Table of Contents Generated by MasterWorks: 7/23/2018

END OF TABLE OF CONTENTS

SECTION 09.66.23- RESILIENT RUBBER ATHLETIC FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Resilient (rubber) Athletic Flooring.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of product indicated.

C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size samples of each resilient product color, texture, and pattern required.

D. Product Schedule: For resilient products. Use same designations indicated on Drawings**.**

1.3 QUALITY ASSURANCE

A. Mockups: Provide resilient products with mockups specified in other Sections.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by Johnsonite, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

1.5 PROJECT CONDITIONS

A. Install resilient products after other finishing operations, including painting, have been completed.

B. Maintain ambient temperatures within range recommended by Johnsonite, but not less than 65 deg F (18 deg C) or more than 85 deg F (29 deg C) in spaces to receive resilient products during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

C. Maintain the ambient relative humidity between 40% and 60% during installation.

D. Until Substantial Completion, maintain ambient temperatures within range recommended by Johnsonite, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

PRODUCTS

1.6 RESILIENT ATHLETIC FLOORING

Manufacturer:

Johnsonite, Inc.	Phone:	(800) 899-8916
16910 Munn Road		(440) 543-8916
Chagrin Falls, Ohio 44023	Tech:	Ext 9297
Web: www.tarkettna.com	Samples:	Ext 9299
E-mail: info@johnsonite.com	Fax:	(440) 543-8920

Manufacturer: (BASIS OF DESIGN)

Ground Control Surfaces	Phone:	(209) 830-0235
25520 Schulte		
Shulte CA 95377		
Web: www.groundcontrolsurfaces.com		
e: info@groundcontrolsurfaces.com		

OR APPROVED EQUAL

A. Resilient Rubber Athletic Sheet Flooring:
   1. REPLAY Sheet Specify – Resilient Rubber Athletic Sheet Flooring with the following physical characteristics:
      a. Manufactured from a composition of recycled truck tire crumb rubber encapsulated in a urethane binder.
      b. Overall thickness:
         1) 1/4"
         2) 5/32"
      c. Roll/Sheet Width: 4'
      d. ASTM D 2240 Standard Test Method for Rubber Property—Durometer Hardness: 65 Shore A.
      e. ASTM D 2047, Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring or 0.6 or greater.
      f. ASTM F 970, Standard Test Method for Static Load Limit – passes 250 PSI.
      g. ASTM D 3389 Standard Test Method for Coated Fabrics Abrasion Resistance: < 1.00 gram weight loss.
      h. ASTM D 2859 Standard Test Method for Ignition Characteristics of Finished Floor Covering Materials (Pill Test): passes with greater than 1" of un-charred area.
      i. Johnsonite offers a RESTART reclamation program for returning jobsite scrap
      j. Replay Rubber Athletic Sheet Flooring contains 92% post-consumer recycled content
      k. SCS FloorScore Certified and meets California Specifications Section 01350
      l. Resilient Rubber athletic Flooring contains 7% rapidly renewable content
      m. 100% Recyclable
      n. Phthalate, chlorine and halogen-free

1.7 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation.

B. Adhesives: As recommended by Johnsonite to meet site conditions.

1. Resilient Rubber Athletic Flooring (For glue down tile only).
    a. Johnsonite 965 Flooring and Tread Adhesive
    b. Johnsonite 975 Two-Part Urethane Adhesive
    c. Johnsonite 140 SpraySmart Adhesive

PART 2 - EXECUTION

2.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

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

2.2 PREPARATION

A. Prepare substrates according to Johnsonite written instructions to ensure adhesion of Resilient Athletic Flooring.
    1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
    2. Remove substrate paint, coatings and other substances that are incompatible with adhesives or contain soap, wax, oil, solvents, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
    3. Mechanically remove contamination on the substrate that may cause damage to the resilient athletic flooring material. Permanent and non-permanent markers, pens, crayons, paint, etc., must not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.
    4. Prepare Substrates according to ASTM F 710 including the following:
        a. For glue down tile:
            1) Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
            2) Perform anhydrous calcium chloride test, ASTM F 1869. Results must not exceed 5 lbs. Moisture Vapor Emission Rate per 1,000 sq. ft. in 24 hours.

                – or –

                a) Perform relative humidity test using in situ probes, ASTM F 2170. Must not exceed 80%.
            3) A pH test for alkalinity must be conducted. Results should range between 7 and 9. If the test results are not within the acceptable range of 7 to 9, the installation must not proceed until the problem has been corrected.
            4) Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
        b. For loose lay (UnderLock, Interlocking) Tile:
            1) The Moisture Vapor Emission Rate (MVER) of the concrete will have no measurable effect on the UnderLock or Interlocking Tile as they are not adhered to the concrete substrate.
            2) Moisture testing must be conducted to identify if the MVER of the concrete is within the approved limits of the patching compound manufacturers specifications. (Follow patching compound manufactures instructions for proper selection and use.)

5. Wood subfloors must have a minimum 18" (45.7 cm) of cross-ventilated space beneath the bottom of the joist.
    a. The floor must be rigid, free of movement.
    b. Single wood and tongue and groove subfloors should be covered with ¼" (6.4 mm) or ½" (12.7 mm) APA approved underlayment plywood.
        1) Use ¼" (6.4 mm) thick underlayment panels for boards with a face width of 3" (76 mm) or less.
        2) Use ½" (12.7 mm) thick underlayment panels for boards with a face width wider than 3" (76 mm).
    c. Do not install over OSB (Oriented Strand Board), particle board, chipboard, lauan or composite type underlayments.

B. Fill cracks, holes, depressions and irregularities in the substrate with good quality Portland cement based underlayment leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

C. Floor covering shall not be installed over expansion joints.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.
    1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

2.3 RESILIENT ATHLETIC FLOORING INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient athletic flooring.

B. Resilient Athletic Rubber Sheet Flooring:
    1. Install with Johnsonite adhesive specified for the site conditions and follow adhesive label for proper use.
    2. Install rolls in sequential order following roll numbers on the labels.
    3. Reverse sheets unless instructed otherwise in Johnsonite Installation Instructions.
    4. Roll the flooring in both directions using a 100 pound three-section roller.

C. Resilient Athletic Rubber Tile Flooring:
    1. Install with Johnsonite adhesive specified for the site conditions and follow adhesive label for proper use.
    2. Do not Quarter Turn tile.
    3. Roll the flooring in both directions using a 100 pound three-section roller.

D. Resilient Athletic Loose Lay UnderLock and Interlocking Tile Flooring:
    1. Do not adhere Loose Lay tile to substrate.
    2. Roll the flooring tabs with a hand roller.

2.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
   1. No traffic for 24 hours after installation.
   2. No heavy traffic, rolling loads, or furniture placement for 72 hours after installation.

D. Wait 72 hours after installation before performing initial cleaning

E. A regular maintenance program must be started after the initial cleaning.

END OF SECTION 09.65.66.23

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Items indicated to be removed and salvaged remain Owner's property. Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse. Include fasteners or brackets needed for reattachment elsewhere.

B. Predemolition Photographs: Show existing conditions of adjoining construction and site improvements. Submit before Work begins.

C. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

D. It is not expected that hazardous materials will be encountered in the Work. If hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with EPA regulations and with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Maintain services/systems indicated to remain and protect them against damage during selective demolition operations. Before proceeding with demolition, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of the building.

B. Locate, identify, shut off, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

D. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

E. Protect walls, ceilings, floors, and other existing finish work that are to remain. Erect and maintain dustproof partitions. Cover and protect furniture, furnishings, and equipment that have not been removed.

F. Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

G. Provide temporary weather protection to prevent water leakage and damage to structure and interior areas.

H. Requirements for Building Reuse:

1. Maintain existing building structure (including structural floor and roof decking) and envelope (exterior skin and framing, excluding window assemblies and nonstructural roofing material) not indicated to be demolished; do not demolish such existing construction beyond indicated limits.
2. Maintain existing interior nonstructural elements (interior walls, doors, floor coverings, and ceiling systems) not indicated to be demolished; do not demolish such existing construction beyond indicated limits.

I. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction.

J. Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved landfill. Do not burn demolished materials.

K. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: ICC-ES evaluation reports for preservative-treated plywood fire-retardant-treated plywood.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS, GENERAL

A. Plywood: DOC PS 1.

B. Oriented Strand Board: DOC PS 2.

2.2 TREATED PLYWOOD

A. Preservative-Treated Plywood: AWPA U1; Use Category UC2.

1. Use treatment containing no arsenic or chromium.
2. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

B. Provide preservative-treated plywood for items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

C. Fire-Retardant-Treated Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use Exterior type for exterior locations and where indicated.
2. Use Interior Type A unless otherwise indicated.
3. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F shall be not less than span ratings specified.
4. Identify with appropriate classification marking of a testing and inspecting agency acceptable to authorities having jurisdiction.

D. Provide fire-retardant-treated plywood for items indicated on Drawings.

2.3 WALL SHEATHING

A. Plywood Wall Sheathing: Exposure 1, Structural I sheathing.

B. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

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. CertainTeed Corporation.
b. Georgia-Pacific Gypsum LLC.
c. National Gypsum Company.

C. Cementitious Backer Units: ASTM C 1325, Type A.

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. C-Cure.
b. Custom Building Products.
c. FinPan, Inc.

2.4 ROOF SHEATHING

A. Plywood Roof Sheathing: Exposure 1, Structural I sheathing.

B. Composite Nail Base Insulated Roof Sheathing: Polyisocyanurate foam with oriented strand board laminated to one face complying with ASTM C 1289, Type V.

2.5 MISCELLANEOUS PRODUCTS

A. Fasteners: Size and type indicated.

1. For roof and wall sheathing, provide fasteners of Type 304 stainless steel.
2. Power-Driven Fasteners: CABO NER-272.

B. Sheathing Joint-and-Penetration Treatment Materials:

1. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant, recommended by tape and sheathing manufacturers for application indicated.
2. Sheathing Tape for Glass-Mat Gypsum Sheathing: Self-adhering, glass-fiber tape recommended by sheathing and tape manufacturers for application indicated.
3. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

C. Adhesives for Field Gluing Panels to Framing: APA AFG-01.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Securely attach to substrates, complying with the following:

1. CABO NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in the IBC.

B. Fastening Methods:

1. Wall and Roof Sheathing:

a. Nail to wood framing.
b. Screw to cold-formed metal framing.

2. Underlayment:

a. Nail to subflooring.

C. Glass-Mat Gypsum Sheathing Joint-and-Penetration Treatment: Seal sheathing joints and penetrations according to sheathing manufacturer's written instructions.

D. Install cementitious backer units and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

END OF SECTION 061600

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Surface-Burning Characteristics: According to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

PART 2 - PRODUCTS

2.1 INSULATION PRODUCTS

A. Glass-Fiber-Blanket Insulation: ASTM C 665, Type III, Class A, foil faced on one side with flame-spread and smoke-developed indexes of 25 and 450, respectively.

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. CertainTeed Corporation.
b. Johns Manville; a Berkshire Hathaway company.

2.2 ACCESSORIES

A. Vapor Retarder: Reinforced polyethylene, 6 mils thick.

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. Raven Industries, Inc.

B. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed to fit between roof framing members and to provide cross-ventilation between insulated attic spaces and vented eaves.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install insulation in areas and in thicknesses indicated or required to produce R-values indicated. Cut and fit tightly around obstructions and fill voids with insulation.

B. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

C. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.

D. Except for loose-fill insulation and insulation that is friction fitted in stud cavities, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

E. Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage. Locate seams at framing members, overlap, and seal with tape. Seal joints caused by pipes, conduits, electrical boxes, and similar items with tape.

END OF SECTION 072100

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 283, ASTM E 783, or ASTM E 2357.

2.2 FLUID-APPLIED MEMBRANE AIR BARRIER

A. Fluid-Applied, Vapor-Retarding Membrane Air Barrier: Elastomeric, modified bituminous membrane with air permeance not greater than 0.004 cfm x sq. ft. at 1.57-lbf/sq. ft. pressure difference per ASTM E 2178 and water-vapor permeance not greater than 0.1 perm per ASTM E 96/E 96M.

1. Elastomeric, Modified Bituminous Membrane:

a. 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:

1) Carlisle Coatings & Waterproofing Inc.
2) Epro Services, Inc.
3) Tremco Incorporated.

B. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: Elastomeric, modified bituminous membrane with air permeance not greater than 0.004 cfm x sq. ft. at 1.57-lbf/sq. ft. pressure difference per ASTM E 2178 and water-vapor permeance not less than 5.5 perms per ASTM E 96/E 96M.

1. Elastomeric, Modified Bituminous Membrane:

a. 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:

1) Henry Company.
2) Hohmann & Barnard, Inc.
3) Tremco Incorporated.

2.3 ACCESSORIES

A. General: Furnish primers, transition and flashing strips, mastics, sealants, and other accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly.

B. Transition Strip: Adhesive rubberized-asphalt compound, bonded to plastic film or spunbonded polyolefin, with an overall thickness of 0.030 inch.

C. Joint Reinforcing Strip: Glass-fiber-mesh tape.

D. Substrate Patching Material: Trowel-grade substrate filler.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Joint Treatment: Prepare and fill joints and cracks in substrate according to ASTM C 1193 and air-barrier manufacturer's written instructions.

1. Concrete and Masonry: Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces. Prime substrate and apply a single thickness of air-barrier manufacturer's recommended preparation coat extending a minimum of 3 inches along each side of joints and cracks. Apply a double thickness of fluid air-barrier material and embed a joint reinforcing strip in preparation coat.
2. Gypsum Sheathing: Apply first layer of fluid air-barrier membrane at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air-barrier membrane over joint reinforcing strip.

B. Install transition strips and auxiliary materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier. Install transition strips so that a minimum of 3 inches of coverage is achieved over both substrates.

C. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier membrane with foam sealant.

D. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier membrane in same day. Reprime areas exposed for more than 24 hours.

E. Apply air-barrier membrane to form a seal with termination strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions.

1. Vapor-Retarding Membrane Air Barrier: Total dry film thickness as recommended by manufacturer, but not less than 40-mil dry film thickness, applied in one coat.
2. Vapor-Permeable Membrane Air Barrier: Total dry film thickness as recommended by manufacturer, but not less than 40-mil dry film thickness, applied in one coat.

END OF SECTION 072726

SECTION 076100 - SHEET METAL ROOFING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Warranty on Finishes: Manufacturer agrees to repair or replace sheet metal roofing that shows evidence of deterioration of factory-applied finishes within 15 years.

C. Installation Warranty: Installer agrees to repair or replace components of sheet metal roofing that fail in materials or workmanship within two years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless otherwise indicated.

2.2 ROOFING SHEET METALS

A. Metallic-Coated Steel Sheet: Galvanized-steel sheet, ASTM A 653/A 653M, G90, or aluminum-zinc alloy-coated steel sheet, ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; with smooth, flat surface; 0.022-inch nominal thickness.

