SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

## PART 1 GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Transition fittings.
  - 2. Dielectric fittings.
  - 3. Mechanical sleeve seals.
  - 4. Sleeves.
  - 5. Escutcheons.
  - 6. Grout.
  - 7. Equipment installation requirements common to equipment sections.
  - 8. Painting and finishing.
  - 9. Concrete bases.
  - 10. Supports and anchorages.

## 1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, 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 mechanical 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 duct shafts.
- 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.
- F. The following are industry abbreviations for rubber materials:
  - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 2. NBR: Acrylonitrile-butadiene rubber.

- 1.4 SUBMITTALS
  - A. Product Data: For the following:
    - 1. Transition fittings.
    - 2. Dielectric fittings.
    - 3. Mechanical sleeve seals.
    - 4. Escutcheons.
  - B. Welding certificates.

#### 1.5 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."
  - 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 Mechanical 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.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

## 1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

# PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
- 2.2 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.

## 2.3 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

## 2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
  - 1. Available Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Dresser Industries, Inc.; DMD Div.
    - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
    - d. JCM Industries.
    - e. Smith-Blair, Inc.
    - f. Viking Johnson.
  - 2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
  - 3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
  - 4. Aboveground Pressure Piping: Pipe fitting.
- B. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.
  - 1. Available Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Fernco, Inc.
    - c. Mission Rubber Company.
    - d. Plastic Oddities, Inc.

## 2.5 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 Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
  - 1. Available Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Eclipse, Inc.
    - d. Epco Sales, Inc.
    - e. Hart Industries, International, Inc.
    - f. Watts Industries, Inc.; Water Products Div.
    - g. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150-psig minimum working pressure as required to suit system pressures.
  - 1. Available Manufacturers:

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- a. Capitol Manufacturing Co.
- b. Central Plastics Company.
- c. Epco Sales, Inc.
- d. Watts Industries, Inc.; Water Products Div.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, fullface- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
  - 1. Available Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Central Plastics Company.
    - d. Pipeline Seal and Insulator, Inc.
  - 2. Separate companion flanges and steel bolts and nuts shall have 150-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
  - 1. Available Manufacturers:
    - a. Calpico, Inc.
    - b. Lochinvar Corp.
- G. 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.
  - 1. Available Manufacturers:
    - a. Perfection Corp.
    - b. Precision Plumbing Products, Inc.
    - c. Sioux Chief Manufacturing Co., Inc.
    - d. Victaulic Co. of America.

# 2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
  - 1. Available Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
  - 2. Sealing Elements: EPDM NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 3. Pressure Plates: Carbon steel Stainless steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.7 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.

## 2.8 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. One-Piece, Floor-Plate Type: Cast-iron floor plate.

## 2.9 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.

## 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 according to the following:
  - 1. New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, castbrass type with polished chrome-plated finish.
    - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - g. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - h. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
    - i. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

- P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
    - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
    - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
      - 1) Seal space outside of sleeve fittings with grout.
  - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
- Q. 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.
  - 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.
- R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - 1. 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.
- S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.
- T. Verify final equipment locations for roughing-in.

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

# 3.3 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. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. 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 unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

## 3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  - 3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

# 3.5 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.
- 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.

# 3.6 PAINTING

- A. Painting of mechanical systems, equipment, and components is specified in Division 9 Section " Painting (Professional Line Products)."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

# 3.7 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
  - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
  - 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

## 3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

# 3.9 GROUTING

- A. Mix and install grout for mechanical 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

# SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. Section Includes:
  - 1. Sleeves.
  - 2. Stack-sleeve fittings.
  - 3. Sleeve-seal systems.
  - 4. Sleeve-seal fittings.
  - 5. Grout.

#### 1.3 ACTION SUBMITTALS

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

### PART 2 - PRODUCTS

### 2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

# 2.2 STACK-SLEEVE FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. <u>Smith, Jay R. Mfg. Co</u>.
  - 2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
- B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with setscrews.

#### 2.3 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. <u>Metraflex Company (The)</u>.
  - 2. Pipeline Seal and Insulator, Inc.
  - 3. <u>Proco Products, Inc</u>.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping 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: Carbon steel.
  - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

## 2.4 SLEEVE-SEAL FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. <u>Presealed Systems</u>.
- B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.
- 2.5 GROUT
  - A. Standard: ASTM C 1107/C 1107M, 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 (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

# PART 3 - EXECUTION

## 3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.
  - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
  - 2. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
  - 3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

## 3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
  - 1. Install fittings that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
  - 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
  - 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level.

- 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
- 5. Using grout, seal the space around outside of stack-sleeve fittings.
- B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

# 3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

## 3.4 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

## 3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves.
    - b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves.
  - 2. Exterior Concrete Walls below Grade:
    - a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
    - b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves with sleeve-seal system.

- 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
- 3. Concrete Slabs-on-Grade:
  - a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system.
    - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
  - b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves with sleeve-seal system.
    - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
- 4. Concrete Slabs above Grade:
  - a. Piping Smaller Than NPS 6 (DN 150): PVC-pipe sleeves.
  - b. Piping NPS 6 (DN 150) and Larger: PVC-pipe sleeves.
- 5. Interior Partitions:
  - a. Piping Smaller Than NPS 6 (DN 150): PVC-pipe sleeves.
  - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 220517

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section Includes:
  - 1. Escutcheons.
  - 2. Floor plates.

## 1.3 ACTION SUBMITTALS

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

## PART 2 - PRODUCTS

# 2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- D. Split-Casting Brass Type: With polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.
- E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

# 2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
  - 1. Escutcheons for New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, castbrass or split-casting brass type with polished, chrome-plated finish.
    - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
    - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
    - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
    - h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass] type with rough-brass finish.
    - i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or splitplate, stamped-steel type with concealed hinge.
    - j. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with rough-brass finish.
    - k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
  - 2. Escutcheons for Existing Piping:
    - a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
    - b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
    - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
    - e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
    - f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
    - g. Bare Piping in Unfinished Service Spaces: Split-casting brass type with roughbrass finish.
    - h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with exposed-rivet hinge.
    - i. Bare Piping in Equipment Rooms: Split-casting brass type with rough-brass finish.
    - j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with concealed hinge.
- C. Install floor plates for piping penetrations of equipment-room floors.

- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. New Piping: One-piece, floor-plate type.
  - 2. Existing Piping: Split-casting, floor-plate type.
- 3.2 FIELD QUALITY CONTROL
  - A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 220518

# SECTION 220V2P - HANWERS AND SUGGORTS FOR GLUMBINW GIGINWAND E. UIGMENT

GART 5 - WENERAL

## 5.5 RELATED DOCUMENTS

AJ Drawings and general provisions of the Contract, including Weneral and Supplementary Conditions and Division 05 Specification Sections, apply to this SectionJ

## 5J2 SUMMARK

- AJ Section Includes:
  - 5J Metal pipe hangers and supportsJ
  - 2J Trape3e pipe hangersJ
  - 4J Fi6erglass pipe hangersJ
  - 7J Metal framing systemsJ
  - VJ Fi6erglass strut systemsJ
  - qJ Thermal-hanger shield insertsJ
  - 8J Fastener systemsJ
  - 9J Gipe standsJ
  - PJ Gipe positioning systemsJ
- BJ Related Sections:
  - 5J Section 0VV000 bMetal Fa6ricationsb for structural-steel shapes and plates for trape3e hangers for pipe and exuipment supportsJ
  - 2J Section 220V5q bEj pansion Fittings and Loops for Glum6ing Gipingb for pipe guides and anchorsJ

#### 5.4 DEFINITIONS

AJ MSS: Manufacturers Standardi3ation Society of The 1 alve and Fittings Industry IncJ

### 5J7 GERFORMANCE RE. UIREMENTS

- AJ Delegated Design: Design trape3e pipe hangers and exuipment supports, including comprehensive engineering analysis 6y a xualified professional engineer, using performance rexuirements and design criteria indicatedJ
- BJ Structural Gerformance: Hangers and supports for plum6ing piping and exuipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE@EI 8J
  - 5J Design supports for multiple pipes, including pipe stands, capa6le of supporting com6ined weight of supported systems, system contents, and test waterJ
  - 2J Design exuipment supports capa6le of supporting com6ined operating weight of supported exuipment and connected systems and componentsJ

4J Design seismic-restraint hangers and supports for piping and exuipment and o6tain approval from authorities having 'urisdictionJ

## 5J/ ACTION SUBMITTALS

- AJ Groduct Data: For each type of product indicatedJ
- BJ Shop Drawings: Signed and sealed 6y a xualified professional engineerJ Show fa6rication and installation details and include calculations for the followingX include Groduct Data for components:
  - 5J Trape3e pipe hangersJ
  - 2J Metal framing systemsJ
  - 4J Fi6erglass strut systemsJ
  - 7J Gipe standsJ
- CJ Delegated-Design Su6mittal: For trape3e hangers indicated to comply with performance rexuirements and design criteria, including analysis data signed and sealed 6y the xualified professional engineer responsi6le for their preparationJ
  - 5J Detail fa6rication and assem6ly of trape3e hangersJ
  - 2J Design Calculations: Calculate rexuirements for designing trape3e hangersJ

### 5.h INFORMATIONAL SUBMITTALS

AJ z elding certificatesJ

## 5.B . UALITK ASSURANCE

- AJ Structural Steel z elding . ualifications: . ualify procedures and personnel according to Az S D5.5005.5M, bStructural z elding Code Steel.b
- BJ Gipe z elding . ualifications: . ualify procedures and operators according to ASME Boiler and Gressure 1 essel CodeJ
- GART 2 GRODUCTS

## 2.5 METAL GIGE HANWERS AND SUGGORTS

- AJ Car6on-Steel Gipe Hangers and Supports:
  - 5J Description: MSS SG-V9, Types 5 through V9, factory-fa6ricated componentsJ
  - 2J Walvani3ed Metallic Coatings: Gregalvani3ed or hot dippedJ
  - 4J Nonmetallic Coatings: Glastic coating, "acket, or linerJ
  - 7J Gadded Hangers: Hanger with fi6erglass or other pipe insulation pad or cushion to support 6earing surface of pipingJ
  - VJ Hanger Rods: Continuous-thread rod, nuts, and washer made of car6on steelJ
- BJ Stainless-Steel Gipe Hangers and Supports:

- 5J Description: MSS SG-V9, Types 5 through V9, factory-fa6ricated componentsJ
- 2J Gadded Hangers: Hanger with fi6erglass or other pipe insulation pad or cushion to support 6earing surface of pipingJ
- 4J Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steelJ

## 2J2 TRAGE/ E GIGE HANWERS

AJ Description: MSS SG-qP, Type VP, shop- or field-fa6ricated pipe-support assem6ly made from structural car6on-steel shapes with MSS SG-V9 car6on-steel hanger rods, nuts, saddles, and U-6oltsJ

## 2,4 FIBERWLASS GIGE HANWERS

- AJ Clevis-Type, Fi6erglass Gipe Hangers:
  - 5J Description: Similar to MSS SG-V9, Type 5, steel pipe hanger ej cept hanger is made of fi6erglass or fi6erglass-reinforced resinJ
  - 2J Hanger Rods: Continuous-thread rod, washer, and nuts made of stainless steelJ
- BJ Strap-Type, Fi6erglass Gipe Hangers:
  - 5J Description: Similar to MSS SG-V9, Type P or Type 50, steel pipe hanger ej cept hanger is made of fi6erglass-reinforced resinJ
  - 2J Hanger Rod and Fittings: Continuous-thread rod, washer, and nuts made of stainless steelJ

## 2J7 METAL FRAMINWSKSTEMS

- AJ MFMA Manufacturer Metal Framing Systems:
  - 5J <u>Manufacturers</u>: Su6"ect to compliance with rexuirements, provide products 6y one of the following:
    - aJ <u>Allied Tu6e ; Conduit</u>J
    - 6J <u>Cooper B-Line, Inc</u>J
    - cJ Flej -Strut IncJ
    - dJ <u>WS Metals Corp</u>J
    - eJ <u>Thomas</u>; <u>Betts Corporation</u>J
    - fJ <u>Unistrut CorporationXTyco International, LtdJ</u>
    - gJ <u>z esanco, Inc</u>J
  - 2J Description: Shop- or field-fa6ricated pipe-support assem6ly for supporting multiple parallel pipesJ
  - 4J Standard: MFMA-7J
  - 7J Channels: Continuous slotted steel channel with inturned lipsJ
  - VJ Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channelJ
  - qJ Hanger Rods: Continuous-thread rod, nuts, and washer made of car6on steelJ
  - 8J Metallic Coating: Hot-dipped galvani3edJ
  - 9J Gaint Coating: Epoj yJ
  - PJ Glastic Coating: Epoj yJ

- BJ Non-MFMA Manufacturer Metal Framing Systems:
  - 5J <u>Manufacturers</u>: Su6"ect to compliance with rexuirements, provide products 6y one of the following:
    - aJ <u>Anvil InternationalXa su6sidiary of Mueller z ater Groducts IncJ</u>
    - 6J Empire Industries, IncJ
    - cJ ERICO International CorporationJ
    - dJ Haydon CorporationXH-Strut DivisionJ
    - eJ <u>NIBCO INC</u>J
    - fJ <u>GHD Manufacturing, IncJ</u>
    - gJ <u>GHS Industries, Inc</u>J
  - 2J Description: Shop- or field-fa6ricated pipe-support assem6ly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipesJ
  - 4J Standard: Comply with MFMA-7J
  - 7J Channels: Continuous slotted steel channel with inturned lipsJ
  - VJ Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channelJ
  - qJ Hanger Rods: Continuous-thread rod, nuts, and washer made of car6on steelJ
  - 8J Coating: / incJ

