

Appendix E: 1972 COMAR 09.20.11.10, Water Supply System Materials

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The rules and regulations contained herein have been approved by the Attorney General of Maryland as to legal form and sufficiency and a copy of each has been filed with the Clerk of the Court of Appeals, with the Secretary of State, with the State Library, with each of the libraries of the respective circuit courts of the several counties and with the Supreme Bench of Baltimore City, and with the State Department of Legislative Reference, pursuant to Article 41, Section 9, of the Annotated Code of Maryland (1971 Replacement Volume).



JOHN R. JEWELL
Secretary, Department of
Licensing and Regulation
State of Maryland

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.09.20.11 WATER SUPPLY AND DISTRIBUTION**.01 QUALITY OF WATER SUPPLY**

Only potable water shall be accessible to plumbing fixtures supplying water for drinking, bathing, culinary use or the processing of food, medical or pharmaceutical products.

.02 IDENTIFICATION OF POTABLE AND NON-POTABLE WATER

In all buildings where dual water distribution systems, one potable water and the other non-potable water, are installed each system shall be identified either by color marking or metal tags as required in ANSI A 13.1-1959 or other appropriate method as may be approved by the Administrative Authority.

.03 WATER REQUIRED

A. Buildings. Every building equipped with plumbing fixtures and used for human occupancy or habitation shall be provided with a potable supply of cold water in the amounts and at the pressures specified in this chapter. For residences or buildings in which people are employed, hot water shall be provided.

.04 PROTECTION OF POTABLE WATER SUPPLY

A. General. A potable water supply system shall be designed, installed and maintained in such manner as to prevent contamination from nonpotable liquids, solids or gases from being introduced into the potable water supply through cross connections or any other piping connections to the system.

B. Interconnections. Interconnection between two or more public water supplies shall be permitted only with the approval of the health authority having jurisdiction.

C. Cross connection control. Cross connections are prohibited except when and where, as approved by the authority having jurisdiction, suitable protective devices are installed, tested and maintained to insure proper operation on a continuing basis.

D. Individual water supplies. Cross connections between an individual water supply and a potable public supply shall not be made unless specifically approved by the authority having jurisdiction.

- E. **Toxic materials.** Piping conveying potable water shall be constructed of non-toxic material.
- F. **Chemicals and other substances.** No chemicals or other substances that could produce either toxic conditions, taste, odor, or discoloration in a potable water system shall be introduced into or used in such systems.
- G. **Painting of water tanks.** The interior surface of a potable water tank shall not be lined, painted, or repaired with any material which will affect either the taste, odor, color or potability of the water supply when the tank is placed in or returned to service.
- H. **Used piping.** Piping which has been used for any other purpose than conveying potable water shall not be used for conveying potable water.
- I. **Connections to boilers.** Potable water connections to boiler feed water systems in which boiler water conditioning chemicals are introduced shall be made through an air gap or provided with an approved backflow preventer located in the potable water line before the point where such chemicals are introduced. Boilers shall be equipped with twin check valves and appropriate testing arrangements in the cold water supply to the boiler. If toxic materials are to be used in the boiler, additional protection must be installed.
- J. **Prohibited connections to fixtures and equipment.** Connection to the potable water supply system for the following shall be protected against backflow:
 - (1) Operating, dissection, embalming and mortuary tables or similar equipment—in such installation the hose used for water supply shall terminate at least 12 inches away from every point of the table or attachments.
 - (2) Water closets equipped with flushometer valves or with flushing tanks with submerged float operated ball-cocks.
 - (3) Seat-acting water closets.
 - (4) Bed pan washers.
 - (5) Bidets.
 - (6) Sterilizers with water supply connections.

- (7) Therapeutic baths with inlets below the rim of the fixture.
- (8) Water operated waste ejectors, such as used by dentists, undertakers and those who practice colonic irrigation.
- (9) Bathtubs with inlets below the rim of the fixture.
- (10) Wash basins with inlets below the rim of the fixture.
- (11) Bar, soda fountain or other sinks with submerged inlets.
- (12) Laundry trays with faucets below the rim.
- (13) Sinks with faucets or water inlets below the rim and sinks with loose hose connections.
- (14) Dishwashing sinks or machines with water inlets below the rim.
- (15) Cuspidors with water supply connections.
- (16) Dental cuspidors with water supply connections.
- (17) Hospital appliances generally, such as sterilizers, condensers, filters, stills, pipette washers, aspirators, washers, etc.
- (18) Frostproof hydrants with underground bleed or automatic livestock watering devices.
- (19) Industrial vats, tanks, etc., of any description which have an inverted water supply connection, or a water supply connection below the top of the spill rim, or in which a hose filler is used.
- (20) Industrial water supplied process appliances with direct water connections.
- (21) A rubber hose with hand control or self-closing faucets attached, as used in connection with baths, industrial vats, tanneries, etc.
- (22) Pressure water supplied sealing rings on sewage and sludge pumps.
- (23) Water supply for priming connections.
- (24) Water supply (hot or cold) to laundry equipment.
- (25) Condenser cooling connections for refrigeration and air conditioning machinery.

