



Coquina Beach
Beach Side Restroom Renovation
Manatee County, Florida

SECTION 07 11 16
CEMENTITIOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes cementitious dampproof coating on exterior side of CMU walls as substrate to exterior stucco finish.

1.2 SUBMITTALS

- A. Submit in accordance with Division 01 requirements.
- B. Product Data: Include data substantiating that materials comply with specified requirements for dampproofing material specified.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed bituminous dampproofing work similar in material, design, and extent to that indicated for Project and that has resulted in construction with a record of successful in-service performance.
- B. Single-Source Responsibility: Obtain primary dampproofing materials and primers from a single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

1.4 PROJECT CONDITIONS

- A. Substrate: Proceed with dampproofing work only after substrate construction and penetrating work have been completed. Starting work means acceptance of substrate.
- B. Weather: Proceed with dampproofing work only when existing and forecast weather conditions will permit work to be performed in accordance with manufacturer's recommendations.
- C. Ventilation: Provide adequate ventilation during application of solvent-based components in enclosed spaces. Maintain ventilation until dampproofing membrane has thoroughly cured.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Material for cementitious dampproof coating shall be cementitious material of a consistency suitable for application by troweling.
 - 1. Basis of Design: "Super Thoroseal" by Thoro Consumer Products, BASF Construction Chemicals, Cleveland, Ohio



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- B. Products from manufacturers are also acceptable provided compliance with all technical requirements as specified herein and as approved by the Architect.

PART 3 - EXECUTION

3.1 PREPARATION OF SUBSTRATE

- A. Clean substrate of projections and substances detrimental to work, including existing paint removal; complying with recommendations of manufacturer.
- B. Install cant strips and similar accessories as shown and as recommended by prime materials manufacturer even though not shown.
- C. Fill voids, seal joints, and apply bond breakers (if any) as recommended by prime materials manufacturer, with particular attention at construction joints.
- D. Install separate flashings and corner protection stripping as recommended by prime materials manufacturer, where indicated to precede application of dampproofing. Comply with details shown and manufacturer's recommendations. Give particular attention to requirements at building expansion joints, if any.
- E. Prime substrate as recommended by prime materials manufacturer.
- F. Protection of Other Work: Do not allow liquid and mastic compounds to enter and clog drains and conductors. Prevent spillage and migration onto other surfaces of work, by masking or otherwise protecting adjoining work.
- G. Before applying dampproofing, fill cracks, holes, voids, and open areas in surfaces. Surfaces shall be dry and free of dirt, grease, excess mortar, or other foreign matter that might interfere with adhesion and penetration of the coating. Surface shall be dry and free of dust or loose particles.

3.2 INSTALLATION

- A. Comply with manufacturer's recommendations for brushed application, except where more stringent requirements are indicated or specified and where project conditions require extra precautions or provisions to ensure satisfactory performance of work.
- B. Install in strict accordance with the manufacturers written installation instructions.
- C. Provide all items and accessories as required for a complete installation in every respect.

3.3 APPLICATION

- A. Apply in two (2) coats in strict accordance with the manufacturers written installation instructions.



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3.4 PROTECTION

- A. After the mastic has set, cover dampproofing mastic with a protective board course. As soon as solvents have left the mixture, apply one board layer over the entire surface of the mastic, holding in place with spots of additional mastic.

3.5 GENERAL INSTALLATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
- C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
- D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.
- E. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.
- F. Recheck measurements and dimensions, before starting each installation.
- G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
- H. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

END OF SECTION 07 11 16



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SECTION 07 21 00
BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following types of insulation:
1. Miscellaneous stuffing insulation.
 2. Kraft-faced batt insulation.
 3. High PSI rigid insulation

1.2 SUBMITTALS

- A. Submit in accordance with Division 1 requirements.
- B. Submit complete product data for each material proposed to be provided.
- C. Submit complete manufacturers installation instructions for each type of insulation as specified.
- D. Submit manufacturer's certificate certifying that insulation meets or exceeds specified requirements.

1.3 QUALITY ASSURANCE

- A. Insulation shall be legibly marked with the following data:
1. Its "R" value per inch and the mean test temperature
 2. The manufacturer's name
 3. The insulation type and its trade name
 4. Water vapor transmission (perm inch average)
 5. UL rating - flame spread, fuel contribution, smoke developed (ASTM E84 and D1692, latest edition)
- B. The "R" values indicated are for the insulation tested at 75 degrees F mean temperature. It shall be for the total thickness of the insulation and shall exclude surface resistance. Manufacturers shall certify that their insulation complies with these requirements.
- C. Insulation delivered to the job without this identification or being less efficient than the insulation specified will be rejected.
- D. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency. Comply with the provisions of the latest editions for the following codes, specifications, and standards:
1. Surface-Burning Characteristics: ASTM E 84.



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2. Combustion Characteristics: ASTM E 136.
- E. Toxicity/Hazardous Materials: Products containing urea-formaldehyde will not be permitted.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect plastic insulation as follows:
1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MISCELLANEOUS STUFFING INSULATION

- A. Shall be inorganic (nonasbestos) mineral wool insulation without facing, for the purpose of filling and stuffing openings in walls around pipes, structural components, conduits, expansion joints to eliminate noise transfer and to insulate. Use to seal top of interior walls, not fire rated walls, between masonry and roof deck, or as otherwise indicated. Use at expansion joints as detailed or as otherwise indicated. Insulation shall have a flame spread rating of 15 or less, and a smoke development rating of 0; per ASTM E84, latest edition. Approved manufacturers are as follows:
1. "Industrial Bulk Wool" packing wool fibers by Thermafiber Corporation, Wabash, Indiana; www.thermafiber.com/
 2. Rock Wool Manufacturing Company, Leeds, Alabama; www.deltainsulation.com/
 3. Roxul AFB, Milton, Ontario, www.roxul.com

2.2 FOIL-FACED BATT INSULATION

- A. Foil-faced preformed formaldehyde-free glass fiber batt insulation conforming to ASTM C665, Type III, Class B, Category 1. Foil facing shall have a perm rating of 0.5. Flame spread shall be 25, smoke developed 50 in accordance with ASTM E136 and ASTM C84. Approved manufacturers are as follows:
1. JohnsManville, Denver, Colorado; <http://www.jm.com/>
 2. Other manufacturers are acceptable provided they can provide a formaldehyde-free glass fiber batt insulation. Submit request for product approval at least 10 days prior to bid due date to the Architect.



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2.3 HIGH PSI RIGID INSULATION

- A. Extruded polystyrene rigid insulation shall conform to ASTM C578, latest edition, Type V, minimum 100 psi compressive strength. Board edges shall be tongue and groove. Thickness shall be 2" or as otherwise indicated. Minimum aged R value of 5.0 per inch. Approved manufacturers are as follows:
 - 1. Basis of Design: Dow Styrofoam Highload 100, Dow Chemical Corporation;
www.dow.com/styrofoam
- B. Products from manufacturers are also acceptable provided compliance with all technical requirements as specified herein and as approved by the Architect.
- C. Provide limited 15 year warranty that insulation's actual thermal resistance will not vary by more than ten percent from its published aged R-value.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare surfaces and areas to receive insulation material as required by the manufacturer. Do not install materials in unsatisfactory areas or to improperly prepared surfaces.

3.2 GENERAL INSTALLATION

- A. Coordinate application of insulation with the appropriate building trades involved.
- B. The installer doing the insulation work shall furnish adhesives or attaching means, if required, so that insulation material will be properly held in alignment and permanently attached to the surfaces which they are to be applied without damaging surface.
- C. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- D. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- E. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.
- F. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- G. Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.



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- H. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.3 MINERAL WOOL INSULATION

- A. Where the Drawings call for interior walls to extend to deck or roof, openings in walls between rooms above the ceiling shall be sealed with mineral wool placed or stuffed in openings to eliminate noise transfer and air movement. Mineral wool insulation shall be provided at other building locations indicated or requiring minor fill to eliminate air movement.
 - 1. Also use mineral wool stuffing at the transition between rigid and semi-rigid insulations where the GWB ends within the interstitial space above the ceiling on exterior tilt wall applications

3.4 BATT INSULATIONS

- A. Install in areas as indicated. Install in strict accordance with the manufacturers written installation instructions. Install in all exterior wall voids, behind beams, and concealed locations in the exterior walls and roof areas of the building whether or not indicated. All gaps shall be filled with batt insulation.
- B. Install thermal insulation as follows:
 - 1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches o.c.
 - 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 - 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw attach short flange of furring channel to web of attached channel. Start from this furring channel with standard width insulation panel and continue in regular manner. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
 - 4. Until gypsum board is installed, hold insulation in place with 10-inch staples fabricated from 0.0625-inch (16-gage)-diameter tie wire and inserted through slot in web of member.
- C. Kraft-faced batt insulation shall be taped and sealed continuous and full height at all locations. The kraft-face forms the vapor barrier. Seal all penetrations and overlap side laps of kraft-face to form a continuous vapor barrier.
- D. All voids in the perimeter of the building shell shall be filled and closed with batt insulation or miscellaneous mineral wool stuffing insulation, whether or not indicated or shown. This includes behind all steel beams, wide flange beams, channels, CMU, miscellaneous framing, etc.



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3.5 RIGID INSULATIONS

- A. Install with adhesive as recommended by the manufacturer with all edges butted tightly. Gaps greater than 1/16" will not be allowed. Seal all edges with sealant as recommended by the manufacturer. Install in strict accordance with the manufacturers written installation instructions.

3.6 CLEAN UP

- A. Clean up all wrappings, scrap, and cut material waste at the end of each day's work. Refer to Section 01 74 13 for additional requirements.

3.7 GENERAL INSTALLATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
- C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
- D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.
- E. Recheck measurements and dimensions, before starting each installation.
- F. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

3.7 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00



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SECTION 07 40 13
PREFORMED METAL ROOFING AND SIDING

PART 1 - GENERAL

1.1 SUMMARY

- A. Preformed metal roofing, siding and soffit panels with related Work as specified herein, and as required for a complete and watertight installation. Work under this Section includes, but is not limited to:
 - 1. Metal roofing, siding and soffit panels.
 - 2. Flashing, closures, and cap trim.
 - 3. Vent roof jacks.
 - 4. Clips, accessories, and fasteners.
 - 5. Sealants for components under this Section.
 - 6. Membrane underlayment.
- B. Related Sections: Section 07 60 00 - Flashing and Sheet Metal for metal fascias wrapped over pressure treated wood.

1.2 SUBMITTALS

- A. Submit complete manufacturer prepared shop drawings for approval in accordance with Division 1 requirements. Shop drawings shall show profile and gage of items, location and type of fasteners; location, gage, shape, and method of attachment of trim; and other details as may be required for a weathertight installation.
 - 1. Do not proceed with manufacture prior to review of shop drawings. Do not use Drawings prepared by Architect for shop or erection drawings.
 - 2. Shop drawings shall show methods of erection, elevations, and plans of roof panels, sections, and details, anticipated loads, flashings, roof curbs, vents, sealants, interfaces with materials not supplied, and proposed identification of components parts and their finishes.
- B. Submit 3 copies of appropriate color selection materials.
- C. Submit pre-roofing conference meeting minutes.
- D. Submit warranties as specified herein.

1.3 QUALITY ASSURANCE

- A. Applicable standards – Comply with the provisions of the latest editions for the following codes, specifications, and standards:
 - 1. AISC: "Steel Construction Manual," American Institute of Steel Construction.
 - 2. AISI: "Cold Form Steel Design Manual," American Iron and Steel Institute.
 - 3. ASTM A792-AZ55: "Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy- Coated by the Hot-Dip Process."



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4. ASTM E 1680: "Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Systems."
 5. ASTM E 1646: "Standard Test for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Differential."
 6. ASTM A 653: "Standard Specifications for Steel Sheet, Zinc-Coated (Galvanized) Steel or Zinc-Iron Alloy-Coated (Galvanized) by Hot-Dip Process."
- B. **Manufacturer's Qualifications:** Manufacturer shall have a minimum of 10 years successful experience in manufacturing panels of this nature, in a permanent, stationary, indoor production facility.
- C. **Installer's Qualifications:** Installer shall have been actively installing the type of metal roofing, siding and soffit panel systems defined in these Specifications for a minimum of 5 years and be approved by the manufacturer of the system being installed.
- D. **Design:** The preformed metal roof system shall be designed to sustain the specified loads in accordance with governing building codes in the county and state which this Project is located in. Components of the preformed metal roof system shall meet the design loads and applied in load combinations as specified in governing building codes, without exceeding the allowable working stresses.
1. The wind load design shall be based upon the requirements of ASCE/SEI 7, latest edition with the wind velocity as indicated on the Structural Drawings.
 2. UL580 Class 90 - Uplift Test
 3. UL 2218 - Class 4 Impact Resistance
- E. When tested in accordance with ASTM E 1680 and ASTM E 1646, the roof panel assembly shall show no more than 0.01 cfm/ft² of air infiltration at 6.24 psf test pressure and no water leakage at 12 psf test pressure for 15 minutes with a volume spray of 5 gallons per hour.
- F. **Structural:** Uniform load capacity shall be determined by testing in accord with the principles of ASTM E 330 adapted to testing of formed sheet panels by clarifying specific sections of this standard as follows:
1. Roof test specimens shall be representative of the main body of the roof, free from influence of perimeter conditions. The setup shall be continuous over one or more supports and contain at least 5 panel widths.
 2. No roof attachments are permitted at the sides other than the standard gable or rake condition. For uplift tests, at least one end seal shall be flexible and in no way restrain the crosswise distortion of panels. One end may simulate an eave condition if at least 12 feet away from the mid-roof clip under evaluation.
 3. Roofing panels and accessories shall be production material of the same type and thickness proposed for use on the Project.
 4. Longitudinal seals or plastic film shall not span any crevice or cracks that may tend to separate under pressure (e.g. plastic films used to seal the chamber must be applied into the side seam of the panel so as to apply a uniform static pressure to the entire cross section of the panel).
 5. Design capacity for conditions of gage, span or loading other than those tested may be determined by the interpolation of test results in accord with the AISI Cold Formed Steel Manual. Extrapolation outside the range of the tests is not



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acceptable. In addition to the clarified ASTM 330 testing, the system, as installed, shall carry an Underwriters Laboratory Wind Uplift Class 90 rating in addition to and not in lieu of other performance criteria set forth by this specification.

- G. Weathertightness: When tested in accord with the principles of NAAM TM-1, the roof system without sealant in the ribs shall show no leakage when exposed to dynamic rain and wind velocity up to 70 mph for 5 minutes.
- H. Thermal Cycle Test: An assembly consisting of clips, 3 or more panels in width, and spanning 3 or more supports with clips positively loaded to 10 pounds shall resist 100,000 thermal cycles and show no visible signs of wear from the exterior and erode no more than 25 percent of the panel of clip material from the underside (non-exposed surfaces).
- I. Roof and siding system shall comply with ASTM E 1592, "Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference", latest edition.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver panels to job site properly packaged to provide against transportation damage.
- B. Handling: Exercise extreme care in unloading, storing, and erecting panels to prevent banding, warping, twisting, and surface damage.
- C. Storage: Store materials and accessories above ground on well skidded platforms. Store under waterproof covering. Provide proper ventilation to panels to prevent condensation build-up between panels.

1.5 JOB CONDITIONS

- A. Pre-Roofing Conference: Before installation of the roofing and associated work, meet at the Project site with the installer, the installer of each component of associated work, the installers of deck or substrate construction to receive roofing work, the installers of other work in and around roofing that must follow the roofing work (including Mechanical Work), the Architect, and other representatives directly concerned with performance of the work, including (where applicable) insurers, test agencies, product manufacturers, governing authorities, and the Owner. Record (by Contractor) the discussions of the conference and the decisions and agreements (or disagreements) reached and furnish a copy of the record to each party attending. Review foreseeable methods and procedures related to the roofing work including, but not necessarily limited to, the following:
 - 1. Review Project requirements (Drawings, Specifications, and other Contract Documents).
 - 2. Review required submittals, both completed and yet to be completed.
 - 3. Review status of substrate work (not by the Metal Roofing Installer), including drying, structural loading limitations, and similar considerations.
 - 4. Review required inspection, testing, certifying, and accounting procedures.



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5. Review regulations concerning code compliance, environmental protection, health, safety, fire, and similar considerations.
6. Consider each party's extant judgment, as advanced in the interest of successful completion of Work.

1.6 WARRANTY

- A. General: Guarantees/warranties shall include, but not be limited to, preformed metal roofing, fascias, roof insulations, flashings, cap flashings, closures and trims, fasteners, accessories, sealants, gutters, and watertight connection to downspouts.
 1. Guarantee/warranty period shall begin on the Date of Substantial Completion for the Project or such date that the roof is accepted by the Architect and Owner.
- B. Installer's Material and Workmanship Warranty: The Contractor shall furnish to the Owner a written guarantee covering the roofing, siding, soffit and flashing work including the installation of products furnished by others and installed under this Section of the Work against defects in materials and workmanship for indicated warranty period. Guarantees are not intended to serve as protection against poor workmanship or inferior or improper materials at the time the roof is installed, but are for the purpose of protecting the Owner against future failures during the intended life of the roof covering.
 1. Warranty Period: 5 years from Date of Substantial Completion.
- C. Manufacturer's Finish Warranty: Preformed metal roofing manufacturer shall furnish to the Owner a written guarantee covering the finish of exposed coated metal surfaces against blistering, peeling, cracking, flaking, checking, chipping, rusting, and excessive chalking and color change for indicated warranty period.
 1. Warranty Period: 20 years from Date of Substantial Completion.
- D. Manufacturer's Weathertightness Warranty: Provide manufacturer's weathertightness warranty equal to Industry Standard weathertightness warranty for indicated warranty period.
 1. Repairs required, either permanent or temporary, to preformed metal roofing or roof flashings under this guarantee to keep the roof watertight shall be started within 3 days after notice of the need for repairs. Should the Contractor fail to make such repairs within a reasonable time period, the Owner may have such repairs made and charge the cost to the Contractor.
 2. Warranty Period: 20 years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Roof Panel Basis of Design: 5-V Crimp Metal Roof Panel as manufactured by McElroy Metals, Inc., Bossier City, Louisiana; www.mcelroymetal.com



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- B. Wall and Soffit Panel Basis of Design: Marquee-Lok Metal Wall and Soffit Panel as manufactured by McElroy Metals, Inc., Bossier City, Louisiana; www.mcelroymetal.com
- C. Products of other manufacturers will be considered providing their products equal or exceed the quality specified; and they can provide products of the type, size, function, and arrangement required and as approved by the Architect.
- D. Finish to be factory applied one mil thick full strength Kynar 500 fluorocarbon based coating over thoroughly cleaned and pretreated galvanized coated steel in single custom color as selected by the Architect. Coating to be applied before fabrication of roofing components.
- E. Metal sheets or coils selected for forming into panels must be cut to size before receipt of finish coating or have cut edges specially coated with similar film of same applied finish after being sized. Actual finish and coating method intended for provision must appear on submitted shop drawings.

2.2 MATERIALS – ROOF PANELS

- A. Panels shall be fabricated in full lengths from ridge to eave without end laps. Panels shall be 24 inches wide maximum with exposed anchors that resist wind uplift yet permit expansion and contraction with temperature changes. Individual panels shall be removable for replacement of damaged material. Panels shall be prefinished 50 ksi steel per ASTM A 792, latest edition, ("Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process") in 26 gauge minimum.
 - 1. 24 gauge "Galvalume" panels finished with full strength Kynar 500 coating as specified above are acceptable.
 - 2. Galvalume sheet shall be produced in accordance with ASTM A792/A792M and shall have a coating designation of AZ 50.
 - 3. Provide regular spangle surface without chemical treatment.
 - 4. Oil coating shall be kept at a minimum. Clean panels of all oil before shipment.
 - 5. Use clean, dry gloves during handling and installation.
 - 6. Care shall be exercised to prevent the roofing panels from sliding over each other during shipment and installation.
- B. Exposed fasteners shall be self tapping, stainless steel screws designed for substrate roof system will be attached to. Provide self drilling, self tapping screws where required by conditions.
- C. Roofing panels shall be manufactured in continuous lengths to eliminate perpendicular panel end laps. End laps will not be allowed.
- D. Roof System Accessories:
 - 1. Ridge Cap:
 - a. Closure strips formed to fit the roof panel profile shall be provided as required. The closure shall be closed cell "EPDM" synthetic rubber or factory formed metal closure to match roofing panel, or manufacturer's standard watertight detail and components.