## 2J/ FIBERWLASS STRUT SKSTEMS

- AJ <u>Manufacturers:</u> Su6"ect to compliance with rexuirements, provide products 6y one of the following:
  - 5J <u>Allied Tu6e ; Conduit</u>J
  - 2J Champion Fi6erglass, IncJ
  - 4J <u>Cooper B-Line, Inc</u>J
- BJ Description: Shop- or field-fa6ricated pipe-support assem6ly similar to MFMA-7 for supporting multiple parallel pipesJ
  - 5J Channels: Continuous slotted fi6erglass channel with inturned lipsJ
  - 2J Channel Nuts: Fi6erglass nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channelJ
  - 4J Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steelJ

## 2.4 GIGE STANDS

- AJ Weneral Rexuirements for Gipe Stands: Shop- or field-fa6ricated assem6lies made of manufactured corrosion-resistant components to support roof-mounted pipingJ
- BJ Compact Gipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or 1-shaped cradle to support pipe, for roof installation without mem6rane penetrationJ
- CJ Low-Type, Single-Gipe Stand: One-piece stainless-steel 6ase unit with plastic roller, for roof installation without mem6rane penetrationJ
- DJ High-Type, Single-Gipe Stand:

- 5J Description: Assem6ly of 6ase, vertical and hori3ontal mem6ers, and pipe support, for roof installation without mem6rane penetrationJ
- 2J Base: Stainless steelJ
- 4J 1 ertical Mem6ers: Two or more cadmium-plated-steel or stainless-steel, continuousthread rodsJ
- 7J Hori3ontal Mem6er: Cadmium-plated-steel or stainless-steel rod with plastic or stainlesssteel, roller-type pipe supportJ
- High-Type, Multiple-Gipe Stand: EJ
  - Description: Assem6ly of 6ases, vertical and hori3ontal mem6ers, and pipe supports, for 5J roof installation without mem6rane penetrationJ
  - 2J Bases: One or moreXplasticJ
  - 1 ertical Mem6ers: Two or more protective-coated-steel channelsJ 4J
  - Hori3ontal Mem6er: Grotective-coated-steel channelJ 7J
  - V.I Gipe Supports: Walvani3ed-steel, clevis-type pipe hangersJ
- FJ Cur6-Mounting-Type Gipe Stands: Shop- or field-fa6ricated pipe supports made from structuralsteel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof cur6J

#### 2JB GIGE GOSITIONINW SKSTEMS

AJ Description: IAGMO GS 72, positioning system of metal 6rackets, clips, and straps for positioning piping in pipe spacesXfor plum6ing fij tures in commercial applicationsJ

#### 2.P MISCELLANEOUS MATERIALS

- AJ Structural Steel: ASTM A 4qQ 4qM, car6on-steel plates, shapes, and 6arsX 6lack and galvani3edJ
- Wrout: ASTM C 5508, factory-mij ed and -packaged, dry, hydraulic-cement, nonshrink and BJ nonmetallic groutXsuita6le for interior and ei terior applicationsJ
  - Groperties: Nonstaining, noncorrosive, and nongaseousJ 5J
  - 2JDesign Mii : V000-psi (47JV-MGa), 29-day compressive strengthJ

## GART 4 - EZECUTION

#### 4.5 HANWER AND SUGGORT INSTALLATION

- AJ Metal Gipe-Hanger Installation: Comply with MSS SG-gP and MSS SG-9PJ Install hangers, supports, clamps, and attachments as rexuired to properly support piping from the 6uilding structureJ
- Metal Trape3e Gipe-Hanger Installation: Comply with MSS SG-gP and MSS SG-9PJ Arrange for BJ grouping of parallel runs of hori3ontal piping, and support together on field-fa6ricated trape3e pipe hangersJ

- 5J Gipes of 1 arious Si3es: Support together and space trape3es for smallest pipe si3e or install intermediate supports for smaller diameter pipes as specified for individual pipe handersJ
- 2J Field fa6ricate from ASTM A 4qQ 4qM, car6on-steel shapes selected for loads 6eing supportedJz eld steel according to Az S D550055MJ
- CJ Fi6erglass Gipe-Hanger Installation: Comply with applica6le portions of MSS SG-qP and MSS SG-9PJ Install hangers and attachments as rexuired to properly support piping from 6uilding structureJ
- DJ Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assem6led metal framing systemsJ
- EJ Fi6erglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assem6led fi6erglass strutsJ
- FJ Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated pipingJ
- WJ Fastener System Installation:
  - 5J Install powder-actuated fasteners for use in lightweight concrete or concrete sla6s less than 7 inches (500 mm) thick in concrete after concrete is placed and completely curedJ Use operators that are licensed 6y powder-actuated tool manufacturerJ Install fasteners according to powder-actuated tool manufacturer& operating manualJ
  - 2J Install mechanical-ej pansion anchors in concrete after concrete is placed and completely curedJInstall fasteners according to manufacturer& written instructionsJ
- HJ Gipe Stand Installation:
  - Gipe Stand Types ej cept Cur6-Mounted Type: Assem6le components and mount on 5J smooth roof surfaceJDo not penetrate roof mem6raneJ
  - 2JCur6-Mounted-Type Gipe Stands: Assem6le components or fa6ricate pipe stand and mount on permanent, stationary roof cur6J See Section 088200 bRoof Accessoriesb for cur6sJ
- IJ Gipe Gositioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plum6ing fij tureJ
- YJ Install hangers and supports complete with necessary attachments, inserts, 60lts, rods, nuts, washers, and other accessoriesJ
- ' J Exuipment Support Installation: Fa6ricate from welded-structural-steel shapesJ
- Install hangers and supports to allow controlled thermal and seismic movement of piping LJ systems, to permit freedom of movement 6etween pipe anchors, and to facilitate action of ej pansion "oints, ej pansion loops, ej pansion 6ends, and similar unitsJ
- Install lateral 6racing with pipe hangers and supports to prevent swayingJ MJ
- NJ Install 6uilding attachments within concrete sla6s or attach to structural steelJ Install additional attachments at concentrated loads, including valves, flanges, and strainers, NGS 2-5Q (DN qV) and larger and at changes in direction of pipingJ Install concrete inserts 6efore concrete is placedXfasten inserts to forms and install reinforcing 6ars through openings at top of insertsJ

- OJ Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not 6e transmitted to connected exuipmentJ
- GJ Gipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not ei ceed maj imum pipe deflections allowed 6y ASME B45 P for 6uilding services pipingJ
- Insulated Giping: . J
  - 5J Attach clamps and spacers to pipingJ
    - Giping Operating above Ambient Air Temperature: Clamp may prolect through aJ insulationJ
    - 6J Giping Operating 6elow Am6ient Air Temperature: Use thermal-hanger shield insert with clamp si3ed to match OD of insertJ
    - Do not ej ceed pipe stress limits allowed 6y ASME B45JP for 6uilding services сJ pipingJ
  - 2J Install MSS SG-V9, Type 4P, protection saddles if insulation without vapor 6arrier is indicatedJFill interior voids with insulation that matches ad'oining insulationJ
    - aJ Option: Thermal-hanger shield inserts may 6e usedJ Include steel weightdistri6ution plate for pipe NGS 7 (DN 500) and larger if pipe is installed on rollersJ
  - 4J Install MSS SG-V9, Type 70, protective shields on cold piping with vapor 6arrierJ Shields shall span an arc of 590 degreesJ
    - Option: Thermal-hanger shield inserts may 6e usedJ Include steel weightaJ distribution plate for pipe NGS 7 (DN 500) and larger if pipe is installed on rollersJ
  - 7J Shield Dimensions for Gipe: Not less than the following:
    - NGS 5Q to NGS 4-5Q (DN 9 to DN P0): 52 inches (40V mm) long and 0.079 inch aJ (5J22 mm) thickJ
    - NGS 7 (DN 500): 52 inches (40V mm) long and 0.Dq inch (5J/2 mm) thickJ 6J
    - NGS V and NGS g (DN 52V and DN 5V0): 59 inches (7V8 mm) long and 0.Dg inch сJ (5JV2 mm) thickJ
    - NGS 9 to NGS 57 (DN 200 to DN 4V0): 27 inches (q50 mm) long and 0.D8V inch dJ (5JP5 mm) thickJ
    - NGS 5g to NGS 27 (DN 700 to DN g00): 27 inches (g50 mm) long and 0.50V inch eJ (2Jg8 mm) thickJ
  - VJ Gipes NGS 9 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shieldJ
  - Thermal-Hanger Shields: Install with insulation same thickness as piping insulationJ dŊ

#### 4J2 METAL FABRICATIONS

- AJ Cut, drill, and fit miscellaneous metal fa6rications for trape3e pipe hangers and exuipment supportsJ
- ΒJ Fit ej posed connections together to form hairline "ointsJ Field weld connections that cannot 6e shop welded 6ecause of shipping si3e limitationsJ

- CJ Field z elding: Comply with Az S D5.5005.5M procedures for shielded, metal arc weldingX appearance and xuality of weldsXand methods used in correcting welding workXand with the following:
  - 5J Use materials and methods that minimi3e distortion and develop strength and corrosion resistance of 6ase metalsJ
  - 2JO6tain fusion without undercut or overlapJ
  - Remove welding fluj immediatelyJ 4J
  - Finish welds at ej posed connections so no roughness shows after finishing and so 7J contours of welded surfaces match ad"acent contoursJ

#### 4,4 **ADYUSTINW**

- AJ Hanger Ad'ustments: Ad'ust hangers to distri6ute loads exually on attachments and to achieve indicated slope of pipeJ
- ΒJ Trim ej cess length of continuous-thread hanger and support rods to 5-5Q inches (70 mm)J

#### 4J7 GAINTINW

- AJ Touchup: Clean field welds and a6raded areas of shop paintJ Gaint ej posed areas immediately after erecting hangers and supportsJ Use same materials as used for shop paintingJ Comply with SSGC-GA 5 rexuirements for touching up field-painted surfacesJ
  - 5J Apply paint 6y 6rush or spray to provide a minimum dry film thickness of 2D mils (0DV mm)J
- BJ Touchup: Cleaning and touchup painting of field welds, 6olted connections, and a6raded areas of shop paint on miscellaneous metal are specified in Section 0PP524 Unterior Gainting b
- CJ Walvani3ed Surfaces: Clean welds, 6olted connections, and a6raded areas and apply galvani3ing-repair paint to comply with ASTM A 890J

#### 4JV HANWER AND SUGGORT SCHEDULE

- Specific hanger and support rexuirements are in Sections specifying piping systems and AJ exuipmentJ
- BJ Comply with MSS SG-qP for pipe-hanger selections and applications that are not specified in piping system SectionsJ
- CJ Use hangers and supports with galvani3ed metallic coatings for piping and exuipment that will not have field-applied finishJ
- Use nonmetallic coatings on attachments for electrolytic protection where attachments are in DJ direct contact with copper tu6ingJ
- EJ Use car6on-steel pipe hangers and supports and metal framing systems and attachments for general service applicationsJ

- FJ Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applicationsJ
- WJ Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tu6ingJ
- HJ Use padded hangers for piping that is su6"ect to scratchingJ
- IJ Use thermal-hanger shield inserts for insulated piping and tu6ingJ
- YJ Hori3ontal-Giping Hangers and Supports: Unless otherwise indicated and ej cept as specified in piping system Sections, install the following types:
  - 5J Ad'usta6le, Steel Clevis Hangers (MSS Type 5): For suspension of noninsulated or insulated, stationary pipes NGS 5<sup>(2)</sup> to NGS 40 (DN 5<sup>(1)</sup> to DN 8<sup>(1)</sup>)J
  - 2J Koke-Type Gipe Clamps (MSS Type 2): For suspension of up to 50V0 deg F (Vqq deg C), pipes NGS 7 to NGS 27 (DN 500 to DN q00), rexuiring up to 7 inches (500 mm) of insulationJ
  - 4J Car6on- or Alloy-Steel, Dou6le-Bolt Gipe Clamps (MSS Type 4): For suspension of pipes NGS 4Q to NGS 4q (DN 20 to DN P00), rexuiring clamp flej i6ility and up to 7 inches (500 mm) of insulationJ
  - 7J Steel Gipe Clamps (MSS Type 7): For suspension of cold and hot pipes NGS 5Q to NGS 27 (DN 5V to DN q00) if little or no insulation is rexuiredJ
  - VJ Gipe Hangers (MSS Type V): For suspension of pipes NGS 502 to NGS 7 (DN 5V to DN 500), to allow off-center closure for hanger installation 6efore pipe erectionJ
  - qJ Ad'usta6le, Swivel Split- or Solid-Ring Hangers (MSS Type q): For suspension of noninsulated, stationary pipes NGS 4Q to NGS 9 (DN 20 to DN 200)J
  - 8J Ad'usta6le, Steel Band Hangers (MSS Type 8): For suspension of noninsulated, stationary pipes NGS 502 to NGS 9 (DN 5V to DN 200)J
  - 9J Ad'usta6le Band Hangers (MSS Type P): For suspension of noninsulated, stationary pipes NGS 52 to NGS 9 (DN 5V to DN 200)J
  - PJ Ad'usta6le, Swivel-Ring Band Hangers (MSS Type 50): For suspension of noninsulated, stationary pipes NGS 5**Q** to NGS 9 (DN 5V to DN 200)J
  - 50J Split Gipe Ring with or without Turn6uckle Hangers (MSS Type 55): For suspension of noninsulated, stationary pipes NGS 4**Q** to NGS 9 (DN 50 to DN 200)J
  - 55J Ej tension Hinged or Two-Bolt Split Gipe Clamps (MSS Type 52): For suspension of noninsulated, stationary pipes NGS 4(9) to NGS 4 (DN 50 to DN 90)J
  - 52J U-Bolts (MSS Type 27): For support of heavy pipes NGS 522 to NGS 40 (DN 5V to DN 8V0)J
  - 54J Clips (MSS Type 2q): For support of insulated pipes not su6"ect to ej pansion or contractionJ
  - 57J Gipe Saddle Supports (MSS Type 4q): For support of pipes NGS 7 to NGS 4q (DN 500 to DN P00), with steel-pipe 6ase stanchion support and cast-iron floor flange or car6on-steel plateJ
  - 5VJ Gipe Stanchion Saddles (MSS Type 48): For support of pipes NGS 7 to NGS 4q (DN 500 to DN P00), with steel-pipe 6ase stanchion support and cast-iron floor flange or car6on-steel plate, and with U-6olt to retain pipeJ
  - 5qJ Ad'usta6le Gipe Saddle Supports (MSS Type 49): For stanchion-type support for pipes NGS 2-5**Q** to NGS 4q (DN qV to DN P00) if vertical ad'ustment is rexuired, with steel-pipe 6ase stanchion support and cast-iron floor flangeJ
  - 58J Single-Gipe Rolls (MSS Type 75): For suspension of pipes NGS 5 to NGS 40 (DN 2V to DN 8V0), from two rods if longitudinal movement caused 6y ej pansion and contraction might occurJ