- (26) Drains from fire sprinklers connected direct to sewers or wastes.
 - (27) Steam tables.
 - (28) Condensers.
 - (29) Stills.
 - (30) Aspirators.
 - (31) Chlorinators.
 - (32) Photographic developing tanks.
 - (33) Fixture inlets or valved outlets with hose attachments which may constitute a cross-connection shall be protected by an approved vacuum breaker installed at least six inches above the highest point of usage and located on the discharge side of the last valve. Fixtures with integral vacuum breakers manufactured as a unit may be installed in accordance with their approval requirements.
 - (34) Laboratory water faucets and cocks with serrated nipples or hose connections.
 - (35) Any other fixture or installation creating a similar hazard.
- K. Refrigerating unit condensers and cooling jackets.** Except where potable water provided for a refrigerator condenser or cooling jacket is entirely outside the piping or tank containing a toxic or flammable refrigerant as listed in ANSI B9.1-1964 Par. 5.1.2&5.1.3 with two separate thicknesses of metal separating the refrigerant from the potable water supply, inlet connection shall be provided with an approved check valve. Also adjacent to and at the outlet side of the check valve, an approved pressure relief valve set to relieve at 5 p.s.i. above the maximum water pressure at the point of installation shall be provided if the refrigeration units contain more than 20 pounds of refrigerants.
- L. Used water return prohibited.** Water used for cooling of equipment or other processes shall not be returned to the

potable water system. Such water shall be discharged into a drainage system through an air gap or may be used for nonpotable purposes on written approval of the Administrative Authority.

.05 PROTECTION AGAINST BACKFLOW AND BACKSIPHONAGE

A. Water outlets. A potable water system shall be protected against backflow and backsiphonage by providing at each outlet by (a) an air gap as specified herein between the potable water outlet and the flood level rim of the fixture it supplies or between the outlet and any other source of contamination, or, where an air gap is impracticable, by (b) a backflow preventer device or vacuum breaker approved as hereinafter provided.

B. Minimum required air gap.

- (1) How measured. The minimum required air gap shall be measured vertically from the lowest end of a potable water outlet to the flood rim or line of the fixture or receptacle into which it discharges.
- (2) Size. The minimum required air gap shall be twice the effective opening of a potable water outlet unless the outlet is a distance less than 3 times the effective opening away from a wall or similar vertical surface in which cases the minimum required air gap shall be 3 times the effective opening of the outlet. In no case shall the minimum required air gap be less than shown in Table .09.20.11.05B(2), MINIMUM AIR GAPS FOR PLUMBING FIXTURES.

TABLE .09.20.11.05B(2)
MINIMUM AIR GAPS FOR PLUMBING FIXTURES

Fixture	Minimum Air Gap	
	When Not Affected By Near Wall ¹ (Inches)	When Affected By Near Wall ² (Inches)
Lavatories and other fixtures with effective opening not greater than ½ inch diameter	1	1½
Sink, laundry trays, goose-neck bath faucets and other fixtures with effective openings not greater than ¾ inch diameter	1½	2¼
Over rim bath fillers and other fixtures with effective openings not greater than 1 inch diameter	2	3
Drinking water fountains-single orifice not greater than 7/16 (0.437) in. diameter or multiple orifices having total area of 0.150 square inches (area of circle 7/16 in. diameter)	1	1½
Effective openings greater than one inch	2X Diameter of effective opening	3X Diameter of effective opening

¹ Side walls, ribs or similar obstructions do not affect air gaps when spaced from inside edge of spout opening a distance greater than three times the diameter of the effective opening for a single wall, or a distance greater than four times the diameter of the effective opening for two intersecting walls.

² Vertical walls, ribs, or similar obstructions extending from the water surface to or above the horizontal plane of the spout opening require a greater air gap when spaced closer to the nearest inside edge of spout opening than specified in Note 1, above. The effect of three or more such vertical walls or ribs has not been determined. In such cases, the air gap shall be measured from the top of the wall.

C. Devices for the protection of the potable water supply.

Approved backflow preventers or vacuum breakers shall be installed with any plumbing fixture or equipment, the potable water supply outlet of which may be submerged and which cannot be protected by a minimum air gap.

D. Approval of devices. Before any device for the prevention of backflow or backsiphonage is installed, it shall have first been certified by a recognized testing laboratory

acceptable to the Administrative Authority. Devices installed in a building potable water supply distribution system for protection against backflow shall be maintained in good working condition by the person or persons responsible for the maintenance of the system.

- E. **Protective devices required.** In the installation of the following list of fixtures and devices, where an air gap is not provided or is impracticable, approved backflow preventers shall be installed in all supply lines according to Table .09.20.11.05E, CROSS CONNECTIONS WHERE PROTECTIVE DEVICES ARE REQUIRED AND CRITICAL LEVEL (C-L) SETTINGS FOR BACKFLOW PREVENTERS.