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- c. Extrudable sealant, nondrying (but skinning) and nonmigratory synthetic elastomer base material, conforming to the performance requirements of Federal Specification TT-C-598-b Type 1. Use at the following locations:
 - 1) Sealing ridge channels.
 - 2) Sealing exposed seams, butts, and laps at roof curbs.
4. Pipe Flashings: Provide (ethylene propylene diene monomer) rubber flashings for vent pipe penetrations in metal roof. Provide clamping rings, sealant, and fasteners as recommended by manufacturer.
5. Membrane Underlayment: Provide one of the following:
 - a. "WinterGuard HT," CertainTeed Corp., Valley Forge, Pennsylvania.
 - b. "Grace Ultra," Grace Construction Products, Cambridge, Massachusetts; www.grace.com
 - c. "TW Metal and Tile Underlayment," Tamko Roofing Products, Joplin, Missouri; www.tamko.com
6. Provide manufacturers standard valley flashing for valleys. Gauge and finish shall match roof panels as a minimum. All valleys shall be watertight and shall be included in the manufacturer's standard roof watertightness warranty. Provide all items as required for a complete installation in every respect.
7. Provide all required accessories necessary for a complete enclosed roof system.

2.3 MATERIALS – WALL AND SOFFIT PANELS

- A. Wall Panels: Shall be roll formed, 12 inches wide by 1 inch deep with flat smooth faces with concealed fasteners. Provide full length pieces formed of 22 gauge Galvalume steel with full strength Kynar 500 coating. Color selected by the Architect.
- B. Soffit Panels: Shall be roll formed, 12 inches wide by 1 inch deep with flat smooth faces with concealed fasteners. Provide full length pieces formed of 24 gauge Galvalume steel with full strength Kynar 500 coating. Color selected by the Architect.
 1. Provide full perforated panels per code for ventilation in the soffits.
- C. Panels are to be manufactured "cut to length," eliminating need for field cutting
- D. Metal Flashings and Closures: Shall be factory formed to configurations indicated on the Drawings from the same type and gauge material as the panels.
- E. Fasteners: Shall be self tapping screws, concealed wherever possible. Type, length, quantity, and location of fasteners shall be as recommended by the manufacturer. Indicate fastening on shop drawings.
- F. Protective Coating: Similar "Peelcote" plastic strippable coating shall be applied to finished surfaces.
- G. Provide all required accessories necessary for a complete wall and soffit system.



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PART 3 - EXECUTION

3.1 INSTALLATION

- A. Substrate shall be completely secured and free of dirt and debris.
- B. The Contractor shall give written notice to the Architect of defects in substrate that would be detrimental to metal roofing installation before start of Work.
- C. Start of metal roofing, siding and soffit installation shall constitute acceptance of substrates by the Contractor.
- D. Membrane Roof Underlayment: Install completely over plywood substrate..

3.2 METAL ROOFING INSTALLATION

- A. Erection of the preformed metal roofing system shall be performed in accordance with the manufacturer's erection drawings and in strict accordance with the panel manufacturer's written instructions.
- B. Preformed metal roofing and fascia work shall be watertight and weathertight, lines and angles sharp and true, plain surfaces free from waves and buckles. Workmen shall be experienced in the trade and thoroughly capable of performing the Work in accordance with these requirements.
- C. Fasteners are to be concealed wherever possible. Exposed fasteners shall be stainless steel painted to match.
- D. Brake formed cap, trim, closure, and flashing sections are to be furnished with a minimum of joints.
 - 1. Brake formed members with exposed corner intersections shall have corner pieces shop fabricated. Other miscellaneous trim corners may be field cut, mitered, or butted.
 - 2. Trim shall be of the same material as, and have a finish to match, the metal roofing panels.
- E. Install roof jacks at pipe penetrations in metal roofing and roof curbs at all roof mounted equipment indicated on the Drawings. Provide required fastened, foam rods, plastic cement, and other sealant or material to provide watertight and weathertight construction.
- F. Use appropriate clips, fasteners, braces, and anchors as indicated on the Drawings and any other items required for a complete installation and as recommended by manufacturer.
- G. Make repairs and perform additional work necessary to provide a roof watertight and acceptable to the Architect prior to start of roofing guarantee.
- H. The installation shall be designed to safely resist the positive and negative loads.



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- I. Roof panel and flashing attachments shall be designed to accommodate the thermal expansion and contraction of the exterior material through a total of 150 degrees F. temperature change.
- J. Factors of safety on design loads to ultimate strength of fasteners shall be as stated in the industry standard for the material into which the fastener is driven.
 - 1. AISI for steel
- K. Provide all items and accessories as required for a complete installation in every respect.

3.3 METAL WALL AND SOFFIT PANEL INSTALLATION

- A. Preformed metal siding and soffit work shall be watertight and weathertight, lines and angles sharp and true; plain surfaces free from waves and buckles. Workmen shall be experienced in the trade and thoroughly capable of performing the Work in accordance with these requirements.
- B. Exposed fasteners are to be colored to match material they are attaching.
- C. Brake formed sill, trim, and closure sections are to be furnished with a minimum of butt joints. Where butt joints occur, provide concealed splice plates with sealant to insure watertightness while allowing for movement from thermal expansion and contraction.
- D. Install panels and accessories in strict accordance with the panel manufacturer's written instructions and the shop drawings. Attach panels to framing members per the manufacturer's written instructions. Show connections and method of installation on the shop drawings.

3.4 GENERAL INSTALLATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
- C. Inspect materials or equipment immediately upon delivery and again before installation. Reject damaged and defective items.
- D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.
- E. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.



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- F. Recheck measurements and dimensions, before starting each installation.
- G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

END OF SECTION 07 40 13



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SECTION 07 60 00
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Metal wall flashing.
 2. Flexible flashing system.
 3. Exposed metal trim/fascia units.
 4. Miscellaneous sheet metal accessories.
 5. Sealants and bonding agents between components of this Section and between the roof and other materials.
- B. Provide all accessories and items essential for the completeness of the sheet metal installation. Such items, unless otherwise shown on the Drawings or specified, shall be the same kind of materials as the item to which applied. Nails, screws, and bolts shall be of the types suited for the purpose intended, and shall be compatible with the metal to which it will contact.
- C. Forming and assembling of sheet metal components shall be performed using methods that will not void the manufacturer's finish warranties.
- D. All flashing and sheet metal items shall be provided and installed to provide for a complete watertight and weathertight installation in every respect.

1.2 SUBMITTALS

- A. Submit in accordance with Division 1 requirements.
- B. Product Data, Flashing, Sheet Metal, and Accessories: Manufacturer's technical product data, installation instructions and general recommendations for each specified sheet material and fabricated product.
- C. Samples of the following flashing, sheet metal, and accessory items:
1. 8-inch-square samples of specified sheet materials to be exposed as finished surfaces.
 2. 12-inch-long samples of factory-fabricated products exposed as finished work. Provide complete with specified factory finish.
- D. Shop drawings showing layout, profiles, methods of joining, and anchorages details. Provide plan layouts at 1/4-inch scale and details at 3-inch scale, for all sheet metal pieces and accessories.



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1.3 QUALITY ASSURANCE

- A. Except as otherwise shown on Drawings or specified, the workmanship of sheet metal work, method for forming joints, anchoring, cleating and provisions for expansion shall conform to the standard details and recommendations of the Copper and Brass Research Association; and workmanship shall be of the best quality, in accordance with best trade practice and the recommendations and specifications of the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).
- B. Where pre-engineered manufactured systems are specified, other field fabricated or shop fabricated substitutions will not be accepted.
- C. All sheet metal flashings shall conform to the criteria of SMACNA "Architectural Sheet Metal Manual" whether or not detailed as such.
- D. Fabricator and installer shall be a company specializing in sheet metal work and installation with five (5) years documented experience.

1.4 PROJECT CONDITIONS

- A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

1.5 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- C. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.



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1.6 GUARANTEE

- A. The equipment support curbs shall be guaranteed to be free from defects in materials and workmanship for a period of fifteen (15) years from the Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The type and locations of the various kinds, gages, thickness, and finish of sheet metal to be used is specified hereinafter under the individual items. Where sheet metal is indicated on Drawings and kind or type of metal is not definitely specified, sheet metal shall match the type as used on the rest of the project.
- B. Stainless Steel: AISI Type 316L, complying with the latest edition of ASTM A 167, 2D annealed finish, soft, except where harder temper required for forming or performance; 0.0156-inch thick (28 gauge) except as otherwise indicated.
- C. Lead: ASTM B 749, latest edition, Type L51121, copper-bearing sheet lead, minimum 4 lb/sq ft (0.0625-inch thick) except not less than 6 lb/sq ft (0.0937-inch thick) for burning (welding) unless otherwise indicated.
- D. Flexible Flashing System: Bituthene® 3000 composite membrane with a thickness of 1.5mm (0.060 in), consisting of 1.4mm (0.056 in.) of rubberized asphalt and 0.1 mm (0.004 in.) of cross laminated, high density polyethylene film. It is self-adhesive and cold applied, used with Bituthen Primers.
 1. Install over existing floor slab and turned up 24 inches to terminate at existing CMU walls per Drawings.
- E. Metal termination bar shall be 1/8 inch by one inch aluminum bar. Used to terminate flexible flashing system.
- F. Shop fabricated aluminum fascia shall be fabricated to configurations indicated on the Drawings.
 1. Fabricate from nominal, .060 inch thick aluminum sheet.
 2. Fascia shall be provided with concealed splice plates for joints 10 feet on center.
 3. Provide air-dried Kynar finish, shop applied. Color selected by the Architect.

2.2 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Solder: For use with steel or copper, provide 50 - 50 tin/lead solder (ASTM B 32, latest edition), with rosin flux.
- B. Solder: For use with stainless steel, provide 60 - 40 tin/lead solder (ASTM B 32, latest edition), with acid-chloride type flux, except use rosin flux over tinned surfaces.



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- C. Fasteners: Same metal as flashing/sheet metal or other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
- D. Bituminous Coating: SSPC - Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
- E. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, non-drying, nonmigrating sealant.
- F. Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed and complying with requirements for joint sealants as specified in Section 07 92 00, Sealants and Caulking.
- G. Epoxy Seam Sealer: 2-part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior nonmoving joints including riveted joints.
- H. Adhesives: Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.
- I. Paper Slip Sheet: 5-lb. rosin-sized building paper.
- J. Polyethylene Underlayment: Minimum 6-mil carbonated polyethylene film resistant to decay when tested in accordance with ASTM E 154, latest edition.
- K. Reglets: Metal or plastic units of type and profile indicated, compatible with flashing indicated, noncorrosive.
- L. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.
- M. Elastic Flashing Filler: Closed-cell polyethylene or other soft closed-cell material recommended by elastic flashing manufacturer as filler under flashing loops to ensure movement with minimum stress on flashing sheet.
- N. Roofing Cement: ASTM D 4586, latest edition, asbestos-free.
- O. Flux: Use resin type flux for pretinned surfaces.

2.3 FABRICATION

- A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for



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forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

- B. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges to be seamed, form seams, and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.
- C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- D. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.
- E. Separations: Provide for separation of metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

PART 3 - EXECUTION

3.1 INSPECTION

- A. The Installer must examine substrates and conditions under which metal flashings will be installed, and notify Contractor in writing of unsatisfactory conditions. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 PREPARATION

- A. Separate dissimilar metals from each other by painting each metal surface in area of contact with a heavy application of bituminous coating.

3.3 INSTALLATION REQUIREMENTS

- A. General: Comply with recommendations with SMACNA "Architectural Sheet Metal Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.
- B. Install work with provisions for thermal expansion of flashings, gravel stops, and other items exposed for more than 15 feet continuous length. Maintain a watertight installation at expansion seams. Locate expansion seams where shown, or if not shown, in conformance with applicable recommendations of "Architectural Sheet Metal Manual" by SMACNA.



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- C. Sheet metal work shall be watertight and weathertight; lines, arises, and angles sharp and true; plain surfaces free from waves and buckles. Workmen shall be experienced in the trade and thoroughly capable of performing the Work in accordance with these requirements.
- D. Underlayment: Where stainless steel is to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper and a course of polyethylene underlayment.
- E. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.
- F. Install flexible flashing in accordance with manufacturer's recommendations. Where required, provide for movement at joints by forming loops or bellows in width of flashing. Locate cover or filler strips at joints to facilitate complete drainage of water from flashing. Seam adjacent flashing sheets with adhesive, seal and anchor edges in accordance with manufacturer's recommendations.
- G. Flashing at Roof Penetrations (Miscellaneous)
 - 1. Work under this Section shall include the flashing of roof penetrations not otherwise specified under other Sections.
 - 2. Flashing at roof penetrations not detailed on the Drawing shall be performed according to the recommendations and specifications of the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA), subject to approval by the Architect.
- H. Aluminum Fascia
 - 1. Aluminum fascia to be wrapped over pressure treated wood in configuration as indicated on the drawings.
 - 2. Joints and splices shall be installed with sealant materials as required for watertight installation.
 - 3. Fasteners and accessories shall be as recommended for proper installation.

3.4 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.
- B. Protection: Advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of Substantial Completion.

3.5 GENERAL INSTALLATION PROVISIONS

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



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- B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
- C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
- D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.
- E. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.
- F. Recheck measurements and dimensions, before starting each installation.
- G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

END OF SECTION 07 60 00



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SECTION 07 92 00
SEALANTS AND CAULKING

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide labor, materials, and equipment necessary to complete sealant work, both interior and exterior of the Project. The extent of each type of sealant and caulking work is indicated on the Drawings and specified herein.
1. Work of this Section is to be subcontracted to a single firm specializing in sealant and caulking installation.
 2. Install in exterior joints in vertical surfaces and non-traffic horizontal surfaces as indicated below:
 - a. Joints between different materials listed above.
 - b. Perimeter joints between materials listed above and frames of doors and windows.
 - c. Control and expansion joints in ceiling and overhead surfaces.
 - d. Other joints as indicated or required.
 3. Install in exterior joints in horizontal traffic surfaces as indicated below:
 - a. Control, expansion, and isolation joints in cast-in-place concrete slabs.
 - b. Other joints as indicated or required.
 4. Install in interior joints in vertical surfaces and horizontal non-traffic surfaces as indicated below:
 - a. Perimeter joints of exterior openings where indicated.
 - b. Joints between tops of non-load-bearing unit masonry walls and underside of cast-in-place concrete slabs and beams.
 - c. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
 - d. Perimeter joints between interior wall surfaces and frames of interior doors, and windows.
 - e. Other joints as indicated or required.
 5. Install in interior joints in horizontal traffic surfaces as indicated below:
 - a. Control and expansion joints in cast-in-place concrete slabs.
 - b. Other joints as indicated or required.
 6. The Work of this Section also includes the preparation of the sealant joint substrates and the installation of the sealant joint backings.
- B. Surface Hardness: Provide types of sealant to withstand anticipated abrasive or possible indentation as recommended by manufacturer.
- C. Compatibility: Provide materials that are compatible with the joint surfaces, joint fillers, and other materials in the joint system.



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- D. VOC limits for sealants and adhesives.

1.2 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide interior and exterior elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.
- B. Provide joint sealants for interior applications that have been produced and installed to establish and maintain airtight continuous seals that are water resistant and cause no staining or deterioration of joint substrates.

1.3 SUBMITTALS

- A. Submit in accordance with Division 1 requirements.
- B. Product data from manufacturers for each joint sealant product required.
 - 1. Certification by joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.
 - a. Refer to Section 09 68 00 Series for VOC limits with regards to adhesives for use with carpet products
 - b. Refer to Section 09 91 00 Series for VOC limits with regards to paints and coatings
- C. Samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.
- D. Samples for verification purposes of each type and color of joint sealant required. Install joint sealant samples in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- E. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.
- F. Qualification data complying with requirements specified in "Quality Assurance" article. Include list of completed projects with project names addresses, names of Architects and Owners, plus other information specified.
- G. Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.



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- H. Product test reports for each type of joint sealants indicated, evidencing compliance with requirements specified based on comprehensive testing of current product formulations.
- I. Pre-construction field test reports indicating which products and joint preparation methods demonstrate acceptable adhesion to joint substrates.
- J. Submit sealant warranties as specified herein.

1.4 QUALITY ASSURANCE

- A. Obtain elastomeric materials only from manufacturers who will, if required, send a qualified technical representative to project site for the purpose of advising the Installer of proper procedures and precautions for the use of the materials.
- B. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.
 - 1. Shall be a sealant and caulking subcontractor with a minimum of 5 years of successful experience in the application of the types of materials required, and who agrees to employ only skilled tradesmen for the Work.
- C. Testing Laboratory Qualifications: To qualify for acceptance, an independent testing laboratory must demonstrate to Architect's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E 699, latest edition, that it has the experience and capability to conduct satisfactorily the testing indicated without delaying progress of the Work.
- D. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.
- E. Preconstruction Compatibility and Adhesion Testing: Submit joint sealant manufacturers samples of materials that will contact or affect joint sealants for compatibility and adhesion testing as indicated below:
 - 1. Use test methods standard with manufacturer to determine if priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - a. Perform tests under normal environmental conditions that will exist during actual installation.
 - 2. Submit not less than 9 pieces of each type of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.
 - 3. Schedule sufficient time for testing and analysis of results to prevent delay in the progress of the Work.
 - 4. Investigate materials failing compatibility or adhesion tests and obtain joint sealant manufacturer's written recommendations for corrective measures, including use of specially formulated primers.
 - 5. Testing will not be required when joint sealant manufacturer is able to submit joint preparation data required above that are acceptable to Architect and are based



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on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

F. Product Testing: Provide comprehensive test data for each type of joint sealant based on tests conducted by a qualified independent testing laboratory on current product formulations within a 24-month period preceding date of Contractor's submittal of test results to Architect.

1. Test elastomeric sealants for compliance with requirements specified by reference to ASTM C 920. Include test results for hardness, stain resistance, adhesion and cohesion under cyclic movement (per ASTM C 719), low-temperature flexibility, modulus of elasticity at 100 percent strain, effects of heat aging, and effects of accelerated weathering.
2. Include test results performed on joint sealants after they have cured for 1 year.
3. VOC Limits (Regulation 8, Rule 51 of the Bay Area Air Quality Management District. www.baaqmd.gov):

a. Sealants

1)	Architectural	250 g/L
2)	Roadways	250 g/L
3)	Roofing Material Installation	450 g/L
4)	PVC Welding	480 g/L
5)	Other	420 g/L

b. Sealant Primers:

1)	Architectural (Non-Porous)	250 g/L
2)	Architectural (Porous)	775 g/L
3)	Other	750 g/L

4. VOC Limits (South Coast Air Quality Management District Rule 1168. <http://www.aqmd.gov/rules>):

a. Adhesives (Welding and Installation):

1)	Non-Vinyl Backed Installation	150 g/L
2)	Carpet Pad Installation	150 g/L
3)	Wood Flooring Installation	150 g/L
4)	Ceramic Tile Installation	130 g/L
5)	Dry Wall and Panel Installation	200 g/L
6)	Subfloor Installation	200 g/L
7)	Rubber Floor Installation	150 g/L
8)	VCT and Asphalt floor tile installation	150 g/L
9)	PVC Welding	510 g/L
10)	CPVC Welding	490 g/L
11)	ABS Welding	400 g/L
12)	Plastic Cement Welding	350 g/L
13)	Cove Base Installation	150 g/L
14)	Adhesive Primer for Plastic	650 g/L
15)	All Others	250 g/L



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b. Adhesives (Substrates)

1)	Metal to Metal	30 g/L
2)	Plastic Foams	120 g/L
3)	Porous Material Except Wood	120 g/L
4)	Wood	30 g/L
5)	Fiberglass	200 g/L

G. Preconstruction Field Testing: Prior to installation of joint sealants, field-test their adhesion to joint substrates as follows:

1. Locate test joints where indicated or, if not indicated, as directed by Architect.
2. Conduct field tests for each application indicated below:
 - a. Each type of elastomeric sealant and joint substrate indicated.
 - b. Each type of non-elastomeric sealant and joint substrate indicated.
3. Notify Architect one week in advance of the dates and times when mock-ups will be erected.
4. Arrange for tests to take place with joint sealant manufacturer's technical representative present.
5. Test Method: Test joint sealants by hand pull method described below:
 - a. Install joint sealants in 5-foot joint lengths using same materials and methods for joint preparation and joint sealant installation required for completed Work. Allow sealants to cure fully before testing.
 - b. Make knife cuts horizontally from one side of joint to the other followed by 2 vertical cuts approximately 2 inches long at side of joint and meeting horizontal cut at top of 2-inch cuts. Place a mark 1 inch from top of 2-inch piece.
 - c. Use fingers to grasp 2-inch piece of sealant just above 1-inch mark; pull firmly down at a 90-degree angle or more while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
 - d. For joints with dissimilar substrates, check adhesion to each substrate separately. Do this by extending cut along one side, checking adhesion to opposite side, and then repeating this procedure for opposite side.
6. Report whether or not sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
7. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.