- 59J Ad"usta6le Roller Hangers (MSS Type 74): For suspension of pipes NGS 2-5Q to NGS 27 (DN qV to DN q00), from single rod if hori3ontal movement caused 6y ej pansion and contraction might occurJ
- 5PJ Complete Gipe Rolls (MSS Type 77): For support of pipes NGS 2 to NGS 72 (DN V0 to DN 50V0) if longitudinal movement caused 6y ei pansion and contraction might occur 6ut vertical ad"ustment is not necessaryJ
- Gipe Roll and Glate Units (MSS Type 7V): For support of pipes NGS 2 to NGS 27 (DN VO 20J to DN q00) if small hori3ontal movement caused 6y ej pansion and contraction might occur and vertical ad"ustment is not necessaryJ
- Ad"usta6le Gipe Roll and Base Units (MSS Type 7q): For support of pipes NGS 2 to 25J NGS 40 (DN V0 to DN 8V0) if vertical and lateral ad"ustment during installation might 6e rexuired in addition to ej pansion and contractionJ
- ' J 1 ertical-Giping Clamps: Unless otherwise indicated and ej cept as specified in piping system Sections, install the following types:
  - 5J Ej tension Gipe or Riser Clamps (MSS Type 9): For support of pipe risers NGS 4Q to NGS 27 (DN 27 to DN q00)J
  - 2J Car6on- or Alloy-Steel Riser Clamps (MSS Type 72): For support of pipe risers NGS 4Q to NGS 27 (DN 20 to DN q00) if longer ends are rexuired for riser clampsJ
- LJ Hanger-Rod Attachments: Unless otherwise indicated and ej cept as specified in piping system Sections, install the following types:
  - 5J Steel Turn6uckles (MSS Type 54): For ad"ustment up to g inches (5V0 mm) for heavy loadsJ
  - 2J Steel Clevises (MSS Type 57): For 520 to 7V0 deg F (7P to 242 deg C) piping installationsJ
  - 4J Swivel Turn6uckles (MSS Type 5V): For use with MSS Type 55, split pipe ringsJ
  - Mallea6le-Iron Sockets (MSS Type 5q): For attaching hanger rods to various types of 7J 6uilding attachmentsJ
  - VJ Steel z eldless Eye Nuts (MSS Type 58): For 520 to 7V0 deg F (7P to 242 deg C) piping installationsJ
- Building Attachments: Unless otherwise indicated and ej cept as specified in piping system MJ Sections, install the following types:
  - 5J Steel or Mallea6le Concrete Inserts (MSS Type 59): For upper attachment to suspend pipe hangers from concrete ceilingJ
  - 2J Top-Beam C-Clamps (MSS Type 5P): For use under roof installations with 6ar-"oist construction, to attach to top flange of structural shapeJ
  - Side-Beam or Channel Clamps (MSS Type 20): For attaching to 6ottom flange of 6eams, 4J channels, or anglesJ
  - 7J Center-Beam Clamps (MSS Type 25): For attaching to center of 6ottom flange of 6eamsJ
  - z elded Beam Attachments (MSS Type 22): For attaching to 6ottom of 6eams if loads are V.J considera6le and rod si3es are largeJ
  - C-Clamps (MSS Type 24): For structural shapesJ dŊ
  - Top-Beam Clamps (MSS Type 2V): For top of 6eams if hanger rod is rexuired tangent to 8J flange edgeJ
  - 9J Side-Beam Clamps (MSS Type 28): For 6ottom of steel I-6eamsJ
  - Steel-Beam Clamps with Eye Nuts (MSS Type 29): For attaching to 6ottom of steel I-PJ 6eams for heavy loadsJ
  - 50J Linked-Steel Clamps with Eye Nuts (MSS Type 2P): For attaching to 6ottom of steel I-6eams for heavy loads, with link ej tensionsJ

- Mallea6le-Beam Clamps with Eitension Gieces (MSS Type 40): For attaching to 55J structural steelJ
- 52J z elded-Steel Brackets: For support of pipes from 6elow or for suspending from a6ove 6y using clip and rodJUse one of the following for indicated loads:
  - aJ Light (MSS Type 45): 8V0 I6 (470 kg)J
  - 6J Medium (MSS Type 42): 5V00 I6 (q90 kg)J
  - сJ Heavy (MSS Type 44): 4000 l6 (54q0 kg)J
- Side-Beam Brackets (MSS Type 47): For sides of steel or wooden 6eamsJ 54J
- Glate Lugs (MSS Type V8): For attaching to steel 6eams if flej i6ility at 6eam is rexuiredJ 57J
- Hori3ontal Travelers (MSS Type V9): For supporting piping systems su6"ect to linear 5VJ hori3ontal movement where headroom is limitedJ
- Saddles and Shields: Unless otherwise indicated and ejcept as specified in piping system NJ Sections, install the following types:
  - 5J Steel-Gipe-Covering Grotection Saddles (MSS Type 4P): To fill interior voids with insulation that matches ad"oining insulationJ
  - 2J Grotection Shields (MSS Type 70): Of length recommended in writing 6y manufacturer to prevent crushing insulationJ
  - 4J Thermal-Hanger Shield Inserts: For supporting insulated pipeJ
- OJ Spring Hangers and Supports: Unless otherwise indicated and ej cept as specified in piping system Sections, install the following types:
  - 5J Restraint-Control Devices (MSS Type 78): z here indicated to control piping movementJ
  - Spring Cushions (MSS Type 79): For light loads if vertical movement does not ej ceed 5-2J 5Q inches (42 mm)J
  - 4J Spring-Cushion Roll Hangers (MSS Type 7P): For exuipping Type 75, roll hanger with sprinasJ
  - 7J Spring Sway Braces (MSS Type V0): To retard sway, shock, vi6ration, or thermal ej pansion in piping systemsJ
  - 1 aria6le-Spring Hangers (MSS Type V5): Greset to indicated load and limit varia6ility VJ factor to 2V percent to allow ej pansion and contraction of piping system from hangerJ
  - 1 aria6le-Spring Base Supports (MSS Type V2): Greset to indicated load and limit dŊ varia6ility factor to 2V percent to allow ej pansion and contraction of piping system from 6ase supportJ
  - 8.J 1 aria6le-Spring Trape3e Hangers (MSS Type V4): Greset to indicated load and limit varia6ility factor to 2V percent to allow ei pansion and contraction of piping system from trape3e supportJ
  - 9J Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected exuipmentJ Include auj iliary stops for erection, hydrostatic test, and load-ad'ustment capa6ilityJ These supports include the following types:
    - Hori3ontal (MSS Type V7): Mounted hori3ontallyJ aJ
    - 1 ertical (MSS Type W): Mounted verticallyJ 6J
    - сJ Trape3e (MSS Type Vq): Two vertical-type supports and one trape3e mem6erJ
- GJ Comply with MSS SG-gP for trape3e pipe-hanger selections and applications that are not specified in piping system SectionsJ

- . J Comply with MFMA-504 for metal framing system selections and applications that are not specified in piping system SectionsJ
- RJ Use mechanical-ej pansion anchors instead of 6uilding attachments where rexuired in concrete constructionJ
- SJ Use pipe positioning systems in pipe spaces 6ehind plum6ing fij tures to support supply and waste piping for plum6ing fij turesJ

END OF SECTION 220V2P

# SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. Section Includes:
  - 1. Warning signs and labels.
  - 2. Pipe labels.
  - 3. Stencils.
  - 4. Valve tags.
  - 5. Warning tags.

# 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

#### 1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

# PART 2 - PRODUCTS

## 2.1 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: Yellow.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
- F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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 rivets or 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.

## 2.2 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 (38 mm) high.

# 2.3 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch (19 mm) for access panel and door labels, equipment labels, and similar operational instructions.

- 1. Stencil Material: Fiberboard or metal.
- 2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
- 3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

## 2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.
  - 1. Tag Material: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Fasteners: Brass wire-link chain.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  - 1. Valve-tag schedule shall be included in operation and maintenance data.

## 2.5 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
  - 1. Size: 3 by 5-1/4 inches (75 by 133 mm) minimum.
  - 2. Fasteners: Brass grommet and wire.
  - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
  - 4. Color: Yellow background with black lettering.

# 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.

#### 3.2 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Section 099123 "Interior Painting."
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles, complying with ASME A13.1] on each piping system.

- 1. Identification Paint: Use for contrasting background.
- 2. Stencil Paint: Use for pipe marking.
- C. 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 (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- D. Pipe Label Color Schedule:
  - 1. Domestic Water Piping:
    - a. Background Color: Blue.
    - b. Letter Color: White.
  - 2. Sanitary Waste and Storm Drainage Piping:
    - a. Background Color: Sanitary Waste: Black. Storm Drainage: Yellow.
    - b. Letter Color: Black.

## 3.3 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

### 3.4 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section includes insulating the following plumbing piping services:
  - 1. Storm-water piping exposed to freezing conditions.
  - 2. Roof drains and rainwater leaders.
- B. Related Sections:
  - 1. Section 220716 "Plumbing Equipment Insulation."

### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail insulation application at pipe expansion joints for each type of insulation.
  - 3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 4. Detail removable insulation at piping specialties, equipment connections, and access panels.
  - 5. Detail application of field-applied jackets.
- C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
  - 1. Preformed Pipe Insulation Materials: 12 inches (300 mm) long by NPS 2 (DN 50).
  - 2. Jacket Materials for Pipe: 12 inches (300 mm) long by NPS 2 (DN 50).
  - 3. Sheet Jacket Materials: 12 inches (300 mm) square.
  - 4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.
# 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.
  - 1. Piping Mockups:
    - a. One 10-foot (3-m) section of NPS 2 (DN 50) straight pipe.
    - b. One each of a 90-degree threaded, welded, and flanged elbow.
    - c. One each of a threaded, welded, and flanged tee fitting.
    - d. One NPS 2 (DN 50) or smaller valve, and one NPS 2-1/2 (DN 65) or larger valve.
    - e. Four support hangers including hanger shield and insert.
    - f. One threaded strainer and one flanged strainer with removable portion of insulation.
    - g. One threaded reducer and one welded reducer.
    - h. One pressure temperature tap.
    - i. One mechanical coupling.
  - 2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
  - 3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
  - 4. Obtain Architect's approval of mockups before starting insulation application.
  - 5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

- 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
- 7. Demolish and remove mockups when directed.
- D. Comply with the following applicable standards and other requirements specified for miscellaneous components:
  - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

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

#### 1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

#### 1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

#### PART 2 - PRODUCTS

#### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. <u>Pittsburgh Corning Corporation; Foamglas</u>.
  - 2. Block Insulation: ASTM C 552, Type I.
  - 3. Special-Shaped Insulation: ASTM C 552, Type III.
  - 4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
  - 5. Preformed Pipe Insulation with Factory-Applied [ASJ] [ASJ-SSL]: Comply with ASTM C 552, Type II, Class 2.
  - 6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. Aeroflex USA, Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.
    - c. <u>K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS</u>.
- H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. <u>CertainTeed Corp.; SoftTouch Duct Wrap</u>.
    - b. Johns Manville; Microlite.
    - c. Knauf Insulation; Friendly Feel Duct Wrap.
    - d. Manson Insulation Inc.; Alley Wrap.
    - e. <u>Owens Corning; SOFTR All-Service Duct Wrap</u>.
- I. Mineral-Fiber, Preformed Pipe Insulation:
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. Fibrex Insulations Inc.; Coreplus 1200.
    - b. Johns Manville; Micro-Lok.
    - c. Knauf Insulation; 1000-Degree Pipe Insulation.
    - d. Manson Insulation Inc.; Alley-K.
    - e. Owens Corning; Fiberglas Pipe Insulation.
  - 2. Type I, 850 Deg F (454 Deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

- J. Phenolic:
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. <u>Kingspan Tarec Industrial Insulation NV; Koolphen K</u>.
    - b. <u>Resolco International BV; Insul-phen</u>.
  - 2. Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type III, Grade 1.
  - 3. Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1.
  - 4. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
  - 5. Factory-Applied Jacket: ASJ. Requirements are specified in "Factory-Applied Jackets" Article.
- K. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials.
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. <u>Armacell LLC; Tubolit</u>.
    - b. Nomaco Insulation; IMCOLOCK and NOMALOCK.

## 2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. Ramco Insulation, Inc.; Super-Stik.
- B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. <u>Ramco Insulation, Inc.; Thermokote V</u>.
- C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. <u>Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote</u>.

## 2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).

- 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
  - a. <u>Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; 81-84</u>.
- 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. <u>Aeroflex USA, Inc.; Aeroseal</u>.
    - b. Armacell LLC; Armaflex 520 Adhesive.
    - c. <u>Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; 85-75</u>.
    - d. K-Flex USA; R-373 Contact Adhesive.
  - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; CP-127</u>.
    - b. Eagle Bridges Marathon Industries; 225.
    - c. <u>Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; 85-60/85-70</u>.
    - d. Mon-Eco Industries, Inc.; 22-25.
  - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Phenolic Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F (minus 59 to plus 149 deg C).
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; CP-96</u>.
    - b. <u>Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; 81-33</u>.

