

SECTION 22 10 16
PLUMBING PIPING (Re-Issued AD-2)

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Description of systems:
1. Systems:
 - a. Cold, hot, and circulating domestic water piping systems within building and to 5 FT outside building wall.
 - b. Drainage piping systems:
 - 1) Soil, waste, vent, indirect, and storm piping within building and to 5 FT outside building wall.
 - 2) Acid resistant waste, and acid vent within building and 5 FT outside building wall.
 - c. Pressure drainage piping.
 - d. Exposed piping in finished areas.
 2. Products:
 - a. Backflow protection devices.
 - b. Cleanouts.
 - c. Drains:
 - 1) Air-gap fittings.
 - 2) Floor drains.
 - 3) Funnels.
 - 4) Roof drains.
 - d. Flashings.
 - e. Traps.
 - f. Valves:
 - 1) Automatic trap primer valves.
 - 2) Backwater valves.
 - 3) Balancing valves, constant flow control.
 - 4) Check valves.
 - 5) Manual valves, potable water.
 - 6) Manual valves, waste-water.
 - 7) Pressure reducing valves.
 - g. Water-hammer arresters.
 - h. Water meters.
- B. Definitions:
1. Caulked: Tamped lead and oakum joint.
 2. Drainage piping: Soil, waste, vent, acid waste, acid vent, indirect, and storm piping.
 3. Brazing: High-temperature soldering.
 4. Pressure drainage piping: Branch piping from discharge of sump pump or sewage ejector to connection with gravity drainage piping.

1.2 QUALITY ASSURANCE

- A. Pipe and fittings standards: See Section 20 11 00.
- B. Fire Protection Systems: See Section 21 10 00.
- C. Valve standards: See Section 20 05 23 (for valves labeled "V-__").
- D. American Water Works Association Standard AWWA-C601: Sterilization Standard.
- E. Plumbing and Drainage Institute Standard WH201: Water-hammer arrester standard.

- F. Plumbing and Drainage Institute Standard G10: Grease interceptor standard..
- G. American Society for Sanitary Engineering Standard ASSE 1001: Pipe Applied Atmospheric Type Vacuum Breakers.
- H. American Society for Sanitary Engineering Standard ASSE 1013: Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.
- I. Standard: American Society for Sanitary Engineering Standard ASSE 1020: Pressure Vacuum Breaker Assembly.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Piping layout drawings at 1/4 IN/FT scale.
- B. Product Data:
 - 1. Include sufficient information to verify compliance with specifications:
 - a. Backflow protection devices.
 - b. Drains.
 - c. Valves.
 - d. Water hammer arresters.
 - e. Water meters.
- C. Contract Closeout Information:
 - 1. Pressure test reports.
 - 2. Disinfection test report.
 - 3. Operating and maintenance data.
 - 4. Certificate of local utility approval of backflow preventer and water meter.

1.4 RELATED SECTIONS

- A. Refer to related Sections under Division 20 – Mechanical General Requirements.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Acceptable manufacturers:
 - 1. Backflow protection device (Reduced-pressure principle):
 - a. Base:
 - 1) Cla-Val.
 - b. Optional:
 - 1) Watts Regulator.
 - 2) Febco.
 - 3) Hersey Measurement.
 - 4) Wilkins Regulator.
 - 2. Backflow protection device (Vacuum breakers):
 - a. Base:
 - 1) Watts Regulator.
 - b. Optional:
 - 1) Febco.
 - 2) Wilkins Regulator.
 - 3. Cleanouts and Drains:
 - a. Base:
 - 1) Wade Division/Tyler Pipe.
 - b. Optional:
 - 1) Watts Drainage - Ancon.
 - 2) Josam Company.

