

**SECTION 15109
SANITARY SEWER AND STORM DRAINS WITHIN BUILDINGS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawing and general provisions of the Contract, including General and Supplementary Conditions apply to this Section

1.2 SUMMARY

- A. This Section includes the following plumbing, piping, and equipments for sanitary and storm drain service with 140°F (60°C) maximum temperature.
1. Piping materials
 2. Cast iron soil piping
 3. Steel piping
 4. Copper tubing
 5. Ductile-iron piping
 6. ABS piping
 7. PVC piping
 8. PE encasement
 9. Floor drains (FD), Floor sinks (FS)
 10. Roof drains (RD)
 11. Clean outs (CO)
- B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Division 2, Section 02721, Storm Sewers.
 2. Division 2, Section 02732, Sanitary Sewers (Gravity).
 3. Division 2, Section 02220, Structure Excavation.
 4. Division 2, Section 02222, Excavation for Utilities.
 5. Division 15, Section 15050, Piping Systems.
 6. Division 15, Section 15072, Cleaning.
 7. Division 15, Section 15073, Pressure/Leak Testing.
 8. Division 15, Section 15074, Identification and Labeling.
 9. Division 15, Section 15100, Valves
 10. Division 15, Section 15440, Plumbing Fixtures.

1.3 REFERENCES

- A. American National Standards Institute (ANSI)
1. ANSI B16.12-91, Cast Iron Threaded Drainage Fittings.
- B. American Society for Testing and Materials (ASTM)
1. ASTM A53-93a, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 2. ASTM A74-94, Standard Specification for Cast Iron Soil Pipe and Fittings.
 3. ASTM C564-93, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
 4. ASTM D2235-93a, Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
 5. ASTM D2321-89, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
 6. ASTM D2564-93, Standard Specification for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Piping Systems.

7. ASTM D2661-94, Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.
8. ASTM D2665-94, Standard Specification for Poly Vinyl Chloride (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
9. ASTM D2855-93, Standard Practice for Making Solvent-Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings.
10. ASTM F477-93, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

- C. Southern Building Code Congress International Incorporated (SBCCI)
1. SPC 1999 Standard Plumbing Code

- D. National Sanitation Foundation (NSF)

1.4 DEFINITIONS

- A. The following are industry abbreviations for plastic piping materials:
1. ABS: Acrylonitrile-butadiene-styrene plastic.
 2. EPDM: Ethylene-propylene-diene terpolymer.
 3. PE: Polyethylene plastic.
 4. PVC: Polyvinyl chloride plastic.

1.5 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).
 2. Sanitary Sewer, Force-Main Piping: 50 psig (345 kPa).

1.6 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings: Indicate dimensions, required clearances, methods of assembly of piping components, and piping accessories.
- B. Submit six (6) copies of the following to the Construction Manager:
1. Design Data: Indicate in sufficient detail to verify that products meet or exceed specified performance requirements.
 2. Certificates: Certify that products meet or exceed specified performance requirements.
 3. Manufacturer's Instructions: Indicate installation and support requirements.
 4. Shop drawings: Provide large-scale (Scale of $\frac{1}{4}'' = 1'-0''$ minimum) layout drawings, indicating all relevant equipment associated with routing of piping. Shop drawings shall be "spool" type that includes all piping connection joints, fittings, hangers, supports required and relevant details as required.
 5. Coordination Drawings: Include relationship to other services that serve same work areas.
 6. Certificates of Shop Inspection and Data Report: As required by ASME Boiler and Pressure Vessel Code.
 7. Maintenance Data: For equipment to include in the maintenance manuals as specified in General and Supplementary Conditions.
- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.7 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-DWD" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-Tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS:

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fittings, and joining materials.
- B. Flexible Transition Couplings for Underground Nonpressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.
- C. Transition Couplings for Underground Pressure Piping: AWWA C219 metal, sleeve-type coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 CAST-IRON SOIL PIPING

- A. Hub-and-Spigot Pipe and Fittings: ASTM A 74, Service class.
 - 1. Gaskets: ASTM C 564, rubber.
- B. Hubless Pipe and Fittings: ASTM A 888 or CISPI 301.
 - 1. Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral, center pipe stop.
 - a. Heavy-Duty, Type 304, Stainless-Steel Couplings: ASTM A 666, Type 304, stainless-steel shield; stainless-steel bands; and sleeve.
 - 1) NPS 1-1/2 to NPS 4 (DN 40 to DN 100): 3-inch-(76-mm-) wide shield with 4 bands.
 - 2) NPS 5 to NPS 10 (DN 125 to DN 250): 4-inch-(102-mm-) wide shield with 6 bands.