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1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
- B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
 - 8. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
 - 9. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer or below 40 deg F (4.4 deg C).
 - 10. When joint substrates are wet.
 - 4. Where joint widths are less than allowed by joint sealant manufacturer for application indicated.
 - 5. Until contaminants capable of interfering with adhesion are removed from joint substrates.
- B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.
- D. Preparation of joint surfaces, backing, and the conditions under which the sealant and caulking is to be installed shall conform to manufacturer's recommendations.
 - 1. Use of bond break tape is prohibited without the expressed permission of the Architect. Each situation will be evaluated with regard to inability to properly use backer rod to prevent adhesion.

1.7 SEQUENCING AND SCHEDULING

- A. Sequence installation of joint sealants to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

1.8 WARRANTIES

- A. All exterior and building envelope weathertight and watertight sealants shall be warranted by the sealant manufacturer for a period of twenty (20) years from the Date of Substantial



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Completion. Include coverage for installed sealants and accessories which fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, and or do not cure.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors: Provide color of exposed joint sealants to comply with the following:
 - 1. Sealants in exterior vertical expansion and control joints in face brick shall match the face brick color. Custom color may be required. An exact match in color is required as selected by the Architect.
 - 2. Sealants in exterior horizontal control and relieving joints in face brick shall match the mortar color. Custom color may be required.
 - 3. Provide manufacturer's complete line of standard and custom colors for Architect's selection. If standard colors do not match the Architect's selection, custom colors will be required at no extra cost.

2.2 MATERIALS

- A. General
 - 1. Where the term "Acceptable Standard" is used within this Section, it refers to the manufacturer and product listed, which is specified as the type and quality required for this Project.
 - 2. Products of other manufacturers will be considered, providing their products equal or exceed the quality specified, and they can provide products of the type and quality required.
 - 3. Single source responsibility for joint sealer materials: Obtain joint sealer materials from a single manufacturer for each different product required.
 - 4. Compatibility: Provide joint sealers, joint fillers, and other related materials that are compatible with on another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and final experience.
- B. Caulking Compounds (Acrylic Latex Sealant)
 - 1. Latex rubber modified, acrylic emulsion polymer sealant compound; manufacturer's standard, one part, non-sag, mildew resistant, acrylic emulsion sealant complying with ASTM C834, latest edition, formulated to be paintable and recommended for exposed applications on interior locations involving joint movement of not more than plus or minus 5 percent.



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2. Acceptable Standard
 - a. "Sonolac"; Sonneborn Building Products, Inc.
 - b. "Acrylic Latex 834"; Tremco, Inc.
 - c. "Acrylic Latex Caulk with Silicone"; DAP, Dayton, Ohio
- C. One-Part Elastomeric Sealant (Silicone) Exterior 20 year warranty:
 1. One component elastomeric sealant, complying with ASTM C920, latest edition, Class 25, Type NS (non-sag), unless Type S (self-leveling) recommended by manufacturer for the application shown.
 - a. Acceptable Standard
 - 1) "Pecora 864 Architectural Silicone Sealant; Pecora Corp.
 - 2) "Dow Corning 795"; Dow Corning Corp.
 - 3) "Silpruf"; General Electric
 - 4) "Omniseal"; Sonneborn Building Products, Inc.
 - 5) "Spectrem 2"; Tremco Mfg. Co.
 - 6) Dow Corning 790; Dow Corning Corp. (Dow Corning 791 with Kynar)
 - 7) Spectrem 1; Tremco Mfg. Co.
 2. One-part mildew resistant silicone sealant: (Around countertops and backsplashes and other wet interior locations.)
 - a. Acceptable Standard
 - 1) "Rhodorsil 6B White"; Rhone-Poulenc Inc.
 - 2) "Dow Corning 786"; Dow Corning Corp.
 - 3) "Sanitary 1700"; General Electric
 - 4) "Proglaze White"; Tremco
 3. All exterior precast concrete panel joints above and below grade: Basis of Design: "Dymeric 240" by Tremco. Color as selected by the Architect. Multi-component, chemically cured, polyurethane sealant. Non-sag.
 - D. One-part self-leveling polyurethane sealant, (for traffic areas and slabs-on-grade)
 1. One component polyurethane self-leveling sealant, complying ASTM C920, Type S, Grade P, Class 25.
 - a. Acceptable Standard
 - 1) "Sonolastic SL 1"; Sonneborn Building Products, Inc.
 - 2) "NR-201 Urexpan"; Pecora Corp.
 - 3) "Vulkem 45 SSL"; Tremco
 2. Install in all horizontal control joints in concrete slabs-on-grade.



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- E. Miscellaneous Materials
1. Provide joint cleaner and joint primer sealer as recommended by the sealant or caulking compound manufacturer.
 2. Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealer substrate tests and field tests.
 3. Cleaners for Nonporous Surfaces: Provide non-staining, chemical cleaners of type which are acceptable to manufacturers of sealants and sealant backing materials, which are not harmful to substrates and adjacent nonporous materials, and which do not leave oily residues or otherwise have a detrimental effect on sealant adhesion or in service performance.
 4. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

2.3 JOINT SEALANT BACKING

- A. Provide sealant backings of material and type that are non-staining; 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. Plastic Foam Joint Fillers: ASTM C 1330, latest edition, preformed, compressible, resilient, non-staining, non-waxing, non-extruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
1. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, non-outgassing in unruptured state.
 2. Type C: Closed-cell material with a surface skin
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer. Provide self adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.



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2.5 MANUFACTURER'S WEB ADDRESSES

A. Web Sites:

1. DAP, Dayton, Ohio; <http://www.dap.com/>
2. Dow Corning Corp. <http://www.dowcorning.com>
3. General Electric Co. <http://www.gesilicones.com>
4. Pecora Corp. <http://www.pecora.com>
5. Rhone-Poulenc Inc.
6. Degussa Building Systems <http://degussabuildingsystems.com>
7. Tremco Inc. <http://biznet.maximizer.com/roofing/index.html>

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

1. Insure all slab penetrations are sealed or will receive sealant

3.2 PREPARATION

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

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
3. Remove laitance and form release agents from concrete.
4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior



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experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

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

3.3 SELECTION OF MATERIAL

- A. Caulking compounds shall be used for interior nonmoving joints and at locations specifically indicated on Drawings.
- B. One component elastomeric silicone sealants shall be used at exterior and interior joints where thermal or dynamic movement is anticipated including, but not limited to, the following locations:
 - 1. Metal to metal joints.
 - 2. Sheet metal flashings, copings, preformed metal caps, fascias, extenders, trim, and panels.
 - 3. Glass to glass joints.
 - 4. Glass to metal joints.
- C. One part self-leveling polyurethane sealants shall be used for exterior and interior horizontal joints subject primarily to pedestrian traffic and light and moderated vehicular traffic, and in all control joints in slab-on-grade; interior.

3.4 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
 - 1. Interior joints which require caulking are to be caulked with the specified caulking compound, unless noted otherwise.
 - 2. Exterior joints which require sealant are to be filled with one of the specified sealants even though the note may read "Caulked".
 - 3. Joints to be filled shall be thoroughly dry and free from dust, dirt, oil, and grease at the time of application or caulks or sealants.
 - 4. Expansion and control joints in exterior walls shall have the joint filler material built into the wall, or between wall and slab, at the time of construction.
 - 5. Masking: Metal shall be masked with masking tape, as well as other surfaces where its required to prevent the sealant smearing the adjacent surface. Upon completion of the caulking, remove the tape.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193, latest edition, for use of joint sealants as applicable to materials, applications, and conditions indicated.



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- C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
 - 1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - a. Do not leave gaps between ends of joint fillers.
 - b. Do not stretch, twist, puncture, or tear joint fillers.
 - c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
- D. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.
- E. Tooling of Non-sag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
 - 1. Provide concave joint configuration per Figure 5A in ASTM C 1193, latest edition, unless otherwise indicated.

3.5 CLEANING

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

3.6 PROTECTION

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

3.7 GENERAL INSTALLATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both



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the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

- B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
- C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
- D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.
- E. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.
- F. Recheck measurements and dimensions, before starting each installation.
- G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

END OF SECTION 07 92 00



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Division 09
Finishes



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SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Moisture resistant gypsum board and accessories.
 2. Metal framing systems to support ceiling mounted gypsum board.

1.2 DEFINITIONS

- A. Gypsum Board Construction Terminology: Refer to ASTM C11 and GA-505 for definitions of terms related to gypsum board assemblies not defined in this Section or in other referenced standards.

1.3 SUBMITTALS

- B. Submit in accordance with Division 01 requirements.
- C. Product data for each type of product specified, including wall boards, metal studs, fasteners, and finishing materials.
- D. Product certificates signed by manufacturers of gypsum board assembly components certifying that their products comply with specified requirements.

1.4 QUALITY ASSURANCE

- A. Materials or operations specified by reference to the published specifications of a manufacturer or other published standards shall comply with the latest editions of the standards listed.
1. Standards include ASTM C840 and GA216.
- B. Refer to "Recommended Specification on Levels of Gypsum Board Finish" as published by the Gypsum Association (and AWCI/CISCA/PDCA) for finish levels required herein.
- C. Fire-Test-Response Characteristics: Where fire-rated gypsum board assemblies are indicated, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119, latest edition, by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
1. Fire Resistance Ratings: As indicated by reference to GA File Numbers in GA-600 "Fire Resistance Design Manual", latest edition, or to design designations in UL "Fire Resistance Directory", latest edition, or in the listing of another nationally recognized testing and inspecting agency acceptable to authorities having jurisdiction.



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- D. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.
- E. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.
- F. Any board that has become wet at any point prior to the Date of Substantial Completion shall be replaced, including board that has been installed and finished.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.
- C. Handle gypsum board to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.

1.6 PROJECT CONDITIONS

- A. Environmental Conditions: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 and with gypsum board manufacturer's recommendations.
- B. Room Temperatures: For non-adhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C). For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F (10 deg C) for 48 hours prior to application and continuously after until dry. Do not exceed 95 deg F (35 deg C) when using temporary heat sources.
- C. Ventilation: Ventilate building spaces, as required, for drying joint treatment materials. Avoid drafts during hot dry weather to prevent finishing materials from drying too rapidly.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Steel Framing and Furring:
 - a. ClarkWestern Building Systems, Monroe, Ohio; www.clarkwestern.com/



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- b. Consolidated Systems, Inc., Columbia, SC; www.csisteel.com/
- c. Dietrich Metal Framing, Inc., Pittsburgh, PA; www.dietrichindustries.com/
- d. Unimast, Inc., Schiller Park, Illinois; www.unimast.com
- e. United States Steel, Chicago, Illinois; www.uss.com

2. Gypsum Board and Related Products:

- a. Georgia-Pacific Corp. Atlanta, Georgia; <http://www.gp.com/>
- b. Gold Bond Building Products Div., National Gypsum Co., Charlotte, North Carolina; <http://www.nationalgypsum.com/>
- c. Fry Reglet; Alpharetta, Georgia; <http://www.fryreglet.com/>
- d. Lafarge Gypsum, Herndon, Virginia; <http://www.lafargecorp.com/>
- e. Pittcon Industries, Riverdale, Maryland; <http://www.pittconindustries.com/>
- f. United States Gypsum Company <http://www.usg.com/>
- g. National Gypsum Co., Charlotte, NC; <http://www.nationalgypsum.com/>

2.2 STEEL FRAMING COMPONENTS FOR CEILING

- A. Provide components of sizes indicated but not less than that required to comply with ASTM C 754, latest edition, for conditions indicated.
- B. Steel Studs and Runners for Ceiling Framing: ASTM C 645, latest edition, with flange edges of studs bent back 90 degrees and doubled over to form 3/16-inch wide minimum lip (return), 20 gage.

2.3 GYPSUM BOARD PRODUCTS

- A. Provide gypsum board of types indicated in maximum lengths available to minimize end-to-end butt joints.
 1. Thickness: Provide gypsum board to comply with ASTM C840, latest edition, for application system and support spacing indicated.
- B. Gypsum Wallboard: ASTM C 36 and as follows:
 1. Type: Type X, moisture resistant gypsum board.
 2. Edges: Tapered.
 3. Thickness: 5/8 inch, unless otherwise noted.

2.4 TRIM ACCESSORIES

- A. Accessories for Interior Installation: Corner beads, edge trim, and control joints complying with ASTM C 1047, latest edition, and requirements indicated below:
 1. Material: Formed metal, complying with the following requirement:
 - a. Sheet steel zinc-coated by hot-dip process.



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2. Shapes indicated below by reference to Fig. 1 designations in ASTM C1047:
 - a. Cornerbead on outside corners, unless otherwise indicated.
 - b. LC-bead with both face and back flanges; face flange formed to receive joint compound. Use LC-beads for edge trim unless otherwise indicated.
 - c. L-bead with face flange only; face flange formed to receive joint compound. Use L-bead where indicated.
 - d. U-bead with face and back flanges; face flange formed to be left without application of joint compound. Use U-bead where indicated.
 - e. One-piece control joint formed with V-shaped slot, with removable strip covering slot opening.

2.5 JOINT TREATMENT MATERIALS

- A. Provide joint treatment materials complying with ASTM C475, latest edition, and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.
- B. Joint Tape for Gypsum Board: Paper reinforcing tape, unless otherwise indicated.
- C. Setting-Type Joint Compounds for Gypsum Board: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.
 3. Where setting-type joint compounds are indicated as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.
 4. For prefilling gypsum board joints, use formulation recommended by gypsum board manufacturer for this purpose.
 5. For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by the gypsum board manufacturer for this purpose.
 6. For topping compound, use sandable formulation.

2.6 MISCELLANEOUS MATERIALS

- A. Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.
- B. Steel drill screws complying with ASTM C1002, latest edition.
- C. Steel drill screws complying with ASTM C954, latest edition, for fastening gypsum board to steel members from 0.033 to 0.112 inch thick.
- D. Corrosion-resistant-coated steel drill screws of size and type recommended by board manufacturer for fastening cementitious backer units.



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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to which gypsum board assemblies attach or abut with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLING STEEL FRAMING, GENERAL

- A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.
- B. Do not bridge building expansion and control joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members as indicated.
- C. Provide all required accessories for a complete installation in every respect.

3.3 APPLYING AND FINISHING GYPSUM BOARD, GENERAL

- A. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840 and GA-216.
- B. Install ceiling board panels across framing to minimize the number of abutting end joints and avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate both edge or end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Position adjoining panels so that tapered edges abut tapered edges, and field-cut edges abut field-cut edges and ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions. Avoid joints at corners of framed openings where possible.
- E. Do not attach gypsum panels across the flat grain of wide-dimension lumber including floor joists and headers. Instead, float gypsum panels over these members using resilient channels or provide control joints to counteract wood shrinkage.
- F. Spot grout hollow metal door frames for solid core wood doors, hollow metal doors, and doors over 32 inches wide. Apply spot grout at each jamb anchor clip and immediately insert gypsum panels into frames.



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- G. Form control joints and expansion joints at locations indicated and as detailed, with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels. Provide vertical control joints spread not more than 30 feet on center in partitions.
1. Control Joint: Apply over face of gypsum board where specified. Cut to length with a fine-toothed hacksaw (32 teeth per inch). Cut end joints square, butt together and align to provide neat fit. Attach control joint to gypsum board with fasteners spaced 6 inches o.c. maximum along each flange. Remove plastic tape after finishing with joint compound or veneer finish.
 - a. Leave a ½ inch continuous opening between gypsum boards for insertion of surface-mounted joint.
 - b. Interrupt wood floor and ceiling plates with a ½ inch gap, wherever there is a control joint in the structure.
 - c. Do not attach gypsum board to steel studs on one side of control joint.
 - d. Provide separate supports for each control joint flange.
 - e. Provide an adequate seal and an additional layer of Type "X" gypsum board behind control joints where sound or fire ratings are prime considerations.
- H. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.

3.3 GYPSUM BOARD APPLICATION METHODS

- A. Single-Layer Application: Install gypsum wallboard panels on metal ceiling studs.
- B. Single-Layer Fastening Methods: Fasten gypsum panels to supports with screws.

3.4 INSTALLING TRIM ACCESSORIES

- A. General: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners.
- B. Install corner beads at external corners.
- C. Install edge trim where edge of gypsum panels would otherwise be exposed or semi-exposed. Provide edge trim type with face flange formed to receive joint compound except where other types are indicated.
 1. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
 2. Install L-bead where edge trims can only be installed after gypsum panels are installed.
 3. Install U-bead where indicated or required.
- D. Install control joints at locations indicated, and where not indicated according to ASTM C 840, and in locations approved by Architect for visual effect.



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- E. All trim, accessories and corner beads shall be installed using screws. "Crimping" tool and staple attachment is not allowed.

3.5 FINISHING GYPSUM BOARD ASSEMBLIES

- A. Apply joint treatment at gypsum board joints (both directions); flanges of corner bead, edge trim, and control joints; penetrations; fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration and levels of gypsum board finish indicated.
- B. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.
- C. Apply joint tape over gypsum board joints and to trim accessories with concealed face flanges as recommended by trim accessory manufacturer and as required to prevent cracks from developing in joint compound at flange edges.
- D. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-214.
 - 1. Level 0: No taping, finishing, or accessories required. This level of finish shall be used in temporary construction only.
 - 2. Level 4: Joints and interior angles shall have tape embedded in joint compound and three separate coats of joint compound applied over joints, angles, fastener heads, and accessories. Joint compound shall be smooth and free of tool marks and ridges. Prepare surface to be coated with a primer/sealer prior to the application of final finishes. This finish level shall be used where painted finishes are to be applied.

3.2 CLEANING AND PROTECTION

- A. Promptly remove any residual joint compound from adjacent surfaces.
- B. Provide final protection and maintain conditions, in a manner suitable to Installer that ensures gypsum board assemblies remain without damage or deterioration at time of Substantial Completion.

END OF SECTION 09 29 00



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SECTION 09 91 00
PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide labor, materials, and equipment necessary for complete painting and finishing work as detailed on the Drawings and as specified herein, of surfaces as scheduled throughout the building.
- B. The type of material to be used and the number of coats to be applied are listed in the "Painting Schedule" in Part 3 of this Section. Also, refer to Room Finish Schedule and Finish Plans.
- C. The term "paint" as used herein, includes enamels, paints, sealers, stains, fillers, emulsions, and other coatings, whether used as prime, intermediate, or finish coats.
- D. The Architect shall not be limited in the number of colors selected for single space or for the complete Project.
- E. The intent is to provide a finished building, interior and exterior, whether or not specifically indicated. Some items may not be specifically indicated to be painted; however, all items shall be finished as directed by the Architect.

1.2 SUBMITTALS

- A. Materials List: Prior to the start of work and before paint materials are delivered to the site, submit a list of materials proposed and the equivalent specified item proposed.
 - 1. This shall in no way be construed as permitting substitution of materials for those specified or approved for this Work by the Architect.
- B. Color Chip Catalog: Provide a current color chip catalog from which colors may be selected. Manufacturers may fulfill this requirement by updating that Architect's office catalog.
- C. Stain Samples: Submit sample of specified wood species with selected stain applied to specified wood types to Architect for approval. Resubmit additional samples as necessary to obtain color desired by Architect.
- D. Manufacturer's Recommendations: In each case where material proposed is not the material specified or specifically described as an acceptable manufacturer, submit for review the current recommended method of application published by the manufacturer.
- E. Certification: Submit written certification from each coating manufacturer attesting that coatings provided under this specification section are specifically formulated and manufactured for the environmental conditions encountered in the State of Florida subtropical regions including factory mixed mildewcides and fungicides of type and quantity to inhibit fungus and mildew growth. Further certify that mildewcides and fungicides do not contain compounds of mercury, lead or other heavy metals.



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- F. Material Safety Data Sheets: Submit Material Safety Data Sheets (MSDS) for each coating product. In hazardous ingredient section of the MSDS form, write in type and quantity of mildewcide incorporated in the coating specified.

1.3 QUALITY ASSURANCE

- A. **Qualifications of Painters:** Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces. If installed painting is rejected, no allowance will be made for lack of mechanics skill.
- B. **Codes and Standards:** In addition to complying with pertinent codes and regulations, comply with "Standard (Type 1)" as defined by the Painting and Decorating Contractors of America in their "Modern Guide to Paint Specifications," current edition.