**TABLE .09.20.11.05E
CROSS CONNECTIONS WHERE PROTECTIVE DEVICES ARE
REQUIRED AND CRITICAL LEVEL (C-L) SETTINGS FOR
BACKFLOW PREVENTERS¹**

Fixture or Equipment	Method of Installation
Aspirators and Ejectors	C-L at least 6 inches above flood level of receptacle
Cup Beverage Vending Machines	C-L at least 12 inches above flood level of machine
Dental Units	On models without built-in vacuum breakers C-L at least 6 inches above flood level rim of bowl
Dishwashing Machines	C-L at least 6 inches above flood level of machine
Flushometers (closet & urinal)	C-L at least 6 inches above top of fixture supplied
Garbage Can Cleaning Machines	C-L at least 6 inches above flood level of machine
Hose Outlets	C-L at least 6 inches above highest point on hose line
Laundry Machines	C-L at least 6 inches above flood level of machine
Lawn Sprinklers	C-L at least 12 inches above highest sprinkler or discharge outlet
Steam Tables	C-L at least 6 inches above flood level
Tank and Vats	C-L at least 6 inches above flood level rim or line
Trough Urinals	C-L at least 30 inches above perforated flush pipe

TABLE .09.20.11.05E

CROSS CONNECTIONS WHERE PROTECTIVE DEVICES ARE REQUIRED AND CRITICAL LEVEL (C-L) SETTINGS FOR BACKFLOW PREVENTERS¹ (Continued)

Fixture or Equipment	Method of Installation
Flush Tanks	Equip with an approved ball cock. In all cases the ball cock should be located above the overflow level of the tank and the outlet terminated one inch above the overflow or provided with a backflow preventer located at least one inch above the overflow.
Hose Bibs (where aspirators or ejectors could be connected)	C-L at least 6 inches above flood level of receptacle served.

¹ Critical Level (C-L) is defined as the level to which the backflow preventer (vacuum breaker) may be submerged before backflow will occur. Where C-L marking is not shown on the preventer, the bottom of the device shall be taken as the C-L.

F. Connections subject to back pressure. Where a potable water connection is made to a line, fixture, tank, vat, pump or other equipment with a hazard of backflow or backsiphonage and where the water connection is subject to backpressure, and an air gap cannot be installed, the Administrative Authority shall require the use of an approved reduced pressure zone backflow preventer. A partial list of such connections is shown in Table .09.20.11.05F, PARTIAL LIST OF CROSS CONNECTIONS SUBJECT TO BACK PRESSURE.

TABLE .09.20.11.05F

PARTIAL LIST OF CROSS CONNECTIONS SUBJECT TO BACK PRESSURE

Chemical Lines	Pumps
Cup Beverage Vending Machines	Steam Lines
Dock Water Outlets	Swimming Pools
Individual Water Supplies	Tank and Vats—Bottom
Industrial Process Water Lines	inlets
Pressure Tanks	Hose Bibs

G. Installation of devices.

- a. Vacuum Breakers—Vacuum breakers shall be installed with the critical level at least six (6) inches above the flood level rim of the fixture they serve and on the discharge side of the last control valve to the fixture. No shut off valve or faucet shall be installed beyond the vacuum breaker.
- b. Reduced Pressure Zone Backflow Preventer—A reduced pressure zone type backflow preventer may be installed subject to full static pressure.
- c. Devices of All Types—Backflow and backsiphonage preventing devices shall be accessibly located preferably in the same room with the fixture they serve. Installation in utility or service spaces, provided they are readily accessible, is also permitted.

H. Tanks and vats—Below rim supply.

- (1) Where a potable water outlet terminates below the rim of a tank or vat and the tank or vat has an overflow of diameter not less than given in Table .09.20.11.08C, SIZES OF OVERFLOW PIPES FOR WATER SUPPLY TANKS, the overflow pipe shall be provided with an air gap as close to the tank as possible.
- (2) The potable water outlet to the tank or vat shall terminate a distance not less than 1½ times the height to which water can rise in the tank above the top of the overflow. This level shall be established at the maximum flow rate of the supply to the tank or vat and with all outlets closed except the air-gapped overflow outlet.
- (3) The distance from the outlet to the high water level shall be measured from the critical point of the potable water supply outlet.

I. Barometric loop. Water connections not subject to back pressure where an actual or potential backflow or backsiphonage hazard exists may in lieu of devices specified in Section .09.20.11.05E, be provided with a barometric loop. Barometric loops shall precede the point of connection.

J. Lawn sprinklers. Lawn sprinkler systems when connected to a potable water system shall be installed in accordance with

these regulations. Adequate and proper provision shall be made to prevent backsiphonage.

.06 WATER SERVICE

A. Separation of water service and building sewer. Except as permitted below, the underground water service pipe and the building drain or building sewer shall be not less than 10 feet apart horizontally and shall be separated by undisturbed or compacted earth.

The water service pipe may be placed in the same trench or less than 10 feet horizontally with the building drain and building sewer provided the following conditions are met:

- (1) The bottom of the water service pipe at all points shall be at least 12 inches above the top of the sewer line at its highest point.
- (2) The water service pipe shall be placed on a solid shelf excavated at one side of the common trench.
- (3) The number of joints in the water service pipe shall be kept to a minimum.