- 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- F. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; CP-82</u>.
    - b. Eagle Bridges Marathon Industries; 225.
    - c. <u>Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; 85-20</u>.
    - d. Mon-Eco Industries, Inc.; 22-25.
  - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- G. PVC Jacket Adhesive: Compatible with PVC jacket.
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. <u>Dow Corning Corporation; 739, Dow Silicone</u>.
    - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
    - c. <u>P.I.C. Plastics, Inc.; Welding Adhesive</u>.
    - d. <u>Speedline Corporation; Polyco VP Adhesive</u>.
  - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

# 2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
  - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. <u>Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; 30-80/30-90</u>.

- b. <u>Vimasco Corporation; 749</u>.
- 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
- 3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
- 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
- 5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; CP-30</u>.
    - b. Eagle Bridges Marathon Industries; 501.
    - c. <u>Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; 30-35</u>.
    - d. Mon-Eco Industries, Inc.; 55-10.
  - 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
  - 3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
  - 4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
  - 5. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; Encacel</u>.
    - b. Eagle Bridges Marathon Industries; 570.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
  - 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
  - 3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
  - 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
  - 5. Color: White.
- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; CP-10</u>.
    - b. Eagle Bridges Marathon Industries; 550.
    - c. <u>Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; 46-50</u>.
    - d. Mon-Eco Industries, Inc.; 55-50.
    - e. <u>Vimasco Corporation; WC-1/WC-5</u>.

- 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
- 3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
- 4. Solids Content: 60 percent by volume and 66 percent by weight.
- 5. Color: White.

## 2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
  - 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; CP-50 AHV2</u>.
    - b. <u>Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; 30-36</u>.
    - c. Vimasco Corporation; 713 and 714.
  - 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fireresistant lagging cloths over pipe insulation.
  - 4. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
  - 5. Color: White.

## 2.6 SEALANTS

- A. Joint Sealants:
  - 1. <u>Joint Sealants for Cellular-Glass and Phenolic Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; CP-76</u>.
    - b. Eagle Bridges Marathon Industries; 405.
    - c. <u>Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; 30-45</u>.
    - d. Mon-Eco Industries, Inc.; 44-05.
    - e. <u>Pittsburgh Corning Corporation; Pittseal 444</u>.
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Permanently flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
  - 5. Color: White or gray.
  - 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. FSK and Metal Jacket Flashing Sealants:

- 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
  - a. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; CP-76</u>.
  - b. Eagle Bridges Marathon Industries; 405.
  - c. <u>Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; 95-44</u>.
  - d. Mon-Eco Industries, Inc.; 44-05.
- 2. Materials shall be compatible with insulation materials, jackets, and substrates.
- 3. Fire- and water-resistant, flexible, elastomeric sealant.
- 4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
- 5. Color: Aluminum.
- 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; CP-76</u>.
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Fire- and water-resistant, flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
  - 5. Color: White.
  - 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
  - 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

#### 2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. (68 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm) for covering pipe and pipe fittings.

- 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
  - a. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; Chil-Glas Number 10</u>.
- B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm), in a Leno weave, for pipe.
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. <u>Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; Mast-A-Fab</u>.
    - b. <u>Vimasco Corporation; Elastafab 894</u>.

## 2.9 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd. (271 g/sq. m).
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. <u>Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.</u>

#### 2.10 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. Johns Manville; Zeston.
    - b. P.I.C. Plastics, Inc.; FG Series.
    - c. <u>Proto Corporation; LoSmoke</u>.
    - d. <u>Speedline Corporation; SmokeSafe</u>.
  - 2. Adhesive: As recommended by jacket material manufacturer.
  - 3. Color: Color-code jackets based on system.
  - 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- C. Metal Jacket:
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> <u>Company; Metal Jacketing Systems</u>.

- b. <u>ITW Insulation Systems; Aluminum and Stainless Steel Jacketing</u>.
- c. <u>RPR Products, Inc.; Insul-Mate</u>.
- 2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.
  - a. Sheet and roll stock ready for shop or field sizing.
  - b. Finish and thickness are indicated in field-applied jacket schedules.
  - c. Moisture Barrier for Indoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
  - d. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
  - e. Factory-Fabricated Fitting Covers:
    - 1) Same material, finish, and thickness as jacket.
    - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
    - 3) Tee covers.
    - 4) Flange and union covers.
    - 5) End caps.
    - 6) Beveled collars.
    - 7) Valve covers.
    - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
- 3. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.
  - a. Sheet and roll stock ready for shop or field sizing.
  - b. Material, finish, and thickness are indicated in field-applied jacket schedules.
  - c. Moisture Barrier for Indoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
  - d. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
  - e. Factory-Fabricated Fitting Covers:
    - 1) Same material, finish, and thickness as jacket.
    - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
    - 3) Tee covers.
    - 4) Flange and union covers.
    - 5) End caps.
    - 6) Beveled collars.
    - 7) Valve covers.
    - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
- D. Underground Direct-Buried Jacket: 125-mil- (3.2-mm-) thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. <u>Pittsburgh Corning Corporation; Pittwrap</u>.
    - b. <u>Polyguard Products, Inc.; Insulrap No Torch 125</u>.

- 2.11 TAPES
  - A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
    - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
      - a. <u>ABI, Ideal Tape Division; 428 AWF ASJ</u>.
      - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
      - c. <u>Compac Corporation; 104 and 105</u>.
      - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
    - 2. Width: 3 inches (75 mm).
    - 3. Thickness: 11.5 mils (0.29 mm).
    - 4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
    - 5. Elongation: 2 percent.
    - 6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
    - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
  - B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
    - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
      - a. <u>ABI, Ideal Tape Division; 491 AWF FSK</u>.
      - b. <u>Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827</u>.
      - c. <u>Compac Corporation; 110 and 111</u>.
        - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
    - 2. Width: 3 inches (75 mm).
    - 3. Thickness: 6.5 mils (0.16 mm).
    - 4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
    - 5. Elongation: 2 percent.
    - 6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
    - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
  - C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
    - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
      - a. <u>ABI, Ideal Tape Division; 370 White PVC tape</u>.
      - b. <u>Compac Corporation; 130</u>.
      - c. Venture Tape; 1506 CW NS.
    - 2. Width: 2 inches (50 mm).
    - 3. Thickness: 6 mils (0.15 mm).
    - 4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
    - 5. Elongation: 500 percent.
    - 6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.
  - D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
    - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:

- a. ABI, Ideal Tape Division; 488 AWF.
- b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
- c. <u>Compac Corporation; 120</u>.
- d. <u>Venture Tape; 3520 CW</u>.
- 2. Width: 2 inches (50 mm).
- 3. Thickness: 3.7 mils (0.093 mm).
- 4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
- 5. Elongation: 5 percent.
- 6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

#### 2.12 SECUREMENTS

- A. Bands:
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. ITW Insulation Systems; Gerrard Strapping and Seals.
    - b. RPR Products, Inc.; Insul-Mate Strapping and Seals.
  - 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch (0.38 mm) thick, 3/4 inch (19 mm) wide with closed seal.
  - 3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 3/4 inch (19 mm) wide with closed seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.
- C. Wire: 0.062-inch (1.6-mm) soft-annealed, galvanized steel.
  - 1. <u>Manufacturers</u>: Subject to compliance with requirements, provide products by one of the following:
    - a. <u>C & F Wire</u>.

## 2.13 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers:
  - 1. <u>Manufacturers</u>: Subject to compliance with requirements, provide products by one of the following:
    - a. McGuire Manufacturing.
    - b. <u>Plumberex</u>.
    - c. <u>Truebro; a brand of IPS Corporation</u>.
    - d. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
  - 2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
- B. Protective Shielding Piping Enclosures:

- 1. <u>Manufacturers</u>: Subject to compliance with requirements, provide products by one of the following:
  - a. <u>Truebro; a brand of IPS Corporation</u>.
  - b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
- 2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and coldwater supplies and trap and drain piping. Comply with ADA requirements.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
  - Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

## 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Cleanouts.

#### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
  - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
  - 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:

- 1. Pipe: Install insulation continuously through floor penetrations.
- 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

## 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
  - 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  - 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  - 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  - 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
  - 1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  - 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  - 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
  - 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  - 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

## 3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
  - 1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  - 3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
  - 4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
  - 1. Install preformed pipe insulation to outer diameter of pipe flange.
  - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
  - 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
  - 2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

- D. Insulation Installation on Valves and Pipe Specialties:
  - 1. Install preformed sections of cellular-glass insulation to valve body.
  - 2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  - 3. Install insulation to flanges as specified for flange insulation application.

#### 3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
  - 1. Install pipe insulation to outer diameter of pipe flange.
  - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
  - 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install mitered sections of pipe insulation.
  - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
  - 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
  - 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  - 3. Install insulation to flanges as specified for flange insulation application.
  - 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

## 3.8 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
  - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  - 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.

- 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
  - 1. Install preformed pipe insulation to outer diameter of pipe flange.
  - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
  - 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
  - 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
  - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
  - 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
  - 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  - 4. Install insulation to flanges as specified for flange insulation application.

# 3.9 INSTALLATION OF PHENOLIC INSULATION

- A. General Installation Requirements:
  - 1. Secure single-layer insulation with stainless-steel bands at 12-inch (300-mm) intervals and tighten bands without deforming insulation materials.
  - 2. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with 0.062-inch (1.6-mm) wire spaced at 12-inch (300-mm) intervals. Secure outer layer with stainless-steel bands at 12-inch (300-mm) intervals.
- B. Insulation Installation on Straight Pipes and Tubes:
  - 1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  - 3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
  - 4. For insulation with factory-applied jackets with vapor retarders on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as

recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

- C. Insulation Installation on Pipe Flanges:
  - 1. Install preformed pipe insulation to outer diameter of pipe flange.
  - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.
- D. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
- E. Insulation Installation on Valves and Pipe Specialties:
  - 1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
  - 2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  - 3. Install insulation to flanges as specified for flange insulation application.

#### 3.10 INSTALLATION OF POLYOLEFIN INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
  - 1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
  - 1. Install pipe insulation to outer diameter of pipe flange.
  - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
  - 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install mitered sections of polyolefin pipe insulation.
  - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
  - 1. Install cut sections of polyolefin pipe and sheet insulation to valve body.

- 2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
- 3. Install insulation to flanges as specified for flange insulation application.
- 4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

## 3.11 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
  - 1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
  - 2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
  - 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
  - 1. Draw jacket material smooth and tight.
  - 2. Install lap or joint strips with same material as jacket.
  - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
  - 4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
  - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
  - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- D. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

## 3.12 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
  - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.
- 3.13 FIELD QUALITY CONTROL
  - A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
  - B. Perform tests and inspections.
  - C. Tests and Inspections:
    - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
  - D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

## 3.14 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Drainage piping located in crawl spaces.
  - 2. Underground piping.
  - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

## 3.15 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
  - 1. NPS 1 (DN 25) and Smaller: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
    - b. Flexible Elastomeric: 1 inch (25 mm) thick.
    - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
    - d. Phenolic: 1 inch (25 mm) thick.
    - e. Polyolefin: 1 inch (25 mm) thick.
  - 2. NPS 1-1/4 (DN 32) and Larger: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches (38 mm) thick.

- b. Flexible Elastomeric: 1 inch (25 mm) thick.
- c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
- d. Phenolic: 1 inch (25 mm) thick.
- e. Polyolefin: 1 inch (25 mm) thick.
- B. Domestic Hot and Recirculated Hot Water:
  - 1. NPS 1-1/4 (DN 32) and Smaller: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
    - b. Flexible Elastomeric: 1 inch (25 mm) thick.
    - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
    - d. Phenolic: 1 inch (25 mm) thick.
    - e. Polyolefin: 1 inch (25 mm) thick.
  - 2. NPS 1-1/2 (DN 40) and Larger: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
    - b. Flexible Elastomeric: 1 inch (25 mm) thick.
    - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
    - d. Phenolic: 1 inch (25 mm) thick.
    - e. Polyolefin: 1 inch (25 mm) thick.
- C. Stormwater and Overflow:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
    - b. Flexible Elastomeric: 1 inch (25 mm) thick.
    - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
    - d. Phenolic: 1 inch (25 mm) thick.
    - e. Polyolefin: 1 inch (25 mm) thick.
- D. Roof Drain and Overflow Drain Bodies:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
    - b. Flexible Elastomeric: 1 inch (25 mm) thick.
    - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
    - d. Phenolic: 1 inch (25 mm) thick.
    - e. Polyolefin: 1 inch (25 mm) thick.
- E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 1 inch (25 mm) thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
    - c. Polyolefin: 1 inch (25 mm) thick.
- F. Sanitary Waste Piping Where Heat Tracing Is Installed:

- 1. All Pipe Sizes: Insulation shall be one of the following:
  - a. Cellular Glass: 2 inches (50 mm) thick.
  - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches (38 mm) thick.
  - c. Phenolic: 1-1/2 inches (38 mm) thick.
- G. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet (3 m) of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
    - b. Flexible Elastomeric: 1 inch (25 mm) thick.
    - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
    - d. Phenolic: 1 inch (25 mm) thick.
    - e. Polyolefin: 1 inch (25 mm) thick.
- H. Hot Service Drains:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
    - b. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch (25 mm) thick.
- I. Hot Service Vents:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
    - b. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch (25 mm) thick.

