for installing fire extinguishers and mounting brackets.

B. Mounting Height: Install extinguishers at heights indicated below.

1. Install fire extinguishers mounted on hangers or brackets attached to a wall so that the top of the fire extinguisher is not more than 3½ ft. above the floor.

2. In no case shall the clearance between the bottom of the fire extinguisher and the floor be less than 4 inches.

C. Locations: Install extinguishers at locations indicated below.

1. Install fire extinguishers at locations specified on the drawings or as directed by the authority having jurisdiction.

2. Fire extinguishers shall be conspicuously located, along normal paths of travel, including exits from areas. Extinguishers shall not be obstructed or obscured from view.

D. Install portable fire extinguishers on the hanger or in the bracket supplied, or place in the fire extinguisher cabinets provided. Verify that the extinguisher operating instructions face outward.

3.03 INSTALLATION OF FIRE EXTINGUISHER CABINETS

A. Comply with manufacturer's written instructions for installing fire extinguisher cabinets.

B. Mounting Height: Install fire extinguisher cabinets at the height required so that the top of the fire extinguisher is not more than 54 inches above the floor.

C. Install fire extinguisher cabinets at locations specified on the drawings.

D. Fire extinguisher cabinets shall protrude no more than 4 inches into corridors, passageways, or aisles.

E. Repair/paint wall surfaces surrounding fire extinguisher cabinet damaged during installation to match existing wall surface.

3.04 SIGNAGE

A. Identify bracket-mounted extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to wall surface.

B. Identify fire extinguisher in cabinet with the words "FIRE EXTINGUISHER" applied to door.

1. Application Process: Decals
2. Lettering Color: Red
3. Orientation: Vertical

3.05 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust cabinet doors that do not swing or operate freely.

B. Refinish or replace cabinets and doors damaged during installation.

C. Provide protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Construction Completion.

END OF SECTION

SECTION 10 51 13

LOCKERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Athletic lockers.

B. Locker bench.

1.2 RELATED SECTIONS

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

B. Section 06 10 00 - Rough Carpentry.

1.3 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI A 117.1 – Accessible and Usable Buildings and Facilities

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings:
1. Dimensioned drawings including plans, elevations, and sections to show locker locations and interfaces with adjacent substrates.
2. Details of assembly, erection, anchorage and clearance requirements.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

A. Mock-Up: Provide a mock-up for evaluation of installation and application workmanship.
1. Provide mock-up in area designated by Owner.
2. Do not proceed with remaining work until workmanship and installation are approved by Owner.
3. Modify mock-up as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

A. Lockers shall be warranted for a period of five years against defective parts and workmanship, excluding vandalism and improper installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
1. Hadrian, Bradley Corp., ASI Storage Solutions, List Industries, Lyon Industries

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

C. Provide all metal lockers from a single manufacturer.

2.2 LOCKERS

1. Height: 36 inches (1830 mm).
2. Depth: 18 inches (455 mm).
3. Width: 12 inches (305 mm).
4. Tier: Double.
5. Door Construction: Perforated double-pan design consisting of a 16 gauge (1.519 mm) outer panel welded to an 18 gauge (1.214 mm) inner panel to form a rigid box construction which is resistant to prying. The outer panel shall be double flanged on all four edges and the inner panel single flanged on all four edges, providing extraordinary rigidity when both panels are welded together.
6. Doors: The door shall be flush with the frame and include a recessed handle and recessed number plate. Doors are hinged on the right to swing from left to right.
7. Ventilation: Staggered 1/2 inch (13 mm) wide by 1 inch (25 mm) high oval perforations.
   a. Straight-through alignment at doors.
   b. Doors of one-tier, two-tier, three-tier, and four-tier shall be ventilated at upper and lower sections.
   c. Sides at exposed end conditions shall be solid.
8. Door Frames: Both vertical members shall be not less than 16 gauge (1.519 mm) and formed into a rigid channel 5/8 inch (16 mm) wide exposed frame and 2-7/16 inches (62 mm) side depth. The frame shall be completed by 3 inches (76 mm) high top and bottom cross members of not less than 18 gauge (1.214 mm) formed as an open box channel and welded to the verticals. The bottom frames' full-width lintel extends back and down to form a rigid box to support the bottom shelf. Both vertical frame members shall be formed to offer a full length 7/16 inch (11 mm) wide continuous door strike. The latch vertical member shall include a welded 11 gauge (3.030 mm) padlock hasp together with a 7/16 inch (11 mm) O.D. air-cushioned rubber bumper.
9. Body: Sides shall be not less than 16 gauge (1.519 mm), ventilated with staggered 1/2 inch

(13 mm) wide by 1 inch (25 mm) high oval perforations. Locker backs shall be solid, not less than 18 gauge (1.214 mm) with right angle flanges on each vertical side. (triple thickness of metal at back corner connections). Shelves, tops, and bottoms shall be not less than 16 gauge (1.519 mm), formed into a sturdy pan, interchangeable, flanged on all sides, with a lip formed front edge.

10. Single Point Latching/Locking Device (Hasp Type): An 11 gauge (3.030 mm) 2 inches (51 mm) by 3/4 inch (19 mm) padlock hasp shall be securely welded to the continuous strike midway up on the frame and centered at the handle location. The hasp shall be formed to protrude through an extruded aluminum recessed handle, which is clip locked and bonded to the door. The handle's inner surface shall be concave and grooved for fingertip door control. To keep the door closed when not in use, a single 1/2 inch (13 mm) O.D. nylon friction catch shall be installed on the door to engage the frame. For multiple tier doors (3-tier and higher) a friction catch is not required for the middle door.
11. Single Point Latching/Locking Device (Positive Latch Option): Spring loaded single point positive latch.
12. Hinge: A full length heavy-duty 16 gauge (1.519 mm) continuous steel piano hinge shall be securely welded to the frame and fastened to the door with screws or rivets.
13. Number Plates: Doors shall have a high strength black laminated plastic number plate 2-1/2 inches (64 mm) wide by 1 inch (25 mm) high with numbers not less than 7/16 inch (11 mm) high. Plates shall accommodate up to four digits, be nestled in a recess flush with door surface and shall be fastened to the door with two rivets. Unless noted otherwise, lockers will be numbered consecutively from 1-up.

B. Accessories:
1. Box Bases: 22 gauge (0.759 mm) galvanneal steel free from surface imperfections and contaminants with an epoxy polyester powder finish.
2. Tops: Slope tops shall be made of mild cold rolled sheet steel free from surface imperfections an epoxy polyester powder finish. The universal support pieces for Slope Tops shall be made from 20 gauge (0.912 mm) galvanneal steel.
   a. Provide galvanneal steel.
   b. 20 gauge (0.912 mm) material.
3. Trim and Fillers: "U" fillers shall be made of 18 gauge (1.214 mm) and all other trim and fillers shall be made of 24 gauge (0.617 mm) mild cold rolled sheet steel free from surface imperfections and contaminants with an epoxy polyester powder finish.
   a. Provide galvanneal steel.

2.3 LOCKER BENCH
1. Accessible: ADA and ANSI A117.1 compliant
2. Back: 18 inches high
3. Dimensions: 42 inches wide x 20 inches deep
4. Seat height: 17 3/4”
5. Seat material: hardwood
6. Pedestals: painted steel

2.4 LOCKER FINISH

A. Epoxy Powder Coating: Steel parts and aluminum pedestals shall be thoroughly machine cleaned, phosphatised, and finished with a high performance epoxy powder coating, baked on to provide a uniform, smooth, protective finish. Door and frame colors shall be selected from Hadrian's standard decorator colors including "special effects" colors.

B. Door Color:

1. Color: As selected by Owner from manufacturer's full line.

C. Frame Color:
1. Color: As selected by Architect from manufacturer's full line.

2.5 FABRICATI0N

A. Each locker built shall have a door mounted in a frame. Individual top, bottom, side, back, shelves, with a common side separating compartments.

B. Materials are completely asbestos free. The paint used shall be a powder coating completely free of all lead and chromate.

C. No fasteners shall be exposed on fronts of locker doors and frames.

D. Sliding rods, springs, turnhandles or moving latches are not permitted for latching/locking devices.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

A. Install metal lockers and accessories at locations shown in accordance with manufacturer's instructions. Install lockers plumb, level, and square.

B. Assemble lockers by riveting, to provide solid permanent fastening while allowing for faster removal by drilling where future rearrangement of lockers or replacement of damaged parts may be required. If acceptable to Architect, bolted assembly will be acceptable.

C. Install locks in sequence after all lockers have been installed.

D. Install number plates in sequence after all lockers have been installed.

E. Install benches by fastening bench tops to pedestals and securely anchoring to the floor using rubber leveling glides or appropriate anchors for the floor material.

3.3 ADJUSTING AND CLEANING

A. Adjust doors and latches to operate without binding. Verify that latches are operating satisfactorily.

B. Touch-up with factory-supplied paint and repair or replace damaged products before Substantial Completion.

3.4 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION

SECTION 11 45 10

RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Appliances:
   a. Refrigerator
   b. Microwave

1.2 RELATED SECTIONS

A. Section 06 10 00 – Rough Carpentry
B. Section 06 20 20 - Finish Carpentry

1.3 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI A 117.1 – Accessible and Usable Buildings and Facilities
   2. US Environmental Protection Agency – Energy Star
   3. Underwriters Laboratories (UL)

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Manufacturer's data sheets on each product to be used.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Typical installation methods.

B. Samples for Verification: For each appliance with factory-applied finishes, submit tow representative units of each type, size, pattern and color.

C. Manufacturer Certificates: Signed by manufacturers certifying that products comply with requirements.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency.

E. Research/Evaluation Reports

F. Maintenance Data: For appliance include in maintenance manuals.

G. Warranties: Special warranties specified in this Section.

H. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

1.5 QUALITY ASSURANCE

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

B. Installer Qualifications: Company specializing in performing Work of this section with minimum two years documented experience with projects of similar scope and complexity.

C. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

B. Regulatory Requirements: Comply with provisions of the following product certifications:
1. UL and NEMA: Provide electrical components required as part of residential appliances that are listed and labeled by UL and that comply with applicable NEMA standards.
2. ANSI: Provide gas-burning appliances that comply with ANSI Z21 Series standards.
3. NAECA: Provide residential appliances that comply with NAECA standards.

C. Regulatory Requirements, Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with ANSI A 117.1 – Accessible and Usable Buildings and Facilities.

1. Operable Parts: Provide controls with forward reach no higher than 48 inches above the floor, horizontal front reach no more than 25 inches, horizontal side reach no more than 24 inches and that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lb.

D. Energy Ratings: Provide residential appliances that carry labels indicating energy-cost analysis (estimated annual operating costs) and efficiency information as required by the FTC Appliance Labeling Rule.

1. Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer of each appliance specified agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Whirlpool, LG, KitchenAid, GE

2.2 APPLIANCES

A. Refrigerator:
   1. Standard Depth, 36-inch wide
   2. Standards Compliance:
      a. ADA height and operation compliant.
      b. UL listed.
   3. Power: 115V, 15/20 amp.
   4. Dimensions (HxWxD): 69 inches x 36 inches x 33 inches
   5. Features: Adjustable door storage, glass shelves, deli drawer, slide out shelves
   6. Finish: Fingerprint resistant stainless steel

B. Microwave:
   1. Standards Compliance:
      a. Energy Star Certified.
      b. UL listed.
   2. Size: 2.2 cu.ft.
   3. Power: 120 V, 15/20 amp.
   4. Dimensions (HxWxD): 14 x 25 x 19 inches
   5. Color: Stainless Steel

2.3 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine roughing-in for piping systems to verify actual locations of piping connections before equipment installation.

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

3.2 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written instructions.

B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.

C. Utilities (Specified by Others): Install as per manufacturer’s recommendations and installation manual, Michigan Mechanical Code, Michigan Electrical Code, and other applicable regulatory requirements for power, potable water and drain.

3.3 CLEANING AND PROTECTION

A. Test each item of residential appliances to verify proper operation. Make necessary adjustments.

B. Verify that accessories required have been furnished and installed.

C. Remove packing material from residential appliances and leave units in clean condition, ready for operation.

END OF SECTION

SECTION 12 32 16

PLASTIC LAMINATE CLAD CASEWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Plastic laminate clad wall and base casework.

1.2 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry.

1.3 SUBMITTALS

A. Action Submittals:
1. Shop Drawings: Illustrate products, installation, and relationship to adjacent construction.
2. Product Data: Manufacturer's descriptive data and product attributes.
3. Samples:
a. Verification samples, finishes.

B. Closeout Submittals:
1. Operation and Maintenance Data.

C. Quality Control Submittals:
1. Manufacturer qualification statement.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Building Code Compliance:

1. Michigan Building Code; 2015 Edition

2. Seismic Performance: Provide casework system capable of withstanding the effects of earthquake motions determined according to the building code in effect for this Project or ASCE 7, "Minimum Design Loads for Buildings and Other Structures," Section 9, "Earthquake Loads," whichever is more stringent.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. Certified for chain of custody by third party group approved by Forest Stewardship Council (FSC).
2. Licensed under Architectural Woodwork Institute (AWI) Quality Certification Program (QCP).

B. Installer Qualifications: Minimum 2 years' experience in work of this Section.

C. Mockups:
1. Full-size base cabinet, wall cabinet, vertical divider and countertop.
2. Approved mockups may remain as part of the Work.

1.6 WARRANTIES

A. Manufacturer's limited lifetime warranty against defects in materials and workmanship, including non-casework accessories.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
1. Case Systems, Inc., 2700 James Savage Rd, Midland, MI 48642
2. LSI Casework, 704 West Main Street, Teutopolis, IL 62467
3. Stevens ID Systems, 704 West Main Street, Teutopolis, IL 62467
4. Jericho Woodworks, 426 Summer Park Dr., Stafford, TX 77477

B. Substitutions: Requests for approval of equal substitutions will be considered in accordance with provisions of Section 01 60 00.

2.2 MATERIALS

A. Panel Core: Particleboard, ANSI A208.1, Grade M-3i.

B. Panel Core: FSC Certified plywood.

C. Surfacing: NEMA LD-3 and ANSI A161.2.
1. Vertical surface decorative grade: VGS.
2. General purpose decorative grade: HGS.
3. Cabinet decorative liner grade: CLS.
4. Non-decorative backer grade: BKH.
5. Decorative thermally fused laminate.

D. Edge Banding:
1. PVC, applied utilizing hot melt adhesive and radiused by automatic trimmer.
2. Adhesive: PVA type, mechanically applied, ULEF, free from VOC's.

2.3 FABRICATION

A. Comply with AWI Grade requirements.

B. General Cabinet Body Construction:
1. Joinery: Concealed interlocking fasteners or dowel construction at manufacturer's discretion.
2. Panels manufactured with balanced construction.
3. Cabinet box style: Reveal overlay
4. Structural components: 3/4 inch thick for bottoms and ends of cabinets, tops of tall cabinets and tops and bottoms of wall cabinets.
5. Fixed interior components: 3/4 inch thick for fixed shelves, dividers, and cubicle compartments.
6. Cabinet body exterior surfaces: High Pressure Laminate
a.Color: As selected from manufacturer's standards
7. Cabinet body interior surfaces: Thermofused melamine
a.Color: As selected from manufacturer's standards
8. Cabinet body front edge: Nominally 3 mm thick PVC.

9. Cabinet body mounting: 3/4 inch thick stretchers, concealed by cabinet back.
10. Exposed laminate back panels: Finished 3/4 inch thick back panel when cabinet rear is exposed.
11. Cabinet backs: 1/2 inch thick, surfaced both sides, fully captured on both sides and bottom.
12. Stretchers:
    a. ¾ inch thick lower stretchers located behind back panel.
    b. ¾ inch thick intermediate stretchers located behind back panel.
13. Adjustable shelf hole pattern: 5 mm diameter holes spaced 1-1/4 inches on center for mounting adjustable shelves, hardware mounting, and replacement and relocation of cabinet components.
14. Intermediate shelves: Fixed.

C. Base Cabinet Construction:
1. Sub-top: Solid 3/4 inch thick sub-top except at sink cabinets.
2. Split removable back panels for sink cabinets.

D. Wall Cabinet Construction:
1. Wall cabinets over 36 inches in width: Fixed intermediate partition.
2. Exterior bottoms: Match standard interior.

E. Tall and Wall Cabinet Top Edges: Raw top edges.

F. Tall, Wall, and Hutch Cabinet Exterior Top Finish: Match standard interior.

G. Door Reveals:
1. Between doors and drawers: 3 mm.
2. Above drawer, base, wall, tall, and hutch doors: 3 mm.

H. Cabinet Toe Bases:
1. Material: Particleboard, moisture resistant
2. Height:102 mm, Recessed.
3. Type: Attached unless otherwise noted.

I. Drawer Fronts and Solid Doors: Surfaced on both sides.
1. Component materials: HPL door interior and exterior; both sides match front surface color.
2. Surfaces: High Pressure Laminate
   a. Color: As selected from manufacturer’s standards
3. Door and drawer front edges: Nominally 3 mm PVC.

J. Drawer Boxes:
1. Material: Particleboard, moisture resistant
2. Core thickness: 1/2 inch thick.
3. Construction: Non-racking, non-deflecting platform bottom carried by bottom mount drawer slides on non-file drawers and side-mounted ball bearing slides on file drawers.
4. Drawer boxes with finished interiors: Surface to match standard interior.
5. Sides, backs, sub-fronts, and bottoms: 1/2 inch thick.
6. Top edges: Nominal 1 mm PVC, matching drawer color.
7. Box corners: Joined with hardwood dowels and glue.
8. Horizontal parting rails between drawers: 3/4 inch thick core, balanced surfaces.
9. File drawer box construction: Full height sides supporting heavy duty support rail.

K. Cabinet Doors:
1. Construction: Solid doors, 3/4 inch thick core.

L. Shelves:
1. Adjustable shelves: Finished on both sides.
   a. Core material: Particle board
   b. Thickness: 1 inch
   c. Edges: 0.2 matching edging
   d. Shelf surfaces in cabinets: Match cabinet interior
   e. Setback for adjustable shelves: 15 mm from front.
   f. Color: As selected from manufacturer's standards

2. Fixed shelves:
   a. Thickness: 1 inch
   b. Edges: 0.2 matching edging
   c. Shelf surfaces cabinets: Match interior.
   d. Wire shelves: White, plastic coated.

M. Solid Surface Countertops:
1. Surfacing: Solid Surface sheet material
   a. Basis of Design: Wilsonart
   b. Composition: Acrylic resins, fire-retardant mineral fillers, and proprietary coloring agents.
   c. Through-the-body color for full thickness of sheet material.
2. Material Thickness: 1 1/2 inch
3. Surface Burning Characteristics: Class 1 and Class A; ASTM E84
4. Backsplashes: 4 inches high, thickness to match countertop thickness.
5. Joint Adhesive: Methacrylate-based adhesive for chemically bonding solid surfacing seams. Color complementary to solid surfacing sheet material. UL 2818 GREENGUARD Gold certified and complies with SCAQMD Rule 1168.
   1. Product: "Wilsonart Hard Surface Adhesive."
6. Elastomeric Sealant: Mildew-resistant silicone sealant for filling gaps between countertops and terminating substrates in wet environment applications. Complies with ASTM C 920, Type S (single component), Grade NS (nonsag).
   1. Product: Acceptable to countertop manufacturer.

2.4 ACCESSORIES

A. Hardware:
1. Hinges: Concealed type, nickel plated, self-closing, minimum Grade 2 per ANSI/BHMA A156.9; two hinges for doors up to 48 inches high; three hinges for doors from 49 to 66 inches high; four hinges f\or doors 67 inches and higher.
2. Pulls: 4" Anodized aluminum wire type.
   a.Horizontal mount on drawers, Vertical mount on doors.
3. Drawer slides:
   a. Standard drawers: Self-closing, bottom mount, epoxy coated, 100 pound rated, minimum Grade 1 per ANSI/BHMA A156.9.
   b. File drawers: Full extension, side mount, 100 pound rated, minimum Grade 1 per ASNI/BHMA A156.9.
4. Wall shelving hardware:
   a. Design: Heavy-duty wall shelving hardware.
   b. Finish: Anochrome.
   c. Shelf clips: Injection molded clear plastic, AWI 400-B-T-9, double pin type except single pin type with anti-tip locking tabs at hardboard shelves.
   d. Adjustable shelf clips: AWI 400-B-T-9; double pin type except single pin type with anti-tip locking tabs at hardboard shelves.

5. Locks:
   a. Locations: As indicated on Drawings.
   b. Type: Dead bolt style.
   c. Keying: Key locks differently by room and master key, provide 2 keys per lock and 6 master keys.
   d. Lock cores: Removable, except at five pin locks.

6. Catches:
   a. Elbow catches: Chrome plated.
   b. Roller catches: Heavy-duty, spring-loaded.
   c. Magnetic catches: White plastic housing.
   d. Catch types:
      1) Magnetic at base and wall cabinets
      2) None for concealed hinges at base, wall and tall cabinets.
7. Countertop Supports: Concealed steel bracket.
   a. Powder coated black, edges rounded for safety
   b. Heavy Duty

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved Shop Drawings.

.

END OF SECTION

SECTION 21 05 00
COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, fittings, sleeves, escutcheons, seals, and connections for sprinkler systems.

B. Incoming fire service backflow preventer.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 09 9123 - Interior Painting: Preparation and painting of interior fire protection piping systems.

C. Section 21 0523 - General-Duty Valves for Water-Based Fire-Suppression Piping.

D. Section 21 0553 - Identification for Fire Suppression Piping and Equipment: Piping identification.

E. Section 21 1200 - Fire-Suppression Standpipes: Standpipe design.

F. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

1.03 REFERENCE STANDARDS

A. ASME A112.18.1 - Plumbing Supply Fittings 2018, with Errata.

B. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fuzing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.

C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250 2015.

D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2016.

E. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250 2016.

F. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard 2017.

G. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings 2018.

H. ASME B16.11 - Forged Fittings, Socket-welding and Threaded 2016 (Errata 2017).

I. ASME B16.25 - Buttwelding Ends 2017.

J. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2018).

K. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.

L. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe 2021.

M. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.

N. ASTM A536 - Standard Specification for Ductile Iron Castings 1984 (Reapproved 2014).

O. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40 2017.

P. ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80 2019.

Q. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR) 2019.

R. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings 2014.

S. AWS D1.1/D1.1M - Structural Welding Code - Steel 2015, with Errata (2016).

T. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems 2010.

U. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings 2012.

V. AWWA C606 - Grooved and Shouldered Joints 2015.

W. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

X. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems 2019.

Y. UL (DIR) - Online Certifications Directory Current Edition.

1.04 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
   1. NFPA 13 - Standard for the Installation of Sprinkler Systems
   2. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems
   3. NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection

B. Delegated Design: Engage a qualified Fire Protection professional engineer, as defined in Section 014000 "Quality Requirements," to design project sprinkler systems. Base calculations on results of fire-hydrant flow test. Flow test shall be performed within one year of construction start.

C. Hydraulic Design Criteria: Sprinkler system design shall be approved by authorities having jurisdiction, Owner's Insurance Underwriter (where applicable) and shall be designed according to the following:
   1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers, or 10 psi, whichever is greater.
   2. Sprinkler Occupancy Hazard Classifications: Refer to Drawings.
   3. Minimum Density for Automatic-Sprinkler Piping Design: Refer to Drawings.
   4. Maximum Protection Area per Sprinkler: According to the latest NFPA 13 standard, UL listing and as specified on Drawings.
   5. Total Combined Hose-Stream Demand Requirement: According to latest NFPA 13 standard unless otherwise indicated on drawings.
   6. Water velocity in the piping system shall not exceed the following:
      a. Underground mains: 16 ft/sec.
      b. Aboveground mains: 32 ft/sec.
      c. Sprinkler branch lines: 20 ft/sec.
   7. Water supply noted on the drawings. If not, Contractor shall make flow test to ascertain water flow.

1.05 SUBMITTALS

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

B. Delegated-Design Submittal: For all sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Shop Drawings and Hydraulic Calculations:
      a. Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals.

b. Indicate installation, layout, weights, mounting and support details, and piping connections.
c. Layout and name (or number) of each room repeated as shown on the Architect's/Engineer's plans.
d. Reflected ceiling plan for each area showing location of partition walls, ceiling grid lines, ceiling light fixtures; proposed location of all fire sprinler heads; and size and location of all piping. Shop drawings shall clearly identify any areas proposed to be protected with "dry type" systems and "anti-freeze type" systems and shall identify sprinkler heads rated for discharge at temperatures other than 165 degrees F.
e. Shop drawings shall be submitted to the Architect/Engineer, AHJ and Owner's Insurance Underwiter (where applicable) for review and approval.

C. Product Data: For each type of product.
1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each fire-department or pump test header connection.
3. Grooved joint couplings and fittings shall be shown on drawings and product submittals, and be specifically identified with the applicable Victaulic style number.

D. Shop Drawings, Product Data and Hydraulic calculations shall be reviewed as one package; review of submittals shall not start until Engineer has all product data, hydraulic calculations and shop drawings.

1.06 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:
1. Provide fire protection work per the mandatory code requirements, standards of NFPA, and the requirements of the Owner's Insurance Underwriter, where applicable, except where more stringent requirements are indicated, as modified and supplemented by the Contract Documents. The NFPA requirements include the appendices and supplements.
2. The provisions and recommendations of the NFPA constitute mandatory minimum requirements for work specified herein. No payment will be made by the Owner for extra charges for work added in order to comply with NFPA Standards and Owner's Insurance Underwriter requirements, where applicable.

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

C. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
1. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified Fire Protection engineer.

D. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
1. All castings used for couplings housings, fittings, or valve and specialty bodies shall be date stamped for quality assurance and traceability.

E. Comply with UL (DIR) requirements.

F. Valves: Bear UL (DIR) product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.

G. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

H. Pipe: Each length of pipe shall be legibly identified at mill by paint, stenciling or raised symbols identifying manufacturer and class type or schedule of pipe. Copper pipe shall be identified at 3

foot intervals.

I. Fittings: To be identified by manufacturer by permanently attached tags, imprints or other approved means indicating class of wall thickened and material.

1.07 DEVIATIONS FROM BASIS OF DESIGN MANUFACTURER

A. Should the Division 23 Contractors submit equipment by a Manufacturer other than that indicated as the Basis of Design on the Drawings, Contractor shall then be responsible for evaluating the impacts of the proposed Manufacturer's equipment, even if the Manufacturer is listed in the specifications as an approved equal. This includes the proposed Manufacturer's electrical, architectural and structural requirements and their subsequent impacts on the current design (roof openings, curbs, structural support, etc.) and coordination of any differing dimensions and clearances with all other trades.

1.08 FIELD CONDITIONS - RENOVATION PROJECTS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:
   1. Notify Architect & Construction Manager no fewer than five days in advance of proposed interruption of sprinkler service.
   2. Do not proceed with interruption of sprinkler service without Architect's and Construction Manager's written permission.

1.09 DELIVERY, STORAGE AND HANDLING

A. Deliver and store valves in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 PRODUCTS

2.01 FIRE PROTECTION SYSTEMS

A. Sprinkler Systems: Comply with NFPA 13.

B. Standpipe and Hose Systems: Comply with NFPA 14.

C. Welding Materials and Procedures: Comply with ASME BPVC-IX.

2.02 BURIED PIPING

A. Steel Pipe: ASTM A53/A53M Schedule 40 or ASTM A135/A135M Schedule 10, black, with AWWA C105/A21.5 polyethylene jacket, or double layer, half-lapped polyethylene tape.
   1. Steel Fittings: ASME B16.9, wrought steel, buttwelded, ASME B16.25, buttweld ends, ASTM A234/A234M, wrought carbon steel or alloy steel, ASME B16.5, steel flanges and fittings, or ASME B16.11, forged steel socket welded and threaded; with double layer, half-lapped polyethylene tape.
   2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings.
   3. Joints: Welded in accordance with AWS D1.1/D1.1M.
   4. Casing: Closed glass cell insulation.

B. Ductile Iron Pipe: AWWA C151/A21.51.
   1. Fittings: AWWA C110/A21.10, standard thickness.
   2. Joints: AWWA C111/A21.11, styrene butadiene rubber (SBR) or vulcanized SBR gasket.
   3. Mechanical Couplings: Shaped composition sealing gasket, steel bolts, nuts, and washers.

2.03 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A53 Schedule 40 or ASTM A135/A135M Schedule 10, black.

1. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
2. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.
3. Ductile iron Fittings: ASTM A536, Grade 65-45-12. In applicable sizes, fittings shall be short pattern, with flow equal to standard pattern fittings.
   a. Basis of Design: Victaulic FireLock.
4. Mechanical Grooved Couplings: Two ductile iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, ASTM A449 compliant steel bolts, nuts; galvanized for galvanized pipe.
   a. Rigid Type: Housings cast with offsetting, angle-pattern, bolt pads to provide system rigidity and support and hanging in accordance with NFPA-13, fully installed at visual pad-to-pad offset contact. Couplings that require exact gapping at specific torque ratings are not permitted.
      1) Installation-Ready for complete installation without field disassembly.
      2) Basis of Design: Victaulic Style 009N and 107N.
   b. Flexible Type: For use in locations where vibration attenuation and stress relief are required.
      1) Basis of Design: Victaulic Installation-Ready Style 177 or Style 77.
   c. Installation-Ready gaskets are center-leg, with pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth.
5. Installation-Ready fittings for Schedule 40 & 10 grooved end steel piping in fire protection applications sizes NPS 1-¼ thru 2½ (DN 32 thru DN 65). Fittings shall consist of a ductile iron housing conforming to ASTM A-536, Grade 65-45-12, with Installation-Ready ends, orange enamel coated, red enamel coated or galvanized. Fittings complete with prelubricated Grade “E” EPDM Type ‘A’ gasket; and ASTM A449 electroplated steel bolts and nuts. System shall be UL listed for a working pressure of 300 psi (2065 kPa) and FM approved for working pressure 365 psi (2517kPa).
6. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.

B. CPVC Pipe (for Residential NFPA 13R applications only): ASTM F442/F442M, SDR 13.5.
   1. Fittings: ASTM F438 Schedule 40, or ASTM F439 schedule 80, CPVC.
   2. Joints: Solvent welded, using ASTM F493 cement.

2.04 PIPE SLEEVES

A. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.

B. Plastic, Sheet Metal, or Moisture-Resistant Fiber: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. Pipe Passing Through Below Grade Exterior Walls:
   1. Zinc coated or cast iron pipe.
   2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

D. Pipe Passing Through Quarry Tile, Terrazzo, or Ceramic Tile Floors:
   1. Brass pipe.
   2. Connect sleeve with floor plate.

E. Pipe Passing Through Concrete Beam Flanges, except where Brass Pipe Sleeves are Specified:
   1. Galvanized steel pipe or black iron pipe with asphalt coating.
   2. Connect sleeve with floor plate except in mechanical rooms.

F. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:
   1. Galvanized steel pipe or black iron pipe with asphalt coating.
   2. Connect sleeve with floor plate except in mechanical rooms.

G. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
   3. Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.

2.05 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Modular/Mechanical Seal:
   1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
   2. Provide watertight seal between pipe and wall/casing opening.
   3. Elastomer element size and material in accordance with manufacturer's recommendations.

2.06 ESCUTCHEONS

A. Material:
   1. Metals and Finish: Comply with ASME A112.18.1.

B. Construction:
   1. One-piece for mounting on chrome-plated tubing or pipe and one-piece or split-pattern type elsewhere.
   2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.07 PIPE HANGERS AND SUPPORTS

A. Supporting Elements: provide UL/FM components per NFPA 13, ANSI B 31.1 and MSS SP-58 except that "C" clamps or any modification thereof are unacceptable.
   1. "C" clamps: With set screw, locknut and restraining strap are acceptable for piping up to 2-1/2".

B. Furnish necessary piping and equipment supporting elements including; building structure attachments; supplementary steel; hanger rods, stanchions and fixtures; vertical pipe attachments; horizontal pipe attachments; anchors; guides.

C. Center Loading Beam Clamps: For attachments to building structure as approved except piping supported from top of steel.

2.08 MECHANICAL COUPLINGS

A. Manufacturers:
   1. Tyco Fire Protection Products: www.tyco-fire.com/#sle.
   2. Victaulic Company: www.victaulic.com/#sle.
   3. Anvil/Gruvlok: www.anvilintl.com
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Rigid Mechanical Couplings for Grooved Joints:
   1. Dimensions and Testing: Comply with AWWA C606.
   2. Minimum Working Pressure: 300 psig.
   3. Housing Material: Fabricate of ductile iron complying with ASTM A536.
   4. Gasket Material: EPDM-HP suitable for operating temperature range from minus 30 degrees F to 250 degrees F.
   5. Bolts and Nuts: Hot dipped galvanized or zinc electroplated steel.

C. Only use grooved coupling as permitted by NFPA 13 and NFPA 14.

2.09 INCOMING FIRE SERVICE BACKFLOW PREVNTER

A. A backflow preventer assembly shall be installed on fire protection systems when connected to a drinking water supply. Degree of hazard present and type of incoming service backflow peventer shall be coordinated with the Authority Having Jurisdiction.

B. Double Check Detector Assembly
   1. ASSE 1048, UL 1469, AWWA C510-92: The main valve body shall be manufactured from 300 Series stainless-steel to provide corrosion resistance, 100% lead free* through the waterway. The double check detector assembly consists of two independently operating, spring loaded check valves, two UL, FM, OSY resilient seated gate valves, and bypass assembly. The bypass assembly consists of a meter, a double check including shutoff valves and required test cocks. Each cam-check shall be internally loaded and provide a positive drip tight closure against reverse flow. Cam-check includes a stainless-steel cam arm and spring, rubber faced disc and a replaceable seat. There shall be no brass or bronze parts used within the cam-check valve assembly. The check valve seats shall be of molded thermoplastic construction. The use of seat screws as a retention method is prohibited. All internal parts shall be accessible through a single cover on the valve assembly. The valve cover shall be held in place through the use of a single grooved style two-bolt coupling. The bypass line shall be hydraulically sized to accurately measure low flow. The bypass line shall consist of a meter, a small diameter double check assembly with test cocks and isolation valves. The bypass line double check valve shall have two independently operating modular poppet check valves, and top mounted test cocks.
   2. May be installed horizontal or vertical "flow up" position.
   3. Basis of Design: Ames Series 3000SS

PART 3 EXECUTION

3.01 FIRE SUPPRESSION PIPING APPLICATIONS

A. CPVC pipe, Schedule 40 or Schedule 80 CPVC fittings, and solvent-cemented joints may be used for residential occupancies ONLY.