2.3 STEEL PIPING

- A. Steel Pipe: ASTM A 53, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.
 - 1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53 or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining methods.
 - 2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
 - 3. Cast-Iron, Threaded, Drainage Fittings: ASME B16.12 galvanized.
 - 4. Gray-Iron; Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
 - 5. Cast-Iron Flanges: ASME B16.1, Class 125.
 - 6. Cast-Iron Flanged Fittings: ASME B16.1, Class 125, galvanized.
 - 7. Steel-Piping, Grooved-End Fittings: ASTM A 47 (ASTM A 47M), galvanized, malleable-iron casting; ASTM A 106, galvanized steel pipe; or ASTM A 536, galvanized, ductile-iron casting with dimensions matching steel pipe.

- a. Steel-Piping, Keyed Couplings: AWWA C606, for steel-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
8. Steel-Piping, Expansion Joints: Compound, galvanized steel fitting with telescoping body and slip-pipe section. Include packing rings, packing, limit rods, chrome-plated finish on slip-pipe section, and flanged ends.
9. Steel-Piping, Double Expansion Joints: Compound, galvanized steel fitting with telescoping body and two slip-pipe sections. Include packing rings, packing, limit rods, chrome-plated finish on slip-pipe sections, and flanged ends.

2.4 COPPER TUBING

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- B. Soft Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, annealed temper.
 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- C. Hard Copper Tube: ASTM B88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper.
 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.5 DUCTILE-IRON PIPING

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
 2. Ductile-Iron Piping, Grooved-End Fittings: ASTM A 47 (ASTM A 47M), malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
 - a. Ductile-Iron-Piping, Keyed Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
 1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Gaskets: AWWA C111, rubber.
 2. Ductile-Iron, Grooved-end Fittings: ASTM A 47 (ASTM A 47M), malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
 - a. Ductile-Iron-Piping, Keyed Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

3. Ductile-Iron, Flexible Expansion Joints: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
4. Ductile-Iron, Deflection Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
5. Ductile-Iron, Expansion Joints: Three-piece, ductile-iron assembly consisting of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

2.6 ABS PIPING

- A. ABS Pipe: ASTM D 2661, Schedule 40, solid wall.
 1. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.
- B. Cellular-Core, ABS Pipe: ASTM F 628, Schedule 40.
 1. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.
- C. ABS Special Fittings: ASTM F409, drainage-pattern tube and tubular fittings with ends as required for application.

2.7 PVC PIPING

- A. PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.
 1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
- B. Cellular-Core, Schedule 40, PVC Pipe: ASTM F 891, Schedule 40.
 1. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Cellular-Core, Sewer and Drain Series, PVC Pipe: ASTM F 891, Series PS 100.
 1. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Series PS 100 sewer and drain pipe.
- D. PVC Special Fittings: ASTM F 409, drainage-pattern tube and tubular fittings with ends as required for application.

2.8 PE ENCASUREMENT

- A. PE encasement for Underground Metal Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch (0.20-mm) minimum thickness, tube or sheet.

2.9 FLOOR DRAINS (FD)

- A. Floor Drains shall be carefully set at locations and elevations indicated on the architectural and plumbing drawings and shall be set level and square with the floor construction.