## 3.16 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Domestic Water Piping:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Cellular Glass: 2 inches (50 mm) thick.
    - b. Flexible Elastomeric: 2 inches (50 mm) thick.
    - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.
    - d. Phenolic: 2 inches (50 mm) thick.
    - e. Polyolefin: 2 inches (50 mm) thick.
- B. Domestic Hot and Recirculated Hot Water:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Cellular Glass: 2 inches (50 mm) thick.
    - b. Flexible Elastomeric: 2 inches (50 mm) thick.
    - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.
    - d. Phenolic: 2 inches (50 mm) thick.
    - e. Polyolefin: 2 inches (50 mm) thick.

- C. Sanitary Waste Piping Where Heat Tracing Is Installed:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Cellular Glass: 2 inches (50 mm) thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.
    - c. Phenolic: 2 inches (50 mm) thick.
- D. Hot Service Drains:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

#### E. Hot Service Vents:

- 1. All Pipe Sizes: Insulation shall be one of the following:
  - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
  - b. Mineral-Fiber, Preformed Pipe Insulation, Type II: 1 inch (25 mm) thick.

## 3.17 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A. Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Cellular glass, 2 inches (50 mm) thick.

## 3.18 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the fieldapplied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
  - 1. None.
  - 2. PVC, Color-Coded by System: 20 mils (0.5 mm) thick.
  - 3. Aluminum, Smooth: 0.020 inch (0.51 mm) thick.
  - 4. Painted Aluminum, Smooth: 0.020 inch (0.51 mm) thick.
  - 5. Stainless Steel, Type 304, Smooth 2B Finish: 0.020 inch (0.51 mm) thick.
- D. Piping, Exposed:
  - 1. None.
  - 2. PVC, Color-Coded by System: 20 mils (0.5 mm) thick.
  - 3. Aluminum, Smooth: 0.020 inch (0.51 mm) thick.
  - 4. Painted Aluminum, Smooth: 0.020 inch (0.51 mm) thick.
  - 5. Stainless Steel, Type 304, Smooth 2B Finish: 0.020 inch (0.51 mm) thick.

# 3.19 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the fieldapplied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
  - 1. None.
  - 2. PVC, Color-Coded by System: 30 mils (0.8 mm) thick.
  - 3. Aluminum, Smooth: 0.040 inch (1.0 mm) thick.
  - 4. Painted Aluminum, Smooth: 0.032 inch (0.81 mm) thick.
  - 5. Stainless Steel, Type 304, Smooth 2B Finish: 0.020 inch (0.51 mm) thick.
- D. Piping, Exposed:
  - 1. PVC: 20 mils (0.5 mm) thick.
  - 2. Painted Aluminum, Smooth with Z-Shaped Locking Seam: 0.020 inch (0.51 mm) thick.
  - 3. Stainless Steel, Type 304, Smooth 2B Finish with Z-Shaped Locking Seam: 0.020 inch (0.51 mm) thick.

#### 3.20 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 220719

SECTION 221413 - STORM DRAINAGE PIPING

PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

# 1.2 SUMMARY

- A. Section Includes:
  - 1. Pipe, tube, and fittings.
  - 2. Specialty pipe fittings.
  - 3. Encasement for underground metal piping.
- B. Related Sections:
  - 1. Section 221429 "Sump Pumps" for storm drainage pumps.
  - 2. Section 334100 "Storm Utility Drainage Piping" for storm drainage piping outside the building.

# 1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
  - 1. Storm Drainage Piping: 10-foot head of water (30 kPa).
  - 2. Storm Drainage, Force-Main Piping: 50 psig (345 kPa).
- B. Seismic Performance: Storm drainage piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

# 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For controlled-flow roof drainage system. Include calculations, plans, and details.

# 1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For storm drainage piping, accessories, and components, from manufacturer.

- 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
- 2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.
- 1.6 QUALITY ASSURANCE
  - A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
  - B. Comply with NSF/ANSI 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

# 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 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.

# 2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
  - 1. <u>Manufacturers</u>: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. <u>ANACO-Husky</u>.
    - b. <u>Dallas Specialty & Mfg. Co</u>.
    - c. <u>Fernco Inc</u>.
    - d. <u>Matco-Norca, Inc</u>.
    - e. <u>MIFAB, Inc</u>.
    - f. <u>Mission Rubber Company; a division of MCP Industries, Inc</u>.
    - g. <u>Stant</u>.
    - h. <u>Tyler Pipe</u>.
  - 2. Standards: ASTM C 1277 and CISPI 310.
  - 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

EASTCHESTER UNION FREE SCHOOL DISTRICT 2021-2022 MS GYMNASIUMS RENOVATIONS AND MS ROOF REPLACEMENTS PROJECT

- C. Heavy-Duty, Hubless-Piping Couplings:
  - 1. <u>Manufacturers</u>: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. <u>ANACO-Husky</u>.
    - b. <u>Clamp-All Corp</u>.
    - c. Dallas Specialty & Mfg. Co.
    - d. MIFAB, Inc.
    - e. Mission Rubber Company; a division of MCP Industries, Inc.
    - f. <u>Stant</u>.
    - g. <u>Tyler Pipe</u>.
  - 2. Standards: ASTM C 1277 and ASTM C 1540.
  - 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

# 2.4 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
- B. Copper Drainage Fittings: ASME B16.23, cast-copper fittings or ASME B16.29, wrought-copper, solder-joint fittings.
- C. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
  - 1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8inch maximum thickness unless thickness or specific material is indicated.
  - 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- D. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

# 2.5 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
  - 1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
  - 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-pipingsystem fitting.
  - 3. Unshielded, Nonpressure Transition Couplings:
    - a. <u>Manufacturers</u>: Subject to compliance with requirements, provide products by one of the following:
      - 1) Dallas Specialty & Mfg. Co.
      - 2) <u>Fernco Inc</u>.
      - 3) <u>Mission Rubber Company; a division of MCP Industries, Inc.</u>
      - 4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
    - b. Standard: ASTM C 1173.

EASTCHESTER UNION FREE SCHOOL DISTRICT 2021-2022 MS GYMNASIUMS RENOVATIONS AND MS ROOF REPLACEMENTS PROJECT

- c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
- d. Sleeve Materials:
  - 1) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
  - 2) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- 4. Shielded, Nonpressure Transition Couplings:
  - a. <u>Manufacturers</u>: Subject to compliance with requirements, provide products by one of the following:
    - 1) Cascade Waterworks Mfg. Co.
    - 2) <u>Mission Rubber Company; a division of MCP Industries, Inc.</u>
  - b. Standard: ASTM C 1460.
  - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- 5. Pressure Transition Couplings:
  - a. <u>Manufacturers</u>: Subject to compliance with requirements, provide products by one of the following:
    - 1) <u>Dresser, Inc</u>.
    - 2) JCM Industries, Inc.
    - 3) <u>Smith-Blair, Inc.; a Sensus company</u>.
    - 4) <u>Viking Johnson; c/o Mueller Co.</u>
  - b. Standard: AWWA C219.
  - c. Description: Metal, sleeve-type couplings same size as, with pressure rating at least equal to and ends compatible with, pipes to be joined.
  - d. Center-Sleeve Material: Manufacturer's standard.
  - e. Gasket Material: Natural or synthetic rubber.
  - f. Metal Component Finish: Corrosion-resistant coating or material.

## PART 3 - EXECUTION

# 3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

## 3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction

loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.

- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. 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.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- K. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. 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.
- L. Lay buried building storm 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.
- M. Install storm drainage piping at the following minimum slopes unless otherwise indicated:
  - 1. Building Storm Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
  - 2. Horizontal Storm-Drainage Piping: 1 percent downward in direction of flow.
- N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
  - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- O. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- P. Install force mains at elevations indicated.
- Q. Plumbing Specialties:

- 1. Install backwater valves in storm drainage gravity-flow piping. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."
- 2. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."
- 3. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."
- R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

# 3.3 JOINT CONSTRUCTION

- A. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

# 3.4 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
  - 1. Install transition couplings at joints of piping with small differences in OD's.
  - 2. In Drainage Piping: Unshielded, nonpressure transition couplings.
  - 3. In Aboveground Force-Main Piping: Fitting-type transition couplings.
  - 4. In Underground Force-Main Piping:
    - a. NPS 1-1/2 (DN 40) and Smaller: Fitting-type transition couplings.
    - b. NPS 2 (DN 50) and Larger: Pressure transition couplings.

## 3.5 VALVE INSTALLATION

- A. General valve installation requirements are specified in Section 220523 "General-Duty Valves for Plumbing Piping."
- B. Shutoff Valves: Install shutoff valve on each sump pump discharge.
  - 1. Install gate or full-port ball valve for piping NPS 2 (DN 50) and smaller.

- 2. Install gate valve for piping NPS 2-1/2 (DN 65) and larger.
- C. Check Valves: Install swing-check valve, between pump and shutoff valve, on each sump pump discharge.
- D. Backwater Valves: Install backwater valves in piping subject to backflow.
  - 1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
  - 2. Install backwater valves in accessible locations.
  - 3. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."

# 3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  - 2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
  - 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  - 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
  - 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 6. Individual, Straight, Horizontal Piping Runs:
    - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.
  - 7. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 8. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting, valve, and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2:60 inches with 3/8-inch rod.
  - 2. NPS 3: 60 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5 : 60 inches with 5/8-inch rod.
  - 4. NPS 6 and NPS 8 : 60 inches with 3/4-inch rod.
  - 5. NPS 10 and NPS 12 : 60 inches with 7/8-inch rod.

- 6. Spacing for 10-foot pipe lengths may be increased to 10 feet . Spacing for fittings is limited to 60 inches .
- G. Install supports for vertical cast-iron soil piping every 15 feet .
- H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/4 : 72 inches with 3/8-inch rod.
  - 2. NPS 1-1/2 and NPS 2:96 inches with 3/8-inch rod.
  - 3. NPS 2-1/2 : 108 inches with 1/2-inch rod.
  - 4. NPS 3 to NPS 5:10 feet with 1/2-inch rod.
  - 5. NPS 6: 10 feet with 5/8-inch rod.
  - 6. NPS 8:10 feet with 3/4-inch rod.
- I. Install supports for vertical copper tubing every 10 feet .
- J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

#### 3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm drainage piping to roof drains and storm drainage specialties.
  - 1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
  - 2. Install horizontal backwater valves in pit with pit cover flush with floor.
  - 3. Comply with requirements for backwater valves, cleanouts and drains specified in Section 221423 "Storm Drainage Piping Specialties."
- D. Connect force-main piping to the following:
  - 1. Storm Sewer: To exterior force main.
  - 2. Sump Pumps: To sump pump discharge.
- E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- F. Make connections according to the following unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

## 3.8 IDENTIFICATION

A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

#### 3.9 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.
  - 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 storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 3. Test Procedure: Test storm drainage piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
  - 4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 5. Prepare reports for tests and required corrective action.
- E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - Cap and subject piping to static-water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  - 3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 4. Prepare reports for tests and required corrective action.
## 3.10 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.

# 3.11 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground storm drainage piping NPS 6 and smaller shall be any of the following:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.
  - 3. Copper DWV tube, copper drainage fittings, and soldered joints.
  - 4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- C. Aboveground, storm drainage piping[NPS 8 and larger shall be any of the following:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.
  - 3. Copper DWV tube, copper drainage fittings, and soldered joints.
  - 4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION 221413

# SECTION 221423 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. Section Includes:
  - 1. Roof drains.
  - 2. Miscellaneous storm drainage piping specialties.
  - 3. Cleanouts.
  - 4. Backwater valves.
  - 5. Trench drains.
  - 6. Channel drainage systems.
  - 7. Through-penetration firestop assemblies.
  - 8. Flashing materials.

### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- 1.4 QUALITY ASSURANCE
  - A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

## PART 2 - PRODUCTS

### 2.1 METAL ROOF DRAINS

- 1 Roof Drains: "Froet Drain" bi-functional roof drains.
  - 2 1. Dual Outlets: 100C(2,3,4,5,6,8)
    - 3 a. Primary Drain Outlet: Attached to storm sewer.
    - 4 b. Overflow Drain Outlet: Indicated on the Drawings.
  - 5 2. Compliance:
    - 6 a. ANSI/ASME A112.6.4.
    - 7 b. IAPMO IGC 187.
    - 8 c. ICC-ES LC 1021.
  - 9 3.Body:
    - 10 a. Bi-functional.

- 11 b. Cast Iron: ASTM A 48, Class 25.
- c. One piece casting including both outlets free of internal bosses
  - 12 d. Anchor flange.
  - 13 e. Powder coated.
- f. Overflow riser pipe must be removable
- 14 4. Dome Strainer:
  - 15 a. Cast Iron: ASTM A 48, Class 25.
  - b. Minimum Free Area by drain size: [2"-30 in<sup>2</sup>] [3'-62 in<sup>2</sup>] [4"-62 in<sup>2</sup>] [5"-95 in<sup>2</sup>] [6'-95 in<sup>2</sup>] [8"-163 in<sup>2</sup>]
- 17 5. Waterproofing Membrane Clamp Ring:
  - 18 a. Width: 2.375 inches (61 mm).
  - 19 b. Cast Iron: ASTM A 48, Class 25.
  - 20 c. Integral Gravel Stop: 1-1/4-inch (32-mm) height minimum.
- d. Anchorage: Four 1.5" bolts pre-applied with anti-seize
- e. Free area height above roof: 1/4-inch
- 21 6. Pipe Size: Indicated on the Drawings.
- 22 8. Low-Profile Bi-functional Roof Drains:
  - 23 a. Primary Strainer: 3 inches (76 mm) high.
  - b. Overflow Inlet: 4 inches (102 mm) high.
- 25 9. Deck Clamp: L-shaped clamp to hold drain body in place.
- 10. Elevation Ring (1.5, 2) is a pre-engineered ring with a fixed height to elevate drain so start of free drainage area is level with height of 1.5" & 2" insulation to eliminate ponding around roof drain.
- 26 11. Drain Extension: Adjust proper primary outlet elevations in relation to roof deck thickness or to adjust drain inlet elevations in relation to insulation thickness.
- 27 12. Drain Pan: 14-guage flat plate. Mount roof drain to drain pan.
- 28 13. Sump Pan: 14-guage galvanized steel.
- 29 14. Deck Mounting Plate:
  - 30 a. 14-guage flat plate.
  - 31 b. Allows drain to be directly mounted to plate elevated 2-1/4 inches (57 mm) above roof deck.
  - 32 c. Eliminates need for deck clamp.
- 33 15. Finishing Ring: Recessed ring to allow drain body to be installed in flush configuration, either directly to roof deck or into drain pan.
- 34 16. Overflow Strainer:
- a. Cast Iron: ASTM A 48, Class 25.

b. Minimum free area by drain size; (2-73 in<sup>2</sup>), (3-105 in<sup>2</sup>), (4-105 in<sup>2</sup>), (5-146 in<sup>2</sup>), (6-146 in<sup>2</sup>), (8-200 in<sup>2</sup>)

- 35 a. Type: Low profile.
- 36 b. Debris strainer for overflow pipe.
- 37 c. Vandal resistant.