1. Finish: Manufacturer's standard two-coat fluoropolymer system with color coat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight.
2. Concealed Finish: Manufacturer's standard white or light-colored acrylic or polyester backer finish.

2.3 ACCESSORIES

A. Felt Underlayment: ASTM D 226, Type II (No. 30), asphalt-saturated organic felts.

B. Self-Adhering, High-Temperature Sheet Underlayment: Butyl or SBS-modified asphalt; slip-resisting-polyethylene surfaced; with release paper backing; cold applied. Stable after testing at 240 deg F and passes after testing at minus 20 deg F; ASTM D 1970.

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. Carlisle Residential; a division of Carlisle Construction Materials.

b. Owens Corning.
c. Protecto Wrap Company.

C. Battens: Fabricate from exterior-type, fire-retardant-treated wood.

D. Fasteners: Wood screws, annular-threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners.

1. Exposed Fasteners: Heads matching color of sheet metal roofing using plastic caps or factory-applied coating.
2. Fasteners for Metallic-Coated Steel Sheet: Hot-dip galvanized steel or Series 300 stainless steel.

E. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene sealant tape 1/2 inch wide and 1/8 inch thick.

F. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane sealant.

G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

H. Metal Accessories: Matching sheet metal roofing in finish and material required for a complete roofing assembly, including trim, copings, fasciae, clips, flashings, metal closures, and similar items.

2.4 FABRICATION

A. Fabricate sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, geometry, metal thickness, and other characteristics of installation.
1. Standing-Seam Roofing: Form standing-seam panels with finished seam height of 1 inch.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Apply self-adhering sheet underlayment at eaves and rakes from edges of roof to at least 24 inches inside exterior wall line.

B. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment.

C. Apply slip sheet over underlayment before installing metal roof panels and related flashing.

D. Metal Protection: Where dissimilar metals contact each other, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating.

1. Coat concealed side of aluminum with bituminous coating where it contacts wood, ferrous metal, or cementitious construction.

E. Anchor roofing securely in place, with provisions for thermal and structural movement. Install with concealed fasteners unless otherwise indicated.

F. Install work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks, considering metal temper and reflectivity. Provide uniform, neat seams with minimum exposure of solder and sealant. Fold back sheet metal to form a hem on concealed side of exposed edges unless otherwise indicated.

1. Install cleats to hold sheet metal panels in position. Attach each cleat with two fasteners to prevent rotation.
2. Space cleats not more than 12 inches o.c. Bend tabs over nails.
3. Provide expansion-type cleats for roof panels that exceed 30 feet in length.

G. Seal joints as shown and as required for leakproof construction. For roofing with 3:12 slopes or less, use cleats at transverse seams.

END OF SECTION 076100

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Coordinate installation of sheet metal flashing and trim with adjoining roofing and wall materials, joints, and seams to provide a leakproof, secure, and noncorrosive installation.

C. Fabricator Qualifications: For copings and low-slope roof edge flashings that are FM Approvals approved, shop shall be listed as able to fabricate required details as tested and approved.

D. Warranty on Finishes: Manufacturer agrees to repair or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within 15 years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standard: Comply with NRCA's "The NRCA Roofing Manual" unless otherwise indicated. Conform to dimensions and profiles shown unless more stringent requirements are indicated.

B. FM Approvals' Listing: Manufacture and install roof edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with name of fabricator and design approved by FM Approvals.

2.2 SHEET METAL

A. Metallic-Coated Steel Sheet: Galvanized steel sheet, ASTM A 653/A 653M, G90, or aluminum-zinc alloy-coated steel sheet, ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; 0.022-inch nominal thickness.

1. Finish: Manufacturer's standard two-coat fluoropolymer system with color coat containing not less than 70 percent PVDF resin by weight.
2. Concealed Finish: Manufacturer's standard white or light-colored acrylic or polyester backer finish.

2.3 ACCESSORIES

A. Felt Underlayment: ASTM D 226, Type II (No. 30), asphalt-saturated organic felts.

B. Self-Adhering, High-Temperature Sheet Underlayment: Butyl or SBS-modified asphalt; slip-resisting-polyethylene surfaced; with release paper backing; cold applied. Stable after testing at 240 deg F and passes after testing at minus 20 deg F; ASTM D 1970.

C. Fasteners: Wood screws, annular-threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners.

1. Exposed Fasteners: Heads matching color of sheet metal roofing using plastic caps or factory-applied coating.
2. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 FABRICATION

A. Fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to the design, dimensions, geometry, metal thickness, and other characteristics of item indicated.

B. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with cited sheet metal standards. Allow for thermal expansion; set true to line and level. Install Work with laps, joints, and seams permanently watertight and weatherproof; conceal fasteners where possible.

B. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

C. Metal Protection: Where dissimilar metals contact each other, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating.

1. Coat concealed side of aluminum with bituminous coating where it contacts wood, ferrous metal, or cementitious construction.

END OF SECTION 076200

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and color Samples.

B. Environmental Limitations: Do not proceed with installation of joint sealants when ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS

A. Low-Emitting Materials: Sealants shall comply with Section 018113.13 - Sustainable Design Requirements - LEED 2009 for New Construction and Major Renovations.

B. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under service and application conditions.

C. Sealant for Use in Building Expansion Joints, One of the Following:

1. Single-component, neutral-curing silicone sealant, ASTM C 920, Type S; Grade NS; Class 50; for Use NT.

a. 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:

1) Adfast.
2) Dow Corning Corporation.
3) GE Construction Sealants; Momentive Performance Materials Inc.

D. Sealant for General Exterior Use Where Another Type Is Not Specified, One of the Following:

1. Single-component, neutral-curing silicone sealant, ASTM C 920, Type S; Grade NS; Class 25; for Use NT.

a. 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:

1) Dow Corning Corporation.
2) GE Construction Sealants; Momentive Performance Materials Inc.
3) Pecora Corporation.

E. Sealant for Exterior Traffic-Bearing Joints, Where Slope Allows Use of Pourable Sealant:

1. Single-component, pourable urethane sealant, ASTM C 920, Type S; Grade P; Class 25; for Use T.

a. 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:

1) BASF Corporation.
2) Pecora Corporation.
3) Polymeric Systems, Inc.

F. Sealant for Use in Interior Joints in Ceramic Tile and Other Hard Surfaces in Kitchens and Toilet Rooms and around Plumbing Fixtures:

1. Single-component, mildew-resistant silicone sealant, ASTM C 920, Type S; Grade NS; Class 25; for Use NT; formulated with fungicide.

a. 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:

1) Adfast.
2) Dow Corning Corporation.
3) GE Construction Sealants; Momentive Performance Materials Inc.

G. Sealant for Interior Use at Perimeters of Door and Window Frames:

1. Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

a. 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:

1) Everkem Diversified Products, Inc.
2) Franklin International.
3) Sherwin-Williams Company (The).

2.2 MISCELLANEOUS MATERIALS

A. Provide sealant backings of materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

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

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

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with ASTM C 1193.

B. Install sealant backings to support sealants during application and to produce cross-sectional shapes and depths of installed sealants that allow optimum sealant movement capability.

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

END OF SECTION 079200

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Samples for plastic-laminate-faced doors.

PART 2 - PRODUCTS

2.1 FLUSH WOOD DOORS

A. 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:

1. Algoma Hardwoods, Inc.

2. Weyerhauser

2.2 DOOR CONSTRUCTION, GENERAL

A. Quality Standard: WDMA I.S.1-A.

B. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

C. WDMA I.S.1-A Performance Grade:

1. Heavy duty unless otherwise indicated.

D. Particleboard-Core Doors: Provide blocking in particleboard cores or provide structural composite lumber cores instead of particleboard cores for doors with exit devices.

2.3 FABRICATION AND FINISHING

A. Factory-fit doors to suit frame-opening sizes indicated and to comply with clearances specified.

B. Factory-machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3.

C. Cut and trim openings to comply with referenced standards.

1. Trim light openings with moldings indicated.
2. Factory-install glazing in doors indicated to be factory finished.
3. Factory-install louvers in prepared openings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install doors to comply with manufacturer's written instructions and WDMA I.S.1-A, and as indicated.

1. Install fire-rated doors to comply with NFPA 80.

B. Align and fit doors in frames with uniform clearances and bevels. Machine doors for hardware. Seal cut surfaces after fitting and machining.

C. Clearances: As follows unless otherwise indicated:

1. 1/8 inch at heads, jambs, and between pairs of doors.
2. 1/8 inch from bottom of door to top of decorative floor finish or covering.
3. 1/4 inch from bottom of door to top of threshold.

END OF SECTION 081416

SECTION 088300 - MIRRORS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 SILVERED, FLAT GLASS MIRRORS

A. 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:

1. Avalon Glass and Mirror Company.
2. Binswanger Glass.
3. D & W Incorporated.
4. Guardian Glass; SunGuard.

B. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror-coating process.

C. Annealed Monolithic Glass Mirrors: Mirror Quality, ultraclear (low-iron) float glass with a minimum 91 percent visible light transmission.

1. Nominal Thickness: 6.0 mm.

D. Safety Glazing Products: Film-backed mirrors complying with testing requirements in 16 CFR 1201 for Category II materials.

2.2 MISCELLANEOUS MATERIALS

A. Mirror Mastic: An adhesive setting compound, asbestos free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

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. Franklin International.
b. Laurence, C. R. Co., Inc.
c. Liquid Nails Adhesive.

2. Low-Emitting Materials: Mastic shall have a VOC content of not more than 70 g/L.

3. Low-Emitting Materials: Mastic shall comply with Green Seal's GS-36 and 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."

B. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror-backing paint as certified by mirror manufacturer.

C. Aluminum J-Channels: Clear, bright anodized aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of each mirror in a single piece.

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. Andscot Company, Inc.
b. Laurence, C. R. Co., Inc.

2.3 FABRICATION

A. Mirror Edge Treatment: Flat polished.

1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.

B. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint as recommended in writing by film-backing manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

1. GANA Publications: "Glazing Manual" and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."

B. Provide a minimum air space of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed so heads do not impose point loads on backs of mirrors.

1. Top and Bottom Aluminum J-Channels: Provide setting blocks 1/8 inch thick by 4 inches long at quarter points.

2. Mirror Clips: Place a felt or plastic pad between mirror and each clip. Locate clips so they are symmetrically placed and evenly spaced.
3. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.

D. Remove nonpermanent labels, and clean surfaces immediately after installation.

END OF SECTION 088300

SECTION 092400 - PORTLAND CEMENT PLASTERING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and finish Samples.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 METAL LATH

A. Expanded-Metal Lath: ASTM C 847, with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.

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. Alabama Metal Industries Company; a Gibraltar Industries company.
b. CEMCO; California Expanded Metal Products Co.
c. ClarkDietrich.

2. Diamond-Mesh Lath: Self-furring, 3.4 lb/sq. yd..

B. Paper Backing: FS UU-B-790, Type I, Grade B, Style 1a, vapor-retardant paper.

1. Provide paper-backed lath at exterior locations.

2.3 ACCESSORIES

A. Comply with ASTM C 1063, and coordinate depth of accessories with thicknesses and number of plaster coats required:

B. Metal Accessories:

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. Alabama Metal Industries Company; a Gibraltar Industries company.
b. CEMCO; California Expanded Metal Products Co.
c. ClarkDietrich.

2. Zinc and Zinc-Coated (Galvanized) Accessories:
3. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653/A 653M, G60 zinc coating.
4. Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60, hot-dip galvanized-zinc coating.
5. External- (Outside-) Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60, hot-dip galvanized-zinc coating.
6. Cornerbeads: Match existing style.
7. Casing Beads: To match existing,with expanded flanges.
8. Control Joints: Fabricated to match existing one-piece-type, M-shaped configuration; with perforated flanges.

C. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch long, free of contaminants, manufactured for use in cement plaster.

D. Bonding Compound: ASTM C 932.

E. Fasteners for Attaching Metal Lath to Substrates: ASTM C 1063.

F. Sound Attenuation Blankets: ASTM C 665, Type I (unfaced blankets).

2.4 PORTLAND CEMENT PLASTER

A. Portland Cement: ASTM C 150/C 150M, Type II.

1. Color for Finish Coats: Gray.

2. Color for Job-Mixed Finish Coats: In color matching Architect's sample. To match existing.

B. Acrylic-Based Finish Coatings: Factory-mixed acrylic-emulsion coating systems, formulated with colorfast mineral pigments and fine aggregates; for use over portland cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic-based finishes.

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. California Stucco Products Corp.
b. Dryvit Systems, Inc.
c. El Rey Stucco Solutions; a Parex USA, Inc. brand.
d. Shamrock Stucco LLC.

2.5 PLASTER MIXES

A. General: Comply with ASTM C 926 for applications indicated.

1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions.

B. Base-Coat Mix: Portland cement and lime.

C. Factory-Prepared Finish-Coat Mixes: For acrylic-based finish coatings; comply with manufacturer's written instructions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.

B. Install metal lath and accessories according to ASTM C 1063.
   1. Install cornerbead at interior and exterior locations.

C. Apply and cure plaster materials and finishes to comply with ASTM C 926. Apply three coats.

   1. Plaster Finish Coats: Apply to provide finish to match existing.

END OF SECTION 092400

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

B. STC-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 90 and classified per ASTM E 413 by a qualified independent testing and inspecting agency.

2.2 PANEL PRODUCTS

A. Provide in maximum lengths available to minimize end-to-end butt joints.

B. Interior Gypsum Board: ASTM C 1396/C 1396M, in thickness indicated, with manufacturer's standard edges. Regular type unless otherwise indicated Type X where indicated Sag-resistant type for ceiling surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. CertainTeed Corporation.
    b. Georgia-Pacific Gypsum LLC.
    c. Or approved equal

C. Water-Resistant Gypsum Backing Board: ASTM C 1396/C 1396M, in thickness indicated. Regular type unless otherwise indicated Type X where required for fire-resistance-rated assemblies and where indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. CertainTeed Corporation.
    b. Georgia-Pacific Gypsum LLC.
    c. Or approved equal

D. Cementitious Backer Units: ANSI A118.9, ASTM C 1288, or ASTM C 1325.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. C-Cure.
b. CertainTeed Corporation.
c. National Gypsum Company.
d. Or approved equal

2.3 ACCESSORIES

A. Trim Accessories: ASTM C 1047, formed from galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet. For exterior trim, use accessories formed from hot-dip galvanized-steel sheet, plastic, or rolled zinc.

1. Provide cornerbead at outside corners unless otherwise indicated.
2. Provide LC-bead (J-bead) at exposed panel edges.
3. Provide control joints where indicated.