B. Water service near sources of pollution. Potable water service pipes shall not be located in, under or above cesspools, septic tanks, septic tank drainage, fields of seepage pits. A separation of 10 feet shall be maintained. Where the water service must cross the sewer line, the bottom of the water service within 10 feet of the point of crossing, shall be at least 12 inches above the top of the sewer line. The sewer line shall be of cast iron with leaded or mechanical joints at least 10 feet on both sides of the crossing.

C. Stop and waste valves prohibited. Combination stop-and-waste valves or cocks shall not be installed underground in water service piping.

D. Water service pipe through wall. Clearance shall be provided around a water service pipe passing through walls to protect it against (a) chemical action from direct contact with concrete, (b) distortion or rupture of water service pipe from shearing action due to settlement, (c) distortion or rupture of the water service pipe caused by expansion or contraction.

Clearance shall be not less than one-half ($\frac{1}{2}$) inch between the outside of the pipe and the wall. Sleeves or arches may be used to provide the wall opening. The space between the pipe and wall structure shall be carefully packed or caulked with lead or waterproof and vermin and rodent resistant material.

.07 WATER PUMPING AND STORAGE EQUIPMENT

- A. **Pumps and other appliances.** Water pumps, filters, softeners, tanks, and all other appliances and devices used to handle or treat potable water shall be protected against contamination.
- B. **Prohibited location of potable supply tanks.** Potable water gravity tanks or manholes of potable water pressure tanks shall not be located directly under any soil or waste piping.

.08 WATER PRESSURE BOOSTER SYSTEMS

- A. **Water pressure booster systems required.** When the water pressure in the public water main or individual water supply system is insufficient to supply the probable peak demand flow to all plumbing fixtures and other water needs freely and continuously with the minimum pressures and quantities specified in Section .09.20.11.14C or elsewhere in this Code and in accordance with good practice, the rate of supply shall be supplemented by:
- (1) An elevated water tank.
 - (2) A hydro-pneumatic pressure booster system.
 - (3) A water pressure booster pump installed in accordance with Section .09.20.11.08G.
- B. **Support.** All water supply tanks shall be supported in accordance with the building code or other regulations which apply.
- C. **Overflows for water supply tanks.** Each gravity or suction water supply tank shall be provided with an overflow having a diameter not less than shown in Table .09.20.11.08C, SIZES OF OVERFLOW PIPES FOR WATER SUPPLY TANKS. The overflow outlet shall discharge above and within not less than six (6) inches of a roof or roof drain, floor or floor drain or over an open water supplied fixture.

The overflow outlet shall be covered by a corrosion resistant screen of not less than 16 x 20 mesh to the inch and by 1/4 inch hardware cloth or shall terminate in a horizontal angle seat check valve. Drainage from overflow pipes shall be directed so as not to freeze on roof walkways.

TABLE .09.20.11.08C

SIZES¹ FOR OVERFLOW PIPES FOR WATER SUPPLY TANKS

Maximum Capacity of Water Supply Line of Tank	Diameter of Overflow Pipe (Inches ID)	Maximum Capacity of Water Supply Line to Tank	Diameter of Overflow Pipe (Inches ID)
0- 13 gpm	1½	356- 640 gpm	5
14- 55 gpm	2	641-1040 gpm	6
56-100 gpm	2½	over-1040 gpm	8
101-165 gpm	3		
166-355 gpm	4		

¹ Computed by the method of NBS Mono. 31, for vertical pipes flowing not greater than ½ full at terminal velocity. (½ full for 1½ in. pipe).

- D. **Covers.** All water supply tanks shall be covered to keep out unauthorized persons, dirt, and vermin. The covers of gravity tanks shall be vented with a return bend vent pipe having an area not less than the area of the down feed riser pipe and the vent shall be screened with corrosion resistant screen having not less than 14 and not more than 20 openings per linear inch.
- E. **Potable water inlet control and location.** Potable water inlets to gravity tanks shall be controlled by a ballcock or other automatic supply valve so installed as to prevent the tank from overflowing. The inlet shall be terminated so as to provide an accepted air gap but in no case less than 4 inches above the overflow.
- F. **Tank drain pipes.** Each tank shall be provided at its lowest point with a valved pipe to permit emptying the tank which shall discharge as required for overflow pipes and not smaller in size than shown in Table .09.20.11.08F, SIZE OF DRAIN PIPES FOR WATER TANKS.

**TABLE .09.20.11.08F
SIZE OF DRAIN PIPES FOR WATER TANKS**

Tank Capacity (gallons)	Drain Pipe (inches)	Tank Capacity (gallons)	Drain Pipe (inches)
Up to 750	1	3001 to 5000	2½
751 to 1500	1½	5001 to 7500	3
1501 to 3000	2	over 7500	4

G. Low pressure cut-off required on booster pumps. When a booster pump is used on a water pressure booster system, there shall be installed a low pressure cut-off on the booster pump to prevent the creation of a vacuum or negative pressure on the suction side of the pump, thus cutting off water to other outlets.