## 38 3.1 EXAMINATION

- 39 A. Examine roof areas to receive bi-functional roof drains.
- 40 B. Verify roof deck is properly supported to receive bi-functional roof drains.

- 41 C. Notify Architect of conditions that would adversely affect installation or subsequent use.
- 42 D. Do not begin installation until unacceptable conditions are corrected.
- 43 3.2 INSTALLATION
  - 44 A. Install bi-functional/standard primary roof drains in accordance with manufacturer's instructions at locations indicated on the Drawings.
  - 45 B. Install bi-functional/standard primary roof drains plumb, level, and to correct elevation.
  - 46 C. Install bi-functional/standard primary roof drains using manufacturer's supplied components and hardware.
  - 47 D. Final Inspection: Inspect bi-functional/standard primary roof drains at time of Substantial Completion to verify drains remain unobstructed.
- 48 3.3 PROTECTION
  - 49 A. Protect installed bi-functional/standard primary roof drains to ensure that, except for normal weathering, drains will be without damage or deterioration at time of Substantial Completion.
  - 50 B. Do not allow construction debris from entering drainage system through installed bi-functional roof drains.

### 3.4 WARRANTY

- A. Standard warranty 1 year on all roof drain products
- B. Optional 25 year Replacement Warranty contractor is required complete all requirements for warranty. Warranty will not be activated until all required paper work is submitted and invoice is paid in full. See website for details.
- C. Optional 25 year Enhanced Installation and Replacement Warranty contractor is required complete all requirements for warranty. Warranty will not be not in effect until all required paper work is submitted, warranty and product invoice is paid in full. See website for details.

## 2.2 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

- A. Downspout Adaptors:
  - 1. Description: Manufactured, gray-iron casting, for attaching to horizontal-outlet, parapet roof drain and to exterior, sheet metal downspout.
  - 2. Size: Inlet size to match parapet drain outlet.
- B. Downspout Boots:
  - 1. Description: Manufactured, ASTM A 48/A 48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 (DN 100) outlet; and shop-applied bituminous coating.
  - 2. Size: Inlet size to match downspout and NPS 4 (DN 100) outlet.
- C. Conductor Nozzles:

- 1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
- 2. Size: Same as connected conductor.

## 2.3 CLEANOUTS

- A. Floor Cleanouts:
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. <u>Josam Company</u>.
    - b. <u>Smith, Jay R. Mfg. Co</u>.
    - c. <u>Tyler Pipe</u>.
    - d. <u>Watts Water Technologies, Inc.</u>
    - e. Zurn Plumbing Products Group; Light Commercial Products Operation.
    - f. Zurn Plumbing Products Group; Specification Drainage Operation.
  - 2. Standard: ASME A112.36.2M, for cast-iron soil pipe with cast-iron ferrule cleanouts.
  - 3. Size: Same as connected branch.
  - 4. Type: Cast-iron soil pipe with cast-iron ferrule.
  - 5. Body or Ferrule Material: Cast iron.
  - 6. Clamping Device: Not required.
  - 7. Outlet Connection: Spigot.
  - 8. Closure: Brass plug with straight threads and gasket.
  - 9. Adjustable Housing Material: Cast iron with set-screws or other device.
  - 10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
  - 11. Frame and Cover Shape: Square.
  - 12. Top-Loading Classification: Heavy Duty.
  - 13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
- B. Test Tees:
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. <u>Josam Company</u>.
    - b. <u>MIFAB, Inc</u>.
    - c. <u>Smith, Jay R. Mfg. Co</u>.
    - d. <u>Tyler Pipe</u>.
    - e. <u>Watts Water Technologies, Inc</u>.
    - f. Zurn Plumbing Products Group; Specification Drainage Operation.
  - 2. Standard: ASME A112.36.2M and ASTM A 74, ASTM A 888, or CISPI 301, for cleanout test tees.
  - 3. Size: Same as connected drainage piping.
  - 4. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or hubless, cast-iron soil-pipe test tee as required to match connected piping.
  - 5. Closure Plug: Countersunk, brass.
  - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- C. Wall Cleanouts:

- 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
  - a. <u>Josam Company</u>.
  - b. <u>MIFAB, Inc</u>.
  - c. <u>Smith, Jay R. Mfg. Co</u>.
  - d. Tyler Pipe.
  - e. Watts Water Technologies, Inc.
  - f. Zurn Plumbing Products Group; Specification Drainage Operation.
- 2. Standard: ASME A112.36.2M, for cleanouts. Include wall access.
- 3. Size: Same as connected drainage piping.
- 4. Body Material: Hubless, cast-iron soil-pipe test tee as required to match connected piping.
- 5. Closure: Countersunk, drilled-and-threaded cast-iron plug.
- 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- 7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
- 8. Wall Access: Square, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

## 2.4 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

- A. Through-Penetration Firestop Assemblies:
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. <u>ProSet Systems Inc</u>.
  - 2. Standard: ASTM E 814, for through-penetration firestop assemblies.
  - 3. Certification and Listing: Intertek Testing Service NA for through-penetration firestop assemblies.
  - 4. Size: Same as connected pipe.
  - 5. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
  - 6. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
  - 7. Special Coating: Corrosion resistant on interior of fittings.

## 2.5 FLASHING MATERIALS

- A. Copper Sheet: ASTM B 152/B 152M,12 oz./sq. ft. (3.7 kg/sq. m or 0.41-mm thickness).
- B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.
- D. Fasteners: Metal compatible with material and substrate being fastened.

- E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- F. Solder: ASTM B 32, lead-free alloy.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
  - 1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
  - 2. Install expansion joints, if indicated, in roof drain outlets.
  - 3. Position roof drains for easy access and maintenance.
- B. Install downspout adapters on outlet of back-outlet parapet roof drains and connect to sheet metal downspouts.
- C. Install downspout boots at grade with top 12 inches (305 mm) above grade. Secure to building wall.
- D. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.
- E. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
  - 1. Use cleanouts the same size as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
  - 2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
  - 3. Locate cleanouts at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
  - 4. Locate cleanouts at base of each vertical soil and waste stack.
- F. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- G. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- H. Install horizontal backwater valves in floor with cover flush with floor.
- I. Install drain-outlet backwater valves in outlet of drains.
- J. Install test tees in vertical conductors and near floor.
- K. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.
- L. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface unless otherwise indicated.

- M. Assemble channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.
- N. Install through-penetration firestop assemblies in plastic conductors at concrete floor penetrations.
- O. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

### 3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

## 3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
  - 1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. (30-kg/sq. m) lead sheets, 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of 4.0-lb/sq. ft. (20-kg/sq. m) lead sheets, 0.0625-inch (1.6-mm) thickness or thinner.
  - 2. Copper Sheets: Solder joints of copper sheets.
- 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 the pipe size, with a minimum length of 10 inches (250 mm) and with skirt or flange extending at least 8 inches (200 mm) around pipe.
  - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
  - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) 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. Fabricate and install flashing and pans, sumps, and other drainage shapes.

## 3.4 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 221423

SECTION 22V000 - FUEL WAS SKSTEMS

GART 5 - WENERAL

#### 5P5 RELATED DOCUMENTS

AP DBJ. rawi Jan wgagBJs dBel ri reai ep ovg CeadBJfot rafshnraw WgagBJs Jan Shddsgc gaoJB Ceanroreai Jan DrI ri rea 5 Sdgf norf Jonea Sgforeait Jdds, oe ovri SgforeaP

# 5P2 SUMMARK

- AP Tvri Sgforea rafshngi phgswJi drdraw. rovra ovg uhrsnraw PGBenhfoi rafshng ovg pesse. rawm
  - 5P Grdgt ohugt proorawit Jan yeraraw c Jog BUsi P
  - 2P GBeogforlg drdg Jan propraw fe Joraw P
  - : P GrdrawidgfrJsorgiP
  - 3P SdgfrJsg IJslgiP
  - VP SgBirfgcgogBiP
  - 4P GBgi i hBg BgwhsloeBP
- 6P Rgslogn Sgforeai rafshng ovg pesse. rawm
  - 5P Drlnirea :: Sgforea 7N Joh BJs WJi DriobBuhorea 7 peBa Joh BJs wJi ig Binfg drdrawt idgfr Jsorgit Jan Jffgiie Brgi ehoim govg uhrsnraw P

### 5P. GROYECT CONDITIONS

- AP WJi S, ioqc GBgiih Bgm Oag dBgiih Bg BJawg P0 PV dirwe BsgiiP
- 6P DginwalJshgiepphgswJiihddsrgn peBovgigi, iogciJBg Jipesse. im
  - 5P Nec raJsHgJoraw 1 Jshgm 5000 6 dh of h PpoP
  - 2P Nec raJsSdgf rpf WBJI ro, m0P4P

### 5P3 SU6 MITTALS

- AP GBenhfoDJoJmFeBovg pesse. rawm
  - 5P SdgfrJso, IJsigiP lafshng dBgiih Bg BJonawt fJdJfno, tigoonawit Jan gsgfoBfJsfeaagforea nJoJepigsgfogn cengsiP
  - 2P GBgiih Bg BgwhsJoeB Plafshng dBgiih Bg BJorawt fJdJfro,tJan igoorawi epigsgfogn cengsiP
- 6P Sved DBJ. rawim FeBphgswJi drdrawP lafshng dsJai Jan JooJfvc gaoi oe eovgB. eBBPSve. nmpgBgaodBgiihBg 9eagi Jan rannfJog dBgiihBg peBgJfv 9eagP
  - 5P brBraw DrJwBJc im Ge. gBt inwaJst Jan feadBes. rBrawP
- CP bgsnrawfgBonpfJogiP

- DP Frgsn xhJsro, -feaoBesogi o Bogde Boi P
- EP OdgBJorea Jan MJraogaJafg DJoJm FeBaJohBJswJi idgfrJsorgi Jan JffgiieBigi oe rafshng ra gcgBwgaf, tedgBJoreat Jan cJraogaJafg cJahJsiP

#### 5PV j UALITK ASSURANCE

- AP b gsnrawm j hJsm, dBefgiigi Jan edgBloeB JffeBnraw oe ASME 6ersgBJan GBgiihBg 1 giigs CengmSgforea IQP
- 6P EsgfoBfJsCec deagaoi Jan DgInfgim Lriogn Jan sJugsgn Jingpragn na NFGA "Ot A Bonfsg 500tu, Jogionaw Jwgaf, Jffgdolusg oe Jhove Borgiv JInaw yh Brinnforeat Jan c JBBgn pe Braogangn higP
- CP NFGA SolanJBnmCec ds . rov NFGA V3t 7NJoreaJsFhgsWJi CengP7

### 5P4 DELI1ERKt STORAWET AND HANDLINW

AP HJansraw FsJccJusg Lrxhmim Rgcelg Jan sgwJss, nrideig epsxhmipBec nBrdi ragXrioraw wJi drdrawP HJansg fJhorehis, oe Jlem idrssJwg Jan rwaroreaP Neorp, phgs wJi ihddsrgBP HJansg psJccJusg sxhmi hign u, laioJssgB. rov dBedgBdBgfJhoreai Jan ne aeosgJlg ea dBgcrigipBec gan epeag nJ, oe ugwraaraw epagXonJ, P

### 5P COORDINATION

- AP EXrioraw Uorstorgim De aeoraog BBh do horstorgi igBiraw pJfrstorgi effhdrgn u, O. ag Be Beovg Bi hasgi i dg Bc roogn hang Bovg pesse. raw feantoreai Jan ovga eas, Jpog BJBBJawraw oe dBelmg ogc de BJB, horsto, ig Birfgi Jffe Bhraw oe BaxhrBgc gaoi rantfJognm
  - 5P Neonp ABfvrogfoaeosgii ov Jao e n J, i na Jn I Jafg epd Bedeign horso, naog BBhdoreai P 2P De aeod Befggn. rov horso, naog BBhdoreai. rov eho ABfvrogfozi. Broog a dg Bo: riirea P
- 6P CeeBhnaJog in 9g Jan sef Jonea epfeaf Bojog uJigiPCJioJafveBuesonaigBoi naoe uJigiPCeaf Bojogt BojnapeBfgc gaot Jan peBc. eBB BojxhnBojc gaoi JBojidgfnorgn na Drlninea: P

### GART 2 - GRODUCTS

### 2P3 MANUFACTURERS

- AP la eovgBGJBo2JBofsgi.vgBg oroogi ugse.raoBenhfg srioit ovg pesse.raw BgxhrBgc gaoi Jdds, oe dBenhfoigsgfoream
  - 5P AlJnsJusg MJahpJfohBgBim Shuygfo oe fecdsJafg .rov BgxhrBgcgaoit cJahpJfohBgBi eppgBaw dBenhfoi ov JocJ, ug nafeBdeBJogn naoe ov g beB8 nafshngt uho JBg aeo src rogn oet cJahpJfohBgB idgfnorgn P
  - 2P MJahpJfohBgBim Shuygfooe fecdsdafg. rov BgxhrBgcgaoitdBelingdBenhfoiu, eagepovg cJahpJfohBgBidgfnpgnP