B. Joint-Treatment Materials: ASTM C 475/C 475M.

1. Joint Tape: Paper unless otherwise recommended by panel manufacturer.
2. Joint Compounds: Drying-type, ready-mixed, all-purpose compounds.
3. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound drying-type, all-purpose compound.
4. Cementitious Backer Unit Joint-Treatment Materials: Products recommended by cementitious backer unit manufacturer.

C. Sound-Attenuation Blankets: ASTM C 665, Type I (unfaced).

D. Textured Finish: Aggregate finish where indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation.
b. Georgia-Pacific Gypsum LLC.
c. National Gypsum Company.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install gypsum board to comply with ASTM C 840.

1. Isolate gypsum board assemblies from abutting structural and masonry work. Provide edge trim and acoustical sealant.
2. Single-Layer Fastening Methods: Fasten gypsum panels to supports with screws.

B. Install cementitious backer units to comply with ANSI A108.11.

C. Fire-Resistance-Rated Assemblies: Comply with requirements of listed assemblies.

D. Finishing Gypsum Board: ASTM C 840.

1. At concealed areas, unless a higher level of finish is required for fire-resistance-rated assemblies, provide Level 1 finish: Embed tape at joints.
2. At substrates for tile, provide Level 2 finish: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges.
3. Unless otherwise indicated, provide Level 4 finish: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges.

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

F. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.

END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product data and Samples.

B. Obtain tile of each type and color or finish from same production run for each contiguous area.

C. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use.

PART 2 - PRODUCTS

2.1 CERAMIC TILE

A. Ceramic tile that complies with ANSI A137.1.

B. Ceramic Tile Type: Factory-mounted ceramic mosaic tile.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Composition: .
3. Surface: abrasive admixture.
4. Module Size: <**Insert dimensions**>.
5. Finish: <**Insert description**> glaze.
6. Color and Pattern: <**Insert color and pattern**>.
7. Grout Color: <**Insert color**>.
8. Trim Units: Coordinated with sizes and coursing of adjoining flat tile:

    a. Base: Coved.
    b. Base Cap for Portland Cement Mortar Installations: Bead (bullnose).
    c. Base Cap for Thinset Mortar Installations: Surface bullnose.
    d. Wainscot Cap for Portland Cement Mortar Installations: Bead (bullnose).
    e. Wainscot Cap for Thinset Mortar Installations: Surface bullnose.
    f. External Corners for Portland Cement Mortar Installations: Bead (bullnose).
    g. External Corners for Thinset Mortar Installations: Surface bullnose.
    h. Internal Corners: Cove.
    i. Internal Corners: Field-butted square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.

C. Tile Type: , square-edged quarry tile.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Face Size: <**Insert dimensions**>.
3. Wearing Surface: <**Insert description**>.
4. Finish: <**Insert description**> glaze.

5. Color and Pattern: <**Insert color and pattern**>.
6. Grout Color: <**Insert color**>.
7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile:

    a. Base: Coved.
    b. Wainscot Cap: Surface bullnose.

D. Ceramic Tile Type: pressed floor tile.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Composition: .
3. Face Size: <**Insert dimensions**>.
4. Glaze: <**Insert description**>.
5. Tile Color and Pattern: <**Insert color and pattern**>.
6. Grout Color: <**Insert color**>.
7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile.

    a. Base: Coved.
    b. Wainscot Cap: Surface bullnose.
    c. External Corners for Portland Cement Mortar Installations: Bead (bullnose).
    d. External Corners for Thinset Mortar Installations: Surface bullnose.
    e. Internal Corners: Cove.
    f. Internal Corners: Field-butted square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.

E. Ceramic Tile Type: porcelain tile.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Face Size: <**Insert dimensions**>.
3. Face: .
4. Tile Color, Glaze, and Pattern: <**Insert color, glaze, and pattern**>.
5. Grout Color: <**Insert color**>.
6. Trim Units: Coordinated with sizes and coursing of adjoining flat tile.

    a. Base: Coved.
    b. Wainscot Cap: Surface bullnose.
    c. External Corners for Portland Cement Mortar Installations: Bead (bullnose).
    d. External Corners for Thinset Mortar Installations: Surface bullnose.
    e. Internal Corners: Cove.
    f. Internal Corners: Field-butted square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.

F. Ceramic Tile Type: Glazed wall tile.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Module Size: <**Insert dimensions**>.
3. Face: .
4. Finish: <**Insert description**> glaze.
5. Color and Pattern: <**Insert color and pattern**>.
6. Grout Color: <**Insert color**>.

7. Mounting: Pregrouted sheets of tiles factory assembled and grouted with manufacturer's standard white silicone rubber.
8. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:

    a. Base for Portland Cement Mortar Installations: Coved.
    b. Base for Thinset Mortar Installations: Straight.
    c. Wainscot Cap for Portland Cement Mortar Installations: Bullnose cap.
    d. Wainscot Cap for Thinset Mortar Installations: Surface bullnose.
    e. External Corners for Portland Cement Mortar Installations: Bullnose shape with radius of at least 3/4 inch (19 mm) unless otherwise indicated.
    f. External Corners for Thinset Mortar Installations: Surface bullnose.
    g. Internal Corners: Field-butted square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.

G. Accessories: Provide vitreous china accessories of type and size indicated, suitable for installing by same method as adjoining wall tile.

1. One soap holder for each shower and tub indicated.
2. One paper holder at each water closet.
3. Color and Finish: <**Insert color and finish**>.

2.2 INSTALLATION MATERIALS

A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, 1/2 inch (12.7 mm) thick.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Fiber-Cement Underlayment: ASTM C 1288, 1/2 inch (12.7 mm) thick.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

C. Low-Emitting Materials: Adhesives and fluid-applied waterproofing membranes shall comply with .

D. Waterproofing Membranes for Thinset Installations: ANSI A118.10,.

E. Setting and Grouting Materials: Comply with material standards in ANSI's "Specifications for the Installation of Ceramic Tile" that apply to materials and methods indicated.

1. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
2. Thinset Mortar Type: mortar.

    a. <Double click here to find, evaluate, and insert list of manufacturers and products.>

3. Thinset Mortar Type for Wood Subfloors: EGP (exterior glue plywood) latex-portland cement mortar, ANSI A118.11.

    a. <Double click here to find, evaluate, and insert list of manufacturers and products.>

4. Water-Cleanable, Tile-Setting Epoxy:

    a. <Double click here to find, evaluate, and insert list of manufacturers and products.>

5. Organic Adhesive: ANSI A136.1, Type I.

    a. <Double click here to find, evaluate, and insert list of manufacturers and products.>

6. Grout Type: Standard cement grout, ANSI A118.6.

    a. <Double click here to find, evaluate, and insert list of manufacturers and products.>

7. Grout Type: High-performance tile grout, ANSI A118.7.

    a. <Double click here to find, evaluate, and insert list of manufacturers and products.>

8. Grout Type: Water-cleanable epoxy.

    a. <Double click here to find, evaluate, and insert list of manufacturers and products.>

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, are specified in tile installation schedules, and apply to types of setting and grouting materials used.

B. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight, aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

C. Lay tile in grid pattern unless otherwise indicated. Align joints where adjoining tiles on floor, base, walls, and trim are the same size.

D. Install , and treat joints according to ANSI A108.11.

E. Install waterproofing to comply with ANSI A108.13.

F. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

G. Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in modified dry-set mortar (thinset).

H. Exterior Floor Tile Installation Method(s):

1. Exterior Patios and Walkways over Concrete: .

I. Exterior Roof/Deck Floor Installation Method(s): .

J. Exterior Wall Tile Installation Method(s):

1. Exterior Walls over Concrete or Masonry: .
2. Exterior Wall, Wood or Metal Studs: .

K. Interior Floor Tile Installation Method(s):

1. Over Concrete Subfloors: .
2. Over Concrete Subfloors with Radiant Heat: .
3. Over Waterproof Membranes on Concrete Subfloors: .
4. Over Wood Subfloors: .
5. Over Wood Subfloors with Radiant Heat: .
6. Over Waterproof Membranes on Wood Subfloors: .

L. Interior Wall Tile Installation Method(s):

1. Over Concrete and Masonry: .
2. Over Waterproof Membrane on Concrete and Masonry: .
3. Over Wood or Metal Studs or Furring: .
4. Over Waterproof Membrane on Wood or Metal Studs or Furring: .
5. Bathtub Wall Installations with No Shower Head, Wood or Metal Studs or Furring: .
6. Bathtub/Shower Wall Installations, Wood or Metal Studs or Furring: .
7. Shower Receptor and Wall Installations: .

END OF SECTION 093013

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product data and Samples.

B. Extra Materials: Deliver to Owner carpet tiles equal to 5 percent of each type and color installed, packaged with protective covering for storage.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Fiber Content: <**Insert content by percentage**>.

C. Face Construction: pile.

D. Density: <**Insert oz./cu. yd. (g/cu. cm)**>.

E. Pile Thickness: <**Insert inches (mm)**> for finished carpet tile.

F. Surface Pile Weight: <**Insert oz./sq. yd. (g/sq. m) excluding weight of backings**>.

G. Total Weight: <**Insert oz./sq. yd. (g/sq. m) including weight of backings**> for finished carpet tile.

H. Primary Backing: <**Insert primary backing**>.

I. Secondary Backing: <**Insert secondary backing**>.

J. Size: <**Insert dimensions**>.

K. Critical Radiant Flux Classification: Not less than per ASTM E 648.

L. Emissions: Provide carpet that complies with testing and product requirements of CRI's "Green Label Plus" program.

2.2 INSTALLATION ACCESSORIES

A. Carpet Tile Adhesives: Pressure-sensitive type that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for conditions indicated for releasable installation.

1. Low-Emitting Materials: Comply with .

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with CRI 104.

B. Carpet Tile Installation Method: .

1. Install borders parallel to walls.

END OF SECTION 096813

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: Include printout of MPI's "MPI Approved Products List" with product highlighted.
2. Samples.

B. Extra Materials: Deliver to Owner 1 gal. of each color and type of finish-coat paint used on Project, in containers, properly labeled and sealed.

PART 2 - PRODUCTS

2.1 PAINT

A. 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:

1. Dunn-Edwards Corporation.
2. Kwal Paint.
3. Sherwin-Williams Company (The).

B. MPI Standards: Provide materials that comply with MPI standards indicated and listed in its "MPI Approved Products List."

1. Block Filler, Latex: MPI #4.
2. Primer, Alkali Resistant, Water Based: MPI #3.
3. Primer, Bonding, Water Based: MPI #17.
4. Primer, Bonding, Solvent Based: MPI #69.
5. Primer, Alkyd, Anticorrosive: MPI #79.
6. Primer, Galvanized, Water Based: MPI #134.
7. Primer, Quick Dry, for Aluminum: MPI #95.
8. Primer, Latex: MPI #6.
9. Primer, Alkyd: MPI #5.
10. Latex, Exterior Flat (Gloss Level 1): MPI #10.
11. Latex, Exterior Low Sheen (Gloss Level 3-4): MPI #15.
12. Latex, Exterior Semigloss (Gloss Level 5): MPI #11.
13. Latex, Exterior, Gloss (Gloss Level 6): MPI #119.
14. Light Industrial Coating, Exterior, Water Based (Gloss Level 3): MPI #161.
15. Light Industrial Coating, Exterior, Water Based, Semigloss (Gloss Level 5): MPI #163.
16. Light Industrial Coating, Exterior, Water Based, Gloss (Gloss Level 6): MPI #164.
17. Alkyd, Exterior Flat (Gloss Level 1): MPI #8.
18. Alkyd, Exterior, Semigloss (Gloss Level 5): MPI #94.

19. Alkyd, Exterior Gloss (Gloss Level 6): MPI #9.
20. Alkyd, Quick Dry, Semigloss (Gloss Level 5): MPI #81.
21. Alkyd, Quick Dry, Gloss (Gloss Level 7): MPI #96.
22. Floor Paint, Latex, Low Gloss (Maximum Gloss Level 3): MPI #60.
23. Floor Enamel, Alkyd, Gloss (Gloss Level 6): MPI #27.

C. Material Compatibility: Provide materials that are compatible with one another and with substrates.

1. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

D. Colors: As selected.

PART 3 - EXECUTION

3.1 PREPARATION

A. Comply with recommendations in MPI's "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove hardware, lighting fixtures, and similar items that are not to be painted. Mask items that cannot be removed. Reinstall items in each area after painting is complete.

C. Clean and prepare surfaces in an area before beginning painting in that area. Schedule painting so cleaning operations will not damage newly painted surfaces.

3.2 APPLICATION

A. Comply with recommendations in MPI's "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Paint exposed surfaces, new and existing, unless otherwise indicated.

1. Do not paint prefinished items, items with an integral finish, operating parts, and labels unless otherwise indicated.

C. Apply paints according to manufacturer's written instructions.

1. Use brushes only where the use of other applicators is not practical.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

1. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

3.3 EXTERIOR PAINT APPLICATION SCHEDULE

A. Concrete, Nontraffic Surfaces:

1. Low-Sheen Latex: Three coats: MPI EXT 3.1A.
2. Low-Sheen Latex: Two coats over alkali-resistant primer: MPI EXT 3.1K.

B. Concrete, Traffic Surfaces:

1. Low-Gloss Latex Floor Paint: Three coats: MPI EXT 3.2A.
2. Gloss Alkyd Floor Enamel: Three coats: MPI EXT 3.2D.

C. Steel:

1. Semigloss Water-Based, Light-Industrial Coating: Two coats over alkyd anticorrosive primer.
2. , Alkyd Quick-Dry: Two coats over alkyd anticorrosive primer: MPI EXT 5.1A.
3. Semigloss, Alkyd: Two coats over alkyd anticorrosive primer: MPI EXT 5.1D.

D. Galvanized Metal:

1. Semigloss Latex: Two coats over waterborne galvanized-metal primer: MPI EXT 5.3H.
2. Semigloss Latex: Two coats over primer recommended by topcoat manufacturer for exterior use on galvanized-metal.
3. Semigloss, Alkyd: Two coats over primer recommended by topcoat manufacturer for exterior use on galvanized-metal.

E. Wood: Including wood trim architectural woodwork windows.

1. Low-Sheen Latex: Two coats over latex primer: MPI EXT 6.3L.
2. Low-Sheen Latex: Two coats over alkyd primer: MPI EXT 6.3A.
3. Semigloss Alkyd: Two coats over alkyd primer: MPI EXT 6.3B.

F. Stucco:

1. To match existing Latex: Three coats: MPI EXT 9.1A.
2. To match existing Latex: Two coats over alkali-resistant primer: MPI EXT 9.1J.

G. Exterior Gypsum Soffit Board:

1. Low-Sheen Latex: Three coats: MPI EXT 9.2A.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: Include printout of MPI's "MPI Approved Products List" with product highlighted.
2. Samples.

B. Mockups: Full-coat finish Sample of each type of coating, color, and substrate, applied where directed.

C. Extra Materials: Deliver to Owner 1 gal. of each color and type of finish-coat paint used on Project, in containers, properly labeled and sealed.