- 3) JONESPEC Plumbing Products.
- 4) Jay R. Smith Manufacturing Co.
- 5) Zurn Industries, Inc.
4. Valves (Automatic trap primer):
 - a. Base:
 - 1) Precision Plumbing Products.
 - b. Optional:
 - 1) Jay R. Smith Manufacturing Co.
 - 2) Wade Division/Tyler Pipe.
5. Valves (Backwater):
 - a. Base:
 - 1) Josam Company.
 - b. Optional:
 - 1) Jay R. Smith Manufacturing Co.
 - 2) Watts Drainage-Ancon, Inc.
6. Valves (Constant flow control balancing valves):
 - a. Base:
 - 1) Griswold Controls COMBO.
 - b. Optional:
 - 1) Flow Design Inc. - Autoflow.
 - 2) Preso.
7. Valves (Pressure reducing):
 - a. Base:
 - 1) Cla-Val.
 - b. Optional:
 - 1) Watts Regulator.
 - 2) Fisher.
 - 3) Wilkins Regulator.
8. Water-hammer arresters:
 - a. Base:
 - 1) Wade Division/Tyler Pipe.
 - b. Optional:
 - 1) Jay R. Smith Manufacturing Co.
 - 2) Josam Company.
 - 3) Zurn Industries, Inc.
9. Water meters:
 - a. Base:
 - 1) Hersey Measurement.
 - b. Optional:
 - 1) Badger Meter.
 - 2) Sensus Technologies.

2.2 PIPE AND FITTINGS

- A. Domestic water piping:
 1. Domestic water piping at service entrance (from 1 FT inside building to 5 FT outside):
Same as indicated for outside utilities.
 2. 2 IN and smaller after service entrance:
 - a. Above grade:
 - 1) Copper, type L, with solder joints, and wrought copper or cast brass fittings.
 - b. Below grade:
 - 1) Copper, type K soft, with brazed joints and wrought copper or cast brass fittings.
 - 2) Where below-grade run of piping is shorter than 50 FT, below-grade joints are not acceptable.
 3. 2-1/2 IN and larger after service entrance:
 - a. Non-softened cold water:

- 1) Copper, type L, with roll-groove joints and wrought copper or cast brass fittings.
 - b. Hot water and soft water:
 - 1) Copper, type L, with roll-groove joints and wrought copper or cast brass fittings.
- B. Drainage piping (soil, waste, vent, indirect, and storm):
 - 1. Above grade:
 - a. Cast-iron, hubless pipe, fittings, bituminous coated and lined and elastomeric sealing sleeves with stainless-steel or cast iron clamps, as allowed by code.
 - 2. Below grade:
 - a. 2 IN diameter or larger.
 - b. Cast-iron, hubbed pipe and fittings, bituminous coated and lined with elastomeric push joints, as allowed by code.
- C. Drainage piping (Acid resistant):
 - 1. Above grade:
 - a. Acid resistant flame retardant polypropylene DWV pipe and fittings as allowed by code:
 - 1) Non-concealed joints and fixture connections: Mechanical joint type.
 - 2) All other joints electro-resistance fusion joints.
 - 2. Below grade:
 - a. Acid resistant polypropylene DWV pipe and fittings:
 - 1) Electro-resistance fusion joints.
- D. Pressure drainage piping:
 - 1. Galvanized steel, cast-iron drainage fittings with threaded joints.
- E. Exposed piping in finished areas:
 - 1. Stainless steel, chrome or nickel plated brass to wall or floor.
 - 2. Piping 2 IN and larger may be provided with chrome or nickel plated brass sleeves to cover pipe and fittings.
 - a. See Section 20 05 00.
- F. Trap primer pipe between primer device and drain:
 - 1. Above grade: Copper, type L, with solder joints, and wrought copper or cast brass fittings.
 - 2. Below grade: Copper, type K soft, with solder joints, and wrought copper or cast brass fittings.

2.3 BACKFLOW PROTECTION DEVICES

- A. Backflow protection devices, general:
 - 1. Approved by local Public Utilities Bureau and the state Environmental Protection Agency.
- B. Reduced-pressure principle backflow preventer (BFP):
 - 1. Two check valves, test cocks, pressure differential relief valve, isolation valves and accessories assembled as an integral unit, horizontally mounted. Tested and certified in conformance with ASSE Standard No. 1013.
 - 2. Threaded ends: 2 IN and smaller.
 - 3. Flanged ends: 2-1/2 IN and larger.
 - 4. Provide 3/4 IN drain line from relief to floor drain, floor sink, mop sink, or service sink.
 - 5. Isolation valves:
 - a. 2 IN and smaller: Ball valve.
 - b. 2-1/2 IN and larger:
 - 1) Non-rising stem.
 - 2) OS&Y.
 - c. Provide No. 1 test cock on inlet valve.
 - 6. Size BFP's to have a pressure loss less than 14 PSI at flows indicated below (refer to plans for pipe sizes):
 - a. 1/2 IN pipe: 2.2 GPM.
 - b. 3/4 IN pipe: 6 GPM.