1.4 FIELD QUALITY CONTROL

- A. **Painting Contractor** shall completely paint and finish one complete room according to the Specifications, as designated by Architect, which will be used as quality standard for remainder of Project.

1.5 PRODUCT HANDLING

- A. **Delivery:** Deliver paint materials to the job site in their original unopened containers with labels intact and legible at time of use.
- B. **Protection**
1. Store only the approved materials at the job site and store only in a suitable and designated area restricted to the storage of paint materials and related equipment.
 2. Use means necessary to ensure the safe storage and use of paint materials and the prompt and safe disposal of waste.
 3. Use means necessary to protect paint materials before, during, and after application and to protect the installed work and materials of other trades.

1.6 EXTRA STOCK

- A. Upon completion of this portion of the Work, deliver to the Owner an extra stock of paint consisting of five gallons of each color used in each coating material used, with such extra stock tightly sealed in clearly labeled containers.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Conform to State and local V.O.C. (Volatile Organic Compound) Regulations. Notify Architect in writing if variations to Specifications are required.



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- B. Do not apply materials when the surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- C. Do not apply exterior coating during rain, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
 - 1. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.1 PAINTING MATERIALS MANUFACTURER

- A. Painting materials shall be the products of the following manufacturers, specified as the type, function, and quality of products to be provided. Paint materials and specification numbers listed herein, unless otherwise designated, are the products of Sherwin-Williams and Tnemec Company, Inc and require no further approval as to manufacturer or catalog number.
- B. Products of the following manufacturers are acceptable as equal to Sherwin-Williams Paint Company, providing their products equal or exceed the quality specified, and the material types and composition are the same; and subject to approval by the Architect of the materials list required to be submitted under preceding Part 1 of this Section.
 - 1. Porter Paint, Louisville, Kentucky
 - 2. Glidden, Cleveland, Ohio
 - 3. ICI Devoe, Cleveland, Ohio
 - 4. MAB Paints, M.A. Bruder & Sons, Inc., Broomall, Pennsylvania
 - 5. Benjamin Moore & Company, Montvale, New Jersey
- C. Products of the following manufacturers are acceptable as equal to Tnemec, providing their products equal or exceed the quality specified.
 - 1. Induron Protective Coatings, Birmingham, Alabama.
 - 2. Ameron Protective Coatings Group, Brea, California.

2.2 COMPATIBILITY

- A. Paint materials selected for coating systems for each type of surface shall be the product of a single manufacturer.
- B. Paint materials and equipment shall be compatible in use; finish coats shall be compatible with prime coats; prime coats shall be compatible with the surface to be coated; tools and equipment shall be compatible with the coating to be applied.
- C. Thinners, when used, shall be only those thinners recommended for that purpose by the manufacturer of the material to be thinned.



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2.3 ACCEPTANCE OF SPECIFICATIONS

- A. By submitting a proposal, the Contractor has reviewed the bidding documents with the painting subcontractor and accepts the Specifications as sufficient to produce approved painting results. If the painting subcontractor contends that the materials or number of coats specified will not produce satisfactory results, he shall so notify the Architect directly or indirectly through a Bidding Contractor 10 days prior to receipt of bids for proper action.

2.4 MATERIALS

- A. Coatings: Ready mixed, except field catalyzed coatings. Prepare pigments:
1. To a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating.
 2. For good flow and brushing properties.
 3. Capable of drying or curing free of streaks or sags.
- B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified; commercial quality.
- C. Mildew Resistance: Provide coatings which are formulated and mixed at the point of manufacture with mildewcides and fungicides to inhibit growth of mildew as encountered in the subtropical regions of the State of Florida. Mildewcides and fungicides containing compounds of mercury, lead or other heavy metals are not acceptable.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which painting work is to be applied and notify the Architect in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Starting of painting work will be constructed as Applicator's acceptance of surfaces and conditions within any particular area.
- C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint surface.
- D. Test shop applied primers for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the maximums as recommended, for the types of coatings to be used, by the manufacturer.



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3.2 SURFACE PREPARATION

A. General

1. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions, and as herein specified, for each particular substrate condition.
2. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish painted or provide surface applied protection prior to surface preparation and painting operations; remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.
3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminates from cleaning process will not fall onto wet, newly painted surfaces.

B. Cementitious Materials

1. Prepare cementitious surfaces of concrete, concrete block, and cement plaster to be painted by removing efflorescence, chalk, dirt, grease, oils, and by roughening as required to remove glaze.
2. Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
3. Clean concrete floor surfaces scheduled to be painted with a commercial solution of muriatic acid or other etching cleaner. Flush floor with clean water to neutralize acid and allow to dry before painting.

C. Wood

1. Clean wood surfaces to be painted of dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer before application of priming coat. After priming fill holes and imperfections in finished surfaces with putty or plastic wood filler. Sandpaper smooth when dried.
2. Prime, stain, or seal wood required to be job painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, and paneling.
3. When transparent finish is required, use spar varnish for backpriming.

D. Ferrous Metals

1. Clean ferrous surfaces, which are not galvanized or shop coated, of oil, grease, dirt, loose mill scale, and other foreign substances by solvent or mechanical cleaning.



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2. Touch-up shop applied prime coats wherever damaged or bare, where required by other Sections or these Specifications. Clean and touch-up with same type shop primer.
- E. Galvanized Surfaces: Clean free of oil and surface contaminants with non-petroleum based solvent.
- F. Aluminum Surfaces: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.
- G. Gypsum Board Surfaces: Fill minor defects with filler compound and spot prime defects after repair.

3.3 MATERIALS PREPARATION

- A. Mix and prepare painting materials in accordance with manufacturer's direction.
- B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign materials and residue.
- C. Stir materials before application to produce a mixture of uniform density and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3.4 APPLICATION

- A. Paint during weather conditions and Project status that will ensure the best possible results.
- B. General: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
 1. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint, until paint film is of uniform finish, color, and appearance. Give special attention to insure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently-fixed equipment or furniture with prime coat only before final installation of equipment.
 3. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.
 4. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 5. Finish exterior doors on tops, bottoms, and side edges same as exterior faces unless otherwise indicated.
 6. Sand lightly between each succeeding enamel or varnish coat.



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- C. Scheduling Painting: Apply first coat material to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
 - 1. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
 - 2. Slightly vary the color of succeeding coats.
- D. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate and as specified, to establish a total dry film thickness as indicated or, if not indicated, as recommended by the coating manufacturer.
- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed to view in interior occupied spaces and exterior walls and roof. Mechanical rooms and electrical rooms are not considered occupied spaces unless specifically noted as such.
- F. Prime Coats: Apply prime coat of material which is required to be painted or finished and which has not been prime coated by others.
 - 1. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn through or other defects due to insufficient sealing.
 - 2. Coordinate manufacturer's prime coats with finish coats as specified herein. If compatibility is not ascertained during the bidding period, and verification submitted with the shop drawings, then prime coat paint system as specified herein shall be applied to the item prior to finish painting as specified herein.
- G. Pigmented (Opaque), Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- H. Transparent (Clear) Finishes: Use multiple coats to produce glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surfaces imperfections.
- I. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

3.5 CLEAN-UP AND PROTECTION

- A. Clean-Up: During progress of Work remove from site discarded paint materials, rubbish, cans, and rags at end of each work day.
- B. Upon completion of painting work clean window glass and other paint- spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.



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- C. Protection: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct damage by cleaning, repairing or replacing and repainting, as acceptable to Architect.
- D. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.
- E. At the completion of Work of other trades, touch-up and restore damaged or defaced painted surfaces.

3.6 PAINT TYPES AND NUMBER OF COATS

- A. The following painting schedules are intended to identify the type of finishes which are required for the various surfaces, and to identify the surfaces to which each finish is to be applied. Refer to Finish Schedule.
- B. To define requirements for quality, function, size, gages, textures, and color, the following list of materials designates the manufacturer's brand, types, and number of coats required; and other requirements that are to be furnished to conform to the requirements of this Project.
- C. Where specific finishes are called for on the Drawings and in the Finish Schedule by code designation, it shall specifically refer to the following identified types of coatings.
- D. The primer indicated under Material Identification is intended for the particular substrate surface specified. Where the same numbered finish is scheduled, but for another substrate, provide the proper primer compatible with substrate and the finish.
- E. Where the substrate has a compatible and satisfactory prime coat already on it, the prime coat specified for the numbered finish may be omitted. Test prime coat for compatibility before applying additional coats.

3.7 FIELD QUALITY CONTROL

- A. The right is reserved by Owner to invoke the following material testing procedure at any time, and any number of times during period of field painting:
 - 1. Engage services of an independent testing laboratory to sample paint being used. Samples of materials delivered to project site will be taken, identified and sealed, and certified in the presence of the Contractor.
 - 2. Testing laboratory will perform appropriate tests for any or all of the following characteristics: Abrasion resistance, apparent reflectivity, flexibility, washability, absorption, accelerated weathering, dry opacity, accelerated yellowness, recoating, skinning, color retention, alkali resistance and quantitative materials analysis.



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- B. If test results show that material being used does not comply with specified requirements, Contractor may be directed to stop painting work, and remove non-complying paint; pay for testing; repaint surfaces coated with rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are non-compatible.

3.8 EXTERIOR PAINTING SCHEDULE

- A. Provide the following exterior paint systems based on Sherwin-Williams and Tnemec for substrates indicated.

- B. **Ferrous Metal:** Provide the following finish systems over exterior ferrous metal.

1. **High-Build Acrylic Polyurethane Enamel:**

- a. **Primer:** Metal primer applied at spreading rate recommended by the manufacturer.
- 1) Tnemec: "Poxiprime" Series 65
- b. **Second Coat:** Epoxy intermediate coat applied at spreading rate recommended by the manufacturer.
- 1) Tnemec: Series 66 Hi-Build Expoxoline
- c. **Third Coat: Semigloss,** acrylic polyurethane enamel applied at spreading rate recommended by the manufacturer.
- 1) Tnemec: Series 1075 Endura-Shield
- d. Surfaces: Any miscellaneous steel fabrications, and all other exterior steel scheduled or indicated to painted or exposed to view.
- e. Primer may not be required on shop primed items if compatibility is confirmed in writing with the manufacturer of the type of shop primer being applied. Contractor shall verify this during the bidding period, and if primer is not compatible, then primer shall be either field applied or shop applied with type as recommended by the finish coat manufacturer. Type of primer and surface preparation shall be as recommended by the painting materials manufacturer.
- f. This paint system shall be spray applied only, brush application is not allowed.

3.9 INTERIOR PAINTING SCHEDULE

- A. Provide the following **interior** paint systems based on **Sherwin-Williams and Tnemec** for substrates indicated:
- B. **Concrete Masonry Units:** Provide the following finish systems over interior concrete masonry block units:



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1. **Epoxy:**
 - a. **Block Filler:** Waterborne epoxy polyamide.
 - 1) Sherwin-Williams: Loxon Block Surfacer A24W200, 1.6 mils DFT.
 - b. **First and Second Coats:** Semi-gloss, waterborne epoxy polyamide.
 - 1) Sherwin-Williams: Water Based Catalyzed Epoxy B70/B60V25 Semi-Gloss, 2.5 to 3 mils DFT.
 - c. Surfaces: New and existing masonry walls.
- C. **Gypsum Board:** Provide the following finish systems over interior gypsum board surfaces:
 1. **Epoxy:**
 - a. **Primer:** Waterborne epoxy polyamide.
 - 1) Sherwin-Williams: Moisture Vapor Barrier Primer B72W1, 1.8 to 2.4 mils DFT.
 - b. **First and Second Coats:** Semi-gloss waterborne epoxy polyamide.
 - 1) Sherwin-Williams: Water Based Catalyzed Epoxy B70/B60V25 Semi-Gloss, 2.5 to 3 mils DFT.
 - c. Surfaces: Gypsum board ceilings.
- D. **Ferrous Metal:** Provide the following finish systems over interior ferrous metal:
 1. **Acrylic Polymer Satin:**
 - a. **Primer:** Metal primer applied at spreading rate recommended by the manufacturer.
 - 1) Tnemec: "Tneme-Fascure" Series 161
 - 2) S-W: "Recoatable Epoxy Primer" B67 Series.
 - 3) Porter Paints: Porter Coatings "Porter Mastic 7000" Epoxy
 - b. **First and Second Coats:** **Semigloss**, acrylic polyurethane enamel applied at spreading rate recommended by the manufacturer.
 - 1) Tnemec: Series 75 Endura-Shield
 - 2) S-W: "Acrolon 218 HS" with SG Hardener, B65 Series
 - 3) Porter Paints: Porter Coatings "9200 PorterThane" Urethane
 - c. Surfaces: Hollow metal doors and frames, miscellaneous steel, etc. where scheduled, noted to be painted, or exposed to view.



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Note: When the manufacturing of paint supplied does not require or recommend a primer, and a single coat will provide required coverage, approval from the Architect must be obtained to delete second coat; and a credit shall be due the Owner.

END OF SECTION 09 91 00



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Division 10
Specialties



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SECTION 10 21 16
SOLID PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. The Work of this Section includes toilet partitions, and accessories indicated on Drawings, schedules, and in these Specifications. Refer to Drawings for location, size, and quantity required.

1.2 SUBMITTALS

- A. Submit in accordance with Division 01 requirements.
- B. Product Data: Submit manufacturer's standard technical data for all required types of products. Include manufacturer's recommendations for cleaning and maintenance methods for indicated types of units.
- C. Complete Shop Drawings by approved manufacturer for proposed toilet compartments. Detail fabrication and installation drawings. Include appurtenances, cutouts, and all accessories. Provide template layouts and installation instructions for anchorage devices built into other work.
- D. Complete suitable color selection materials for components (actual samples) in triplicate quantity, for all available color groups.
- E. Sample warranty.
- F. Submit warranty as specified herein.

1.3 ACCESSIBILITY REQUIREMENTS

- A. Toilet compartments shall be provided to conform with the Americans With Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. These requirements supersede Technical Specifications in this Section.

1.4 WARRANTY

- A. Manufacturer's Warranty: Toilet compartment manufacturer shall warrant plastic panels to remain free from warping, breaking, and from material and manufacturing defects for indicated period of time. Products which become defective during warranty period shall be repaired to eliminate all evidence of damage. If such repairs to completely eliminate all evidence of damage cannot be made, defective units shall be removed and replaced with new units that comply with indicated requirements.
 - 1. Warranty Period: Fifteen (15) years from the Date of Substantial Completion.



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1.5 FLORIDA ACCESSIBILITY CODE FOR BUILDING CONSTRUCTION

- A. Compartment system shall conform with the Accessibility Requirements Manual from the Florida Department of Community Affairs, Florida Board of Building Codes and Standards.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design: Toilet compartments shall be the products of "Poly-Mar HD", solid one inch thick plastic as manufactured by Santana Products Company, Scranton, Pennsylvania; specified as the type, size, function, and quality of equipment; www.hinyhider.com.
- B. Products of the following manufacturers are acceptable, providing their solid plastic toilet compartments equals or exceeds the quality specified; and they can provide equipment of the type, size, function, and arrangement required.
1. Accurate Partitions, Lyons, Illinois; www.accuratepartitions.com
 2. Comtec Industries, Inc., div. of Compression Polymers Group Corp., Moosic, Pennsylvania; www.comtecindustries.com
 3. General Partitions Manufacturing Corp., Erie, PA; www.genpartitions.com
 4. Rockville Partitions, Inc, Rockville, Maryland; www.rockvillepartitions.com
 5. Columbia Partitions by Partition Systems Incorporated of South Carolina, Columbia SC; www.psisc.com
 6. Sanymetal, Div. of Crane.
- C. Type: Floor supported with overhead top rail bracing, solid plastic compartments in colors as selected by the Architect.

2.2 MATERIALS

- A. Materials, panels, doors, pilasters, and screens shall be fabricated from polymer resins High Density Polyethylene (HDPE) containing a minimum of 75% recycled material manufactured under high pressure forming a single component section which is waterproof, corrosion-proof, impact resistant nonabsorbent, and has a self lubricating Poly-Glaze "280" surface that resists marking with pens, pencils, lipstick, and other writing or marking utensils.
1. Colors: As selected by Architect from manufacturer's full range.

2.3 CONSTRUCTION

- A. Partitions shall have edges machined to a radius of 0.250 inch and sharp corners removed. Dividing toilet partition panels and doors shall be 55 inches high and mounted 14 inches above finished floor.



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- B. Pilasters for the toilet partitions shall be 82 inches high and fastened to 3 inches high stainless steel shoes with theftproof stainless steel sex bolts.
 - 1. Pilaster Shoe: Formed, ASTM A167, latest edition, type 304 stainless steel with No. 4 finish, 3 inch high, with adjustable screw jack.
- C. Unless dimensioned otherwise on Drawings, toilet partitions are to be 60 inches deep and 36 inches wide.
 - 1. Outswinging doors (for handicapped) shall be 34 inches wide.
 - 2. Inswinging doors (for handicapped) are to be 34 inches wide (if compartment has side entry, minimum is 36 inches), and other (inswinging) doors to be either 24 inches or 26 inches wide for each run
- D. Provide internal reinforcement for all accessories.
- E. Refer to the Drawings for the heights and configurations of the toilet compartments.
- F. Properties:
 - 1. Dual component compression molded High Density Polyethylene (HDPE) of solid Poly-Mar HD, Poly-Marble HD, or Poly-Granite HD virgin resin materials in colors that extend throughout the surface; the panels, doors, and pilasters shall have combined recycled and/or virgin material (HDPE) as the core material.
 - 2. Doors, panels and pilasters shall be a minimum of 1 inch thick and all edges machined to a radius of 0.250 inch and all exposed surfaces to be free of saw marks.

2.4 TOILET PARTITION HARDWARE

- A. Door hardware shall be as follows:
 - 1. Hinges shall be stainless steel continuous hinges. Door closures to be factory set to accommodate all conditions and allow for a positive opening and closing action free of impediment.
 - 2. Each handicapped door to include: (1) stainless steel door pull (1) stainless steel wall stop.
 - 3. Door strike and keeper shall be fabricated from stainless steel with brushed satin finish with wrap around flange surface mounted and thru-bolted to pilaster with one-way sex bolts. Size of strike shall be 6 inches in length.
 - 4. Door latch housing shall be fabricated from stainless steel with brushed satin finish, surface mounted and thru-bolted to door with one-way sex bolts. Slide bolt and button shall be heavy aluminum with black anodized finish.
- B. Satin finish stainless steel pilaster shoes shall be anchored to finished floor with anchors and #14 x 1 ½ inch stainless steel Phillips head screws.
- C. Full length continuous wall brackets shall be satin finish stainless steel. Brackets shall be used for all panels to pilaster, pilasters to wall and panel to wall connections. Wall brackets shall be thru-bolted to panels and pilasters with one-way sex bolts. Attachment



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of brackets to adjacent wall construction shall be accomplished by #14 x 1 ½ inch stainless steel Phillips head screws anchored directly behind the vertical edge of panels and pilasters at 13 inch intervals along the full length of bracket and at each 13 inch interval alternately spaced between anchor connections.

- D. Headrail brackets shall be 18-gauge stainless steel.
- E. Stainless steel shall be Type 316 with satin finish.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units as shown in true and plumb condition.
- B. Anchor brackets securely with fasteners indicated on approved Shop Drawings.
- C. Install in accordance with manufacturer's written installation instructions and approved Shop Drawings.
- D. All parts shall be erected in a substantial manner, straight, level, and plumb.
- E. No evidence of drilling, cutting, or patching shall be visible in the finished work.
- F. Clearance at vertical edges of doors shall be uniform top to bottom and shall not exceed ¼ inch.
- G. Finished surfaces shall be cleaned after installation and left free of imperfections.
- H. Authorized factory installers to be utilized.
- I. Provide all items and accessories as required for a complete and total installation in every respect.

3.2 ADJUSTMENT

- A. Doors are to be adjusted so that they are approximately 3 inches open when cubicle is unoccupied.
- B. Door at handicapped cubicles shall be easily removable from exterior side when locked.

3.3 GENERAL INSTALLATION PROVISIONS

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



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- B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
- C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
- D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.
- E. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.
- F. Recheck measurements and dimensions, before starting each installation.
- G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
- H. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.
- I. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

END OF SECTION 10 21 16



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SECTION 10 28 13
TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes toilet accessory items as scheduled and specified. Refer to the Toilet Accessory Schedule on the Drawings for product numbers.