- B. Floor drains shall be provided with deep seal p-traps except where noted on the drawings or in the specifications.
 - 1. Floor drains; service weight cast iron bell and spigot type or cast iron screwed recessed type, adjustable. 2-inch traps shall have common seal (2 inch), 3-inch and larger traps shall have deep seal (4 inch).
- C. Floor drains may have threaded or caulked outlets.
- D. Floor drains in floors above grade with membrane waterproofing shall be flashed with four pound sheet lead and secured with flashing clamps.
- E. Toilet, Shower, and Locker Room Areas:
 - 1. FD: Toilet room and other finished area floor drains shall be cast iron drain with two piece cast iron body, reversible collar, and adjustable square nickel bronze top.

2.10 ROOF DRAINS (RD)

- A. General:
 - 1. Roof drains shall be carefully set at locations and elevations indicated on the architectural and plumbing drawings and shall be set level with the roof construction.
 - 2. Roof drains may have threaded or calked outlets.
 - 3. Roof drains shall be flashed with minimum 30 inch diameter membrane roofing and secured with flashing clamps.
- B. Concrete Roofs:
 - 1. RD: Roof drains in concrete roofs shall be cast iron body drains with flange, extension flange equal to insulation thickness, flashing ring with gravel stop, and mushroom dome strainer.
 - 2. OD: Overflow roof drain shall be oblique scupper drain, dura-coated cast iron body with reversible back or bottom outlet, complete with member flashing clamp.

2.11 CLEANOUTS (CO)

- A. Provide at ends of pipe line runs and changes of direction for underground and suspended lines and spaced as required by Code for straight runs of pipe.
- B. Cleanouts at base of stacks and downspouts shall be service weight wye branch or tee branch cleanout with full size iron screw plug.
- C. Cleanouts in threaded drain lines shall be full size iron threaded plug.
- D. Cleanouts in suspended soil pipe lines shall be soil pipe iron body ferrules with brass screw plug.
- E. Floor cleanouts may have threaded or caulked outlets.
- F. Floor cleanouts shall be carefully set at locations and elevations indicated on the drawings and shall be set level and square with the finished floor construction.
- G. Finished Areas:
 - 1. Cleanouts in finished areas shall be adjustable cleanout with square nickel bronze top and neoprene seal plug.
- H. Heavy Traffic:

1. Cleanouts in concrete floors where heavy traffic occurs shall be adjustable cast iron cleanout bodies with heavy-duty cast iron tractor cover and neoprene seal plug.
- I. Tile:
 1. Cleanouts in vinyl tile floors shall be adjustable cleanout with square top recess.
- J. Wall Cleanout Covers:
 1. Polished stainless steel covers and with flat head stainless steel screws.
- K. Grade Cleanout:
 1. Access housings for cleanouts at grade outside of building shall be installed in an 18-inch by 18-inch concrete collar set flush with grade.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 2, Sections 02220 "Structure Excavation" and 02222 "Excavation for Utilities" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground pressure piping, unless otherwise indicated.
- C. Aboveground, Soil, Waste, and Vent Piping: Use any of the following piping materials for each size range:
 1. NPS 1-1/4 and NPS 1-1/2 (DN 32 and DN 40): Use NPS 1-1/2 (DN 40) hubless, cast-iron soil piping and one of the following:
 - a. Couplings: Heavy-duty, Type 304, stainless steel.
 2. NPS 1-1/4 and NPS 1-1/2 (DN 32 and DN 40): Steel pipe; cast-iron, threaded drainage fittings; and threaded joints.
 3. NPS 1-1/4 and NPS 1-1/2 (DN 32 and DN 40): Copper DWV tube, copper drainage fittings, and soldered joints.
 4. NPS 2 to NPS 4 (DN 50 to DN 100): Service class, cast-iron soil piping; gaskets; and gasketed joints.
 5. NPS 2 to NPS 4 (DN 50 to DN 100): Hubless, cast-iron soil piping and one of the following:
 - a. Couplings: Heavy-duty, Type 304, stainless steel.
 6. NPS 2 to NPS 4 (DN 50 to DN 100): Steel pipe; cast-iron, threaded drainage fittings; and threaded joints.
 7. NPS 2 to NPS 4 (DN 50 to DN 100): Copper DWV tube, copper drainage fittings, and soldered joints.
 - a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2 (DN 65 and DN 90): Hard copper tube, Type M (Type C); copper pressure fittings; and soldered joints.
 8. NPS 5 and NPS 6 (DN 125 and DN 150): Service class, cast-iron soil piping; gasket; and gasketed joints.
 9. NPS 5 and NPS 6 (DN 125 and DN 150): Hubless, cast-iron soil piping and one of the following:
 - a. Couplings: Heavy-duty, Type 304, stainless steel.
 10. NPS 5 and NPS 6 (DN 125 and DN 150): Copper DWV tube, copper drainage fittings, and soldered joints.