- c. 1 IN pipe: 13 GPM.
 - d. 1-1/4 IN pipe: 22 GPM.
 - e. 1-1/2 IN pipe: 35 GPM.
 - f. 2 IN pipe: 75 GPM.
 - g. 2-1/2 IN pipe: 125 GPM.
 - h. 3 IN pipe: 170 GPM.
 - i. 4 IN pipe: 315 GPM.
 - j. 6 IN pipe: 720 GPM.
 - k. 8 IN pipe: 1250 GPM.
- C. Pressure type vacuum breakers (PTVB):
- 1. Designed to protect against back-siphonage in continuous-pressure piping systems. Tested and certified in conformance with ASSE Standard No. 1020.
 - 2. Bronze body and lightweight internal floats designed to eliminate spillage.
 - 3. Provide isolation ball valve on inlet and outlet of PTVB.
 - 4. Provide outlet connection on VB compatible with equipment/fixture being served.
 - 5. Mount bottom of VB at least 12 IN above the flood-level rim of the equipment/fixture being served.
 - 6. Provide test cocks.
 - 7. Match VB size to pipe size indicated on plans.
- D. Atmospheric vacuum breakers (VB):
- 1. Bronze body and lightweight internal float designed to eliminate spillage. Tested and certified in conformance with ASSE Standard No. 1001.
 - 2. Provide isolation valve immediately upstream of VB.
 - 3. Provide outlet connection on VB compatible with equipment/fixture being served.
 - 4. Mount bottom of VB at least 6 IN above the flood-level rim of the equipment/fixture being served.
 - 5. Match VB size to pipe size indicated on plans.

2.4 CLEANOUTS

- A. Cleanouts, general:
- 1. Provide flashing collars and clamps for CO bodies being installed in floors with finishes installed over waterproofing.
 - a. Coordinate with Division 09 and Room-Finish installers.
 - 2. Dimensions are nominal.
 - 3. Body material (unless indicated otherwise): Coated cast iron.
 - 4. Cleanout plugs:
 - a. Extra-heavy, threaded, tapered, brass plug with solid hexagonal nut.
 - b. Comply with Plumbing Code.
 - c. Provide with American Standard pipe threads.
 - 5. Cleanouts on lines completely accessible from within pipe chases do not require covers.
 - 6. Cleanouts in exposed piping in equipment rooms do not require special covers.
- B. Interior, floor-mounted cleanouts:
- 1. Extra-heavy, flanged, cast-iron ferrule, tapped for cleanout plug with spigot or inside-caulk outlet.
- C. Example:
- 1. Two-piece, threaded, adjustable housing.
 - a. ANSI load class: Light duty, unless noted otherwise.
 - b. Example: [Wade 6000](#).
 - 2. Top and cover as specified below by floor finish.
 - a. Resilient tile and sheet finish: Round flange top with scoriated cover.
 - b. Ceramic tile finish: Square flange top with scoriated cover.
 - c. Poured finish: Round, wide-flange top with scoriated cover.
 - d. Carpet finish: Round top with standard top tapped for carpet-marker bolt.

- e. Terrazzo finish: Round top with recessed-for-terrazzo cover.
 - f. Quarry tile finish: Square, heavy-duty top with heavy-duty scoriated cover.
 - g. Concrete finish (unfinished areas):
 - 1) Heavy, round frame; satin-bronze, scoriated tractor top.
 - 2) ANSI load class: Heavy duty.
 - 3) Example: [Wade 6000Z](#).
- D. Cleanouts in vertical piping:
- 1. Tapped cleanout tee.
 - 2. Extra-heavy, threaded, brass plug with solid hexagonal nut.
- E. Cleanouts in hubs of combination wye and eighth bends or wyes.
- 1. Tapped spigot.
 - 2. Extra-heavy, threaded, brass plug with solid hexagonal nut.
- F. Cleanouts at ends of hubless combination wye and 1/8th bends or wyes.
- 1. Blind plug.
- G. Covers over cleanouts in concealed vertical piping:
- 1. Square, nickel-bronze frame with secured, smooth, stainless-steel access cover.
 - 2. 6 x 6 IN for pipe sizes 4 IN and less.
 - 3. 9 x 9 for pipe sizes 5 IN and larger.
 - 4. Example: [Wade W-8480-S](#).