1.2 SUBMITTALS

- A. Submit in accordance with Division 01 requirements.
- B. Product data for each toilet accessory item specified, including construction details relative to materials, dimensions, gages, profiles, mounting method, specified options, and finishes.
- C. Samples of each toilet accessory item to verify design, operation, and finish requirements. Acceptable full-size samples will be returned and may be used in the Work.
- D. Schedule indicating types, quantities, sizes, and installation locations (by room) for each toilet accessory item to be provided for project.
- E. Setting Drawings where cutouts are required in other Work, including templates, substrate preparation instructions, and directions for preparing cutouts and installing anchorage devices.
- F. Maintenance instructions including replaceable parts and service recommendations.
- G. Submit warranty as specified herein.

1.3 QUALITY ASSURANCE

- A. Inserts and Anchorages: Furnish accessory Manufacturers' standard inserts and anchoring devices that must be set in concrete or built into masonry. Coordinate delivery with other Work to avoid delay.
- B. Single-Source Responsibility: Provide products of same Manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise acceptable to Architect.

1.4 PROJECT CONDITIONS

- A. Coordination: Coordinate accessory locations, installation, and sequencing with other Work to avoid interference with and ensure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.



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1.5 WARRANTY

- A. Toilet Accessory Warranty: Provide manufacturers one (1) year warranty from the Date of Substantial Completion, against defects in material and workmanship.

PART 2 - PRODUCTS

2.1 TOILET ACCESSORY MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide toilet accessories by one of the following:
1. Basis of Design: Bobrick Washroom Equipment, Inc., Clifton Park, NY
 2. Bradley Corporation, Menomonee Falls, WI
 3. American Specialties, Inc., Yonkers, New York
 4. A&J Washroom Accessories, New Windsor, New York
- B. Products on the Toilet Accessory Schedule are based on Bobrick.

2.2 MATERIALS, GENERAL

- A. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 0.034-inch (22-gage) minimum thickness.
- B. Brass: Leaded and unleaded, flat products, ASTM B 19; rods, shapes, forgings, and flat products with finished edges, ASTM B 16; Castings, ASTM B 30.
- C. Sheet Steel: Cold-rolled, commercial quality ASTM A 366, 0.04-inch (20-gage) minimum. Surface preparation and metal pretreatment as required for applied finish.
- D. Galvanized Steel Sheet: ASTM A 527, G60.
- E. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.
- F. Baked Enamel Finish: Factory-applied, gloss white, baked acrylic enamel coating.
- G. Stainless Steel Mirror Surfaces: Not less than 0.04-inch (20-gage) AISI Type 302/304 stainless steel sheet, stretcher-leveled with No. 8 polished mirror finish. Bond to 1/4-inch minimum hardboard backing.
- H. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of stainless steel where concealed.

2.3 FABRICATION

- A. No names or labels are permitted on exposed faces of toilet and bath accessory units. On either interior surface not exposed to view or on back surface, provide identification of



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each accessory item either by a printed, waterproof label or a stamped nameplate indicating Manufacturer's name and product model number.

- B. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.
- C. Recessed Toilet Accessories, General: Except where otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors or access panels with full-length, stainless steel piano hinge. Provide anchorage that is fully concealed when unit is closed.
- D. Framed Mirror Units, General: Fabricate frames for glass mirror units to accommodate wood, felt, plastic, or other glass edge protection material. Provide mirror backing and support system that will permit rigid, tamperproof glass installation and prevent moisture accumulation, as follows:
 - 1. Provide galvanized-steel backing sheet, not less than 0.034 inch (22 gage) and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.
- E. Mirror Unit Hangers: Provide system for mounting mirror units that will permit rigid, tamperproof, and theftproof installation, as follows:
 - 1. One-piece, stainless steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
 - 2. Heavy-duty wall brackets of stainless steel, equipped with concealed locking devices requiring a special tool to remove.
- F. Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing, resupply, etc. Provide minimum of six keys to Owner's representative.

2.4 MOP HOLDERS WITH SHELF AND RAG HOOKS

- A. Surface mounted utility shelf with holders with spring loaded rubber cam holders to accommodate mop or broom handles. Bobrick No. B-224 X 30"

2.5 UTILITY HOOKS

- A. Surface-mounted utility hook shall be type-304 stainless steel satin finish. Flange shall be 22 gauge and equipped with concealed, 16 gauge mounting bracket that is secured to concealed, 16-gauge wall plate with locking set screw: Bobrick No. B-6707.

2.6 HAND DRYER

- A. Hand Dryer: XLERATOR Model XL-BW as manufactured by Excel Dryer, Inc., East Longmeadow, MA; www.exceldryer.com.



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1. Warranty Period: 5 years; limited warranty.
2. Controls: Automatic, activated by infrared optical sensor. Operates while hands are under blower. Shut-off within 2 seconds when hands removed, or in 35 seconds if hands not removed.
3. Cover: One piece, vandal resistant, reinforced white thermoplastic (Bulk Molding Compound).
4. Wall Plate: Injection molded, rib reinforced plate with metal L brackets to attach cover, with ten 5/16 inch (8 mm) diameter holes for surface mounting to wall and three 7/8 inch (22 mm) diameter holes for electrical wiring; bottom hole suitable for surface conduit.
5. Power Source: See Electrical Drawings.
6. Combination Motor and Blower: Series commutated, through-flow discharge, vacuum type; 5/8 HP, 20,000 RPM. Air flow rate: 19,000 linear feet per minute (97 meters per second) at air outlet, 16,000 linear feet per minute (81 meters per second) at average hand position of 4 inches below air outlet.
7. Heater: Nichrome wire element, mounted inside blower housing to be vandal proof.
8. Heater Safeguard: Automatic resetting thermostat to open when air flow is restricted and close when air flow is resumed.
9. Air Temperature: 135 degrees F (55 degrees C) measured at average hand position of 4 inches below air outlet. Air Heater Output: 900 watts.
10. All metal parts coated according to Underwriters Laboratories, Inc. requirements.
11. Mount dryers at heights indicated on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install toilet accessory units according to manufacturers' instructions, using fasteners appropriate to substrate as recommended by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights indicated.
- B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to Manufacturer's instructions for type of substrate involved.
- C. Install grab bars to withstand a downward load of at least 250 lbf, complying with ASTM F 446.
- D. Provide all items and accessories as required for a complete and total installation in every respect, whether or not specified or indicate don the Drawings.

3.2 ADJUSTING AND CLEANING

- A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.
- B. Clean and polish all exposed surfaces strictly according to manufacturer's recommendations after removing temporary labels and protective coatings.



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3.3 GENERAL INSTALLATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
- C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
- D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.
- E. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.
- F. Recheck measurements and dimensions, before starting each installation.
- G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
- H. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

END OF SECTION 10 28 13



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Division 22
Plumbing



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SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Sleeves.
5. Escutcheons.
6. Grout.
7. Equipment installation requirements common to equipment sections.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."



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1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- C. Solvent Cements for Joining Plastic Piping:
 1. ABS Piping: ASTM D 2235.
 2. CPVC Piping: ASTM F 493.
 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 4. PVC to ABS Piping Transition: ASTM D 3138.

2.3 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- D. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.



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2.4 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.5 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated and rough brass.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated and rough brass.

2.6 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.



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PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. 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.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors.
- M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- O. Verify final equipment locations for roughing-in.



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- P. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- F. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- G. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
1. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 2. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.



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- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.5 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 22 05 00



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SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Bronze swing check valves.

B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

- A. ASME Compliance: 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.

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. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.



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- E. Valves in Insulated Piping: With 2-inch 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. Flanged: With flanges according to ASME B16.1 for iron valves.
 - 2. Solder Joint: With sockets according to ASME B16.18.
 - 3. Threaded: With threads according to ASME B1.20.1.

2.2 BRASS BALL VALVES

- A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.

 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Brass.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.3 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. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.



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2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.4 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.

B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:
 - a. Standard: MSS SP-80, Type 4.



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- b. CWP Rating: 200 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: PTFE or TFE.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

3.2 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball valves.
 - 2. Throttling Service: Ball valves.
 - 3. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.



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3.4 DOMESTIC COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 125, nonmetallic disc.
3. Ball Valves: Two piece, full port, brass or bronze with bronze trim.
4. Bronze Swing Check Valves: Class 125, nonmetallic disc.
5. Bronze Globe Valves: Class 125, nonmetallic] disc.

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SECTION 22 05 29
HANGERS AND SUPPORTS FOR
PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Steel pipe hangers and supports.
 2. Fastener systems.

1.2 DEFINITIONS

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.4 SUBMITTALS

- A. Product Data: For the following:
1. Steel pipe hangers and supports.
 2. Powder-actuated fastener systems.
- B. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers



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offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
 - 1. Bergen-Power Pipe Supports.
 - 2. B-Line Systems, Inc.; a division of Cooper Industries.
 - 3. Carpenter & Paterson, Inc.
 - 4. Empire Industries, Inc.
 - 5. ERICO/Michigan Hanger Co.
 - 6. Globe Pipe Hanger Products, Inc.
 - 7. Grinnell Corp.
 - 8. National Pipe Hanger Corporation.
 - 9. PHD Manufacturing, Inc.
 - 10. PHS Industries, Inc.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. Hilti, Inc.
 - b. ITW Ramset/Red Head.
 - c. Masterset Fastening Systems, Inc.
 - d. MKT Fastening, LLC.
 - e. Powers Fasteners.
- B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Empire Industries, Inc.
 - c. Hilti, Inc.
 - d. ITW Ramset/Red Head.



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- e. MKT Fastening, LLC.
- f. Powers Fasteners.

2.4 MISCELLANEOUS MATERIALS

- A. 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, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 - 5. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
 - 6. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.



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- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
 - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 - 6. C-Clamps (MSS Type 23): For structural shapes.
 - 7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 - 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 - 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

- J. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel 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 building structure.

- B. Fastener System Installation:
 - 1. Install powder-actuated fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

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

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

- E. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and



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larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

- F. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

3.3 ADJUSTING

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

3.4 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 22 05 29



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SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Equipment labels.
 2. Warning signs and labels.
 3. Pipe labels.

1.2 SUBMITTAL

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 2. Letter Color: White.
 3. Background Color: Black.
 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 7. Fasteners: Stainless-steel self-tapping screws.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.



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2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Red.
- C. Background Color: White.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.



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3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Paint piping as specified.
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:
 - 1. Domestic Water Piping:
 - a. Background Color: White.
 - b. Letter Color: Blue.
 - 2. Sanitary Waste and Storm Drainage Piping:
 - a. Background Color: White.
 - b. Letter Color: Green.

END OF SECTION 22 05 53



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SECTION 22 11 16
DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Escutcheons.
3. Sleeves and sleeve seals.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control reports.

1.3 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.
- C. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 CPVC PIPING

- A. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.

2.3 PVC PIPE AND FITTINGS

- A. PVC Pipe: ASTM D 1785, Schedule 40 and Schedule 80.



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1. PVC Socket Fittings: ASTM D 2466 for Schedule 40 and ASTM D 2467 for Schedule 80.

2.4 PIPING JOINING MATERIALS

- A. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.
 1. Use CPVC solvent cement that has a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.5 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
- B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.6 TRANSITION FITTINGS

- A. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- B. Sleeve-Type Transition Coupling: AWWA C219.
- C. Plastic-to-Metal Transition Fittings:
 1. Description: CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert and one solvent-cement-socket or threaded end.
- D. Plastic-to-Metal Transition Unions:
 1. Description: CPVC or PVC four-part union. Include brass threaded end, solvent-cement-joint plastic end, rubber O-ring, and union nut.



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2.7 ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One Piece, Stamped Steel: Chrome-plated finish with setscrew or spring clips.
- C. Split Plate, Stamped Steel: Chrome-plated finish with concealed hinge, setscrew or spring clips.
- D. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

2.8 SLEEVES

- A. Cast-Iron Wall Pipes: Fabricated of cast iron, and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- D. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.

2.9 SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Stainless steel.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.10 GROUT

- A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.



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PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with requirements for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements for pressure gages, drain valves and strainers.
- C. Install shutoff valve immediately upstream of each dielectric fitting.
- D. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.
- E. Install domestic water piping level without pitch and plumb.
- F. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- H. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- J. Install piping adjacent to equipment and specialties to allow service and maintenance.
- K. Install piping to permit valve servicing.
- L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- M. Install piping free of sags and bends.
- N. Install fittings for changes in direction and branch connections.



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3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- E. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 3. PVC Piping: Join according to ASTM D 2855.

3.4 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.

3.5 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.



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3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1 and Smaller: 36 inches with 3/8-inch rod.
 - 2. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.
- E. Install supports for vertical CPVC piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.
- F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow 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 required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.

3.8 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.
- B. Escutcheons for New Piping:
 - 1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.



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2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, stamped steel with set screw or spring clips.
3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece or split plate, stamped steel with set screw.
4. Bare Piping in Unfinished Service Spaces: One piece, stamped steel with set screw or spring clips.
5. Bare Piping in Equipment Rooms: One piece, stamped steel with set screw or spring clips.
6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

3.9 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- B. Sleeves are not required for core-drilled holes.
- C. Permanent sleeves are not required for holes formed by removable PE sleeves.
- D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- E. Install sleeves in new partitions, slabs, and walls as they are built.
- F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals specified in this Section.
- I. Seal space outside of sleeves in concrete slabs and walls with grout.
- J. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
- K. Install sleeve materials according to the following applications:
 1. Sleeves for Piping Passing through Concrete Floor Slabs: Steel pipe.
 2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Steel pipe.
 - a. Extend sleeves 2 inches above finished floor level.
 - b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements in Division 07 Section "Flashing and Sheet Metal" for flashing.
 3. Sleeves for Piping Passing through Gypsum-Board Partitions:



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- a. PVC pipe sleeves for pipes smaller than NPS 6.
 - b. Galvanized-steel sheet sleeves for pipes NPS 6 and larger.
 - c. Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
4. Sleeves for Piping Passing through Concrete Roof Slabs: Steel pipe.
 5. Sleeves for Piping Passing through Exterior Concrete Walls:
 - a. Steel pipe sleeves for pipes smaller than NPS 6.
 - b. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.

3.10 SLEEVE SEAL INSTALLATION

- A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
- B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.11 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. Label pressure piping with system operating pressure.

3.12 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 2. 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:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.



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C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. 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.
3. 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.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
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 for corrective action required.

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

E. Prepare test and inspection reports.

3.13 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.



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3.14 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Under-building-slab, domestic water, building service piping, NPS 3 and smaller, shall be the following:
 - 1. PVC, Schedule 40 pipe; PVC, Schedule 40 socket fittings; and solvent-cemented joints.
- D. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be one of the following:
 - 1. PVC, Schedule 40 pipe; PVC, Schedule 40 socket fittings; and solvent-cemented joints.
- E. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
 - 1. CPVC Tubing System: CPVC tube; CPVC socket fittings; and solvent-cemented joints.

3.15 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 22 11 16



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SECTION 22 11 19
DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following domestic water piping specialties:
 - 1. Vacuum breakers.
 - 2. Strainers.
 - 3. Hose bibbs.
 - 4. Wall hydrants.
 - 5. Water hammer arresters.

- B. See Division 22 Section "Water Fountains" for water filters for water coolers.

1.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. NSF Compliance:
 - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
 - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

- A. Hose-Connection Vacuum Breakers:



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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrowhead Brass Products, Inc.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. Legend Valve.
 - e. MIFAB, Inc.
 - f. Prier Products, Inc.
 - g. Watts Industries, Inc.; Water Products Div.
 - h. Woodford Manufacturing Company.
 - i. Zurn Plumbing Products Group; Light Commercial Operation.
 - j. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1001.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Rough bronze.

2.2 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
 - a. Strainers NPS 2 and Smaller: 0.033 inch.
 - b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
6. Drain: Factory-installed, hose-end drain valve.

2.3 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Operating key.



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13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.4 WALL HYDRANTS

A. Moderate-Climate Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Prier Products, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
 - g. Woodford Manufacturing Company.
 - h. Zurn Plumbing Products Group; Light Commercial Operation.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.21.3M for concealed outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Inlet: NPS 3/4 or NPS 1.
6. Outlet: Concealed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052; and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounting with cover.
8. Box and Cover Finish: Polished nickel bronze.
9. Operating Keys(s): Two with each wall hydrant.

B. Vacuum Breaker Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrowhead Brass Products, Inc.
 - b. Mansfield Plumbing Products LLC.
 - c. McDonald, A. Y. Mfg. Co.
 - d. Prier Products, Inc.
 - e. Smith, Jay. R. Mfg. Co.; Division of Smith Industries, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Woodford Manufacturing Company.
 - h. Zurn Plumbing Products Group; Light Commercial Operation.
2. Standard: ASSE 1019, Type A or Type B.
3. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
4. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
5. Pressure Rating: 125 psig.
6. Operation: Loose key.



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7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
8. Inlet: NPS 1/2 or NPS 3/4.
9. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.5 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. PPP Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Tyler Pipe; Wade Div.
 - h. Watts Drainage Products Inc.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.
- C. Install water hammer arresters in water piping according to PDI-WH 201.
- D. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

3.2 FIELD QUALITY CONTROL

- A. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

END OF SECTION 22 11 19



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SECTION 22 13 16
SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following soil and waste, sanitary drainage and vent piping inside the building:
1. Pipe, tube, and fittings.
 2. Special pipe 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.

1.3 SUBMITTALS

- A. Field quality-control inspection and test reports.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 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-drain" for plastic drain piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Solid-Wall PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.
1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
 2. Solvent Cement and Adhesive Primer:
 - a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).



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PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- C. Aboveground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
 - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- D. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
 - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

3.2 PIPING INSTALLATION

- A. Sanitary sewer piping outside the building as specified.
- B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 22 Section "Common Work Results for Plumbing."
- 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 2 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. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- G. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.



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- H. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- I. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- J. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
- B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 - 2. NPS 3: 48 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
- F. Install supports for vertical PVC piping every 48 inches.
- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

- A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.



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- 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.
 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code
 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.6 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. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- 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.
1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 2. Prepare reports for tests and required corrective action.

3.7 CLEANING

- 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.

3.8 PROTECTION

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

END OF SECTION 22 13 16



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SECTION 22 13 19
SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts.
2. Floor drains.
3. Roof flashing assemblies.
4. Miscellaneous sanitary drainage piping specialties.
5. Flashing materials.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

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. Exposed Cast-Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: as required to match connected piping.
5. Closure: Countersunk, brass plug.



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6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Oatey.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
 - g. Zurn Plumbing Products Group; Light Commercial Operation.
 - h. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: As Required.
7. Outlet Connection: Inside caulk.
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, Extra-Heavy Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - 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: as required to match connected piping.
5. Closure: Countersunk or raised-head, 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.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:



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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Commercial Enameling Co.
 - b. Josam Company; Josam Div.
 - c. MIFAB, Inc.
 - d. Prier Products, Inc.
 - e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - f. Tyler Pipe; Wade Div.
 - g. Watts Drainage Products Inc.
 - h. Zurn Plumbing Products Group; Light Commercial Operation.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: As required, see drawings.
6. Anchor Flange: As required, see drawings.
7. Clamping Device: As required, see drawings..
8. Outlet: Side.
9. Backwater Valve: Not required.
10. Coating on Interior and Exposed Exterior Surfaces: Not required.
11. Sediment Bucket: As required, see drawings.
12. Top or Strainer Material: Nickel bronze.
13. Top of Body and Strainer Finish: Nickel bronze.
14. Top Shape: Round.
15. Top Loading Classification: Heavy 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: Cleanout and trap-seal primer valve drain connection.

2.3 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Acorn Engineering Company; Elmdor/Stoneman Div.
 - b. Thaler Metal Industries Ltd.

B. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch- thick, lead flashing collar and skirt extending at least 10 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

1. Open-Top Vent Cap: Without cap.
2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
3. Extended Vent Cap: With field-installed, vandal-proof vent cap.



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2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
 - a. NPS 2: 4-inch- minimum water seal.
 - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

C. 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 side inlet.

D. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

E. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

F. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

2.5 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.



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- B. Fasteners: Metal compatible with material and substrate being fastened.
- C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- D. Solder: ASTM B 32, lead-free alloy.
- E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- C. 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. Use NPS 4 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 for piping NPS 4 and smaller and 100 feet for larger piping.
 - 4. Locate at base of each vertical soil and waste stack.
- D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
 - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.



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4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- G. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- H. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- I. Assemble open drain fittings and install with top of hub 1 inch above floor.
- J. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- K. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 2. Size: Same as floor drain inlet.
- L. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- M. Install vent caps on each vent pipe passing through roof.
- N. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- O. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.