PART 2 - PRODUCTS

2.1 PAINT

A. 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:

1. Dunn-Edwards Corporation.
2. Sherwin-Williams Company (The).
3. Valspar Corporation (The).

B. MPI Standards: Provide materials that comply with MPI standards indicated and listed in its "MPI Approved Products List."

1. Block Filler, Latex: MPI #4.
2. Primer Sealer, Latex: MPI #50.
3. Primer, Alkali Resistant, Water Based: MPI #3.
4. Primer Sealer, Institutional Low Odor/VOC: MPI #149.
5. Primer, Latex, for Interior Wood: MPI #39.
6. Primer Sealer, Alkyd, Interior: MPI #45.
7. Primer, Bonding, Water Based: MPI #17.
8. Primer, Bonding, Solvent Based: MPI #69.
9. Primer, Alkyd, Anticorrosive: MPI #79.
10. Primer, Galvanized, Water Based: MPI #134.
11. Primer, Quick Dry, for Aluminum: MPI #95.
12. Latex, Interior, Flat, (Gloss Level 1): MPI #53.
13. Latex, Interior, (Gloss Level 2): MPI #44.
14. Latex, Interior, (Gloss Level 4): MPI #43.
15. Latex, Interior, Semigloss, (Gloss Level 5): MPI #54.

16. Latex, Interior, Gloss, (Gloss Level 6, except Minimum Gloss of 65 Units at 60 Degrees): MPI #114.
17. Latex, Institutional Low Odor/VOC, Flat (Gloss Level 1): MPI #143.
18. Latex, Institutional Low Odor/VOC, (Gloss Level 2): MPI #144.
19. Latex, Institutional Low Odor/VOC, Semigloss (Gloss Level 5): MPI #147.
20. Latex, High-Performance Architectural, (Gloss Level 2): MPI #138**.**
21. Latex, High-Performance Architectural, Semigloss (Gloss Level 5): MPI #141.
22. Alkyd, Interior, Flat (Gloss Level 1): MPI #49.
23. Alkyd, Interior, Semigloss (Gloss Level 5): MPI #47.
24. Alkyd, Interior, Gloss (Gloss Level 6): MPI #48.
25. Alkyd, Quick Dry, Semigloss (Gloss Level 5): MPI #81.
26. Alkyd, Quick Dry, Gloss (Gloss Level 7): MPI #96.
27. Floor Paint, Latex, Low Gloss (Maximum Gloss Level 3): MPI #60.
28. Floor Enamel, Alkyd, Gloss (Gloss Level 6): MPI #27.

C. Material Compatibility: Provide materials that are compatible with one another and with substrates.

1. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

D. Low-Emitting Materials: Comply with Section 018113.13 - Sustainable Design Requirements - LEED 2009 for New Construction and Major Renovations.

E. Colors: As selected.

PART 3 - EXECUTION

3.1 PREPARATION

A. Comply with recommendations in MPI's "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove hardware, lighting fixtures, and similar items that are not to be painted. Mask items that cannot be removed. Reinstall items in each area after painting is complete.

C. Clean and prepare surfaces in an area before beginning painting in that area. Schedule painting so cleaning operations will not damage newly painted surfaces.

3.2 APPLICATION

A. Comply with recommendations in MPI's "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Paint exposed surfaces, new and existing, unless otherwise indicated.

1. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces.
2. Paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint the back side of access panels.

4. Color-code mechanical piping in accessible ceiling spaces.
5. Do not paint prefinished items, items with an integral finish, operating parts, and labels unless otherwise indicated.

C. Apply paints according to manufacturer's written instructions.

1. Use brushes only where the use of other applicators is not practical.
2. Use rollers for finish coat on interior walls and ceilings.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

1. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

3.3 INTERIOR PAINT APPLICATION SCHEDULE

A. Concrete, Nontraffic Surfaces:

1. Semigloss Latex: Three coats: MPI INT 3.1E.
2. Semigloss Latex: Two coats over primer/sealer: MPI INT 3.1A.
3. Semigloss Institutional Low-Odor/VOC Latex: Two coats over low-odor/VOC primer/sealer: MPI INT 3.1M.
4. Semigloss High-Performance Architectural Latex: Two coats over alkali-resistant, water-based primer: MPI INT 3.1C.
5. Semigloss Alkyd: Two coats over primer/sealer: MPI INT 3.1D.

B. Concrete, Traffic Surfaces:

1. Low-Gloss Latex Floor Paint: Three coats: MPI INT 3.2A.
2. Gloss Alkyd Floor Enamel: Three coats: MPI INT 3.2B.

C. Steel:

1. Semigloss, Quick-Dry Enamel: Two coats over quick-drying alkyd metal primer: MPI INT 5.1A.
2. Semigloss Latex: Two coats over alkyd anticorrosive primer: MPI INT 5.1Q.
3. Semigloss High-Performance Architectural Latex: Two coats over alkyd anticorrosive primer: MPI INT 5.1R.
4. Semigloss, Alkyd Enamel: Two coats over alkyd anticorrosive primer: MPI INT 5.1E.

D. Wood: Including wood trim architectural woodwork windows.

1. Semigloss Latex: Two coats over latex primer for wood: MPI INT 6.3T.
2. Semigloss Latex: Two coats over alkyd primer: MPI INT 6.3U.
3. Semigloss Institutional Low-Odor/VOC Latex: Two coats over latex primer for wood: MPI INT 6.3V.
4. Semigloss High-Performance Architectural Latex: Two coats over latex primer for wood: MPI INT 6.3A.

5. Semigloss Alkyd: Two coats over alkyd primer: MPI INT 6.3B.

E. Gypsum Board:

1. Gloss Level 4 Latex: Two coats over latex primer/sealer: MPI INT 9.2A.
2. Gloss Level 2 Institutional Low-Odor/VOC Latex: Two coats over low-odor/VOC primer/sealer: MPI INT 9.2M.
3. Gloss Level 2 High-Performance Architectural Latex: Two coats over latex primer/sealer: MPI INT 9.2B.
4. Semigloss Alkyd: Two coats over latex primer/sealer: MPI INT 9.2C.

F. Spray-Textured Ceilings:

1. Flat Latex: One coat over primer/sealer: MPI INT 9.1A
2. Gloss Level 4 Latex: Two coats: MPI INT 9.1E.
3. Gloss Level 4 Latex: One coat over alkyd primer/sealer: MPI INT 9.1B.

END OF SECTION 099123

SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 FENCE COMPONENTS

A. Fabric: Metallic-coated steel, diameter wire.

1. Polymer Coating: ASTM F 668, Class 2a or 2b.
2. Color: .
3. Selvage: Knuckled .

B. Fabric: Aluminum, ASTM F 1183, 2-inch (50-mm) mesh, 0.148-inch- (3.76-mm-) diameter wire.

1. Selvage: Knuckled .

C. Posts and Rails: pipe complying with ASTM F 1043 requirements for industrial fence.

D. Tension Wire: .

E. Fittings and Accessories: ASTM F 626 and as follows:

1. Post and Line Caps: Provide weathertight cap for each post. Provide line post caps with loop to receive tension wire or top rail.
2. Post Brace Assembly: Same material as top rail with 3/8-inch- (9.5-mm-) diameter rod and adjustable tightener.
3. Bottom and Center Rail: Same material as top rail with cap on each end.

F. Gate Posts, Swing Gates, and Accessories: ASTM F 900, same metal and finish as posts and rails, with galvanized hardware and accessories.

G. Privacy Slats: , sized to fit mesh specified for direction indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fence to comply with ASTM F 567.

B. Excavation: Drill post holes 8 inches (200 mm) in diameter and 40 inches (1.02 m) in depth, equally spaced, but not more than 10 feet (3.05 m) apart.

C. Setting Posts: Set posts in holes approximately 4 inches (102 mm) above bottom of excavation. Align posts vertically and align tops. Pour concrete footings with tops .

END OF SECTION 323113

SECTION 16100 - SCOPE OF WORK

PART 1. GENERAL

1.01 RELATED DOCUMENTS

A. The requirements of the General Conditions, Supplementary Conditions, Division 1, and Drawings apply to all Work herein.

1.02 SCOPE

A. General: Provide all labor, materials, tools, machinery, equipment, supplies, transportation, storage, utilities, appliances, drayage, hauling, hoisting, excavation, backfill, supervision, and services necessary to complete the Electrical Work under this Contract. Pay all fees, tap charges, meter charges, permits, licenses, inspections, and special fees assessed by the local utilities and local authorities having jurisdiction. Coordinate Work with the Work of the other trades so as to resolve conflicts without impeding job progress.

B. Examine the Architectural, Structural, Mechanical, Plumbing, and Electrical Drawings and other Divisions, and Sections of the Specifications in order to determine the extent of Work required to be completed under this Division. Failure to examine all the Contract Documents for this Project will not relieve the Contractors of the responsibility to perform all the Work required for a complete, fully operational and satisfactory installation.

C. Project Location: The Work to be performed under this Contract is all in connection with **NMSU office and locker room improvements in Las Cruces, New Mexico**

D. Work Included: The Work includes but is not limited to the following systems, equipment, and services:

1. New wiring, disconnect switches, motor controllers and conduit as required as indicated on drawings.

2. Connection of all motors, equipment, interlocks, interconnections, and other components.

3. Connection of all equipment furnished under other Divisions and/or by the Owner.

4. Furnishings of Record Drawings.

All systems, equipment, and services specified herein shall be furnished and installed complete and ready to use. .

1.03 WORK OF OTHER DIVISIONS

A. The following is a partial list of work not included in Division 16:

1. Factory finish painting is included in the work of this Division. Prime, protective, and field finish painting is included in the Work of Division 9, except as otherwise specified herein. The Work of this Division includes coordinating the painting of Division 16 systems with the Division 9 contractor.

2. Motors and motor controllers that are an integral part of the equipment are furnished under Division 15 with the driven equipment. All other motor controllers, electrical power wiring and connections are included in the Work of this Division.

3. Concrete housekeeping pads, equipment pads, and water curbs are specified under another Division. Dimensions and locations of pads and curbs for equipment furnished under this Division are included in the Work of this Division.

4. Installing access doors. Access doors are included in the Work of this Division.

5. Owner and General Contractor furnished equipment. Electrical provisions, including rough-in, interconnection of components, and final connections, are included in the Work of this Division.

6. Building Controls shall be furnished and installed under Division 15. Control power for Temperature Control equipment shall be provided by Division 16. Refer to Division 15 for additional requirements.

7. Telephone and data wiring, cables and equipment shall be furnished, installed, and connected under separate contract to the Owner.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The requirements of the General Conditions, Supplementary Conditions, Division 01 and Drawings apply to all Work herein.

1.02 COMPLETE PERFORMANCE

A. The Contractor shall furnish and install all items specified herein and as indicated on the Drawings. The Contractor shall also furnish and install all items necessary to make the systems function which may be reasonably implied as essential, whether mentioned in the Contract Documents or not.

B. Each Division 26 contractor shall provide competent, experienced full time superintendents who are authorized to make decisions on behalf of the Contractor.

C. Work shall be executed in strict accordance with the best practice of the trades in a thorough, substantial and workmanlike manner by competent workmen.

1.03 SITE FAMILIARIZATION

A. General: Become familiar with the Drawings and Specifications, examine the premises, and understand the conditions under which the Contract shall be performed, prior to submitting a bid.

B. Site: Be informed of the site conditions, verify locations of new and existing equipment, and determine exact requirements for connections.

C. Coordination: Tender of a proposal for this project infers that the Contractor has visited the site and has become familiar with the Drawings and site conditions and has included in his proposal, all work necessary to properly install complete and functioning systems on the project. Failure to comply with this requirement shall not be considered justification for the omission or faulty installation of any Work covered by the Contract Documents.

1.04 CODES AND STANDARDS

A. General: All Work shall comply with the most recently revised versions of all applicable laws, rules, regulations and ordinances of all Federal, State and Local Authorities and applicable Utilities. None of the terms or provisions of this Specification shall be construed as waiving any part of the rules, regulations or requirements of these Authorities.

B. Asbestos: Be aware of and comply with Asbestos NESHAP (National Emission Standard for Hazardous Air Pollutants) regulations, as well as all other applicable codes, laws, and regulations.

C. Conflict: In the event of conflict between the Contract Documents and the local enforcing authority, the latter shall rule. Any modifications resulting therefrom shall be made without any additional cost to the Owner or Architect/Engineer. This Contractor shall report any such modifications to the Architect/Engineer and secure his approval prior to proceeding with the work.

D. Precedence: Where Contract Document requirements exceed the requirements of the Codes and Standards, the Contract Documents shall take precedence provided they are not in conflict with those Codes and Standards.

E. Approval Labels: All items of equipment and all materials for which approval standards have been established by Underwriters' Laboratories, Inc. (UL), Factory Mutual (FM), Certified Ballast Manufacturer (CBM), Electrical Testing Laboratory, or the National Electrical Manufacturers Association (NEMA) shall be so approved and shall bear approval labels.

1.05 DRAWINGS AND SPECIFICATIONS

A. Drawings: The Drawings are schematic in nature and indicate approximate locations of the electrical items, except where specific locations are noted and dimensioned on the Drawings. All items are shown approximately to scale. The intent is to show how these items shall be integrated into the construction. Locate all items by on the job measurements and in accordance with the Contract Documents. Coordinate with other trades.

B. Location: Prior to locating outlets, switches, fixtures, fire alarm devices, and other exposed devices, obtain the Architect's approval as to exact location. Locations shall not be determined by scaling Drawings. Mount outlets, switches, and other wall-mounted devices at heights as directed by the Architect. Contractor shall be responsible for costs of redoing work of trades necessitated by failure to comply with this requirement.

C. Specifications: The specifications are intended to supplement the Drawings and it is not in the scope of the Specifications to mention any part of the work, which the Drawings are competent to fully explain. Conversely, any part of the work, which the specifications are competent to fully explain, may not be mentioned on the Drawings.

D. Disagreement: Disagreement between the Drawings and Specifications or within the Drawings or Specifications shall be estimated using the better quality or greater quantity of material or installation, and a request for information shall be made to the Architect/ Engineer.

1.06 DISCREPANCIES

A. Clarification: Clarification shall be obtained before submitting a proposal for the Work under this Division as to discrepancies or omissions from the Contract Documents or questions as to the intent thereof.

B. Detailed Instructions: Should it appear that the work hereby intended to be done or any of the materials relative thereto is not sufficiently detailed or explained in the Drawings or Specifications, then the Contractor shall apply in a timely manner to the Engineer for clarification or explanations as may be necessary, allowing a reasonable time for the Engineer to respond. The Contractor shall conform to this additional information as a part of the Contract without additional cost to the Owner or Engineer.