B. Standard-pressure, wet-pipe sprinkler system, NPS 2 (DN 50) and smaller, shall be one of the following:
   1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
   2. Schedule 40, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
   3. Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.

C. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 (DN 65) and larger, shall be one of the following:
   1. Schedule 40, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
   2. Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.
   3. Schedule 10, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
   4. Schedule 10, black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
   5. Schedule 10, black-steel pipe with plain ends; welding fittings; and welded joints.

D. High-pressure, wet-pipe sprinkler system, shall be one of the following:
   1. Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel or groove plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions. Unions or flanges for servicing and disconnect are not required in installations using grooved joint couplings.

3.03 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.

B. Install standpipe piping, hangers, and supports in accordance with NFPA 14.

C. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

D. Install piping to conserve building space, to not interfere with use of space and other work.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Pipe Hangers and Supports:
   1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   2. Place hangers within 12 inches of each horizontal elbow.
   3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   6. Provide copper plated hangers and supports for copper piping.

H. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

I. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

J. Structural Considerations:
   1. Do not penetrate building structural members unless indicated.

K. Provide sleeves when penetrating footings, floors, and walls. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

L. 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.

M. Escutcheons:
   1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
   2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
   3. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.

N. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

O. Grooved joints shall be installed in accordance with the manufacturer's latest published instructions. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service. Gaskets shall be molded and produced by the grooved coupling manufacturer. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Grooved coupling manufacturer's factory trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products. Factory trained representative shall periodically visit the jobsite to ensure best practices in grooved product installation are being followed. Contractor shall remove and replace any improperly installed products.

P. Where pipes are in partitions, furred out spaces and chases, obtain information as to their exact location and size and install work so as to be entirely concealed in allotted space. If conflicts arise making this impossible, obtain instructions from Architect before proceeding with work.

Q. Where there is evidence that parts of fire protection work will interfere with other work, assist in working out space conditions and/or structure, make necessary adjustments to accommodate work.

R. Fire protection work installed before coordinating with other work so as to cause interference with other work to be changed to correct such condition without additional cost to Owner.

S. Accessibility:
   1. Install fire protection work to permit removal (without damage to other parts) of coils, heat exchangers, pumps, fan shafts and wheels, belt guards, sheaves and drives and other parts requiring periodic replacement or maintenance.
   2. Arrange pipes and equipment to permit ready access to valves, cocks, traps, starters, motors, dampers, control components and to clear openings of swinging and overhead doors and of access panels.

T. When necessary to install "U"-shaped dip in a pipe due to a conflict with duct work or other building components, Contractor shall install a ¾" diameter hose nipple and cap pointing down at lowest point in pipe dip. Contractor shall try to arrange piping layout to avoid such dips; no such dip shall be installed without prior approval of Engineer. All such conditions shall be clearly located and noted on record drawings given to Owner.

U. When necessary to install inverted "U" in branch piping to rise above an obstruction, Contractor shall install an upright ¾" diameter air vent nipple and cap at high point of inverted "U". Contractor shall try to arrange piping layout to avoid such high points; no such installation shall be made without approval of Engineer. All such conditions shall be clearly located and noted on record drawings given to Owner.

V. Contractor shall provide Owner with at least 24 hours prior notice before commencing sprinkler installations. Owner shall be responsible for deactivating building alarm system and notifying local fire department or other agencies. Under no circumstances shall Contractor attempt to deactivate building alarm system or circumvent any valve tamper switch. Contractor shall perform all work during normal business hours. By the end of each working day, Contractor shall cap all pipe ends.

W. Pressure test completed work in progress, repair any leaks and otherwise make the sprinkler system water tight so that fire alarm and sprinkler protection system can be reactivated by Owner during non-business hours.

3.04 SOUND CONTROL

A. Penetrations shall be maintained airtight to prevent sound transfer.

B. Piping shall pass through sleeves. Pack sleeves tight with glass fiber or oakum and caulked on both sides with non-hardening acoustical sealant.

3.05 CLEANING

A. Flush entire piping system of foreign matter in accordance with NFPA 13.

B. Upon completion of work, clean all parts of the installation.

C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

3.06 TESTING AND ACCEPTANCE

A. After completing branch system, Contractor shall test fire sprinkler piping hydrostatically for a period of two hours at not less than 200 psi or at 50 psi in excess of the maximum operating static pressure when the maximum static pressure exceeds 150 psi. Contractor shall check system for leakage of joints and measure hydrostatic pressure at low point of each system or zone being tested.

B. The Contractor shall repair or replace piping and fittings as required to eliminate leakage (in accordance with NFPA standards for “little or no leakage”) and retest as specified to demonstrate compliance.

C. Upon satisfactory completion and testing of branch piping system, Contractor shall provide Owner with a letter certifying that branch piping system has been completed in accordance with NFPA 13 and is operational, complete and has no defects.

D. Test shall be witnessed by Architect/Owner and any authorities having jurisdiction who may so require.

END OF SECTION

SECTION 21 05 23
DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Bronze butterfly valves with indicators.

B. Iron butterfly valves with indicators.

C. Check valves.

D. Bronze OS&Y gate valves.

E. Iron OS&Y gate valves.

F. Trim and drain valves.

1.02 RELATED REQUIREMENTS

A. Section 21 0500 - Common Work Results for Fire Suppression: Pipe and fittings.

B. Section 21 0553 - Identification for Fire Suppression Piping and Equipment.

C. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

D. Section 28 4600 - Fire Detection and Alarm.

1.03 ABBREVIATIONS AND ACRONYMS

A. EPDM: Ethylene-propylene diene monomer.

B. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

C. NRS: Non-rising stem.

D. OS&Y: Outside screw and yoke.

E. PTFE: Polytetrafluoroethylene.

F. SBR: Styrene-butadiene rubber.

1.04 REFERENCE STANDARDS

A. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fuzing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.

B. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL (DIR) - Online Certifications Directory Current Edition.

1.05 SUBMITTALS

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

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   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. Where listed products are specified, provide products listed, classified, and labeled by UL (DIR) or testing firm acceptable to authorities having jurisdiction as suitable for the purpose indicated.

C. Welding Materials and Procedures: Comply with ASME BPVC-IX.

D. Grooved end valves shall be of the same manufacturer as the adjoining couplings.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Comply with NFPA 13 for valves.

B. Valve Pressure Ratings: Not less than minimum pressure rating indicated or higher as required.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:
   1. Worm-gear actuator with handwheel for quarter-turn valves, except trim and drain valves.
   2. Handwheel: For other than quarter-turn trim and drain valves.
   3. Hand-lever: For quarter-turn trim and drain valves 2 NPS and smaller.

2.02 BRONZE BUTTERFLY VALVES WITH INDICATORS

A. Minimum Pressure Rating: 175 psig.

B. Body Material: Bronze.

C. Seat: EPDM.

D. Stem: Bronze or stainless steel.

E. Disc: Bronze with EPDM coating.

F. Actuator: Worm gear or traveling nut.

G. Supervisory Switch: Internal or external.

2.03 IRON BUTTERFLY VALVES WITH INDICATORS

A. Minimum Pressure Rating: 300 psig.

B. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.

C. Seat: Pressure-responsive EPDM.

D. Stem: Stainless steel, offset from the disc centerline to provide complete 360-degree circumferential seating.

E. Disc: Ductile iron, electroless-nickel plated.

F. Actuator: Weatherproof actuator housing with worm gear or traveling nut.

G. Supervisory Switch: Internal or external.

H. Body Design: Grooved-end connections.
   1. Basis of Design: Victaulic Series 705.

2.04 CHECK VALVES

A. Minimum Pressure Rating: 250 psig.

B. Type: Center guided or spring-assisted swing check valve for vertical or horizontal installation.

C. Body Material: Cast iron, ductile iron.

D. Center guided check with elastomeric seal or elastomer coated disc.

E. Hinge Spring: Stainless steel.

F. End Connections: Flanged, grooved, or threaded.
   1. Basis of Design: Victaulic Series 717.

2.05 BRONZE OS&Y GATE VALVES

A. Minimum Pressure Rating: 175 psig.

B. Body and Bonnet Material: Bronze or brass.

C. Wedge: One-piece bronze or brass.

D. Wedge Seat: Bronze.
E. Stem: Bronze or brass.
F. Packing: Non-asbestos PTFE.
G. Supervisory Switch: External.
H. End Connections: Threaded.

2.06 IRON OS&Y GATE VALVES

A. Minimum Pressure Rating: 250 psig.
B. Body and Bonnet Material: Cast or ductile iron.
C. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
D. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
E. Stem: Brass or bronze.
F. Packing: Non-asbestos PTFE or EPDM.
G. Supervisory Switch: External.
H. End Connections: Flanged or grooved ends.
   1. Basis of Design: Victaulic Series 771.

2.07 TRIM AND DRAIN VALVES

A. Ball Valves:
   1. Description:
      a. Pressure Rating: 175 psig.
      b. Body Design: Two piece.
      c. Body Material: Forged brass or bronze.
      d. Port Size: Full or standard.
      e. Seat: PTFE.
      f. Stem: Bronze or stainless steel.
      g. Ball: Chrome-plated brass.
      h. Actuator: Hand-lever.

PART 3 EXECUTION

3.01 EXAMINATION

A. Confirm valve interior to be free of foreign matter and corrosion.
B. Remove packing materials.
C. Examine guides and seats by operating valves from the fully open position to the fully closed position.
D. Examine valve threads and mating pipe for form and cleanliness.
E. Examine grooved ends for form and cleanliness. Ends shall be clean and free from indentations and projections, and roll marks in the area from valve end to (and including) the groove.

3.02 INSTALLATION

A. Comply with specific valve installation requirements and application in all applicable Division 21 Sections.
B. Install listed fire protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections.
   1. Install permanent identification signs indicating portion of system controlled by each valve.
C. Provide drain valves plugged with hose adapter with cap and chain at main shut off valves, low points of piping and any apparatus. Drain valve to be size ¾” minimum.

D. Provide OS&Y gate valves for shut-off or isolating services. Valves to have OS&Y tamper monitor switch as required by NFPA or where indicated on drawings.

E. Where approved, butterfly valves may be used instead of gate valves. Valves to have tamper monitor switch as required by NFPA or where indicated on drawings.

F. In addition to tamper monitor switches (only if required by Owner or local authorities), provide each control valve with approved padlock and chain. All padlocks shall be keyed alike

G. Provide hand wheels for gate valves.

H. Valves with threaded connections to have unions at equipment arranged for easy access, service, maintenance, and equipment removal without system shutdown.

I. Valves in horizontal piping installed with stem at or above the pipe center.

J. Position valves to allow full stem movement.

K. Install valve tags. Comply with Section 21 0553 requirements for valve tags, schedules, and signs on surfaces concealing valves; and the appropriate NFPA standard applying to the piping system in which valves are installed.

END OF SECTION

SECTION 21 05 53
IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

1.02 SUBMITTALS

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

B. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Control Panels: Nameplates.

B. Pumps: Nameplates.

C. Valves: Nameplates.

2.02 NAMEPLATES

A. Manufacturers:
   1. Brimar Industries, Inc: www.pipemarker.com/#sle.
   2. Kolbi Pipe Marker Company: www.kolbipipemarkers.com/#sle.
   3. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: Laminated three-layer plastic with engraved letters.

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.

END OF SECTION

SECTION 21 12 00
SUPPRESSION STANDPIPES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Valves.

B. Fire department connections.

1.02 RELATED REQUIREMENTS

A. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance (O&M) data, warranties and bonds.

B. Section 21 0500 - Common Work Results for Fire Suppression: Fire protection piping.

C. Section 21 0523 - General-Duty Valves for Water-Based Fire-Suppression Piping.

D. Section 21 0553 - Identification for Fire Suppression Piping and Equipment.

1.03 REFERENCE STANDARDS

A. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems 2019.

B. NFPA 1963 - Standard for Fire Hose Connections 2019.

C. UL 405 - Fire Department Connection Devices Current Edition; Including All Revisions.

D. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's catalog sheet for equipment indicating rough-in size, finish, and accessories.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with NFPA 14. Maintain one copy on site.

1.06 WARRANTY

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

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 VALVES

A. Specialty Valves:
   1. Hose Connection Valve:
      a. Angle type; brass finish; 2-1/2 NPS, thread to match fire department hardware, 300 psi working pressure, with threaded cap and chain of same material and finish.

B. Hose Connection Valve Cabinets:
   1. Style: Recessed mounted.
   2. Tub: 16 gage, 0.0598 inch thick steel, prepared for pipe and accessory rough-in.
   3. Door: 12 gage, 0.1046 inch thick steel, flush, glazed with 1/4 inch (6.35 mm) thick wired glass full panel; hinged, positive latch device.
   4. Finish: Prime coated.

2.02 FIRE DEPARTMENT CONNECTIONS

A. Type: Free standing made of corrosion resistant metal complying with UL 405.
   1. Manufacturers:
      a. Elkhart Brass Manufacturing Company, Inc; _____: www.elkhartbrass.com/#sle.
      b. Fire End & Croker Corporation; _____: www.croker.com/#sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.

2. Inlets: Two way, 2-1/2 inch swivel fittings, internal threaded. Thread size and inlets according to NFPA 1963 or Authority Having Jurisdiction. Brass caps with gaskets, chains, and lugs.
3. Rated Working Pressure: 175 psi.
4. Finish: Chrome.
5. Sleeve: Brass, 18 inches height.
6. Signage: Raised or engraved lettering 1 inch minimum indicating system type.

B. At the low point near each fire department connection, install a 90-degree elbow with drain connection to allow for localized system drainage to prevent freezing.
1. Basis of Design: Victaulic #10-DR.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NFPA 14.

C. Connect standpipe system to water source ahead of domestic water connection.

D. Flush entire system of foreign matter.

3.02 FIELD QUALITY CONTROL

A. Test entire system in accordance with NFPA 14.

B. Test shall be witnessed by Fire Marshal.

END OF SECTION

SECTION 21 13 00
SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wet-pipe sprinkler system.

B. Dry-pipe sprinkler system.

C. System design, installation, and certification.

1.02 RELATED REQUIREMENTS

A. Section 21 0500 - Common Work Results for Fire Suppression: Pipe and fittings.

B. Section 21 0523 - General-Duty Valves for Water-Based Fire-Suppression Piping.

C. Section 21 0553 - Identification for Fire Suppression Piping and Equipment.

D. Section 21 1200 - Fire-Suppression Standpipes: Fire Department Connections.

1.03 REFERENCE STANDARDS

A. ITS (DIR) - Directory of Listed Products current edition.

B. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

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

B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Sprinklers shall be referred to on drawings, submittals and other documentation, by the sprinkler identification or Model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
   3. Sprinkler Wrenches: For each sprinkler type.

E. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

1.05 QUALITY ASSURANCE

A. Comply with UL (DIR) requirements.

B. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

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

D. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
   1. All castings used for couplings housings, fittings, or valve and specialty bodies shall be date stamped for quality assurance and traceability.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sprinklers, Valves, and Equipment:
   1. Victaulic Company: www.victaulic.com
   2. Viking Corporation: www.vikinggroupinc.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for building areas noted.

B. Occupancy: Refer to Schedule on Drawings.

C. Water Supply: Determine volume and pressure from water flow test data.

D. Interface system with building fire and smoke alarm system.

E. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

2.03 SPRINKLERS

A. Sprinklers shall be glass bulb type, with hex shaped wrench boss integrally cast into the sprinkler body to reduce the risk of damage during installation.
   1. Wrenches shall be provided by the sprinkler manufacturer that directly engage the hex-shaped wrench boss integrally cast in the sprinkler body.

B. Suspended Ceiling Type: Concealed pendant type with matching push on escutcheon plate.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Fusible Link: Glass bulb type temperature rated for specific area hazard.
      a. Basis of Design: Victaulic Model V38.

C. Exposed Area Type: Pendant type with guard.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Fusible Link: Glass bulb type temperature rated for specific area hazard.
      a. Basis of Design: Victaulic Model V27.

D. Sidewall Type: Semi-recessed horizontal sidewall type with matching push on escutcheon plate.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Fusible Link: Glass bulb type temperature rated for specific area hazard.

E. Flexible Drop System: Stainless steel, multiple use, open gate type.
   1. Application: Use to properly locate sprinkler heads.
   2. Include all supports and bracing.
   3. Provide braided type tube as required for the application.
   4. The drop system shall consist of a braided type 304 stainless steel flexible tube, zinc plated steel Male threaded nipple or Victaulic FireLock IGS Groove Style 108 coupling for connection to branch-line piping, and a zinc plated steel reducer with a female thread for connection to the sprinkler head.
   5. The drop shall include a UL approved Series AH1 with 3” bend radius; AH2 or AH2-CC braided hose with a bend radius to 2” to allow for proper installation in confined spaces.
   6. The flexible drop shall attach to the ceiling grid using a one-piece open gate Series AB1 or AB2 bracket. The bracket shall allow installation before the ceiling tile is in place.
   7. Manufacturers:
      a. Victaulic Company; Victaulic VicFlex™ Multiple-Use Flexible Stainless Steel Sprinkler Drop System [with captured coupling Style 108].
      b. Substitutions: See Section 01 6000 - Product Requirements.

8. In lieu of rigid connections to dry sprinkler heads, a Victaulic VicFlex™ dry sprinkler, Model VS1, may be used. The sprinkler shall provide a vertical or horizontal flexible connection with a bend radius to 2", and allow for up to 4 bends
9. In lieu of rigid pipe offsets or return bends for sprinkler drops in wet, dry, and preaction systems in cold storage applications, the Victaulic VicFlex™ V33, V36, or V40 Dry Sprinkler with Integral AB6 Assembly may be used.
10. In lieu of threaded steel piping systems, the Victaulic FireLock IGS System with "Installation-Ready™ fittings and couplings may be used for NPS 1 (DN 25) Schedule 10 and Schedule 40 carbon steel pipe in fire protection applications. System rated for a working pressure to 365 psi (2517 kPa).
    a. Groove: IGS "Innovative Groove System" groove with shortened "A" dimension and tapered groove backside for ease of installation.
    b. Grooving Tool: Victaulic RG2100, with IGS Confirmation Gauge.
    c. Victaulic V9 sprinkler heads may be used in direct substitution where applicable.

2.04 PIPING SPECIALTIES

A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm, pressure retard chamber and variable pressure trim with the following additional capabilities and features:
    1. Activate electric alarm.
    2. Test and drain valve.
    3. Replaceable internal components without removing valve from installed position.
    4. Manufacturers:
        a. Victaulic Company; Series 751 with Series 760 motor alarm: www.victaulic.com/#sle.
        b. Substitutions: See Section 01 6000 - Product Requirements.

B. Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm, accelerator, and with the following additional capabilities and features:
    1. Activate electric alarm.
    2. Test and drain valve.
    3. Externally resettable.
    4. Replaceable internal components without removing valve from installed position.
    5. Required air pressure shall be 13-psi (90-kPa).
    6. Manufacturers:
        a. Victaulic Company; Series 768N- NXT: www.victaulic.com/#sle.
        b. Substitutions: See Section 01 6000 - Product Requirements.

C. Riser Manifold Assemblies
    1. Riser Manifold: integral vane type flow switch and test drain assembly with pressure gauge, grooved connections, 250 psi maximum working pressure; all components to be UL listed.
    2. Universal Manifold Check Assembly: Ductile iron construction, incorporating a control valve, check valve, flow switch, adjustable relief valve, and system gauges in one compact body/footprint. The assembly should include the following additional capabilities and features:
        a. Activate electric alarm.
        b. Test and drain assembly with a universal test orifice and adjustable relief valve with a range of 175 to 310 psi.
        c. Replaceable internal components without removing valve from installed position.
        d. Rated for use at the maximum service pressure of 300 psi.
        e. UL Listed and FM Approved.
        f. Manufacturers:

1) Victaulic Company; Model Globe UMC: https://globesprinkler.com/product-detail/umc-floor-control-shotgun-riser-assembly.
2) Substitutions: See Section 01 6000 - Product Requirements.

D. Test Connections:
1. Inspector's Test Connection:
a. Acceptable Manufacturers
1) AFG Manufacturing
2) Elkhart Brass
3) Guardian Fire Equipment Inc.
4) Potter-Roemer
b. UL/FM Cast brass body with spring loaded position indicator with positive shut-off. In-line flow with self-draining, clearable sight glass. Tamper-proof orifice permanently installed. Model 1000 Test and Drain manufactured by AFG Manufacturing Inc.

E. Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.

F. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.

B. Install equipment in accordance with manufacturer's instructions.

C. Locate outside alarm gong on building wall as indicated.

D. Place pipe runs to minimize obstruction to other work.

E. Place piping in concealed spaces above finished ceilings.

F. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.

G. Do not install sprinklers that have been dropped, damaged, show a visible loss of fluid, or a cracked bulb.

H. The sprinkler bulb protector shall be removable by hand, without tools or devices that may damage the bulb.

I. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

J. Flush entire piping system of foreign matter.

K. Hydrostatically test entire system.

L. Require test be witnessed by Fire Marshal.

3.02 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION

SECTION 22 00 05
BASIC PLUMBING REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. This section applies to all sections of Division 22.

B. Drawings and general provisions of the contract, including Division 00 and Division 01 specification sections, apply to work of this section.

C. Provide all items, articles, materials, operations or methods listed, mentioned or scheduled on drawings and/or herein, including all labor, materials, equipment and incidentals necessary and required for their completion.

D. The items in this section are supplementary to the requirements set forth in other portions of the specifications as indicated under item "A" above.

1.02 APPLICATION

A. This section applies to all plumbing work. The contractors involved shall check all sections of the specifications in addition to the particular section covering their specific trade. Each distinct section of the specifications aimed for one trade may have detailed information with regards to other trades, therefore, it is imperative that all sections be reviewed to get a complete picture of all other trades' functions and work required.

B. The plumbing contractor is responsible for the installation and operation of the plumbing systems.

C. The plumbing contractor is responsible for receiving, unloading and placement of all of the owner provided equipment.

1.03 INSPECTION OF SITE

A. Each Contractor shall visit the site prior to bid submission to determine all existing conditions that may affect his work and shall make appropriate allowances for such conditions in his bid. Failure to visit the site shall not be cause for a request for additional compensation later in the project during construction.

B. The submitting of a proposal implies that the contractor has visited the site and understands the conditions under which the work must be conducted.

C. Install Work in locations shown on Drawings, unless prevented by Project conditions.

D. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Owner before proceeding.

1.04 ALTERNATES AND SUBSTITUTIONS

A. Refer to Division 01 - General Requirements for procedures to submit products by a Manufacturer that is not listed as approved equal in the Specifications.

1.05 DEVIATIONS FROM BASIS OF DESIGN MANUFACTURER

A. Products identified wiithin the schedules and details are used as the basis of design for laying out and coordinating with other trades such as structural, architectural, and electrical. Should Division 22 Contractor submit products by a manufacturer other than that indicated as Basis of Design in the Drawings, Contractor shall then be responsible for evaluating the impacts of the proposed Manufacturer's equipment, even if the Manufacturer is listed in the specifications as an approved equal. This includes the proposed Manufacturer's electrical, architectural and structural requirements and their subsequent impacts on the current design and coordination of any differing dimensions and clearances with all other trades. This evaluation shall be included as part of the proposed product submittal.

1.06 MATERIALS

A. Plumbing equipment is to be furnished with motors, electrical controls and protective devices, and integral operating devices which are normally included by the manufacturer or required by the Contract Documents.

B. The Plumbing trades shall provide all control wiring, 120 volts and less, for the equipment and devices furnished under Division 22 of these specifications, including all wiring devices, transformers, conduit, etc. Any conduits used for control wiring shall meet the specifications as indicated in Division 26.

C. Power wiring 120 volts and greater shall be by the Electrical Trades.

1.07 CODES, PERMITS AND FEES

A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for plumbing work shall be secured and paid for by the contractor. All work shall conform to all applicable codes, rules and regulations. Applicable publications listed in all sections of Division 22 shall be the latest issue, unless otherwise noted.

B. Rules of local utility companies and municipalities shall be complied with. Check with the utility company and/or municipality supplying service to the installation and determine all devices including, but not limited to: meters, regulators, valves which will be required and include the cost of all such items in the proposal.

C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.

1.08 MAINTENANCE

A. Provide 8 hours of instruction to the owner's designated personnel in the maintenance and operation of equipment and systems.

B. Provide complete maintenance and operating instructional manuals covering all mechanical equipment herein specified, together with parts lists. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. Manuals shall be submitted in electronic format for review. When approved, four (4) bound hard copies and an indexed electronic PDF shall be provided to the owner. Maintenance and operating instructional manuals shall be provided when construction is approximately 75% complete.

1.09 WARRANTY AND GUARANTEE

A. Contractor shall guarantee all work installed by him or his subcontractors to be free from defect in material and workmanship for a period of one year from date of final acceptance of the work, unless a longer period is stipulated under specific headings. Contractor shall repair or replace at no additional cost to the owner, any material or equipment developing defects and shall also make good any damage caused by such defects or the correction of defects. Repairs or replacements shall bear additional guarantee, as originally called for, dated from the final acceptance of the repair or replacement. This requirement shall be binding even though it will exceed product guarantees normally furnished by some manufacturers. Contractor shall submit his own and each equipment manufacturers written certificates, warranting that each item of equipment furnished complies with all requirements of the drawings and specifications. Note that guarantee shall run from date of final acceptance of the work, not from date of installation of a device or piece of equipment.

1.10 SUBMITTALS

A. Shop drawings and samples shall be submitted in compliance with the Conditions of the Contract and Division 1 General Requirements.

B. Contractor shall provide submittals where items are referred to by symbolic designation on the drawings. All submittals shall bear the same designation (plumbing piping, plumbing fixtures, etc.). Refer to other sections of the electrical specifications for additional requirements.

C. Shop Drawings: Each piece of equipment shall be identified by the number shown in the schedules and by specification article number pertaining to the item. Shop drawings shall as a minimum be ¼" equals 1' 0" scale, and shall be newly prepared by the Contractor and not reproduced from the Architect's drawings. Layouts shall be made for all floor plans including all ductwork, piping, electrical distribution and other mechanical equipment. Layouts shall show clearances of piping, ducts, etc., above floor.

D. Contractor shall obtain Engineer's approval on all the work before any equipment is purchased, or any work installed. Contractor shall also secure approval of the Governmental Authorities having jurisdiction on all equipment and on the layout of the complete system.

E. The Engineer's review and approval of shop drawings is a gratuitous assistance and in no way does it relieve the Contractor from responsibility for errors or omissions which may exist on the shop drawings. Where such errors or omissions are discovered later, they must be made good by the Contractor, without any additional cost to the Owner, irrespective of any approval by the Engineer.
   1. The Contractor shall incorporate with his shop drawings, a letter indicating all deviations from the plans and/or specifications. If in the opinion of the Architect, the deviations are not equal, the Contractor will be required to furnish the item as specified and as indicated on the drawings.
   2. Record documents shall be submitted in compliance with the requirements of the Specifications.

F. Engineer WILL NOT REVIEW:
   1. Submittals not specified.
   2. Submittals not reviewed by Contractor; including Contractor stamp with signature comments.
   3. Submittals made after work is delivered to site and/or installed.
   4. Submittal resubmissions unless resubmission is required by Architect/Engineer.

G. Installation of any item that requires submittal approval by the engineer shall be installed at the contractors risk. The contractor, at his cost, shall remove all work installed prior to approval of the submittal.

H. The engineer will not be responsible for errors in quantities, or dimensions required to fit the job condition, details of fabrication to insure proper assembly at the job, or for errors resulting from errors in submittals.

I. For underground piping, record dimensions and invert elevations of all piping, including all offsets, fittings, cathodic protection and accessories. Locate dimensions from benchmarks that will be preserved after construction is complete.

1.11 RECORD DRAWINGS

A. Refer to Division 01 - General Requirements for procedures. All literature shall be furnished in accordance with requirements listed in Division 01.

B. Contractor shall provide the following record drawings as part of the Project closeout document process:
   1. Contract Documents, specifications and submittals, indicating "As-Built" conditions and actual products selected for use.
   2. Product and Maintenance manuals for all equipment listed within this specification manual and in Contract Documents. Provide with parts lists as applicable.

1.12 QUALITY ASSURANCE

A. Other referenced standards:

1. Comply with referenced standards, guidelines, data sheets from various associations, including NFPA, ANSI, ASTM, ASME, ASHRAE.

PART 2 PRODUCTS

2.01 SLEEVES AND ESCUTCHEONS

A. Provide sleeves wherever pipes pass through exterior wall and floors. Sleeves shall be schedule 40 steel pipe cut to length. Sleeves shall terminate flush with walls, partitions and ceilings in finished areas. All sleeves through floor shall extend 2" above floor. Provide cast brass nickel-plated escutcheons with positive catches on each visible sleeve penetration. Sleves are to be sealed at each installation with a 3M approved sealant. The space between the inside of the sleeve and the outside of the pipe or conduit with in the sleeve shall be sealed at each installation with a 3M approved sealant.

2.02 DIELECTRIC UNIONS

A. Dielectric unions shall be used to connect dissimilar metals (such as steel and copper) to prevent electrolytic action.

B. Dielectric waterway fittings shall be a copper-silicon casting conforming to UNS C87850, and UL classified in accordance with ANSI / NSF-61 for potable water service.

2.03 BUILDING ATTACHMENTS FOR PLUMBING WORK SUPPORTS

A. General Requirements:
   1. Provide building attachments required for supporting plumbing work, suitably selected and installed for the loads applied with a minimum additional safety factor of 3.
   2. Where specified attachments are not suitable for conditions, submit to Engineer for approval, proposal for alternate building attachments.
   3. If specially designed building attachments are required, retain the services of a licenced structural engineer to design such building attachments.
   4. Approved Manufacturers: Grinnell, or equivalent products by Michigan Hanger and B-Line.
   5. Provide supplemental trapeze supports where necessary. Design trapeze to support all trades. Coordinate loads, and supports with all trades. Size trapeze for maximum deflection of 1/64 of the span.

B. Attachments to Structural Steel:
   1. Support plumbing work from building structural steel where possible and approved. No welding or bolting to structural steel is permitted unless authorized by Architect. C-clamps are not permitted.
      a. Center beam clamp - for loads over 120 lb.: Malleable center hung Grinnell Fig. 228.
      b. Side beam clamp with retaining clips - for loads up to 120 lb.

C. Cast in Place Concrete Inserts:
   1. Provide inserts selected for applied load of present load plus 100% for future, and coordinated with concrete work. Except as detailed on drawings, inserts shall be Unistrut or Grinnell. Plan, lay out and coordinate setting of inserts prior to concrete pour. Use Grinnell Fig. 285 lightweight concrete insert for loads up to 400# or Grinnell Fig. 281 Wedge Type concrete insert for loads up to 1200#

D. Drilled Insert Anchors:
   1. Where plumbing work cannot be supported from structural steel, or cast in place concrete inserts, provide drilled concrete insert anchors. Submit for approval, project specific installation drawings for all loads over 100 lbs. Install inserts in web of beam if possible and approved. Insert depth shall not exceed two thirds the thickness of the concrete. Where existing concrete appears to be deteriorating, or where applied load at insert exceeds 1000 lbs., conduct test of concrete to determine derated capacity of insert. Anchors may be adhesive or expansion type up to 1000 lbs., and shall be adhesive type for loads over 1000 lbs.

PART 3 EXECUTION

3.01 GENERAL

A. Existing piping: when encountered during the course of work, protect, brace and support existing piping where required for proper execution of the work.

B. Interruption of existing active piping: when the course of work makes shut-down of services unavoidable, the plumbing contractor shall schedule the shut-down at such time as approved by the owners representative, which will cause least interference with established operating routine.

C. Arrange work accordingly, providing such fittings as duct transitions traps, valves and accessories necessary to complete all construction in an orderiy fashion.

D. Install all equipment in strict accordance all directions and recommendations furnished by the manufacturer.

3.02 INTERPRETATION OF CONTRACT DOCUMENTS

A. Should there be discrepancy or a question of intent, refer matter to Architect/Engineer for decision before ordering any equipment or materials or before starting any related work.

B. Drawings and Specifications are to be taken together. Work specified and not shown or work shown and not specified shall be performed or furnished as though mentioned in both Specifications and Drawings. If there is discrepancy between Drawings and Specifications as to quantity or quality to be provided, the greater quantity or better quality shall be provided.

C. Minor items and accessories or devices reasonably inferable as necessary to complete and proper installation and operation of any system shall be provided by Contractor for such system whether or not specifically called for by Specifications or Drawings.

D. Architect/Engineer may change location of any equipment 5’ and any piping, ductwork, conduit, etc. 10’ in any direction without extra charge, provided such changes are made before installation.

E. Locations of items not definitely fixed by dimensions are approximate only and exact locations necessary to secure the best conditions and results shall be determined at the site and shall be subject to review and approval by Architect/Engineer.

F. Follow drawings in laying out work, check drawings of other trades to verify spaces in which work will be installed, and maintain maximum headroom and space conditions at all points.
   1. Where headroom or space conditions appear inadequate, notify Architect or Owner’s field representative before proceeding with installation.
   2. Pipe/duct rerouting and size changes shall be made at no additional cost to the Owner.

G. Furnish advance information on locations and sizes of frames, boxes, sleeves and openings needed for the work, and also furnish information and shop drawings necessary to permit installation of other work without delay.

H. Where there is evidence that parts of the Work specified in Divisions 21, 22, and 23 will interfere with other work, assist in working out space conditions to make satisfactory adjustments, revise and submit coordinated shop drawings.