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3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
 - C. Set flashing on floors and roofs in solid coating of bituminous cement.
 - D. Secure flashing into sleeve and specialty clamping ring or device.
 - E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Flashing and Sheet Metal."
 - F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 LABELING AND IDENTIFYING

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19



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SECTION 22 42 13.13
COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Water closets.
 2. Flushometer valves.
 3. Toilet seats.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 FLOOR-MOUNTED WATER CLOSETS

- A. Water Closets: Floor mounted, top spud.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Kohler Co.
 2. Bowl:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Style: Flushometer valve.
 - e. Height: Standard.
 - f. Rim Contour: Elongated.
 - g. Water Consumption: 1.28 gal. per flush.
 - h. Spud Size and Location: NPS 1-1/2; top.
 3. Flushometer Valve: As scheduled on drawings.
 4. Toilet Seat: As scheduled on drawings.
 5. Support: Existing to be revised



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2.2 FLUSHOMETER VALVES

- A. Battery Powered Sensor, Piston Flushometer Valves:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Hydrotek
 2. Standard: ASSE 1037.
 3. Minimum Pressure Rating: 125 psig.
 4. Features: Include integral check stop and backflow-prevention device.
 5. Material: Brass body with corrosion-resistant components.
 6. Exposed Flushometer-Valve Finish: Chrome plated.
 7. Style: Exposed.
 8. Consumption: 1.28 gal. per flush.
 9. Minimum Inlet: NPS 1.
 10. Minimum Outlet: NPS 1-1/4.

2.3 TOILET SEATS

- A. Toilet Seats:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Kohler
 2. Standard: IAPMO/ANSI Z124.5.
 3. Material: Plastic.
 4. Type: Commercial (Heavy duty).
 5. Shape: Elongated rim, open front.
 6. Hinge: Self-sustaining, check.
 7. Hinge Material: Noncorroding metal.
 8. Seat Cover: Not required.
 9. Color: White.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Water-Closet Installation:
1. Install level and plumb according to roughing-in drawings.
 2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
 3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.
- B. Flushometer-Valve Installation:
1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.



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3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
 4. Install actuators in locations that are easy for people with disabilities to reach.
- C. Install toilet seats on water closets.
- D. Joint Sealing:
1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
 2. Match sealant color to water-closet color.
 3. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."

3.2 CONNECTIONS

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.3 ADJUSTING

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.

3.4 CLEANING AND PROTECTION

- A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.
- C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 13.13



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SECTION 22 42 13.16
COMMERCIAL URINALS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Urinals.
 2. Flushometer valves.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 WALL-HUNG URINALS

- A. Urinals: Wall hung, back outlet, washout.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Kohler Co.
 2. Fixture:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Washout with extended shields.
 - d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
 - e. Water Consumption: 0.5 gallons per flush.
 - f. Spud Size and Location: NPS 3/4, top.
 - g. Outlet Size and Location: NPS 2, back.
 - h. Color: White.
 3. Waste Fitting:
 - a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
 - b. Size: NPS 2.



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4. Support: ASME A112.6.1M, Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights.

2.2 URINAL FLUSHOMETER VALVES

A. Battery-Powered, Solenoid-Actuator, Piston Flushometer Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Hydrotek
2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Style: Exposed.
8. Actuator: Solenoid complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
9. Trip Mechanism: Battery-powered electronic sensor complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
10. Consumption: 0.5 gal. per flush.
11. Minimum Inlet: NPS 3/4.
12. Minimum Outlet: NPS 1-1/4.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.
- B. Examine walls and floors for suitable conditions where urinals will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Urinal Installation:

1. Install urinals level and plumb according to roughing-in drawings.
2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
3. Install wall-hung, bottom-outlet urinals with tubular waste piping attached to supports.
4. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:



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1. Install supports, affixed to building substrate, for wall-hung urinals.
2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
3. Use carriers without waste fitting for urinals with tubular waste piping.
4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

C. Flushometer-Valve Installation:

1. Install flushometer-valve water-supply fitting on each supply to each urinal.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Division 22 Section "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.
3. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

- A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.
- B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to urinals, allow space for service and maintenance.

3.4 ADJUSTING

- A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.



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3.5 CLEANING AND PROTECTION

- A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed urinals and fittings.
- C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 13.16



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SECTION 22 42 16.13
COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Lavatories.
2. Faucets.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.
 1. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - a. Servicing and adjustments of automatic faucets.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

- A. Lavatory: Vitreous china, wall mounted, with back.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Kohler Co.
 2. Fixture:
 - a. Standard: ASME A112.19.2/CSA B45.1.
 - b. Type: For wall hanging.



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- c. Nominal Size: Rectangular, 21.5 by 18.25 inches.
- d. Faucet-Hole Punching: One holes.
- e. Faucet-Hole Location: Top.
- f. Color: White.
- g. Mounting Material: Chair carrier.
3. Faucet: Battery powered deck mounted sensor faucet. Faucet provide a single cold water supply, 0.5 gpm spray outlet.
4. Support: ASME A112.6.1M, Type II, concealed-arm lavatory carrier with escutcheons.

2.2 METAL CONSTRUCTION, BATTERY POWERED SENSOR FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
- B. Lavatory Faucets: Battery powered sensor-type, solid-metal valve.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Hydrotek
 2. Standard: ASME A112.18.1/CSA B125.1.
 3. General: Coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
 4. Body Type: Centerset.
 5. Body Material: Commercial, solid metal.
 6. Finish: Polished chrome plate.
 7. Maximum Flow Rate: 0.5 gpm.
 8. Mounting Type: Deck, exposed.
 9. Valve Handle(s): Battery powered sensor.
 10. Spout: Rigid type.
 11. Spout Outlet: Aerator.

2.3 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.
- F. Risers:
 1. NPS 3/8.
 2. Chrome-plated, soft-copper flexible tube riser.



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2.4 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
- C. Trap:
 - 1. Size: NPS 1-1/2 by NPS 1-1/4.
 - 2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.
 - 3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
- B. Examine counters and walls for suitable conditions where lavatories will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install lavatories level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-mounted lavatories.
- C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.
- D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Division 22 Section "Escutcheons for Plumbing Piping."
- E. Seal joints between lavatories and counters and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."
- F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Division 22 Section "Plumbing Piping Insulation."



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3.3 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

- A. After completing installation of lavatories, inspect and repair damaged finishes.
- B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed lavatories and fittings.
- D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 16.13



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SECTION 22 47 00
WATER FOUNTAINS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Wall mounted barrier-free drinking fountain.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for fixtures for people with disabilities.
- B. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- C. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.

PART 2 - PRODUCTS

2.1 PRESSURE WATER FOUNTAINS

- A. Water Fountains:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Haws Corporation.
 - 2. Description: Accessible, Model 1119.14a pedestal drinking fountain.
 - a. Pedestal: 14 gauge stainless steel wall mount with stainless steel back plate.



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- b. Bubbler: Two, polished chrome-plated brass vandal-resistant bubbler head backed against a pedestal guard.
- c. Control: Push button.
- d. Supply: 1/2" with optional 1/2" stop assembly.
- e. Filter: Optional 12" x2" in-line lead removal element.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Set wall mounted drinking fountains in locations shown on plans.
- B. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view.

3.2 INSTALLATION

- A. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.
- B. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- D. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- E. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

- A. Connect fixtures with water supplies, traps, and risers, and with soil, waste, and vent piping. Use size fittings required to match fixtures.

3.4 FIELD QUALITY CONTROL

- A. Water Fountain Testing: Test for compliance with requirements. Test and adjust controls and safeties.
 1. Remove and replace malfunctioning units and retest as specified above.
 2. Report test results in writing.



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3.5 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.

END OF SECTION 22 47 00



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Division 26
Electrical



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SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL CONSTRUCTION

PART 1 - GENERAL

1.1 The electrical work included in all other divisions are the responsibility of the contractor performing the Division 26 work unless noted otherwise.

1.2 PROJECT OVERVIEW

A. Provide power and lighting for the construction of a park building.

1.3 SCOPE

A. The work under this section includes basic electrical requirements, which are applicable to all Division 26 sections. This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections. Included are the following topics:

B. Section Includes:

1. GENERAL

- a. Project Overview
- b. Scope
- c. Related Work
- d. Reference Standards
- e. Regulatory Requirements
- f. Quality Assurance
- g. Continuity of Existing Services and Systems
- h. Protection of Finished Surfaces
- i. Approved Electrical Testing Laboratories
- j. Sleeves for Raceways and Cables
- k. Sleeve Seals
- l. Grout
- m. Sealing
- n. Owner Furnished Equipment
- o. Work by Owner
- p. Provisions for Future Work
- q. Intent
- r. Omissions
- s. Submittals
- t. Project/Site Conditions
- u. Work Sequence and Scheduling
- v. Work by Other Trades
- w. Offsite Storage
- x. Request and Certificate for Payment
- y. Salvage Materials
- z. Certificates and Inspections



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- aa. Operating and Maintenance Data
- bb. Training of Owner Personnel
- cc. Record Drawings

2. PRODUCTS

- a. Access Panels and Doors
- b. Identification
- c. Sealing

3. EXECUTION

- a. Excavation and Backfill
- b. Concrete Work
- c. Cutting and Patching
- d. Building Access
- e. Equipment Access
- f. Coordination
- g. Sleeves: Installation for Electrical Penetrations
- h. Sealing
- i. Housekeeping and Clean Up

4. RELATED WORK

- a. Applicable provisions of Division 1 govern work under this Section.

5. REFERENCE STANDARDS

- a. Abbreviations of standards organizations referenced in this and other sections are as follows:
 - 1) ANSI American National Standards Institute
 - 2) ASTM American Society for Testing and Materials
 - 3) EPA Environmental Protection Agency
 - 4) ETL Electrical Testing Laboratories, Inc.
 - 5) IEEE Institute of Electrical and Electronics Engineers
 - 6) IES Illuminating Engineering Society
 - 7) ISA Instrument Society of America
 - 8) NBS National Bureau of Standards
 - 9) NEC National Electric Code
 - 10) NEMA National Electrical Manufacturers Association
 - 11) NESC National Electrical Safety Code
 - 12) NFPA National Fire Protection Association
 - 13) UL Underwriters Laboratories Inc.

6. REGULATORY REQUIREMENTS

- a. All work and materials are to conform in every detail to applicable rules and requirements of the National Electrical Code (ANSI/NFPA 70), other applicable National Fire Protection Association codes, the National Electrical Safety Code, and present manufacturing standards (including NEMA).
- b. All Division 26 work shall be done under the direction of a currently certified State of Florida Certified Master Electrician.



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7. QUALITY ASSURANCE

- a. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system and the assigned space and for obtaining the performance from the system into which these items are placed.
- b. Manufacturer references used herein are intended to establish a level of quality and performance requirements unless more explicit restrictions are stated to apply.
- c. All materials, except medium voltage equipment and components, shall be listed by and shall bear the label of an approved electrical testing laboratory. If none of the approved electrical testing laboratories has published standards for a particular item, then other national independent testing standards, if available, applicable, and approved by DSF, shall apply and such items shall bear those labels. Where one of the approved electrical testing laboratories has an applicable system listing and label, the entire system, except for medium voltage equipment and components, shall be so labeled.

8. CONTINUITY OF EXISTING SERVICES AND SYSTEMS

- a. No outages shall be permitted on existing systems except at the time and during the interval specified by the Owner and Architect. This will require written approval. Any outage must be scheduled when the interruption causes the least interference with normal institutional schedules and business routines. No extra costs will be paid to the Contractor for such outages which must occur outside of regular weekly working hours. If required by the serving utility, include these costs in bid.
- b. This Contractor shall restore any circuit interrupted as a result of this work to proper operation as soon as possible.

9. PROTECTION OF FINISHED SURFACES

- a. Furnish one can of touch-up paint for each different color factory finish furnished by the Contractor. Deliver touch-up paint with other "loose and detachable parts" as covered in the General Requirements.

10. APPROVED ELECTRICAL TESTING LABORATORIES

- a. The following laboratories are approved for providing electrical product safety testing and listing services as required in these specifications:
 - 1) Underwriters Laboratories Inc.
 - 2) Electrical Testing Laboratories, Inc.

1.4 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.



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- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

1.5 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 3. Pressure Plates: Stainless steel. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

1.6 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

1.7 SEALING

- 1. Sealing of sleeves/openings between conduits, cable trays, wireways, troughs, cablebus, busduct, etc. and the structural or partition opening shall be the responsibility of the contractor whose work penetrates the opening.

1.8 WORK BY OWNER

- A. Asbestos abatement and PCB equipment (other than light fixture ballasts) removal and disposal, if required, will be by the Owner under separate contract.
- B. Electrical testing not described in these contract documents will be by the Owner under separate contract.



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1.9 INTENT

- A. The Contractor shall furnish and install all the necessary materials, apparatus, and devices to complete the electrical equipment and systems installation herein specified, except such parts as are specifically exempted herein.
- B. If an item is either called for in the specifications or shown on the plans, it shall be considered sufficient for the inclusion of said item in this contract. If a conflict exists within the Specifications or exists within the Drawings, the Contractor shall furnish the item, system, or workmanship, which is the highest quality, largest, or most closely fits the Owners intent). Refer to the General Conditions of the Contract for further clarification.
- C. It must be understood that the details and drawings are diagrammatic. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.
- D. All sizes as given are minimum except as noted.
- E. Materials and labor shall be new (unless noted or stated otherwise), first class, and workmanlike, and shall be subject at all times to the Owner's and Architect's inspections, tests and approval from the commencement until the acceptance of the completed work.
- F. Whenever a particular manufacturer's product is named, it is intended to establish a level of quality and performance requirements unless more explicit restrictions are stated to apply.

1.10 OMISSIONS

- A. No later than ten (10) days before bid opening, the Contractor shall call the attention of the Owner and Architect to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

1.11 SUBMITTALS

- A. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Failure to do this may result in the submittal(s) being returned to the Contractor for correction and resubmission. Failing to follow these instructions does not relieve the Contractor from the requirement of meeting the project schedule.
- B. On request from the Architect, the successful bidder shall furnish additional drawings, illustrations, catalog data, performance characteristics, etc.
- C. Submittals shall be grouped to include complete submittals of related systems, products, and accessories in a single submittal. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered equipment.
- D. The submittals must be approved before fabrication is authorized.
- E. Submit sufficient quantities of submittals to allow the following distribution:



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- | | | |
|----|-----------------------------------|----------|
| 1. | Operating and Maintenance Manuals | 3 copies |
| 2. | Architect | 2 copies |
| 3. | Engineer | 1 copy |

1.12 PROJECT/SITE CONDITIONS

- A. Install Work in locations shown on Drawings, unless prevented by Project conditions.
- B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Owner and Architect before proceeding.
- C. Tools, materials and equipment shall be confined to areas designated by the Owner and Architect.

1.13 WORK SEQUENCE AND SCHEDULING

- A. Install work in phases to accommodate user Owner's occupancy requirements. During the construction period coordinate electrical schedule and operations with the Owner and Architect.

1.14 WORK BY OTHER TRADES

- A. Every attempt has been made to indicate in this trade's specifications and drawings all work required of this Contractor. However, there may be additional specific paragraphs in other trade specifications and addenda, and additional notes on drawings for other trades which pertain to this Trade's work, and thus those additional requirements are hereby made a part of these specifications and drawings.
- B. Electrical details on drawings for equipment to be provided by others are based on preliminary design data only. This Contractor shall lay out the electrical work and shall be responsible for its correctness to match equipment actually provided by others.

1.15 OFFSITE STORAGE

- A. No material will be accepted for offsite storage unless submittals for the material have been approved.

1.16 REQUEST AND CERTIFICATE FOR PAYMENT

- A. Within 10 days after Notice to Proceed, the successful bidder will submit to the Owner and Architect in a form prescribed below and by the General Conditions of the Contract, Scheduling and Coordination of Work, Reports, Records and Data, and Payments to Contractor, a cost breakdown of the proposed values for work performed which, if approved by the Owner, will become the basis for construction progress and monthly payments. The cost breakdown items shall reflect actual work progress stages as closely as feasible.



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- B. In addition, if payment will be requested for approved off-site stored material, then that material shall be listed as a line item and the Contractor may be compensated by the Owner.

1.17 SALVAGE MATERIALS

- A. No materials removed from this project shall be reused. All materials removed shall become the property of and shall be disposed of by the Contractor.

1.18 CERTIFICATES AND INSPECTIONS

- A. Obtain and pay for all required installation inspections.

1.19 OPERATION AND MAINTENANCE DATA

- A. Assemble material in three-ring or post binders, using an index at the front of each volume and tabs for each system or type of equipment. In addition to the data indicated in the General Requirements, include the following information:
 1. Copies of all approved submittals.
 2. Manufacturer's wiring diagrams for electrically powered equipment.
 3. Records of tests performed to certify compliance with system requirements.
 4. Certificates of inspection by regulatory agencies.
 5. Parts lists for manufactured equipment.
 6. Preventative maintenance recommendations.
 7. Warranties.
 8. Additional information as indicated in the technical specification sections.

1.20 RECORD DRAWINGS

- A. The Contractor shall maintain at least one copy each of the specifications and drawings on the job site at all times.
- B. The Owner will provide the Contractor with a suitable set of contract drawings on which daily records of changes and deviations from contract shall be recorded. Dimensions and elevations on the record drawings shall locate all buried or concealed piping, conduit, or similar items.
- C. The daily record of changes shall be the responsibility of Contractor's field superintendent. No arbitrary mark-ups will be permitted.
- D. At completion of the project, the Contractor shall submit the marked-up record drawings to the Owner and Architect prior to final payment.



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PART 2 - PRODUCTS

2.1 IDENTIFICATION

- A. See Electrical section 260553 – Identification for Electrical Systems.

2.2 NON-RATED PENETRATIONS:

- A. Conduit Penetrations Through Below Grade Walls:

- 1. In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated conduit and the cored opening or a water-stop type wall sleeve.

- B. Conduit and Cable Tray Penetrations:

- 1. At conduit and cable tray penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between conduit and sleeve, or the core drilled opening.

PART 3 - EXECUTION

3.1 EXCAVATION AND BACKFILL

- A. Perform all excavation and backfill work to accomplish indicated electrical systems installation. Blasting will not be allowed.

3.2 CONCRETE WORK

- A. Confirm with the Construction Manager or General Contractor that the Division 3 Contractor will perform all cast-in-place concrete unless noted otherwise elsewhere. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for the support of electrical equipment.

3.3 CUTTING AND PATCHING

- A. Refer to Division 1, General Requirements, Cutting and Patching.

3.4 BUILDING ACCESS

- A. Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.



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3.5 EQUIPMENT ACCESS

- A. Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Where access is required in plaster or drywall walls or ceilings, furnish the access doors to the General Contractor and reimburse the General Contractor for installation of those access doors.

3.6 COORDINATION

- A. The Contractor shall cooperate with other trades in locating work in a proper manner. Should it be necessary to raise or lower or move longitudinally any part of the electrical work to better fit the general installation, such work shall be done at no extra cost to the Owner, provided such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.
- B. The Contractor shall verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to light fixtures, panelboards, devices, etc. and recessed or semi-recessed units installed in/on architectural surfaces.
- C. Coordinate all work with other contractors prior to installation. Any installed work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.
- D. Verify system completion to the testing consultant. Demonstrate the starting, interlocking and control features of each system so the testing contractor can perform its work.
- E. Comply with NECA 1.
- F. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- G. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- H. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- I. Right of Way: Give to piping systems installed at a required slope.

3.7 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATION

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.



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- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- K. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- L. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.
- M. Pipe sleeves for conduits 6" in diameter and smaller, in new poured concrete construction, shall be schedule 40 steel pipe, plastic removable sleeve or sheet metal sleeve, all cast in place.
- N. In wet area floor penetrations, top of sleeve to be 2 inches above the adjacent floor. In existing wet area floor penetrations, core drill sleeve openings large enough to insert schedule 40 sleeve and grout the area around the sleeve. If a pipe clamp resting on the sleeve supports the pipe penetrating the sleeve, weld a collar or struts to the sleeve that will transfer weight to the existing floor structure. Wet areas for this paragraph are rooms or spaces containing air handling unit coils, converters, pumps, chillers, boilers, and similar waterside equipment.
- O. Pipe penetrations in existing concrete floors that are not in wet areas may omit the use of schedule 40 sleeve and use the core drilled opening as the sleeve.