C. Interpretations: Should any doubt or question arise respecting the true meaning of Drawings or Specifications, reference shall be made to the Engineer, whose written decision shall be final and conclusive. No alleged statement by the Engineer will be accepted as an excuse for non-compliance and inferior work.

D. Contractor Agreement: Consideration will not be granted for misunderstanding of the amount of work to be performed. Tender of a proposal conveys full Contractor agreement of the items and conditions specified, shown, scheduled, or required by the nature of the project.

1.07 REQUESTS FOR INFORMATION (RFI)

A. General: Submit all contractor Requests For Information (RFI) in writing to the Architect/Engineer for response. Submit RFI's on a standard form, which has a space for the requested information and the Architect/Engineer's response.

B. Solution Proposal: In general, the contractor shall propose solutions to identified problems for review and approval of the Architect/Engineer. The RFI shall include hand sketches, marked drawing prints, equipment cutsheets, drawing and specification references, any other back-up information, etc., as required to sufficiently explain the problem and proposed solution.

1.08 QUALITY ASSURANCE

A. General: Materials and equipment shall be new, of best grade and quality, and standard products of reputable manufacturers regularly engaged in the production of such materials and equipment.

B. Workmanship: Work shall be executed and materials installed in accordance with the best practice of the trades in a thorough, substantial, workmanlike manner by competent workmen, presenting a neat appearance when completed.

C. In all cases, the Engineer shall be the sole judge of the quality and equivalence of manufacturers, products, materials, and methods.

D. Manufacturers/Products/Materials/Methods: Manufacturers, products, materials, and methods described in the various sections of the Specifications and indicated on the Drawings are intended to establish a standard of quality only. It is not the intention of the Engineer to discriminate against any manufacturer, product, material, or method that is equal to the standards as indicated and/or specified, nor is it intended to preclude open, competitive bidding. The fact that a specific manufacturer is listed as an acceptable manufacturer shall not be interpreted to mean that the manufacturer's standard product will meet the requirements of the project design, Specifications, and space constraints.

1. Wherever a definite manufacturer, product, material, or method is specified and there is not a statement that another manufacturer, product, material, or method will be acceptable, it is the intention of the Engineer that the specified manufacturer, product, material, or method is the only one that shall be used without Prior Approval.
2. Wherever a definite manufacturer, product, material, or method is specified as "NO SUBSTITUTE", it is the intention of the Engineer that the listed item is the only one acceptable.

E. Alternate Manufacturers/Products/Materials/Methods: Products by Alternate reliable manufacturers, products, materials, or methods may be accepted provided they have equal capacity, construction, and performance.

1. Wherever a definite material or manufacturer's product is specified and the Specification states that products of listed manufacturers may be provided, it is the intention of the Engineer that Alternate products of manufacturers that are specified (i.e., listed) are the

only products that will be acceptable and that products of non-listed manufacturers will not be considered for Substitution without Prior Approval.

F. Substitute Manufacturers/Products/Materials/Methods: Products by Substitute reliable manufacturers, products, materials, or methods may be accepted provided they have equal capacity, construction, and performance.

1. Wherever the expression "Or Approved Equal" is used in the Contract Documents, it is the intention of the Engineer that Substitute manufacturers, products, materials, and methods may be used only with Prior Approval. Under no circumstances shall any Substitution of manufacturers, products, materials, or methods be made without the prior written approval of the Engineer.

G. Coordination: Where Alternate or Substituted equipment is used on the project, it shall be the responsibility of the Contractor or Subcontractor involved to verify that the equipment will fit in the space available, including all required Code and maintenance clearances, and to coordinate all equipment requirements and provisions with the Mechanical (HVAC) and Plumbing Design and all other Contractors. Where the use of Alternate or Substitute materials affects the cost of provisions made by other Contractors, the Contractor providing the Alternate or Substitute shall be responsible for the other Contractor's cost adjustment. There shall be no additional cost to the Owner or Architect/Engineer due to the use or acceptance of any Alternate or Substitute manufacturer, product, material, or method.

1.09 CONFERENCE PRIOR TO START OF WORK

A. If required, immediately upon the award of this Contract, but prior to commencing any Work, the Contractor, together with designated major sub-contractors, shall confer with the Architect and Engineer concerning the Work under this Contract.

B. The conference will be at a mutually agreed place and acceptable time.

1.10 CHANGE ORDERS

A. Refer to DIVISION 1 for requirements concerning Change Orders.

1.11 COORDINATION

A. This Contractor shall be responsible for the coordination of all items, which will affect the installation of the Work of this Division. The coordination shall include, but not be limited to, voltage, ampacity, capacity, electrical/piping connections, structural supports, space requirements, locating devices in Architectural finish elements, staging the construction and building requirements, and special conditions.

B. By submitting shop drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other disciplines.

C. Holes or other openings required in surfaces with special Architectural finishes (stone, cloth, finished wood, etc.) shall be reviewed and approved by the Owner or Architect prior to any cutting or drilling.

1.12 SHOP DRAWINGS AND SUBMITTALS

A. General: After the Contract is awarded but prior to proceeding with the Work requiring Shop Drawing review, the Contractor shall obtain complete shop drawings and product data from the manufacturers, suppliers, vendors, and Sub-Contractors for all materials and equipment specified herein, and make formal submission to the Architect. A minimum period of two (2) weeks should be allowed in the Construction Schedule exclusive of travel time for the Engineers review.

B. Certification: Each Contractor responsible for the Work shall review and certify the shop drawing, submittal and/or product data to be in full compliance with the requirements of the Contract Documents.

C. The Contractor shall provide the Engineer with a minimum of five (5) certified copies of product data and shop drawings for equipment as noted in the Specifications for his approval, three (3) of which will be returned to the Contractor for his files and maintenance and operating instruction brochures. Regardless of the number of shop drawings submitted, only two (2) will be retained by the Engineer for his use. If the Contractor needs more than three (3) copies of certain shop drawings for his use, he shall submit as many additional sets of the particular drawings as he requires in addition to the minimum number listed above. The Contractor shall examine, mark up as required, and approve all shop drawings prior to their submission to the Engineer.

D. The Engineer's review of shop drawings and submittal data shall not relieve the Contractor of the responsibility for dimensions or errors that may be contained therein, or for deviations from any requirements of the Contract Documents. It shall be clearly understood that the Engineers noting some errors but overlooking some others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the shop drawing or product data, the Contract Documents shall govern the Work and are neither waived nor superseded in any way by the review of shop drawings, product data and samples.

E. A SUBMITTAL SHALL NOT CONTAIN INFORMATION FROM MORE THAN ONE SPECIFICATION SECTION. A specification section can be subdivided into separate submittals for items that are listed in the section. Shop drawings shall be separately bound.

F. Each submittal shall contain the following items in a suitable binder:
   1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal.
   2. The Specification Section Number or Drawing Reference Number covering the items being submitted and the product name or description.
   3. An index page listing all data within the submittal including the product name and description.
   4. Dimensional data and actual sketches as applicable to show that the submitted equipment will fit into the space available with all required Code and maintenance clearances.
   5. Identification of each item of material or equipment matching that indicated on the Drawings.
   6. Sufficient performance data, capacity, sound data where applicable, diagrammatic data and descriptive information to show its compliance with the requirements of the Contract Documents. Any options or special requirements shall be clearly indicated. All applicable information shall be clearly indicated. All non-applicable data shall be crossed out.

G. Submittals will be marked with one of the following levels of status:
   1. NO EXCEPTIONS TAKEN.

2. MAKE CORRECTIONS NOTED AND SUBMIT WRITTEN RESPONSE.
3. REVISE AND RESUBMIT ENTIRE SUBMITTAL AS NOTED.
4. REJECTED AS NOTED.
5. NO ACTION TAKEN

H. NO EXCEPTIONS TAKEN: The submittal was reviewed and general compliance with the design concept and general requirements of the Contract Documents was noted.

I. MAKE CORRECTIONS NOTED AND SUBMIT WRITTEN RESPONSE: The submittal was reviewed and found to have minor deviations from the requirements of the Contract Documents or missing information. A complete resubmittal is not required, however, a written response to all review comments shall be submitted.

J. REVISE AND RESUBMIT ENTIRE SUBMITTAL: The submittal was reviewed and major deviations from the requirements of the Contract Documents were noted. The shop drawing or product data shall be revised to eliminate the deviations. A complete resubmittal is required with a written response to each review comment.

K. REJECTED AS NOTED: The submittal was found to be in direct conflict with the requirements of the Contract Documents and was not reviewed further. A complete submittal on the product specified is mandatory.

L. NO ACTION TAKEN: This status is assigned to O & M Manuals, Record Drawings, and non-applicable submittals made to the Engineer. Should there be comments with this status, the contractor shall address and satisfy them all via written correspondence.

M. Materials and equipment which are purchased or installed without a "NO EXCEPTIONS TAKEN" shop drawing review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Architect/Engineer for any reason shall be at the expense of the Contractor.

N. Shop Drawings shall be complete and certified by the Contractor prior to submission to the Engineer for review. Where more than two reviews are required for a given submittal to obtain a status of "NO EXCEPTIONS TAKEN", the owner shall be reimbursed by the Contractor for any expense in connection with more than the two submittals set forth herein.

1.13 RECORD DRAWINGS

A. The Contractor shall maintain, on a daily basis, a complete set of black line record prints clearly stamped "Record Drawings" on the job site on which he shall note all details and alterations required to be made to meet actual site conditions and Changes made by Change Order notices. All deviations from the Contract Documents shall be noted on the Record Drawings. This requirement shall not be construed as authorization for the Contractor to make changes in the layout or Work without definite instructions from the Architect. These drawings shall be kept available for inspection by the Architect/Engineer at all times. Refer to Division 1 for additional requirements concerning Record Drawings.

B. The Record Drawings shall indicate accurate dimensions in two directions from a column for all buried or concealed Work and for recording any deviations from the Work indicated on the Contract Documents as a result of coordination.

C. Within thirty (30) days of completion of the Work, the Contractor shall transfer all marks from the Record Drawings to a set of Record Sepias using a red pencil and shall submit the Record Sepias and three (3) sets of black line prints to the Architect/Engineer for review.

D. The reproducible Record Sepias shall have the Engineer's name and seal completely blackened out. Each Drawing shall be marked with a rubber stamp impression identical to the example below and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS

DATE: _____

(NAME OF GENERAL CONTRACTOR)

BY: _____

(NAME OF SUBCONTRACTOR)

BY: _____

1.14 EXECUTION AND COORDINATION OF WORK

A. The Drawings attempt to show reasonable indications of the locations of conduit and equipment without always indicating elevations and dimensions. The Contractor shall perform field measurements of actual conditions prior to fabricating conduit. Exact locations of equipment and connections thereto shall be coordinated with "No Exceptions Taken" shop drawings, equipment drawings, rough-in drawings, building conditions and all other trades. Any reasonable changes in the locations indicated on the Contract Documents, up to a distance of three (3) feet, shall be made by the Contractor without any additional cost to the Owner.

B. Interferences with other trades shall be resolved by giving precedence to systems required to be sloped for drainage for proper operation. Where space requirements conflict, the following order of precedence shall be observed:

1. Building lines.
2. Structural members.
3. Soil and drain piping.
4. Steam and condensate piping.
5. Sprinkler piping.
6. Vent piping.
7. Supply ductwork.
8. Exhaust ductwork.
9. Chilled water and heating hot water piping.
10. Domestic water piping.
11. Electrical conduit.

C. Manufacturer's Recommendations: With exceptions as specified and/or indicated on the Drawings or in the Specifications, apply, install, erect, use, clean, and condition, manufactured articles, materials, and equipment per Manufacturer's current printed recommendations. Keep copies of such printed recommendations at job site and make them available as required.

D. Architectural Approval: Devices exposed to occupant view or mounted on walls, ceilings, floors, etc. in finished spaces shall:
   1. Be located in exact locations shown on the Architectural Drawings or locations approved by the Architect.
   2. Have appearances acceptable to the Architect.

1.15 SAFETY REGULATIONS

A. All electrical work shall be performed in compliance with all applicable and governing safety regulations. All safety lights, guards and signs required for the performance of the electrical Work shall be provided and operated by the Electrical Contractor.

1.16 STORAGE AND PROTECTION OF MATERIALS

A. The Contractor shall properly store all material and equipment at the jobsite and protect it from the elements and from damage. Any equipment damaged due to improper protection shall be replaced by the Contractor at his expense.

B. The Contractor shall protect the work, equipment, and material of all other trades from damage by his work or other workmen, and shall make good all damage thus caused.

C. The Contractor shall be responsible for all work, materials, and equipment until finally inspected, tested, and accepted; protect work against theft, injury or damage; and carefully store material and equipment received on site which are not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material. The Contractor shall cover and protect in an acceptable manner to the Owner, all his equipment and materials from damage due to water, spray-on fireproofing, construction debris, etc.

D. If any item of equipment is received prior to the time it is required, the Contractor shall be responsible for its proper storage and protection until such time as it may be required. The Contractor shall pay for all costs of demurrage or storage.

1.17 SCAFFOLDING

A. The Contractor shall provide his own scaffolding and ladders to facilitate the necessary adjustment and balancing of the system.

1.18 SLEEVES, CUTTING, PATCHING AND FIRE SAFING

A. Where it becomes necessary to cut through any wall, floor or ceiling to permit the installation of any Work of Division 16, or to repair any defects that may appear, the cutting shall be performed under the supervision of the General Contractor. Inform the Owner's representative before any work commences. No structural member shall be altered without the written permission of the Structural Engineer.

B. The Contractor shall be responsible for the timely placing of sleeves for all piping passing through walls, partitions, beams, floors, and roofs while the same are under construction.

C. In the remodel of existing areas, the Contractor shall install new sleeves and seal existing piping penetrations through new walls with materials specified herein. Provide water stops at new penetrations of existing floors.

D. Seal all Division 16 material and system support penetrations of fire rated construction with factory built devices or with manufactured fill, void or cavity materials "Classified" by Underwriter's Laboratories, Inc. for use as a Through-Penetration Firestop.

E. If holes and/or sleeves are not properly installed and cutting and patching becomes necessary, it shall be done at no additional expense to the Owner.

F. Unused sleeves shall be sealed with fire-stop devices and systems to maintain the fire rating of the construction penetrated.

G. This Contractor shall be responsible for patching fire proofing on steel and concrete structural members where it has been removed or disturbed for the installation of his hangers, braces or brackets.

1.19 FINAL REVIEW

A. At a time designated, the entire system shall be reviewed for compliance with the Contract Drawings and Specifications. The Contractor shall be present at this review.

B. The entire system shall be operating properly with all systems balanced and all controls adjusted.

C. Certificates and Documents required herein shall be in order and presented to the Architect at least two (2) weeks prior to the review.

D. After the review, any changes or corrections noted as necessary for the Work to comply with these Specifications and the Drawings shall be accomplished without delay in order to secure final acceptance of the Work.