2.5 DRAINS

- A. Drains, general:
- 1. Provide flashing clamps with seepage openings for drain bodies with flashing collars being installed in floors with finishes installed over waterproofing.
 - a. Coordinate with Division 09 and Room-Finish installers.
 - 2. Provide underdeck clamps for drain bodies except those installed in slabs on grade.
- B. Air-gap fittings:
- 1. Inlet: Female IPS or collar with set screw.
 - 2. Outlet: Spigot or IPS.
 - 3. Material: Cast-iron or bronze.
 - 4. Minimum air-gap area: 2 times inlet area.
 - 5. Examples: Jay R. [Smith 3950 series](#).
- C. Downspout nozzles:
- 1. DSN-1:
 - a. Cast bronze nozzle with rough bronze finish and flange for securing nozzle to wall.
 - b. Example: Jay R. Smith 1770.
- D. Floor drains:
- 1. General:
 - a. Dimensions are nominal.
 - b. Provide trap-primer taps where trap primer valves are required: See paragraph on trap primer valves.
 - c. Material (unless indicated otherwise): Coated cast iron.
 - 2. D-6:
 - a. 12 IN diameter flashing collar.
 - b. Adjustable top.
 - c. 8 IN diameter, removable, non-tilt tractor grate.
 - d. Cast iron strainer.
 - e. Example: [Wade 1340TD](#).
 - 3. D-5:
 - a. 10 IN diameter flashing collar.
 - b. Reversible flashing clamp with seepage openings and tapped opening for strainer body.
 - c. Threaded strainer body.

- d. 6 IN square, secured, satin nickel bronze, removable strainer.
 - e. Example: [Wade 1100G](#).
- E. Floor sinks:
- 1. General:
 - a. Dimensions are nominal.
 - b. Provide trap-primer taps where trap primer valves are required: See paragraph on trap primer valves.
 - c. Material (unless indicated otherwise): Coated cast iron.
 - d. Provide flashing collars.
 - 2. D-3:
 - a. Dimensions: 12 x 12 x 6 IN floor sink with square top.
 - b. Material of construction: 304 stainless steel.
 - c. Stainless-steel sediment basket and optional dome bottom strainer, same grade as body.
 - d. Grate:
 - 1) Removable, full size, medium duty anti-tilt type.
 - 2) Material of construction: stainless-steel, same grade as body.
 - 3) Size: 10 IN square.
 - e. Example: Jay R. Smith 9697.
- F. Funnels:
- 1. Material: Match to associated grate, strainer, or P-trap.
 - 2. Secure to grates and strainers with screws.
 - 3. 6 IN diameter, 4 IN tall.
 - 4. 8 x 3 IN oval, 4 IN tall.
- G. Roof drains:
- 1. General:
 - a. Dimensions are nominal.
 - b. Material (unless indicated otherwise): Coated cast iron.
 - c. Provide deck clamps.
 - d. Provide bearing pan/sump receiver (where occurs at steel decks).
 - 2. D-1:
 - a. Flashing collar diameter: 16 to 19 IN.
 - b. Flashing clamp with gravel stop.
 - c. Mushroom dome: coated cast iron.
 - d. Mushroom dome height: 5 IN.
 - e. Mushroom dome diameter: 11 to 14 IN.
 - f. Provide bearing pan/sump receiver.
 - g. Provide solid or adjustable extension to allow for insulation thickness between concrete deck and waterproof membrane.
 - 1) Coordinate extension height with roof insulator.
 - h. Example: [Wade 3000](#).
 - 3. D-2 (overflow drain):
 - a. Flashing collar diameter: 16 to 19 IN.
 - b. Flashing clamp with integral 2 IN tall water dam.
 - c. Mushroom dome: coated cast iron.
 - d. Mushroom dome height: 5 IN.
 - e. Mushroom dome diameter: 11 to 14 IN.
 - f. Provide bearing pan/sump receiver.
 - g. Provide solid extension to allow for insulation thickness.
 - 1) Coordinate extension height with roof insulator.
 - h. Example: [Wade 3000SD](#).
 - 4. D-7:
 - a. 6 IN round flashing collar.
 - b. Nickel bronze flashing clamp ring.
 - c. Provide Bearing pan.