I. After review and without additional cost to the Owner, make minor modifications in the work as required by structural interferences, by interferences with work of other sections or for proper execution of the work.

J. Work installed before coordinating with other work so as to cause interference with other work shall be changed and corrected without additional cost to the Owner.

K. Drawings are diagrammatic in nature and are a graphic representation of requirements and shall be followed as closely as actual building construction will permit. All changes from the plans necessary to make the work conform to the building as constructed and to fit the work of

other trades or to conform to rules of the Governmental Authorities having jurisdiction, NFPA, OSHA and the Owner's Insurance Underwriters, shall be made by the Contractor without extra cost to the Owner.

L. The layout of the piping, ductwork, equipment, etc., as shown on the drawings shall be checked and exact locations shall be determined by the dimensions of the equipment approved and the Contractor shall obtain approval for the revised layout before the apparatus is installed. The Contractor shall field measure or consult existing record Architectural and Structural Drawings if available for all dimensions, locations of partitions, locations and sizes of structural supports, foundations, etc.

M. Omission in the Drawings and/or Specifications of any items necessary for the proper completion or operation of the work outlined in this specification shall not relieve the Contractor from furnishing same without additional cost to the Owner.

N. The Equipment Shop Drawings should be furnished to the installing Contractor by the purchasing Contractor before roughing in. Contractor shall not install any piping or ductwork for said equipment until he has received approved shop drawings for same.

3.03 ALTERATIONS IN PRESENT BUILDING AND SYSTEMS

A. Contractor shall take particular note of the revisions and alterations to the existing systems, facilities and equipment due to the new construction as indicated on the Drawings and/or in Specification. Contractor shall remove, reroute or alter all services, ductwork, etc., as required or as indicated on the drawings.

B. The Contractor shall maintain all services in the existing building. In case, where new service connections are to be made to existing services and service interruptions can in no way be avoided, the service interruptions shall be with the minimum of inconvenience to the Owner and the work shall be done at such time of any day, Saturday and Sunday included, and only as directed by the Owner or the Architect.

3.04 ACCESSIBILITY

A. Do not locate traps, valves, controls, unions, cleanouts, etc. in any system at a location that will be inaccessible after construction is completed. Maintain accessibility for all components in plumbing systems.

3.05 ACCESS PANELS:

A. Refer to Division 08 - Openings; Provide access doors in locations as required by applicable codes and as indicated below. Coordinate locations with architectural trades.

B. Submit shop drawings for review before ordering panels. Where fire rating is required, furnish label doors compatible with fire rating of assembly.

C. Contractor shall confer with other trades with respect to access panel locations, and shall wherever practical group valves, traps, dampers, etc. in such way as to be accessible from single panel and eliminate as many access panels as possible.

D. Furnish access panels to access valves, traps, control valves or devices, dampers, damper motors, etc. Access panels shall be sized as necessary for ample access, or as indicated on drawings, but no smaller than 12" x 12" where devices are within easy reach of operator, and at least 24"x24" when operator must pass through opening in order to reach the devices. Architectural Trades shall install access panels coordinated with Mechanical Trades.

E. Access panels in fire rated walls or ceiling must be U.L. labeled for intended use. Unless otherwise indicated on plans, access doors shall be hinged flush type steel framed panel, 14 gauge minimum for frame, and with anchor straps. Only narrow border shall be exposed. Hinges shall be concealed type. Locking device shall be flush type and screw driver operated. Metal surfaces shall be prime coated with rust-inhibitive paint. Panels shall be compatible with architectural adjacent materials.

3.06 PROTECTION OF ELECTRICAL EQUIPMENT

A. Contractor shall furnish and install sheet metal drain pans beneath piping that is routed above electrical equipment and/or above the 3' access space in front of such equipment. Electrical equipment, for the purpose of addressing drain pan requirements, shall be defined as free-standing or wall-mounted switchgear, transformers, distribution boards or motor control centers.
   1. Drain pans shall be 20 gauge galvanized sheet metal with a minimum 4" high turned up edge. Bottom of drain pan shall slope to a single drainage point at ⅛" per foot. A 1" diameter clear plastic tube shall allow collected fluid to drain to the nearest open site floor drain. Secure plastic tubing to building structure only.
   2. Drain pan shall be hung from building structure with angle iron trapeze hangers (no hanger shall penetrate the drain pan). Consider drain pan to be full of water for hanger load calculations.
   3. Drain pans shall include liquid detectors with alarms only if noted on the drawings. Liquid detectors shall be specified in Section 22 10 06 Plumbing Piping Specialties.

B. Contractor shall include provisions to adjust the local lighting layout, at no extra cost to Owner, in order to accommodate any detrimental effect the drain pan has on the illumination of the electrical equipment and access space.

3.07 CUTTING, PATCHING AND DAMAGE TO OTHER WORK

A. Refer to Division 01 - General Requirements.

B. All cutting required shall be done by the contractor whose work is involved, without extra cost the owner. All patching and restoration including the furnishing and installation of access panels in ceiling, walls; etc. Within the building lines shall be done by the respective, responsible contractor. No cutting of structural steel, concrete, or wood shall be done without prior approval and explicit directions of the architect patched by the respective, responsible contractor.

C. The contractor, under whose jurisdiction the work may fall, shall provide labor, material, and tools required to cut, repair, protect, cap, or relocate existing pipes, conduits, or utilities interfering with or uncovered during work, per regulations of the authorities having jurisdiction.

3.08 EXCAVATION AND BACKFILLING

A. Provide all excavation, trenching, tunneling, removal of materials, de-watering and backfilling required for the proper laying of pipes and plumbing work. Coordinate the work with other excavating and backfilling in same area.

3.09 ROUGH-IN FOR CONNECTION TO EQUIPMENT

A. It shall be the responsibility of each contractor to study the architectural, structural, electrical, and mechanical drawings, conferring with the various trades involved and checking with the supplier of equipment in order to properly rough-in for all equipment.

3.10 MATERIAL AND EQUIPMENT

A. All material and equipment shall be new and of the best quality used for the purpose in good commercial practice, and shall be the standard product of reputable manufacturers. The material and equipment must meet approval of state and local codes in the area it is being used. Roof decks shall not be used to support piping, conduit, equipment, devices, etc.

3.11 SEAL PENETRATIONS

A. Seal the space around pipes in sleeves and around duct openings through walls, floors and ceilings. Provide adequate clearance to allow for proper sealing.

3.12 SOUND CONTROL

A. Penetrations shall be maintained airtight to pevent sound transfer.

B. Piping shall pass through sleeves. Pack sleeves tight with glass fiber or oakum and caulked on both sides with non-hardening acoustical sealant.

3.13 FIRESTOPPING

A. Refer to Division 07 - Thermal and Moisture Protection for more information.

B. Provide UL classified firestopping system for plumbing penetrations through rated walls and floors to maintain the fire rating.

3.14 CONTROL WIRING

A. All control wiring for plumbing and electrical equipment, including motor starters, shall be 120 volt maximum and wired with one side of the coil grounded and the operating contacts in the north side of the circuit. All control wiring shall be installed in conduit.

3.15 CLEANING, FLUSHING, AND INSPECTING

A. Refer to Division 01 - General Requirements; all plumbing equipment and components shall be cleaned as frequently as necessary through the construction process and again prior to project completion.

B. Clean exterior surfaces of installed piping systems of superfluous materials and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

C. Sufficient flushing water shall be introduced into the mains to produce a velocity of not less than 4’ per second and this flow rate shall be continued until the discharge is clean and clear and does not show evidences of silt or foreign matter when a sample is visually inspected.

D. Inspect pressure piping in accordance with procedures of ASME B31.

3.16 DELIVERY, STORAGE AND PROTECTION OF EQUIPMENT AND MATERIALS

A. Refer to Division 01 - General Requirements; all equipment and materials shall be delivered, stored and secured per manufacturer's recommendations.

B. On-site storage shall be coordinated with Construction Manager/General Contractor and be performed in a manner as to avoid damage, deterioration and loss.

C. Contractor shall provide temporary protection for installed equipment prior to project completion.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. All equipment shall be inspected prior to installation to assure that equipment is free from defect and damage.

F. Protect plumbing fixtures and piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

3.17 PIPING TESTS

A. Test pressure piping in accordance with ASME B31.

B. General: Provide temporary equipment for testing, including pump and gauges. Test piping systems before insulation is installed wherever feasible and remove control devices before testing. Test each natural section of each piping system independently, but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.

1. Test each piping system at 150% of operating pressure, or other pressure as required by Authority Having Jurisdiction, whichever is greater.
    a. Domestic water systems and equipment vents shall be tested hydrostatically for minimum of four hours at 1½ times design pressure for that system, or 100 psig

minimum, whichever is greater, unless otherwise specified.

b. Storm, soil, waste and vent piping shall be tested with water for minimum of 24 hours at 10 feet head.

c. Acid resistant waste and vent systems shall be tested as per manufacturer's recommendations.

2. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.

C. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics or other temporary repair methods.

D. Drain test water from piping systems after testing and repair work has been completed.

END OF SECTION

SECTION 22 05 19
METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure gauges and pressure gauge taps.

B. Thermometers and thermometer wells.

1.02 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments 2013.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers 2014.

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers 2014, with Editorial Revision (2017).

D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service Current Edition, Including All Revisions.

1.03 SUBMITTALS

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

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

1.04 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

A. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
   1. Case: Steel with brass bourdon tube.
   2. Size: 4-1/2 inch diameter.
   3. Mid-Scale Accuracy: One percent.
   4. Scale: Psi and kPa.

2.02 PRESSURE GAUGE TAPPINGS

A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi.

2.03 STEM TYPE THERMOMETERS

A. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
   1. Size: 9 inch scale.
   2. Window: Clear Lexan.
   3. Accuracy: 2 percent, per ASTM E77.
   4. Calibration: Degrees F.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install pressure gauges with pulsation dampers. Provide gauge cock to isolate each gauge. Extend nipples to allow clearance from insulation.

C. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

D. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.02 SCHEDULES

A. Pressure Gauges, Location and Scale Range:
   1. Pumps, 0 to 120 psi.
   2. Pressure reducing valves, 0 to 120 psi.

B. Stem Type Thermometers, Location and Scale Range:
   1. Domestic hot water supply and recirculation, 0 to 180 degrees F.

END OF SECTION

SECTION 22 05 23
DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Applications.
B. General requirements.
C. Ball valves.
D. Butterfly valves.
E. Check valves.
F. Gate valves.
G. Manual balancing valves.
H. Automatic balancing valves.
I. Pressure reducing valves.
J. Plug valves.
K. Drain valves.
L. Relief valves.

1.02 RELATED REQUIREMENTS

A. Section 08 3100 - Access Doors and Panels.
B. Section 22 0553 - Identification for Plumbing Piping and Equipment.
C. Section 22 0719 - Plumbing Piping Insulation.
D. Section 22 1005 - Plumbing Piping.

1.03 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.
B. EPDM: Ethylene propylene copolymer rubber.
C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
D. PTFE: Polytetrafluoroethylene.
E. TFE: Tetrafluoroethylene.

1.04 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose (Inch) 2013 (Reaffirmed 2018).
B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250 2015.
C. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard 2017.
D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves 2017.
E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2018.
F. ASME B16.34 - Valves - Flanged, Threaded and Welding End 2017.
G. ASME B31.9 - Building Services Piping 2020.
H. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fuzing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.
I. ASTM A48/A48M - Standard Specification for Gray Iron Castings 2003 (Reapproved 2016).

J. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings 2004 (Reapproved 2019).
K. ASTM A536 - Standard Specification for Ductile Iron Castings 1984 (Reapproved 2014).
L. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings 2017.
M. AWWA C606 - Grooved and Shouldered Joints 2015.
N. MSS SP-67 - Butterfly Valves 2017.
O. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends 2011.
P. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends 2018.
Q. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service 2010a.
R. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends 2011.
S. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves 2013.
T. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010.
U. NSF 61 - Drinking Water System Components - Health Effects 2020.
V. NSF 372 - Drinking Water System Components - Lead Content 2020.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
C. Grooved joint valves shall be referred to on drawings and product submittals, and be identified by the manufacturer's listed model or series designation.

1.06 QUALITY ASSURANCE

A. Manufacturer:
   1. Obtain valves for each valve type from single manufacturer.
B. Welding Materials and Procedures: Comply with ASME BPVC-IX.
C. Grooved end valves shall be of the same manufacturer as the adjoining couplings.
D. All castings used for valve bodies shall be date stamped for quality assurance and traceability.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Use the following precautions during storage:
   1. Maintain valve end protection and protect flanges and specialties from dirt.
      a. Provide temporary inlet and outlet caps.
      b. Maintain caps in place until installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Provide the following valves for the applications if not indicated on drawings:
   1. Shutoff: Ball or butterfly.
      a. Gate valves shall only be used on shut off for pumped sanitary/storm piping only.
      b. Plug valves or ball valves can be used for natural gas shutoff.
   2. Dead-End: Single-flange butterfly (lug) type.
   3. Swing Check:
      a. 2 NPS and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
      b. 2-1/2 NPS and Larger for Domestic Water: Iron swing check valves with closure control, metal or resilient seat check valves.

c. 2-1/2 NPS and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
4. Spring Loaded Check: At pump discharge.
5. Automatic Balancing Valves: At all domestic hot water connections to hot water return piping.
6. Manual Balancing Valves: At hot water return pump discharge only.

B. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.

C. Required Valve End Connections for Non-Wafer Types:
1. Steel Pipe:
a. 2 NPS and Smaller: Threaded ends.
b. 2-1/2 NPS to 4 NPS: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
c. 5 NPS and Larger: Grooved or flanged ends.
d. Grooved-End Copper Tubing and Steel Piping: Grooved.
2. Copper Tube:
a. 2 NPS and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
b. 2-1/2 NPS to 4 NPS: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
c. 5 NPS and Larger: Grooved or flanged ends.

D. Domestic, Hot and Cold Water Valves:
1. 2 NPS and Smaller:
a. Bronze: Provide with solder-joint or threaded ends.
b. Ball: Two piece, full port, bronze with bronze or stainless steel trim.
1) Heat treated DZR brass valves by Jomar are allowed as specified below.
c. Bronze Swing Check: Class 125, bronze disc.
2. 2-1/2 NPS and Larger:
a. Iron, 2-1/2 NPS to 4 NPS: Provide with threaded or flanged ends.
b. Iron Ball: Class 150.
c. Iron Single-Flange Butterfly: 200 CWP, EPDM seat, aluminum-bronze disc.
d. Grooved End, Cast Brass Butterfly: 300 CWP, Fluoroelastomer pressure-responsive seat, aluminum-bronze disc.

E. Sanitary Waste and Storm Drainage Water Valves:
1. 2 NPS and Smaller:
a. Bronze: Provide with solder-joint or threaded.
b. Ball: Two piece, full port, bronze with bronze or stinless steel trim.
c. Bronze Spring Loaded Check: Class 125, nonmetallic disc.
d. Bronze Gate: Class 125, NRS.
2. 2-1/2 NPS and Larger:
a. Iron, 2-1/2 NPS to 4 NPS: Provide with threaded or flanged ends.
b. Iron Ball: Class 150.
c. Iron Swing Check with Closure Control: Class 125, lever and spring.
d. Iron Gate: Class 125, NRS.

F. Natural Gas Valves:
1. Ball Valve: 4 NPS and Smaller:
a. Bronze: Provide with solder-joint or threaded ends with union.
b. Ball: Class 150, regular port, teflon seats.
2. Plug: 2-1/2 NPS an Larger:
a. Lubricated Plug: Class 125, regular gland.

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. Gear Actuator: Quarter-turn valves 8 NPS and larger.
   2. Handwheel: Valves other than quarter-turn types.
   3. Hand Lever: Quarter-turn valves 6 NPS and smaller.

D. Valves in Insulated Piping: With 2 NPS stem extensions and the following features:
   1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
   2. Butterfly Valves: Extended neck.
   3. Memory Stops: Fully adjustable after insulation is installed.

E. Valve-End Connections:
   1. Threaded End Valves: ASME B1.20.1.
   2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
   3. Pipe Flanges and Flanged Fittings 1/2 NPS through 24 NPS: ASME B16.5.
   4. Solder Joint Connections: ASME B16.18.
   5. Grooved End Connections: Copper-tube dimensions, similar to AWWA C606.

F. General ASME Compliance:
   1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
   2. Solder-joint Connections: ASME B16.18.
   3. Building Services Piping Valves: ASME B31.9.

G. Valve Materials for Potable Water: NSF 61 and NSF 372.

H. Bronze Valves:
   1. Fabricate from dezincification resistant material.
   2. Copper alloys containing more than 15 percent zinc are not permitted.

I. Source Limitations: Obtain each valve type from a single manufacturer.

2.03 BRONZE BALL VALVES

A. Two Piece, Full Port with Bronze or Stainless Steel Trim:
   1. Comply with MSS SP-110.
   2. SWP Rating: 150 psig.
   3. CWP Rating: 600-1000 psig.
   4. Body: Lead Free Bronze.
   5. Ends: Threaded.
   6. Seats: PTFE or TFE.
   7. Manufacturers:
      a. Apollo Valves: www.apollovalves.com/#sle.
      b. Nibco: www.nibco.com
   8. Jomar Valves with heat trated DZR brass - CW511 alloy body and end connection and CW510L brass alloy ball and stem and TEA coated ball are allowed.
      a. Substitutions: See Section 01 6000 - Product Requirements.

B. For Natural Gas Service: Two Piece, Regular Port with Bronze, Chrome Plated Brass or Stainless Steel Trim:
   1. Comply with MSS-SP110.
   2. SWP Rating: 150 psig.

3. CWP Rating: 400 psig.
4. Body: Bronze
5. Ends: Threaded or Solder with union.
6. Stem: Blow-out proof
7. Manufacturers:
    a. Apollo Valves: www.apollovalves.com
    b. Jomar Valves: www.jomarvalve.com
    c. Viega: www.viega.us
    d. Substitutions: See Section01 6000-Product Requirements.

2.04 IRON BALL VALVES - NOT FOR DOMESTIC

A. Class 125, Full Port, Stainless Steel Trim:
1. Comply with MSS SP-72.
2. CWP Rating: 200 psig.
3. Body: ASTM A536 Grade 65-45-12, ductile iron.
4. Ends: Flanged.
5. Seats: PTFE, TFE, or Teflon.
6. Operator: Lever, with locking handle.
7. Manufacturers:
    a. Apollo Valves: www.apollovalves.com/#sle.
    b. Ferguson Enterprises Inc: www.fnw.com/#sle.
    c. Substitutions: See Section 01 6000 - Product Requirements.

2.05 IRON, SINGLE FLANGE BUTTERFLY VALVES

A. Lug type: Bi-directional dead-end service without use of downstream flange.
1. Comply with MSS SP-67, Type I.
2. CWP Rating: 200 psig.
3. Body: ASTM A126, cast iron or ASTM A536, ductile iron.
4. Stem: One or two-piece stainless steel.
5. Seat: EPDM.
6. Disc: Bronze or Stainless Steel.
7. Manufacturers:
    a. Apollo Valves: www.apollovalves.com/#sle.
    b. Jomar valves: www.jomarvalve.com.
    c. Nibco: www.nibco.com.
    d. Substitutions: See Section 01 6000 - Product Requirements.

2.06 BRASS, GROOVED-END BUTTERFLY VALVES

A. Grooved Ends: Bi-directional dead-end service.
1. CWP Rating: 300 psig.
2. Body: Cast brass, UNS C87850.
3. Stem: Stainless steel, offset from the disc centerline to provide complete 360-degree circumferential seating.
4. Seat: Pressure responsive Fluoroelastomer.
5. Disc: Aluminum-bronze.
6. UL classified in accordance with NSF-61 for potable water service, and meets the lead requirements of NSF-372.
7. Manufacturer: Victaulic

2.07 BRONZE SWING CHECK VALVES

A. Class 125: CWP Rating: 200 psig (1380 kPa).
1. Comply with MSS SP-139, Type 3.
2. Design: Horizontal flow.

3. Body: Bronze, ASTM B62.
4. Ends: Threaded or soldered as indicated.
5. Disc: Lead Free Bronze ASTM B584.
6. Manufacturers:
    a. Apollo Valves: www.apollovalves.com/#sle.
    b. Milwaukee: www.milwaukeevalve.com.
    c. Jomar: www.jomarvalve.com.
    d. Nobco: www.nibco.com
    e. Substitutions: See Section 01 6000 - Product Requirements.

2.08 BRONZE SPRING LOADED CHECK VALVES

A. Class 125: CWP Rating 200 psig (1380 kPa).
1. Design: Vertical flow.
2. Body: Bronze, ASTM B61 or ASTM B62
3. Spring: Bronze
4. Ends: Threaded or soldered as indicated.
5. Disc: Nonmetallic
6. Manufacturers:
    a. Milwaukee: www.milwaukeevalve.com
    b. Apollo Valves[<>]: www.apollovalves.com/#sle.
    c. Substitutions: See Section01 6000-Product Requirements.

2.09 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125 with Lever and Spring-Closure Control.
1. Comply with MSS SP-71, Type I.
2. Description:
    a. CWP Rating: 200 psig.
    b. Design: Clear or full waterway.
    c. Body: ASTM A126, gray iron or ductile iron with bolted bonnet.
    d. Ends: Flanged or threaded as indicated.
    e. Spring: Stainless steel.
    f. Trim: Bronze or stainless steel.
    g. Gasket: Asbestos free.
    h. Closer Control: Factory installed, exterior lever, and spring.
3. Manufacturers:
    a. Apollo Valves: www.apollovalves.com/#sle.
    b. Flomatic Valves: www.flomatic.com/#sle.
    c. Nibco: www.nibcoc.com.
    d. Substitutions: See Section 01 6000 - Product Requirements.

2.10 BRONZE GATE VALVES - PUMPED SANITARY/STORM ONLY

A. Non-Rising Stem (NRS) or Rising Stem (RS):
1. Comply with MSS SP-80, Type I.
2. Class 125: CWP Rating: 200-285 psig.
3. Body: ASTM B584 Lead Free, bronze with integral seat and screw-in bonnet.
4. Ends: Threaded or solder joint .
5. Stem: Bronze.
6. Disc: Solid wedge; bronze.
7. Packing: Asbestos free.
8. Handwheel: Malleable iron, bronze, or aluminum.
9. Manufacturers:
    a. Apollo Valves: www.apollovalves.com/#sle.

b. Ferguson Enterprises Inc: www.fnw.com/#sle.
c. Jomar Valve: www.jomarvalve.com.
d. Nibco: www.nibco.com
e. Substitutions: See Section 01 6000 - Product Requirements.

2.11 IRON GATE VALVES - PUMPED SANITARY/STORM ONLY

A. NRS or OS & Y:
1. Comply with MSS SP-70, Type I.
2. Class 125: CWP Rating: 200-285 psig.
3. Body: ASTM A126, gray iron or ductile iron with bolted bonnet.
4. Ends: Flanged.
5. Trim: Bronze or stainless steel.
6. Disc: Solid wedge.
7. Packing and Gasket: Asbestos free.
8. Manufacturers:
a. Apollo Valves: www.apollovalves.com/#sle.
b. Ferguson Enterprises Inc: www.fnw.com/#sle.
c. Nibco: www.nibco.com.
d. Substitutions: See Section 01 6000 - Product Requirements.

2.12 PVC COMBINATION CHECK AND BALL VALVE - PUMPED SANITARY/STORM ONLY

A. Rated for 25 psi (58 ft of head)
1. Full flow PVC check valve, ball valve, union combination
2. Gasket & Flapper: Neoprene, replaceable flapper
3. Backing plates & rivet: Stainless steel
4. Screws: Stainless steel
5. Manufacturers:
a. Zoeller: www.zoellerpumps.com
b. Manufacturer of sanitary/storm pump
c. Substitutions: See Section01 6000-Product Requirements.

2.13 LUBRICATED PLUG VALVES

A. Regular Gland with Threaded or Flanged Ends.:
1. Comply with MSS SP-78, Type II.
2. Class 125: CWP Rating: 200 psig.
3. Body: ASTM A48/A48M or ASTM A126, cast iron with lubrication sealing system.
4. Pattern: Regular or short.
5. Plug: Cast iron or bronze with sealant groove.
6. Manufacturers:
a. Homestead: www.homesteadvalve.com.
b. Norgas Controls: www.norgascontrols.com.
c. Flowserve Corporation: www.flowserve.com.
d. Substitutions: See Section 01 6000 - Product Requirements.

2.14 MANUAL BALANCING VALVES

A. Construction: Class 125, Lead free brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain, calibrated nameplate with memory stop.

B. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

C. Manufacturers:
1. ITT Bell & Gossett: www.bellgossett.com/#sle.

2. Jomar Valve: www.jomarvalve.com
3. Caleffi; www.caleffi.com
4. Nibco: www.nibco.com
5. Substitutions: See Section 01 6000 - Product Requirements.

2.15 AUTOMATIC BALANCING VALVES

A. Thermostatic balancing valves:
   1. Manufacturers:
      a. ITT Bell & Gossett; Temp Setter: www.bellgossett.com
      b. Caleffi; Thermosetter: www.caleffi.com
      c. Substitutions: See Section 01 6000 - Product Requirements.
   2. The valve shall be certified lead free according to NSF/ANSI 61 standards.
   3. The valve body shall be constructed out of 316 stainless steel or DZR low-lead brass
   4. The valve shall be rated for 145 PSIG working pressure.
   5. The valve shall have a temperature adjustment dial in degrees F. The dial shall have an adjustment range of 98°F (37°C) to 140°F (60°C).
   6. The valve shall include a pre-formed thermal insulation block/shell.

2.16 WATER PRESSURE REDUCING VALVES

A. Valves over 2 inches: ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.
   1. Manufacturers:
      a. Amtrol: www.amtrol.com
      b. Apollo valves: www.apollovalves.com
      c. Watts Regulator Company: www.wattsregulator.com
      d. Substitutions: See Section 01 6000 - Product Requirements.

2.17 DRAIN VALVES

A. Drain Valve with hose thread and chain and dust cap; chrome plated ball, blow-out-proof stem, and adjustable packing gland.

B. Manufacturers:
   1. Hammond: www.hammondvalve.com
   2. Apollo valves: www.apollovalves.com
   3. Nibco: www.nibco.com/valves
   4. Milwaukee: www.milwaukeevalve.com
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.18 RELIEF VALVES

A. Pressure Relief Valves: Bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.

B. Manufacturers:
   1. CASH (A.W.) Valve Manufacturing Corp: www.cashvalve.net
   2. Zurn Industries; Wilkins-Regulator Division: www.zurn.com
   3. Watts Regulator Company: www.wattsregulator.com
   4. Substitutions: See Section 01 6000 - Product Requirements.

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.

C. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

D. Provide access where valves and fittings are not exposed.

E. Install check valves where necessary to maintain direction of flow as follows:
   1. Spring Loaded Check: Install with stem plumb and vertical.
   2. Swing Check: Install horizontal maintaining hinge pin level.

F. Provide chainwheels on operators for valves 4 NPS and larger where located 96 NPS or more above finished floor, terminating 60 NPS above finished floor.

G. Install valves with stems upright or horizontal, not inverted.

END OF SECTION

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Pipe markers.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems 2020.

1.03 SUBMITTALS

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

B. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Piping: Pipe markers.

B. Pumps: Nameplates.

C. Equipment and Tanks: Nameplates.

D. Valves: Tags.

2.02 NAMEPLATES

A. Manufacturers:
   1. Brimar Industries, Inc: www.pipemarker.com/#sle.
   2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   3. Seton Identification Products: www.seton.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: Laminated three-layer plastic with engraved letters.

2.03 TAGS

A. Manufacturers:
   1. Brimar Industries, Inc: www.pipemarker.com/#sle.
   2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   3. Seton Identification Products: www.seton.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

2.04 PIPE MARKERS

A. Manufacturers:
   1. Brimar Industries, Inc: www.pipemarker.com/#sle.
   2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   3. Seton Identification Products: www.seton.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.
   1. Install in clear view and align with axis of piping.
   2. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

END OF SECTION

SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 22 1005 - 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 2019.

B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement 2007 (Reapproved 2013).

C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.

D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2019.

E. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021.

G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.

H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER

A. Manufacturers:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Knauf Insulation: www.knaufinsulation.com/#sle.
   4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
   5. Substitutions: See Section 01 6000 - 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-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.
   1. Vapor Barrier Lap Adhesive shall be compatible with the insulation and as recommended by the insulation manufacturer.

F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

G. Indoor Vapor Barrier Finish:
   1. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
   1. Aeroflex USA, Inc: www.aeroflexusa.com/#sle.
   2. Armacell LLC: www.armacell.us/#sle.
   3. K-Flex USA LLC: www.kflexusa.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.04 JACKETS

A. PVC Plastic.
   1. Manufacturers:
      a. Johns Manville Corporation: www.jm.com/#sle.
      b. Proto Corporation: www.protocorporation.com.
      c. Substitutions: See Section 01 6000 - 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.
      e. Connections: Brush on welding adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. 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. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

H. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 SCHEDULES

A. Plumbing Systems:
   1. Domestic Hot Water Supply & Recirculation:
      a. Pipe Size Range: 1/2 to 1-1/4 inch
         1) Thickness: 1 inch
      b. Pipe Size Range: 1-1/2 to 8 inch
         1) Thickness: 1-1/2 inch
   2. Domestic Cold Water: 1 inch thick.
   3. Roof Drain Bodies: 1/2 inch thick.
   4. Roof Drainage Above Grade: 1/2 inch thick with PVC jacket.
   5. Plumbing Vents Within 10 Feet of the Exterior: 1/2 inch thick with PVC jacket.

B. Cooling Systems:
   1. Condensate Drains from Cooling Coils: 1 inch thick.

C. Other Systems:
   1. Piping Exposed to Freezing with Heat Tracing: 1 inch or as recommended by heat tracing manufacturer.

END OF SECTION

SECTION 22 07 19.11
UNDER-LAVATORY PIPE AND SUPPLY COVERS - PLUMBEREX

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Under-lavatory pipe and supply covers.

1.02 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011 (Reaffirmed 2022).

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019.

D. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2021.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.

F. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

1.03 SUBMITTALS

A. Product Data: Provide catalog illustrations of covers, sizes, and finishes.

PART 2 PRODUCTS

2.01 UNDER-LAVATORY PIPE AND SUPPLY COVERS

A. Manufacturers:
   1. Plumberex Specialty Products, Inc: www.plumberex.com/#sle.

B. General:
   1. Insulate exposed drainage piping including hot, cold, and tempered water supplies under lavatories or sinks per ADA Standards.
   2. Adhesives, sewing threads, and two-ply laminated materials are prohibited.
   3. Exterior Surfaces: Smooth nonabsorbent with no finger recessed indentations for easy cleaning.
   4. Construction: 1/8 inch (3.2 mm) PVC with antimicrobial, antifungal, and ultraviolet light (UV) resistant properties.
      a. Provide one piece injected molded design with internal bridge at top of J-bend to prevent separating.
      b. Comply with ASTM C1822 for covers on accessible lavatory piping.
      c. Comply with ASME A112.18.9 for covers on accessible lavatory piping.
      d. Thermal Resistance: R value of 0.504 or lower when tested by ASTM C177.
      e. Microbial and Fungal Resistance for Interior and Exterior: Comply with ASTM G21.

C. ASTM E84 Compliant, Under-Lavatory Insulators:
   1. Construction: Soft, non-laminated, flexible PVC with antimicrobial, antifungal, and UV-resistant properties. Fusion molded one piece universal design for multiple P-trap configurations. Adhesives, sewing threads, and two ply laminated materials shall not be allowed. Exterior surfaces shall be smooth nonabsorbent with no finger recessed indentations for easy cleaning. Supply riser shall be flexible and a minimum of 15 inches (381 mm) inches in length.
   2. Provide with weep hole for condensation drainage and ventilation.
   3. Fasteners: Reusable, fusion bonded Velcro and tamper resistant snap-locking fasteners with no sharp or abrasive external surfaces. No cable tie fasteners allowed.

D. Under-Lavatory Covers with Snap-Lock Fasteners:
   1. Construction: PVC with antimicrobial, antifungal, and UV-resistant properties, one piece injected molded design with internal bridge at top of J-bend to prevent separating.
   2. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces. No cable ties allowed.
   3. Maintenance: Valve and supply cover shall be accessible for maintenance without removal and with removable, reusable access cap.
   4. Provide with weep hole for condensation drainage and ventilation.
   5. Vandal Resistance: Internal line grooves for trimming not easily torn by hand. All trim line grooves shall require tool cutting only.
   6. Color: High gloss white.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that walls, floor finishes, lavatories, and piping are prepared and ready for installation of under-lavatory guards.

B. Confirm location and size of fixtures and piping before installation.

3.02 INSTALLATION

A. Install under-lavatory guards according to manufacturer's written instructions..

3.03 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 22 10 05
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Sanitary sewer.
   2. Domestic water.
   3. Natural Gas
   4. Flanges, unions, and couplings.
   5. Pipe hangers and supports.
   6. Valves.
   7. Check.
   8. Water pressure reducing valves.

1.02 RELATED REQUIREMENTS

A. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

B. Section 22 07 19 - Plumbing Piping Insulation.

1.03 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2018.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2018.

D. ASME B31.1 - Power Piping; 2022.

E. ASME B31.9 - Building Services Piping; 2017.

F. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2023.

G. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fuzing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications; 2019.

H. ASSE 1003 - Water Pressure Reducing Valves for Potable Water Distribution Systems; 2023.

I. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.

J. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2021.

K. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2019.

L. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

M. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2020.

N. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.

O. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2018.

P. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.

Q. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2023.

R. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.

S. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020.

T. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2020.

U. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2021.

V. ASTM D2855 - Standard Practice for the Two-Step (Primer & Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2015.

W. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2023.

X. AWWA C651 - Disinfecting Water Mains; 2014, with Addendum (2020).

Y. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018.

Z. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

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. Welder Certificate: Include welders certification of 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.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

C. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

1.06 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET (____) OF BUILDING

A. Cast Iron Pipe: ASTM A74 extra heavy weight.
   1. Fittings: Cast iron.
   2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

B. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74, service weight.