3.8 SEALING

- A. Non-Rated Surfaces:



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1. When the opening is through a non-fire rated wall, floor, ceiling or roof the opening must be sealed using an approved type of material.
2. Use galvanized sheet metal sleeves in hollow wall penetrations to provide a backing for the sealant. Grout area around sleeve in masonry construction.
3. Install escutcheons or floor/ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces for this paragraph include only those rooms with finished ceilings and the penetration occurs below the ceiling.
4. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the conduit and tighten in place, in accordance with the manufacturer's instructions. Install so that the bolts used to tighten the seal are accessible from the interior of the building or vault.
5. At interior partitions, conduit penetrations are required to be sealed for all clean rooms, laboratories, and most hospital spaces, computer rooms, dormitory rooms, tele/data/com rooms and similar spaces where the room pressure or odor transmission must be controlled. Apply sealant to both sides of the penetration in such a manner that the annular space between the conduit sleeve and the conduit is completely filled.

3.9 HOUSEKEEPING AND CLEAN UP

- A. The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work and shall repair all damage to new and existing equipment resulting from its work. When job is complete, this Contractor shall remove all tools, excess material and equipment, etc., from the site.

END OF SECTION 26 05 00



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SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

1.4 RECEIVING, STORING AND PROTECTING

- A. Receive, store, and protect, and handle products according to NECA 1 Standard Practices for Good Workmanship in Electrical Construction.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.



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7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.2 EQUIPMENT GROUNDING CONDUCTORS

- A. Provide NRTL-listed THHN/THWN insulated copper wire.
- B. Use solid grounding conductors 10 AWG and smaller where not subject to vibration or repeated flexing.
- C. Use stranded grounding conductors for 8 AWG and larger.
- D. Use stranded grounding conductors where subject to vibration or repeated flexing. Use stranded grounding conductors in flexible conduit at motor connections.
- E. Color code grounding conductors as follows:
 1. Equipment ground:
 - a. Conductors 6 AWG and smaller: Green colored insulation.
 - b. Conductors 4 AWG and larger: Green colored insulation or black colored insulation with 3/4 inch wide band of water and oil-resistant green plastic adhesive tape.

2.3 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Exothermic Weld Grounding Connections:
 1. Provide molds and welding material for making exothermic weld connections.
 2. In interior locations and in vaults, use low smoke emission type welding material.
 3. Match mold and weld material to material types, shapes and sizes to be joined.
 4. Manufacturer: ERICO Cadweld
- D. Compression Grounding Connections:
 1. Use two-hole heavy-duty compression lugs for bolted connections to ground bars, ground plates, and equipment ground pads.
 2. Manufacturer: Burndy "Hyground"

2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, 3/4 inch by 10 feet (19 mm by 3 m) in diameter.



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PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade.
- C. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Flexible raceway runs.
 - 6. Armored and metal-clad cable runs.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
 - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Test Wells: Ground rod driven through drilled hole in bottom of handhole and shall be at least 12 inches deep, with cover.



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1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- E. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
- F. Bonding Bushings:
1. Install bonding bushings on metallic conduit containing circuits rated 100 amperes and higher.
 2. Install bonding bushings on metallic conduits entering enclosures through concentric, eccentric or oversize knockouts.
 3. Install bonding bushings on metallic conduits that terminate to a metallic enclosure without effective electrical connection such as locknuts or threaded bushings.
 4. Bond conduit bonding bushing lug to the equipment ground bar or ground lug in switchgear, panelboards, transformers, motor control centers, starters, disconnect switches, cabinets, etc. Size bonding jumpers in accordance with the NEC.
- ### 3.4 FIELD QUALITY CONTROL
- A. Attach grounds permanently before permanent building service is energized.
- B. Perform the following tests and inspections and prepare test reports:
1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.
 - a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural



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drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

- b. Perform tests by fall-of-potential method according to IEEE 81.
- C. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
 2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
- D. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26



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SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
1. Hangers and supports for electrical equipment and systems.
 2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.
- E. Do not drill or otherwise compromise structural members.

1.3 SUBMITTALS

- A. Product Data: For steel slotted support systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
1. Shop Drawings: Submit shop drawings showing details of fabricated hangers, and supports. Provide detail drawings along with catalog cuts, templates, and erection and installation details, as appropriate. Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction.
- C. Welding certificates.

1.4 QUALITY ASSURANCE

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



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- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper B-Line, Inc.; a division of Cooper Industries.
 - b. ERICO International Corporation.
 - c. Thomas & Betts Corporation.
 - d. Unistrut; Tyco International, Ltd.
 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 5. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.



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2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Hilti Inc.
 - 3) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

2.3 COATINGS

- A. Provide products for use indoors protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic.
- B. Provide products for use outdoors or in damp or corrosive indoor locations with hot-dip galvanized coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic.

2.4 RACEWAY SUPPORTING DEVICES

- A. Provide supports as described below for the installation of raceway systems.
- B. Use pressed steel, single bolt hangers to support individual RGS, IMC or EMT conduit runs from threaded rods or beam clamps. Manufacturer: Steel City "6H Series".
- C. For individual runs of EMT up to 1-inch trade size above accessible ceilings, use spring steel conduit clips with positive snap closure. Manufacturer: ERICO CADDY "M Series".



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- D. Use malleable iron conduit clamps to secure individual RGS, IMC or EMT conduit runs across, parallel, or perpendicular to beams, channels and angle supports. Manufacturer: Steel City "RC, EC, and PC Series".
- E. Use two-piece carbon steel riser clamps for individual vertical conduits passing through floors. Manufacturer: Kindorf "C-210 Series".
- F. Use snap-on type one-hole steel straps to secure individual conduits up to 2-inch trade size to flat, dry interior surfaces. Manufacturer: T&B "1210 Series" for RGS and IMC and "4100 Series" for EMT.
- G. Use one-hole malleable iron straps to secure individual conduits up to 4-inch trade size to flat, dry interior surfaces. Manufacturer: T&B "1275 Series".
- H. Use one-hole malleable iron straps and conduit spacers to secure individual conduits to flat exterior or damp flat interior surfaces. Manufacturer: T&B "1275 Series" straps with 1350 Series" spacers.
- I. Support multiple parallel horizontal conduits with trapeze hangers fabricated from framing channel materials specified below.

2.5 OUTLET BOX SUPPORTING DEVICES

- A. Provide pre-fabricated sheet steel brackets to support outlet boxes from metal studs in dry-wall construction.
- B. Provide brackets for single-outlet boxes that are inset to allow for dry-wall ring and have a far-side support leg. Manufacturer: ERICO CADDY "H Series".
- C. Provide brackets for multiple outlet boxes that are inset to allow for dry-wall rings and span from stud to stud. Manufacturer: ERICO CADDY "RBS Series".

2.6 FASTENERS

- A. Provide fasteners of the types, materials, and construction features as follows:
 - 1. Pre-set concrete inserts:
 - a. Continuous inserts: Design load 2000 lbs per ft of insert length with safety factor of five (5) in 3000 psi concrete. Manufacturer: B-Line "B221"
 - b. Spot inserts: NRTL-listed with design load of 1000 lb. Manufacturer: B-Line "B2506"
 - c. Metal deck bolts: Adjustable with bolt sizes from 3/8 inch to 3/4 inch. Manufacturer: B-Line "B3019"
 - 2. Expansion anchors: NRTL listed carbon steel wedge type studs. Manufacturer: Hilti "Kwik Bolt III". Note restrictions on use of expansion bolts in Part 3 of this Section.
 - 3. Toggle bolts: All steel-spring head type.
 - 4. Masonry screw anchors: Case hardened steel. Manufacturer: Hilti "Kwik-Con II".
 - 5. Powder-Driven Threaded Studs: Heat-treated steel, designed for the intended service. Note restrictions on use of powder-driven fasteners in Part 3 of this Section.



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6. Beam clamps: NRTL-listed, or compliant with Federal Specification WW-H-171E, or compliant with Manufacturers' Standardization Society SP-69 and SP-58.

2.7 FRAMING CHANNEL SYSTEMS

- A. Provide U-channel framing systems that conform to the Metal Framing Manufacturers' Association standards publication MFMA-4 and are fabricated using minimum 12-gage steel, with 9/16-inch-diameter holes, from 1-1/2 to 1-7/8 inches on center, in the surface opposite the "U" opening.
- B. Provide fittings and accessories that mate and match with U-channel and are of the same manufacturer. Use two-piece, single bolt type conduit straps on U-channel supports.
- C. Manufacturers: Unistrut, B-Line, Superstrut.

2.8 FABRICATED SUPPORTING DEVICES

- A. Provide shop- or field-fabricated supports or manufactured supports assembled from U-channel components.
- B. Provide steel brackets fabricated from angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

2.9 SLEEVES AND SEALS

- A. Provide pipe sleeves of one of the following:
 1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snap-lock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gage metal for sleeve diameter noted:
 - a. 3-inch and smaller: 20-gage.
 - b. 4-inch to 6-inch: 16-gage.
 - c. over 6-inch: 14-gage.
 2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe two pipe sizes larger than the penetrating raceway.
 3. Plastic Pipe: Fabricate from Schedule 80 PVC plastic pipe two pipe sizes larger than the penetrating raceway.

PART 3 - EXECUTION

3.1 GENERAL

- A. Locate each item of rigid electrical equipment entirely on one side only of a building expansion joint.



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- B. Piping, cable trays, etc., which cross an expansion joint to rigid electrical equipment, shall have flexible joints that are capable of accommodating calculated thermal and seismic displacements.
- C. Conform to manufacturer's instructions and recommendations for selection and installation of hangers, and supports.
- D. Do not use wire or perforated strap for permanent electrical supports.
- E. Attach each item of electrical equipment as shown.
- F. Provide and install electrical conduit, busways, cable trays, etc. which cross an expansion joint to rigid electrical equipment, with flexible joints as shown.
- G. Do not support conduits, busways, cable trays, etc. from ceiling suspension wires.

3.2 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.
 - 2. Support three or more parallel runs of horizontal raceways together on trapeze hangers.
 - 3. Do not support conduits from ceiling suspension wires.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.3 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.



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- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
1. To Wood: Fasten with lag screws or through bolts.
 2. To New Concrete: Bolt to concrete inserts.
 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. To Existing Concrete: Expansion anchor fasteners.
 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 7. To Light Steel: Sheet metal screws.
 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.4 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Division 09 for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29



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SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Conduits and fittings
- B. Outlet boxes
- C. Pull and junction boxes
- D. Surface metal raceways
- E. Wireway

1.2 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.4 RECEIVING, STORING, AND PROTECTING

- A. Receive, store, and protect, and handle products according to NECA 1 – *Standard Practices for Good Workmanship in Electrical Construction*.

PART 2 - PRODUCTS

2.1 COATINGS

- A. Provide products with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic that is suitable for the environment in which the product will be installed and used.



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- 2.2 INTERMEDIATE METAL CONDUIT AND FITTINGS (IMC)
- A. Furnish intermediate metal conduit (IMC) that meets the requirements of UL1242 – *Intermediate Metal Conduit*, ANSI C80.6 – *Electrical Intermediate Metal Conduit (EIMC)*.
 - B. Furnish zinc-plated, threaded, malleable iron fittings and conduit bodies that meet the requirements of UL514B – *Fittings for Conduit and Outlet Boxes*, and ANSI/NEMA FB1 – *Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies*.
- 2.3 RIGID METAL CONDUIT AND FITTINGS (RMC)
- A. Furnish rigid metal conduit (RMC) that meets the requirements of UL6 – *Rigid Metal Electrical Conduit*, NEMA C80.1 – *Electrical Rigid Steel Conduit (ERSC)*.
 - B. Furnish zinc-plated, threaded, malleable iron fittings and conduit bodies that meet the requirements of UL514B and ANSI/NEMA FB1.
- 2.4 PLASTIC-COATED STEEL CONDUIT AND FITTINGS
- A. Furnish PVC exterior coated, urethane interior coated, RMC or IMC that meets the requirements of NEMA RN 1 – *PVC Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit*.
 - B. Use factory-fabricated elbows.
 - C. Furnish 40 mil PVC exterior coated, urethane interior coated, zinc-plated, threaded, malleable iron fittings and conduit bodies meeting the requirements of UL514B – *Fittings for Conduit and Outlet Boxes* and NEMA RN 1 PVC.
- 2.5 RIGID NON-METALLIC CONDUIT AND FITTINGS (RNC)
- A. Furnish rigid non-metallic conduit (RNC) that meets the requirements of UL651 – *Schedule 40 and 80 Rigid PVC Conduit*, NEMA TC 2 – *Electrical Plastic Tubing and Conduit*.
 - B. Furnish non-metallic, solvent-welded socket fittings that meet the requirements of UL514C – *Non-Metallic Fittings for Conduit and Outlet Boxes*, and NEMA TC 3 – *PVC Fittings for Use with Rigid PVC Conduit and Tubing*.
- 2.6 ELECTRICAL METALLIC TUBING AND FITTINGS (EMT)
- A. Furnish galvanized electrical metallic tubing (EMT) that meets the requirements of UL797 – *Electrical Metallic Tubing*, NEMA C80.3 – *Steel Electrical Metallic Tubing (EMT)*.
 - B. Furnish compression or set-screw type fittings that meet the requirements of UL514B – *Fittings for Conduit and Outlet Boxes*, and ANSI/NEMA FB1 – *Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies*. Furnish insulated throat connectors.



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2.7 FLEXIBLE METAL CONDUIT AND FITTINGS

- A. Furnish galvanized steel flexible metal conduit that meets the requirements of UL1 – *Flexible Metal Electrical Conduit*.
- B. Furnish zinc-plated malleable iron fittings that meet the requirements of UL514B – *Fittings for Conduit and Outlet Boxes*, and ANSI/NEMA FB1 – *Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies*. Furnish insulated throat connectors.

2.8 LIQUID-TIGHT FLEXIBLE METAL CONDUIT AND FITTINGS

- A. Furnish liquid-tight flexible metal conduit that meets the requirements of UL360 – *Liquid-Tight Flexible Steel Conduit, Electrical*.
- B. Furnish zinc-plated malleable iron or zinc-plated steel liquid-tight fittings that meet the requirements of UL514B – *Fittings for Conduit and Outlet Boxes*, and ANSI/NEMA FB1 – *Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies*. Furnish insulated throat connectors.

2.9 INSULATING BUSHINGS

- A. Provide NRTL listed insulating bushings with 105 °C rated insulation.
- B. Manufacturer: O-Z/Gedney, Type IB.

2.10 GROUNDING BUSHINGS

- A. Provide NRTL listed, galvanized malleable iron, 150°C rated insulated throat grounding bushings with lay-in type ground cable lugs.
- B. Manufacturer: O-Z/Gedney, Type BLG.

2.11 EXPANSION FITTINGS

- A. Furnish NRTL listed expansion fittings with hot dipped galvanized malleable iron body, factory installed packing and a bonding jumper.
- B. Manufacturer: O-Z/Gedney, Type AX, TX or EXE with Type BJ bonding jumper.

2.12 CORROSION PROTECTION TAPE

- A. Furnish pressure-sensitive, 10 mil thick. PVC based tape for corrosion protection of metal conduit and fittings.
- B. Manufacturer: 3M, Type 50.



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2.13 RACEWAY MEASURING TAPE

- A. Furnish raceway measuring tape with permanently printed measurements in one-foot increments and minimum 1200 lb average breaking strength.
- B. Manufacturer: Greenlee "39243".

2.14 SURFACE METAL RACEWAY

- A. Furnish surface metal raceway that meets the requirements of UL5 – *Surface Metal Electrical Raceways and Fittings*.
- B. Furnish surface metal raceway fabricated from cold rolled galvanized steel with a thickness of not less than 0.040 inches and coated with a baked enamel finish.
- C. Furnish fittings required for a complete installation.
- D. Manufacturer: Wiremold "500" or "700" series.

2.15 OUTLET BOXES

- A. Provide outlet boxes selected for specific installations using the guidance in NEMA OS 3, *Selection and Installation Guidelines for Electrical Outlet Boxes*, and the requirements of this Section.
- B. For dry locations provide galvanized steel outlet boxes that comply with UL Standard 514-A – *Metallic Outlet Boxes* and ANSI/NEMA OS1 – *Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports*.
 - 1. For luminaire outlets use 4 inch x 1-1/2 inch deep octagonal boxes with fixture stud attachment as required to support luminaires.
 - 2. For flush outlets in stud walls or above-grade cast-in-place concrete walls use 4 inch square x 1-1/2 inch deep boxes; provide deeper boxes or multiple gang boxes as required to fit devices. Provide raised device covers that match the thickness of the wallboard and the number of devices. Provide supplemental box supports to prevent movement of the box.
 - 3. For flush outlets in above-grade masonry walls use masonry boxes with conduit knockouts. Provide boxes with depth suitable for the masonry unit size. Provide multiple gang boxes as required by the number of devices.
 - 4. For surface outlet boxes in EMT raceway systems, use 4 inch x 2-1/8 inch deep square boxes. Provide deeper boxes or multiple gang boxes as required to fit devices. Provide square surface covers that match the installed device and have not less than two holes for securing the device to the cover.
- C. For damp or wet locations and for surface-mounted RMC or IMC raceway systems, provide outlet boxes that comply with UL Standard 498 and 514, ANSI/NEMA FB1.
 - 1. For lighting fixture outlets use 4 inch x 2-1/16 inch deep round cast malleable iron boxes with threaded hubs.
 - 2. For flush or surface wall-mounted outlets, use 4-11/16 square, 2-11/16 inch deep cast malleable iron boxes with threaded hubs. Provide multiple gang boxes as required to fit devices. Provide gasketed cast malleable iron or cast copper-free aluminum covers that



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match the installed device and have not less than two holes for securing the device to the cover.

2.16 PULL AND JUNCTION BOXES

- A. For dry locations in clean, non-contamination environments use galvanized sheet steel pull and junction boxes that comply with UL Standard 50 Type 1 and the NEC as to size and construction. Use boxes not less than 4 inches square x 1-1/2 inches deep with screw-secured covers. Provide larger boxes as required by the number and size of conduits and conductors.
- B. For dry locations in dusty or possible contamination (e.g. beryllium, explosives, or uranium) environments use galvanized steel pull and junction boxes that comply with UL Standard 50 Type 12 and the NEC as to size and construction. Use boxes not less than 6 inches square x 4 inches deep with gasketed covers. Provide larger boxes as required by the number and size of conduits and conductors.
- C. For damp or wet, non-corrosive locations, in conduit runs up to 3/4 inch trade size, provide 4-11/16 inches square, 2-11/16 inches deep cast malleable iron pull and junction boxes with threaded hubs and gasketed cast malleable iron or cast copper-free aluminum covers.
- D. For damp or wet, non-corrosive locations, in conduit runs 1 inch trade size and larger, provide galvanized sheet-steel pull and junction boxes and covers that comply with UL 50 Type 3R.
- E. For damp or wet, non-corrosive locations that are subject to hose-directed water, provide pull and junction boxes and covers that comply with UL 50 Type 4.
- F. For damp or wet, corrosive locations provide pull and junction boxes and covers that comply with UL 50 Type 4X.
- G. For locations subject to occasional submersion provide pull and junction boxes and covers that comply with UL 50 Type 6.
- H. Provide connection points for equipment grounding conductors in each box.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install complete systems of raceways and boxes for wiring systems.
- B. Install raceways and boxes according to NECA 1 Standard Practices for Good Workmanship in Electrical Construction, NECA 101 Standard for Installing Steel Conduits (Rigid, IMC, EMT), NECA 111 Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC), the NEC, the manufacturer's instructions, and requirements in this Section.
- C. Raceway termination points and box locations shown on the Drawings are in approximate locations unless dimensioned. Verify locations before rough-in.



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- D. Raceway routing is shown on the Drawings in approximate locations unless dimensioned. Coordinate routing with structure and with work of other trades. Route as required for a complete wiring system.
- E. Ground and bond raceways and boxes as required in Section 260526 Grounding and Bonding for Electrical Systems.
- F. Support raceways and boxes in accordance with the requirements of Section 260529 Hangers and Supports for Electrical Systems and the NEC.
- G. Identify raceways and boxes as required in Section 260553, Identification for Electrical Systems.
- H. Arrange raceway and boxes to maintain headroom and present neat appearance.
- I. Install knockout closures in unused openings in boxes or raceways.