1.20 WARRANTIES AND GUARANTEES

A. General: Contractor shall guarantee all material and equipment installed by him against defects in workmanship and material for a period of twelve (12) months after final acceptance of the Work by the Owner and he shall repair or replace any materials or equipment developing such defects within that time, promptly on due notice given him by the Owner and at Contractor's sole cost and expense.

B. Equipment: All equipment bearing a manufacturer's guarantee shall be construed to have an extended guarantee to the Owner by the manufacturer. Any such equipment that proves defective in materials or workmanship within the guarantee period is to be replaced by the Contractor in accordance with the manufacturer's guarantee.

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

3.01 SUBMITTALS

A. Submittals shall include, but not be limited to, the following:
   1. List of proposed manufacturers and subcontractors for major equipment and systems.
   2. Record drawings.

END OF SECTION

SECTION 16120 - GENERAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The requirements of the General Conditions, Supplementary Conditions, Division 1, and Drawings apply to all Work herein.

B. Requirements of the following Sections apply to this section:
1. Scope of Work - Section 26 04 00
2. Basic Division 26 Requirements - Section 26 05 00

1.02 SCOPE

A. Provide and install general Division 26 materials and methods as shown, scheduled, specified, and required.

PART 2 - PRODUCTS

2.01 SLEEVES

2.02 FIRE BARRIERS

PART 3 - EXECUTION

3.01 SLEEVES

A. General: This Contractor shall be responsible for the timely placement of sleeves in construction. If sleeves are not placed during construction, this contractor shall secure written permission to perform a core drill or cut and patch installation at no cost to the Owner. No piping shall pass through the above obstructions without sleeves, unless noted otherwise. Furnish and install sleeves around all conduit passing through masonry, CMU and concrete walls and partitions, suspended slabs, plaster or drywall ceilings, structural members, other building features and where shown on the drawings.

B. Partitions: Sleeves shall be required for conduit passing through rated drywall and plaster partitions where required by the UL Classification for the Through-Penetration Firestop used. Sleeves shall be installed in accordance with the Firestop UL Classification. Sleeves are not required for conduit passing through non-rated drywall or plaster partitions where conduit shall be muddied in.

C. Sizing Sleeves: Sleeves shall be one size larger than the conduit passing through the sleeve, except where larger sizes are required for mechanical seals. All sleeves in floors shall extend 2 inches above the finished floor.

D. Materials:
1. Non-Supporting Vertical Construction: Provide 18 gauge galvanized steel sleeves.
2. Non-Supporting Horizontal Construction: Provide 16 gauge galvanized steel sleeves.

3. Horizontal Construction Supporting Risers 3" and Smaller: Provide schedule 40 galvanized pipe sleeves.
4. Horizontal Construction Supporting Risers 4" and Larger: Provide Thunderline "Link-Seal" Model WS galvanized steel wall sleeves or schedule 40 galvanized pipe sleeve with three, six (6) inch long, 3/8" diameter reinforcing rods welded radially to the sleeve on 120 degree centers, set in concrete.

5. Exterior Building Construction Below Grade: Provide Thunderline "link-seal" Model WS galvanized wall sleeves or Schedule 40 black steel pipe with 1/4" thick steel plate secured to the piping with continuous fillet weld. The plate shall be located in the middle of the wall and shall be four inches wider all around than the sleeve it encircles. The entire assembly shall be hot dipped galvanized after fabrication. Seal off annular opening between conduit and sleeve with "Link Seal" casing seal as manufactured by Thunderline Corporation, Livonia, Michigan, or “Pipelinx” by Mason-Dallas, Inc. The conduit sleeve shall be sized to accommodate the casing seal. Casing seals shall be Series 300 for conduit sizes 3/4" through 4", Series 400 for conduit 5" and larger.

E. Installation: At no point shall the conduit touch the sleeve it passes through. Clearance around conduit shall not be less than ½" or more than 1". Seal all sleeves, which are not in exterior construction below grade or rated construction with approved non-hardening mastic. Seal sleeves through fire rated construction as specified herein and as detailed on the Drawings. Sleeves below grade shall be sealed with Thunderline "Link-Seal" Model LS or Mason-Dallas “Pipelinx” mechanical seals.

F. Existing Construction: Sleeves are not required where new openings are core-drilled into existing construction, unless noted otherwise on the Drawings.

G. Option: At the Contractor's option, water proof, fire rated sleeve/coupling penetrators and systems as manufactured by ProSet Systems, Inc. may be used in lieu of galvanized sleeves specified hereinabove.

3.02 CUTTING AND PATCHING

A. Where it becomes necessary to cut through any wall, floor or ceiling to permit the installation of any Work of Division 16, or to repair any defects that may appear, the cutting shall be performed under the supervision of the General Contractor. Inform the Owner's representative before any work commences. No structural member shall be altered without the written permission of the Structural Engineer.

B. Patching of all openings cut by this Contractor, or repairing of any damage to the work of other trades, occasioned by cutting operations, or occasioned by the failure of any part of work installed under this Contract shall be performed by the trade whose work is involved, but shall be paid for by this Contractor.

C. Any openings cut through exterior walls or roofs shall be provided with suitable covers while they are left open to protect the property or materials involved. Any openings cut through walls below grade shall be properly protected to prevent entrance of water or other damaging elements.

D. Water Stops: Provide water stops at new penetrations of existing floors. Water stops shall be at least 16 gauge and be sized as specified herein for sleeves. Water stops shall be securely attached to the top of the floor slab with a waterproof mastic applied between the bottom flange of the water stop and the floor slab. The thickness of the firesafing system shall not exceed the existing floor thickness.

3.03 FIRESTOP

A. Where Division 26 materials and system supports pass through fire or smoke rated construction, they shall be firestopped with a factory built UL Classified Through-Penetration Firestop Device, or with manufactured Fill, Void, or Cavity Materials Classified by Underwriters Laboratories, Inc. for use in a UL Classified Through-Penetration Firestop System to prevent the spread of smoke, fire, toxic gas, or water.

B. The Firestop Devices, Materials, and Systems shall meet all the fire test and hose stream test requirements of ASTM E119, "Standard Test Methods for Fire Tests of Building Construction and Materials", or ASTM E814, "Standard Test Method for Fire Tests of Through-Penetration Fire Stops".

C. "F" ratings of the Firestop used shall be not less than the required fire resistance rating of the wall or floor penetrated. "T" ratings shall be as required by local code for the type of building construction.

D. Fill, Void, or Cavity Materials shall only be installed in accordance with UL classified system numbers.

E. All firestop Devices and Systems shall be approved for such use by the authority having jurisdiction.

F. Excessive shrinkage of the firestop materials, which would permit the transmission of smoke or water prior to exposure to a fire condition, is unacceptable. Where a mastic is used to seal the surface of the firestop, the mastic shall be non-hardening. The Firestop System used shall accommodate expansion and contraction of the electrical systems without damaging the firestop or reducing its effectiveness as a barrier to the passage of smoke, fire, toxic gas, or water.

G. Submittal data for Firestop Materials shall include the U.L. System Numbers listed in the U.L. Fire Resistance Directory under which the material was tested in accordance with ASTM E 814 (UL 1479) or ASTM E119.

H. If it complies with these Specifications, firestop Devices, Systems, and Materials manufactured by one of the following manufacturers will be acceptable:
   1. Tremco Fire-Resistive Joint System using Dymeric sealant and Cerablanket-FS mineral filler.
   2. 3M Fire Barrier Penetration Sealing Systems (Electro Products Division).
   3. GE Pensil 1851 Silicone RTM by General Electric.
   4. ProSet Systems, Inc.
   5. The Rectorseal Corporation
   6. STI

3.04 PAINTING

A. Field painting will be provided under corresponding division utilizing these guidelines.

B. All equipment, which has a factory paint finish, which is damaged during shipping and handling, or installation, shall be repaired by touching up, repainting entirely, or replacing with an undamaged unit.

C. All equipment not finished at the factory shall be given a prime coat and then finish painted with two coats of enamel in a color as directed by the Architect/Engineer. No nameplates on equipment shall be painted, and suitable protection shall be afforded such plates to prevent their being rendered illegible during the painted operations.

D. All conduit exposed to view in finished areas shall be finish painted as directed by the Architect/Engineer.

E. Before painting, all surfaces to be painted shall be suitably prepared. This shall include removing all oil, rust, scale, dirt, and other foreign material. Surfaces shall be made smooth by grinding, filing, brushing, or other approved method. In the painting operations, the unless specified otherwise, and where finish painting is specified, it shall be painted using materials and colors selected and approved by the Architect/Engineer. Refer to Division 9 for additional requirements.

3.05 IDENTIFICATION AND LABELING OF ELECTRICAL EQUIPMENT

A. Equipment: All service entrance equipment, distribution equipment, and distribution panelboards, including their associated branch circuit devices, and each new major item of electrical equipment including lighting and power panelboards, motor starters, transfer switches, and disconnect switches, shall be properly identified by the attachment of engraved nameplates constructed from laminated plastic, at least 1/16 inch thick 3-ply, with black surfaces and white core. Emergency power equipment nameplates shall have red surfaces and white core.

1. Engraving shall be condensed gothic, at least 1/4 inch high. The engraved nameplates shall be securely attached to the device or panelboard using non-corroding screws. The use of adhesive or tape attachment is not acceptable.
2. Labeling shall include the name of equipment the device feeds. Consult the Mechanical, Electrical and Plumbing drawings for label nomenclature.
3. Transfer Switches: Transfer switch nameplates shall include the name and circuit number for the normal and emergency power sources to the transfer switch.
4. Fire Pump: Fire pump controller, transfer switch, emergency power source, and overcurrent protection device shall be labeled as per NFPA-20.

B. Miscellaneous Switch Plates or Device Plates: Device and switch plates for all 20-amp devices circuited to "emergency" circuits, special purpose outlets, pilot lights, remote operated light switches and all remote control devices shall be identified by engraving the switch plate or device plate.

1. Nomenclature shall include the panel and circuit of the outlet or switch, or the indication of the pilot, or the area of control, or equipment served. Consult the Architect/Engineer for label nomenclature.
2. Plates shall be stainless steel or as otherwise specified.
3. Engraving shall be 3/16 inch condensed gothic and shall be filled with black enamel.

C. Conduits: All exposed conduits shall have the voltage marked on 50 foot centers, at least one in each room and at all junction boxes and electrical devices. Markers shall be Brady B-500 vinyl cloth with black letters on an orange background or an approved equal. Emergency power conduits shall also by labeled to indicate the type of service. Designations shall be approved by the Architect/Engineer.

3.06 PROHIBITED LABELS AND IDENTIFICATION

A. In all public areas and other high profile areas of the project, installation of any device or equipment with markings or insignias intended to identify the manufacturer, vendor or other source is prohibited. Also prohibited is installation of any device or equipment, which bears evidence that markings or insignias have been removed. Certification, testing and approval labels are exceptions to this requirement.

3.07 WARNING SIGNS

A. Provide warning signs where there is a hazardous exposure associated with access to or operation of electrical facilities. Provide text of sufficient clarity and lettering of sufficient size to convey adequate information at each location. Mount warning signs permanently in an appropriate and effective location in the space, at equipment, and on raceways.

B. Comply with recognized industry standards for color and design.

END OF SECTION

SECTION 16130 - GROUNDING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The requirements of the General Conditions, Supplementary Conditions, Division 1, and Drawings apply to all Work herein.

B. Requirements of the following Division 16 Sections apply to this section:

1. Scope of Work - Section 16006
2. Basic Division 16 Requirements - Section 16010
3. General Division 16 Materials and Methods - Section 16050

1.02 SCOPE

A. General: Furnish and install ground equipment as specified, shown, and required.

B. Related Sections: Other Division 15 and 16 Sections contain requirements related to the work of this Section. These may include, but not be limited to, the following sections:

1. Lightning Protection Systems - Section 16670

1.03 QUALITY ASSURANCE

A. Manufacturers: If they comply with these specifications and requirements, products of the following manufacturers will be acceptable:

1. Burndy
2. Copperweld
3. MEFCO

B. Codes and Standards: National Electrical Code (NEC), Article 250.

PART 2 - PRODUCTS

2.01 GROUNDING SYSTEM MATERIALS

A. Ground Clamps: Connections of connecting grounding conductors to copper, brass, or lead pipes should be made with ground clamps made of copper and if pipes are of steel or iron, the ground clamps should be made of galvanized iron. These clamps shall be designed to provide permanent and positive pressure and to avoid mechanical injury to the pipe.

B. Grounding Conductors and Jumpers: Grounding conductors and jumpers shall be connected to each other and to items to be grounded by means of approved type compression connectors, approved by the Owner's duly authorized representative. No solder connections shall be made.

C. All concrete encased or direct buried underground grounding electrode conductors shall be of bare copper, Class B, stranded.

D. Bonding conductors shall be bare copper, sized as indicated or larger if required by code.

E. Grounding Electrodes: Grounding electrodes shall be a minimum of 3/4 inch diameter by 10 feet long, copper clad steel with high-strength steel core and electrolytic-grade copper outer sheath, molten welded to the core.

PART 3 - EXECUTION

3.01 SUBMITTALS

A. Shop drawing submittals shall include, but not be limited to, the following:

1. Cut sheets of ground rods, clamps and connectors.
2. Additional information as required in Section 16070.

3.02 INSTALLATION

A. General: The electrical distribution system shall be grounded in accordance with Article 250 of the National Electrical Code (NEC), as shown and specified, and recognized industry practices to ensure that products serve the intended functions.

B. Building Equipment Grounding System: The building equipment grounding system shall consist of the ground wire, and electrically continuous metallic conduit system as shown. Every item of equipment served by the electrical system shall be bonded to the building equipment grounding system. All conduit systems, cabinets, junction boxes, motor frames, electrically operated and/or controlled cooling-heating units, miscellaneous equipment, etc., shall be grounded. Portions of metallic piping and duct systems which are electrically isolated shall be bonded to the equipment grounding system with a flexible bonding jumper.

C. System Neutral: The system neutral shall be grounded to the grounding electrode system at the service entrance only, and shall be kept isolated from the building. Separately derived systems shall be grounded at one point.

D. Miscellaneous: Provide bonding and grounding wires run in conduit and sized per the NEC and in accordance with the local electrical inspection department. Metallic piping and duct systems which enter the building shall be grounded at the point of entry to the building, in accordance with the NEC.

E. Continuity: Continuity of the building equipment grounding system shall be maintained throughout the project. Grounding jumpers shall be installed across conduit expansion fittings, all liquid-tight flexible metal conduit, light fixture pigtails in excess of 6 feet, and all other non-electrically continuous raceway fittings. Any point of poor or incomplete continuity of a raceway system being used as a ground conductor shall have a jumper connected across this point.