## 2P2 GIGINW MATERIALS

AP RgpgBoe GJBo: 7Grdraw AddsrfJoneai 7 ABorfsg peBJddsrfJoneai ep drdgt ohugt proorawt Jan yeraraw c JogBJsiP

### 2P. GIGESt TU6 ESt FITTINWSt AND YOININW MATERIALS

- AP Soggs Grdgm ASTM A V: qA V: Mk T, dg E eBSk WBJ ng 6k usJf 8P b Jssov of 8agi i ep. Behwo i oggs drdg i v Jssfec ds, nov ASME 6:4450 MP
  - 5P MJssgJusg-IBea TvBgJngn Fromawim ASME 654P:t Cslii 5V0t ioJanJBn dJoogBat .rov ovBgJngn gani JffeBnnaw oe ASME 651720175P
  - 2P Soggs TvBgJngn Froorawim ASME 6541755t peBwgn ioggs. rov ovBgJngn gani JffeBnraw oe ASME 651720175P
  - : P Soggsb gsnraw Froorawi mASME 65417 t. Behw oi oggse BASME 6541755t pe Bwgn i oggsP
  - 3P Uareaim ASME 654P;/tCsJii 5V0tcJssgJusg nBea.rov uBJii-oe-nBeaigJot wBehan yeraot Jan ov ByJngn gani JffeBhnaw oe ASME 65P20P5P
  - VP CJiel Bea Fslawgi Jan Fslawgn Froorawim ASME 654 PSt Cslii 52 VP
  - 4P YeraoCec dehan Jan TJdgmShroJusg peBaJdhBJswJi P
  - "P SoggsFsJawgi Jan FsJawgn Froorawi mASME 654PVP
  - ; P WJi8goMJogBJsmTvnf8agiitcJogBJstJano,dgihnoJusgpeBaJohBJswJiP

## 2P3 GROTECTI1E COATINW

AP FhBariv drdg Jan proorawi. rov pJfoeB,-JddsrgntfeBBeirea-BgirioJaodes, gov, sgag feJoraw peBhig ra feaoJfo. rov c JogBJsiov Joc J, feBBen g ovg drdgP

#### 2PV GIGINWSGECIALTIES

- AP FsgXrusg Ceaagf oe B mANSI (25P23t feddgBJsse, P
- 6P j hrf 8-DrifeaagfoDgl rfgimANSI (25P35t feal gargafgehoogoi Jan c JofvrawdshwfeaagfoeBP

#### 2P4 SGECIALTK 1AL1ES

- AP 1Jsl git NGS 2 Jan Sc Jssg BmTvBg Jngn gani Jffe Bnraw oe ASME 65120175 peBdrdg ov Bg Jni P
- 6P 1Jslgit NGS 2-502 Jan LJBwgBm FsJawgn gani JffeBnraw oe ASME 654PV peBioggspsJawgi Jan JffeBnraw oe ASME 654P23 peBfeddgBJan feddgBJsse, psJawgi P
- CP AddsJafg Ceaagf oeB1 Jst gi mANSI (25P5V Jan CSA laogBaJoreaJssi ogn P
  - 5P MJahpJfohBgBim
    - JP Ac gBf Ja 1 Js g laf P
    - uP 6) Z lanhi dagi t laf P
    - fP 6BJii CBJpoMJahpJfohBawCeP
    - nP Crc ugBe 1 Js git SPdPAP
    - gP CeauBlfe lanhi dBgit laf RAdesse Drl P
    - pP EPMPGsJionf Jan EsgfoBof GBenhfoit Lon RKNge 1 Jsl g Drl P

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- wP YMF Cec dJa, P
- vP Yec JBlaogBaJoreaJsLonP
- rP Zg, WJi Cec deagaoit laf P
- yP Lgwgan 1 Jslg Jan Froorawt laf P
- 8P Mf DeaJsnt APKPMpwPCeP
- sP MhgssgBCeRRMhgssgBWJiGBenhfoiDrlP
- cP Ng. cJa HJoogBisg, Lon RkSdgfrJsg, 1Jsl gi Drl P
- aP ReugBoMJahpJfdhBawCeP
- eP Solog Mgolsit laf P
- dP b Jooi lanhioBigit laf Rkb JogBGBenhfoi Drl P
- DP WJi Soedim 6 Bea9g uen, . rov AWA ioJc dt dshwo, dg . rov uBea9g dshw Jan psJoeBixh JBg vgJnt uJsso, dg . rov fvBec g-dsJogn uBJii uJssJan sglgBvJan sgt eBuhoogBps, IJslg . rov ioJrasgii-ioggs nrif Jan psheBef JBuea gsJioec gBigJsJan sglgBvJan sgk 2-dirw crarch c dBgiih Bg BJoraw P
- EP WJi 1 Jsl git NGS 2 Jan Sc JssgBm ASME 654P: Jan CSA laogBaJoreaJssriogn uBea9g uen, Jan 52V-dirw dBgii hBg BJorawP
  - 5P MJahpJfohBgBim
    - JP CBJag 1 Jsl gi P
    - uP Dhawi t ZJBt laf P
    - f P WBaaqssCeBdP
    - nP Heag, gsslaogBaJoreaJslafP
    - qP Mrs Jh8qq 1Js q Cec dJa, P
    - pP MhgsggBCeRtMhgsggBWJi GBenhfoi Drl P
    - WP NI6CO INCP
    - vP Rgn-b vrog 1 Jsl g CeBdP
  - 2P TJc dgBdBeepFgJdnBgmlaf shng ngi rwa peBsef 8rawP
- FP Gshw 1 Jst git NGS 2-502 Jan LJBwgBm ASME 654P; Jan MSS SG-"; fJiorBeat shuBf Jogn dshw IJst git . rov 52V-dirw dBgii hBg BJorawP
  - 5P MJahpJfohBgBim
    - JP NeBnidBec 1JslgitlafP
    - uP Osi ea Tgf vaesewrgi t laf R Hec gi og Jn 1 Js g Drl P
    - fP bJseBovCeP
  - 2P TJc dgBdBeepFgJdnBgmlaf shng ngi rwa peBsef 8rawP
- WP WgagBJsDho, 1 Jst git NGS 2-502 Jan LJBwgBm ASME 654P; t f JionBea uen, t i hno Jusg peBphgs wJi i gBinfgt. nov 7b OW7 rannf Jogn ea I Jst g uen, t Jan 52V-dirw dBgi i hBg BJorawP
  - 5P WJog 1 Jst gim MSS SG-" 0t OS) K o, dg. rov i esm. gnwgP
  - 2P 6 hoog Bas, 1 Jst gim MSS SG-4" t shwo, dg . rov sgl gBv Jansg P
- HP Ahoec Jonf WJi 1 Jstgim ANSI (251725t. rov gsgfobof Jsc gfv Janf Jsedg Bloe Bpe BJfoh Joneau, Jddsc Janf Jhoec Jonf i vhoeppongl nfg P
  - 5P MJahpJfohBgBim
    - JP ASCO WgagBJsCeadBesi P

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- uP ASCO Ge. gBTgf vaesewrgi t LGkDrl ri rea epEc gB eaP
- fP ASCO 1Jst g CJaJnJt Drl ri rea epEc gB ea Esgf oBf CJaJnJ Lrc rognP
- nP Dhawit ZJBt laf P
- gP Efsodig Cec uhioreat laf P
- pP WGS WJiGBeogforea S, iogcilaf P
- wP Heag, .gsslaogBaJoreaJslafP
- vP Yevai ea Ceadesi P
- IP EsgfoBfJss, OdgBJogn WJi 1 Jslgim UL 32/tuBea9gtJshcrahcteBfJionBeauen, iesgaem IJslgk 520-1 Jft 40 H9t Cslii 6t feaorahehi-nho, cesngn fersP lafshng NEMA ISC 4t T, dg 3t fers gafseih Bg Jan gsgfoBfJss, edgagn Jan fseign nhJs fersiP 1 Jslg deirorea iv Jss aeBc Jss, ug fseignP
  - 5P MJahpJfohBgBim
    - JP ASCO WgagBJsCeadBesi P
    - uP ASCO Ge. gBTgf vaesewrgi t LGkDrl ri rea epEc gB eaP
    - f P Dhawit ZJB± laf P
    - nP Efsrdig Cec uhioreat laf P
    - gP We, ga 1 Jst g CeBdRkT, fe Eal nBeac gaoJsS, i ogc i P
    - pP MJwaJdbes1Jstg CeBdP
    - wP GJB&gBHJaanpra CeBdeBJoneak Corc Jog) lanhioBJs CeaoBeoi WBehdk S&raagB1Jolg Drl P
    - vP bJooilanhioBigitlafP
- YP EJBovxhJ8g 1Jslgim Lriogn na CSA laogBaJoreaJszi 7CgBonprgn GBenhfo Lrioraw DrBgfoeB,m Cec deagaoi peBWJi Jan EsgfoBfJsExhrdc gao7Ji fec ds, raw. rov ASCE 2V Jan UL sriogn P
  - 5P EJBovxhJ8g-1Jslgt T,dg 5mb eB8raw-dBgiihBg BJoraw ri 2V dirw 52V dirw PCJieJshc rahc uen, .rov ioJrasgii-ioggsraogBaJsdJBoiP6haJ-NtBgigeiogct O-BrawigJsPTvBgJngn gan feaagforeaiP
    - JP MJahpJfohBgBim
      - 5& SJpg TjhJ8g CeBdP
- GART : EQECUTION
- : P3 GREGARATION
  - AP Cseig gxhrdc gao ivhoepplJstgi ugpeBg ohBaraw eppphgs wJi oe dBgc rigi eBigforea ep drdrawP GgBpeBc sgJ8Jwg ogio Ji idgfnorgn ra 7Frgsn jhJsno, CeaoBes7 ABorfsg oe ngogBc rag ov Jo Jss gxhrdc gao ri ohBagn eppra Japogfogn drdraw igforeaP
- : F2 GIGINWAGGLICATIONS
  - AP FsJawgithareaitoBJaironeatJan idgfrJsproonawi .rov dBgiihBg BJorawi iJcg Ji eBvrwvgBovJa i,iogc dBgiihBg BJoraw cJ, ug hign na JddsfJoreai ugse.thasgii eovgB rig rannfJognP
  - 6P FhgsWJi Grdrawt 2 di rweBLgi i m

### EASTCHESTER UNION FREE SCHOOL DISTRICT 2025-2022 MS WKMNASIUMS RENO1 ATIONS AND MS ROOF REGLACEMENTS GROYECT

- 5P NGS 3 Jan Sc JssgBm Soggsdrdgt c JssgJusg-rBea ov By Jngn proorawit Jan ov By Jngn yeraoi P
- 2P NGS 3 Jan LJBwgBm Soggsdrdgt i oggs. gsnraw proorawit Jan. gsngn yeraoiP
- CP UangBwBehan FhgsWJi Grdrawm Soggsdrdgtioggs.gsnraw proorawit Jan.gsngn yeraoiP EafJig ra feaoJrac gaofean hroP
- DP CeaoJrac gaoCeanhroim Soggsdrdgt i oggs. gsnraw proorawit Jan. gsngn yeraoi P

## : P. 1AL1E AGGLICATIONS

- AP AddsJafg Svhoepp1Jstgi peBGBgiihBg 0PV dirweBLgiimAddsJafg feaagfoeBlJstg eBwJiioedP
- 6P Grdraw Lrag 1 Jsl git NGS 2 Jan Sc Jssg BmWJi I Jsl gP
- CP Grdraw Lrag 1 Jst git NGS 2-502 Jan LJBwgBmGshwl Jst g eBwgagBJsnho, I Jst gP
- DP 1Jst gi JoSgBt rf g MgogBt NGS 2 Jan Sc JssgBmWJi IJst gP
- EP 1Jst gi JoSgBr fg MgogBr NGS 2-502 Jan LJBvgBmGshw IJst gP

#### : P3 GIGINWINSTALLATION

- AP 6 Jinf drdraw naioJssJonea ByxhnBycgaoi JBy idgfnprgn na DnIninea 22 Sgfonea 7Ceccea beBB Rgihsoi peBGshcunaw7
- 6P CeafgJsgn LefJoreaim EXfgdoJi idgfnprgn ugse. traioJssfeafgJsgn wJi drdraw ra JnBorw of ean hro feaioBhfogn ep Sfvgn hsg 30 tigJc sgiit usJf8 ioggs drdg . rov . gsngn yeraoiP 1 gao fean hro oe ehoim g Jan og Bc raJog . rov if Bygagn I gao fJdP
  - 5P Auelg-Cgrsnaw LefJoreaim WJi drdraw cJ, ug raioJsogn ra Jffgiirusg idJfgit ihuygfooe JddBelJs epJhoveBoorgi vJl raw yhBrinnforeat .vgovgBeBaeo ihfv idJfgi JBg hign Ji dsgahc iPDe aeosefJog IJsłgi Juelg fgrsnawiP
  - 2P la GJBororeaim De aeoraioJss feafgJsgn drdraw ra iesm dJBororeaiP GBeogfo ohuraw pBec dv, infJsnJcJwg. vga raioJssgn raimg dJBororeai eBvesse. JssiP
    - JP EXfgdoreamThurawdJiirawovBehwvdJBororeai eB. JssiP
  - :P la b Josim WJi drdraw.rov.gsngn yeraoi Jan dBeogforlg.BJddraw idgfmygn ra GJBo.2 7GBeogforlg CeJoraw7 ABonfog c J, ug raioJosgn ra c JieaB, Josit i huygfo oe JddBelJsep JhoveBrongi v Jlraw yhBinnforeaP
  - 3P GBevrurogn LefJoreaim De aeoraioJsswJi drdraw ra eBov/Behwv fnBihsJoraw JnBnhfoit fseovgi eBoBliv fvhogit fvrc ag,i eBwJi Igaoi 'polngiða' IgaonsJoraw nhfoit eBnhc u. JrogBeB gsglJoeBivJpoiP
    - JP EXfgdoreamAffgiirusg Juelg-fgrsrawidJfgidgfrorgn JuelgP
- CP DBrdi Jan Sgnrc gao TBJdim laioJss nBrdi Joderaoi .vgBg feangaiJog c J, fessgfoP lafshng ehosgoi epigBinfg c gogBiP LefJog .vgBg BgJnns, Jffgiinusg peBfsgJaraw Jan gc do, rawP De aeo raioJss.vgBg feangaiJog .ehon ug i huygfoore pBgg9rawP

