

SECTION 22 1116

PLUMBING PIPING

PART 1 - GENERAL

1.1 STIPULATIONS

- A. The specifications sections "General Conditions of Contract", "Special Conditions", and "Division 1 – General Requirements" form a part of this section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. Section Includes:
 - a. Water distribution, including cold and hot-water supply.
 - b. Drainage and vent systems, including sanitary.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - a. Division 23 Section "Identification for HVAC Piping and Equipment"
 - b. Division 23 Section "General-Duty Valves for HVAC Piping"
 - c. Division 23 Section "HVAC Insulation"

1.4 SUBMITTALS

- A. Product Data Sheets for all materials.

1.5 QUALITY ASSURANCE

- A. Comply with the provisions of ASME B31.9 "Building Services Piping" for materials, products, and installation.
- B. Provide listing/approval stamp, label, or other marking on piping made to specified standards.

1.5 SYSTEM PERFORMANCE REQUIREMENTS

- A. Water Distribution Systems, Above Ground: 125 psig.
- B. Soil, Waste, and Vent Systems: 10-foot Head of Water.

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.
- B. Hard Copper Tube: ASTM B 88, Types K and L, water tube, drawn temper.
- A. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.
- B. Copper Drainage Tube: ASTM B 306, Type DWV, drawn temper.
- C. Steel Pipe: ASTM A 53, Type S, Grade A, Schedule 40, seamless, galvanized, plain ends.
 - 1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53 or ASTM A 106, Schedule 40, seamless, galvanized, carbon-steel pipe.
- D. Flanged, Ductile-Iron Pipe: AWWA C115 ductile-iron barrel with 250-psig pressure rating and AWWA C104 cement-mortar lining.
- E. Hub and Spigot, Cast-Iron Soil Pipe: ASTM A 74, Service Class.
- F. Hubless, Cast-Iron Soil Pipe: CISPI 301.

2.2 PIPE FITTINGS AND TUBE FITTINGS

- A. Wrought-Copper, Solder-Joint Pressure Fittings: ASME B16.22.
- B. Cast-Copper-Alloy, Solder-Joint Pressure Fittings: ASME B16.18.
- C. Bronze Flanges: ASME B16.24, Classes 150 and 300.
- D. Copper Unions: ASME B16.18, cast-copper-alloy body, hexagonal stock, with ball-and-socket joint, metal-to-metal seating surfaces, and solder-joint, threaded, or solder-joint and threaded ends.
- E. Threaded Ends: Threads conforming to ASME B1.20.1.
- F. Malleable Iron Fittings: ASME B16.3.
- G. Ductile-Iron Flanged Fittings: AWWA C110, ductile- or gray-iron standard pattern; with 250-psig minimum pressure rating and AWWA C104 cement-mortar lining.

- H. Hub and Spigot, Cast-Iron Soil Pipe Fittings: ASTM A 74, Service Class.
- I. Hubless, Cast-Iron Soil Pipe Fittings: CISPI 301.

2.3 SPECIALTY VALVES

- A. Comply with requirements in Division 23 Section "General-Duty Valves for Mechanical Piping" for general-duty metal valves.

2.4 FLEXIBLE CONNECTORS

- A. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
 - A. Working-Pressure Rating: Minimum 200 psig.
 - B. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
 - C. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance.
- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install water-pressure-reducing valves downstream from shutoff valves.
- G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- H. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

- I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- J. Install piping adjacent to equipment and specialties to allow service and maintenance.
- K. Install piping to permit valve servicing.
- L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- M. Install piping free of sags and bends.
- N. Install fittings for changes in direction and branch connections.
- O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- P. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 23 Section "Meters and Gages for Mechanical Piping" for pressure gages.
- Q. Install thermostats in hot-water circulation piping.
- R. Install thermometers on outlet piping from each water heater. Comply with requirements in Division 23 Section "Meters and Gages for Mechanical Piping" for thermometers.

3.2 PIPING APPLICATIONS

- A. General: Use pipe, tube, fittings, and joining methods for piping systems according to the following applications.
- B. Water Distribution Piping Above Ground:
 - a. 3-1/2 inch and Smaller: Hard copper tube, Type L; wrought-copper or cast-copper-alloy pressure fittings; copper unions; bronze flanges; and solder joints with Alloy Sn95 solder
- C. Soil, Waste, and Vent Piping Above Ground:
 - a. 1-1/4 inch and 1-1/2 inch NPS: Hard copper drainage tube; copper, solder-joint drainage fittings; and soldered joints.
 - b. 2 inch to 6 inch: Hubless cast-iron soil pipe; hubless cast-iron soil pipe fittings; stainless-steel, cast-iron, or FM-type heavy-duty couplings for hubless cast-iron soil pipe and fittings; and hubless joints.

3.3 WATER DISTRIBUTION PIPING INSTALLATION

- A. Install piping with 1/32 inch per foot (1/4%) slope downward toward drain.

