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## **SECTION 221316 - SANITARY WASTE AND VENT PIPING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Ductile-iron pipe and fittings.
  - 2. Specialty pipe fittings.
  - 3. Encasement for underground metal piping.
- B. Related Requirements:
  - 1. Section 221329 "Sanitary Sewerage Pumps" for effluent and sewage pumps.
  - 2. Section 226600 "Chemical-Waste Systems for Laboratory and Healthcare Facilities" for chemical-waste and vent piping systems.
  - 3. Section 333115 "Site Sanitary Sewerage Piping" for sanitary sewerage piping and structures outside the building.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
- C. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Plans and elevations, or Building Information Model (BIM) drawn to scale, showing items described in this Section and coordinated with all building trades.
- B. Seismic Qualification Certificates: For waste and vent 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 piping anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

#### **1.4 FIELD CONDITIONS**

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner

or others unless permitted under the following conditions and then only after arranging to provide temporary service in accordance with requirements indicated:

1. Notify [Architect][Construction Manager][Owner] no fewer than [two]<Insert number> days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without [Architect's][Construction Manager's][Owner's] written permission.

## 1.5 WARRANTY

- A. Listed manufacturers to provide labeling and warranty of their respective products.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation are capable of withstanding the following minimum working pressure unless otherwise indicated:
  1. Soil, Waste, and Vent Piping: **[10 ft. head of water]**<Insert pressure>.
  2. Waste, Force-Main Piping: **[50 psig][100 psig][150 psig]**<Insert pressure>.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation to withstand the effects of earthquake motions determined in accordance with [ASCE/SEI 7]<Insert requirement>. See Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment":
  1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified[ **and the unit will be fully operational after the seismic event**]."
  2. Component Importance Factor: **[1.5][1.0]**.
- C. <Insert requirements for Component Amplification Factor and Component Response Modification Factor>.

### 2.2 PIPING MATERIALS

- A. Piping materials to bear label, stamp, or other markings of specified testing agency.
- B. 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.

### 2.3 DUCTILE-IRON PIPE AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
  1. [American Cast Iron Pipe Company]
  2. [Apollo Valves; a part of Aalberts Integrated Piping Systems]

3. [McWane Ductile; a part of the McWane family of companies]
4. [U.S. Pipe]
5. <Insert manufacturer's name>

B. Ductile-Iron, Mechanical-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot ends unless grooved or flanged ends are indicated.
2. Ductile-Iron Fittings: AWWA C110/A21.10, mechanical-joint, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
3. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Ductile-Iron, Push-on-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot ends unless grooved or flanged ends are indicated.
2. Ductile-Iron Fittings: AWWA C110/A21.10, push-on-joint, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
3. Gaskets: AWWA C111/A21.11, rubber.

D. Ductile-Iron, Grooved-Joint Piping: AWWA C151/A21.51, with round-cut-grooved ends in accordance with AWWA C606.

## 2.4 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections of same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

## 2.5 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Standard: ASTM A674 or AWWA C105/A 21.5.

B. Material: [Linear low-density polyethylene film of 0.008-inch][or][high-density, cross-laminated polyethylene film of 0.004-inch] minimum thickness.

C. Form: [Sheet][or][tube].

D. Color: [Black][or][natural]<Insert color>.

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## **PART 3 - EXECUTION**

### **3.1 EARTH MOVING**

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

### **3.2 INSTALLATION OF PIPING**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
  - 1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
  - 2. Install piping as indicated unless deviations to 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"]****[Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment"]**.
- K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
  - 1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
  - 2. Use long-turn, double Y-branch, and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
    - a. Straight tees, elbows, and crosses may be used on vent lines.
  - 3. Do not change direction of flow more than 90 degrees.
  - 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
    - a. Reducing size of waste piping in direction of flow is prohibited.