F. Main Conductors: All main grounding conductors shall be stranded copper conductors, sized as per Article 250 of the NEC, and run in the same conduit as the circuit conductors, unless shown or specified otherwise. All main grounding conductors shall be

continuous without joints or splices over their entire length. No automatic cutout or switch shall be placed in the grounding conductor of the interior wiring system unless the opening of the cutout or switch disconnects all sources of energy.

G. Separately Derived System Grounding: Bond the case and neutral of each transformer directly to the nearest available effectively-grounded structural metal member of the structure, or transformer grounding distribution system, in accordance with the local electrical inspection department. Flexible conduit shall not be used as a ground path to a transformer.

H. Non-Metallic Conduit: Where non-metallic conduit is shown or used at the Contractor's Option, a ground wire sized per Article 250 of the NEC shall be included in each conduit. It shall be the Contractor's responsibility to verify and provide the proper size of conduit for the feeder with added ground wire.

END OF SECTION

SECTION 16140 – POWER DISTRIBUTION EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The requirements of the General Conditions, Supplementary Conditions, Division 1, and Drawings apply to all Work herein.

B. Requirements of the following Division 16 Sections apply to this section:

1. Scope of Work - Section 16006
2. Basic Division 16 Requirements - Section 16010
3. General Division 16 Materials and Methods - Section 16050

1.02 SCOPE

A. General: Furnish and install power distribution equipment as shown, scheduled and specified.

B. Types: The types of power distribution equipment include, but are not limited to, the following:

1. Fusible Switch Distribution Switches
2. Circuit Breaker Distribution Panelboards
3. Safety and Disconnect Switches
4. Manual Motor Disconnect (Snap) Switches
5. Fuses

1.03 QUALITY ASSURANCE

A. Manufacturers: If they comply with these specifications and requirements, products of the following manufacturers will be acceptable:

B. Motor Controllers:

1. Siemens, GE, Square D, Cutler Hammer

C. Safety and Disconnect Switches:

1. Siemens, GE, Square D, Cutler Hammer

D. Codes and Standards:

1. Power distribution equipment shall be listed by Underwriter's Laboratories and shall bear the UL label.

PART 2 - PRODUCTS

A. Circuit Breakers:

1. Circuit breakers shall be of the molded case, thermal magnetic type equipped with the individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large,, permanent, individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indication shall be clearly shown by the breaker handle taking position between "ON" and "OFF". Provisions for additional breakers shall be such that no additional connectors will be required to add breakers. All 2 and 3 pole breakers shall have common trips. Circuit directory cards shall be provided. Cardholder shall be permanently attached on the inside on the panel door. Directory cards shall be type written with description of the load served.

2. Provide distribution panel circuit breakers with conventional interrupting capacity, or high interrupting capacity as required by the system available fault current loads as indicated on the Drawings.

B. Added Circuit Breakers:

1. All added circuit breakers on existing panels shall match existing type and ratings.

2.02 MANUAL MOTOR DISCONNECT (SNAP) SWITCHES

A. General: Toggle type disconnect switches (horsepower rated) may be used as the disconnecting means for individual fractional HP motors having resettable, integrally mounted, thermal overload protection, provided each motor full-load rating does not exceed 10 amperes and the motor branch circuit over-current device does not exceed 20A at 120V.
Manual motor starter enclosures shall be NEMA 1, general purpose type, unless indicated otherwise.

2.03 SAFETY AND DISCONNECT SWITCHES

A. Furnish and install safety switches as specified herein and as indicated on the drawings with number of switched poles as indicated.

B. Safety switches shall be general duty type, dead-front, sheet steel enclosed, surface mounted, of the type and size indicated. Safety switches shall be rated for the voltage of the circuit in which they are installed. Safety switches used as motor disconnects shall be horsepower rated for the motor served.

C. Safety switches shall be quick-make, quick-break type with permanently attached arc suppressor and constructed such that blades are visible in the OFF position with the door open. All current carrying parts shall be constructed of high conductivity copper with silver-plated switch contacts. Lugs shall be suitable for copper cable, shall accept compression connectors where required, and shall be front removable. Fuse clips shall be positive pressure rejection-type, suitable for use with UL Class R fuses. The operating handle shall be part of the box, not of the cover.

D. The switch shall have provisions to padlock in the off position. Safety switches shall have a cover interlock to prevent unauthorized opening of the switch door

when the switch mechanism is in the "on" position. Cover interlock shall have an override mechanism to permit switch inspection by authorized personnel.

E. Where a neutral is present in the circuit, furnish a solid neutral block with the safety switch. Where a ground conductor is present in the circuit, furnish a solid ground block with the safety switch.

PART 3 - EXECUTION

3.01 SAFETY AND DISCONNECT SWITCHES

A. Shop drawing submittal shall include, but not be limited to, the following:

1. Cut sheets of the safety and disconnect switches with ratings, voltage, poles, and all associated accessories clearly indicated.

2. Additional information as required in Section 16010.

B. INSTALLATION

1. Indoors: Safety switches installed in indoor locations shall be NEMA 1 general purpose enclosures, unless otherwise indicated.

2. Outdoors: Safety switches installed in outdoor locations shall be NEMA 3R (water resistant) enclosures, unless otherwise indicated.

3. Wet Areas: Safety switches installed at cooling towers, in kitchen and laundries and in other wet areas, shall be NEMA 4 (stainless steel) enclosures, unless otherwise indicated.

4. Provide all safety switches where shown and at each motor which is out of site of, or greater than 50 feet from, the switch or panel from which the motor circuit is fed.

5. Provide all safety and disconnect switches with galvanized angle iron, unistrut, or other suitable supports where mounting on wall or other rigid surface is impractical. Where devices are mounted on drywall surfaces, provide galvanized back plate on opposite side of drywall for anchoring support. Switches shall not be supported by conduit alone.

6. Where safety and disconnect switches are mounted on equipment served, the switch shall not inhibit removal of any service panels or interfere with any required access areas.

7. Install disconnect switches used with motor-driven appliances, motors, and controllers within site of the controller position unless otherwise indicated.

END OF SECTION

SECTION 16150 – CONDUCTORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The requirements of the General Conditions, Supplementary Conditions, Division 1, and Drawings apply to all Work herein.

B. Requirements of the following Division 16 Sections apply to this section:

1. Scope of Work - Section 16006
2. Basic Division 16 Requirements - Section 16010
3. General Division 16 Materials and Methods - Section 16050

1.02 SCOPE

A. Furnish and install conductors for all new circuits as shown, scheduled, specified, and required. All conductors for power shall be installed in conduit.

B. Related Sections: Other Division 15 and 16 Sections contain requirements related to the work of this Section. These may include, but not be limited to, the following sections:

1. Conduit - Section 16110

1.03 QUALITY ASSURANCE

A. Manufacturers: If they comply with these specifications and requirements, products of the following manufacturers will be acceptable:

1. Wire and Cable:

a. American Insulated Wire
b. General Cable
c. Southwire/Senator
d. Cerro/Circle
e. Essex
f. Encro

2. Cable Lugs and Termination Fittings:

a. Blackburn
b. Burndy
c. Ideal
d. Ilsco
e. Penn Union
f. MAC
g. Thomas & Betts
h. AMP

3. Pre-Insulated Spring Type Connectors:

a. Buchanan
b. Ideal
c. 3-M Scotchlock
d. GB

B. Codes and Standards: All conductors furnished and installed shall comply with the requirements and latest revisions of the National Electrical Code (NEC), National Electrical Safety Code (NESC), Standards of the Underwriter's Laboratories (UL), National Electrical Manufacture's Association (NEMA), Institute of Electrical and Electronic Engineers (IEEE).

PART 2 - PRODUCTS

2.01 CONDUCTORS

A. General: All feeder and branch circuit conductors shall be soft drawn, annealed copper, having a conductivity of not less than 98% of that of pure copper, and meeting before stranding, the requirements of ASTM B-3, "Standard Specifications for Soft or Annealed Copper Wire for Electrical Purposes", latest edition.

B. Insulation:

1. No. 10 and Smaller: Unless otherwise specified or noted, all conductors No. 10 and smaller shall be solid copper THHN or THWN with an insulating outer jacket suitable for conductor temperatures of 75˚C wet or 90˚C dry, except for NEC Class 1, 2, or 3 conductors which maybe stranded if terminated as required herein.

2. No. 8 and Larger: Unless otherwise specified or noted, all conductors No. 8 and larger shall be THWN/THHN, 600 volt, stranded, with a thermoplastic insulating compound and an outer jacket suitable for conductor temperatures of 75˚C wet or 90˚C dry, inclusive. Stranded wire shall be terminated as specified herein.

3. High Temperature Areas: In the ceiling areas of equipment rooms where the temperature may exceed 102˚F under operating conditions, higher temperature insulation shall be used on conductors. Acceptable types are RHH, THHN, and XHHW.

PART 3 - EXECUTION

3.01 SUBMITTALS

A. Shop drawing submittals shall include, but not be limited to, the following:

1. The Contractor shall submit to the Engineer for review, a list of the proposed manufacturers of conductors, cable lugs, cable connectors, and termination fittings listed herein. The Contractor may install wire, cable, cable lugs, cable connectors and termination fittings furnished by any manufacturer listed on the approved submittal.

2. Cut sheets on all 600 volt conductors with manufacturers name, ratings and capacities, insulation characteristics, and available colors, clearly listed.

3. Cut sheets indicating all cable lugs, termination fittings and cable connectors.

4. Cut sheets indicating types of conductor identification bands.

5. Additional information as required in Section 16010.

3.02 INSTALLATION

A. Mains and feeders are to be run their entire length in continuous pieces without joints or splices, unless otherwise indicated.

B. Conductors may be run in multiple sizes 1/0 through 750 MCM inclusive, provided all multiple conductors are the same size, length, and type of insulation, and they shall be so arranged and terminated as to insure equal division of the total current between all conductors involved.

C. All underground feeders shall be type THHW. If direct burial use, RHW.

D. Home Runs: Except where specifically indicated, provide branch circuit home runs with not more than two different line conductors and a common neutral in a single raceway for 3-wire, single-phase systems, nor more than three different line conductors and a common neutral in a single raceway for 4-wire, 3-phase systems. For all ground fault circuits, provide a separate neutral conductor for each line conductor. Several circuits may be installed in one conduit provided that the temperature derating factors are not exceeded and that the conduit fill is not exceeded. Install a neutral conductor for each three-phase circuit. Use home run circuit numbers as indicated for panelboard connections.

E. In general, use No. 12 AWG conductors for single phase, 20 ampere circuits. Conductors for lighting and power branch circuits shall be of such a size that the drop in potential from the panelboards to the farthest point on the circuits shall not exceed 2% at maximum load and 80% power factor.

F. For 20 ampere branch circuits operating at 150 volts or less, utilize No. 10 AWG wire for the entire branch circuit when the first outlet is in excess of 75 feet from the panelboard.

G. For 20 ampere branch circuits operating at 151 to 300 volts, utilize No. 10 AWG wire for the entire branch circuit when the first outlet is in excess of 150 feet from the panelboard.

H. No conductor smaller than No. 12 AWG copper shall be used for power or lighting purposes, including switch legs.

I. Control circuit conductors may be No. 14 AWG, and may be run in the same conduit with power wiring, subject to compliance with control system performance requirements and NEC conductor insulation requirements. No conductor smaller than No. 18 AWG shall be used for control circuits.

J. Conductors for connection to individual light fixtures in grid type ceilings, using 72 inch long (max.) by 3/8 inch (minimum) flexible metal conduit fixture-tails, from their

associated junction boxes, shall be #14 AWG THHN, 600 volt, solid, with a thermoplastic insulating compound and an outer jacket suitable for conductor temperature of 90˚C.

K. All conductors in vertical conduits or raceways shall be supported in the manner set forth in the latest edition of the National Electric Code.

L. Before any conductor is pulled into any conduit, the conduit shall be thoroughly swabbed in such a manner as to remove all foreign material and to permit the wire itself to be pulled into a clean, dry conduit.

M. Powdered soapstone, Ideal Yellow 77, or Polywater may be used as a lubricant where necessary.

N. Wire pulling lubricant shall not be used when installing branch circuit conductors from panelboards with "isolation" transformers.

O. All conductors shall be new, unused, in good condition, and shall be delivered in standard coils, packaged, or rolls. Samples of all conductors shall be submitted by the Contractor when requested by the Engineer for the purpose of determining acceptability.

P. Wire which has been rejected by the Engineer shall not be used again. Decisions as to the quality of the wire furnished, and the acceptance of such wire shall be made by the Owner's duly authorized representative.

3.03 IDENTIFICATION OF 600 VOLT CONDUCTORS

A. Each and every main, feeder and branch circuit conductor shall be identified at each outlet point where such conductors terminate. A definite number and/or letter code shall be employed and shall uniform throughout each conductor.

B. Feeder bundles passing through a junction or support box shall also be identified within such enclosure, but may be identified in such locations as a group.

C. Where two or more circuits run to a single outlet box, each conductor shall be tagged and identified by circuit.

3.04 COLOR CODING OF 600 VOLT CONDUCTORS

A. The color of the insulation of the conductors shall as specified on drawings

3.05 SPLICES, TAPS, AND TERMINATIONS FOR 600 VOLT CONDUCTORS

A. Splices and taps on branch circuits shall occur only when such circuits divide and shall consist of one "through" circuit to which the remaining circuit shall be spliced or tapped.

B. No splices or taps shall be made in any conductor except in outlet boxes, junction boxes, splice boxes, or other devices and equipment in exposed and accessible locations approved for the purpose by the latest edition of the NEC.

C. All No. 10 AWG and smaller solid conductors shall be spliced with pre-insulated spring connectors. All No. 10 AWG and smaller stranded conductors for NEC Class 1, 2, 3

wiring shall be terminated with AMP "PIDG" UL, listed premium grade insulated fork connectors, or approved equal, and shall be spliced in a junction box with AMP "Plastic-Grip" UL listed standard grade insulated butt splices, or approved equal.

D. All No. 8 AWG and larger copper conductors shall be connected with high conductivity, wrought copper, color-keyed compression connectors. Compression connectors for all feeders shall be Thomas & Betts Series 54200, or equal, two-hole connectors. Where equipment or devices cannot be provided by the manufacturer to accept two-hole connectors, T & B Series 54100, or approved equal, single-hole connectors with auto-rotation lug or restraint shall be used. Where equipment or devices cannot be provided by the manufacturer to accept either two-hole or single-hole compression connectors, set-screw type connectors may be used.

E. All No. 8 AWG and larger copper conductors which are to be spliced or tapped in wireways, gutters, or junction boxes shall be sliced or tapped using hydraulically applied, high conductivity compression connector, T & B 54700 or approved equal, compression taps, and 3-M electrical tape or manufactured connector covers approved for the purpose.

F. The manufacturer's recommended installing tool shall be used for the installation of all hydraulically applied compression type lugs or connectors. Modifications of connectors are not acceptable.