### EASTCHESTER UNION FREE SCHOOL DISTRICT 2025-2022 MS WKMNASIUMS RENO1ATIONS AND MS ROOF REGLACEMENTS GROYECT

- 5P CeaidBh fon Bidi Jan ignrc gaodBidi hiraw ogg prooraw. rov ueoneec e hosgo dshwwgn eBfJddgn P Uig crarch c-sgawov arddsg ep: drdg nrJcgogBit uho aeo sgii ov Ja: rafvgi seawt Jan iJcg ir9g Ji feaagfogn drdg PlaioJss. rov idJfg ugo gga ueoneec ep n Bid Jan peee BpeB Bigcel Jsepdshwe BfJd P
- DP CeafgJsdrdg raioJssJoreai ra. Jssitdrdg idJfgithorsro, idJfgitJuelg fgrsrawitugse. wBJng eB poseBitJan na poseBfvJaagsithasgii rannfJogn oe ug gXdeign oe Irg. P
- EP laioJssphgswJi drdrawJohanpeBc wBJng ep0P5 dgBf gaoisedg hd. JBn oe. JBn BrigBP
- FP Uig gffgadBf BynhfgBproorawi oe c J8g Bynhforeai ra drdg ir9giP laioJssproorawi . rov sglgsimg ne. aP
- WP CeaagfouBJafv drdrawpBec oed eBimg epveB9eaoJsdrdrawP
- HP laioJoshareai ra drdgi NGS 2 Jan ic JosgBi Jnylfgao oe gJfv IJolgat Jopra Jsfeaagforea oe gJfv drgfg epgxhrdc gaot Jan goig. vgBg Ji rannf Jogn P Uareai JBg aeo BgxhrBgn ea polawgn ngl nfgi P
- IP laioJssfeBBhwJogntioJrasgii-ioggsohurawi,iogc JffeBhrawoecc JahpJfohBgBzi. Brooga raioBhforeaiP lafshng ioB8gBdsJogi oe dBeogfo ohuraw pBec dhafohBg. vgBg ohuraw ri BgioBJragn Jan fJaaeo celgP
- YP laioulssiobalnagBeanasgoepgJfv snag dBgiihBg BgwhsuloeBJan Jhoec Jonf Jan gsgfoBfJss, edgBuogn IJslgP
- ZP laioJssdBgiihBg wJwg hdioBgJc Jan ne. aioBgJc pBec gJfv srag dBgiihBg BgwhsJoeBP GBgiihBg wJwgi JBg idgfmpgn na DrInirea 22 Sgforea 7MgogBi Jan WJwgi P7
- LP laioJsspsJawgi ea IJsl git i dgfrJsorgit Jan gxhrdc gaov JI raw NGS 2-502 Jan sJBwgBf ea agforeai P

## : PV YOINT CONSTRUCTION

- AP 6 Jinf drdnaw yenao feaioBh forea ni idgf nprgn na DrIninea 22 Sgforea 7Cec cea beBB Rgihosi peB Gohc unaw7
- 6P UigcJogBUsiihroJusgpeBphgswJiP
  - 5P 6 BJ9gn Yeraoim MJ8g . rov u BJ9raw Jsse, . rov c gsoraw derao w BgJogBov Ja 5000 ngw FP 6 BJ9raw Jsse, i feaoJraraw dvei dve Bhi JBg d Bevrurogn P
- CP GJofv pJfoeB,-Jddsogn dBeogfod g feJonaw Ji Bojfec c gangn u, c JahpJfohBojBJopogon . goni Jan . vgBo; nJc Jwg oe feJonaw effhB: nhBraw feaioBohfoneaP

#### : P4 HANWER AND SUGGORT INSTALLATION

- AP Grdg v Jawg B Jan i hdde Bo Jan gxhrdc gao i hdde Bo c Jog BU si Jan rai oJ sslorea ByxhrByc gaoi JBy i dgf norgn ra Drl ri rea 22 Sgforea 7 H Jawg Bi Jan Shdde Boi pe BGshc uraw Grdraw Jan Exhrdc gad 77
- 6P laioJosvJawgBipeBveB9eaoJsioggsdrdnaw. nov ovg pesse. naw cJXrchcidJfnawJan cnarchcBen in9gim
  - 5P NGS 5 Jan Sc Jssg Bm MJ Xrc hc i dJat / 4 raf vgi kc rarc hc Ben i r9gt : q raf vP

EASTCHESTER UNION FREE SCHOOL DISTRICT 2025-2022 MS WKMNASIUMS RENO1 ATIONS AND MS ROOF REGLACEMENTS GROYECT

- 2P NGS 5-503mMJXrc hc i dJat 50; rafvgi kc rarc hc Ben i r9gt: q rafvP
- : P NGS 5-502 Jan NGS 2mMJXrc hc i dJat 50; raf vgi kc rarc hc Ben i r9gt : q raf vP
- 3P NGS 2-5¢2 oe NGS : -5¢2mMJXrc hc i dJat 50 pggdkc rarc hc Ben i r9gt 5¢2 raf vP
- VP NGS 3 Jan LJBwgBmMJXrchcidJat 50 pggdxcrarchc Benir9gt Vq rafvP
- CP laioJosvJawgBr peBveB9eaoJsvJBn feddgBohunaw. rov ovg pesse. raw cJXnchc idJfraw Jan cranchc Ben in9gim
  - 5P NGS: q mMJXrc hc i dJat 3; raf vgi kc rarc hc Ben i r9gt: q raf vP
  - 2P NGS 502 Jan NGS Vq mMJXrc hc i dJat "2 raf vgi kc rarc hc Ben i r9gt : q raf vP
  - : P NGS: d8 Jan NGS " q mMJXrc hc i dJat; 3 raf vgi kc rarc hc Ben i r9gt: q raf vP
  - 3P NGS 5mMJXrc hc idJat / 4 rafvgik crarc hc Ben in 9gt : g rafvP
- DP laioJssvJawgBi peBveB9eaoJsfeBBhwJogntioJrasgii-ioggsohuraw. rov ovg pesse. raw cJXrchc idJfrawJan crarchc Ben in9gim
  - 5P NGS: q Jan NGS 5o2mMJXrc hc idJat 3; rafvgik crarc hc Ben ir9gt: q rafvP

  - : P Odoream Shdde Boch uraw poec i dBh foh Bo, Jffe Bhraw oe c Jahp Ifoh Bo, Bocoga raidBh foreai P

#### : P CONNECTIONS

- AP DBJ. rawi ranıf Jog wgag BJs J BBJ awgc gao epphgsw Ji drdrawt proorawit Jan i dgfr Jsorgi P
- 6P laioJssdrdraw Jnylfgaooe JddsJafgi oe Jsse. ig Birfg Jan c Jraoga JafgP
- CP Ceaagfodrdraw one JddscJafgi hiraw wJi. rov iv hoeppiJslgi Jan hareaiPlaioJssIJslg hdioBgJc pBec Jan. rov ra "2 rafvgi epgJfv JddscJafgPlaioJssharea ne. aioBgJc pBec IJslgP
- DP Sgnrc gao TBJdim laioJssogg prooraw. rov fJddgn arddsg ra ueooec oe peBc nBrdt Jifseig Ji dBJforfJsoe rasgoepgJfv JddsJafg hiraw wJiP
- EP WBehan gxhrdcgaoJffeBhraw oe Drlrirea 24 Sgforea 7WBehanraw Jan 6eanraw peBEsgfoBfJs S,iogci F7
  - 5P De aeohig wJi drdg Ji wBehanraw gsgf dBengP
- FP Ceaagfo. nBaw Jffe Bhraw oe Drl ri rea 24 Sgforea 7Ceanhfoe Bi Jan CJusgi P7

#### : P, LA6 ELINW AND IDENTIFKINW

- AP Exhrdc gao NJc gdslogi Jan Srwaim laioJss gawBll gn dslionf-slc raJog gxhrdc gao aJc gdslog eB irwa ea eBagJBgJfv i gBirfg c gogBidBgiihBg BgwhsloeBiJan idgfrJso, IJsl gP
  - 5P TgXom la Jnnrorea oe aJcg ep mgaonprgn harot nriorawhriv ugo gga chsordsg haroit rapeBc edgBloeBepedgBloreaJsBgxhrBgcgaoit rannfJog iJpgo, Jan gcgBwgaf, dBgfJhoreait Jan . JBa epvJ9JBni Jan rcdBedgBedgBloreaiP
  - 2P NJcgdsJogit drdg mgaonpfJoneat Jan inwai JBg idgfnprgn na DrIninea 22 Sgforea 71 ngaonpfJonea peBGshcuraw Grdraw Jan Exhrdcgaol**77**

### : 🖻 GAINTINW

- AP Cecds, nov ByxhrBycgaoina DrIninea 0/dJnaonaw Sgforeai peBdJnaonaw naog BeeBJang Xog BeeB a Joh BJswJi drdnawP
- 6P GJraogXdeigntgXogBeBcgoJsdrdrawtlJsigitJan drdrawidgfrJsorgitgXfgdofecdeagaoit.rov pJfoeB-JddsrgndJraoeBdBeogforigfeJorawP
  - 5P As8, n S, i ogc mMGI EQT VP5DP
    - JP GBrc g CeJomAs8, n Jaorf eBBeirl g c goJsdBrc gBP
    - uP langBc gnrJog CeJom EXog BeBJs8, n gaJc gsc Jof vraw oedf eJoP
    - fP TedfeJomEXogBeBJs8, n gaJc gs'igc rwseii&P
    - nP CeseBm Kgsse. P
- CP DJcJwgJan Tehfvhdm RgdJnBcJBBgnJan nJcJwgn pJfoeB,-Jddsrgn pranivgi . rov cJogBdsi Jan u, dBefgnhBgi oe cJofv eBwraJspJfoeB, pranivP
- : P50 NATURAL WAS GIGINW SCHEDULE
  - AP Auel gwBehan a Joh Blsw Ji drdrawt NGS 2 Jan i c Jsog Bliv Jssug ovg pesse. rawm
    - 5P Soggsdrdg. rov c JssgJusg-rBea proorawi Jan ov BgJngn yeraoiP
  - 6P Auel gwBehan a Joh BJswJi drdrawt NGS 2-5o2 Jan sJBwgBliv Jssug ovg pesse. rawm
    - 5P Soggsdrdg.rov. Behwvo-ioggsproorawi Jan.gsngn yeraoiP

#### : 155 WAS GIGINW TESTS

- AP TgioaJohBJswJii, iogci JffeBhraw oz 2020 Ng. KeBBSoJog FhgsWJi Ceng hasgii eovgBrig aeognm
  - 1. TgiodBgiih Bgiiv Jssug 5V dir peBeag '5&veh BpeBioggsdrdnawP
- B. TgioiivJssug. roagiignu, horso, fecdJa, PMJ8gJBBJawgcgaoitdBelmgJssagfgiiJB, rogcioe fecdsgogogionawJandJ, JssfeioiP
- C. Assogioi i vJssug dgBpeBs gn dBreBoe ovg feaagforea epgxhrdc gadPRgwhsloeBivJssug rieslogn pBec ogiodBgiihBgiPSeJd ogioivJssug feanhfogn ea JssyeraoiPRgdJrBsgJ8i Jan ngpgfoi. rov ag. c JogBJsiPRgogioi, iogc haorsiJoripJfoeB, BgihsoiJBg euoJragnP
- D. 1gBnp feBBgfodBgiihBgigoonawi peBdBgiihBg BgwhsJoeBP
- E. GBeImg. Brooga fgBonpfJorea ovJoogioivJIg ugga feanhfogn Jan iJoripJfoeBos, fec dogogn PShuc ro oe CeaioBhforea MJaJwgBP
- : P52 WAS LINE GURWINW
  - A. A ofec dsgorea epdBgiih Bg ogiot dh Bwg Jssa Joh BJsw Jii, iogc i Jffe Bhnaw oe 2020 Ng. KeBB Solog FhgsW Ji Ceng BgxhrBgc gaoiP

- : P5: FIELD j UALITK CONTROL
  - 6P TgiotraidgfotJan dhBwg drdraw JffeBnraw oe NFGA V3 Jan BgxhrBgc gaoi ep JhoveBrongi v JIraw yh Brinnforea P
  - CP RgdJrBsgJ8i Jan ngpgfoi .rov ag. cJogBdsi Jan Bgogio i,iogc haors iJoriplfoeB, Bgihsoi JBg euoJragnP
  - DP 1gBap fJdJfrorgi Jan dBgiihBg BJonawi epigBirfg cgogBit dBgiihBg BgwhsJoeBit IJslgit Jan idgfrJsongiP
  - EP 1gBp, feBBgfodBgiihBgigoonawi peBdBgiihBg BgwhsJoeBiP
  - FP 1gBap, ov Joidgf mpgn drdraw ogioi JBg fec dsg og P

END OF SECTION 22V000