- d. 4-1/4 IN diameter, 4-1/2 IN tall, removable, bronze, dome strainer, painted cast iron body with threaded outlet.
- e. Example: Wade [3240B47](#).

2.6 DRIP PANS OVER CRITICAL AREAS

- A. Drip pans:
 - 1. Field- or shop-fabricated: See detail.

2.7 FLASHINGS

- A. On floors above grade, allow for flashings provided by others at penetrations in floors with finishes installed over waterproofing.
 - 1. Coordinate with Division 09 and Room-Finish installers.

2.8 TRAPS

- A. Traps, general:
 - 1. Cast brass or cast iron, one piece pattern, 3 IN minimum seal.
 - 2. Same material, coating, and finish as piping system into which they are installed except traps 2 IN NPS and under, not buried in earth, shall be cast brass with union and cleanout.
 - 3. Place trap cleanouts in accessible locations.
- B. Provide deep-seal traps for drain bodies in ventilation housings: Traps need to maintain seal against static pressure in fan housing.
- C. Traps for drains with buried outlet: Cast iron P-traps, unless otherwise indicated.

2.9 VALVES

- A. Automatic trap primer valves.
 - 1. General:
 - a. Rebuildable.
 - b. Integral vacuum breaker on drain branch.
 - c. Connections: Soldered or threaded.
 - d. Provide trap primers as indicated on plans.
 - 2. Automatic trap primer valve: TP-1
 - a. Serves single drain.
 - b. 1/2 IN bronze.
 - c. Designed to be installed in the supply line to an individual fixture with branch extended to drain.
 - d. Examples: [Wade 2400](#), [Smith 2699](#).
 - 3. Automatic trap primer valve: TP-1
 - a. Serves one to four drains.
 - b. 1/2 IN brass.
 - c. Integral backflow preventer.
 - d. Designed to be installed at end of dead-end line with continuation to drain.
 - 1) Activated by 5 PSI drop or more in main.
 - e. Automatically adjusts to line pressures between 35 and 75 PSIG.
 - f. Example: Precision Plumbing Products Prime-Rite.
 - 4. Automatic trap primer valve: TP-1
 - a. Serves one to eight drains.
 - b. Body: Polypropylene.
 - c. Internal parts: Stainless steel, monel metal.
 - d. Integral backflow preventer.
 - e. Designed to be installed at end of dead-end line with continuation to drain.
 - 1) Activated by 3 PSI drop or more in main.
 - f. Automatically adjusts to line pressures between 35 and 75 PSIG.
 - g. Example: Precision Plumbing Products Oregon #1.