1. Fittings: Cast iron.
2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. PVC Pipe: ASTM D2729.
1. Fittings: PVC.
2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. Copper Pipe: ASTM B42, hard drawn.
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.

2.05 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Fittings: Cast iron, coated.
3. Joints: ASTM B32, alloy Sn95 solder.
4. Mechanical Press Sealed Fittings: Double pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, non toxic synthetic rubber sealing elements.

2.06 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
2. Joints: Threaded or welded to ASME B31.1.

2.07 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches (80 mm) and Under:
1. Ferrous pipe: Class 150 malleable iron threaded unions.

2.08 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
3. Trapeze Hangers: Welded steel channel frames attached to structure.
4. Vertical Pipe Support: Steel riser clamp.

B. Plumbing Piping - Water:
1. Hangers for Pipe Sizes 1/2 Inch (15 mm) to 1-1/2 Inches (40 mm): Malleable iron, adjustable swivel, split ring.
2. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.09 BALL VALVES

A. Manufacturers:
1. Tyco flow control: www.tycoflowcontrol.com
2. Nibco, Inc: www.nibco.com
3. Milwaukee Valve Company: www.milwaukeevalve.com

B. Construction, 4 Inches (100 mm) and Smaller: MSS SP-110, Class 150, 400 psi (2760 kPa) CWP, bronze body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder ends with union.

2.10 PIPING SPECIALTIES

A. Flow Controls:
1. Manufacturers:

a. ITT Bell & Gossett: www.bellgossett.com/#sle.
b. Griswold Controls: www.griswoldcontrols.com/#sle.
c. Taco, Inc: www.taco-hvac.com/#sle.

2.11 WATER PRESSURE REDUCING VALVES

A. Manufacturers:
1. Tyco Flow Control: www.tycoflowcontrol.com
2. Watts Regulator Company; _____: www.wattsregulator.com
3. ITT Bell & Gossett: www.bellgossett.com

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Establish elevations of buried piping outside the building to ensure not less than 4 ft (_____ m) of cover.

G. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

H. Install valves with stems upright or horizontal, not inverted. Refer to Section 22 05 23.

I. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

J. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

K. Sleeve pipes passing through partitions, walls and floors.

L. Inserts:
1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

M. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9.
2. Support horizontal piping as indicated.

3. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
5. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping.
9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
10. Support cast iron drainage piping at every joint.

3.04 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Install globe valves for throttling, bypass, or manual flow control services.

3.05 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch (10 mm) vertically of location indicated and slope to drain at minimum of 1/8 inch per foot (1:100) slope.

B. Water Piping: Slope at minimum of 1/32 inch per foot (1:400) and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed and clean.

B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe Size: 1/2 inches (15 mm) to 1-1/4 inches (32 mm):
         1) Maximum Hanger Spacing: 6.5 ft (2 m).
         2) Hanger Rod Diameter: 3/8 inches (9 mm).
      b. Pipe Size: 1-1/2 inches (40 mm) to 2 inches (50 mm):
         1) Maximum Hanger Spacing: 10 ft (3 m).
         2) Hanger Rod Diameter: 3/8 inch (9 mm).

c. Pipe Size: 2-1/2 inches (65 mm) to 3 inches (75 mm):
   1) Maximum Hanger Spacing: 10 ft (3 m).
   2) Hanger Rod Diameter: 1/2 inch (13 mm).
d. Pipe Size: 4 inches (100 mm) to 6 inches (150 mm):
   1) Maximum Hanger Spacing: 10 ft (3 m).
   2) Hanger Rod Diameter: 5/8 inch (15 mm).

END OF SECTION

SECTION 22 10 06
PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Drains.
B. Cleanouts.
C. Hose bibbs.
D. Hydrants.
E. Air admittance valves.
F. Backflow preventers.
G. Strainers.
H. Water hammer arrestors.
I. Sanitary waste interceptors.
J. Mixing valves.
K. Air Vents.
L. Trap seals.
M. Natural gas regulators.

1.02 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.
B. Section 22 3000 - Plumbing Equipment.
C. Section 22 4000 - Plumbing Fixtures.

1.03 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor and Trench Drains 2019.
B. ASME A112.6.4 - Roof, Deck, and Balcony Drains 2008 (Reaffirmed 2012).
C. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers 2011.
D. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance 2011 (Reaffirmed 2016).
E. NSF 61 - Drinking Water System Components - Health Effects 2020.
F. NSF 372 - Drinking Water System Components - Lead Content 2020.
G. PDI-WH 201 - Water Hammer Arresters 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
C. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors, and other specialties applicable to project.
D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 01 6000 - Product Requirements, for additional provisions.
    2. Extra Loose Keys for Outside Hose Bibbs: One.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 DRAINS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
   2. Josam Company: www.josam.com/#sle.
   3. Zurn Industries, LLC: www.zurn.com/#sle.
   4. MIFAB: www.mifab.com.
   5. Watts: www.watts.com
   6. Substitutions: See Section 01 6000 - Product Requirements.

B. Floor Drains:
   1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, and reversible clamping collar.
   2. Strainer: Refer to Plumbing Fixture Schedule for size, type and accessories.

2.03 CLEANOUTS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
   2. MIFAB, Inc: www.mifab.com/#sle.
   3. Zurn Industries, LLC: www.zurn.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Cleanouts at Exterior Surfaced Areas
   1. Round cast nickel bronze access frame and non-skid cover.

C. Cleanouts at Exterior Unsurfaced Areas:
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

D. Cleanouts at Interior Finished Floor Areas:
   1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

E. Cleanouts at Interior Finished Wall Areas:
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

F. Cleanouts at Interior Unfinished Accessible Areas: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.04 HOSE BIBBS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
   2. Watts Regulator Company: www.wattsregulator.com/#sle.
   3. Zurn Industries, LLC: www.zurn.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Interior Hose Bibbs for Public Areas:
   1. Moderate climate, anti-siphon narrow wall hydrant with chrome plated face, integral vacuum breaker, 3/4" hose connection, 360 degree swivel pipe connection with 3/4" female/1" male threads. Bronze head, seat casting, internal working parts, and loose key.
   2. Complies with ASSE 1019.

2.05 HYDRANTS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.

2. Zurn Industries, LLC: www.zurn.com/#sle.
3. Prier: www.prier.com.
4. Woodford: www.woodfirdmfg.com
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Wall Hydrants:
1. ASSE 1019; freeze resistant, lead free, self-draining type with chrome plated lockable recessed box hose thread spout, lockshield and removable key, and integral vacuum breaker.

C. Roof Hydrants:
1. Non-freeze roof hydrant with ASSE 1052 double check valve, galvanized casing and adjustable flow wheel lock handle with deck flange and underdeck clamp. Lead free. Route drain to nearest floor drain or mop sink.

2.06 AIR ADMITTANCE VALVES

A. Manufacturers:
1. IPS Corporation: Studor; www.ipscorp.com
2. Sioux Chief: Turbo Vent; www.siouxchief.com
3. Oatey: Sure Vent; www.oatey.com
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: ASSE 1050 and 1051; Valve shall provide positive seal at 0 psi and under positive line pressure to prevent sewer gasses from entering the occupied space. ABS/PVC body with Schedule 40 adapter and actuating device.

C. When device is located in a wall, provide with recessed access box with vented cover plate. Access box shall be fire rated when installing in fire rated walls. Refer to Architectural drawings.

2.07 BACKFLOW PREVENTERS

A. Manufacturers:
1. Apollo Valves: www.apollovalves.com/#sle.
2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
3. Zurn Industries, LLC: www.zurn.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Reduced Pressure Backflow Preventers:
1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.
2. Provide with air gap fitting; pipe to adjacent floor drain receptor
3. Device shall be approved for vertical installation.

C. Double Check Valve Backflow Preventers:
1. ASSE 1012; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

D. Dual Check Valve Backflow Preventers:
1. ANSI/ASSE 1024 bronze body with two compact replaceable check modules with Buna "N" seals and stainless steel springs and one union with seal.

E. Carbonated Beverage Machine Backflow Preventers:
1. ASSE 1022 316 stainless steel dual check with atmospheric port designed for protection of the water supply from carbon dioxide gas and carbonated water. Atmospheric vent provides visual indication in the event the downstream check fails. Vent discharge shall be

piped to an indirect waste receptor. Proviede with wye pattern strainer.

2.08 STRAINERS

A. Manufacturers:
   1. Armstrong International, Inc: www.armstronginternational.com
   2. Green Country Filter Manufacturing: www.greencountryfilter.com
   3. WEAMCO: www.weamco.com
   4. Substitutions: See Section01 6000-Product Requirements.

B. Size 2 inches and Under:
   1. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen. Lead free.

C. Size 1-1/2 inch to 4 inches:
   1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen. Lead free.

D. Size 5 inch and Larger:
   1. Class 125, flanged iron body, basket patern with 1/8 inch stainless steel perforated screen. Lead free.

2.09 WATER HAMMER ARRESTORS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
   2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
   3. Zurn Industries, LLC: www.zurn.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Water Hammer Arrestors:
   1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range 34 to 250 degrees F and maximum 150 psi working pressure.

2.10 MIXING VALVES

A. Thermostatic Mixing Valves:
   1. Manufacturers:
      a. Acorn: www.acorneng.com
      b. Powers: www.powerscontrols.com.
      c. Caleffi; www.caleffi.com/usa/en-us
      d. Substitutions: See Section 01 6000 - Product Requirements.
   2. Hi-Lo Master Mixing Valve:
      a. The Thermostatic Mixing Valve shall be IAPMO lab certified to ASSE 1017 and CSA standards and capable of meeting the control accuracy requirements of these standards at the manufacturer's listed minimum flow rates.
      b. The valve shall contain an advanced paraffin sensor with a temperature range of 100°F to 160°F (37.8°C to 71°C) and factory set at 120°F (38°C) with a lock nut to prevent unauthorized temperature changes.
      c. Checks and screens must be integral to the valve.
      d. External inlet shut-offs will be included with the valve and shall be a reliable ball valve design.
      e. Body material shall be “lead-free” brass with corrosion resistant internal components. Include outlet temperature gauge.
   3. Point of Use Mixing Valve:
      a. The Thermostatic Mixing Valve shall be IAPMO lab certified to ASSE 1069, ASSE 1070 and CSA B125.3 standards and capable of meeting the control accuracy

requirements of these standards at the manufacturer's listed minimum flow rates.

b. Valve shall have an adjustable outlet temperature range of 90°F-115°F (32°C-46°C), factory set at 105°F (41°C).
c. Valve shall be a solid brass body with a capacity of 12 GPM (45 LPM) at 45 PSI (310 kPa) differential and a maximum operating pressure of 125 PSIG (862 kPa). Supply pressure variation shall be up to 20%.
d. Valve shall contain a copper encapsulated, paraffin-based thermal actuator.

2.11 AIR VENTS

A. Manufacturers:
1. Cash Acme, a brand of Reliance Worldwide Corporation: www.cashacme.com/#sle.
2. ITT Bell & Gossett: www.bellgossett.com/#sle.
3. Taco, Inc: www.taco-hvac.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

2.12 FLOOR DRAIN TRAP SEALS

A. Manufacturers:
1. MIFAB, Inc: www.mifab.com/#sle.
2. JR Smith: www.jrsmith.com.
3. Zurn: www.zurn.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: Push-fit EPDM or silicone fitting with a one-way membrane. For use in floor drain outlets or the adjustable strainer throats to minimize evaporation of the trap seal.

C. Standard: Required flow rates per ASSE 1072.

D. Size: To match floor drain in which protection device is to be installed

E. Do not use in applications where the room/space has atmospheric pressure less than ambient pressure of the exterior of the room/space or building

2.13 NATURAL GAS PRESSURE REGULATORS

A. Manufacturers:
1. Fisher
2. Eaton
3. Harper Wyman Co
4. Substitutions: See Section 01 6000-Product Requirements.

B. Comply with ANSI Z21.18

C. Provide with inlet and outlet pressure gage on piping.

D. Regulator shall be capable of towndown from 10 psi (or max pressure from Utility) to median pressure range of equipment served.

E. Regulator to be "ventless" where installed indoors, as approved by AHJ.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Coordinate clean-out locations with Architect prior to installation.

C. 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.

D. Encase exterior cleanouts in concrete flush with grade.

E. Install floor cleanouts at elevation to accommodate finished floor.

F. 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.

G. Pipe relief from backflow preventer to nearest drain.

H. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to any fixture or equipment with quick closing valves..

I. Coordinate all electrical and controls requirements of leak detection system with Division 26 an Temperature Controls Contractor.

END OF SECTION

SECTION 22 30 00
PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water Heaters:
   1. Commercial gas fired.
   2. Commercial electric.

B. Diaphragm-type compression tanks.

C. In-line circulator pumps.

1.02 RELATED REQUIREMENTS

A. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ANSI Z21.10.1 - Gas Water Heaters - Volume I - Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less 2014.

B. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels 2019.

C. ICC (IPC) - International Plumbing Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

E. UL 174 - Standard for Household Electric Storage Tank Water Heaters Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

B. Product Data:
   1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Indicate pump type, capacity, power requirements.
   3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
   4. Provide electrical characteristics and connection requirements.

C. Project Record Documents: Record actual locations of components.

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

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Pump Seals: One of each type and size.
   3. Extra Water Softener Salt: 50 pounds.

1.05 QUALITY ASSURANCE

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

B. Certifications:
   1. All products in contact with potable water: NSF approved.
   2. Gas Water Heaters: Certified by CSA International to ANSI Z21.10.1, as applicable, in addition to requirements specified elsewhere.
   3. Electric Water Heaters: UL listed and labeled to UL 174.

4. Pressure Vessels for Heat Exchangers: ASME labeled to ASME BPVC-VIII-1.
5. Water Tanks: ASME labeled to ASME BPVC-VIII-1.
6. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

C. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

D. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.06 WARRANTY

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

B. Provide five year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.01 WATER HEATERS

A. Manufacturers:
1. O. Smith Water Products Co: www.hotwater.com/#sle.
2. PVI: www.pvi.com/#sle.
3. Lochinvar: www.lochinvar.com/#sle.
4. Bradford White: www.bradfordwhite.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Performance:
1. The water heater shall comply with the energy efficiency requirements of the latest edition of the ASHRAE 90.1 standard.
2. The water heater’s efficiency shall be verified through third party testing by AHRI and listed in the AHRI Certification Directory.
3. Minimum hot water storage temperature shall be 140 degrees F, unless otherwise noted on Schedules.

2.02 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Manufacturers:
1. Amtrol Inc: www.amtrol.com/#sle.
2. Bell & Gossett, a xylem brand: www.bellgossett.com/#sle.
3. Taco, Inc: www.taco-hvac.com/#sle.
4. Lochinvar: www.lochinvar.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 150 psi and 240 degrees F max working temperature, with heavy duty butyl fixed diaphragm sealed into tank, and steel legs or saddles.

C. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 12 psig.

2.03 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:
1. Armstrong Fluid Technology: www.armstrongfluidtechnology.com/#sle.
2. Bell & Gossett, a xylem brand: www.bellgossett.com/#sle.
3. Taco: www.tacocomfort.com.
4. Grundfos Pumps: www.grundfos.com
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Small Circulator Pump:

1. The pumps shall be of the high efficiency type specifically designed for quiet operation
2. Pump to be suitable for 203°F (95°C) operation at 150 psig (10.3 Bar) working pressure
3. The pumps shall have a ceramic ball bearing lubricated by the system fluid.
4. Pump body shall be lead-free (less than 0.25% Pb) brass
5. Pump to have built-in adjustable thermostat from 68°F to 158°F (20°C to 70°C)
6. Motor shall be spherical permanent magnet electrically commutated motor (ECM)
7. Motor shall be non-overloading at any point on the pump curve and shall have built in overload protection
8. Accessories:
    a. Pre-wired 6 foot electrical plug.
    b. Timer

C. Performance: Refer to Schedules.

D. Notify engineer upon start-up and comissioning of pumps to ensure proper setpoints are used.

2.04 HYDROPENUMATIC TANKS

A. Manufacturers:
1. Bell and Gossett: www.bellgossett.com
2. Wessels: www.westank.com
3. Amtrol: www.amtrol.com
4. Substitutions: See Section 01 6000 - Product Requirements.

B. ASME , bladder style tank with 125 psi rated pressure or 150 psi rated pressure as indicated on Schedules. Gallon capacity as indicated on Schedules.

C. Tank shall be provided with pressure relief valve and shall be pre-charged to 10 psi less than the initial pressure at tank.

D. Tank shall be provided by Pressure Booster Pump Manufacturer, when recommended.

2.05 ELECTRICAL WORK

A. Provide electrical motor driven equipment specified complete with motors, motor starters, controls, and wiring.

B. Electrical characteristics to be as specified or indicated.

C. Supply manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices not shown.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related gas venting and electrical work to achieve operating system.

C. Provide for the service of a competent factory-trained supervising agent from the equipment manufacturer to inspect the completed installation, start the system and acquaint the operators with the proper operation and maintenance of the equipment.

D. Notify engineer upon start-up and comissioning of pumps to ensure proper setpoints are used.

E. Domestic Water Storage Tanks:
1. Provide steel pipe support, independent of building structural framing members.
2. Clean and flush prior to delivery to site. Seal until pipe connections are made.

F. Pumps:
1. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve, balancing valve and isolating valve on discharge.

2. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
3. Reduction from line size to pump connection size shall be made with eccentric reducers attached to the pump with tops flat to allow continuity of flow and to avoid air pockets.
4. Provide temperature and pressure gauges where and as detailed or directed.
5. All piping shall be brought to equipment and pump connections in such a manner so as to prevent the possibility of any load or stress being applied to the connections or piping.
6. Power wiring, as required, shall be the responsibility of the electrical contractor. All wiring shall be performed per manufacturer's instruction and per applicable state, federal, and local codes.
7. Control wiring for remote mounted switches and sensor / transmitters shall be the responsibility of the control's contractor. All wiring shall be performed per manufacturer's instructions and applicable state, federal, and local codes.
8. Power and control wiring shall run in separate channel.
9. Pumps that are supplied with an integrated VFD and should not be used with any external VFDs.
10. Pumps shall NOT be run dry to check rotation.

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water closets.
B. Urinals.
C. Lavatories.
D. Sinks.
E. Service sinks.
F. Electric water coolers.
G. Bathtubs.
H. Showers.
I. Eye and face wash fountains.
J. Emergency showers.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Owner-furnished fixtures.
B. Section 22 1005 - Plumbing Piping.
C. Section 22 1006 - Plumbing Piping Specialties.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
B. IAPMO Z124 - Plastic Plumbing Fixtures 2017.
C. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment 2014.
D. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration. 2013.
E. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use 1997 (Reaffirmed 2017).
F. ASME A112.18.1 - Plumbing Supply Fittings 2018, with Errata.
G. ASME A112.19.1 - Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures 2018.
H. ASME A112.19.2 - Ceramic Plumbing Fixtures 2018.
I. ASME A112.19.3 - Stainless Steel Plumbing Fixtures 2017.
J. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks 2017.
K. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices 2015.
L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021.
M. IAPMO Z124 - Plastic Plumbing Fixtures 2017.
N. ISFA 2-01 - Classification and Standards for Solid Surfacing Material 2013.
O. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
P. NSF 61 - Drinking Water System Components - Health Effects 2020.
Q. NSF 372 - Drinking Water System Components - Lead Content 2020.

1.04 SUBMITTALS

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

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

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

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Faucet Washers: Two sets of each type and size.
   3. Extra Toilet Seats: One of each type and size.
   4. Flush Valve Service Kits: One for each type and size.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.06 WARRANTY

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

B. Provide five year manufacturer warranty for electric water cooler.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 REGULATORY REQUIREMENTS

A. Comply with applicable codes for installation of plumbing systems.

B. Perform work in accordance with local health department regulations.

2.03 FLUSH VALVE WATER CLOSETS

A. Water Closets: Vitreous china, ASME A112.19.2, wall hung or floor mounted as indicated on Schedules, siphon jet flush action, china bolt caps.
   1. Flush Valve: Exposed (top spud).
   2. Flush Operation: Refer to Schedules.
   3. Manufacturers:
      a. American Standard, Inc: www.americanstandard-us.com/#sle.
      b. Kohler Company: www.kohler.com/#sle.
      c. Zurn Industries, Inc: www.zurn.com/#sle.
      d. Sloan: www.sloan.com.
      e. Substitutions: See Section 01 6000 - Product Requirements.

B. Flush Valves: ASME A112.18.1, diaphragm type , complete with dual filtered by-pass, vacuum breaker stops and accessories.
   1. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.
   2. Manufacturers:
      a. American Standard, Inc: www.americanstandard-us.com/#sle.
      b. Sloan Valve Company: www.sloanvalve.com/#sle.
      c. Zurn Industries, Inc: www.zurn.com/#sle.
      d. Kohler Company[<>]: www.kohler.com/#sle.
      e. Substitutions: See Section 01 6000 - Product Requirements.

C. Seats:

1. Manufacturers:
   a. Bemis Manufacturing Company: www.bemismfg.com/#sle.
   b. Church Seat Company: www.churchseats.com/#sle.
   c. Centoco: www.centoco.com
   d. Manufacturer of Closet Bowl.
   e. Substitutions: See Section 01 6000 - Product Requirements.
2. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover.

D. Water Closet Carriers For Wall Hung Closets:
1. Manufacturers:
   a. Jay R. Smith MFG. Co: www.jrsmith.com/#sle.
   b. JOSAM Company: www.josam.com/#sle.
   c. Zurn Industries, Inc: www.zurn.com/#sle.
   d. Substitutions: See Section 01 6000 - Product Requirements.
2. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.04 TANK TYPE WATER CLOSETS

A. Tank Type Water Closet Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com/#sle.
2. Kohler Company: www.kohler.com/#sle.
3. Zurn Industries, Inc: www.zurn.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Bowl: ASME A112.19.2; wall or floor mounted as indicated in Schedules, siphon jet, vitreous china, close-coupled closet combination with elongated rim, insulated vitreous china closet tank with fittings and lever flushing valve, bolt caps.

C. Seat Manufacturers:
1. Bemis Manufacturing Company: www.bemismfg.com/#sle.
2. Church Seat Company: www.churchseats.com/#sle.
3. Centoco: www.centoco.com
4. Manufacturer of Closet Bowl.
5. Substitutions: See Section 01 6000 - Product Requirements.

D. Seat: Solid white plastic, open front, brass bolts, without cover, complete with self-sustaining hinge.

2.05 WALL HUNG URINALS

A. Wall Hung Urinal Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com/#sle.
2. Kohler Company: www.kohler.com/#sle.
3. Zurn Industries, Inc: www.zurn.com/#sle.
4. Sloan: www.sloan.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Urinals: Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.
1. Flush Valve: Exposed (top spud).
2. Flush Operation: Refer to Schedules.
3. Trap: Integral.

C. Flush Valves: ASME A112.18.1, diaphragm type , complete with dual filtered by-pass, vacuum breaker stops and accessories.
1. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.
2. Manufacturers:

a. American Standard, Inc: www.americanstandard-us.com/#sle.
b. Sloan Valve Company: www.sloanvalve.com/#sle.
c. Zurn Industries, Inc: www.zurn.com/#sle.
d. Kohler Company[<>]: www.kohler.com/#sle.
e. Substitutions: See Section 01 6000 - Product Requirements.

D. Carriers:
1. Manufacturers:
a. Jay R. Smith MFG. Co: www.jrsmith.com/#sle.
b. JOSAM Company: www.josam.com/#sle.
c. Zurn Industries, Inc: www.zurn.com/#sle.
d. Substitutions: See Section 01 6000 - Product Requirements.
2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

2.06 LAVATORIES

A. Lavatory Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com/#sle.
2. Kohler Company: www.kohler.com/#sle.
3. Zurn Industries, Inc: www.zurn.com/#sle.
4. Sloan: www.sloan.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Vitreous China Basin: ASME A112.19.2; vitreous china wall hung or counter-top mounted as indicated on Schedules, with overflow.

C. Supply Faucet Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com/#sle.
2. Kohler Company: www.kohler.com/#sle.
3. Zurn Industries, Inc: www.zurn.com/#sle.
4. Symmons: www.symmons.com.
5. Delta Faucet: www.deltafaucet.com
6. Sloan: www.sloan.com
7. Substitutions: See Section 01 6000 - Product Requirements.

D. Supply Faucet: ASME A112.18.1; chrome plated supply fitting with water economy aerator with maximum flow of 0.5 gallon per minute (low-flow), ADA compliant handles.

E. Accessories:
1. Lavatory P-trap shall be chrome plated cast brass adjustable ground joint swivel with cleanout, with 17- gauge seamless brass adjustable wall bend provided with deep bell flange. P-Trap to have 2” water seal and rough-in complete, adapter extensions are not allowed. P-Trap shall be certified by CSA or other recognized third-party testing authority and marked with manufacturer’s name. No private label wholesale products will be allowed.
2. Offset waste with perforated open strainer.
3. Screwdriver Loose key stops.
4. Lavatory supply kits shall include chrome plated all brass stops with brass stems, no plastic stems. Kits shall have 12” chrome plated copper risers and shallow brass flange. Inlet shall be ½” compression and outlet shall be 3/8” compression. Supply kit shall be certified by recognized independent third-party testing authority, will be marked with the manufacturer’s name and comply with the SDWA (Safe Drinking Water Act) “No Lead” restrictions of ANSI NSF 61, Sec. 9. No private label wholesale products will be allowed.
5. All exposed lavatory and sink trim on wheelchair accessible fixtures shall be covered with a seamless antimicrobial vinyl insulating outer shell. Material shall be flame retardant and

fungal and bacterial resistant. Insulating kits shall include covers for, drain tailpiece, all P-Trap components, and hot/cold water supplies.

6. Install with point of use thermostatic mixing valve. Refer to Section 22 1006.
7. Carrier for Wall Mounted Lavatories:
   a. Manufacturers:
      1) Jay R. Smith MFG. Co: www.jrsmith.com/#sle.
      2) JOSAM Company: www.josam.com/#sle.
      3) Zurn Industries, Inc: www.zurn.com/#sle.
      4) Substitutions: See Section 01 6000 - Product Requirements.
   b. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.

2.07 SINKS

A. Sink Manufacturers:
   1. American Standard, Inc: www.americanstandard-us.com/#sle.
   2. Elkay: www.elkay.com.
   3. Just Manufacturing: www.justmfg.com
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. General: ASME A112.19.3, stainless steel, self rimming and undercoated.

C. Bowl Quanitity and Size: Refer to Schedules.

D. Faucet:
   1. Gooseneck faucet with ADA wristblade handles
   2. Flowrate: Refer to Schedules.
   3. Manufacturers:
      a. Kohler Company: www.kohler.com/#sle.
      b. Chicago Faucet: www.chicagofaucets.com
      c. Delta Faucet: www.deltafaucet.com
      d. Substitutions: See Section01 6000-Product Requirements.

E. Accessories:
   1. Garbage Disposal:
      a. Provide garbage disposal for sink. For multiple bowl sinks, coordinate which drain to install disposal in with Architect.
      b. Disposal shall have stainless steel grind chamber, continuous feed, automatic reversing action with 120V, single phase motor. Refer to Schedules for motor HP.
      c. Manufacturers:
         1) In-Sink-Erator
         2) Substitutions: See Section01 6000-Product Requirements.
   2. Drain:
      a. Removable basket strainer.
   3. Sink P-trap shall be chrome plated cast brass adjustable ground joint swivel with cleanout, with 17- gauge seamless brass adjustable wall bend provided with deep bell flange. P-Trap to have 2” water seal and rough-in complete, adapter extensions are not allowed. P-Trap shall be certified by CSA or other recognized third-party testing authority and marked with manufacturer’s name. No private label wholesale products will be allowed.
   4. Screwdriver, Loose key stops.
   5. Lavatory supply kits shall include chrome plated all brass stops with brass stems, no plastic stems. Kits shall have 12” chrome plated copper risers and shallow brass flange. Inlet shall be ½” compression and outlet shall be 3/8” compression. Supply kit shall be certified by recognized independent third-party testing authority, will be marked with the manufacturer’s name and comply with the SDWA (Safe Drinking Water Act) “No Lead” restrictions of ANSI NSF 61, Sec. 9. No private label wholesale products will be

allowed.

6. All exposed lavatory and sink trim on wheelchair accessible fixtures shall be covered with a seamless antimicrobial vinyl insulating outer shell. Material shall be flame retardant and fungal and bacterial resistant. Insulating kits shall include covers for, drain tailpiece, all P-Trap components, and hot/cold water supplies.
7. Install with point of use thermostatic mixing valve, where noted in Schedules or where fixture must be ADA compliant. Refer to Section 22 1006.

2.08 BATHTUBS AND SHOWERS

A. Bathtub/Shower Manufacturers:
   1. American Standard, Inc: www.americanstandard-us.com/#sle.
   2. Kohler Company: www.kohler.com/#sle.
   3. Sterling: www.sterlingplumbing.com
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Bathtub/Shower: Refer to Schedules.

C. Bath and Shower Trim: ASME A112.18.1; ASSE 1016; concealed shower and over rim supply with diverter spout, pressure balanced mixing valve, bent shower arm with adjustable spray ball joint showerhead with maximum flow rate as listed in Schedules and escutcheon, lever operated pop-up waste and overflow.

2.09 SHOWER RECEPTORS

A. Solid Surfacing Shower Receptors: Solid plastic resin casting, self-supporting, for installation over conventional subfloor; complying with IAPMO Z124.
   1. Material: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, renewable material filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
   2. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 450 or less, Class A, when tested in accordance with ASTM E84.
   3. Where indicated in Schedules that fixture shall be ADA: Shower base to be recessed flush with finished floor and comply with ADA Standards and approved by the authorities having jurisdictions (AHJ).
   4. Color and Pattern: As indicated.
   5. Manufacturers:
      a. Acorn Engineering Company: www.acorneng.com/#sle.
      b. American Standard, Inc: www.americanstandard-us.com/#sle.
      c. Best Bath Systems: www.bestbath.com/#sle.
      d. Sterling: www.sterlingplumbing.com
      e. Substitutions: See Section 01 6000 - Product Requirements.

B. Drain Trim: Removable chrome plated strainer and tail piece.

2.10 SHOWERS

A. Shower Valve:
   1. Comply with ASME A112.18.1 and ASSE 1016.
   2. Provide in wall diverter valve body with integral thermostatic mixing valve to supply shower head.
   3. Shower Valve Manufacturers:
      a. American Standard, Inc: www.americanstandard-us.com/#sle.
      b. DXV by American Standard, Inc: www.dxv.com/#sle.
      c. Grohe America, Inc: www.grohe.com/us/#sle.
      d. Symmons
      e. Substitutions: See Section 01 6000 - Product Requirements.

B. Shower Head:
   1. ASME A112.18.1; chrome plated head with integral wall bracket, built-in flow control.
   2. Shower Head Manufacturers:
      a. American Standard, Inc: www.americanstandard-us.com/#sle.
      b. DXV by American Standard, Inc: www.dxv.com/#sle.
      c. Grohe America, Inc: www.grohe.com/us/#sle.
      d. Symmons
      e. Substitutions: See Section 01 6000 - Product Requirements.

2.11 BI-LEVEL, ELECTRIC WATER COOLERS

A. Bi-level, Electric Water Cooler Manufacturers:
   1. Elkay Manufacturing Company: www.elkay.com/#sle.
   2. Haws Corporation: www.hawsco.com/#sle.
   3. Murdock Manufacturing, Inc: www.murdockmfg.com/#sle.
   4. Oasis International: www.oasiscoolers.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Water Cooler: Bi-level, electric, mechanically refrigerated; mounting as specified on Schedules , ADA compliant; elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket; integral air cooled condenser.
   1. Capacity: 8 gallons per hour of 50 degrees F water with inlet at 80 degrees F and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.
   2. Electrical: 115 V, 60 Hertz compressor, 6 foot cord and plug for connection to electric wiring system including grounding connector.

C. Bottle Filler: Materials to match fountain.

2.12 SERVICE SINKS

A. Service Sink Manufacturers:
   1. American Standard, Inc: www.americanstandard-us.com/#sle.
   2. Elkay Manufacturing Company: www.elkay.com/#sle.
   3. Just Manufacturing Company: www.justmfg.com/#sle.
   4. Fiat: www.fiatproducts.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Bowl: ASME A112.19.1; porcelain enamelled (inside only) cast iron roll-rim sink or white molded stone, with 12 inch high back, concealed hanger, chrome plated strainer, stainless steel rim or vinyl bumper guards.

C. Trim: ASME A112.18.1 exposed wall type supply, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.

D. Accessories:
   1. 5 feet of 1/2 inch diameter plain end reinforced plastic hose.
   2. Hose clamp hanger.
   3. Mop hanger.

2.13 EMERGENCY EYE AND FACE WASH

A. Emergency Wash Manufacturers:
   1. Haws Corporation: www.hawsco.com/#sle.
   2. Therm-Omega-Tech, Inc: www.thermomegatech.com/#sle.
   3. Bradley Safety: www.bradleysafety.com.
   4. Acorn: www.acorneng.com
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Emergency Wash: ANSI Z358.1; mounting as specified in Schedules , self-cleaning, non-clogging eye and face wash with quick opening, full-flow valves, stainless steel or ABS eye and face wash receptor, twin eye wash heads and face spray ring, dust cover , control valve and fittings.

C. Thermostatic Mixing Valve: Thermostatic mixing valve, ASSE 1071 listed, with combination stop, strainer, and check valves, and flexible stainless steel connectors.

2.14 EMERGENCY SHOWERS

A. Emergency Shower Manufacturers:
1. Haws Corporation: www.hawsco.com/#sle.
2. Therm-Omega-Tech, Inc: www.thermomegatech.com/#sle.
3. Bradley Safety: www.bradleysafety.com.
4. Acorn: www.acorneng.com
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Emergency Shower: ANSI Z358.1; mounting as specified in Schedules , self- cleaning, non-clogging 8 inch diameter stainless steel or plastic deluge shower head with elbow, one inch full flow valve with pull chain and 8 inch diameter ring, one inch interconnecting fittings.