G. All bolt and screw connections shall be torqued in accordance with the manufacturer's recommendations. Submittals shall include these recommendations.

END OF SECTION

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Bronze ball valves.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

1.3 QUALITY ASSURANCE

A. ASME Compliance:

   1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Use the following precautions during storage:

   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:
   1. Hand lever: For quarter-turn valves NPS 6 (DN 150) and smaller except plug valves.

E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections:
1. Solder Joint: With sockets according to ASME B16.18.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Milwaukee Valve Company.
b. NIBCO INC.
c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. Body Design: Two piece.
d. Body Material: Bronze.
e. Ends: Solder.
f. Seats: PTFE or TFE.
g. Stem: Bronze.
h. Ball: Chrome-plated brass.
i. Port: Full.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully close. Examine guides and seats made accessible by such operations.

C. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Locate valves for easy access and provide separate support where necessary.

B. Install valves in horizontal piping with stem at or above center of pipe.

C. Install valves in position to allow full stem movement.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

3.4 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.

1.2 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.

3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.3 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Plastic.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

2.4 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:
1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

J. Insulated Piping:

1. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

3.2 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

END OF SECTION 220529

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic tempered hot-water piping.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

C. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I.

D. Mineral-Fiber, Preformed Pipe Insulation:

1. Type I, 850 Deg F (454 Deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive 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."

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive 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. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
4. Color: White or gray.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches (75 mm).

2. Thickness: 11.5 mils (0.29 mm).
3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.8 SECUREMENTS

A. Bands:
1. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

C. Wire: 0.062-inch (1.6-mm) soft-annealed, galvanized steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

1. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
2. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PIPING INSULATION SCHEDULE, GENERAL

A. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.4 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 (DN 25) and Smaller: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.

2. NPS 1-1/4 (DN 32) and Larger: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

B. Domestic Hot and Tempered Hot Water:

1. NPS 1-1/4 (DN 32) and Smaller: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.

2. NPS 1-1/2 (DN 40) and Larger: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

END OF SECTION 220719

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.2 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
   1. Do not interrupt water service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) water tube, annealed temper.

C. Copper Pressure-Seal-Joint Fittings:

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Elkhart Products Corporation.
      b. NIBCO Inc.
      c. Viega.

   2. Fittings for NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
   3. Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

2.3 PIPING JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys.

B. Flux: ASTM B 813, water flushable.

C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.5 DIELECTRIC FITTINGS

A. Dielectric Unions:

1. Standard: ASSE 1079.
2. Pressure Rating: 150 psig (1035 kPa).
3. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Install domestic water piping level and plumb.

B. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

C. Install piping to permit valve servicing.

D. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

E. Install piping free of sags and bends.

F. Install fittings for changes in direction and branch connections.

G. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

D. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

3.3 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
   1. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

   1. Piping Inspections:

      a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
      b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

         1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
         2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

      c. Re-inspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for re-inspection.

   2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 221116

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.

1.2 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa) .

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

C. Adhesive Primer: ASTM F 656.

1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer 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."

D. Solvent Cement: ASTM D 2564.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Solvent cement 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."

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping at indicated slopes.

C. Install piping free of sags and bends.

D. Install fittings for changes in direction and branch connections.

E. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

F. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
   1. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
   2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

G. Install aboveground PVC piping according to ASTM D 2665.

H. Plumbing Specialties:
   1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.

I. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.2 JOINT CONSTRUCTION

A. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.3 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect drainage and vent piping to the following:

   1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.

3.4 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.5 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cleanouts.
   2. Floor drains.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Metal Floor Cleanouts :

   1. ASME A112.36.2M, Cast-Iron Cleanouts:

      a. 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:

         1) Josam Company.
         2) Oatey.
         3) Sioux Chief Manufacturing Co., Inc.
         4) Smith, Jay R. Mfg. Co.
         5) Tyler Pipe.
         6) Watts Drainage Products.
         7) Zurn Plumbing Products Group.

   2. Standard: ASME A112.36.2M for adjustable housing cleanout.
   3. Size: Same as connected branch.
   4. Type: Adjustable housing .
   5. Body or Ferrule: Cast iron .
   6. Clamping Device: Required.
   7. Outlet Connection: Inside calk .

8. Closure: Brass plug with straight threads and gasket .
9. Adjustable Housing Material: Cast iron with threads .
10. Frame and Cover Material and Finish: Polished bronze .
11. Frame and Cover Shape: Round .
12. Top Loading Classification: Heavy Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
14. Standard: ASME A112.3.1.
15. Size: Same as connected branch.
16. Housing: Stainless steel.
17. Closure: Stainless steel with seal.
18. Riser: Stainless-steel drainage pipe fitting to cleanout.

B. Cast-Iron Wall Cleanouts :

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. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.
    d. Tyler Pipe; Wade Div.
    e. Watts Drainage Products.
    f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure: Countersunk , brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
8. Wall Access: Round , nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

C. Plastic Floor Cleanouts :

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. Canplas LLC.
    b. IPS Corporation.
    c. NDS Inc.
    d. Plastic Oddities.
    e. Sioux Chief Manufacturing Company, Inc.
    f. Zurn Plumbing Products Group; Light Commercial Operation.

2. Size: Same as connected branch.
3. Body: PVC.
4. Closure Plug: PVC.

5. Riser: Drainage pipe fitting and riser to cleanout of same material as drainage piping.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains :

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. Commercial Enameling Co.
   b. Josam Company; Josam Div.
   c. MIFAB, Inc.
   d. Prier Products, Inc.
   e. Smith, Jay R. Mfg. Co.
   f. Tyler Pipe; Wade Div.
   g. Watts Drainage Products.
   h. Zurn Plumbing Products Group .

2. Standard: ASME A112.6.3 with backwater valve.
3. Pattern: Floor drain.
4. Body Material: Gray iron .
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom .
9. Backwater Valve: Drain-outlet type .
10. Coating on Interior and Exposed Exterior Surfaces: Not required .
11. Sediment Bucket: Not required .
12. Top or Strainer Material: Nickel bronze .
13. Top of Body and Strainer Finish: Nickel bronze .
14. Top Shape: Round .
15. Top Loading Classification: Medium Duty .
16. Funnel: Not required .
17. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
18. Trap Material: Cast iron .
19. Trap Pattern: Deep-seal P-trap .
20. Trap Features: Trap-seal primer valve drain connection .

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Floor-Drain, Trap-Seal Primer Fittings :

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 (DN 15) side inlet.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.

END OF SECTION 221319

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

1.2 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

C. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

A. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

2.4 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: Aluminum.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches (75 mm).
2. Thickness: 6.5 mils (0.16 mm).
3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

END OF SECTION 230713

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 PERFORMANCE REQUIREMENTS

A. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of the following products:
   1. Sealants and gaskets.

1.3 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. 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."

C. 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."

D. 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."

2.2 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

B. 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 (1524 mm) in Diameter: Flanged.

C. 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 (2286 mm) in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches (1830 mm) in width (major dimension) with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and 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."

2.3 SHEET METAL 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 Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90 (Z275).
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.4 SEALANT 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: 4 inches (102 mm) .
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
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 (2500 Pa), 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.

2.5 HANGERS AND SUPPORTS

A. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

B. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

B. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

C. 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.

D. 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."

3.2 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."

3.3 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

3.4 DUCT SCHEDULE

A. Supply Ducts:
   1. Pressure Class: Positive 2-inch wg (500 Pa) .
   2. Minimum SMACNA Seal Class: A.
   3. SMACNA Leakage Class for Rectangular: 12.
   4. SMACNA Leakage Class for Round and Flat Oval: 12.

B. Return Ducts:
   1. Pressure Class: Positive or negative 2-inch wg (500 Pa).
   2. Minimum SMACNA Seal Class: A.
   3. SMACNA Leakage Class for Rectangular: 12.
   4. SMACNA Leakage Class for Round and Flat Oval: 12.

C. Exhaust Ducts:
   1. Pressure Class: Negative 3-inch wg (750 Pa).
   2. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
   3. SMACNA Leakage Class for Rectangular: 12.
   4. SMACNA Leakage Class for Round and Flat Oval: 6.

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Manual volume dampers.
   2. Fire dampers.
   3. Flexible ducts.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product specified.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. 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.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

   1. Galvanized Coating Designation: G90 (Z275).
   2. Exposed-Surface Finish: Mill phosphatized.

B. Extruded Aluminum: Comply with ASTM B 221 (ASTM B 221M), Alloy 6063, Temper T6.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

   1. Standard leakage rating, with linkage outside airstream.
   2. Suitable for horizontal or vertical applications.
   3. Frames:

a. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet steel .
b. Mitered and welded corners.
c. Flanges for attaching to walls and flangeless frames for installing in ducts.

4. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized -steel, 0.064 inch (1.62 mm) thick.

5. Blade Axles: Galvanized steel .
6. Bearings:

a. Oil-impregnated bronze .
b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

7. Tie Bars and Brackets: Galvanized steel.

B. Jackshaft:

1. Size: 0.5-inch (13-mm) diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.4 FIRE DAMPERS

A. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.

B. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 2000-fpm (10-m/s) velocity.

C. Fire Rating: 1-1/2 and 3 hours.

D. Frame: Curtain type with blades inside airstream ; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.

E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.05 (1.3 mm) thick, as indicated, and of length to suit application.

2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

F. Mounting Orientation: Vertical or horizontal as indicated.

G. Blades: Roll-formed, interlocking, 0.024-inch- (0.61-mm) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.

H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

I. Heat-Responsive Device: Replaceable, 165 deg F (74 deg C) rated, fusible links.

J. Heat-Responsive Device:, resettable link and switch package, factory installed, 165 deg F (74 deg C) rated.

2.5 TURNING VANES

A. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

B. Vane Construction: Single wall for ducts up to 48 inches (1200 mm) wide and double wall for larger dimensions.

2.6 FLEXIBLE DUCTS

A. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 10 to plus 160 deg F (Minus 23 to plus 71 deg C).
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1 .

B. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches (75 through 460 mm), to suit duct size.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.

C. Set dampers to fully open position before testing, adjusting, and balancing.

D. Install fire and smoke dampers according to UL listing.

END OF SECTION 233300

SECTION 238113 - PACKAGED TERMINAL AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes packaged terminal air conditioners and their accessories and controls, in the following configurations:

1. Through-the-wall air conditioners.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, furnished specialties, electrical characteristics, and accessories.

1.3 QUALITY ASSURANCE

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

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged terminal air conditioners that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Sealed Refrigeration System: Manufacturer's standard, but not less than five years from date of Substantial Completion, including components and labor.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Description: Factory-assembled and -tested, self-contained, packaged terminal air conditioner with room cabinet, electric refrigeration system, heating, and temperature controls; fully charged with refrigerant and filled with oil; with hardwired chassis.

2.2 CHASSIS

A. Cabinet: 0.052-inch- (1.32-mm-) thick steel with removable front panel with concealed latches.

1. Mounting: Wall with wall sleeve.
2. Discharge Grille: Punched-louver discharge grille allowing four-way discharge-air pattern.
3. Louvers: Extruded aluminum with enamel finish; beige color.
4. Finish: Baked enamel.
5. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
6. Subbase: Enameled steel with adjustable leveling feet and adjustable end plates, with factory-installed and -wired, fused disconnect switch and receptacle sized for unit.
7. Wall Sleeves: Galvanized steel with polyester finish.

B. Refrigeration System: Direct-expansion indoor coil with capillary restrictor; and hermetically sealed scroll compressor with vibration isolation and overload protection.

1. Indoor and Outdoor Coils: Seamless copper tubes mechanically expanded into aluminum fins with capillary tube distributor on indoor coil.
2. Constant-pressure expansion valve.
3. Reversing valve.
4. Charge: R-410A.

C. Indoor Fan: Forward curved, centrifugal; with motor and positive-pressure ventilation damper with concealed manual operator.

D. Filters: Washable polyurethane in molded plastic frame.

E. Condensate Drain: Drain pan to direct condensate to outdoor coil for re-evaporation.

1. Comply with ASHRAE 62.1 for drain pan construction and connections.

F. Outdoor Fan: Propeller type with separate or driven by indoor fan motor.

2.3 HEATING

A. Electric-Resistance Heating Coil: Nickel-chromium-wire, electric-resistance heating elements with contactor and high-temperature-limit switch.

2.4 CONTROLS

A. Control Module: Unit-mounted digital panel with touchpad temperature control and with touchpad for heating, cooling, and fan operation. Include the following features:
1. Heat-Pump Ambient Control: Field-adjustable switch changes to heat-pump heating operation above 40 deg F (5 deg C) and to supplemental heating below plus 25 deg F (minus 4 deg C).
2. Reverse-Cycle Defrost: Solid-state sensor monitors frost buildup on indoor coil and reverses unit to melt frost.

B. Outdoor Air: Manual intake damper.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb, maintaining manufacturer's recommended clearances and tolerances.

B. Install wall sleeves in finished wall assembly; seal and weatherproof.

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Inspect for and remove shipping bolts, blocks, and tie-down straps.
2. After installing packaged terminal air conditioners and after electrical circuitry has been energized, test for compliance with requirements.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Packaged terminal air conditioners will be considered defective if they do not pass tests and inspections.

END OF SECTION 238113

SECTION 238323 - RADIANT-HEATING ELECTRIC PANELS

PART 1 - GENERAL

1.1 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.2 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace electric heating panels that fail in materials or workmanship within specified warranty period.

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

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR RADIANT-HEATING ELECTRIC PANELS

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

2.2 PREFABRICATED RADIANT-HEATING ELECTRIC PANELS

A. Description: Sheet-metal-enclosed panel with heating element suitable for surface mounting. Comply with UL 2021.

1. Panel: Minimum 0.0276-inch- (0.7-mm-) thick, galvanized sheet steel back panel riveted to minimum 0.0396-inch- (1.0-mm-) thick, galvanized sheet steel front panel with fused-on crystalline surface.
2. Heating Element: Powdered graphite sandwiched between sheets of electric insulation.
3. Heating Element: Insulated resistive wires.
4. Electrical Connections: Nonheating, high-temperature, insulated-copper leads, factory connected to heating element.
5. Exposed-Side Panel Finish: Factory prime coated, ready for field painting.
6. Surface-Mounted Trim: Sheet metal with baked-enamel finish in manufacturer's **standard** paint color as selected by Architect.

B. Wall Thermostat: Bimetal, sensing elements calibrated from 55 to 90 deg F (13 to 32 deg C); with contacts suitable for **line**-voltage circuit, and manually operated on-off switch with contactors, relays, and control transformers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install radiant-heating panels level and plumb.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operate electric-heating elements through each stage to verify proper operation and electrical connections.
2. Test and adjust controls and safeties.

B. Radiant-heating electric panels will be considered defective if they do not pass tests and inspections.

END OF SECTION 238323