5. Automatic trap primer valve: TP-2
 - a. Serves one to four drains.
 - b. 1/2 IN brass.
 - c. Integral backflow preventer.
 - d. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power
 - e. Example: Precision Plumbing Products MP-500-115V. with distribution unit DU
 6. Automatic trap primer valve: TP-1
 - a. Serves one to eight drains.
 - b. Body: Polypropylene.
 - c. Internal parts: Stainless steel, monel metal.
 - d. Integral backflow preventer.
 - e. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power
 - f. Example: Precision Plumbing Products MP-500-115V with two (2) distribution units
 7. Trap primer distribution reservoir.
 - a. Copper reservoir with brass fittings and clear plastic inspection cover.
 - 1) Feeds up to four traps through separate lines.
 - 2) Provide mounting brackets.
 - b. Example: [Precision Plumbing Products](#).
- B. Backwater valves:
1. Coated cast iron body.
 2. Hubbed inlet.
 3. Offset spigot outlet.
 4. Gasketed and bolted cover.
 5. Removable, automatic bronze valve seat and flapper that hangs open during periods of non-operation.
 6. Example: [JayR. Smith 7012](#).
- C. Balancing valves, constant flow control:
1. Factory calibrated, direct acting, automatic pressure compensating.
 2. Control flow rates within 5 percent of flow rating over operating pressure differential range.
 - a. Set flow rating according to pipe sizes indicated on plans:
 - 1) 1/2 IN: 1.0 GPM.
 - 2) 3/4 IN: 2.5 GPM.
 - 3) 1 IN: 6 GPM.
 - 4) 1-1/4 IN: 9 GPM.
 3. Pressure differential range:
 - a. 1-14 PSID.
 4. Threaded-brass or copper-sweat body with stainless-steel internal parts.
 5. Provide a metal identification tag with chain for each installed valve.
 - a. Identify zone or location, valve model number, flow rate, direction of flow, and differential pressure range.
 6. Provide with integral unions to allow field exchange of internal components without removing valve body from pipeline.
 7. Provide manual valve upstream and downstream of each valve.
- D. Check valves:
1. 2 IN and smaller: V-24 or V-25.
 2. 2-1/2 IN and larger: V-28 or V-29.
- E. Manual valves, potable-water:
1. 2 IN and less: V-13 or V-14.
 2. 2-1/2 to 4 IN:
 3. 6 IN and larger:

- a. V-34 or V-35 or V-62.
- b. Totally enclosed gear operator and wheel handle.
- c. At equipment and at service entrance:
 - 1) Use lug type valves, V-33.
 - 2) Use groove-end type valves, V-62.
- 4. Balancing cocks:
 - a. Constant flow control balancing valves.
- F. Manual valves, waste-water:
 - 1. Drainage piping shut off: V-37.
 - 2. Pressure drainage piping:
 - a. Shut off: V-2.
 - b. Check: V-28.
- G. Pressure reducing valves:
 - 1. Use pilot-operated or direct-acting PRV based on pipe size indicated on plans.
 - a. 2 IN and smaller: direct-acting.
 - b. 3 IN and larger: pilot-operated.
 - 2. Direct-acting PRV.
 - a. Bronze bodied, diaphragm and spring type valve with integral thermal bypass and removable, stainless-steel strainer.
 - b. Pressure adjustment range: 15 to 75 PSIG.
 - c. Size PRV's to have a maximum fall-off pressure of 15 PSIG at flows indicated below (refer to plans for pipe sizes):
 - 1) 1/2 IN pipe: 2.2 GPM.
 - 2) 3/4 IN pipe: 6 GPM.
 - 3) 1 IN pipe: 13 GPM.
 - 4) 1-1/4 IN pipe: 22 GPM.
 - 5) 1-1/2 IN pipe: 35 GPM.
 - 6) 2 IN pipe: 75 GPM.

2.10 WATER-HAMMER ARRESTERS

- A. Water-hammer arresters:
 - 1. Engineered, and certified in accordance with Plumbing and Drainage Institute (PDI) Standard WH-201.
 - 2. Type and construction:
 - a. Bellows type and constructed entirely of stainless steel.
 - b. Piston type is not acceptable.
- B. Water-hammer arrestors shall be bellows type and constructed entirely of stainless steel.

2.11 WATER METERS

- A. Water meters, general:
 - 1. Use threaded fittings on meters 2 IN and less in size.
 - 2. Use flanged connections on meters 2-1/2 IN and larger.
 - 3. Provide valve on each side of meter.
 - 4. Provide meters that can be remotely read by building's energy management system.
 - a. Coordinate with Control Provider.
- B. Private water meters:
 - 1. As shown on drawings
 - 2. Provide vertical-shaft turbine meters on main water supply to building and on cold water supply to laboratory water system and make-up water lines to HVAC and Plumbing equipment.
 - 3. Match size to pipe size indicated on drawings.