C. Thermostatic Mixing Valve: Thermostatic mixing valve, ASSE 1071 listed, with combination stop, strainer, and check valves, and flexible stainless steel connectors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

D. Examine floors and substrates and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

E. Inspect fixtures and accessories that are to be removed and relocated. Damaged or blemished items shall be brought to Architect’s/Engineer’s attention before reinstalling.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Install components level and plumb.

C. Piping exposed to view shall be chrome plated.

D. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

B. Adjust or replace washers to prevent leaks at faucets and stops.

3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

A. Clean plumbing fixtures and equipment.

3.07 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Do not permit use of fixtures by construction personnel.

C. Repair or replace damaged products before Date of Substantial Completion.

3.08 FEILD QUALITY CONTROL

A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

B. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match to be judged by Architect/Engineer. Remove cracked or dented units and replace with new units.

END OF SECTION

SECTION 23 00 05
BASIC HVAC REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. This section applies to all sections of Division 23.

B. Drawings and general provisions of the contract, including Division 00 and Division 01 specification sections, apply to work of this section.

C. Provide all items, articles, materials, operations or methods listed, mentioned or scheduled on drawings and/or herein, including all labor, materials, equipment and incidentals necessary and required for their completion.

D. The items in this section are supplementary to the requirements set forth in other portions of the specifications as indicated under item "A" above.

1.02 APPLICATION

A. This section applies to all mechanical work. The contractors involved shall check all sections of the specifications in addition to the particular section covering their specific trade. Each distinct section of the specifications aimed for one trade may have detailed information with regards to other trades, therefore, it is imperative that all sections be reviewed to get a complete picture of all other trades' functions and work required.

B. The mechanical contractor is responsible for the installation and operation of the hvac systems and temperature control systems.

C. The mechanical contractor is responsible for receiving, unloading and placement of all of the owner provided equipment.

1.03 INSPECTION OF SITE

A. Visit the site, examine and verify the conditions under which the work must be conducted before submitting proposal.

B. The submitting of a proposal implies that the contractor has visited the site and understands the conditions under which the work must be conducted.

1.04 ALTERNATES AND SUBSTITUTIONS

A. Refer to Division 01 - General Requirements for procedures.

1.05 DEVIATION FROM BASIS OF DESIGN MANUFACTURER

A. Products identified within the schedules and details are used as the basis of design for laying out and coordinating with other trades such as structural, architectural, and electrical. Should the Division 23 Contractors submit equipment by a Manufacturer other than that indicated as the Basis of Design in the Drawings, Contractor shall then be responsible for evaluating the impacts of the proposed Manufacturer’s equipment, even if the Manufacturer is listed in the specifications as an approved equal. This includes the proposed Manufacturer’s electrical, architectural and structural requirements and their subsequent impacts on the current design (roof openings, curbs, structural support, etc.) and coordination of any differing dimensions and clearances with all other trades.

1.06 MATERIALS

A. Mechanical equipment is to be furnished with motors, electrical controls and protective devices, and integral operating devices which are normally included by the manufacturer or required by the Contract Documents.

B. The Mechanical Trades shall provide all control wiring, 120 volts and less, for the equipment and devices furnished under Division 22, and 23 of these specifications, including all wiring devices, conduit, etc.

C. Power wiring 120 volts and greater shall be by the Electrical Trades.

1.07 DRAWINGS

A. The drawings are diagrammatic and show the general location and arrangement of all equipment, piping and related items. They shall be followed as closely as elements of the construction will permit.

B. Examine the drawings of other trades and verify the conditions governing the work on the job site. The mechanical and electrical contractor shall check all documents including architectural, structural, plumbing, HVAC and electrical to avert possible installation conflicts. Arrange work accordingly, providing such fittings, traps, valves and accessories as may be required to meet such conditions.

C. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.

D. The architectural and structural drawings take precedence in all matters pertaining to the building structure, mechanical drawings in all matters pertaining to mechanical trades and electrical drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.

E. Do not scale drawings for measurements.

F. Field verifications of actual existing conditions are required by the contractor since actual locations, distances, and levels will be governed by actual field conditions. All measurements shall be verified at the site.

G. If during field verification, the contractor identifies that there may require substantial changes from the original plans, the contractor shall notify the architect for agreement on necessary adjustment before the installation is started

H. Discrepancies shown between plans, or between plans and actual field conditions, or between plans and specifications shall promptly be brought to the attention of the Architect/Engineer for a decision.

I. Drawings and specifications are intended to cover the completed installation of systems to function as described. The omission of the expressed reference to any item of labor and material necessary to comply with practice codes, ordinances, etc., shall not relieve the contractor from providing such additional labor and material at no cost to Owner.

1.08 CODES, PERMITS AND FEES

A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for mechanical work shall be secured and paid for by the contractor. All work shall conform to all applicable codes, rules and regulations. Applicable publications listed in all sections of Division 23 shall be the latest issue, unless otherwise noted.

B. Rules of local utility companies and municipalities shall be complied with. Check with the utility company and/or municipality supplying service to the installation and determine all devices including, but not limited to: meters, regulators, valves which will be required and include the cost of all such items in the proposal.

C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.

1.09 MAINTENANCE

A. Provide 40 hours of instruction to the owner's designated personnel in the maintenance and operation of equipment and systems.

B. Provide complete maintenance and operating instructional manuals covering all mechanical equipment herein specified, together with parts lists. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. Four (4) copies of all literature shall be furnished for owner and shall be bound in book or ring binder form. Maintenance and operating instructional manuals shall be provided when construction is approximately 75% complete.

1.10 WARRANTY AND GUARANTEE

A. Contractor shall guarantee all work installed by themselves or their subcontractors to be free from defect in material and workmanship for a period of one year from date of final acceptance of the work, unless a longer period is stipulated under specific headings. Contractor shall repair or replace at no additional cost to the owner, any material or equipment developing defects and shall also make good any damage caused by such defects or the correction of defects. Repairs or replacements shall bear additional guarantee, as originally called for, dated from the final acceptance of the repair or replacement. This requirement shall be binding even though it will exceed product guarantees normally furnished by some manufacturers. Contractor shall submit his own and each equipment manufacturers written certificates, warranting that each item of equipment furnished complies with all requirements of the drawings and specifications. Note that guarantee shall run from date of final acceptance of the work, not from date of installation of a device or piece of equipment.

1.11 SUBMITTALS

A. Refer to Division 01 - General Requirements for procedures.

B. Contractor shall provide submittals where items are referred to by symbolic designation on the drawings. All submittals shall bear the same designation (hvac equipment, piping equipment, etc.). Refer to other sections of the mechanical specifications for additional requirements.

C. Engineer WILL NOT REVIEW:
   1. Submittals not specified.
   2. Submittals not reviewed by Contractor, including Contractor stamp with signature comments.
   3. Submittals made after work is delivered to site and/or installed.
   4. Submittal resubmissions unless resubmission is required by Architect/Engineer.

D. Types of submittals include the following:
   1. Shop Drawings
   2. Product Data Sheets
   3. Samples
   4. Manufacturers Instructions
   5. Maintenance Data
   6. Warranty

E. Installation of any item that requires submittal approval by the engineer shall be installed at the contractors risk. The contractor, at his cost, shall remove all work installed prior to approval of the submittal.

F. The engineer will not be responsible for errors in quantities, or dimensions required to fit the job condition, details of fabrication to insure proper assembly at the job, or for errors resulting from mistakes in submittals.

1.12 RECORD DRAWINGS

A. Refer to Division 01 - General Requirements for procedures.

B. Contractor shall provide the following record drawings as part of the Project closeout document process:
   1. Contract Documents, specifications and submittals, indicating "As-Built" conditions and actual products selected for use.

2. Product and Maintenance manuals for all equipment listed within this specification manual and in Contract Documents. Provide with parts lists as applicable.

C. Record drawings shall be maintained by the contractor up to date as the project progresses.

D. Recording all deviations from the contract documents, indicate exact locations of all buried services both inside and outside of the building; include concealed piping and equipment in the entire contract. Final record drawings shall reflect the as-built conditions.

1.13 QUALITY ASSURANCE

A. Other referenced standards:
1. Comply with referenced standards, guidelines, data sheets from various associations, including NFPA, ANSI, ASTM, ASME, ASHRAE

PART 2 PRODUCTS

2.01 SLEEVES AND ESCUTCHEONS

A. Provide sleeves wherever pipes pass through exterior wall, and floors. Sleeves shall be schedule 40 steel pipe cut to length. Sleeves shall terminate flush with walls, partitions and ceilings in finished areas. All sleeves through floor shall extend 2" above floor. Provide cast brass nickel-plated escutcheons with positive catches on each visible sleeve penetration. Sleves are to be sealed at each installation with a 3M approved sealant. The space between the inside of the sleeve and the outside of the pipe or conduit with in the sleeve shall be sealed at each installation with a 3M approved sealant.

2.02 DIELECTRIC UNIONS

A. Dielectric unions shall be used to connect dissimilar metals (such as steel and copper) to prevent electrolytic action.

2.03 FILTERS

A. Provide and maintain filters in air handling systems throughout the construction period and prior to final acceptance of the building. Do not run air handling equipment without all prefilters and final filters as specified. Immediately prior to final building acceptance by the owner, contractor shall replace all disposable type air filters with new.

2.04 BUILDING ATTACHMENTS FOR MECHANICAL WORK SUPPORTS

A. General Requirements:
1. Provide building attachments required for supporting mechanical work, suitably selected and installed for the loads applied with a minimum additional safety factor of 3.
2. Where specified attachments are not suitable for conditions, submit to Engineer for approval, proposal for alternate building attachments.
3. If specially designed building attachments are required, retain the services of a licenced structural engineer to design such building attachments.
4. Approved Manufacturers: Grinnell, or equivalent products by Michigan Hanger and B-Line.
5. Provide supplemental trapeze supports where necessary. Design trapeze to support all trades. Coordinate loads, and supports with all trades. Size trapeze for maximum deflection of 1/64 of the span.

B. Attachments to Structural Steel:
1. Support mechanical work from building structural steel where possible and approved. No welding or bolting to structural steel is permitted unless authorized by Architect. C-clamps are not permitted.
a. Center beam clamp - for loads over 120 lb.: Malleable center hung Grinnell Fig. 228.
b. Side beam clamp with retaining clips - for loads up to 120 lb.

C. Cast in Place Concrete Inserts:
1. Provide inserts selected for applied load of present load plus 100% for future, and coordinated with concrete work. Except as detailed on drawings, inserts shall be Unistrut

or Grinnell. Plan, lay out and coordinate setting of inserts prior to concrete pour. Use Grinnell Fig. 285 lightweight concrete insert for loads up to 400# or Grinnell Fig. 281 Wedge Type concrete insert for loads up to 1200#

D. Drilled Insert Anchors:
   1. Where mechanical work cannot be supported from structural steel, or cast in place concrete inserts, provide drilled concrete insert anchors. Submit for approval, project specific installation drawings for all loads over 100 lbs. Install inserts in web of beam if possible and approved. Insert depth shall not exceed two thirds the thickness of the concrete. Where existing concrete appears to be deteriorating, or where applied load at insert exceeds 1000 lbs., conduct test of concrete to determine derated capacity of insert. Anchors may be adhesive or expansion type up to 1000 lbs., and shall be adhesive type for loads over 1000 lbs.
   2. Manufacturers: Hilti

PART 3 EXECUTION

3.01 GENERAL

A. Existing piping and ductwork: when encountered during the course of work, protect, brace and support existing piping and ductwork where required for proper execution of the work.

B. Interruption of existing active piping and ductwork: when the course of work makes shut-down of services unavoidable, the mechanical contractor shall schedule the shut-down at such time as approved by the owners representative, which will cause least interference with established operating routine.

C. Arrange work accordingly, providing such fittings as duct transitions traps, valves and accessories necessary to complete all construction in an orderiy fashion.

D. Install all equipment in strict accordance all directions and recommendations furnished by the manufacturer.

3.02 ACCESSIBILITY

A. Do not locate valves, traps, controls, unions, dampers, etc. in any system at a location that will be inaccessible after construction is completed. Maintain accessibility for all components in mechanical, electrical, and plumbing systems.

3.03 ACCESS DOORS AND PANELS

A. Refer to Division 08 - Openings; Provide access doors in locations as required by applicable codes and as indicated below. Coordinate locations with architectural trades.

B. Furnish access panels to access valves, traps, control valves or devices, dampers, damper motors, etc. Access panels shall be sized as necessary for ample access, or as indicated on drawings, but no smaller than 12" x 12" where devices are within easy reach of operator, and at least 24"x24" when operator must pass through opening in order to reach the devices. Architectural Trades shall install access panels coordinated with Mechanical Trades.

C. Access panels in fire rated walls or ceiling must be U.L. labeled for intended use. Unless otherwise indicated on plans, access doors shall be hinged flush type steel framed panel, 14 gauge minimum for frame, and with anchor straps. Only narrow border shall be exposed. Hinges shall be concealed type. Locking device shall be flush type and screw driver operated. Metal surfaces shall be prime coated with rust-inhibitive paint. Panels shall be compatible with architectural adjacent materials Manufacturer: Milcor, Bilco.

3.04 CUTTING AND PATCHING

A. Refer to Division 01 - General Requirements and Division 02 - Existing Conditions.

B. All cutting required shall be done by the contractor whose work is involved, without extra cost the owner. All patching and restoration including the furnishing and installation of access panels in ceiling, walls; etc. Within the building lines shall be done by the respective,

responsible contractor. No cutting of structural steel, concrete, or wood shall be done without prior approval and explicit directions of the architect patched by the respective, responsible contractor.

C. The contractor, under whose jurisdiction the work may fall, shall provide labor, material, and tools required to cut, repair, protect, cap, or relocate existing pipes, conduits, or utilities interfering with or uncovered during work, per regulations of the authorities having jurisdiction.

3.05 ROUGH-IN FOR CONNECTION TO EQUIPMENT

A. It shall be the responsibility of each contractor to study the architectural, structural, electrical, and mechanical drawings, conferring with the various trades involved and checking with the supplier of equipment in order to properly rough-in for all equipment.

3.06 MATERIAL AND EQUIPMENT

A. All material and equipment shall be new and of the best quality used for the purpose in good commercial practice, and shall be the standard product of reputable manufacturers. The material and equipment must meet approval of state and local codes in the area it is being used. Roof decks shall not be used to support piping, conduit, equipment, devices, etc.

3.07 SEAL PENETRATIONS

A. Seal the space around pipes in sleeves and around duct openings through walls, floors and ceilings. Provide adequate clearance to allow for proper sealing.

3.08 SOUND CONTROL

A. Penetrations shall be maintained airtight to prevent sound transfer.

B. Piping, ductwork, etc. shall pass through sleeves. Pack sleeves tight with glass fiber or oakum and caulked on both sides with non-hardening acoustical sealant.

3.09 FIRESTOPPING

A. Refer to Division 07 - Thermal and Moisture Protection for more information.

B. Provide UL classified firestopping system for mechanical penetrations through rated walls and floors to maintain the fire rating.

3.10 DELIVERY, STORAGE AND HANDLING OF EQUIPMENT AND MATERIALS

A. Refer to Division 01 - General Requirements; All equipment and materials shall be delivered, stored and secured per manufacturer's recommendations.

B. On-site storage shall be coordinated with Construction Manager and be performed in a manner as to avoid damage, deterioration and loss.

C. Contractor shall provide temporary protection for installed equipment prior to project completion.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. All equipment shall be inspected prior to installation to assure that equipment is free from defect and damage.

F. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

G. Protect dampers, grilles, louvers from damage to operating linkages and blades.

3.11 CLEANING

A. Refer to Division 01 - General Requirements; all mechanical equipment and components shall be cleaned as frequently as necessary through the construction process and again prior to project completion.

3.12 CONTROL WIRING

A. All control wiring for mechanical and electrical equipment, including motor starters, shall be 120 volt maximum and wired with one side of the coil grounded and the operating contacts in the north side of the circuit. All control wiring shall be installed in conduit.

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. Measurement of final operating condition of HVAC systems.

1.02 RELATED REQUIREMENTS

A. Section 23 0005 - Basic HVAC Requirements.

1.03 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition 2016.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems 2008 (Reaffirmed 2017).

C. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems 2015, with Errata (2017).

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing 2002.

1.04 SUBMITTALS

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

B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

C. 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 six weeks prior to starting the testing, adjusting, and balancing work.
   2. Include at least the following in the plan:
      a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      d. Final test report forms to be used.
      e. Details of how TOTAL flow will be determined; for example:
         1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
         2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
      f. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
      g. Procedures for formal deficiency reports, including scope, frequency and distribution.

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 Owner and Engineer and for inclusion in operating and maintenance manuals.
   3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.

4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
5. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
6. Include the following on the title page of each report:
   a. Name of Testing, Adjusting, and Balancing Agency.
   b. Address of Testing, Adjusting, and Balancing Agency.
   c. Telephone number of Testing, Adjusting, and Balancing Agency.
   d. Project name.
   e. Project location.
   f. 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. AABC (NSTSB), AABC National Standards for Total System Balance.
   2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
   3. 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. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. 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.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

F. Approved TAB Agencies:
   1. Baromatic.
   2. Enviroaire.
   3. Controls Solutions Inc. (CSI).
   4. Environmental Testing Services.
   5. Substitutions must be approved by Engineer during Bid Phase.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.

4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

B. Beginning of work means acceptance of existing conditions.

3.03 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.04 RECORDING AND ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.05 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

M. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

N. On fan powered VAV boxes, adjust air flow switches for proper operation.

O. For fans with variable pitch sheaves: Sheaves in equipment provided by manufacturer are for final belt and sheave sizing ONLY. TAB contractor shall be responsible for providing and installing final sheave and belt for fan.

3.06 SCOPE

A. Test, adjust, and balance the following:
   1. Air Inlets and Outlets.

3.07 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. Service factor.
   6. Starter size, rating, heater elements.
   7. 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. 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.

D. Exhaust Fans:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.
9. Sheave Make/Size/Bore.
10. Number of Belts/Make/Size.
11. Fan RPM.

E. Duct Traverses:
1. System zone/branch.
2. Duct size.
3. Design velocity.
4. Design air flow.
5. Test velocity.
6. Test air flow.
7. Duct static pressure.
8. Air temperature.

END OF SECTION

SECTION 23 07 13
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

1.02 RELATED REQUIREMENTS

A. Section 23 0005 - Basic HVAC Requirements.

B. Section 23 3100 - HVAC Ducts and Casings: Glass fiber ducts.

1.03 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2017.

B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.

C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).

D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation 2014 (Reapproved 2019).

E. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation 2020.

F. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material) 2019.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021.

H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.

I. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015.

J. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).

K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified in this section and approved by manufacturer.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville: www.jm.com/#sle.
   3. Knauf Insulation: www.knaufinsulation.com/#sle.
   4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
   5. Substitutions: See Section 01 6000 - 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 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. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Tie Wire: Annealed steel, 16 gage, 0.0508 inch diameter.

2.03 GLASS FIBER, RIGID

A. Manufacturer:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville: www.jm.com/#sle.
   3. Knauf Insulation: www.knaufinsulation.com/#sle.
   4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulation: ASTM C612; rigid, noncombustible blanket.
   1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 450 degrees F.
   3. Maximum Water Vapor Absorption: 5.0 percent.

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 two coats of vapor barrier mastic and glass tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

2.04 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
   1. Aeroflex USA, Inc: www.aeroflexusa.com/#sle.
   2. Armacell LLC: www.armacell.us/#sle.
   3. K-Flex USA LLC: www.kflexusa.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature: 180 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

D. Weather Barrier Coating: Air dried, contact adhesive, compatible with insulation and ASTM E84 compliant.

2.05 DUCT LINER

A. Manufacturers:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville: www.jm.com/#sle.
   3. Knauf Insulation: www.knaufinsulation.com/#sle.
   4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Note: Choose the liner type - Elastomeric Foam or Glass Fiber.

C. Elastomeric Foam Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature: 180 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

D. Glass Fiber Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; rigid board and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer.
   1. Fungal Resistance: No growth when tested according to ASTM G21.
   2. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
   3. Service Temperature: Up to 250 degrees F.
   4. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.
   5. Minimum Noise Reduction Coefficients:
      a. 1 inch Thickness: 0.45.

E. Adhesive: Waterproof, fire-retardant type, ASTM C916.

F. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated Ducts Conveying Air Below Ambient Temperature:
   1. Provide insulation with vapor barrier jackets.
   2. Finish with tape and vapor barrier jacket.
   3. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with with calked aluminum jacket with seams located on bottom side of horizontal duct section.

E. Slope exterior ductwork to shed water.

F. External Duct Insulation Application:
   1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
   2. Secure insulation without vapor barrier with staples, tape, or wires.

3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

G. Duct and Plenum Liner Application:
1. Adhere insulation with adhesive for 90 percent coverage.
2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for air-flow. Increase duct size to allow for insulation thickness.

3.03 SCHEDULES

A. Exhaust and Relief Ducts Within 10 ft of Exterior Openings:
1. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.

B. Outside Air Intake Ducts:
1. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.

C. Plenums:
1. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.
2. Rigid Glass Fiber Duct Insulation: 1-1/2 inches thick.

D. Return Air Ducts:
1. Duct Liner: 1 inch thick. First 10 feet from equipment only.

E. Supply Ducts:
1. Duct Liner: 1 inch thick. First 10 feet from equipment only.
2. Located in plenum or unconditioned space:
a. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.
3. Located exposed in conditioned space:
a. No insulation required.

F. Tranfer Ducts:
1. Duct Liner: 1 inch thick. First 10 feet from equipment only.

G. Ducts Exposed to Outdoors:
1. Flexible Elastomeric Duct Insulation: 2 inches thick
2. Cover finished insulation with field applied a glass cloth jacket embedded in Foster No. 60-60 fire resistive mastic.

END OF SECTION

SECTION 23 23 00
REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators.

D. Valves.

E. Strainers.

F. Filter-driers.

1.02 RELATED REQUIREMENTS

A. Section 23 07 16 - HVAC Equipment Insulation.

B. Section 23 62 13 - Packaged Air-Cooled Refrigerant Compressor and Condenser Units.

C. Section 23 63 13 - Air Cooled Refrigerant Condensers.

1.03 REFERENCE STANDARDS

A. AHRI 495 - Performance Rating of Refrigerant Liquid Receivers; 2005.

B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2022, with Addendum (2024).

C. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2023.

D. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fuzing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications; 2019.

E. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2022.

F. ASME B31.9 - Building Services Piping; 2017.

G. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2023.

H. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

I. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.

J. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013.

K. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018.

L. UL 429 - Electrically Operated Valves; Current Edition, Including All Revisions.

1.04 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

C. Liquid Indicators:
   1. Use line size liquid indicators in main liquid line leaving condenser.

2. If receiver is provided, install in liquid line leaving receiver.
3. Use line size on leaving side of liquid solenoid valves.

D. Valves:
1. Use service valves on suction and discharge of compressors.
2. Use gauge taps at compressor inlet and outlet.
3. Use gauge taps at hot gas bypass regulators, inlet and outlet.
4. Use check valves on compressor discharge.
5. Use check valves on condenser liquid lines on multiple condenser systems.

E. Strainers:
1. Use line size strainer upstream of each automatic valve.
2. Where multiple expansion valves with integral strainers are used, use single main liquid line strainer.
3. On steel piping systems, use strainer in suction line.
4. Use shut-off valve on each side of strainer.

F. Filter-Driers:
1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.
2. Use a filter-drier on suction line just ahead of compressor.
3. Use filter-driers for each solenoid valve.

G. Solenoid Valves:
1. Use in liquid line of systems operating with single pump-out or pump-down compressor control.
2. Use in liquid line of single or multiple evaporator systems.
3. Use in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into the suction line when system shuts down.

H. Flexible Connectors: Utilize at or near compressors where piping configuration does not absorb vibration.

1.05 SUBMITTALS

A. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with ASME B31.9 for installation of piping system.

B. Welders Certification: In accordance with ASME BPVC-IX.

2.02 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
1. Fittings: ASME B16.22 wrought copper.
2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.
3. Mechanical Press Sealed Fittings: Double pressed type complying with UL 207 and ICC (IMC)-2018.

B. Pipe Supports and Anchors:
1. Provide hangers and supports that comply with MSS SP-58.
a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Hangers for Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
4. Wall Support for Pipe Sizes to 3 Inches (75 mm): Cast iron hook.

5. Vertical Support: Steel riser clamp.
6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
7. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
8. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.03 REFRIGERANT

A. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

2.04 MOISTURE AND LIQUID INDICATORS

A. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F (93 degrees C) and maximum working pressure of 500 psi (3450 kPa).

2.05 VALVES

A. Diaphragm Packless Valves:
   1. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends, with positive backseating; for maximum working pressure of 500 psi (3450 kPa) and maximum temperature of 275 degrees F (135 degrees C).

B. Service Valves:
   1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi (3450 kPa).

2.06 STRAINERS

A. Straight Line or Angle Line Type:
   1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi (2960 kPa).

2.07 CHECK VALVES

A. Globe Type:
   1. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc; for maximum temperature of 300 degrees F (149 degrees C) and maximum working pressure of 425 psi (2930 kPa).

B. Straight Through Type:
   1. Brass body and disc, phosphor-bronze or stainless steel spring, neoprene seat; for maximum working pressure of 500 psi (3450 kPa) and maximum temperature of 200 degrees F (93 degrees C).

2.08 PRESSURE REGULATORS

A. Brass body, stainless steel diaphragm, direct acting, adjustable over 0 to 80 psi (0 to 550 kPa) range, for maximum working pressure of 450 psi (3100 kPa).

2.09 PRESSURE RELIEF VALVES

A. Straight Through or Angle Type: Brass body and disc, neoprene seat, factory sealed and stamped with ASME UV and National Board Certification NB, selected to ASHRAE Std 15, with standard setting of 235 psi (1620 kPa).

2.10 FILTER-DRIERS

A. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

B. Construction: UL listed.
   1. Connections: As specified for applicable pipe type.

2.11 SOLENOID VALVES

A. Valve: AHRI 760 I-P, pilot operated, copper, brass or steel body and internal parts, synthetic seat, stainless steel stem and plunger assembly (permitting manual operation in case of coil failure), integral strainer, with flared, solder, or threaded ends; for maximum working pressure of 500 psi (3450 kPa).

B. Coil Assembly: UL 429 UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires, integral junction box with pilot light.

2.12 EXPANSION VALVES

A. Angle or Straight Through Type: AHRI 750; design suitable for refrigerant, brass body, internal or external equalizer, bleed hole, adjustable superheat setting, replaceable inlet strainer, with non-replaceable capillary tube and remote sensing bulb and remote bulb well.

B. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10 degrees F (6 degrees C) superheat. Select to avoid being undersized at full load and excessively oversized at part load.

2.13 ELECTRONIC EXPANSION VALVES

A. Valve:
   1. Brass body with flared or solder connection, needle valve with floating needle and machined seat, stepper motor drive.

B. Evaporation Control System:
   1. Electronic microprocessor based unit in enclosed case, proportional integral control with adaptive superheat, maximum operating pressure function, preselection allowance for electrical defrost and hot gas bypass.

C. Refrigeration System Control: Electronic microprocessor based unit in enclosed case, with proportional integral control of valve, on/off thermostat, air temperature alarm (high and low), solenoid valve control, liquid injection adaptive superheat control, maximum operating pressure function, night setback thermostat, timer for defrost control.

2.14 RECEIVERS

A. Internal Diameter 6 inch (150 mm) and Smaller:
   1. AHRI 495, UL listed, steel, brazed; 400 psi (2760 kPa) maximum pressure rating, with tappings for inlet, outlet, and pressure relief valve.

B. Internal Diameter Over 6 inch (150 mm):
   1. AHRI 495, welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; 400 psi (2760 kPa) with tappings for liquid inlet and outlet valves, pressure relief valve, and magnetic liquid level indicator.

2.15 FLEXIBLE CONNECTORS

2.16 ENGINEERED WALL SEALS AND INSULATION PROTECTION

A. Pipe Penetration Wall Seal: Seals HVAC piping wall penetrations with compression gasket wall mounted rigid plastic outlet cover.
   1. Wall Outlet Size, Stucco and Masonry Applications: 7-1/2 inch wide by 10 inch high (190.5 mm wide by 254 mm high).

a. Elastomeric Sleeve Diameter: 1-11/16 inch (43 mm).
2. Outlet Cover Color: Gray.
3. Water Penetration: Comply with ASTM E331.
4. Air Leakage: Comply with ASTM E283.
5. Air Permeance: Comply with ASTM E2178.

B. Insulation Protection System: Mechanical line insulation and PVC cover.
1. PVC Insulation Cover Color: Black with full-length velcro fastener.
2. Weatherization and Ultraviolet Exposure Protection: Comply with ASTM G153.
3. Water/Vapor Permeability: Comply with ASTM E96/E96M.
4. Anti-Fungal and Anti-Microbial Resistance: Comply with ASTM G21.
5. Flame Spread and Smoke Development Rating of 25/450: Comply with ASTM E84.
6. Adhesive free.

2.17 EXTERIOR PENETRATION ACCESSORIES

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

PART 3 EXECUTION

3.01 PREPARATION

A. Remove scale and dirt on inside and outside before assembly.

B. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

E. Inserts:
1. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
2. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).

F. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.5.
2. Install hangers to provide minimum 1/2 inch (13 mm) space between finished covering and adjacent work.
3. Place hangers within 12 inches (300 mm) of each horizontal elbow.
4. Provide copper plated hangers and supports for copper piping.

G. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

H. Provide clearance for installation of insulation and access to valves and fittings.

I. Flood piping system with nitrogen when brazing.

J. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.

K. Prepare unfinished pipe, fittings, supports, and accessories ready for finish painting. See Section 09 91 23.

L. Insulate piping and equipment.

M. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.

N. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

O. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

P. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

Q. Fully charge completed system with refrigerant after testing.

END OF SECTION

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single-wall rectangular ducts and fittings.

B. Single-wall round ducts and fittings.

C. Sheet metal materials.

D. Sealants and gaskets.

E. Hangers and supports.

1.02 RELATED REQUIREMENTS

A. Division 03 - Concrete

B. Division 07 - Thermal Moisture Protection: Firestopping

C. Section 23 0005 - Basic HVAC Requirements

D. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

E. Section 23 0713 - Duct Insulation: External insulation and duct liner.

F. Section 23 3300 - Air Duct Accessories.

G. Section 23 3700 - Air Outlets and Inlets.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.

B. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes 2017.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

D. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.

E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.

G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2018.

H. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations 2021.

I. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).

J. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors current edition, including all revisions.

K. UL 1978 - Grease Ducts Current Edition, Including All Revisions.

L. UL 2221 - Tests of Fire Resistive Grease Duct Enclosure Assemblies Current Edition, Including All Revisions.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.05 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 - General Requirements for submittal procedures.

B. Product Data: Provide data for duct materials, duct liner, duct connections, and factory fabricated fittings.

C. Shop Drawings: Submit 1/4 scale, double line shop drawings that indicate duct fittings, duct size, bottom of duct elevations, necessary offsets to accommodate building structure, particulars such as gages, sizes, welds, elevations, all fittings, and configuration prior to start of work for all systems.

1.06 REGULATORY REQUIREMENTS

A. Construct ductwork to SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 1995, Second Edition with Addendum No. 1.

PART 2 PRODUCTS

2.01 SINGLE-WALL RECTANGULAR DUCT AND FITTING ASSEMBLIES

A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.

B. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.02 SINGLE-WALL ROUND DUCT AND FITTING ASSEMBLIES

A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.

B. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. McGill AirFlow LLC.
b. Spiral Manufacturing Co., Inc.

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

E. Tees and Laterals: Select types ansd fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.03 MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

C. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

D. Galvanealed Sheet Steel (FOR EXPOSED, PAINTED DUCTWORK): Comply with ASTM A653-09; hot dipped zinc iron coated steel, annealed, coating designation "A" (A60, A40)

E. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

F. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

G. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

H. Tie Rods: Galvanized steel, 1/4-inchminimum diameter for lengths 36 inches or less; 3/8-inchminimum diameter for lengths longer than 36 inches.

I. Aluminum for Ducts: ASTM B209 (ASTM B209M); aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T651 or of equivalent strength.

2.04 SEALANTS AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index

of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:
   1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
   2. Tape Width: 3 inches.
   3. Sealant: Modified styrene acrylic.
   4. Water resistant.
   5. Mold and mildew resistant
   6. Maximum Static-Pressure Class: 10-ing wg, positive and negative
   7. Service: Indoor and outdoor
   8. Service Temperature: Minus 40 to plus 200 deg F.
   9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
   10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:
   1. Application Method: Brush on.
   2. Solids Content: Minimum 65 percent.
   3. Shore A Hardness: Minimum 20.
   4. Water resistant.
   5. Mold and mildew resistant.
   6. VOC: Maximum 75 g/L (less water).
   7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
   8. Service: Indoor or outdoor.
   9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.
   1. General: Single-component, acid-curing, silicone, elastomeric.
   2. Type: S.
   3. Grade: NS.
   4. Class: 25.
   5. Use: O.
   6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:
   1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg pressure class, positive or negative.

2.05 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, "Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:
   1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
   2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
   3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.06 DUCTWORK FABRICATION

A. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Provide turning vanes in all mitered elbows.

C. Construct T'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.

D. T's, bends, and elbows: construct according to SMACNA (DCS).

E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

F. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

G. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

H. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

I. 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.

2.07 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Flat Oval Ducts: Machine made from round spiral lockseam duct.
   1. Manufacture in accordance with SMACNA (DCS).
   2. Fittings: Manufacture at least two gages heavier metal than duct.
   3. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Flexible Ducts: Black polymer film supported by helically wound spring steel wire.
   1. UL labeled.
   2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   3. Pressure Rating: 4 inches WG positive and 0.5 inches WG negative.
   4. Maximum Velocity: 4000 fpm.
   5. Temperature Range: Minus 20 degrees F to 175 degrees F.