3.4 DRAINAGE AND VENT PIPING INSTALLATION

- A. Install cast-iron soil pipe and cast-iron soil pipe fittings according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings"
- B. Make changes in direction for drainage and vent piping using appropriate Y branches, Y branches with 1/8 bends, and long-sweep 1/4, 1/5, 1/6, 1/8, and 1/16 bends. Sanitary tees and short-sweep quarter bends may be used on vertical stacks of drainage lines where change in direction of flow is from horizontal to vertical. Use long-turn double-Y-branch and 1/8-bend fittings where two (2) fixtures are installed back-to-back or side by side and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. Make no change in direction of flow greater than 90. Where different sizes of drainage pipes and fittings are connected, use proper size standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.
- C. Install drainage and vent piping at the following minimum slopes, except where another slope is indicated:
 - a. Horizontal Sanitary Drainage Piping: 1/8 inch per foot (1%).
 - b. Horizontal Storm Drainage Piping: 1/8 inch per foot (1%).
 - c. Vent Piping: 1/8 inch per foot (1%).

3.5 JOINT CONSTRUCTION

- A. Basic piping joint construction is specified in Division 23 Section "Common Work Results for Plumbing"
 - A. Cast-Iron Soil Pipe and Cast-Iron Soil Pipe Fitting Joints: Make joints according to recommendations in CISPI 1990 revised and edited edition of "Cast Iron Soil Pipe and Fittings Handbook, Volume I," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - a. Compression Joint: Make with neoprene gasket matching class of pipe and fittings.
 - b. Hubless Joint: Make with neoprene gasket and sleeve or clamp.

3.6 INSTALLATION OF VALVES

- A. Sectional Valves: Install sectional valves close to main on each branch and riser serving two (2) or more plumbing fixtures or equipment connections and where indicated. Use ball valves for sectional valves 2 inches and smaller. Use gate or butterfly valves for sectional valves 2-1/2 inch and larger.
- B. Shutoff Valves: Install shutoff valves on inlet to each plumbing equipment item, on each supply to each plumbing fixture not having stops on supplies, and elsewhere as indicated. For shutoff valves 2 inch and smaller, use ball valves; for shutoff valves 2-1/2 inch and larger, use gate or butterfly valves.

- C. Drain Valves: Install drain valves on each plumbing equipment item located to drain equipment for service and repair. Install drain valve at base of each riser, at low points of horizontal runs, and where required to drain water distribution piping system.
 - a. Install hose-end drain valves at low points in water mains, risers, and branches.
 - b. Install stop and waste drain valves where indicated.
- D. Check Valves: Install swing check valve on discharge side of each pump and elsewhere as indicated. Use MSS SP-80, Class 125, cast-bronze body for 2 inch and smaller piping and MSS SP-71, Class 125, cast-iron body for 2-1/2 inch and larger piping.
- E. Balance Valves: Install valve in each hot-water circulating loop, discharge side of each pump, and elsewhere as indicated. Use ball valve for 2 inch and smaller piping and butterfly valve for 2-1/2 inch and larger piping.
- F. Plug Valves: Install valve at all gas piping equipment connections and piping risers for proper isolation and shut-off.
- G. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

3.7 HANGERS AND SUPPORTS INSTALLATION

- A. Install hangers for horizontal piping with following maximum spacing and minimum rod sizes:

Nom. Pipe Size (Inches)	Steel Pipe Max. Span (Feet)	Copper Tube Max. Span (Feet)	Min. Rod Diameter (Inches)
Up to 3/4	7	5	3/8
1	7	6	3/8
1-1/4	7	7	3/8
1-1/2	9	8	3/8
2	10	8	3/8
2-1/2	11	9	1/2
3	12	10	1/2
3-1/2	6	6	1/2
4-6	6	6	5/8, 1/2 for copper

Support vertical steel pipe and copper tube at each floor.

Conform to table below for maximum spacing of supports:

	Horizontal	Vertical
Pipe Material	In Feet	In Feet
Cast-Iron Soil Pipe	5	15

Copper Tubing - 1-1/4" and Smaller	6	10
Copper Tubing - 1-1/2" and Larger	6	10
Steel Pipe	6	15

- B. Pipe Attachments: Install the following:
- Riser Clamps: MSS Type 8 or Type 42 for vertical runs.
 - Adjustable Steel Clevis Hangers: MSS Type 1 for individual straight horizontal runs 100 feet and less.
 - Adjustable Roller Hangers: MSS Type 43 for individual straight horizontal runs longer than 100.
 - Spring Cushion Rolls: MSS Type 49, where indicated, for individual straight horizontal runs longer than 100'.
 - Pipe Rolls: MSS Type 44 for multiple straight horizontal runs 100' or longer. Support pipe rolls on trapeze
 - Spring Hangers: MSS Type 52 for support of base of vertical runs.
- C. Support cast-iron soil pipe and fittings not included in table, at maximum horizontal spacing of 5 feet, except 10 feet sections of pipe may be supported at 10 feet spacing and at maximum vertical spacing of 15 feet.