PART 3 - EXECUTION

3.1 GENERAL

A. General:

1. Install piping as indicated and to provide fixtures and items of equipment with proper drainage, vent, and water connections as required by governing codes.
2. Hold piping as close to structure as possible to maintain maximum head room.
3. Run piping concealed wherever possible.
4. Under no circumstances reduce pipe size indicated without written consent of Architect.
5. Size branches to individual fixtures as scheduled.
6. Consult the following before roughing in piping:
 - a. Manufacturer's data.
 - b. Large-scale Architectural, and Mechanical Drawings of rooms containing equipment and plumbing fixtures.
7. Stub piping through wall directly behind item being served (e.g., equipment, plumbing fixtures, vending machines).
 - a. Cap and protect until such time as installation is performed.
 - b. Exception: Upon approval of Architect, piping mains and/or branches may be run in lab benches, in built-in counters, and in cabinet work.
8. Plug or cap piping immediately after installation.
9. Install chromed escutcheons on finished-area sides of pipe penetrations.
 - a. Secure escutcheons so they make contact with floor, wall, or ceiling.
10. Install equipment in accordance with manufacturer's instructions.
11. Connect equipment furnished by BNL or other divisions in accordance with Section 20 05 00.
12. Install piping supports, sleeves, and seals as indicated in Section 20 05 29.

3.2 DOMESTIC WATER PIPING SYSTEMS

A. General:

1. Install plumbing without cross- or inter-connections between potable and non-potable lines.
2. Provide unvalved system drains on trapped portions of systems: See Section 20 05 19.
3. Provide thermometers and pressure gauges where indicated on drawings: See Section 20 05 19.

B. Service entrance installation through floor:

1. Provide reaction anchorage at buried elbow where water service turns up below the floor.
2. Terminate top of exterior piping material with flange connection.
 - a. Tie flange back to buried elbow with tie rods of same diameter as flange bolts.
 - b. Permanently protect below-grade tie rods against corrosion.
 - c. Provide minimum of one tie rod for each two flange bolt holes.

C. Backflow protection devices.

1. Provide at following locations:
 - a. At fixtures and equipment as indicated and required by Code.
 - b. Where specified in Section 22 42 00: Plumbing Fixtures.
 - c. Where specified in Section 22 60 80: High Purity Water Systems.
2. Pipe drain from reduced pressure principle backflow preventers to drain or mop sink.
3. Install vacuum breakers over mop sink or over drain in unfinished area.

D. Balance hot water circulation system.

E. Provide manual isolation valves at following locations.

1. To isolate groups of fixtures and equipment on branch runouts from piping mains.
2. On each branch serving a rest room.
3. On inlet and outlet of each equipment.
4. On each branch to hose bibb or wall hydrant.

5. At main feed points to domestic water pipe risers.
 6. As indicated and as required to adequately service parts of systems and equipment.
- F. Wire isolation valves on emergency showers open and tag "Do Not Close".
- G. Provide water-hammer arresters on hot and cold water lines in accordance with PDI Standard WH-201 sizing and placement data; the Contractor shall be responsible for sizing of water hammer arrestors in accordance with this standard.
- H. Testing of domestic water system:
1. Upon completion of system or a section of system, test piping hydrostatically to pressure not less than 50 percent in excess of pipe's working pressure, but in no case less than 150 PSI.
 - a. System shall hold pressure for 24 hours.
 2. Repair leaks or replace defective pipe disclosed by tests.
 3. Repeat tests until piping indicates tight.
- I. Sterilization of domestic water system:
1. Sterilize system as indicated or in accordance with AWWA-C652 or CS186.
 2. Thoroughly flush potable water systems.
 3. After flushing, introduce chlorine or chlorine compound into system with dosage sufficient to give an initial residual chlorine content of 50 PPM.
 4. Collect samples from various taps and fixtures throughout buildings during introduction of chlorine to assure uniform distribution.
 5. Open and close valves several times.
 6. After a 24 hour contact period, flush traces of heavily chlorinated water from systems.
 7. After flushing is complete, indicate effectiveness of disinfection by submitting laboratory reports of bacteriological tests on samples taken from system.
 8. If unsatisfactory results are obtained, repeat disinfection process until satisfactory.
 9. Do not put system into service until tests are approved by Plumbing Inspector.

3.3 DRAINAGE PIPING SYSTEMS

- A. General:
1. Changes of direction and junctions: Make with wye fittings and eighth bends.
 - a. Use sanitary tee fittings in vertical pipe only.
 - 1) Sanitary crosses not allowed.
 2. Provide P-trap for each direct waste-pipe connection to equipment.
 3. Trap fixtures as required by governing code.
 4. For ice makers, provide either of the indirect drain options listed below:
 - a. Floor sink.
 - b. Dedicated, under-counter P-trap.
 5. Provide air gaps at indirect drains.
- B. Slopes:
1. Install horizontal soil, waste, and storm lines with following slopes:
 - a. 3 IN and smaller pipes:
 - 1) 1/4 IN/FT.
 - b. 4 IN and larger pipes:
 - 1) 1/8 IN/FT.
 - c. Slopes indicated on plans override those indicated here.
- C. Vents:
1. Run vent stacks parallel to soil and waste stacks to receive branch vents from fixtures.
 - a. Each vent stack shall originate from a soil or waste stack at its base.
 2. To permit proper flashing, offset through-the-roof piping away from walls on roof before passing through roof.
 3. Carry vent stacks 4 IN and larger full size through roof.
 4. Install vent lines so they will drain and not trap water.

5. Where possible combine soil, waste or vent stacks before passing through roof to minimize roof openings.
 6. Where minimum vent-through-roof size is larger than vent size, provide increased minimum of 12 IN below roof line.
 - a. Minimum vent-through-roof size:
 - 1) 4 IN.
 7. Extend vent stacks at least 12 IN above roofing.
- D. Acid resistant waste and vent piping:
1. Install piping system free of stresses and in accordance with manufacturer's recommendations.
 2. Provide accessories as indicated or required for complete connections.
 3. Laboratory sinks furnished by other divisions:
 - a. See fixture S-1 in Section 22 42 00.
 - b. Make final connections.
- E. Provide cleanouts on drainage piping as indicated below and on plans.
1. Locations:
 - a. At dead ends.
 - b. At changes of direction greater than 45 degrees.
 - c. At junction of building drain and building sewer.
 - d. 36 IN to 48 IN above finished floor in vertical piping that connects to horizontal soil, waste, or storm piping immediately below in ceiling space or under grade.
 - e. As test tee to receive test plugs in each riser at least every other floor.
 - f. At maximum 50 FT intervals in horizontal 4 IN and smaller drains.
 - g. At maximum 100 FT intervals in horizontal, 5 IN and larger drains.
 2. Sizes:
 - a. 4 IN diameter and smaller piping: Match pipe size.
 - b. 5 IN diameter and larger piping: Not less than 4 IN.
 3. Where cleanouts occur in concealed spaces, provide with extensions to wall or to floor above.
 - a. Make extensions using long sweep ells or wye and eighth bends.
 4. Where cleanouts are indicated in ceiling spaces above critical areas, extend cleanouts through floor above.
 5. Install carpet-marker bolts after carpet installation.
- F. Install piping and drains to allow for flashings provided under Roofing System section.
1. Coordinate with Roofing installer.
- G. Floor drains and floor sinks:
1. At locations with waterproofing: Set top of flashing collar 1/2 IN below level of waterproofing.
 2. At locations without waterproofing: Place drain integrally with poured concrete. Set top of drain flush with finished floor.
 3. Set over P-traps.
- H. Drains in plenums: Indirectly waste plenum drains to receptor outside of plenum.
- I. Backwater valves:
1. Install valves in 30 IN diameter RCP basin.
 2. Provide light-duty frame and solid cover with lift hole.
 - a. Set cover at grade level.
 - b. Neenah R-6450 or optional manufacturer.
 3. Set RCP on 6 IN thick, WWF-reinforced, 42 IN diameter concrete pad with 12 IN diameter center hole.
 4. Set pad on 12 IN of granular fill.
 5. Set valve bottom 4 IN above top of concrete pad.
- J. Testing of drainage piping systems:

1. Do not insulate, conceal, or install furring around pipe until it has been tested to satisfaction of BNL and Plumbing Inspector.
 - a. If inspection or test indicates defects, replace such defective work or material and repeat inspection and tests.
2. Test piping at completion of installation of each stack or section of piping.
 - a. Fill system with water to highest point and check joints and fittings for leaks.
 - b. Eliminate leaks before proceeding with work or concealing piping.
 - c. Minimum test height: 10 FT.
 - d. Make repairs to piping with new material.
 - e. Peening and chiseling of holes or screwed joints is not allowed.

END OF SECTION