D. Kitchen Cooking Hood and Grease Exhaust: Nominal 3 inches thick ceramic fiber insulation between 20 gage, 0.0375 inch, Type 304 stainless steel liner and 24 gage, 0.0239 inch aluminized steel sheet outer jacket.
   1. Tested and UL listed for use with commercial cooking equipment in accordance with NFPA 96.
   2. Certified for zero clearance to combustible material in accordance with:
      a. UL 2221 with a 2 hour rating.
   3. Materials and construction of the modular sections and accessories to be in accordance with the terms of the following listings:
      a. UL 1978.
      b. UL 2221.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install in accordance with manufacturer's instructions.

C. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

D. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

E. Install round ducts in maximum practical lengths.

F. Install ducts with fewest possible joints.

G. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

H. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

I. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

J. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

K. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

L. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

M. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

N. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

O. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

P. Kitchen Hood Exhaust: Provide residue traps at base of vertical risers with provisions for clean out.

Q. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

R. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

S. Use double nuts and lock washers on threaded rod supports.

3.02 HANGERS AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   1. Where practical, install concrete inserts before placing concrete.
   2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
   4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
   5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.03 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.04 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
   1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   2. Outdoor, Supply-Air Ducts: Seal Class A.

3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.
13. All locations, Laboratory Exhaust Ducts: Seal Class A.

3.05 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.
   1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
   2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
   3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:
   1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
   2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:
   1. Air outlets and inlets (registers, grilles, and diffusers).
   2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
   3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
   4. Coils and related components.
   5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
   6. Supply-air ducts, dampers, actuators, and turning vanes.
   7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:
   1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
   2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.

3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.06 FIELD QUALITY CONTROLS

A. Perform tests and inspections.

B. Leakage Tests:
   1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
   2. Test the following systems:
      a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections, selected by Architect from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.
   3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
   4. Keep open ends of ductwork covered during construction.
   5. Test for leaks before applying external insulation.
   6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
   7. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:
   1. Visually inspect duct system to ensure that no visible contaminants are present.
   2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCAACR, "Assessment, Cleaning and Restoration of HVAC Systems."
      a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.07 SCHEDULES

A. Supply Ducts:
   1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
      a. Pressure Class: Positive 1-inch wg.
      b. Minimum SMACNA Seal Class: C.
      c. SMACNA Leakage Class for Rectangular: 12
      d. SMACNA Leakage Class for Round and Flat Oval: 6.
   2. Ducts Connected to Constant-Volume Air-Handling Units:
      a. Pressure Class: Positive 4-inch wg.
      b. Minimum SMACNA Seal Class: A.
      c. SMACNA Leakage Class for Rectuangular: 6.

d. SMACNA Leakage Class for Round and Flat Oval: 3.

3. Ducts Connected to Variable-Air-Volume Air-Handling Units:
   a. Pressure Class: Positive 4-inch wg.
   b. Minimum SMACNA Seal Class: A.
   c. SMACNA Leakage Class for Rectangular: 6.
   d. SMACNA Leakage Class for Round and Flat Oval: 3.

B. Return Ducts:
   1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
      a. Pressure Class: Positive or negative 1-inch wg.
      b. Minimum SMACNA Seal Class: B.
      c. SMACNA Leakage Class for Rectangular: 12.
      d. SMACNA Leakage Class for Round and Flat Oval: 6.
   2. Ducts Connected to Air-Handling Units:
      a. Pressure Class: Positive or negative 4-inch wg.
      b. Minimum SMACNA Seal Class: A.
      c. SMACNA Leakage Class for Rectangular: 6.
      d. SMACNA Leakage Class for Round and Flat Oval: 3.

C. Exhaust Ducts:
   1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
      a. Pressure Class: Negative 2-inch wg.
      b. Minimum SMACNA Seal Class: C if negative pressure, and A if positive pressure.
      c. SMACNA Leakage Class for Rectangular: 24.
      d. SMACNA Leakage Class for Round and Flat Oval: 12.
   2. Ducts Connected to Fans Exhausting Laboratory and Process (ASHRAE 62.1, Class 3 and 4) Air:
      a. Type 316, stainless-steel sheet.
         1) Exposed to View: No. 4 finish.
         2) Concealed: No. 2D finish.
      b. Pressure Class: Positive or negative 6-inch wg.
      c. Minimum SMACNA Seal Class: A.
      d. SMACNA Leakage Class: 3.

D. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
   1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
      a. Pressure Class: Positive or negative 2-inch wg.
      b. Minimum SMACNA Seal Class: B.
      c. SMACNA Leakage Class for Rectangular: 12.
      d. SMACNA Leakage Class for Round and Flat Oval: 6.
   2. Ducts Connected to Air-Handling Units:
      a. Pressure Class: Positive or negative 2-inch wg.
      b. Minimum SMACNA Seal Class: B.
      c. SMACNA Leakage Class for Rectangular: 12.
      d. SMACNA Leakage Class for Round and Flat Oval: 6.

E. Intermediate Reinforcement:
   1. Stainless-Steel Ducts:
      a. Exposed to Airstream: Match duct material.
      b. Not Exposed to Airstream: Match duct material.

F. Elbow Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
      a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:
1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:
1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90 degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90 degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90 degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Welded.

G. Branch Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.
1) Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

c. Velocity 1000 fpm or Lower: 90-degree tap.
d. Velocity 1000 to 1500 fpm: Conical tap.
e. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air turning devices/extractors.
B. Backdraft dampers - metal.
C. Backdraft dampers - fabric.
D. Combination fire and smoke dampers.
E. Duct access doors.
F. Duct test holes.
G. Fire dampers.
H. Flexible duct connectors.
I. Smoke dampers.
J. Volume control dampers.

1.02 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project procedural and administrative requirements.
B. Division 07 - Thermal and Moisture Protection: Firestopping
C. Section 23 0005 - Basic HVAC Requirements
D. Section 23 3100 - HVAC Ducts and Casings.
E. Section 23 3600 - Air Terminal Units: Pressure regulating damper assemblies.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2018.
B. NFPA 92 - Standard for Smoke Control Systems 2018.
C. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations 2021.
D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).
E. UL 33 - Safety Heat Responsive Links for Fire-Protection Service Current Edition, Including All Revisions.
F. UL 555 - Standard for Fire Dampers Current Edition, Including All Revisions.
G. UL 555S - Standard for Smoke Dampers Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 - General Requirements for submittal procedures.
B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

1.05 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.02 BACKDRAFT DAMPERS - METAL

A. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.03 BACKDRAFT DAMPERS - FABRIC

A. Fabric Backdraft Dampers: Factory-fabricated.
   1. Blades: Neoprene coated fabric material.
   2. Birdscreen: 1/2 inch nominal mesh of galvanized steel or aluminum.
   3. Maximum Velocity: 1000 fpm (5 mps) face velocity.

2.04 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:
   1. Nailor Industries, Inc: www.nailor.com.
   2. Ruskin Company: www.ruskin.com.
   3. United Enertech: www.unitedenertech.com.
   4. Greenheck: www.greenheck.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

C. Provide factory sleeve and collar for each damper.

D. Multiple Blade Dampers: Fabricate with 16 gage, 0.0598 inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.

E. Operators: UL listed and labelled spring return electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on interior of duct and link to damper operating shaft.

F. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure, stainless steel springs with locking devices to ensure positive closure for units mounted horizontally.

G. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

2.05 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

2.06 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.07 FIRE DAMPERS

A. Manufacturers:
   1. Nailor Industries, Inc: www.nailor.com.
   2. Ruskin Company: www.ruskin.com.
   3. United Enertech: www.unitedenertech.com.

4. Greenheck: www.greenheck.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

C. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0 inch pressure class ducts up to 12 inches in height.

D. Fusible Links: UL 33, separate at 165 degrees F with adjustable link straps for combination fire/balancing dampers.

2.08 FLEXIBLE DUCT CONNECTORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.

2.09 SMOKE DAMPERS

A. Manufacturers:
1. Nailor Industries, Inc: www.nailor.com.
2. Ruskin Company: www.ruskin.com.
3. United Enertech: www.unitedenertech.com.
4. Greenheck: www.greenheck.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.

C. Dampers: UL Class 1 airfoil blade type smoke damper, normally open automatically operated by electric actuator.

2.10 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Single Blade Dampers:
1. Blade: 24 gage, 0.0239 inch, minimum.

C. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
1. Blade: 18 gage, 0.0478 inch, minimum.

D. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

E. Quadrants:
1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30 inches provide regulator at both ends.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 3100 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as

indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96 Provide minimum 8 by 8 inch size for hand access, size for shoulder access, and as indicated. Provide 4 by 4 inch for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.

G. Demonstrate re-setting of fire dampers to Owner's representative.

H. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

I. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

J. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

SECTION 23 34 23
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof exhausters.

B. Cabinet exhaust fans.

1.02 RELATED REQUIREMENTS

A. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

B. Section 23 3300 - Air Duct Accessories: Backdraft dampers.

C. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program 2015.

B. AMCA 99 - Standards Handbook 2016.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans 2005 (Reaffirmed 2012).

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating 2016.

E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans 2014.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data 2014.

1.04 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 - General Requirements for submittal procedures.

B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

1.05 FIELD CONDITIONS

A. Permanent ventilators may not be used for ventilation during construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Greenheck Fan Corporation: www.greenheck.com.

B. Loren Cook Company: www.lorencook.com.

C. PennBarry, Division of Air System Components: www.pennbarry.com.

2.02 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.

B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.

D. Fabrication: Comply with AMCA 99.

E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.03 CABINET EXHAUST FANS

A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.

B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.

C. Grille: Molded white plastic.

D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Hung Cabinet Fans:
   1. Install fans with resilient mountings and flexible electrical leads. Refer to Section 22 0548.
   2. Install flexible connections specified in Section 23 3300 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. Install backdraft dampers on inlet to roof and wall exhausters.

E. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

END OF SECTION

SECTION 23 81 27
SMALL SPLIT-SYSTEM HEATING AND COOLING

SECTION 23 8127

SMALL SPLIT-SYSTEM HEATING AND COOLING

2.01 SECTION INCLUDES

A. Air-source heat pumps.

B. Air cooled condensing units.

C. Indoor air handler (fan & coil) units for duct connection.

D. Indoor ductless fan & coil units.

E. Controls.

2.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Mounting pad for outdoor unit.

B. Section 23 3100 - HVAC Ducts and Casings.

2.03 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2008.

B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.

C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.

D. ASHRAE Std 23.1 - Methods of Testing for Rating Positive Displacement Refrigerant Compressors and Condensing Units; 2010.

E. NEMA MG 1 - Motors and Generators; 2014.

F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

G. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2015.

H. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

2.04 SUBMITTALS

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

B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

PART 2 PRODUCTS

3.01 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
   1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator; auxiliary electric heat.
   2. Cooling: Outdoor electric condensing unit with evaporator coil in central ducted indoor unit.
   3. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

B. Performance Requirements: See Drawings for additional requirements.

3.02 INDOOR UNITS FOR DUCTED SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating and cooling element(s), controls, and accessories; wired for single power connection with control transformer.
   1. Air Flow Configuration: Upflow.
   2. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.

B. Supply Fan: Centrifugal type rubber mounted with direct or belt drive with adjustable variable pitch motor pulley.
   1. Motor: NEMA MG 1; 1750 rpm single speed, permanently lubricated, hinge mounted.

C. Air Filters: 1 inch thick urethane, washable type arranged for easy replacement.

D. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
   1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
   2. Manufacturers: System manufacturer.

3.03 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
   1. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23.1 and UL 207.

B. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.

C. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gage ports, thermometer well (in liquid line).
   1. Provide thermostatic expansion valves.

D. Operating Controls:
   1. Control by room thermostat to maintain room temperature setting.

3.04 ACCESSORY EQUIPMENT

A. Room Humidistat: Electric, adjustable, to energize humidifier when fan operating, to maintain setting.

B. Room Thermostat: Duct-mounted, electric solid state microcomputer based room thermostat with remote sensor to maintain temperature setting; low-voltage; with following features:
   1. Automatic switching from heating to cooling.
   2. Preferential rate control to minimize overshoot and deviation from setpoint.
   3. Thermostat Display:
      a. System Mode Indication: Heating, Cooling, Fan Auto, Off, and On, Auto or On, Off.

PART 3 EXECUTION

4.01 INSTALLATION

A. Install in accordance with NFPA 90A and NFPA 90B.

B. Install refrigeration systems in accordance with ASHRAE Std 15.

END OF SECTION

SECTION 26 00 05
BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. This section applies to all sections of Division 26 and Division 28.

B. Drawings and general provisions of the contract, including Division 00 and Division 01 specification sections, apply to work of this section.

C. Provide all items, articles, materials, operations or methods listed, mentioned or scheduled on drawings and/or herein, including all labor, materials, equipment and incidentals necessary and required for their completion.

D. The items in this section are supplementary to the requirements set forth in other portions of the specifications as indicated under Item "A" above.

1.02 DRAWINGS

A. The drawings show the location and general arrangement of equipment, electrical systems and related items. They shall be followed as closely as elements of the construction will permit.

B. Examine the drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly, providing such fittings, conduit, junction boxes and accessories as may be required to meet such conditions.

C. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.

D. The architectural and structural drawings take precedence in all matters pertaining to the building structure, mechanical drawings in all matters pertaining to mechanical trades and electrical drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.

1.03 INSPECTION OF SITE

A. Visit the site, examine and verify the conditions under which the work must be conducted before submitting proposal.

B. The submitting of a proposal implies that the contractor has visited the site and understands the conditions under which the work must be conducted.

1.04 TEMPORARY FACILITIES

A. Provide and remove upon completion of the project, in accordance with the general conditions, a complete temporary electrical and telephone service during construction.

1.05 ALTERNATES

A. Refer to Division 01 - General Requirements for procedures.

1.06 GUARANTEE

A. Contractor guarantees that the installation is free from defects and agrees to replace or repair, any part of this installation which becomes defective within a period of one year following final acceptance, unless noted otherwise, provided that such failure is due to defects in the equipment, material or installation or to follow the specifications and drawings. File with the Owner any and all guarantees from the equipment manufacturers.

1.07 CODES, PERMITS AND FEES

A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for electrical work shall be secured and paid for by the contractor. All work shall conform to all

applicable codes, rules and regulations. Applicable publications listed in all sections of Division 26 shall be the latest issue, unless otherwise noted.

B. Rules of local utility companies shall be complied with. Check with the utility company supplying service to the installation and determine all devices including, but not limited to, all current and potential transformers, meter boxes, C.T. cabinets and meters which will be required and include the cost of all such items in proposal.

C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.

1.08 STANDARDS OF MATERIAL AND WORKMANSHIP:

A. All materials shall be new, unless noted otherwise. The electrical and physical properties of all materials, and the design, performance characteristics, and methods of construction of all items of equipment, shall be in accordance with the latest issue of the various, applicable standard specifications of the following recognized authorities:
   1. N.S.I. - American National Standards Institute
   2. S.T.M. - American Society for Testing Materials
   3. C.E.A. - Insulated Cable Engineers Association
   4. E.E.E. - Institute of Electrical and Electronics Engineers
   5. E.C. - National Electrical Code (NFPA 70)
   6. E.C.A. - National Electrical Contractors Association
   7. E.M.A. - National Electrical Manufacturer's Association
   8. F.P.A. - National Fire Protection Association
   9. L. - Underwriters Laboratories, Inc.

B. Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the Trades involved.

C. All equipment of the same or similar systems shall be by the same manufacturer.

1.09 RECORD DRAWINGS

A. Refer to Division 01 - General Requirements for procedures. All literature shall be furnished in accordance with requirements listed in Division 01.

B. Contractor shall provide the following record drawings as part of the Project closeout document process:
   1. Contract Documents, specifications and submittals, indicating "As-Built" conditions and actual products selected for use.
   2. Product and Maintenance manuals for all equipment listed within this specification manual and in Contract Documents. Provide with parts lists as applicable.

1.10 SUBMITTALS

A. Refer to Division 01 - General Requirements for procedures.

B. Contractor shall provide submittals where items are referred to by symbolic designation on the drawings. All submittals shall bear the same designation (light fixtures, wiring devices, etc.). Refer to other sections of the electrical specifications for additional requirements.

C. Engineer WILL NOT REVIEW:
   1. Submittals not specified.
   2. Submittals which do not indicate optional equipment being provided.
   3. Submittals not reviewed by Contractor; including Contractor stamp with signature comments.
   4. Submittals made after work is delivered to site and/or installed.
   5. Submittal resubmissions unless resubmission is required by Architect/Engineer.

1.11 MANUFACTURERS LISTED

A. The listing of specific manufacturers does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed are not relieved from meeting these specifications in their entirety.

B. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer five (5) days prior to bid date.

1.12 USE OF EQUIPMENT

A. The use of any equipment, or any part thereof for purposes other than testing even with the Owner's consent, shall not be construed to be an acceptance of the work on the part of the Owner, nor be construed to obligate the Owner in any way to accept improper work or defective materials.

B. Do not use Owner's light fixtures for temporary lighting except as allowed and directed by the Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 INSTALLATION OF EQUIPMENT

A. Install all equipment in strict accordance with all directions and recommendations furnished by the manufacturer. Where such directions are in conflict with the drawings and specifications, report such conflicts to the Architect/Engineer for resolution.

B. Equipment location shall be as close as practical to locations shown on the drawings.

C. Working clearances shall not be less than specified in NFPA 70 (National Electric Code).

3.02 COORDINATION

A. Install work to avoid interference with work of other trades including, but not limited to, architectural and mechanical trades. Remove and relocate any work that causes an interference at Contractor's expense. Disputes regarding the cause of an interference will be resolved by the Construction Manager or Architect/Engineer.

3.03 CUTTING, PATCHING AND DAMAGE TO OTHER WORK

A. Refer to Division 01 - General Requirements and Division 02 - Existing Conditions.

B. All cutting, patching and repair work shall be performed by the contractor through approved, qualified subcontractors. Contractor shall include full cost of same in bid.

3.04 EXCAVATION AND BACKFILLING

A. Provide all excavation, trenching, tunneling, dewatering and backfilling required for the electrical work. Coordinate the work with other excavating and backfilling in the same area.

B. Where conduit is installed less than 30" below the surface of pavement, provide concrete encasement, 4" minimum coverage, all around or as shown on the electrical drawings.

C. Backfill all excavations inside building, under drives and parking areas with well-tamped granular material. Backfill all excavations under wall footings with lean mix concrete up to underside of footings and extend concrete within excavation a minimum of four (4) feet each side of footing. Granular backfill shall be placed in layers not more than 8 inches in thickness, 95 percent compaction throughout with approved compaction equipment. Tamp, roll as required. Excavated material shall not be used.

D. Backfill outside building with granular material to a height 12 inches over top of pipe compacted to 95 percent compaction as specified above. Backfill remainder of excavation with unfrozen, excavated material in such a way to prevent settling. Tamp, roll as required.

3.05 EQUIPMENT FOUNDATION AND SUPPORTS

A. Shall be as required or as shown on plans or specified.

B. Provide concrete house keeping bases 4" above finished floor, with leveling channels, where noted, for floor-mounted equipment. Coordinate requirements with Division 03 - Concrete.

C. For equipment suspended from ceilings or walls, furnish and install all inserts, rods, structural steel frames, brackets and platforms required.

3.06 EQUIPMENT CONNECTIONS

A. Make connections to equipment, motors, lighting fixtures, and other items included in the work in accordance with the approved shop drawings and rough-in measurements furnished by the manufacturers of the particular equipment furnished. All additional connections not shown on the drawings, but called out by the equipment manufacturer's shop drawings shall be provided.

3.07 ACCESS DOORS AND PANELS

A. Refer to Division 08 - Openings; Provide access doors in locations as required per N.E.C. Coordinate locations with architectural trades.

3.08 CLEANING

A. Refer to Division 01 - General Requirements; All equipment shall be cleaned as frequently as necessary through the construction process and again prior to project completion.

B. Final cleanup shall include, but not be limited to, washing of fixture lenses or louvers, switchboards, substations, motor control centers, panels, etc. Fixture reflectors and lenses or louvers shall be left with no water marks or cleaning streaks.

3.09 DELIVERY, STORAGE AND PROTECTION OF EQUIPMENT AND MATERIALS

A. Refer to Division 01 - General Requirements; All equipment and materials shall be delivered, stored and secured per manufacturer's recommendations.

B. On-site storage shall be coordinated with Construction Manager and be performed in a manner as to avoid damage, deterioration and loss.

3.10 DRAWINGS AND MEASUREMENTS

A. Electrical drawings are not intended to be scaled for rough-in measurements nor to serve as submittals. Field measurements necessary for ordering materials and fitting the installation to the building construction and arrangement shall be taken by the Contractor.

END OF SECTION

SECTION 26 05 05
SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition and extension of existing electrical work.

1.02 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements

B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements.

C. Section 26 0005 - Basic Electrical Requirements.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that abandoned wiring and equipment serve only abandoned facilities.

B. Demolition drawings are based on casual field observation and existing record documents.

C. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with utility company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
   2. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Notify Owner before partially or completely disabling system.
   2. Notify local fire service.
   3. Make notifications at least 24 hours in advance.
   4. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
   1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
   2. PCB- and DEHP-containing lighting ballasts.
   3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

F. Disconnect and remove abandoned panelboards and distribution equipment.

G. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

H. Repair adjacent construction and finishes damaged during demolition and extension work.

I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

3.04 CLEANING AND REPAIR

A. See Division 01 - General Requirements.

B. Clean and repair existing materials and equipment that remain or that are to be reused.

C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

D. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

END OF SECTION

SECTION 26 05 19
VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Metal-clad cable.

C. Wiring connectors.

D. Electrical tape.

E. Heat shrink tubing.

F. Oxide inhibiting compound.

G. Wire pulling lubricant.

H. Cable ties.

I. Firestop sleeves.

1.02 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.

C. Section 07 8400 - Firestopping.

D. Section 26 0005 - Basic Electrical Requirements.

E. Section 26 0505 - Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.

F. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

G. Section 26 0536 - Cable Trays for Electrical Systems: Additional installation requirements for cables installed in cable tray systems.

H. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

I. Section 28 4600 - Fire Detection and Alarm: Fire alarm system conductors and cables.

J. Division 31 - Earthwork: Excavating, bedding, and backfilling.

1.03 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire 2013 (Reapproved 2018).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft 2011 (Reapproved 2017).

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes 2010, with Editorial Revision (2020).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation 2004 (Reapproved 2020).

E. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

F. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC) 2012.

G. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy 2009.

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.

I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 44 - Thermoset-Insulated Wires and Cables Current Edition, Including All Revisions.

K. UL 83 - Thermoplastic-Insulated Wires and Cables Current Edition, Including All Revisions.

L. UL 486A-486B - Wire Connectors Current Edition, Including All Revisions.

M. UL 486C - Splicing Wire Connectors Current Edition, Including All Revisions.

N. UL 486D - Sealed Wire Connector Systems Current Edition, Including All Revisions.

O. UL 1569 - Metal-Clad Cables Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

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

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Service entrance cable is not permitted.

F. Armored cable is not permitted.

G. Metal-clad cable is permitted only as follows:
   1. Where not otherwise restricted, may be used:
      a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
         1) Maximum Length: 6 feet.
      b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.

H. Manufactured wiring systems are not permitted.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductor Material:
   1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
   2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
   3. Tinned Copper Conductors: Comply with ASTM B33.

H. Minimum Conductor Size:
   1. Branch Circuits: 12 AWG.
      a. Exceptions:
         1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
         2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
         3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.

I. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

J. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
   2. Color Coding Method: Integrally colored insulation.
   3. Color Code:
      a. 480Y/277 V, 3 Phase, 4 Wire System:
         1) Phase A: Brown.
         2) Phase B: Orange.
         3) Phase C: Yellow.
         4) Neutral/Grounded: Gray.
      b. 208Y/120 V, 3 Phase, 4 Wire System:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Phase C: Blue.
         4) Neutral/Grounded: White.
      c. Equipment Ground, All Systems: Green.

d. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
   1. Copper Building Wire:
      a. Cerro Wire LLC: www.cerrowire.com.
      b. Encore Wire Corporation: www.encorewire.com.
      c. General Cable Technologies Corporation: www.generalcable.com.
      d. Southwire Company: www.southwire.com.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
   1. Feeders and Branch Circuits:
      a. Size 10 AWG and Smaller: Stranded.
      b. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
   1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.

2.04 METAL-CLAD CABLE

A. Manufacturers:
   1. AFC Cable Systems Inc: www.afcweb.com/#sle.
   2. Encore Wire Corporation: www.encorewire.com/#sle.
   3. Southwire Company: www.southwire.com/#sle.

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:
   1. Size 10 AWG and Smaller: Stranded.
   2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

F. Provide oversized neutral conductors where indicated or required.

G. Grounding: Full-size integral equipment grounding conductor.

H. Armor: Steel, interlocked tape.

2.05 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 0526.

C. Wiring Connectors for Splices and Taps:
   1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
   2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

D. Wiring Connectors for Terminations:
   1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.

2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

H. Mechanical Connectors: Provide bolted type or set-screw type.

I. Compression Connectors: Provide circumferential type or hex type crimp configuration.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:
1. Unless dimensioned, circuit routing indicated is diagrammatic.
2. When circuit destination is indicated without specific routing, determine exact routing required.
3. Arrange circuiting to minimize splices.
4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
9. Provide oversized neutral/grounded conductors where indicated and as specified below.
   a. Provide 200 percent rated neutral for feeders fed from K-rated transformers.
   b. Provide 200 percent rated neutral for feeders serving panelboards with 200 percent rated neutral bus.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install metal-clad cable (Type MC) in accordance with NECA 120.

E. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

H. Terminate cables using suitable fittings.
   1. Metal-Clad Cable (Type MC):
      a. Use listed fittings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

I. Install conductors with a minimum of 12 inches of slack at each outlet.

J. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.

K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

L. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

M. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.
   4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
   5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

N. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

O. Insulate ends of spare conductors using vinyl insulating electrical tape.

P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07.

Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
   1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

C. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

1.02 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements

B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, repairs.

C. Section 26 0005 - Basic Electrical Requirements

D. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

E. Section 26 0536 - Cable Trays for Electrical Systems: Additional grounding and bonding requirements for cable tray systems.

F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

G. Section 26 5600 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

H. Division 31 - Earthwork: Excavating, trenching and fill.

1.03 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System 2012.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings 2017.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.

E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 467 - Grounding and Bonding Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify exact locations of underground metal water service pipe entrances to building.
   2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
   3. Notify Strategic Energy Solutions, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

B. Project Record Documents: Record actual locations of grounding electrode system components and connections.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Grounding System Resistance:
   1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
   2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
   3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

F. Grounding Electrode System:
   1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.
      b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
   2. Metal Underground Water Pipe(s):
      a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
      b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
      c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
   3. Concrete-Encased Electrode:
      a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
   4. Ground Ring:
      a. Provide a ground ring encircling the building or structure consisting of bare copper conductor not less than 2 AWG in direct contact with earth, installed at a depth of not less than 30 inches.

b. Where location is not indicated, locate ground ring conductor at least 24 inches outside building perimeter foundation.
c. Provide ground enhancement material around conductor.
d. Provide connection from ground ring conductor to:
1) Perimeter columns of metal building frame.
2) Ground rod electrodes located as indicated.

5. Ground Rod Electrode(s):
a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
b. Space electrodes not less than 10 feet from each other and any other ground electrode.
c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.

6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

G. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

H. Cable Tray Systems: Also comply with Section 26 0536.

I. Pole-Mounted Luminaires: Also comply with Section 26 5600.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
1. Use insulated copper conductors unless otherwise indicated.
a. Exceptions:

1) Use bare copper conductors where installed underground in direct contact with earth.
2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
4. Manufacturers - Mechanical and Compression Connectors:
a. Advanced Lightning Technology (ALT): www.altfab.com
b. Burndy LLC: www.burndy.com
c. Harger Lightning & Grounding: www.harger.com
d. Thomas & Betts Corporation: www.tnb.com
5. Manufacturers - Exothermic Welded Connections:
a. Burndy LLC: www.burndy.com
b. Cadweld, a brand of Erico International Corporation: www.erico.com
c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com

D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.
4. Manufacturers:
a. Advanced Lightning Technology (ALT): www.altfab.com
b. Erico International Corporation: www.erico.com
c. Harger Lightning & Grounding: www.harger.com
d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com

E. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
4. Where rod lengths of greater than 10 feet are indicated or otherwise required, sectionalized ground rods may be used.
5. Manufacturers:
a. Advanced Lightning Technology (ALT): www.altfab.com/#sle.
b. Erico International Corporation: www.erico.com/#sle.
c. Galvan Industries, Inc: www.galvanelectrical.com/#sle.
d. Harger Lightning & Grounding: www.harger.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

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

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.

D. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
   3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
   4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.13.

C. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements

B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, and cutting and patching requirements.

C. Division 03 - Concrete: Concrete equipment pads.

D. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

E. Section 26 0005 - Basic Electrical Requirements

F. Section 26 0533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

G. Section 26 0536 - Cable Trays for Electrical Systems: Additional support and attachment requirements for cable tray.

H. Section 26 0533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

I. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

J. Section 26 5600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.

D. MFMA-4 - Metal Framing Standards Publication 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 5B - Strut-Type Channel Raceways and Fittings Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.

4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Division 03.

1.05 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. 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 electrical work.
2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
2. Conduit Clamps: Bolted type unless otherwise indicated.
3. Manufacturers:
a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com
b. Erico International Corporation: www.erico.com
c. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com
d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com
e. Thomas & Betts Corporation: www.tnb.com

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
1. Manufacturers:
a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
b. Erico International Corporation: www.erico.com/#sle.
c. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
e. Thomas & Betts Corporation: www.tnb.com/#sle.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.

1. Comply with MFMA-4.
2. Channel (Strut) Used as Raceway (only where specifically indicated): Listed and labeled as complying with UL 5B.
3. Manufacturers:
   a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com
   b. Thomas & Betts Corporation: www.tnb.com
   c. Unistrut, a brand of Atkore International Inc: www.unistrut.com

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 1/2 inch diameter.
   b. Single Conduit up to 1 inch (27 mm) trade size: 1/4 inch diameter.
   c. Single Conduit larger than 1 inch (27 mm) trade size: 3/8 inch diameter.
   d. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
   e. Outlet Boxes: 1/4 inch diameter.
   f. Luminaires: 1/4 inch diameter.

F. Non-Penetrating Rooftop Supports for Low-Slope Roofs: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
1. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
2. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
3. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
4. Manufacturers:
   a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com
   b. Erico International Corporation: www.erico.com
   c. PHP Systems/Design: www.phpsd.com
   d. Unistrut, a brand of Atkore International Inc: www.unistrut.com

G. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

PART 3 EXECUTION

3.01 INSTALLATION

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

B. Perform work in accordance with NECA 1 (general workmanship).

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:
1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.

3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 4 inch high concrete pad constructed in accordance with Division 03.
5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Conduit Support and Attachment: Also comply with Section 26 0533.13.

I. Cable Tray Support and Attachment: Also comply with Section 26 0536.

J. Box Support and Attachment: Also comply with Section 26 0533.16.

K. Secure fasteners according to manufacturer's recommended torque settings.

L. Remove temporary supports.

3.02 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 26 05 33.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).
B. Aluminum rigid metal conduit (RMC).
C. Flexible metal conduit (FMC).
D. Electrical metallic tubing (EMT).
E. Rigid polyvinyl chloride (PVC) conduit.
F. Conduit fittings.
G. Accessories.

1.02 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.
B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.
C. Division 07 - Thermal and Moisture Protection: Firestopping.
D. Section 07 8400 - Firestopping.
E. Section 26 0005 - Basic Electrical Requirements
F. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.
G. Section 26 0526 - Grounding and Bonding for Electrical Systems.
H. Section 26 0529 - Hangers and Supports for Electrical Systems.
I. Section 26 0533.16 - Boxes for Electrical Systems.
J. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
K. Section 28 4600 - Fire Detection and Alarm: Fire alarm wiring in conduit.
L. Division 31 - Earthwork: Excavating, trenching and fill.
M. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2015.
B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S) 2015.
C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
D. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2013.
E. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit 2004.
F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2017.
G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
H. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit 2018.
I. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit 2020.
J. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2016.

K. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 1 - Flexible Metal Conduit Current Edition, Including All Revisions.

M. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.

N. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.

O. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.

P. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
   1. Under Slab on Grade: Use galvanized steel rigid metal conduit or rigid PVC conduit.
   2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit or rigid PVC conduit.
   3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit or rigid PVC conduit.
   4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
   5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.

D. Embedded Within Concrete:
   1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit or rigid PVC conduit.
   2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.

E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.

I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

K. Exposed, Exterior: Use galvanized steel rigid metal conduit or PVC-coated galvanized steel rigid metal conduit.

L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit.

M. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
   1. Maximum Length: 6 feet.

N. Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit.
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
   3. Vibrating equipment includes, but is not limited to:
      a. Transformers.
      b. Motors.

O. Fished in Existing Walls, Where Necessary: Use flexible metal conduit.

2.02 CONDUIT REQUIREMENTS

A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.

B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 3/4 inch (21 mm) trade size.
   2. Flexible Connections to Luminaires: 3/8 inch (12 mm) trade size.
   3. Underground, Interior: 1 inch (27 mm) trade size.
   4. Underground, Exterior: 1 inch (27 mm) trade size.

E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube & Conduit: www.alliedeg.com
   2. Republic Conduit: www.republic-conduit.com
   3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
   1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
   1. AFC Cable Systems, Inc: www.afcweb.com
   2. Electri-Flex Company: www.electriflex.com
   3. International Metal Hose: www.metalhose.com

B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

C. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.

2.05 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. Allied Tube & Conduit: www.alliedeg.com
   2. Republic Conduit: www.republic-conduit.com
   3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use compression (gland) or set-screw type.
      a. Do not use indenter type connectors and couplings.
   4. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.
   5. Embedded Within Concrete (where permitted): Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.06 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
   1. Cantex Inc: www.cantexinc.com
   2. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com
   3. JM Eagle: www.jmeagle.com

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.07 ACCESSORIES

A. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

B. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

C. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

D. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

E. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.