- D. Underground, Soil, Waste, and Vent Piping: Use any of the following piping materials for each size range:
 - 1. NPS 1-1/2 (DN 40): Hubless, cast-iron soil piping and one of the following:
 - a. Couplings: Heavy-duty, Type 304, stainless steel.
 - 2. NPS 2 to NPS 4 (DN 50 to DN 100): Service class, cast-iron soil piping; gaskets; and gasketed joints.
 - 3. NPS 2 to NPS 4 (DN 50 to DN 100): Hubless, cast-iron soil piping and one of the following:
 - a. Couplings: Heavy-duty, Type 304, stainless steel.
 - 4. NPS 5 and NPS 6 (DN 125 and DN 150): Service class, cast-iron soil piping; gaskets; and gasketed joints.
 - 5. NPS 5 and NPS 6 (DN 125 and DN 150): Hubless, cast-iron soil piping and one of the following:
 - 6. Couplings: Heavy-duty, Type 304, stainless steel.

3.3 PIPING INSTALLATION

- A. Refer to Division 2, Section 02732 "Sanitary Sewer" (Gravity) " for site sanitary sewer piping.
- B. Refer to Division 15, Section 15050 "Piping Systems" for basic piping installation.
- C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Refer to Division 15, Section 15050 "Piping Systems" for wall penetration systems.
- E. 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. Building Sanitary 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 Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- F. Install engineered soil and waste drainage and vent piping systems in locations indicated and as follows:
 - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
 - 2. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
- G. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

- A. Refer to Section 15050, "Piping System" for basic piping joint construction.
- B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
 - 2. Hubless Joints: make with rubber gasket and sleeve or clamp.

- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- D. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturers' written instructions.

3.5 VALVE INSTALLATION

- A. Refer to Division 15, Section 15100 "Valves" for general-duty valves.
- B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.
 - 1. Use gate (V-1) or full-port ball (V-6468) valve for piping NPS 2 (DN 50) and smaller.
 - 2. Use gate (V-4) valve for piping NPS 2-1/2 (DN 65) and larger.
- C. Check Valves: Install swing check (V-201, V-204) valve, upstream from shutoff valve, on each sewage pump discharge.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Provide hangers and supports as follows:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - 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 hanger.
 - c. Longer Than 100 Feet (30 m), if indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
- D. 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 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 - 2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
 - 3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
 - 4. NPS 6 (DN 150): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
 - 5. NPS 8 to NPS 12 (DN 200 to DN 300): 60 inches (1500 mm) with 7/8 inch (22-mm) rod.
 - 6. NPS 15 (DN 375): 60 inches (1500 mm) with 1-inch (25-mm) rod.
 - 7. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).
- E. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).
- F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4 (DN 32): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
 - 2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
 - 3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.

4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
 5. NPS 3 (DN 80): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
 6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
 7. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.
- G. Install supports for vertical steel piping every 15 feet (4.5 m).
- H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4 (DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
 2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
 3. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
 4. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
 5. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
 6. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.
- I. Install supports for vertical copper tubing every 10 feet (3 m).
- 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 soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section 15440 "Plumbing Fixtures."

3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
1. Test sanitary drainage and vent piping according to Sections 15073, "Pressure/Leak Testing".
- D. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- E. Place plugs in ends of uncompleted piping at end of each day and when work stops.

3.9 CLEANING

- A. Clean piping in accordance with Section 15072, "Cleaning".

END OF SECTION 15109