3.2 CONDUIT INSTALLATION

- A. For low-voltage wiring systems (less than 600 volts) use conduit materials according to the NEC and the following:
 - 1. Outdoors - underground:
 - 2. Direct buried: Use RNC, plastic-coated RMC, tape-wrapped RMC, or tape-wrapped IMC. Do not use RNC where subject to physical damage. Install with 24 inches minimum cover from top of conduit to finished grade or top of paving.
 - a. Concrete encased: Use RNC, plastic-coated RMC, RMC, or IMC for concrete encased underground work. Install with 24 inches minimum cover from top of encasement to finished grade or paving.
 - 3. Outdoors - exposed: Use RMC or IMC.
 - 4. Outdoor corrosive locations (including cooling towers): Use plastic-coated RMC and fittings.
 - 5. Outdoors - concealed: Use RMC or IMC for concealed outdoor work. Do not use bare RMC or IMC in direct contact with earth. EMT may be used for concealed outdoor work where not in contact with earth, not encased in concrete, and where not exposed to deteriorating agents.
 - 6. Indoors – exposed outside of designated electrical rooms or telecommunications rooms:
 - a. Located less than 8 ft above the floor: Use RMC or IMC.
 - b. Exposed to severe physical damage: Use RMC or IMC.
 - c. Exposed to moisture: Use RMC or IMC.
 - d. Exposed to corrosives: Use plastic-coated RMC and fittings.
 - e. Located more than 8 ft above the floor, not exposed to deteriorating agents, and not subject to severe physical damage: Use RMC, IMC, or EMT.
 - 7. Indoors – concealed:
 - a. Within drywall partitions and above false ceilings: Use RMC, IMC, or EMT.
 - b. Within masonry or cast-in-place concrete walls or floors: Use RMC or IMC.
 - c. Direct-buried under building floor slabs on grade: Use RNC, plastic-coated RMC, tape-wrapped RMC, or tape-wrapped IMC. Locate top of conduits not less than 12 inches below the bottom of the concrete slab. Install warning tape approximately 6



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- inches above the conduits; install multiple warning tapes above parallel conduit runs wider than 18 inches.
- d. Concrete encased under building floor slabs on grade: Use RNC, plastic-coated RMC, RMC, or IMC. Locate top of concrete encasement not less than 12 inches below the bottom of the concrete slab. Install warning tape approximately 6 inches above the concrete encasement; install multiple warning tapes above concrete encasements wider than 24 inches.
8. Connection to vibrating equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment) - Use a minimum of 18 inches; maximum length as determined by the NEC:
- a. Outdoors: Use liquidtight flexible metal conduit.
 - b. In mechanical rooms: Use liquidtight flexible metal conduit.
 - c. Wet, damp, or corrosive indoor locations: Use liquidtight flexible metal conduit.
 - d. Dry indoor locations: Use flexible metal conduit.
9. Connections to luminaires: Use 3/8 inch flexible metal conduit or metal-clad cable in 6 foot maximum lengths for tap conductors to luminaires above suspended ceilings.
- B. Use 3/4-inch or larger conduit to enclose multiple conductors larger than 12 AWG.
- C. Conceal conduits, unless otherwise indicated on the Drawings, with finished walls, floors and ceilings. Unless otherwise indicated on the Drawings, install concealed conduits with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions.
- D. Position parallel underground conduits with not less than 7-1/2 inches center-to-center separation.
- E. Install expansion fittings where embedded conduits cross building expansion joints.
- F. Use conduit hubs to fasten conduit to boxes in damp and wet locations.
- G. Use sealing locknuts, hubs, or similar water-resistant fittings on conduits entering the top of switchgear, switchboards, motor control centers, panelboards, cabinets, pull boxes, and similar enclosures that are exposed in structures with automatic fire sprinkler systems.
- H. Install insulating bushings or connectors with an insulated throat to protect conductors or cables at conduit terminations.
- I. Install conduits with the following limits of bends and distance between pull points:
1. 50 ft with 3 equivalent 90 degree bends.
 2. 100 ft with 2 equivalent 90 degree bends.
 3. 150 ft with 1 equivalent 90 degree bend.
 4. 200 ft straight run with no bends.
 5. Provide large sweep radius elbows for 90 degree elbows (minimum) unless otherwise noted.
- J. Stub-Up Connections:



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1. Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs, and set flush with the finished floor or equipment pad.
 2. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches above the floor.
 3. Where equipment connections are not made under this Subcontract, install threaded insert plugs set flush with the floor.
- K. Install conduit sealing fittings according to the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with NRTL-listed conduit sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:
1. Where conduits enter or leave NEC Class I hazardous locations.
 2. Where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces and air-conditioned spaces.
 3. Where conduits go between areas where air pressure differential must be maintained.
 4. Where conduits enter an enclosure protected by a clean agent total flooding fire suppression system.
 5. Where otherwise required by the NEC.
- L. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduits dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- M. Install plastic-coated RMC and fittings according to the NEC and manufacturer's instructions. Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.
- N. Do not use RNC 90 degree elbows larger than 2 inch trade size; use plastic-coated RMC, tape-wrapped RMC, or tape-wrapped IMC for 2-1/2 inch trade size and larger 90 degree elbows.
- O. Maintain the following minimum clearances between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C):
1. 6" at perpendicular crossings.
 2. 12" between parallel runs.
- P. Avoid moisture traps in conduit system; provide junction boxes with drain fitting at low points in conduit system.
- Q. Install corrosion protection tape on metal conduits and fittings in contact with soil using half-lapped wrappings.
- R. Install grounding bushings at the following locations:
1. At every entry to enclosures on metallic conduits containing circuits rated 100 amperes and higher.
 2. On metallic conduits entering enclosures through concentric, eccentric or oversize knockouts.
 3. On metallic conduits that terminate to a metallic enclosure without effective electrical connection such as locknuts or threaded bushings.



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- S. Install conduit measuring tape in empty raceways. Leave not less than 12 inches of slack at each end of the tape. Secure each end of tape.
- T. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
 - 1. Run parallel or banked raceways together on common supports.
 - 2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- U. Join raceways with fittings designed and approved for that purpose and make joints tight.
 - 1. Use insulating bushings to protect conductors.
- V. Tighten set screws of threadless fittings with suitable tools.
- W. Terminations:
 - 1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
 - 2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
- X. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.
- Y. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.3 OUTLET BOX INSTALLATION

- A. Install outlet boxes with centers at the following heights unless noted otherwise on the Drawings:
 - 1. Receptacle, telephone and data outlets:
 - a. Common Areas (such as conference and break rooms): 18 inches above finished floor.
 - b. Offices and Workstations: 18 inches above finished floor.
 - 2. Receptacle, telephone and data outlets at lab benches and counters -- center 44 inches maximum above finished floor; coordinate locations to be above, or completely within, bench and counter backsplashes.
 - 3. Light switches: center 48 inches above finished floor and within 6 inches of door frame.



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4. Thermostats: center 48 inches above finished floor.
 5. Wall mounted emergency lights: 80 inches above finished floor or 12 inches below the ceiling; whichever is lower.
- B. Coordinate outlet box locations with modular furniture and associated hangers.
- C. Where the Drawings show outlets as adjacent, align outlet boxes with each other and group them symmetrically.
- D. Orient boxes to accommodate wiring devices oriented as specified in Section 262726 Wiring Devices.
- E. Install a multi-gang box where more than one device is mounted together. Do not use sectional type boxes.
- F. Install box with plaster ring for single or multiple device outlets.
- G. Use flush mounted outlet boxes in finished areas.
1. Install flush outlet boxes and fittings in walls and ceilings so that front edge is flush with the finished surface. Repair broken wall or ceiling surfaces so no gaps or open spaces exceed 1/8 inch at the edge of boxes or fittings.
 2. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
 3. Do not install flush mounting boxes back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.
 4. Secure flush mounting boxes to interior wall and partition studs. Accurately position to allow for surface finish thickness.
 5. Install stamped steel bridges to fasten multiple flush mounting outlet boxes between studs.
 6. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- H. Install adjustable steel channel fasteners for hung ceiling outlet box.
- I. Do not fasten boxes to ceiling support wires or other piping systems.
- J. Support boxes independently of conduit.
- K. Install partitions in boxes as follows:
1. Between 277 volt devices.
 2. Between 277 volt light switches devices and 120 volt devices.
 3. Between either 120 volt or 277 volt devices and low voltage control switches.
- L. Install a blank cover plate on each outlet box in which no device is installed.
- 3.4 PULL AND JUNCTION BOX INSTALLATION
- A. Install pull and junction boxes as shown on the Drawings and as required for splices, taps, wire pulling, and compliance with regulatory requirements.



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- B. Install indoor pull and junction boxes in accessible locations above accessible ceilings and in unfinished spaces. Position boxes so covers can be removed. Place boxes to maintain headroom.
- C. Install a concrete collar around handholes not placed in sidewalks or pavement.

3.5 WIREWAY INSTALLATION

- A. Install wireways at locations indicated on the Drawings.
- B. Mount plumb and level.

3.6 SURFACE METAL RACEWAY INSTALLATION

- A. Install surface metal raceway at locations indicated on the Drawings.
- B. Use flat-head screws, clips, and straps to fasten raceway channel to surfaces.
- C. Mount plumb and level.

3.7 ADJUSTING

- A. Adjust flush-mounted outlets to make front flush with finished floor, wall, or ceiling material.
- B. Install knockout closures in unused openings in boxes.

3.8 CLEANING

- A. Clean interior of boxes to remove dust, debris, and other material.
- B. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
- C. Repair damage to paint or PVC finishes with matching touch-up coating recommended by the manufacturer.

3.9 FIELD QUALITY CONTROL

- A. Provide final protection and maintain conditions to ensure that coatings and finishes are without damage or deterioration at final inspection.

3.10 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.



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- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- G. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.
- H. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- I. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 24 inches of slack at each end of pull wire.
- J. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.
- K. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.
 - 1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F temperature change.
 - 2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
 - 3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.



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- L. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

3.11 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified.
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified.
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, placing them 24 inches o.c. Align planks along the width and along the centerline of conduit.

END OF SECTION 26 05 33



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SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Identification for raceways.
 2. Identification of power and control cables.
 3. Identification for conductors.
 4. Warning labels and signs.
 5. Instruction signs.
 6. Equipment identification labels.
 7. Miscellaneous identification products.

1.2 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
1. Black letters on an orange field.
 2. Legend: Indicate voltage and system.



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- C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- F. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Colors for Raceways Carrying Circuits at 600 V and Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.



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- D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- D. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.5 FLOOR MARKING TAPE

- A. 2-inch- wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.
 - 1. Manufacturer: 3M Safety Stripe Tape 5700.

2.6 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Baked-Enamel Warning Signs:
 - 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal size, 7 by 10 inches.
- D. Metal-Backed, Butyrate Warning Signs:



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1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.7 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.
 1. Engraved legend with black letters on white face.
 2. Punched or drilled for mechanical fasteners.
 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.
- C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.8 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.
- B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
- C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in Division 9 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.



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2.10 OUTLET LABELS

- A. See Section 262726, Part 3.2 for all device labeling details. Submit details to Engineer prior to placing order.
- B. Provide black, 10 point minimum size lettering on a white background.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Apply identification devices to surfaces that require finish after completing finish work.
- C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas. Color coding should be the same as the junction box color coding below.
- F. Painted Identification: Comply with requirements in Division 9 painting Sections for surface preparation and paint application.
- G. Install all signs and labels plumb and neatly on all equipment and wiring.
- H. Color Coding of Junction Boxes: Paint junction boxes inside and out before installation of the systems listed below:
 - 1. Apply the following colors to the systems listed below:
 - a. Fire Alarm System: Bright Red.
 - b. Intercom: Yellow.
 - c. TV: Green.
 - d. Security System: Orange
 - e. Emergency Power: Red
 - f. Telecommunication System: White
 - g. Energy Management System: Purple or as per Owner.
 - h. 480V Power: Blue
 - i. 208V Power: Black



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3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Install labels at 10-foot (3-m) maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Emergency Power.
 - 2. Power.
 - 3. UPS.
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- E. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.



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- G. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Metal-backed, butyrate warning signs.
 - 1. Comply with 29 CFR 1910.145.
 - 2. Identify system voltage with black letters on an orange background.
 - 3. Apply to exterior of door, cover, or other access.
 - 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
- I. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer or load shedding.
- K. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 - 1. Labeling Instructions:
 - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label 4 inches (100 mm) high.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

3.3 OUTLET LABELS

- A. Outlet label shall be visible on outside of device cover for each receptacle outlet and light switch (all device cover plates).

END OF SECTION 26 05 53



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SECTION 26 09 23
LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following lighting control devices:
 - 1. Outdoor photoelectric switches.
- B. See Division 262726 Section "Wiring Devices" for manual light switches.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, and partition assemblies.

PART 2 - PRODUCTS

2.1 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Area Lighting Research, Inc.; Tyco Electronics.
 - 2. Intermatic, Inc.
 - 3. Novitas, Inc.
 - 4. Watt Stopper (The).



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- B. Description: Solid state, with DPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
 - 1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
 - 2. Time Delay: 15-second minimum, to prevent false operation.
 - 3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
 - 4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

- A. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- B. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- C. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
 - 1. Identify circuits or luminaries controlled by photoelectrics at each sensor.
- B. Label switches with a unique designation.

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.



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2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
- B. Lighting control devices that fail tests and inspections are defective work.

END OF SECTION 26 09 23



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SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Receptacles, receptacles with integral GFCI, and associated device plates.
 2. Wall-switches.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.
- D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.4 RECEIVING, STORING, AND PROTECTING

- A. Receive, store, and protect, and handle products according to NECA 1, *Standard Practices for Good Workmanship in Electrical Construction*.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 3. Leviton Mfg. Company Inc. (Leviton).
 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).



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2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 5351 (single), 5352 (duplex).
 - b. Hubbell; HBL5351 (single), CR5352 (duplex).
 - c. Leviton; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; GF20.
 - b. Pass & Seymour; 2084.

2.4 WALL SWITCHES

1. Single and two pole: Provide hard, use specification grade, recess mounted single and two pole quiet toggle switches, 20 ampere, 120/277 volts ac. provide with mounting yoke insulated from mechanism, plaster ears, switch handle, and side-wired screw terminals.

2.5 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
 2. Material for Finished Spaces: 0.035-inch- thick, satin-finished stainless steel.
 3. Material for Unfinished Spaces: Galvanized steel.
 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.6 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.



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1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. TVSS Devices: Blue.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
 1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted provided the outlet box is large enough.
- D. Device Installation:
 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
 6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.



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7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
10. Adjust devices and wall plates to be flush and level.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles, Switches and all other device cover plates: Identify panelboard and circuit number from which served. Use factory applied hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes. No field installation methods are permitted.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.

END OF SECTION 26 27 26



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SECTION 26 28 13
FUSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches, panelboards, switchboards and enclosed controllers.
- B. SUBMITTALS
- C. Product Data: For each type of product indicated.
- D. Operation and maintenance data.

1.2 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. Comply with NEMA FU 1 for cartridge fuses.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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. Cooper Bussmann, Inc.
 - 2. Edison Fuse, Inc.
 - 3. Ferraz Shawmut, Inc.
 - 4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.



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PART 3 - EXECUTION

3.1 FUSE APPLICATIONS

- A. Service Entrance: Class RK1, time delay.
- B. Feeders: Class RK1, fast acting.
- C. Motor Branch Circuits: Class RK5, time delay.
- D. Other Branch Circuits: Class J, fast acting.
- E. Control Circuits: Class CC, fast acting.

3.2 INSTALLATION

- A. Install fuses in fusible devices, not until equipment is ready to be energized. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block and holder.

END OF SECTION 26 28 13



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SECTION 26 51 00
INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Interior lighting fixtures, lamps, and ballasts.
 - 2. Lighting fixture supports.
- B. See Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.2 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes.
- B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
- C. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.
- D. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.4 RECEIVING, STORING AND PROTECTING

- A. Receive, store, and protect, and handle products according to NECA 1- Standard Practices for Good Workmanship in Electrical Construction.



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PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified on drawings.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
- C. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.
- D. Metal Parts: Free of burrs and sharp corners and edges.
- E. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- G. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
1. White Surfaces: 85 percent.
 2. Specular Surfaces: 83 percent.
 3. Diffusing Specular Surfaces: 75 percent.
 4. Laminated Silver Metalized Film: 90 percent.
- H. Plastic Diffusers, Covers, and Globes:
1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch minimum unless different thickness is indicated.
 - b. UV stabilized.
 2. Glass: Annealed crystal glass, unless otherwise indicated.



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2.3 BALLASTS

- A. Electronic Ballasts for Linear Fluorescent Lamps: Comply with ANSI C82.11; instant-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.
1. Sound Rating: A.
 2. Total Harmonic Distortion Rating: Less than 10 percent.
 3. Transient Voltage Protection: IEEE C62.41, Category A or better.
 4. Operating Frequency: 20 kHz or higher.
 5. Lamp Current Crest Factor: 1.7 or less.
 6. BF: 0.85 or higher.
 7. Power Factor: 0.98 or higher.
- B. Ballasts for Compact Fluorescent Lamps: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:
1. Lamp end-of-life detection and shutdown circuit.
 2. Automatic lamp starting after lamp replacement.
 3. Sound Rating: A.
 4. Total Harmonic Distortion Rating: Less than 20 percent.
 5. Transient Voltage Protection: IEEE C62.41, Category A or better.
 6. Operating Frequency: 20 kHz or higher.
 7. Lamp Current Crest Factor: 1.7 or less.
 8. BF: 0.95 or higher, unless otherwise indicated.
 9. Power Factor: 0.98 or higher.
 10. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for non consumer equipment.
- C. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:
1. Lamp end-of-life detection and shutdown circuit.
 2. Sound Rating: A.
 3. Total Harmonic Distortion Rating: Less than 15 percent.
 4. Transient Voltage Protection: IEEE C62.41, Category A or better.
 5. Lamp Current Crest Factor: 1.5 or less.
 6. Power Factor: .90 or higher.
 7. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for non consumer equipment.
 8. Protection: Class P thermal cutout.

2.4 LAMPS

- A. Low-Mercury Fluorescent Lamps: Comply with EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.
- B. T8 Rapid-Start low-mercury Fluorescent Lamps: Rated 25 W maximum, nominal length 48 inches (1220 mm), CRI 81 (minimum), color temperature 4100 K, and average rated life 20,000 hours, unless otherwise indicated.



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- C. T8 Rapid-Start low-mercury Fluorescent Lamps: Rated 17 W maximum, nominal length of 24 inches, 1300 initial lumens (minimum), CRI 81 (minimum), color temperature 4100 K, and average rated life of 20,000 hours, unless otherwise indicated.
- D. Compact Fluorescent Lamps: 4-Pin, low mercury, CRI 81 (minimum), color temperature 4100 K, average rated life of 10,000 hours at 3 hours operation per start, unless otherwise indicated.
 - 1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
 - 2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
 - 3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
 - 4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
 - 5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
 - 6. 55 W: T4, triple tube, rated 4300 initial lumens (minimum).
- E. Metal-Halide Lamps: ANSI C78.1372, with a minimum CRI 65, and color temperature 4000 K.
- F. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K.
- G. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature 4000 K.

2.5 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 10 gage.
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 10 gage.
- F. Rod Hangers: 1/4-inch minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install interior lighting system in accordance with the NEC, manufacturer's instructions, approved shop drawings, and the following NECA National Electrical Installation Standards:



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1. NECA/IESNA 500, Recommended Practice for Installing Indoor Commercial Lighting Systems (ANSI)
 2. NECA/IESNA 502, Recommended Practice for Installing Industrial Lighting Systems (ANSI).
- B. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- C. Comply with NFPA 70 for minimum fixture supports.
- D. Suspended Lighting Fixture Support:
1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
- E. Install in accordance with manufacturers instructions.
- F. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- G. Support all luminaires independent of ceiling framing.
- H. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
- I. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.
- J. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure.
- K. Install recessed luminaires to prevent removal from below.
- L. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- M. Install wall mounted luminaires, emergency lights, and exit signs at height as indicated on Drawings.
- N. Install accessories furnished with each luminaire.
- O. Connect luminaires, emergency lighting units and exit signs to branch circuit outlets.
- P. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions with luminaire.
- Q. Bond products and metal accessories to branch circuit equipment grounding conductor.
- R. Install specified lamps in each luminaire and exit sign.
- S. Fixtures are not to be used as a raceway unless stamped for use as raceway by Manufacturer. Single fixture in lay-in ceilings shall not be used for raceway and shall be connected to an outlet



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box located within 6'-0" of fixture with flexible 3/8" conduit or 3/8" MC cable. #14 THHN/THWN is acceptable for single fixture connections.

- T. Adjust aimable lighting fixtures to provide required light intensities.

3.2 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and re-transfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.3 ADJUSTING AND CLEANING

- A. Align luminaires and clean lenses and diffusers at completion of work. Clean paint splatters, dirt, and debris from installed luminaires.
- B. Aim and adjust luminaires as indicated on Drawings or as directed by the A/E.
- C. Touch up luminaire finish at completion of work.

END OF SECTION 26 51 00