H. Pressure tanks—vacuum relief. All water pressure tanks shall be provided with a vacuum relief valve at the top of the tank which will operate up to a maximum water pressure of 200 p.s.i. and to maximum water temperatures of 200° F. The minimum size of such vacuum relief valves shall be ½ inch.

.09 DISINFECTION OF POTABLE WATER SYSTEM

New or repaired potable water systems shall be disinfected prior to use whenever required by the authority having jurisdiction. The method to be followed shall be that prescribed by the health authority or, in case no method is prescribed by him, the following:

- A. The pipe system shall be flushed with clean, potable water until no dirty water appears at the points of outlet.
- B. The system or part thereof shall be filled with a water-chlorine solution containing at least 50 parts per million of chlorine and the system or part thereof shall be valved off and allowed to stand for 24 hours.
- C. The system or part thereof shall be filled with a water-chlorine solution containing at least 200 parts per million of chlorine and allowed to stand for 3 hours.
- D. Following the allowed standing time the system shall be flushed with clean potable water until no chlorine remains in the water coming from the system.

- E. The procedure shall be repeated if it is shown by a bacteriological examination made by the authority that contamination still persists in the system.

.10 WATER SUPPLY SYSTEM MATERIALS

A. Water service pipe. Water service piping to point of entrance to the building shall be made of asbestos cement pipe, brass pipe, copper tube, or copper pipe, cast iron water pipe, galvanized wrought iron pipe, galvanized open-hearth iron pipe, or galvanized steel pipe, or plastic pipe which shall be of Polyethylene PE-Type 3, 3306 as defined by ASTM D-1248-68, 160 lb. working pressure and shall conform to the Commercial Standard CS 255-63 or to the appropriate National Sanitation Foundation standard. Copper tube when used underground shall not be less than type L. All threaded ferrous pipe and fittings shall be galvanized or cement lined. When used underground in corrosive soil or fill, all ferrous pipe and fittings shall be coal-tar enamel coated and threaded joints shall be coated and wrapped when installed.

Any other ferrous or nonferrous, metallic or nonmetallic material may be used if approved for this use by one of the organizations listed in .09.20.04, and when used must comply with the requirements of Section .09.20.04.01B.

B. Water distribution system pipe. Water distribution system pipe shall be of brass pipe, copper tube, or copper pipe, galvanized wrought iron pipe, galvanized open-hearth iron pipe, galvanized steel pipe. Copper tube when used underground shall not be less than type L and when used above ground not less than type M.

Any other ferrous or nonferrous, metallic or nonmetallic material may be used if approved for this use by one of the organizations listed in .09.20.04, and when used must comply with the requirements of Section .09.20.04.01B.

C. Fittings. The materials of which water supply system pipe fittings are made shall conform to the type of piping materials used in the water supply system. The fittings shall have no ledges, shoulders, or reductions which can retard or obstruct flow in the piping.

D. Material strength. All materials used for water piping must be suitable for use with the maximum temperature and

pressure and velocities that may be encountered in the installation, including temporary increases and surges.

.11 ALLOWANCE FOR CHARACTER OF SOIL AND WATER

When selecting the material and size for water service supply pipe, tube, or fittings, due consideration shall be given to the action of the water on the interior of the pipe and of the soil, fill or other material on the exterior of the pipe. Chapter .09.20.14 gives recommendations concerning allowances to be made in sizing water piping because of the properties of the water.

.12 WATER SUPPLY CONTROL VALVES

- A. **Curb valve.** On each water service from a street main to a building an approved gate valve or ground key stopcock or ball valve shall be installed near the curblin between the property line and the curb. This valve or stopcock shall be provided with an approved curb valve box and shall not be under a driveway.
- B. **Building valve.** Each building water service shall be provided with a gate valve with bleed or a stop-and-waste valve or other full-way valve with bleed located inside the building near the point where the water service enters. Where there are two or more water services serving one building a check valve shall be installed on each service in addition to the above valves.
- C. **Tank controls.** Supply lines from pressure or gravity tanks shall be valved at or near the tanks.
- D. **Valves in dwelling units.** All water closets and kitchen sinks shall have individual fixture valves installed. Valves must also be installed for each bath, shower, powder room or fixture group. A group of fixtures means two or more fixtures adjacent to each other in the same family unit, but not necessarily in the same room. In a one family unit, one or two bathrooms back to back or one over the other may be considered a group. However, in each dwelling unit with two or more bathroom groups not adjacent to each other, one or more control valves or individual fixture valves shall be provided so that each group may be isolated from the other.

In more than single family dwelling units, one or more control valves shall be provided so that the water to any

plumbing fixture or group of fixtures in any one dwelling unit may be shut off without stopping flow of water to fixtures in other dwelling units. These valves shall be accessible inside the building unit controlled.