F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.

G. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

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

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

E. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated without specific routing, determine exact routing required.
   3. Conceal all conduits unless specifically indicated to be exposed.
   4. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
   5. Unless otherwise approved, do not route conduits exposed:
      a. Across floors.
      b. Across roofs.
      c. Across top of parapet walls.
      d. Across building exterior surfaces.
   6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
   7. Arrange conduit to maintain adequate headroom, clearances, and access.
   8. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
   9. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
   10. Group parallel conduits in the same area together on a common rack.

F. Conduit Support:
   1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
   3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
   4. Use conduit strap to support single surface-mounted conduit.
      a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
   5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
   6. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
   7. Use of wire for support of conduits is not permitted.

G. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
5. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
6. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

H. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07.

I. Underground Installation:
1. Provide trenching and backfilling in accordance with Division 31.

J. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Secure conduits to prevent floating or movement during pouring of concrete.

K. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Division 03 with minimum concrete cover of 2 inches on all sides unless otherwise indicated.

L. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where conduits are subject to earth movement by settlement or frost.

M. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

N. Provide grounding and bonding in accordance with Section 26 0526.

O. Identify conduits in accordance with Section 26 0553.

3.03 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 26 05 33.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

1.02 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 03 - Concrete: Concrete.

C. Division 07 - Thermal and Moisture Protection: Firestopping.

D. Division 08 - Openings: Access Doors.

E. Section 08 3100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

F. Section 26 0005 - Basic Electrical Requirements.

G. Section 26 0526 - Grounding and Bonding for Electrical Systems.

H. Section 26 0529 - Hangers and Supports for Electrical Systems.

I. Section 26 0533.13 - Conduit for Electrical Systems:
   1. Conduit bodies and other fittings.
   2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

J. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

K. Section 26 2726 - Wiring Devices:
   1. Wall plates.

L. Section 26 2813 - Fuses: Spare fuse cabinets.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2010.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports 2013.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. SCTE 77 - Specification for Underground Enclosure Integrity 2017.

H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.

I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.

J. UL 508A - UL Standard for Safety Industrial Control Panels 2018.

K. UL 514A - Metallic Outlet Boxes Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
   4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
   5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
   6. Coordinate the work with other trades to preserve insulation integrity.
   7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
   8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.
   1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.

C. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Keys for Lockable Enclosures: Two of each different key.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended.
   4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
   1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
   2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
   3. Use suitable concrete type boxes where flush-mounted in concrete.

4. Use suitable masonry type boxes where flush-mounted in masonry walls.
5. Use raised covers suitable for the type of wall construction and device configuration where required.
6. Use shallow boxes where required by the type of wall construction.
7. Do not use "through-wall" boxes designed for access from both sides of wall.
8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
12. Wall Plates: Comply with Section 26 2726.
13. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com
    b. Hubbell Incorporated; Bell Products: www.hubbell-rtb.com
    c. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com
    d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com
    e. Thomas & Betts Corporation: www.tnb.com

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
3. Junction and Pull Boxes Larger Than 100 cubic inches:
    a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
    b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
    a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
    b. Back Panels: Painted steel, removable.
    c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

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

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:
   1. Locate boxes to be accessible. Provide access panels in accordance with Division 08 as required where approved by the Architect.
   2. Unless dimensioned, box locations indicated are approximate.
   3. Locate boxes as required for devices installed under other sections or by others.
   4. Locate boxes so that wall plates do not span different building finishes.
   5. Locate boxes so that wall plates do not cross masonry joints.
   6. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
   7. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
      a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
   8. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0533.13.

I. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.

J. Install boxes plumb and level.

K. Flush-Mounted Boxes:
   1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
   2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
   3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

L. Install boxes as required to preserve insulation integrity.

M. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

N. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

O. Close unused box openings.

P. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

Q. Provide grounding and bonding in accordance with Section 26 0526.

3.03 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Underground warning tape.

F. Floor marking tape.

G. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 09 - Finishes: Interior and Exterior Painting.

C. Section 09 9113 - Exterior Painting.

D. Section 09 9123 - Interior Painting.

E. Section 26 0005 - Basic Electrical Requirements

F. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

G. Section 26 0536 - Cable Trays for Electrical Systems: Additional identification requirements for cable tray systems.

H. Section 26 0573 - Power System Studies: Arc flash hazard warning labels.

I. Section 26 2726 - Wiring Devices: Device and wallplate finishes; factory pre-marked wallplates.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. UL 969 - Marking and Labeling Systems Current Edition, Including All Revisions.

1.04 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.

B. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Panelboards:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify power source and circuit number. Include location when not within sight of equipment.

4) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
5) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

b. Transformers:
1) Identify kVA rating.
2) Identify voltage and phase for primary and secondary.
3) Identify power source and circuit number. Include location when not within sight of equipment.

c. Enclosed switches, circuit breakers, and motor controllers:
1) Identify voltage and phase.
2) Identify power source and circuit number. Include location when not within sight of equipment.
3) Identify load(s) served. Include location when not within sight of equipment.

d. Transfer Switches:
1) Identify voltage and phase.
2) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.

2. Service Equipment:
a. Use identification nameplate to identify each service disconnecting means.

3. Emergency System Equipment:
a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.

4. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.

5. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.

6. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Section 09 9123 and 09 9113.

7. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
a. Service equipment.
b. Industrial control panels.
c. Motor control centers.
d. Elevator control panels.
e. Industrial machinery.

8. Arc Flash Hazard Warning Labels: Comply with Section 26 0573.

C. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

D. Identification for Cable Tray: Comply with Section 26 0536.

E. Identification for Boxes:

1. Use voltage markers to identify highest voltage present.
2. Use voltage markers or color coded boxes to identify systems other than normal power system.
    a. Color-Coded Boxes: Field-painted in accordance with Division 09 per the same color code used for raceways.

F. Identification for Devices:
1. Wiring Device and Wallplate Finishes: Comply with Section 26 2726.
2. Use identification label to identify fire alarm system devices.
    a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
3. Use identification label to identify serving branch circuit for all receptacles.
    a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.

G. Identification for Luminaires:
1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Materials:
    a. Indoor Clean, Dry Locations: Use plastic nameplates.
    b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches by 4 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/2 inch.
5. Color: Black text on yellow background unless otherwise indicated.

D. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Power source and circuit number or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

E. Format for Fire Alarm Device Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Red text on white background.

2.03 VOLTAGE MARKERS

A. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

B. Minimum Size:
   1. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
   2. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

C. Legend:
   1. Markers for Voltage Identification: Highest voltage present.
   2. Markers for System Identification:
      a. Emergency Power System: Text "EMERGENCY".

D. Color: Black text on orange background unless otherwise indicated.

2.04 UNDERGROUND WARNING TAPE

A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

B. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.

C. Legend: Type of service, continuously repeated over full length of tape.

D. Color:
   1. Tape for Buried Power Lines: Black text on red background.
   2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.05 FLOOR MARKING TAPE

A. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlaminate, 3 inches wide, with alternating black and white stripes.

2.06 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
   1. Materials:
      a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
      b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
   2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
   3. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
   3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

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

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. Surface-Mounted Equipment: Enclosure front.
   2. Flush-Mounted Equipment: Inside of equipment door.
   3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
   4. Elevated Equipment: Legible from the floor or working platform.
   5. Branch Devices: Adjacent to device.
   6. Interior Components: Legible from the point of access.
   7. Boxes: Outside face of cover.
   8. Conductors and Cables: Legible from the point of access.
   9. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

END OF SECTION

SECTION 26 05 73
POWER SYSTEM STUDIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Short-circuit study.

B. Protective device coordination study.

C. Arc flash and shock risk assessment.
   1. Includes arc flash hazard warning labels.

D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.02 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Section 26 0005 - Basic Electrical Requirements.

C. Section 26 0553 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.

D. Section 26 2416 - Panelboards.

E. Section 26 2813 - Fuses.

F. Section 26 2816.16 - Enclosed Switches.

1.03 REFERENCE STANDARDS

A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels 2011.

B. IEEE 141 - IEEE Recommended Practice for Electrical Power Distribution for Industrial Plants 1993 (Reaffirmed 1999).

C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems 2001, with Errata (2003).

D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis 1997.

E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems 2006.

F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations 2018, with Errata (2019).

G. NEMA MG 1 - Motors and Generators 2018.

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.

I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 70E - Standard for Electrical Safety in the Workplace 2018.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Existing Installations: Coordinate with equipment manufacturer(s) to obtain data necessary for completion of studies.
   2. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Submit study reports prior to or concurrent with product submittals.
   2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.

1.05 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

B. Study reports, stamped or sealed and signed by study preparer.

C. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.
   1. Identify modifications made in accordance with studies that:
      a. Can be made at no additional cost to Owner.
      b. As submitted will involve a change to the contract sum.

1.06 POWER SYSTEM STUDIES

A. Scope of Studies:
   1. Perform analysis of new electrical distribution system as indicated on drawings.
   2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
   3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.

B. General Study Requirements:
   1. Comply with NFPA 70.
   2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:
   1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
      a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
         1) Obtain up-to-date information from Utility Company.
      b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
      c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.
      d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
      e. Protective Devices:
         1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
         2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).

f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.

D. Short-Circuit Study:
1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.
2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
a. Maximum utility fault currents.
b. Maximum motor contribution.
c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.

E. Arc Flash and Shock Risk Assessment:
1. Comply with NFPA 70E.
2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
3. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
a. Maximum and minimum utility fault currents.
b. Maximum and minimum motor contribution.
c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

F. Study Reports:
1. General Requirements:
a. Identify date of study and study preparer.
b. Identify study methodology and software product(s) used.
c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
d. Identify base used for per unit values.
e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
f. Include conclusions and recommendations.
2. Short-Circuit Study:
a. For each scenario, identify at each bus location:
1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
2) Fault point X/R ratio.
3) Associated equipment short circuit current ratings.
b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
3. Arc Flash and Shock Risk Assessment:
a. For the worst case for each scenario, identify at each bus location:
1) Calculated incident energy and associated working distance.
2) Calculated arc flash boundary.
3) Bolted fault current.
4) Arcing fault current.
5) Clearing time.
6) Arc gap distance.

b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.

1.07 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in the preparation of studies of similar type and complexity using specified computer software.

B. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

PART 2 PRODUCTS

2.01 ARC FLASH HAZARD WARNING LABELS

A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
   1. Materials: Comply with Section 26 0553.
   2. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
      a. Include the following information:
         1) Arc flash boundary.
         2) Available incident energy and corresponding working distance.
         3) Nominal system voltage.
         4) Equipment identification.
         5) Date calculations were performed.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install arc flash warning labels in accordance with Section 26 0553.

3.02 FIELD QUALITY CONTROL

A. Provide the services of field testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Adjust equipment and protective devices for compliance with studies and recommended settings.

D. Notify Strategic Energy Solutions, Inc. of any conflicts with or deviations from studies. Obtain direction before proceeding.

END OF SECTION

SECTION 26 09 35
DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Distributed Digital Lighting Control System
B. Digital Load Controllers (Room and Fixture Controllers)
C. Digital Wall or Ceiling Mounted Occupancy Sensor
D. Digital Wall Switch Occupancy Sensors
E. Digital Wall Switches

1.02 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.
B. Section 26 0005 - Basic Electrical Requirements.
C. Section 26 0529 - Hangers and Supports for Electrical Systems.
D. Section 26 0533.13 - Conduit for Electrical Systems.
E. Section 26 0533.16 - Boxes for Electrical Systems.
F. Section 26 0553 - Identification for Electrical Systems.
G. Section 26 2726 - Wiring Devices.
H. Section 26 3323 - Central Battery Equipment and Inverters.
I. Section 26 5100 - Interior Lighting.
J. Section 26 5600 - Exterior Lighting.

1.03 REFERENCE STANDARDS

A. FCC Article 15, Section J, Class A.
B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
C. NEMA WD 7 - Occupancy Motion Sensors Standard; Current Edition.
D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
E. NFPA 70 - National Electrical Code; Most recent edition adopted by Authority Having Jurisdiction, including all applicable Amendments and Supplements.
F. UL 508 - Standard for Industrial Control Equipment; Current Edition, including all Revisions.
G. UL 916 - Standard for Energy Management Equipment; Current Edition, including all Revisions.
H. UL 924 - Standard for Emergency Lighting and Power Equipment
I. UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products Installed in Air-Handling Spaces.

1.04 DESIGN / PERFORMANCE REQUIREMENTS

A. Digital lighting control system shall accommodate the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories that suit the required lighting and electrical system parameters.
B. Digital lighting control system shall be wireless control devices with either embedded fixtures and/or powerpack relay accessories. Refer to schedules for further information.
C. Digital lighting control system shall be wired control devices with compatible space occupancy/vacancy sensors. Refer to schedules for further information.

D. System shall comply with FCC emission standards specified in part 15, sub-part J for commercial and residential application.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 - General Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Catalog sheets and specifications.
   2. Ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
   3. Storage and handling requirements and recommendations.
   4. Installation instructions.

C. Shop Drawings: Wiring diagrams a for the various components of the System specified including:
   1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
   2. Show location of all devices, including at minimum sensors, load controllers, and switches/dimmers for each area on reflected ceiling plans.
   3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
   4. Network riser diagram including floor and building level details. Include network cable specification. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

E. Closeout Submittals:
   1. Project Record Documents: Record actual installed locations and settings for lighting control devices.
   2. Operation and Maintenance Manual:
      a. Include approved Shop Drawings and Product Data.
      b. Include Sequence of Operation, identifying operation for each room or space.
      c. Include manufacturer's maintenance information.
      d. Operation and Maintenance Data: Include detailed information on device programming and setup.
      e. Include startup and test reports.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing of centralized and distributed lighting control systems with a minimum of 10 years documented experience.

B. Installer Qualifications: Company certified by the manufacturer and specializing in installation of networked lighting control products with minimum three years documented experience.

C. System Components: Demonstrate that individual components have undergone quality control and testing prior to shipping.

1.07 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to commencing Work of this section. Meeting to be attended by Contractor, Architect, system installer, factory authorized manufacturer's representative, and representative of all trades related to the system installation.

B. Review installation procedures and coordination required with related Work and the following:
   1. Confirm the location and mounting of all devices, with special attention to placement of switches, dimmers, and any sensors.
   2. Review the specifications for low voltage control wiring and termination.

3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
4. Discuss requirements for integration with other trades

C. Inspect and make notes of job conditions prior to installation:
1. Record minutes of the conference and provide copies to all parties present.
2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
3. Installation shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.

1.08 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
1. Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).
2. Relative humidity: Maximum 90 percent, non-condensing.

1.09 WARRANTY

A. Manufacturer shall provide a 5 year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
1. Wattstopper (Legrand)
2. Eaton Greengate
3. nLight (Acuity Brands)
4. Leviton
5. Enlighted (Siemens)
6. Engineer pre-approved equal.

2.02 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

A. System General: Provide digital lighting control system complete with all necessary enclosures, wiring, and system components to ensure a complete and properly functioning system as indicated on the Drawings and specified herein. If a conflict is identified, between the Drawing, this specification, contact the Engineer for clarification prior to proceeding.
1. Space Control Requirements: Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality as indicated in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room, open plan system and training room. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors and Manual-ON switches.
2. Daylit Areas: Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:
a. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.
b. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.

c. Multiple-level switched daylight harvesting controls may be utilized for areas marked on drawings.
d. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.

3. Conference, meeting, training, auditoriums, and multipurpose rooms shall have controls that allow for independent control of each local control zone. Rooms larger than 300 square feet shall instead have at least four preset lighting scenes unless otherwise specified. Occupancy / vacancy sensors shall be provided to turn off all lighting in the space. Spaces with up to four moveable walls shall include controls that can be reconfigured when the room is partitioned.

B. Equipment Required: Lighting Control and Automation system as defined under this section covers the following equipment.
1. Digital Lighting Management (DLM) local network: Free topology, plug-in wiring system for power and data to room devices.
2. Digital Fixture Controllers: Self-configuring, digitally addressable one relay fixture-integrated controllers for on/off/0-10V dimming control.
3. Digital Occupancy Sensors: Self-configuring, digitally addressable, calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
4. Digital Switches: Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
5. Digital Daylighting Sensors: Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications for daylight harvesting using switching, bi-level, tri-level or dimming control.

C. Local Network: Digital lighting control local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.
1. Features of the digital lighting control local network include:
a. Automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
b. Simple replacement of any device in the local digital lighting control network with a standard off the shelf unit without requiring significant commissioning, configuration or setup.
c. Ability to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
d. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.
2. Digital room devices connect to the local network using pre-terminated low voltage cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.
3. If manufacturer's pre-terminated low voltage cables are not used for the installation each cable must be individually tested and observed by authorized service representative following installation.

2.03 DIGITAL LOAD CONTROLLERS (ROOM AND FIXTURE CONTROLLERS)

A. Digital Load Controllers: Digital controllers for lighting zones, fixtures and/or plug loads automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting and plug load control requirements. Controllers are simple to install, and do not have dip switches/potentiometers, or require special configuration for standard applications. Control units

include the following features

1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
2. Simple replacement using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf device.
3. Multiple room controllers connected together in a local network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are assigned starting with load 1 to a maximum of 64, assigned based on each controller's device ID's from highest to lowest.
4. Device Status LEDs to indicate:
    a. Data transmission
    b. Device has power
    c. Status for each load
    d. Configuration status
5. Quick installation features including:
    a. Standard junction box mounting
    b. Quick low voltage connections using standard RJ-45 patch cable
6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
    a. Turn on to 100 percent
    b. Turn off
    c. Turn on to last level
7. Each load be configurable to operate in the following sequences based on occupancy:
    a. Auto-on/Auto-off (Follow on and off)
    b. Manual-on/Auto-off (Follow off only)
8. Polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
9. BACnet object information shall be available for the following objects:
    a. Load status
    b. Schedule state, normal or after-hours
    c. Demand Response enable and disable
    d. Room occupancy status
    e. Total room lighting and plug loads watts
    f. Electrical current
    g. Total watts per controller
    h. Total room watts/sq ft.
    i. Force on/off all loads
10. UL 2043 plenum rated
11. Manual override and LED indication for each load
12. Zero cross circuitry for each load
13. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
14. Dimming Room Controllers shall share the following features:
    a. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
    b. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
    c. The following dimming attributes may be changed or selected using a wireless configuration tool:

1) Establish preset level for each load from 0-100 percent
2) Set high and low trim for each load
3) Initiate lamp burn in for each load of either 0, 12 or 100 hours

d. Override button for each load provides the following functions:
1) Press and release for on/off control
2) Press and hold for dimming control

e. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver. LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.

f. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100 percent dimming range defined by the minimum and maximum calibration trim.

g. Calibration and trim levels must be set per output channel. Devices that set calibration or trim levels per controller (as opposed to per load) are not acceptable.

h. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.

B. Fixture Controllers shall include
1. A form factor and product ratings to allow various OEM fixture manufacturers to mount the device inside the ballast/driver cavity of standard-sized fluorescent or LED general lighting fixtures.
2. One 3A 120/277V rated mechanically held relay.
3. Programmable behavior on power up following the loss of normal power:
a. Turn on to 100 percent
b. Turn off
c. Turn on to last level
4. Requirement for 7 mA of 24VDC operating power from the digital lighting control local network.
5. Fixture Controller does not require a connection to a neutral conductor to operate, and unlike other types of Load Controllers it does not contribute power to the digital lighting control local network to drive accessory devices.
6. Power to drive the fixture controller electronics can come from any room controller
7. 0-10V dimming capability via a single 0-10 volt analog output from the device for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Fixture Controller.
8. Connect to a single or dual RJ-45 adaptor with 24 inch leads. Single adaptor mounts in a 1/2 inch KO and dual adaptor in a 2.2 by 1.32 inch rectangular hole for connection to the digital lighting control local network.
9. Adaptor leads are insulated for use in a fixture cavity, and the lead length allows the OEM fixture manufacturer flexibility to position the Fixture Controller and the RJ45 jack in the best locations on each fixture.
10. A complete set of dimming features described above in the paragraph detailing On/Off/Dimming Enhanced Room Controllers.

2.04 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR

A. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
1. Digital calibration and pushbutton configuration for the following variables:
a. Sensitivity, 0-100 percent in 10 percent increments
b. Time delay, 1-0 minutes in 1 minute increments
c. Test mode, Five second time delay

d. Detection technology, PIR, Ultrasonic or Dual Technology activation and/or re-activation.
e. Walk-through mode

2. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the digital lighting control local network.
3. Programmable control functionality including:
   a. Each sensor may be programmed to control specific loads within a local network.
   b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
   c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.
   d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
   e. Ultrasonic and Passive Infrared
   f. Ultrasonic or Passive Infrared
   g. Ultrasonic only
   h. Passive Infrared only
   i. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
4. One or two RJ-45 port(s) for connection to digital lighting control local network.
5. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
6. Device Status LEDs, which may be disabled for selected applications, including:
   a. PIR detection
   b. Ultrasonic detection
   c. Configuration mode
   d. Load binding
7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
8. Manual override of controlled loads.
9. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.

B. BACnet object information shall be available for the following objects:
   1. Detection state
   2. Occupancy sensor time delay
   3. Occupancy sensor sensitivity, PIR and Ultrasonic

C. Units shall not have any dip switches or potentiometers for field settings

D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology digital lighting control local network. No additional configuration will be required.

2.05 DIGITAL WALL SWITCH OCCUPANCY SENSORS

A. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:
   1. Digital calibration and pushbutton configuration for the following variables:
      a. Sensitivity: 0-100 percent in 10 percent increments
      b. Time delay: 1-30 minutes in 1 minute increments
      c. Test mode: Five second time delay
      d. Detection technology: PIR, Dual Technology activation and/or re-activation.

e. Walk-through mode
f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the digital lighting control local network.

2. Programmable control functionality including:
   a. Each sensor may be programmed to control specific loads within a local network.
   b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
   c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.
   d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
      1) Ultrasonic and Passive Infrared
      2) Ultrasonic or Passive Infrared
      3) Ultrasonic only
      4) Passive Infrared only
3. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
4. Two RJ-45 ports for connection to digital lighting control local network.
5. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote personal controls.
6. Device Status LEDs including
   a. PIR detection
   b. Ultrasonic detection
   c. Configuration mode
   d. Load binding
7. Assignment of any occupancy sensor to a specific load within the room without wiring or special tools.
8. Assignment of local buttons to specific loads within the room without wiring or special tools
9. Manual override of controlled loads
10. All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.

B. BACnet object information shall be available for the following objects:
   1. Detection state
   2. Occupancy sensor time delay
   3. Occupancy sensor sensitivity, PIR and Ultrasonic
   4. Button state
   5. Switch lock control
   6. Switch lock status

C. Units shall not have any dip switches or potentiometers for field settings.

D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology digital lighting control local network. No additional configuration will be required.

E. Two-button wall switch occupancy sensors, when connected to a single relay dimming room or fixture controller, shall operate in the following sequence as a factory default:
   1. Left button
      a. Press and release - Turn load on
      b. Press and hold - Raise dimming load
   2. Right button

a. Press and release - Turn load off
b. Press and hold - Lower dimming load

F. Low voltage momentary pushbuttons shall include the following features:
1. Load/Scene Status LED on each switch button with the following characteristics:
a. Bi-level LED
b. Dim locator level indicates power to switch
c. Bright status level indicates that load or scene is active
2. The following button attributes may be changed or selected using a wireless configuration tool:
a. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
b. Individual button function may be configured to Toggle, On only or Off only.
c. Individual scenes may be locked to prevent unauthorized change.
d. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
e. Ramp rate may be adjusted for each dimmer switch.
f. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.

2.06 DIGITAL WALL SWITCHES

A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 6 button configuration. Wall switches shall include the following features:
1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
3. Configuration LED on each switch that blinks to indicate data transmission.
4. Load/Scene Status LED on each switch button with the following characteristics:
a. Bi-level LED
b. Dim locator level indicates power to switch
c. Bright status level indicates that load or scene is active
d. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
5. Programmable control functionality including:
a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority
b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.
6. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.

B. BACnet object information shall be available for the following objects:
1. Button state
2. Switch lock control
3. Switch lock status

C. Two RJ-45 ports for connection to digital lighting control local network.

D. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology digital lighting control local network. No additional configuration shall be required to achieve multi-way switching.

E. Load and Scene button function may be reconfigured for individual buttons from Load to Scene, and vice versa.

1. Individual button function may be configured to Toggle, On only or Off only.
2. Individual scenes may be locked to prevent unauthorized change.
3. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
4. Ramp rate may be adjusted for each dimmer switch.
5. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until measurements have been verified and work areas have been properly prepared.

B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that required pre-installation meeting specified in Part 1 of this specification has been completed, recorded meeting minutes have been distributed and all outstanding issues noted have been resolved prior to the start of installation.

3.02 INSTALLATION

A. Install system in accordance with the approved system shop drawings and manufacturer's instructions.

B. All wiring associated with the specified controls system shall be installed within conduit or conduits unless otherwise indicated on the Drawings. Refer to 26 0533.13 - Conduit for Electrical Systems for requirements.

C. Install all room/area devices using manufacturer's factory-tested low voltage cable with pre-terminated RJ-45 connectors.
   1. If pre-terminated cable is not used for room/area wiring, each field-terminated cable shall be tested following installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.
   2. If fixtures have internal digital lighting control Control Modules, ensure that they are also connected with low voltage cable.
   3. Install all room to room network devices using manufacturer-supplied network wire or wireless devices. Network wire substitution is not permitted and may result in loss of product warranty.
   4. Low voltage wiring topology must comply with manufacturer's specifications.
   5. Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing and topology on as built drawings.
   6. All lighting control low voltage wiring jacket colors shall be coordinated with and approved by Owner.
      a. If there is no selection provided by Owner, jacket color shall be yellow.

D. All line voltage connections shall be tagged to indicate circuit and switched legs.

E. Test all devices to ensure proper communication.

F. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.

G. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
   1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
   2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
   3. Load Parameters (e.g. blink warning, etc.)

H. Post start-up tuning - Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from beneficial occupancy. Provide a detailed report to the Architect / Owner of post start-up activity.

I. Tighten all panel Class I conductors from both circuit breaker and to loads to torque ratings as marked on enclosure UL label.

J. All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.

K. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.

L. Verify all non-panel-based lighting loads to be free from short circuits prior to connection to room controllers.

M. Remote Access for Network Systems: If “REMOTE ACCESS AND ENHANCED WARRANTY FOR NETWORKED SYSTEMS” is specified in Part 1 of this specification, ensure Segment Manager enclosure is installed in a location with good to excellent cellular phone coverage based on building orientation and geographic location, and mount magnetic antenna for the modem. For cases where alternate mounting locations are not available and a stronger cellular signal is needed, the manufacturer shall offer additional antenna options to improve signal quality. Verify final mounting location with Engineer and Owner prior to proceeding with the Work.

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Engineer and Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.

B. Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.
   1. Verify Class I and II wiring connections are terminated properly by validating system performance.
   2. Set IP addresses and other network settings of system front end hardware per facilities IT instructions.
   3. Verify / complete task programming for all switches, dimmers, time clocks, and sensors.
   4. Verify that the control of each space complies with the Sequence of Operation.
   5. Correct any system issues and re-test.

C. Provide a report in table format with drawings, or using a software file that can be opened in the manufacturer's system software including each room or space that has lighting control installed. Indicate the following:
   1. Date of test or inspection.
   2. Loads per space, or Fixture Address identification.
   3. Quantity and Type of each device installed
   4. Reports providing each device's settings.

3.04 DEMONSTRATION AND TRAINING

A. Before Substantial Completion, arrange and provide a one-day Owner instruction period to designated Owner personnel. Set-up, starting of the lighting control system and Owner instruction includes:
   1. Confirmation of entire system operation and communication to each device.
   2. Confirmation of operation of individual relays, switches, and sensors.
   3. Confirmation of system Programming, photocell settings, override settings, etc.
   4. Provide training to cover installation, programming, operation, and troubleshooting of the lighting control system.

3.05 PRODUCT SUPPORT AND SERVICE

A. Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

END OF SECTION

SECTION 26 22 00
VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General purpose transformers.

1.02 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 03 - Concrete: Concrete equipment pads.

C. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

D. Section 26 0005 - Basic Electrical Requirements

E. Section 26 0526 - Grounding and Bonding for Electrical Systems.

F. Section 26 0529 - Hangers and Supports for Electrical Systems.

G. Section 26 0533.13 - Conduit for Electrical Systems: Flexible conduit connections.

H. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

I. Section 26 2416 - Panelboards.

1.03 REFERENCE STANDARDS

A. 10 CFR 431, Subpart K - Energy Efficiency Program for Certain Commercial and Industrial Equipment - Distribution Transformers Current Edition.

B. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers 2015.

C. IEEE C57.96 - IEEE Standard Guide for Loading Dry-Type Distribution and Power Transformers 2013.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

E. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers 2015.

F. NEMA ST 20 - Dry-Type Transformers for General Applications 2014.

G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.

I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 506 - Standard for Specialty Transformers Current Edition, Including All Revisions.

K. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate the work with placement of supports, anchors, etc. required for mounting.
   4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

5. Notify Strategic Energy Solutions, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 FIELD CONDITIONS

A. Ambient Temperature: Do not exceed the following maximum temperatures during and after installation of transformers.
   1. Greater than 10 kVA: 104 degrees F maximum.
   2. Less than 10 kVA: 77 degrees F maximum.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB/GE: www.geindustrial.com

B. Eaton Corporation: www.eaton.com

C. Schneider Electric; Square D Products: www.schneider-electric.us

D. Siemens Industry, Inc: www.usa.siemens.com

E. Source Limitations: Furnish transformers produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 TRANSFORMERS - GENERAL REQUIREMENTS

A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.

B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
   1. Altitude: Less than 3,300 feet.
   2. Ambient Temperature:
      a. Greater than 10 kVA: Not exceeding 104 degrees F.
      b. Less than 10 kVA: Not exceeding 77 degrees F.

C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.

D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.

E. Basic Impulse Level: 10 kV.

F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

G. Isolate core and coil from enclosure using vibration-absorbing mounts.

H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.03 GENERAL PURPOSE TRANSFORMERS

A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.

B. Insulation System and Allowable Average Winding Temperature Rise:
   1. Less than 15 kVA: Class 180 degrees C insulation system with 115 degrees C average winding temperature rise.
   2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.

C. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.

D. Winding Taps:
   1. Less than 3 kVA: None.
   2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.
   3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
   4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.

E. Energy Efficiency: Comply with 10 CFR 431, Subpart K.

F. Sound Levels: Standard sound levels complying with NEMA ST 20

G. Mounting Provisions:
   1. Less than 15 kVA: Suitable for wall mounting.
   2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
   3. Larger than 75 kVA: Suitable for floor mounting.

H. Transformer Enclosure: Comply with NEMA ST 20.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   2. Construction: Steel.
      a. Less than 15 kVA: Totally enclosed, non-ventilated.
      b. 15 kVA and Larger: Ventilated.
   3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
   4. Provide lifting eyes or brackets.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.

C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install transformers in accordance with NECA 409 and IEEE C57.94.

D. Use flexible conduit, under the provisions of Section 26 0533.13, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.

F. Install transformers plumb and level.

G. Transformer Support:

1. Provide required support and attachment in accordance with Section 26 0529, where not furnished by transformer manufacturer.
2. Use integral transformer flanges, accessory brackets furnished by manufacturer, or field-fabricated supports to support wall-mounted transformers.
3. Unless otherwise indicated, mount floor-mounted transformers on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.
4. Use trapeze hangers assembled from threaded rods and metal channel (strut) to support suspended transformers. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

H. Provide grounding and bonding in accordance with Section 26 0526.

I. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.

J. Where not factory-installed, install lugs sized as required for termination of conductors as indicated.

K. Identify transformers in accordance with Section 26 0553.

3.03 ADJUSTING

A. Measure primary and secondary voltages and make appropriate tap adjustments.

B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.

C. Division 03 - Concrete: Concrete equipment pads.

D. Section 26 0005 - Basic Electrical Requirements.

E. Section 26 0526 - Grounding and Bonding for Electrical Systems.

F. Section 26 0529 - Hangers and Supports for Electrical Systems.

G. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

H. Section 26 0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

I. Section 26 2200 - Low-Voltage Transformers: Small power centers with integral primary breaker, transformer, and panelboard.

J. Section 26 2813 - Fuses: Fuses for fusible switches and spare fuse cabinets.

K. Section 26 4300 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e (Amended 2017).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

C. NECA 407 - Standard for Installing and Maintaining Panelboards 2015.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

E. NEMA PB 1 - Panelboards 2011.

F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less 2013.

G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.

H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.

K. UL 67 - Panelboards Current Edition, Including All Revisions.

L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.

M. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.

N. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.

O. UL 1699 - Arc-Fault Circuit-Interrupters Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
   4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include documentation of listed series ratings as indicated in Section 26 0573.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Panelboard Keys: Two of each different key.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB/GE: www.geindustrial.com

B. Eaton Corporation: www.eaton.com

C. Schneider Electric; Square D Products: www.schneider-electric.us

D. Siemens Industry, Inc: www.usa.siemens.com

E. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature:

a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
b. Panelboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.

C. Short Circuit Current Rating:
1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
1. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
a. Indoor Clean, Dry Locations: Type 1.
b. Outdoor Locations: Type 3R.
2. Boxes: Galvanized steel unless otherwise indicated.
a. Provide wiring gutters sized to accommodate the conductors to be installed.
b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
3. Fronts:
a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
4. Lockable Doors: All locks keyed alike unless otherwise indicated.

J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

K. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 4300, list and label panelboards as a complete assembly including surge protective device.
1. Provide Surge Protective Devices internally mounted within all panels which are specified as part of the Emergency distribution power system.

L. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.