3.8 CONNECTIONS

- A. Supply Runouts to Fixtures: Install hot and cold-water supply piping runouts of sizes indicated, but not smaller than required by plumbing code to fixtures.
- B. Drainage Runouts to Fixtures: Provide drainage and vent piping runouts, with approved trap, of sizes indicated, but not smaller than required by plumbing code, to plumbing fixtures and drains.
- C. Locate drainage piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.
- D. Mechanical Equipment Connections: Connect hot and cold-water supply piping system to mechanical equipment as indicated. Provide shutoff valve and union for each connection; provide drain valve on drain connection. Use flanges instead of unions for connections 2-1/2 inch and larger.

3.9 FIELD QUALITY CONTROL

- A. Inspect water distribution piping as follows:
- Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the authority having jurisdiction.
 - During progress of the installation, notify the plumbing official having jurisdiction at least 24 hours prior to time inspection must be made. Perform tests specified below in presence of the plumbing official.

- c. Roughing-In Inspection: Arrange for inspection of piping system before concealed or closed-in after system roughing-in and prior to setting fixtures.
 - d. Final Inspection: Arrange for final inspection by plumbing official to observe tests specified below and to ensure compliance with requirements of plumbing code.
 - e. Reinspection's: When a plumbing official finds that piping system will not pass test or inspection, make required corrections and arrange for reinspection by the plumbing official.
 - f. Reports: Prepare inspection reports signed by plumbing official.
- B. Test water distribution piping as follows:
- a. Test for leaks and defects in new water distribution piping systems and parts of existing systems 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 system tested.
 - b. Leave uncovered and unconcealed in new, altered, extended, or replaced water distribution piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved for testing.
 - c. Cap and subject the piping system to a static water pressure of 50 psig above the operating pressure without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - d. Repair leaks and defects with new materials and retest system or portion thereof until satisfactory results are obtained.
 - e. Prepare reports for tests and required corrective action.
- C. Inspect drainage piping as follows:
- a. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction.
 - b. During progress of installation, notify the plumbing official having jurisdiction at least 24 hours prior to time such inspection must be made. Perform tests specified below in presence of the plumbing official.
 - c. Roughing-In Inspection: Arrange for inspection of piping system after system roughing-in, before concealing, and prior to setting fixtures.
 - d. Final Inspection: Arrange for final inspection by plumbing official to observe tests specified below and to ensure compliance with requirements of plumbing code.
 - e. Reinspection's: Make required corrections and arrange for reinspection by plumbing official when piping system fails to pass test or inspection.
 - f. Reports: Prepare inspection reports signed by the plumbing official.
- D. Drainage and Vent Piping System Tests: Test drainage and vent systems according to procedures of authority having jurisdiction or, in absence of published procedure, as follows:
- a. Test for leaks and defects in new drainage and vent piping systems and parts of existing systems that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.

- b. Leave uncovered and unconcealed in new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose for testing work that has been covered or concealed before it has been tested and approved.
- c. Rough Plumbing Test Procedure: Except for outside leaders and perforated or open-jointed drain tile, test piping of plumbing drainage and venting systems on completion of roughing-in piping installation. Tightly close all openings in piping system and fill with water to point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before inspection starts through completion of inspection. Inspect joints for leaks.
- d. Finished Plumbing Test Procedure: After plumbing fixtures have been set and their traps filled with water, test connections and prove gastight and watertight. Plug stack openings on roof and building drain where it leaves the building and introduce air into the system equal to pressure of 1-inch water column. Use a U tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
- e. Repair leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
- f. Prepare reports for tests and required corrective action.

3.10 CLEANING

- A. Clean and disinfect water distribution piping as follows:
 - a. Purge new water distribution piping systems and parts of existing potable water systems that have been altered, extended, or repaired prior to use.
 - b. Use purging and disinfecting procedure prescribed by authority having jurisdiction or, if a method is not prescribed by that authority, the procedure described in either AWWA C651 or AWWA C652 or as described below:
 - c. Flush piping system with clean, water until dirty water does not appear at outlets.
 - d. Fill system or part thereof with water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) and allow to stand for 24 hours.
 - e. Drain system or part thereof of previous solution and refill with water/chlorine solution containing at least 200 parts per million of chlorine. Isolate and allow to stand for 3 hours.
 - f. Flush system with clean, potable water until chlorine does not remain in water coming from system following allowed standing time.
- B. Prepare and submit reports for purging and disinfecting activities.
- C. Clean interior of piping system. Remove dirt and debris as work progresses.

3.11 COMMISSIONING

- A. Before operating systems, perform these steps:
 - a. Close drain valves, hydrants, and hose bibbs.

- b. Open shutoff valves to full open position.
 - c. Open throttling valves to proper setting.
 - d. Remove plugs used during testing of piping systems and plugs used for temporary sealing of piping during installation.
 - e. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 - f. Remove filter cartridges from housings and verify that cartridges are as specified for application where used, clean, and ready for use.
- B. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.
- C. Check plumbing specialties and verify proper settings, adjustments, and operation.
- D. Energize pumps and verify proper operation.

3.12 PROTECTION

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

END OF SECTION 221116