- E. **Riser valves.** Except in single family dwellings a valve shall be installed at the foot of each water supply riser. In multi-story buildings a valve shall be installed at the top of each water supply down-feed pipe and also at the base where required to isolate this riser for servicing.
- F. **Individual fixture valves.** In occupied buildings other than dwellings, the water service line to each fixture or other piece of equipment shall be provided with a valve or fixture stop to shut off the water to the fixture or to the room in which it is located. Sill cocks and wall hydrants shall be separately controlled by a valve inside the building.
- G. **Water heating equipment valve.** The cold water branch to each hot water storage tank or water heater shall be provided with a valve located near the equipment and only serving this equipment. Each tank or heater shall be equipped with an approved automatic relief valve as specified in Paragraph .09.20.11.16A.
- H. **Meter valve.** A gate valve or other full-way valve shall be installed in the line on the discharge side of each water meter. The valve shall not be less in size than the building water service.
- I. **Valves to be accessible.** All water supply control valves shall be placed so as to be accessible for service and maintenance.
- J. **Control valve design.** Except to single fixtures, control valves on all water lines shall when fully opened have a cross sectional area not less than 85 per cent of the cross sectional area of the line in which they are installed.

.13 WATER SUPPLY DISTRIBUTION

- A. **Size of water service.** The water service pipe shall be of sufficient size to furnish water to the building in the quantities and at the pressures required elsewhere in this Code. It shall, in no case, be less than $\frac{3}{4}$ inch nominal diameter.
- B. **Supply demand.** The supply demand in gallons per minute in the building water distributing system shall be determined on the basis of the load in terms of supply fixture units

and of the relationship between load and supply demand as shown in Tables .09.20.11.13B(1) and .09.20.11.13B(2).

TABLE .09.20.11.13B (1)
SIZING THE WATER SUPPLY SYSTEM

Fixture	Occupancy	Type of Supply Control	Load in Fixture ^{1 2} Units
Bathroom Group ³	Private	Flush valve for closet	8
Bathroom Group	Private	Flush tank for closet	6
Bathtub	Private	Faucet	2
Bathtub	Public	Faucet	4
Clothes Washer	Private	Faucet	2
Clothes Washer	Public	Faucet	4
Combination Fixture	Private	Faucet	3
Kitchen Sink	Private	Faucet	2
Kitchen Sink	Hotel, Restaurant	Faucet	4
Laundry Trays (1 to 3)	Private	Faucet	3
Lavatory	Private	Faucet	1
Lavatory	Public	Faucet	2
Separate Shower	Private	Mixing Valve	2
Service Sink	Office, Etc.	Faucet	3
Shower Head	Private	Mixing Valve	2
Shower Head	Public	Mixing Valve	4
Urinal-Pedestal	Public	Flush Valve	10
Urinal-Stall or Wall	Public	Flush Valve	5
Urinal-Stall or Wall	Public	Flush Tank	3
Water Closet	Private	Flush Valve	6
Water Closet	Private	Flush Tank	3
Water Closet	Public	Flush Valve	10
Water Closet	Public	Flush Tank	5

Water supply outlets for items not listed above shall be computed at their maximum demand, but in no case less than:

Fixture	Number of Fixture Units	
	Private Use	Public Use
3/8 inch	1	2
1/2 inch	2	4
3/4 inch	3	6
1 inch	6	10

¹ For supply outlets likely to impose continuous demands, estimate continuous supply separately and add to total demand for fixtures.

² The given weights are for total demand. For fixtures with both hot and cold water supplies, the weights for maximum separate demands may be taken as 3/4 the listed demand for the supply.

³ A bathroom group for the purposes of this table consists of not more than one water closet, one lavatory, one bathtub, one shower stall or not more than one water closet, two lavatories, one bathtub or one separate shower stall.

TABLE .09.20.11.13B (2)
ESTIMATING DEMAND

Supply Systems Predominantly For Flush Tanks		Supply Systems Predominantly For Flush Valves	
Load (Water Supply Fixture Units)	Demand GPM	Load (Water Supply Fixture Units)	Demand GPM
6	5		
8	6.5		
10	8	10	27
12	9.2	12	28.6
14	10.4	14	30.2
16	11.6	16	31.8
18	12.8	18	33.4
20	14	20	35
25	17	25	38
30	20	30	41
35	22.5	35	43.8
40	24.8	40	46.5
45	27	45	49
50	29	50	51.5
60	32	60	55
70	35	70	58.5
80	38	80	62
90	41	90	64.8
100	43.5	100	67.5
120	48	120	72.5
140	52.5	140	77.5
160	57	160	82.5
180	61	180	87
200	65	200	91.5
225	70	225	97
250	75	250	101
275	80	275	105.5
300	85	300	110
400	105	400	126
500	125	500	142
750	170	750	178
1,000	208	1,000	208
1,250	240	1,250	240
1,500	267	1,500	267
1,750	294	1,750	294
2,000	321	2,000	321
2,250	348	2,250	348
2,500	375	2,500	375
2,750	402	2,750	402
3,000	432	3,000	432
4,000	525	4,000	525
5,000	593	5,000	593
6,000	643	6,000	643
7,000	685	7,000	685
8,000	718	8,000	718
9,000	745	9,000	745
10,000	769	10,000	769

.14 PROCEDURE IN SIZING THE WATER DISTRIBUTION SYSTEM

- A. **Design of building water distribution system.** Water piping systems shall be designed and installed so that the maximum velocity at any time shall not exceed 10 ft. per second. If a manufacturer's recommendations, or an industry's standards, limits the recommended velocities in any particular piping material to a value lower than 10 ft. per second, then the reduced velocity limit shall be the maximum design.
- B. **Size of fixture supply.** The minimum sizes of a fixture supply pipe shall be as shown in Table .09.20.11.14B, MINIMUM SIZES OF FIXTURE SUPPLY PIPES. The fixture supply pipe shall be extended to within at least 30 inches of the point of connection to the fixture, and be within the same area and physical space as the point of connection to the fixture.

**TABLE .09.20.11.14B
MINIMUM SIZES OF FIXTURE WATER SUPPLY PIPES**

Type of Fixture or device	Nominal Pipe Size (Inches)	Type of Fixture or device	Nominal Pipe Size (Inches)
Bath tubs	½	Shower (single head)	½
Combination sink and tray	½	Sinks (service)	½
Drinking fountain	¾	Sinks (flushing rim)	¾
Dishwasher (domestic)	½	Urinal (flush tank)	½
Electric drinking water cooler	¾	Urinal (direct flush valve)	¾
Kitchen sink, residential	½	Water closet (tank type)	¾
Kitchen sink, commercial	¾	Water closet (flush valve type)	1
Lavatory	¾	Hose bib	½
Laundry, tray 1, 2 or 3 compartments	½	Wall hydrant	½

- C. **Minimum flow rates and pressures required in water distribution system.** Based on the minimum static pressure available, pipe sizes shall be selected so that under conditions of peak demand a minimum flow pressure at the point of discharge shall be not less than required to maintain minimum flow rates listed in Table .09.20.11.14C. Pipe sizes for flush valve water closets and urinals shall be adequate to maintain flow pressures of 25 pounds per square inch for blowout action

and 15 pounds per square inch for jet action fixtures or as required by the manufacturer.

D. **Maximum flow rates.** Flow rates for fixtures in commercial and public buildings shall be regulated at the fixture to prevent flow rates from exceeding maximum rates listed in Table .09.20.11.14C for either hot or cold water.

E. **Mixed water temperature control.** The temperature of mixed water to multiple or gang showers shall be controlled by a master thermostatic blender or such showers may be individually regulated by balanced pressure mixing valves. Individual showers in commercial and public buildings subject to rapid rise of mixed water temperature due to system pressure fluctuation shall have balanced pressure mixing valves in addition to flow regulation as required by Paragraph .09.20.11.14D.

TABLE .09.20.11.14C

MINIMUM AND MAXIMUM FLOW RATES PER OUTLET

Fixture	Flow Rate Minimum	GPM Maximum
Lavatory.....	2	4
Sink.....	4	8
Bathtub.....	6	—
Laundry Tray.....	5	—
Shower.....	4	8
Water Closets		
Tank Type.....	3	6
Blowout Action } Jet Action }	Depends on Flow Pressure	
Drinking Fountain.....	0.75	2.0
Wall Hydrant.....	5	—

F. **Inadequate water pressure.** Whenever water pressure from the street main or other sources of supply is insufficient to provide flow pressures at fixture outlets as required under Section .09.20.11.14C, a booster pump and pressure tank or other approved means shall be installed on the building water supply system.

G. **Variable street pressures.** Where street water main pressures fluctuate, the building water distribution system shall be designed for the minimum pressure available.

- H. **Excessive pressures.** When street main pressure exceeds 80 p.s.i., an approved pressure reducing valve shall be installed in the water service pipe near its entrance to the building to reduce the water pressure to 80 p.s.i. or lower except where the water service pipe supplies water directly to a water pressure booster system, an elevated water gravity tank, or to pumps provided in connection with a hydropneumatic or elevated gravity water supply tank system. Pressure at any fixture shall be limited to no more than 80 p.s.i. under no-flow conditions.
- I. **Water hammer.** All building water supply systems in which quick acting valves are installed shall be provided with devices to absorb high pressures resulting from the quick closing of these valves. These pressure absorbing devices shall be either air chambers or approved mechanical devices. Water pressure absorbers shall be placed as close as possible to the quick acting valves or installed also at the ends of long pipe runs or near batteries of fixtures.
- a. **Air Chambers** — Where air chambers are installed, they shall be in an accessible place and each air chamber shall be provided with an accessible means for restoring the air in event the chamber becomes waterlogged.
 - b. **Mechanical Devices** — Where mechanical devices are used the manufacturer's specifications shall be followed as to location and method of installation.

.15 HOT WATER DISTRIBUTION

- A. **Hot water supply system.** In residences and buildings intended for human occupancy, hot water shall be supplied to all plumbing fixtures and equipment used for bathing, washing, culinary purpose, cleansing, laundry or building maintenance.
- B. **Return circulation—where required.** Hot water supply systems in buildings four or more stories high or in buildings where developed length of hot water piping from the source of hot water supply to the farthest fixture supplied exceeds 100 feet shall be of the return circulation type and shall be recirculated to within 75 feet of the hot water outlet.

C. **Minimum requirements for hot water storage tanks.** Hot water storage tanks shall be adequate in size, when combined with the B.T.U. input of the water heating equipment to provide the rise in temperature necessary.

The water heater and storage tank shall be sized to provide sufficient hot water to provide both daily requirements and hourly peak loads of the occupants of the building.

Hot water storage tanks shall meet construction requirements of ASME, AGA or UL as appropriate.

Storage tanks less in volume than those requirements specified by ASME shall be of durable materials and constructed to withstand 125 p.s.i. with a safety factor of 2.

The water inlets and outlets of a hot water storage tank shall be not less than the hot water distribution pipe served.

All storage tanks shall be protected against excessive temperatures and pressure conditions as specified in this Code.

D. **Drain cocks or valves for hot water storage tanks.** Drain cocks or valves for emptying shall be installed at the lowest point of each hot water storage tank.

.16 SAFETY DEVICES

A. **Pressure relief valves and temperature relief valves required.**

Equipment used for heating water or storing hot water shall be protected by approved safety devices in accordance with one of the following methods:

- (1) A separate pressure relief valve and a separate temperature relief valve; or
- (2) A combination pressure and temperature relief valve; or
- (3) A combination of either "1" or "2" above and an energy cut-off device.

Safety devices shall meet the requirements of the American National Standards Institute, American Society of Mechanical Engineers, or the Underwriters Laboratories. Listing by Underwriters Laboratories, American Gas Association or National Board of Boiler and Pressure Vessel Inspectors shall constitute evidence of conformance with these standards. Where a device is not listed by any of these, it must have certification by an approved laboratory as having met these requirements.

b. b. B. **Pressure relief valves.** Pressure relief valves shall meet the ANSI standards and the ASME standards when required by the Administrative Authority. The valves shall have a relief rating adequate to meet the pressure conditions in the equipment served. They shall be installed either directly in a top tank tapping or in the hot or cold outlet line close to the tank. There shall be no shutoff valve between the pressure relief valve and the tank. The pressure relief valve must be set to open at not less than 25 p.s.i. above the street main pressure or not less than 25 p.s.i. above the setting of any house water pressure regulating valve. The setting shall not exceed the tank rated working pressure.

C. **Temperature relief valves.** Temperature relief valves shall be of adequate relief rating, expressed in BTU/HR, for the equipment served. They shall be installed so that the temperature sensing element is immersed in the hottest water within the top 6 inches of the tank. The valve shall be set to open when the stored water temperature is 210° F. (or less).

These valves must be approved by an appropriate standard or by the Administrative Authority for the intended use, and shall be sized so that when the valve opens, the water temperature cannot exceed 210° F. with the water heating equipment operating at maximum input.

D. **Combination pressure-temperature relief valves.** Combination pressure-temperature relief valves shall comply with all the requirements of the separate pressure and temperature relief valves.

E. **Energy cut-off devices.** Deleted.

F. **Installation of relief valves.** No check valve or shut-off valve shall be installed between any safety device and the hot water equipment used, nor shall there be any shut-off valve or traps or dips in the discharge pipe from the relief valve. The discharge pipe shall not be smaller than the relief valve outlet and it shall be in indirect connection into a plumbing fixture, floor drain, sump pit or other approved point of discharge. Relief outlets when connected to the building drainage system shall be indirectly connected.

The terminal end of a discharge pipe must not be threaded.

In addition to all other requirements, if the relief outlet discharge piping is installed so that it leaves the room or enclosure in which the water heater and relief valve are located, there must be an air gap installed before or at this point of leaving the room or enclosure.

This air gap may be the same one used to comply with other provisions at this section. All piping after the air gap, or indirect connection must be sized as a gravity drain using Par. .09.20.12.04B to determine equivalent fixture unit load and Table .09.20.12.05A to determine drain sizes, and such other tables and regulations as may be applicable. These provisions as to air gap and drain sizing apply to single and multiple relief valve piping installations.

Acrylonitrile-Butadiene-Styrene (ABS) and Polyvinyl Chloride (PVC), DWV plastic pipe and fittings conforming to Table .09.20.04.01C, in one- or two-family homes only may be used to extend relief valve discharge piping and also serve for the air-conditioning condensate waste. At the point to discharge into non-metallic material, an air gap must be installed.

- G. **Vacuum relief valves.** Where a hot water storage tank or an indirect water heater is located at an elevation above the fixture outlets in the hot water system, a vacuum relief valve shall be installed on the storage tank or heater.
- H. **Pressure marking of hot water storage tank.** Hot water storage tanks shall be permanently marked in an accessible place with the maximum allowable working pressure, in accordance with the applicable standard.