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- L. Lay buried building waste piping beginning at low point of each system.
1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
  2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
  3. Maintain swab in piping and pull past each joint as completed.
- M. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
1. Building Sanitary Waste: Two percent downward in direction of flow for piping **NPS 3** and smaller; [1][2]<Insert number> percent downward in direction of flow for piping **NPS 4** and larger.
  2. Horizontal Sanitary Waste Piping: [**Two**]<Insert number> percent downward in direction of flow.
  3. Vent Piping: [**One**]<Insert number> percent down toward vertical fixture vent or toward vent stack.
- N. Install cast-iron soil piping in accordance with 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 in accordance with ASTM A674 or AWWA C105/A 21.5.
- O. Install steel piping in accordance with applicable plumbing code.
- P. Install stainless steel piping in accordance with ASME A112.3.1 and applicable plumbing code.
- Q. Install aboveground copper tubing in accordance with CDA's "Copper Tube Handbook."
- R. Install aboveground ABS piping in accordance with ASTM D2661.
- S. Install aboveground PVC piping in accordance with ASTM D2665.
- T. Install underground [**ABS**][and][**PVC**] piping in accordance with ASTM D2321.
- U. Install engineered soil and waste and vent piping systems as follows:
1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
  2. Hubless, Single-Stack Drainage System: Comply with ASME B16.45 and hubless, single-stack aerator fitting manufacturer's written installation instructions.
  3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
- V. Install underground, ductile-iron, force-main piping according to AWWA C600.
1. Install buried piping inside building between wall and floor penetrations and connection to sanitary sewer piping outside building with restrained joints.
  2. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
  3. Install encasement on piping in accordance with ASTM A674 or AWWA C105/A 21.5.
- W. Install underground, copper, force-main tubing in accordance with CDA's "Copper Tube Handbook."
1. Install encasement on piping in accordance with ASTM A674 or AWWA C105/A 21.5.
- X. Install force mains at elevations indicated.
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Y. Plumbing Specialties:

1. Install backwater valves in sanitary waster gravity-flow piping.
  - a. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."
2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
  - a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
  - b. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
3. Install drains in sanitary waste gravity-flow piping.
  - a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

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

AA. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220500 "Common Work Results for Plumbing."

BB. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 220500 "Common Work Results for Plumbing."

CC. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220500 "Common Work Results for Plumbing."

### 3.3 JOINT CONSTRUCTION

A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hub-and-Spigot, Cast-Iron Soil Piping Caulked Joints: Join in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum caulked joints.

C. Hubless, Cast-Iron Soil Piping Coupled Joints:

1. Join hubless, cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1.

1. Cut threads full and clean using sharp dies.
2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as

follows:

- a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
  - c. Do not use pipe sections that have cracked or open welds.
- E. Join stainless steel pipe and fittings with gaskets in accordance with ASME A112.3.1.
- F. Join copper tube and fittings with soldered joints in accordance with ASTM B828. Use ASTM B813, water-flushable, lead-free flux and ASTM B32, lead-free-alloy solder.
- G. Grooved Joints: Cut groove ends of pipe in accordance with AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
- H. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
- I. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings in accordance with the following:
1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
  2. ABS Piping: Join in accordance with ASTM D2235 and ASTM D2661 appendixes.
  3. PVC Piping: Join in accordance with ASTM D2855 and ASTM D2665 appendixes.
- J. Joint Restraints and Sway Bracing:
1. Provide joint restraints and sway bracing for storm drainage piping joints to comply with the following conditions:
    - a. Provide axial restraint for pipe and fittings [**5 inches**]<Insert dimensions> and larger, upstream and downstream of all changes in direction, branches, and changes in diameter greater than two pipe sizes.
    - b. Provide rigid sway bracing for pipe and fittings [**4 inches**]<Insert dimensions> and larger, upstream and downstream of all changes in direction 45 degrees and greater.
    - c. Provide rigid sway bracing for pipe and fittings [**5 inches**]<Insert dimensions> and larger, upstream and downstream of all changes in direction and branch openings.

### 3.4 INSTALLATION OF SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: [**Unshielded**][**Shielded**], 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.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric [**nipples**][**unions**].
3. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric [**flanges**][**flange kits**][**nipples**].
4. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

### 3.5 INSTALLATION OF VALVES

- A. General valve installation requirements for general-duty valve installation are specified in Section 220523 "General-Duty Valves for Plumbing Piping."
- B. Shutoff Valves:
  1. Install shutoff valve on each sewage pump discharge.
  2. Install [**gate**][**full-port ball**] valve for piping **NPS 2** and smaller.
  3. Install [**gate**]<**Insert type**> valve for piping **NPS 2-1/2** and larger.
- C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage 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. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
  3. Install backwater valves in accessible locations.
  4. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

### 3.6 INSTALLATION OF HANGERS AND SUPPORTS

- 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"**][**Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment"**].
  1. Install [**carbon-steel**]<**Insert material**> pipe hangers for horizontal piping in noncorrosive environments.
  2. Install [**stainless steel**][**fiberglass**] pipe hangers for horizontal piping in corrosive environments.
  3. Install [**carbon-steel**]<**Insert material**> 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. Install individual, straight, horizontal piping runs:
    - a. 100 Ft. (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Ft. (30 m): MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Ft. (30 m) if Indicated: MSS Type 49, spring cushion rolls.
  7. Multiple, Straight, Horizontal Piping Runs 100 Ft. (30 m) or Longer: MSS Type 44 pipe rolls.



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- Support pipe rolls on trapeze.
  - 8. Base of Vertical Piping: MSS Type 52 spring hangers.
  - C. Install hangers for **[cast-iron][steel][stainless steel][and][copper]** soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
  - D. Install hangers for **[ABS][and][PVC]** piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
  - E. Support horizontal piping and tubing within **12 inches** of each fitting[, **valve,**] and coupling.
  - F. Support vertical runs of **[cast-iron][steel][stainless steel][and][copper]** soil piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
  - G. Support vertical runs of **[ABS][and][PVC]** piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

### 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 waste and vent piping to the following:
    - 1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
    - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
    - 3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
    - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
    - 5. Install horizontal backwater valves **[with cleanout cover flush with floor][in pit with pit cover flush with floor]<Insert description>**.
    - 6. Comply with requirements for **[backwater valves][cleanouts][and][drains]** specified in Section 221319 "Sanitary Waste Piping Specialties."
    - 7. Equipment: Connect waste piping as indicated.
      - a. Provide shutoff valve if indicated and union for each connection.
      - b. Use flanges instead of unions for connections **NPS 2-1/2** and larger.
  - D. Connect force-main piping to the following:
    - 1. Sanitary Sewer: To exterior force main.
    - 2. Sewage Pump: To sewage pump discharge.
  - E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
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F. Make connections in accordance with 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.

### 3.8 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping.
- B. 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 and before setting fixtures.
  2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary waste and vent piping in accordance with 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.
    - a. 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 waste and vent piping until it has been tested and approved.
    - a. Expose work that was covered or concealed before it was tested.
  3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
    - a. Close openings in piping system and fill with water to point of overflow, but not less than **10 ft. head of water**.
    - b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    - c. Inspect joints for leaks.
  4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with

water, test connections and prove they are gastight and watertight.

- a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of **1 inch wg**.
    - b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
    - d. Inspect plumbing fixture connections for gas and water leaks.
  5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  6. Prepare reports for tests and required corrective action.
- E. Test force-main piping in accordance with 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.
    - a. Expose work that was covered or concealed before it was tested.
  2. Cap and subject piping to static-water pressure of **50 psig** above operating pressure, without exceeding pressure rating of piping system materials.
    - a. Isolate test source and allow to stand for four hours.
    - b. 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 AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed Plastic Piping: Protect **[ABS][PVC]** plumbing vents exposed to sunlight with two coats of water-based latex paint.
- E. Repair damage to adjacent materials caused by waste and vent piping installation.

### 3.11 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller are to be the following:
  1. Service cast-iron soil pipe and fittings; gaskets; and gasketed joints.

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2. Hubless, cast-iron soil pipe and fittings[ **and hubless, single-stack aerator fittings**]; **[CISPI][heavy-duty]** hubless-piping couplings; and coupled joints.
  3. Galvanized-steel pipe, drainage fittings, and threaded joints.
  4. Stainless steel pipe and fittings, sealing rings, and gasketed joints.
  5. Copper Type DWV tube, copper drainage fittings, and soldered joints.
  6. **[Solid-wall][Cellular-core]** ABS pipe, ABS socket fittings, and solvent-cemented joints.
  7. **[Solid-wall][Cellular-core]** PVC pipe, PVC socket fittings, and solvent-cemented joints.
  8. Dissimilar Pipe-Material Couplings: **[Unshielded][Shielded]**, nonpressure transition couplings.
- C. Aboveground, soil and waste piping NPS 5 (DN 125) and larger are to be the following:
1. Service cast iron, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings [ **and hubless, single-stack aerator fittings**]; **[CISPI][heavy-duty]** hubless-piping couplings; and coupled joints.
  3. Galvanized-steel pipe, drainage fittings, and threaded joints.
  4. Stainless steel pipe and fittings, sealing rings, and gasketed joints.
  5. **[Solid-wall][Cellular-core]** PVC pipe, PVC socket fittings, and solvent-cemented joints.
  6. Dissimilar Pipe-Material Couplings: **[Unshielded][Shielded]**, nonpressure transition couplings.
- D. Aboveground, vent piping NPS 4 (DN 100) is to be the following:
1. Service cast iron, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings; **[CISPI][heavy-duty]** hubless-piping couplings; and coupled joints.
  3. Galvanized-steel pipe, drainage fittings, and threaded joints.
  4. Stainless steel pipe and fittings gaskets, and gasketed joints.
  5. Copper Type 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**; copper pressure fittings; and soldered joints.
6. **[Solid-wall][Cellular-core]** ABS pipe, ABS socket fittings, and solvent-cemented joints.
  7. **[Solid-wall][Cellular-core]** PVC pipe, PVC socket fittings, and solvent-cemented joints.
  8. Dissimilar Pipe-Material Couplings: **[Unshielded][Shielded]**, nonpressure transition couplings.
- E. Aboveground, vent piping NPS 5 (DN 125) and larger is to be the following:
1. Service cast iron, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings; **[CISPI][heavy-duty]** hubless-piping couplings; and coupled joints.
  3. Galvanized-steel pipe, drainage fittings, and threaded joints.
  4. **[Solid-wall][Cellular-core]** PVC pipe, PVC socket fittings, and solvent-cemented joints.
  5. Dissimilar Pipe-Material Couplings: **[Unshielded][Shielded]**, nonpressure transition couplings.
- F. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller are to be the following:
1. **[Extra-heavy][Service]** cast-iron soil piping; **[gaskets; and gasketed][caulking materials; and caulked]** joints.
  2. Hubless, cast-iron soil pipe and fittings; **[CISPI][heavy-duty][cast-iron]** hubless-piping couplings; and coupled joints.
  3. Stainless steel pipe and fittings, gaskets, and gasketed joints.
  4. **[Solid-wall][Cellular-core]** ABS pipe, ABS socket fittings, and solvent-cemented joints.
  5. **[Solid-wall][Cellular-core]** PVC pipe, PVC socket fittings, and solvent-cemented joints.
  6. Dissimilar Pipe-Material Couplings: **[Unshielded][Shielded]**, nonpressure transition couplings.
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- G. Underground, soil and waste piping NPS 5 (DN 125) and larger are to be the following:
1. **[Extra-heavy][Service]**, cast-iron soil piping; **[gaskets; and gasketed][caulking materials; and caulked]** joints.
  2. Hubless, cast-iron soil pipe and fittings; **[CISPI][heavy-duty][cast-iron]** hubless-piping couplings; coupled joints.
  3. **[Solid-wall][Cellular-core]** PVC pipe, PVC socket fittings, and solvent-cemented joints.
  4. Dissimilar Pipe-Material Couplings: **[Unshielded][Shielded]**, nonpressure transition couplings.
- H. Aboveground sanitary-sewage force mains NPS 1-1/2 and NPS 2 (DN 40 and DN 50) are to be the following:
1. Hard copper tube, **Type L**; copper pressure fittings; and soldered joints.
  2. Galvanized-steel pipe, pressure fittings, and threaded joints.
- I. Aboveground sanitary-sewage force mains NPS 2-1/2 to NPS 6 (DN 65 to DN 150) are to be the following:
1. Hard copper tube, **Type L**; copper pressure fittings; and soldered joints.
  2. Galvanized-steel pipe, pressure fittings, and threaded joints.
  3. Grooved-end, galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.
- J. Underground sanitary-sewage force mains NPS 4 (DN 100) and smaller are to be the following:
1. **[Hard][Soft]** copper tube, **Type L**; **[wrought-]**copper pressure fittings; and soldered joints.
  2. Ductile-iron, mechanical-joint piping and mechanical joints.
  3. Ductile-iron, push-on-joint piping and push-on joints.
  4. Ductile-iron, grooved-joint piping and grooved joints.
  5. Fitting-type transition coupling for piping smaller than **NPS 1-1/2** and pressure transition coupling for **NPS 1-1/2** and larger if dissimilar pipe materials.
- K. Underground sanitary-sewage force mains NPS 5 (DN 125) and larger are to be the following:
1. Hard copper tube, **Type L**; **[wrought-]**copper pressure fittings; and soldered joints.
  2. Ductile-iron, mechanical-joint piping and mechanical joints.
  3. Ductile-iron, push-on-joint piping and push-on joints.
  4. Ductile-iron, grooved-joint piping and grooved joints.
  5. Pressure transition couplings if dissimilar pipe materials.

END OF SECTION 221316