M. Load centers are not acceptable.

2.03 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
1. Main and Neutral Lug Material: Copper
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase and Neutral Bus Material: Copper
   2. Ground Bus Material: Copper

D. Circuit Breakers:
   1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.

E. Enclosures:
   1. Provide surface-mounted enclosures unless otherwise indicated.
   2. Fronts: Provide trims to cover access to load terminals, wiring gutters, and other live parts, with exposed access to overcurrent protective device handles.
   3. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Copper
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
   2. Phase and Neutral Bus Material: Copper
   3. Ground Bus Material: Copper

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
   1. Provide surface-mounted or flush-mounted enclosures as indicated.
   2. Provide clear plastic circuit directory holder mounted on inside of door.

2.05 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
   1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
   2. Interrupting Capacity:
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated.
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   3. Conductor Terminations:
      a. Lug Material: Copper
   4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
   6. Provide the following circuit breaker types where indicated:
      a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
      b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.

c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.

7. Do not use tandem circuit breakers.
8. Do not use handle ties in lieu of multi-pole circuit breakers.
9. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
10. Provide the following features and accessories where indicated or where required to complete installation:

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 26 0529.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

I. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

J. Provide grounding and bonding in accordance with Section 26 0526.

K. Install all field-installed branch devices, components, and accessories.

L. Provide filler plates to cover unused spaces in panelboards.

M. Provide code required clearance access on floor in front of panel with black and yellow striped tape. Clerance shall be width of panel and appropriate distance per NEC from panelboard.

N. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
1. Fire detection and alarm circuits.
2. Intrusion detection and access control system circuits.
3. Video surveillance system circuits.

3.03 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than _____ amperes. Tests listed as optional are not required.

D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

E. Test GFCI circuit breakers to verify proper operation.

F. Test AFCI circuit breakers to verify proper operation.

G. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Wall plates.

1.02 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.

C. Section 26 0005 - Basic Electrical Requirements.

D. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.

E. Section 26 0526 - Grounding and Bonding for Electrical Systems.

F. Section 26 0533.16 - Boxes for Electrical Systems.

G. Section 26 0533.23 - Surface Raceways for Electrical Systems: Surface raceway systems, including multioutlet assemblies.

H. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

I. Section 26 0583 - Wiring Connections: Cords and plugs for equipment.

J. Section 26 0953 - Distributed Digital Lighting Controls

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for 2017h.

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification) 2017g.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2010.

E. NEMA WD 1 - General Color Requirements for Wiring Devices 1999 (Reaffirmed 2015).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2016.

G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 20 - General-Use Snap Switches Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.

L. UL 1310 - Class 2 Power Units Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.

2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
6. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide tamper resistant receptacles for receptacles installed in areas listed below:
1. All 15 and 20-ampere 125 and 250-volt nonlocking type receptacles in the areas listed below shall be listed tamper-resistant receptacles, unless otherwise excluded in NEC.
a. Dwelling units in all areas specified in NEC 210.52 and 550.13.
b. Business offices, corridors, waiting rooms and the like in clinics, medical and dental offices and outpatient facilities.
c. All early childhood/daycare areas and K-12 Educational Classrooms.

E. Provide GFCI protection for receptacles installed within 6 feet of sinks.

F. Provide GFCI protection for receptacles installed in kitchens.

G. Provide GFCI protection for receptacles serving electric drinking fountains.
1. Outlet shall be readily accessible.

H. Provide GFCI protection for outlets serving vending machines. Outlets shall be readily accessible.

2.02 WIRING DEVICE FINISHES

A. Provide wiring device finishes as described below unless otherwise indicated.

B. Wiring Devices, Unless Otherwise Indicated: White with gray stainless steel wall plate.

C. Wiring Devices Connected to Emergency Power: Red with stainless steel wall plate factory engraved "Emergency".

2.03 WALL SWITCHES

A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

2.04 RECEPTACLES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com
   2. Leviton Manufacturing Company, Inc: www.leviton.com
   3. Lutron Electronics Company, Inc; Designer Style: www.lutron.com
   4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:
   1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
   2. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
   3. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFCI Receptacles:
   1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
      a. Provide test and reset buttons of same color as device.
   2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
   3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
   4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.

E. USB Charging Devices:
   1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.
      a. Charging Capacity - Two-Port Devices: 2.1 A, minimum.
   2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type A) USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.

2.05 WALL PLATES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell-wiring.com
   2. Leviton Manufacturing Company, Inc: www.leviton.com
   3. Lutron Electronics Company, Inc: www.lutron.com
   4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
   5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

B. Wall Plates: Comply with UL 514D.
   1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
   2. Size: Standard.
   3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

D. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

E. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switches: 48 inches above finished floor.
      b. Receptacles: 18 inches above finished floor or 6 inches above counter.
   2. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
   3. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Install wiring devices plumb and level with mounting yoke held rigidly in place.

J. Install wall switches with OFF position down.

K. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

L. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

M. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

N. Identify wiring devices in accordance with Section 26 0553.

3.04 FIELD QUALITY CONTROL

A. Inspect each wiring device for damage and defects.

B. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

C. Test each receptacle to verify operation and proper polarity.

D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

E. Correct wiring deficiencies and replace damaged or defective wiring devices.

END OF SECTION

SECTION 26 28 13
FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fuses.

1.02 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Section 26 0005 - Basic Electrical Requirements.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 0573 - Power System Studies: Additional criteria for the selection of protective devices specified in this section.

E. Section 26 2416 - Panelboards: Fusible switches.

F. Section 26 2816.16 - Enclosed Switches: Fusible switches.

1.03 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses 2012.

B. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements Current Edition, Including All Revisions.

C. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses Current Edition, Including All Revisions.

D. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com

B. Littelfuse, Inc: www.littelfuse.com

C. Mersen: ep-us.mersen.com

2.02 APPLICATIONS

A. Service Entrance:
   1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
   2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

B. Feeders:
   1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
   2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

2.03 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.

H. Class L Fuses: Comply with UL 248-10.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION

SECTION 26 28 16.16
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Section 26 0005 - Basic Electrical Requirements.

C. Section 26 0526 - Grounding and Bonding for Electrical Systems.

D. Section 26 0529 - Hangers and Supports for Electrical Systems.

E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 0573 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.

G. Section 26 2813 - Fuses.

H. Section 26 3600 - Transfer Switches: Automatic and non-automatic switches listed for use as transfer switch equipment.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.

E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.

I. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB/GE: www.geindustrial.com
B. Eaton Corporation: www.eaton.com
C. Schneider Electric; Square D Products: www.schneider-electric.us
D. Siemens Industry, Inc: www.usa.siemens.com

2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
B. Provide products listed, classified, and labeled as suitable for the purpose intended.
C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between -22 degrees F and 104 degrees F.
D. Horsepower Rating: Suitable for connected load.
E. Voltage Rating: Suitable for circuit voltage.
F. Short Circuit Current Rating:
   1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
G. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
H. Provide with switch blade contact position that is visible when the cover is open.
I. Conductor Terminations: Suitable for use with the conductors to be installed.
J. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
K. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
L. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
M. Heavy Duty Switches:
   1. Comply with NEMA KS 1.
   2. Conductor Terminations:
      a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
      a. Provide means for locking handle in the ON position where indicated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Perform work in accordance with NECA 1 (general workmanship).
C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 0526.

H. Identify enclosed switches in accordance with Section 26 0553.

3.02 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

END OF SECTION

SECTION 26 43 00
SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surge protective devices for service entrance locations.

B. Surge protective devices for distribution locations.

C. Surge protective devices for branch panelboard locations.

1.02 RELATED REQUIREMENTS

A. Section 26 0005 - General Electrical Requirements.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 2300 - Low-Voltage Switchgear.

D. Section 26 2413 - Switchboards.

E. Section 26 2416 - Panelboards.

1.03 ABBREVIATIONS AND ACRONYMS

A. EMI/RFI: Electromagnetic Interference/Radio Frequency Interference.

B. SPD: Surge Protective Device.

1.04 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 1283 - Standard for Electromagnetic Interference Filters Current Edition, Including All Revisions.

E. UL 1449 - Standard for Surge Protective Devices Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Field-installed, Externally Mounted Surge Protective Devices:
   1. ABB/GE: www.geindustrial.com/#sle.
   2. Current Technology; a brand of Thomas & Betts Power Solutions: www.tnbpowersolutions.com/#sle.
   3. Raycap; www.raycap.com

B. Factory-installed, Internally Mounted Surge Protective Devices:
   1. Same as manufacturer of equipment containing surge protective device, to provide a complete listed assembly including SPD.

2.02 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.

B. Unless otherwise indicated, provide field-installed, externally-mounted or factory-installed, internally-mouonted SPDs.

C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.

D. Protected Modes:
   1. Wye Systems: L-N, L-G, N-G, L-L.

E. UL 1449 Voltage Protection Ratings (VPRs):
   1. 208Y/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.
   2. 480Y/277V System Voltage: Not more than 1,500 V for L-N, L-G, and N-G modes and 2,000 V for L-L mode.

F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.

G. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   1. Indoor clean, dry locations: Type 1.

H. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:
   1. Provide surface-mounted SPD where mounted in non-public areas or adjacent to surface-mounted equipment.
   2. Provide flush-mounted SPD where mounted in public areas or adjacent to flush-mounted equipment.

I. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.
   1. Switchgear: See Section 26 2300.
   2. Switchboards: See Section 26 2413.
   3. Panelboards: See Section 26 2416.

2.03 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

A. Surge Protective Device:
   1. Protection Circuits: Field-replaceable modular or non-modular.
   2. Surge Current Rating: Not less than 120 kA per mode/240 kA per phase.
   3. UL 1449 Nominal Discharge Current (I-n): 20 kA.
   4. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
   5. Diagnostics:
      a. Protection Status Monitoring: Provide indicator lights to report the protection for each phase.
      b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
      c. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.
      d. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.

2.04 SURGE PROTECTIVE DEVICES FOR DISTRIBUTION LOCATIONS

A. Surge Protective Device:
   1. Protection Circuits: Field-replaceable modular or non-modular.
   2. Surge Current Rating: Not less than 80 kA per mode/160 kA per phase.
   3. UL 1449 Nominal Discharge Current (I-n): 20 kA.

4. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
5. Diagnostics:
   a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
   b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
   c. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.
   d. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.

2.05 SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

A. Surge Protective Device:
   1. Protection Circuits: Field-replaceable modular or non-modular.
   2. Surge Current Rating: Not less than 60 kA per mode/120 kA per phase.
   3. UL 1449 Nominal Discharge Current (I-n): 20 kA.
   4. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
   5. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs (UL 1283 listing not available for Type 1 SPDs).
   6. Diagnostics:
      a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
      b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
      c. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.
      d. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.

C. Verify system grounding and bonding is in accordance with Section 26 0526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.

E. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.

F. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.

G. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 0526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

H. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

END OF SECTION

SECTION 26 51 00
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Ballasts and drivers.

D. Fluorescent emergency power supply units.

E. LED emergency power supply units.

F. Emergency Lighting Control Units (Transfer Switches)

G. Accessories.

1.02 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, repairs.

C. Section 26 0005 - Basic Electrical Requirements.

D. Section 26 0533.13 - Conduit for Electrical Systems.

E. Section 26 0529 - Hangers and Supports for Electrical Systems.

F. Section 26 0533.16 - Boxes for Electrical Systems.

G. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

H. Section 26 0935 - Distributed Digital Lighting Control System: Devices for automatic control of lighting, including occupancy sensors, daylighting controls, networked control stations and motion sensors.

I. Section 26 2726 - Wiring Devices: Manual wall switches and wall dimmers.

J. Section 26 5600 - Exterior Lighting.

1.03 REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code) 2013 (Corrigendum 2019).

B. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits 2002 (Corrigendum 2012).

C. IES LM-63 - IESNA Standard File Format for Electronic Transfer of Photometric Data and Related Information 2002 (Reaffirmed 2008).

D. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products 2008.

E. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules 2015, with Errata (2017).

F. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

G. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems 2006.

H. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems 2006.

I. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts 2016.

J. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility 2012.

K. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL 924 - Emergency Lighting and Power Equipment Current Edition, Including All Revisions.

N. UL 1598 - Luminaires Current Edition, Including All Revisions.

O. UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits Current Edition, Including All Revisions.

P. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
   2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
   3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
   4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70 and NFPA 101.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70 and NFPA 101.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s), light engines, drivers and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.
   2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
   3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
   4. Air-Handling Recessed Fluorescent Luminaires: Suitable for air supply/return, heat removal, or combination as indicated.

H. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.03 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:
   1. Sealed maintenance-free lead calcium unless otherwise indicated.
   2. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.04 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
   3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

B. Dimmable LED Drivers:
   1. Dimming Range: Continuous dimming from 100 percent to 10 percent relative light output unless dimming capability to lower level is indicated, without flicker.
   2. Control Compatibility: Fully compatible with the dimming controls to be installed.

C. Dimmable LED Drivers: Comply with Section 26 0935 - Distributed Digital Lighting Control System.

2.05 LED EMERGENCY POWER SUPPLY UNITS

A. Manufacturers:
   1. Iota Engineering, LLC: www.iotaengineering.com/#sle.
   2. Lithonia Lighting: www.lithonia.com/#sle.
   3. Philips Emergency Lighting/Bodine: www.bodine.com/#sle.
   4. Manufacturer Limitations: Where possible, for each type of luminaire provide fluorescent emergency power supply units produced by a single manufacturer.
   5. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

B. Description: Self-contained fluorescent emergency power supply units suitable for use with indicated luminaires, complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

C. Operation: Upon interruption of normal power source, solid-state control automatically switches connected lamp(s) to the fluorescent emergency power supply for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

D. Battery: Sealed maintenance-free high-temperature nickel cadmium unless otherwise indicated.

E. Diagnostics: Provide accessible and visible multi-chromatic combination test switch/indicator light to display charge, test, and diagnostic status and to manually activate emergency operation.

F. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status and field selectable audible alert.

2.06 EMERGENCY LIGHTING CONTROL DEVICES (TRANSFER DEVICES)

A. Manufacturers:
   1. Philips Emergency Lighting Bodine: www.philips.com/bodine
   2. Iota Engineering: www.iotaengineering.com
   3. Engineer pre-approved equal

B. General Requirements:
   1. The emergency lighting control device shall work in conjunction with an auxiliary generator or a central inverter system to power light fixtures for egress lighting regardless of fixture wall switch position.
   2. All units shall be UL924 listed and approved.

C. Operation:
   1. Device shall sense loss of normal power and switch the AC driver input power connected to an unswitched generator (or central inverter) supplied lighting circuit.
   2. The device shall be capable of bypassing the wall switch when the auxiliary generator (or central inverter) powers.
   3. Unit shall be capable of 120/277 volt operation.

D. Equipment:
   1. Emergency Lighting Control Device - 3 Amp
      a. For use within a single luminaire. Device shall be suitable for indoor and damp locations and capable of being used with fluorescent or LED lighting loads. Device shall be UL listed for installation inside, on top of or remote from the fixture. Shall include power loss sensing, UL924 listed and approved.

2. Emergency Lighting Control Device - 20 Amp
   a. For use adjacent to local switching means. Device shall be suitable for indoor and damp locations and capable of being used with incadescent, fluorescent and LED lighting loads. Shall include power loss sensing, UL 924 listed and approved.
3. Branch Circuit Emergency Lighting Transfer Switch
   a. Mounted onto junction box type, verify with field conditions. Device shall be suitable for indoor, damp and plenum (UL 2043) locations and capable of being used with incadescent, fluorescent and LED lighting loads. Shall include power loss sensing, UL 924 listed and approved.

2.07 MICRO AND MINI INVERTERS

A. Manufacturers:
   1. Philips Emergency Lighting Bodine: www.philips.com/bodine
   2. Iota Engineering: www.iotaengineering.com
   3. Engineer pre-approved equal.

B. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

C. Operation: Upon interruption of normal power source, solid-state control automatically switches connected lamp(s) to the emergency power supply for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

D. Battery:
   1. Hightemperature rechargable, replaceable nickel-cadmium.
   2. Battery shall be sized to supply all connected lamps where indicated.

E. Diagnostics: Unit shall include test switch and charge indicator light.

F. Unit shall be sine wave output capable with dual voltage input and output capabilities.

G. Provide with low-voltage battery disconnect.

H. Installation locations shall be coordinated with selected manufacturer's requirements and said manufacturer's distance limitations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

B. Verify that suitable support frames are installed where required.

C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.

B. Install products in accordance with manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
   3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
   4. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   5. See appropriate Division 09 section where suspended grid ceiling is specified for additional requirements.

G. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
   3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

H. Suspended Luminaires:
   1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   2. Install canopies tight to mounting surface.

I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to bottom of luminaire.

J. Install accessories furnished with each luminaire.

K. Bond products and metal accessories to branch circuit equipment grounding conductor.

L. Emergency Lighting Units:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

M. Exit Signs:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

N. LED Emergency Power Supply Units:
   1. For field-installed units, install inside luminaire unless otherwise indicated. Where installation inside luminaire is not possible, install on top of luminaire.

O. Identify luminaires connected to emergency power system in accordance with Section 26 0553.

P. Install lamps in each luminaire.

3.03 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

C. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

END OF SECTION

SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaires.

B. Ballasts and Drivers.

C. Poles and accessories.

1.02 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project administrative and procedural requirements.

B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.

C. Division 03 - Concrete: Materials and installation requirements for concrete bases for poles.

D. Section 26 0005 - Basic Electrical Requirements.

E. Section 26 0526 - Grounding and Bonding for Electrical Systems.

F. Section 26 0529 - Hangers and Supports for Electrical Systems.

G. Section 26 0533.16 - Boxes for Electrical Systems.

H. Section 26 0935 - Distributed Digital Lighting Control System: Automatic controls for lighting including outdoormotion sensors and outdoor photo controls.

I. Section 26 2726 - Wiring Devices: Receptacles for installation in poles.

J. Section 26 5100 - Interior Lighting.

1.03 REFERENCE STANDARDS

A. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing 2010.

B. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code) 2013 (Corrigendum 2019).

C. IEEE C2 - National Electrical Safety Code 2017.

D. IES LM-63 - IESNA Standard File Format for Electronic Transfer of Photometric Data and Related Information 2002 (Reaffirmed 2008).

E. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products 2008.

F. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules 2015, with Errata (2017).

G. IES RP-8 - Recommended Practice for Design and Maintenance of Roadway and Parking Facility Lighting 2018.

H. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

I. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems 2006.

J. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts 2016.

K. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility 2012.

L. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL 1598 - Luminaires Current Edition, Including All Revisions.

N. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
   2. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

B. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

H. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.
   2. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

I. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

J. Exposed Hardware: Stainless steel.

2.03 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

2.04 POLES

A. All Poles:
   1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
   2. Structural Design Criteria:
      a. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
   3. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.
   4. Unless otherwise indicated, provide with the following features/accessories:
      a. Top cap.
      b. Handhole.
      c. Anchor bolts with leveling nuts or leveling shims.
      d. Anchor base cover.
      e. Provision for pole-mounted weatherproof GFI receptacle where indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

B. Verify that suitable support frames are installed where required.

C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires in accordance with NECA/IESNA 501.

E. Provide required support and attachment in accordance with Section 26 0529.

F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Pole-Mounted Luminaires:
   1. Grounding:
      a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
   2. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.
   3. Install weather resistant GFI duplex receptacle with weatherproof cover as specified in Section 26 2726 in designated poles.

H. Install accessories furnished with each luminaire.

I. Bond products and metal accessories to branch circuit equipment grounding conductor.

J. Install lamps in each luminaire.

END OF SECTION

SECTION 28 46 00
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire alarm system design and installation, including all components, wiring, and conduit.

B. Transmitters for communication with supervising station.

C. Circuits from protected premises to supervising station, including conduit.

D. Replacement and removal of existing fire alarm system components, wiring, and conduit indicated.

E. Maintenance of fire alarm system under contract for specified warranty period.

1.02 RELATED REQUIREMENTS

A. Division 01 - General Requirements: Project adminstrative and procedural requirements.

B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.

C. Division 07 - Thermal and Moisture Protection: Materials and methods for work to be performed by this installer.

D. Division 08 - Openings: Door hardware, coiling fire doors and smoke and/or fire curtains to be released by fire alarm system.

E. Division 14 - Conveying Equipment: Elevator systems monitored and controlled by fire alarm system and sensors and interlocks by fire alarm system.

F. Section 21 1300 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.

G. Section 21 3000 - Fire Pumps: Supervisory devices.

H. Section 23 3300 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.

I. Section 26 0005 - Basic Electrical Requirements.

J. Section 26 0505 - Selective Demolition for Electrical

K. Section 26 0533.13 - Conduit for Electrical Systems.

L. Section 26 0533.16 - Boxes for Electrical Systems.

M. Section 26 0553 - Identification for Electrical Systems.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits 2002 (Corrigendum 2012).

D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 72 - National Fire Alarm and Signaling Code Most Recent Edition Cited by Referring Code or Reference Standard.

F. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

B. Evidence of designer qualifications.

C. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
   1. Copy (if any) of list of data required by authority having jurisdiction.
   2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
   4. System zone boundaries and interfaces to fire safety systems.
   5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
   6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
   7. List of all devices on each signaling line circuit, with spare capacity indicated.
   8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
   9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
   10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
   11. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
   12. Certification by Contractor that the system design complies with Contract Documents.

D. Evidence of installer qualifications.

E. Evidence of instructor qualifications; training lesson plan outline.

F. Evidence of maintenance contractor qualifications, if different from installer.

G. Inspection and Test Reports:
   1. Submit inspection and test plan prior to closeout demonstration.
   2. Submit documentation of satisfactory inspections and tests.
   3. Submit NFPA 72 "Inspection and Test Form," filled out.

H. Operating and Maintenance Data: Revise and resubmit until acceptable; have one set available during closeout demonstration:
   1. Complete set of specified design documents, as approved by authority having jurisdiction.
   2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
   3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
   4. List of recommended spare parts, tools, and instruments for testing.
   5. Replacement parts list with current prices, and source of supply.
   6. Detailed troubleshooting guide and large scale input/output matrix.
   7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.

8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

I. Project Record Documents: Have one set available during closeout demonstration:
   1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
   2. "As installed" wiring and schematic diagrams, with final terminal identifications.
   3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

J. Closeout Documents:
   1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
   2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer , with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
   1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
   2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
   3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.

C. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

D. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Alarm Control Units and Accessories:
   1. Honeywell Security & Fire Solutions/Notifier: www.notifier.com.
   2. National Time & Signal: www.natsco.net.
   3. Siemens Building Technologies, Inc: www.usa.siemens.com.
   4. Simplex, a brand of Johnson Controls: www.simplex-fire.com.
   5. Provide control units made by the same manufacturer.

B. Initiating Devices and Notification Appliances:
   1. Same manufacturer as control units.
   2. Provide initiating devices and notification appliances made by the same manufacturer, where possible.

2.02 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide a new automatic fire detection and alarm system:

1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
2. Protected Premises: Entire building shown on drawings.
3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
   a. ADA Standards.
   b. The requirements of the local authority having jurisdiction .
   c. Applicable local codes.
   d. Contract Documents (drawings and specifications).
   e. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
5. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
6. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
7. Program notification zones and voice messages as directed by Owner.
8. Fire Command Center: Location indicated on drawings.
9. Fire Alarm Control Unit: New, located at fire command center.

B. Supervising Stations and Fire Department Connections:
1. Public Fire Department Notification: By on-premises supervising station.
2. On-Premises Supervising Station: Existing proprietary station operated by Owner, located at _____.
3. Means of Transmission to On-Premises Supervising Station: Directly connected noncoded system.

C. Circuits:
1. Initiating Device Circuits (IDC): Class B, Style A.
2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
3. Notification Appliance Circuits (NAC): Class B, Style W.

D. Spare Capacity:
1. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

E. Power Sources:
1. Primary: Dedicated branch circuits of the facility power distribution system.
2. Secondary: Storage batteries.
3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
4. Each Computer System: Provide uninterruptible power supply (UPS).

2.03 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
1. Sprinkler water control valves.
2. Dry-pipe sprinkler system pressure.
3. Dry-pipe sprinkler valve room low temperature.
4. Fire pump(s).
5. Elevator shut-down control circuits.
6. Chute interlocks and controls.

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:

1. Sprinkler water flow.
2. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.

C. Elevators:
1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.
3. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.

D. HVAC:
1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

E. Doors:
1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 7100.
2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from. Refer to Division 08.

2.04 COMPONENTS

A. General:
1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.

C. Master Control Unit: As specified for Basis of Design above, or equivalent.

D. Remote Annunciators: locate per plans.

E. Initiating Devices:
1. Addressable Systems:
a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.

F. Circuit Conductors: Copper or optical fiber; provide 200 feet extra; color code and label.

G. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.

H. Locks and Keys: Deliver keys to Owner.

I. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
2. Provide one for each control unit where operations are to be performed.
3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
4. Provide extra copy with operation and maintenance data submittal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.

B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

C. Obtain Owner's approval of locations of devices, before installation.

D. Install instruction cards and labels.

3.02 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E. Provide all tools, software, and supplies required to accomplish inspection and testing.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.03 OWNER PERSONNEL INSTRUCTION

A. Provide the following instruction to designated Owner personnel:
   1. Hands-On Instruction: On-site, using operational system.
   2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.

B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
   1. Initial Training: 1 session pre-closeout.

C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
   1. Initial Training: 1 session pre-closeout.

D. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

3.04 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
   1. Be prepared to conduct any of the required tests.
   2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
   3. Have authorized technical representative of control unit manufacturer present during demonstration.
   4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
   5. Repeat demonstration until successful.

3.05 MAINTENANCE

A. See Division 01 for additional requirements relating to maintenance service.

B. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:

1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
3. Record keeping required by NFPA 72 and authorities having jurisdiction.

C. Provide trouble call-back service upon notification by Owner:
1. Provide on-site response within 2 hours of notification.
2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

D. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

E. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

F. Comply with Owner's requirements for access to facility and security.

END OF SECTION

SECTION 32 39 13

BOLLARDS

PART 1 GENERAL

1.1 SUMMARY

A. Provide and install concrete filled pipe bollards as located and detailed on drawings.

1.2 RELATED SECTIONS

A. Section 09 96 00 High Performance Coatings

1.3 REFERENCE STANDARDS

A. ASTM A36- Standard Specification for carbon Structural Steel.

B. ASTM A312- Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

C. ASTM A500- Standard Specification for Cold- Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

D. ASTM A536- Standard Specification for Ductile Iron Castings.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Samples: Submit manufacturer’s standard colors for selection. Submit sample of color specified.

C. Setting Drawings: Show embedded items and cutouts required for work specified in other Sections.

D. Maintenance Data: Submit manufacturer’s field touch-up, cleaning and maintenance instructions.

E. Warranty Documentation: Submit sample of manufacturer’s warranty.

F. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to site in manufacturer’s original, unopened containers and packaging.

B. Storage: Store in clean, dry area in accordance with manufacturer’s instructions. Keep materials in manufacturer’s original, unopened containers until installation.

C. Handling: Protect materials and finish during handling and installation to prevent damage.

1.6 WARRANTY

A. Provide manufacturer's standard warranty against defects in materials and workmanship.

1. Warranty Period: Five years from date of invoice.

2. Coatings: Two years, against peeling, cracking or significant color change.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer:

1. Reliance Foundry Co Ltd. (basis of design)

2.2 METAL BOLLARDS

A. Model: Reliance Foundry; R-1007-06

1. Size:

a. Typical: 36 inches high x 6 inches diameter.

b. Truck Doors: 36 inches high x 8 inches diameter

2. Design: Cylindrical with rounded top.

3. Material: Steel ASTM 500 B Steel.

4. Color Coating:

a. Type: Polyester powder coat over epoxy primer

b. Color: Safety Yellow

5. Installation:

a. Embedded

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine paving or other substrates for compliance with manufacturer's requirements for placement and location of embedded items, condition of substrate, and other conditions affecting installation of bollards.

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

3.2 INSTALLATION

A. General: Comply with manufacturer's installation instructions and setting drawings.

B. Damaged, cracked, chipped, deformed or marred bollards are not acceptable. Field touch-up minor imperfections in accordance with manufacturer's instructions.

3.3 CLEANING AND PROTECTION

A. Protect bollards against damage.

B. Immediately prior to Substantial Completion, clean bollards in accordance with manufacturer's instructions to remove dust, dirt, adhesives, and other foreign materials.

C. Touch up damaged finishes according to manufacturer's instructions.

3.4 CLOSEOUT ACTIVITIES

A. Provide executed warranty.

END OF BOLLARDS

SECTION 41 67 19

INDUSTRIAL SAFETY EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Industrial guardrails / safety barriers.

B. Overhead door track protection.

1.2 RELATED SECTIONS

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

B. Section 04 40 00 - Stone Assemblies.

C. Section 05 10 00 - Structural Metal Framing.

D. Section 05 50 00 - Metal Fabrications.

1.3 REFERENCES

A. ASTM A 36 - Standard Specification for Carbon Structural Steel.

B. ASTM A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

C. ASTM A 1011 - 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.

D. OSHA 29 CFR 1910.23 - Guarding Floor and Wall Openings and Holes.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Showing overall dimensions (width, height). Supporting construction requirements and equipment structural attachment. Operating range and required clearances.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Providing sole source for design, engineering, manufacturing and warranty claims handling. Company specializing in manufacturing products specified with a minimum 20 years experience.

B. Installer Qualifications: Installer Qualifications: Trained, certified and approved by manufacturer, with documented experience on similar projects.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.
   4. Accepted mock-ups shall be comparison standard for remaining Work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 SEQUENCING

A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.

B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturesr: Omega Industrial Safety, FS Industries, Rhino Rails

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 INDUSTRIAL GUARDRAILS / SAFETY BARRIERS

A. General: Industrial Guardrails / Safety Barriers.
   1. Rail Sections: Rails shall be a two rib design minimum of 1.75 inches (44 mm) wide by 12 inches (305 mm) high by required lengths from 13 to 120 inch (330 to 3048 mm) in 12 inch (305 mm) increments. Rail section fabricated of hot rolled; cold formed 11-gauge steel meeting the requirements of ASTM A 1011, Grade 50 steel.
   2. Mounting Posts: Minimum HSS 4 x 4 x 3/16 inches (102 x 102 x 4.87 mm) upright,

with a 10 x 10 x 0.50 inch (254 x 254 x 13 mm) base plate, constructed from cold formed structural steel tubing meeting the requirements of ASTM A 500 - Grade B, with a minimum yield of 46 ksi (317 MPa). Provide mounting posts types from the following as indicated on the Drawings.

a. Guardrail Mounting Post: 18 inch (457 mm) Mounting Post.
b. Guardrail Perimeter Mounting Post: 18 inch (457 mm) Offset Perimeter Mounting Post.
c. Guardrail Corner Mounting Post: 18 inch (457 mm) Offset Corner Mounting Post

3. Optional Accessories: Provide where indicated on the Drawings.
   a. Wrap-Around Flairs: Provide at the end of a run as indicated. Wraps around 180 degrees.
   b. Corner Caps: Provide at corner posts as indicated to provide a smooth transition.
   c. Vinyl Stripping and Post Caps: Provide at the top of rail edge and caps as indicated to eliminate sharp edges.
   d. Inside Corner Guard Brackets.
   e. Guardrail Inline Mounting Brackets.

B. Finish: Heat cured, polyester based powder coating with sea spray and ultraviolet enhancements. Standard color is O.S.H.A. approved Traffic Safety Yellow.

C. Removable Guard Rail Lift Out Assembly:
   1. Description:
      a. Handrail Assembly 42 inch (1067 mm) High:
         1) Two Horizontal Rail System.
         2) Rails slide out from the top leaving a temporary opening to allow access.
         3) All hardware included.
      b. Swing Gates: Right, left or double as indicated on the Drawings. 48 inch (1219 mm) wide gate requires an opening 53 inches (1346 mm) and Mounts to a Guard Rail Post.

2.3 OVERHEAD DOOR TRACK PROTECTION

A. Z-Guard.
   1. Material: Constructed of hot rolled, cold formed 3/16 inch (5 mm) or 7 gage steel meeting the requirements of ASTM E 36 steel, modified to a minimum yield of 36 ksi (248 MPa).
   2. Description:
      a. Z-Guard shall be a minimum of 5 inches (127 mm) wide with a minimum projection from the wall of 6 inches (152 mm) by 48 inches (1219 mm) tall. The vertical flange shall have two wall mounting holes to accommodate 1/2 inch (13 mm) anchors suitable for anchoring to the specific wall construction. Trak-Shield has a Z-Shaped configuration, with a flared inside edge and mitered inside corners to eliminate catch points.
   3. Finish: Heat cured, polyester based powder coating with sea spray and ultraviolet enhancements. The standard color is OSHA approved Traffic Safety Yellow.

B. Track-Shield.
   1. Material: Constructed of hot rolled, cold formed 3/16 inch (5 mm) or 7 gage steel

meeting the requirements of ASTM E 36 steel, modified to a minimum yield of 36 ksi (248 MPa).

2. Description:
   a. Trak-Shield is a minimum of 5 inches (127 mm) wide with a minimum projection from the wall of 6 inches (152 mm) by 48 inches (1219 MM) tall. The vertical flange shall have two wall mounting holes to accommodate 1/2 inch (13 mm) anchors suitable for anchoring to the wall construction. Trak-Shield has a Z-Shaped configuration, with a flared inside edge and mitered inside top corner to eliminate catch points. Base plates shall be manufactured from 10 ix 10 inch x 3/8 inch (254 x 254 x 9.5 mm) ASTM A 36 steel and shall have three base plate mounting holes to accommodate 5/8 inch (16 mm) diameter anchors.
3. Finish: Heat cured, polyester based powder coating with sea spray and ultraviolet enhancements. Standard color is OSHA. approved Traffic Safety Yellow.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until the substrates have been properly prepared.

B. Examine the opening and conditions under which equipment is to be installed and notify the Architect and Contractor in writing of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

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

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Before Substantial Completion, conduct a demonstration in the presence of the Owner's representative to ensure that all equipment operates properly in every aspect. Conduct a detailed user/operator training session at time and place agreed upon by Owner's representative.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION