# CHAPTER 2

## DEFINITIONS

**201.0 General.**

For the purpose of this code, the following terms have the meanings indicated in this chapter.

No attempt is made to define ordinary words, which are used in accordance with their established dictionary meanings, except where a word has been used loosely and it is necessary to define its meaning as used in this code to avoid misunderstanding.

The definitions of terms are arranged alphabetically according to the first word of the term.

**202.0 Definition of Terms.**

**203.0 – A –**

**ABS** – Acrylonitrile-butadiene-styrene.

**Accessible** – When applied to a fixture, connection, appliance, or equipment, "accessible" means having access thereto, but which first may require the removal of an access panel, door, or similar obstruction. "Readily accessible" means direct access without the necessity of removing any panel, door, or similar obstruction.

**Airbreak** – A physical separation which may be a low inlet into the indirect waste receptor from the fixture, appliance, or device indirectly connected.

**Airgap, Drainage** – The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe, plumbing fixture, appliance, or appurtenance conveying waste to the flood-level rim of the receptor.

**Airgap, Water Distribution** – The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet conveying potable water to the flood-level rim of any tank, vat, or fixture.

**Anchors** – See Supports.

**Approved** – Acceptable to the Authority Having Jurisdiction.

**Approved Testing Agency** – An organization primarily established for purposes of testing to approved standards and approved by the Authority Having Jurisdiction.

**Area Drain** – A receptor designed to collect surface or storm water from an open area.

**Aspirator** – A fitting or device supplied with water or other fluid under positive pressure that passes through an integral orifice or constriction, causing a vacuum.

**Authority Having Jurisdiction** – The organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, installations, or procedures. The Authority Having Jurisdiction shall be a federal, state, local, or other regional department or an individual such as a plumbing official, mechanical official, labor department official, health department official, building official, or others having statutory authority. In the absence of a statutory authority, the Authority Having Jurisdiction may be some other responsible party. This definition shall include the Authority Having Jurisdiction's duly authorized representative.

**204.0 – B –**

**Backflow** – The flow of water or other liquids, mixtures, or substances into the distributing pipes of a potable supply of water from any sources other than its intended source. See Back-Siphonage, Back-Pressure Backflow.

**Backflow Connection** – Any arrangement whereby backflow can occur.

**Back-Pressure Backflow** – Backflow due to an increased pressure above the supply pressure, which may be due to pumps, boilers, gravity, or other sources of pressure.

**Backflow Preventer** – A device or means to prevent backflow into the potable water system.

**Back-Siphonage** – The flowing back of used, contaminated, or polluted water from a plumbing fixture or vessel into a water supply pipe due to a pressure less than atmospheric in such pipe. See Backflow.

**Backwater Valve** – A device installed in a drainage system to prevent reverse flow.

**Bathroom Group** – A group of fixtures consisting of a water closet, one or two lavatories, and either a bathtub, a combination bath/shower, or a shower and may include a urinal or bidet and an emergency floor drain.

**Bathroom, Half** – A room equipped with only a water closet and lavatory.

**Battery of Fixtures** – Any group of two (2) or more similar, adjacent fixtures that discharge into a common horizontal waste or soil branch.

**Boiler Blowoff** – An outlet on a boiler to permit emptying or discharge of sediment.

**Branch** – Any part of the piping system other than a main, riser, or stack.

**Branch, Fixture** – See Fixture Branch.

**Branch, Horizontal** – See Horizontal Branch.

**Branch Vent** – A vent connecting one (1) or more individual vents with a vent stack or stack vent.

**Building** – A structure built, erected, and framed of component structural parts designed for the housing, shelter, enclosure, or support of persons, animals, or property of any kind.

**Building Drain** – That part of the lowest piping of a drainage system that receives the discharge from soil, waste, and other drainage pipes inside the walls of the building and conveys it to the building sewer beginning two (2) feet (610 mm) outside the building wall.

**Building Drain (Sanitary)** – A building drain that conveys sewage only.

**Building Drain (Storm)** – A building drain that conveys storm water or other drainage, but no sewage.

**Building Sewer** – That part of the horizontal piping of a drainage system that extends from the end of the building drain and that receives the discharge of the building drain and conveys it to a public sewer, private sewer, private sewage disposal system, or other point of disposal.

**Building Sewer (Combined)** – A building sewer that conveys both sewage and storm water or other drainage.

**Building Sewer (Sanitary)** – A building sewer that conveys sewage only.

**Building Sewer (Storm)** – A building sewer that conveys storm water or other drainage, but no sewage.

**Building Subdrain** – That portion of a drainage system that does not drain by gravity into the building sewer.

**Building Supply** – The pipe carrying potable water from the water meter or other source of water supply to a building or other point of use or distribution on the lot. Building supply shall also mean water service.

## 205.0 – C –

**Certified Backflow Assembly Tester** – A person who has shown competence to test and maintain backflow assemblies to the satisfaction of the Authority Having Jurisdiction.

**Cesspool** – A lined excavation in the ground that receives the discharge of a drainage system or part thereof, so designed as to retain the organic matter and solids discharging therein, but permitting the liquids to seep through the bottom and sides.

**Chemical Waste** – See Special Wastes.

**Clarifier** – See Interceptor.

**Clear Water Waste** – Cooling water and condensate drainage from refrigeration and air-conditioning equipment; cooled condensate from steam heating systems; and cooled boiler blowdown water.

**Clinic Sink** – A sink designed primarily to receive wastes from bedpans and having a flush rim, an integral trap with a visible trap seal, and the same flushing and cleansing characteristics as a water closet.

**Code** – A standard that is an extensive compilation of provisions covering broad subject matter or that is suitable for adoption into law independently of other codes and standards.

**Combination Thermostatic/Pressure Balancing Valve** – A mixing valve that senses outlet temperature and incoming hot and cold water pressure and compensates for fluctuations in incoming hot and cold water temperatures and/or pressures to stabilize outlet temperatures.

**Combination Waste and Vent System** – A specially designed system of waste piping embodying the horizontal wet venting of one or more sinks or floor drains by means of a common waste and vent pipe, adequately sized to provide free movement of air above the flow line of the drain.

**Combined Building Sewer** – See Building Sewer (Combined).

**Common** – That part of a plumbing system that is so designed and installed as to serve more than one (1) appliance, fixture, building, or system.

**Conductor** – A pipe inside the building that conveys storm water from the roof to a storm drain, combined building sewer, or other approved point of disposal.

**Confined Space** – A room or space having a volume less than fifty (50) cubic feet per 1,000 Btu/h (1.4 $m^3$/293 W) of the aggregate input rating of all fuel-burning appliances installed in that space.

**Contamination** – An impairment of the quality of the potable water that creates an actual hazard to the public health through poisoning or through the spread of disease by sewage, industrial fluids, or waste. Also defined as High Hazard.

**Continuous Vent** – A vertical vent that is a continuation of the drain to which it connects.

**Continuous Waste** – A drain connecting the compartments of a set of fixtures to a trap or connecting other permitted fixtures to a common trap.

**CPVC** – Chlorinated Poly (Vinyl Chloride).

**Critical Level** – The critical level (C-L or C/L) marking on a backflow prevention device or vacuum breaker is a point conforming to approved standards and established by the testing laboratory (usually

stamped on the device by the manufacturer) that determines the minimum elevation above the flood-level rim of the fixture or receptor served at which the device may be installed. When a backflow prevention device does not bear a critical level marking, the bottom of the vacuum breaker, combination valve, or the bottom of any such approved device shall constitute the critical level.

**Cross-Connection** – Any connection or arrangement, physical or otherwise, between a potable water supply system and any plumbing fixture or any tank, receptor, equipment, or device, through which it may be possible for nonpotable, used, unclean, polluted, and contaminated water, or other substances to enter into any part of such potable water system under any condition.

**206.0 – D –**

**Department Having Jurisdiction** – The Authority Having Jurisdiction, including any other law enforcement agency affected by any provision of this code, whether such agency is specifically named or not.

**Design Flood Elevation** – The elevation of the "design flood," including wave height, relative to the datum specified on the community's legally designated flood hazard map.

**Developed Length** – The length along the center line of a pipe and fittings.

**Diameter** – Unless specifically stated, "diameter" is the nominal diameter as designated commercially.

**Domestic Sewage** – The liquid and water-borne wastes derived from the ordinary living processes, free from industrial wastes, and of such character as to permit satisfactory disposal, without special treatment, into the public sewer or by means of a private sewage disposal system.

**Downspout** – The rain leader from the roof to the building storm drain, combined building sewer, or other means of disposal located outside of the building. See Conductor and Leader.

**Drain** – Any pipe that carries waste or waterborne wastes in a building drainage system.

**Drainage System** – Includes all the piping within public or private premises that conveys sewage or other liquid wastes to a legal point of disposal, but does not include the mains of a public sewer system or a public sewage treatment or disposal plant.

**Durham System** – A soil or waste system in which all piping is threaded pipe, tubing, or other such rigid construction, using recessed drainage fittings to correspond to the types of piping.

**207.0 – E –**

**Effective Opening** – The minimum cross-sectional area at the point of water supply discharge measured or expressed in terms of (1) diameter of a circle or (2) if the opening is not circular, the diameter of a circle of equivalent cross-sectional area. (This is applicable also to airgap.)

**Essentially Nontoxic Transfer Fluid** - Essentially nontoxic at practically nontoxic, Toxicity Rating Class 1 (reference "Clinical Toxicology of Commercial Products" by Gosselin, Smith, Hodge, & Braddock).

**Existing Work** – A plumbing system or any part thereof that has been installed prior to the effective date of this code.

**208.0 – F –**

**Fixture Branch** – A water supply pipe between the fixture supply pipe and the water distributing pipe.

**Fixture Drain** – The drain from the trap of a fixture to the junction of that drain with any other drain pipe.

**Fixture Supply** – A water supply pipe connecting the fixture with the fixture branch.

**Fixture Unit** – A quantity in terms of which the load-producing effects on the plumbing system of different kinds of plumbing fixtures are expressed on some arbitrarily chosen scale.

**Flammable Vapor or Fumes** – The concentration of flammable constituents in air that exceeds 25 percent of its lower flammability limit (LFL).

**Flood Hazard Area** – The greater of the following two areas:

(1) The area within a floodplain subject to a one (1) percent or greater chance of flooding in any given year.

(2) The area designated as a flood hazard area on a community's flood hazard map, or otherwise legally designated.

**Flood Hazard Area Subject to High Velocity Wave Action** – Area within the flood hazard area that is subject to high velocity wave action, and shown on a Flood Insurance Rate Map or other flood hazard map as Zone V, VO, VE or V1-30.

**Flood Level** – See Flooded.

**Flood-Level Rim** – The top edge of a receptor from which water overflows.

**Flooded** – A fixture is flooded when the liquid therein rises to the flood-level rim.

**Flush Tank** – A tank located above or integral with water closets, urinals, or similar fixtures for the purpose of flushing the usable portion of the fixture.

**Flush Valve** – A valve located at the bottom of a tank for the purpose of flushing water closets and similar fixtures.

**Flushometer Tank** – A tank integrated within an air accumulator vessel that is designed to discharge a predetermined quantity of water to fixtures for flushing purposes.

**Flushometer Valve** – A valve that discharges a predetermined quantity of water to fixtures for flushing purposes and is actuated by direct water pressure.

**FOG Disposal System** – A grease interceptor that reduces nonpetroleum fats, oils, and grease (FOG) in effluent by separation, mass and volume reduction.

## 209.0 – G –

**Gang or Group Shower** – Two (2) or more showers in a common area.

**Grade** – The slope or fall of a line of pipe in reference to a horizontal plane. In drainage, it is usually expressed as the fall in a fraction of an inch (mm) or percentage slope per foot (meter) length of pipe.

**Gravity Grease Interceptor** – A plumbing appurtenance or appliance that is installed in a sanitary drainage system to intercept nonpetroleum fats, oils, and greases (FOG) from a wastewater discharge and is identified by volume, thirty (30) minute retention time, baffle(s), not less than two (2) compartments, a total volume of not less than three-hundred (300) gallons, and gravity separation. [These interceptors comply with the requirements of Chapter 10 or are designed by a registered professional engineer.] Gravity grease interceptors are generally installed outside.

**Grease Interceptor** – A plumbing appurtenance or appliance that is installed in a sanitary drainage system to intercept nonpetroleum fats, oil, and greases (FOG) from a wastewater discharge.

**Grease Removal Device (GRD)** – Any hydromechanical grease interceptor that automatically, mechanically removes non-petroleum fats, oils and grease (FOG) from the interceptor, the control of which are either automatic or manually initiated.

## 210.0 – H –

**Hangers** – See Supports.

**High Hazard** – See Contamination.

**Horizontal Branch** – A drain pipe extending laterally from a soil or waste stack or building drain with or without vertical sections or branches, which receives the discharge from one (1) or more fixture drains and conducts it to the soil or waste stack or to the building drain.

**Horizontal Pipe** – Any pipe or fitting that is installed in a horizontal position or which makes an angle of less than forty-five (45) degrees with the horizontal.

**Hot Water** – Water at a temperature exceeding or equal to 120°F (49°C).

**House Drain** – See Building Drain.

**House Sewer** – See Building Sewer.

**Hydromechanical Grease Interceptor** – A plumbing appurtenance or appliance that is installed in a sanitary drainage system to intercept nonpetroleum fats, oil, and grease (FOG) from a wastewater discharge and is identified by flow rate, and separation and retention efficiency. The design incorporates air entrainment, hydromechanical separation, interior baffling, and/or barriers in combination or separately, and one of the following:

A – External flow control, with air intake (vent): directly connected

B – External flow control, without air intake (vent): directly connected

C – Without external flow control, directly connected

D – Without external flow control, indirectly connected

[These interceptors comply with the requirements of Table 10-2.] Hydromechanical grease interceptors are generally installed inside.

## 211.0 – I –

**Indirect Waste Pipe** – A pipe that does not connect directly with the drainage system but conveys liquid wastes by discharging into a plumbing fixture, interceptor, or receptacle that is directly connected to the drainage system.

**Individual Vent** – A pipe installed to vent a fixture trap and that connects with the vent system above the fixture served or terminates in the open air.

**Industrial Waste** – Any and all liquid or waterborne waste from industrial or commercial processes, except domestic sewage.

**Insanitary** – A condition that is contrary to sanitary principles or is injurious to health.

Conditions to which "insanitary" shall apply include the following:

(1) Any trap that does not maintain a proper trap seal.

(2) Any opening in a drainage system, except where lawful, that is not provided with an approved liquid-sealed trap.

(3) Any defective fixture, trap, pipe, or fitting.

(4) Any trap, except where in this code exempted, directly connected to a drainage system, the seal

of which is not protected against siphonage and back-pressure by a vent pipe.

(5) Any connection, cross-connection, construction, or condition, temporary or permanent, that would permit or make possible by any means whatsoever for any unapproved foreign matter to enter a water distribution system used for domestic purposes.

(6) The foregoing enumeration of conditions to which the term "insanitary" shall apply, shall not preclude the application of that term to conditions that are, in fact, insanitary.

**Interceptor (Clarifier)** – A device designed and installed so as to separate and retain deleterious, hazardous, or undesirable matter from normal wastes and permit normal sewage or liquid wastes to discharge into the disposal terminal by gravity.

**Invert** – The lowest portion of the inside of a horizontal pipe.

## 212.0 – J –

**Joint, Brazed** – Any joint obtained by joining of metal parts with alloys that melt at temperatures exceeding 1000°F (538°C), but less than the melting temperature of the parts to be joined.

**Joint, Soldered** – A joint obtained by the joining of metal parts with metallic mixtures or alloys that melt at a temperature up to and including 840°F (449°C).

## 213.0 – K –

No definitions

## 214.0 – L –

**Labeled** – Equipment or materials bearing a label of a listing agency (accredited conformity assessment body). See Listed (third-party certified).

**Lavatories in Sets** – Two (2) or three (3) lavatories that are served by one (1) trap.

**Leader** – An exterior vertical drainage pipe for conveying storm water from roof or gutter drains. See Downspout.

**Liquid Waste** – The discharge from any fixture, appliance, or appurtenance in connection with a plumbing system that does not receive fecal matter.

**Listed (Third-party certified)** – Equipment or materials included in a list published by a listing agency (accredited conformity assessment body) that maintains periodic inspection on current production of listed equipment or materials and whose listing states either that the equipment or material complies with approved standards or has been tested and found suitable for use in a specified manner.

**Listing Agency** – An agency accredited by an independent and authoritative conformity assessment body to operate a material and product listing and labeling (certification) system and that is accepted by the Authority Having Jurisdiction, which is in the business of listing or labeling. The system includes initial and ongoing product testing, a periodic inspection on current production of listed (certified) products, and makes available a published report of such listing in which specific information is included that the material or product conforms to applicable standards and found safe for use in a specific manner.

**Lot** – A single or individual parcel or area of land legally recorded or validated by other means acceptable to the Authority Having Jurisdiction on which is situated a building or which is the site of any work regulated by this code, together with the yards, courts, and unoccupied spaces legally required for the building or works, and that is owned by or is in the lawful possession of the owner of the building or works.

**Low Hazard** – See Pollution.

## 215.0 – M –

**Macerating Toilet System** – A system comprised of a sump with macerating pump and with connections for a water closet and other plumbing fixtures, which is designed to accept, grind, and pump wastes to an approved point of discharge.

**Main** – The principal artery of any system of continuous piping to which branches may be connected.

**Main Sewer** – See Public Sewer.

**Main Vent** – The principal artery of the venting system to which vent branches may be connected.

**May** – A permissive term.

**Mobile Home Park Sewer** – That part of the horizontal piping of a drainage system that begins two (2) feet (610 mm) downstream from the last mobile home site and conveys it to a public sewer, private sewer, private sewage disposal system, or other point of disposal.

## 216.0 – N –

**Nuisance** – Includes, but is not limited to:

(1) Any public nuisance known at common law or in equity jurisprudence.

(2) Whenever any work regulated by this code is dangerous to human life or is detrimental to health and property.

(3) Inadequate or unsafe water supply or sewage disposal system.

**217.0 – O –**

**Offset** – A combination of elbows or bends in a line of piping that brings one (1) section of the pipe out of line but into a line parallel with the other section.

**Oil Interceptor** – See Interceptor.

**218.0 – P –**

**PB** – Polybutylene.

**PE** – Polyethylene.

**PE-AL-PE** – Polyethylene-aluminum-polyethylene.

**PEX** – Cross-linked polyethylene.

**PEX-AL-PEX** – Cross-linked polyethylene–aluminum-cross-linked polyethylene.

**Person** – A natural person, his heirs, executor, administrators, or assigns and shall also include a firm, corporation, municipal or quasi-municipal corporation, or governmental agency. Singular includes plural, male includes female.

**Pipe** – A cylindrical conduit or conductor conforming to the particular dimensions commonly known as "pipe size."

**Plumbing** – The business, trade, or work having to do with the installation, removal, alteration, or repair of plumbing systems or parts thereof.

**Plumbing Appliance** – Any one (1) of a special class of devices or equipment that is intended to perform a special plumbing function. Its operation and/or control may be dependent upon one (1) or more energized components, such as motors, controls, heating elements, or pressure- or temperature-sensing elements. Such device or equipment may operate automatically through one (1) or more of the following actions: a time cycle, a temperature range, a pressure range, a measured volume or weight; or the device or equipment may be manually adjusted or controlled by the user or operator.

**Plumbing Appurtenance** – A manufactured device, a prefabricated assembly, or an on-the-job assembly of component parts that is an adjunct to the basic piping system and plumbing fixtures. An appurtenance demands no additional water supply, nor does it add any discharge load to a fixture or the drainage system. It performs some useful function in the operation, maintenance, servicing, economy, or safety of the plumbing system.

**Plumbing Fixture** – An approved-type installed receptacle, device, or appliance that is supplied with water or that receives liquid or liquid-borne wastes and discharges such wastes into the drainage system to which it may be directly or indirectly connected. Industrial or commercial tanks, vats, and similar processing equipment are not plumbing fixtures, but may be connected to or discharged into approved traps or plumbing fixtures when and as otherwise provided for elsewhere in this code.

**Plumbing Official** – See Authority Having Jurisdiction.

**Plumbing System** – Includes all potable water, building supply, and distribution pipes; all plumbing fixtures and traps; all drainage and vent pipes; and all building drains and building sewers, including their respective joints and connections, devices, receptors, and appurtenances within the property lines of the premises and shall include potable water piping, potable water treating or using equipment, medical gas and medical vacuum systems, liquid and water heaters and vents for same.

**Pollution** – An impairment of the quality of the potable water to a degree that does not create a hazard to the public health but which does adversely and unreasonably affect the aesthetic qualities of such potable water for domestic use. Also defined as Low Hazard.

**Potable Water** – Water that is satisfactory for drinking, culinary, and domestic purposes and that meets the requirements of the Health Authority Having Jurisdiction.

**PP** – Polypropylene.

**Pressure** – The normal force exerted by a homogeneous liquid or gas, per unit of area, on the wall of the container.

**Static Pressure** – The pressure existing without any flow.

**Residual Pressure** – The pressure available at the fixture or water outlet after allowance is made for pressure drop due to friction loss, head, meter, and other losses in the system during maximum demand periods.

**Pressure-Balancing Valve** – A mixing valve that senses incoming hot and cold water pressures and compensates for fluctuations in either to stabilize outlet temperature.

**Private or Private Use** – Applies to plumbing fixtures in residences and apartments, to private bathrooms in hotels and hospitals, and to restrooms in commercial establishments where the fixtures are intended for the use of a family or an individual.

**Private Sewage Disposal System** – A septic tank with the effluent discharging into a subsurface disposal field, into one (1) or more seepage pits, or into a combination of subsurface disposal field and seepage pit or of such other facilities as may be permitted under the procedures set forth by other regulating agencies.

**Private Sewer** – A building sewer that receives the discharge from more than one (1) building drain and conveys it to a public sewer, private sewage disposal system, or other point of disposal.

**Public or Public Use** – Applies to plumbing fixtures that are not defined as private or private use.

**Public Sewer** – A common sewer directly controlled by public authority.

**PVC** – Poly(vinyl chloride).

**PVDF** – Polyvinylidene Fluoride.

## 219.0 – Q –

No definitions

## 220.0 – R –

**Receptor** – An approved plumbing fixture or device of such material, shape, and capacity as to adequately receive the discharge from indirect waste pipes, so constructed and located as to be readily cleaned.

**Regulating Equipment** – Includes all valves and controls used in a plumbing system that are required to be accessible or readily accessible.

**Relief Vent** – A vent, the primary function of which is to provide circulation of air between drainage and vent systems or to act as an auxiliary vent on a specially designed system.

**Remote Outlet** – When used for sizing water piping, it is the furthest outlet dimension, measuring from the meter, the longest of either the developed length of the cold-water piping to the furthest outlet on the cold-water piping or through the water heater to the furthest outlet on the hot-water piping.

**Rim** – See Flood-Level Rim.

**Riser** – A water supply pipe that extends vertically one (1) full story or more to convey water to branches or fixtures.

**Roof Drain** – A drain installed to receive water collecting on the surface of a roof and to discharge it into a leader, downspout, or conductor.

**Roughing-In** – The installation of all parts of the plumbing system that can be completed prior to the installation of fixtures. This includes drainage, water supply, gas piping, vent piping, and the necessary fixture supports.

## 221.0 – S –

**Sand Interceptor** – See Interceptor.

**SDR** – An abbreviation for "standard dimensional ratio," which is the specific ratio of the average specified outside diameter to the minimum wall thickness for outside controlled diameter plastic pipe.

**Seepage Pit** – A lined excavation in the ground which receives the discharge of a septic tank so designed as to permit the effluent from the septic tank to seep through its bottom and sides.

**Septic Tank** – A water-tight receptacle that receives the discharge of a drainage system or part thereof, designed and constructed so as to retain solids, digest organic matter through a period of detention, and allow the liquids to discharge into the soil outside of the tank through a system of open joint piping or a seepage pit. **Sewage** – Any liquid waste containing animal or vegetable matter in suspension or solution and that may include liquids containing chemicals in solution.

**Sewage Ejector** – A device for lifting sewage by entraining it on a high-velocity jet stream, air, or water.

**Sewage Pump** – A permanently installed mechanical device, other than an ejector, for removing sewage or liquid waste from a sump.

**Shall** – Indicates a mandatory requirement.

**Shielded Coupling** – An approved elastomeric sealing gasket with an approved outer shield and a tightening mechanism.

**Shock Arrester** – See Water Hammer Arrester.

**Should** – Indicates a recommendation or that which is advised but not required.

**Single-Family Dwelling** – A building designed to be used as a home by the owner of such building, which shall be the only dwelling located on a parcel of ground with the usual accessory buildings.

**Size and Type of Tubing** – See Diameter.

**Slip Joint** – An adjustable tubing connection, consisting of a compression nut, a friction ring, and a compression washer, designed to fit a threaded adapter fitting or a standard taper pipe thread.

**Slope** – See Grade.

**Soil Pipe** – Any pipe that conveys the discharge of water closets, urinals, clinic sinks, or fixtures having similar functions of collection and removal of domestic sewage, with or without the discharge from other fixtures, to the building drain or building sewer.

**Special Wastes** – Wastes that require some special method of handling, such as the use of indirect waste piping and receptors, corrosion-resistant piping, sand, oil or grease interceptors, condensers, or other pretreatment facilities.

**Stack** – The vertical main of a system of soil, waste, or vent piping extending through one (1) or more stories.

**Stack Vent** – The extension of a soil or waste stack above the highest horizontal drain connected to the stack.

**Standard** – A document, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions shall be located in an appendix, footnote, or fine print note and are not to be considered a part of the requirements of a standard.

**Storm Drain** – See Building Drain (Storm).

**Storm Sewer** – A sewer used for conveying rainwater, surface water, condensate, cooling water, or similar liquid wastes.

**Subsoil Drain** – A drain that collects subsurface or seepage water and conveys it to a place of disposal.

**Sump** – An approved tank or pit that receives sewage or liquid waste and which is located below the normal grade of the gravity system and which must be emptied by mechanical means.

**Supports** – Supports, hangers, and anchors are devices for properly supporting and securing pipe, fixtures, and equipment.

**222.0 – T –**

**Tailpiece** – The pipe or tubing that connects the outlet of a plumbing fixture to a trap.

**Thermostatic (Temperature Control) Valve** – A mixing valve that senses outlet temperature and compensates for fluctuations in incoming hot or cold water temperatures.

**Trap** – A fitting or device so designed and constructed as to provide, when properly vented, a liquid seal that will prevent the back passage of air without materially affecting the flow of sewage or wastewater through it.

**Trap Arm** – That portion of a fixture drain between a trap and the vent.

**Trap Primer** – A device and system of piping that maintains a water seal in a remote trap.

**Trap Seal** – The vertical distance between the crown weir and the top dip of the trap.

**Crown Weir (Trap Weir)** –The lowest point in the cross-section of the horizontal waterway at the exit of the trap.

**Top Dip (of trap)** – The highest point in the internal cross-section of the trap at the lowest part of the bend (inverted siphon). By contrast, the bottom dip is the lowest point in the internal cross-section.

**223.0 – U –**

**Unconfined Space** – A room or space having a volume equal to not less than fifty (50) cubic feet per 1,000 Btu/h (1.4 $m^3$/293 W) of the aggregate input rating of all fuel-burning appliances installed in that space. Rooms communicating directly with the space in which the appliances are installed, through openings not furnished with doors, are considered a part of the unconfined space.

**Unsanitary** – See Insanitary.

**224.0 – V –**

**Vacuum** – Any pressure less than that exerted by the atmosphere.

**Vacuum Breaker** – See Backflow Preventer.

**Vacuum Relief Valve** – A device that prevents excessive vacuum in a pressure vessel.

**Vent** – Any pipe provided to ventilate a plumbing system, to prevent trap siphonage and back-pressure, or to equalize the air pressure within the drainage system.

**Vent Pipe** – See Vent.

**Vent Stack** – The vertical vent pipe installed primarily for the purpose of providing circulation of air to and from any part of the drainage system.

**Vent System** – A pipe or pipes installed to provide a flow of air to or from a drainage system or to provide a circulation of air within such system to protect trap seals from siphonage and back-pressure.

**Vented Flow Control Device** – A device installed upstream from the hydromechanical grease interceptor having an orifice that controls the rate of flow through the interceptor, and an air intake (vent) downstream from the orifice, which allows air to be drawn into the flow stream.

**Vertical Pipe** – Any pipe or fitting that is installed in a vertical position or that makes an angle of not more than 45 degrees with the vertical.

**225.0 – W –**

**Wall-Hung Water Closet** – A water closet installed in such a way that no part of the water closet touches the floor.

**Waste** – See Liquid Waste and Industrial Waste.

**Waste Pipe** – A pipe that conveys only liquid waste, free of fecal matter.

**Water-Conditioning or Treating Device** – A device that conditions or treats a water supply so as to change its chemical content or remove suspended solids by filtration.

**Water-Distributing Pipe** – In a building or premises, a pipe that conveys potable water from the building

supply pipe to the plumbing fixtures and other water outlets.

**Water Hammer Arrester** – A device designed to provide protection against hydraulic shock in the building water supply system.

**Water Main (Street Main)** – A water supply pipe for public or community use.

**Water Supply System** – The building supply pipe, the water-distributing pipes, and the necessary connecting pipes, fittings, control valves, backflow prevention devices, and all appurtenances carrying or supplying potable water in or adjacent to the building or premises.

**Wet Room** – A barrier free floor with a shower and drainage fixture(s).

**Welded Joint or Seam** – Any joint or seam obtained by the joining of metal parts in the plastic molten state.

**Welder, Pipe** – A person who specializes in the welding of pipes and holds a valid certificate of competency from a recognized testing laboratory, based on the requirements of the ASME Boiler and Pressure Vessels code, Section IX.

**Wet Vent** – A vent that also serves as a drain.

**Whirlpool Bathtub** – A bathtub fixture equipped and fitted with a circulating piping system designed to accept, circulate, and discharge bathtub water upon each use.

**226.0 – X –**

No definitions.

**227.0 – Y –**

**Yoke Vent** – A pipe connecting upward from a soil or waste stack to a vent stack for the purpose of preventing pressure changes in the stacks.

**228.0 – Z –**

No definitions.

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# CHAPTER 6

## WATER SUPPLY AND DISTRIBUTION

### 601.0 Water Required.

**601.1** Except where not deemed necessary for safety or sanitation by the Authority Having Jurisdiction, each plumbing fixture shall be provided with an adequate supply of potable running water piped thereto in an approved manner, so arranged as to flush and keep it in a clean and sanitary condition without danger of backflow or cross-connection. Water closets, urinals, and trap primers in designated non residential buildings may be provided with reclaimed water as defined, regulated and adopted in Chapter 16 of this code.

**601.2 Identification of a Potable and Nonpotable Water System.** In buildings where potable water and nonpotable water systems are installed, each system shall be clearly identified in accordance with Sections 601.2.1 through 601.2.4.

**601.2.1 Potable Water.** Green background with white lettering.

**601.2.2 Color and Information.** Each system shall be identified with a colored pipe or band and coded with paints, wraps and materials compatible with the piping.

Except as required in Sections 1610.0 and 1617.0, nonpotable water systems shall have a yellow background with black uppercase lettering, with the words "CAUTION: NONPOTABLE WATER, DO NOT DRINK." Each nonpotable system shall be identified to designate the liquid being conveyed, and the direction of normal flow shall be clearly shown. The minimum size of the letters and length of the color field shall conform to Table 6-1.

The background color and required information shall be indicated every twenty (20) feet (6,096 mm) but not less than once per room, and shall be visible from the floor level.

**601.2.3 Fixtures.** Where vacuum breakers or backflow preventers are installed with fixtures listed in Table 14–1, identification of the discharge side shall be permitted to be omitted.

**601.2.4 Outlets.** Each outlet on the nonpotable water line that is used for special purposes shall be posted with black uppercase lettering as follows: "CAUTION: NONPOTABLE WATER, DO NOT DRINK."

**601.3** Faucets and diverters shall be connected to the water distribution system so that hot water corresponds to the left side of the fittings.

### 602.0 Unlawful Connections.

**602.1** No installation of potable water supply piping or part thereof shall be made in such a manner that it will be possible for used, unclean, polluted, or contaminated water, mixtures, or substances to enter any portion of such piping from any tank, receptor, equipment, or plumbing fixture by reason of back-siphonage, suction, or any other cause, either during normal use and operation thereof, or when any such tank, receptor, equipment, or plumbing fixture is flooded or subject to pressure exceeding the operating pressure in the hot or cold water piping.

**TABLE 6-1**
**Minimum Length of Color Field and Size of Letters**

| Outside Diameter of Pipe or Covering | | Minimum Length of Color Field | | Minimum Size of Letters | |
|---|---|---|---|---|---|
| inches | (mm) | inches | (mm) | inches | (mm) |
| 1/2 to 1-1/4 | (15 to 32) | 8 | (203) | 1/2 | (12.7) |
| 1-1/2 to 2 | (40 to 50) | 8 | (203) | 3/4 | (19.1) |
| 2-1/2 to 6 | (65 to 150) | 12 | (305) | 1-1/4 | (32) |
| 8 to 10 | (200 to 250) | 24 | (610) | 2-1/2 | (64) |
| Over 10 | (Over 250) | 32 | (813) | 3-1/2 | (89) |

**602.2** No person shall make a connection or allow one (1) to exist between pipes or conduits carrying domestic water supplied by any public or private water service system, and any pipes, conduits, or fixtures containing or carrying water from any other source or containing or carrying water that has been used for any purpose whatsoever, or any piping carrying chemicals, liquids, gases, or any substances whatsoever, unless there is provided a backflow prevention device approved for the potential hazard and maintained in accordance with this code. Each point of use shall be separately protected when potential cross-contamination of individual units exists.

**602.3** No plumbing fixture, device, or construction shall be installed or maintained or shall be connected to any domestic water supply when such installation or connection provides a possibility of polluting such water supply or cross-connection between a distributing system of water for drinking and domestic purposes and water that becomes contaminated by such plumbing fixture, device, or construction unless there is provided a backflow prevention device approved for the potential hazard.

**TABLE 6-2**
**Backflow Prevention Devices, Assemblies and Methods**

| Device, Assembly, or Method[1] | Applicable standards | Degree of Hazard | | | | Installation[2,3] |
|---|---|---|---|---|---|---|
| | | Pollution (Low Hazard) | | Contamination (High Hazard) | | |
| | | Back-Siphonage | Back-Pressure | Back-Siphonage | Back-Pressure | |
| Airgap | ASME A112.1.2 | X | | X | | See Table 6-3 in this chapter. |
| Air gap fittings for use with plumbing fixtures, appliances and appurtenances | ASME A112.1.3 | X | | X | | Air gap fitting is a device with an internal air gap and typical installation includes plumbing fixtures, appliances and appurtenances. The critical level shall not be installed below the flood level rim. |
| Atmospheric-type vacuum breaker (consists of a body, checking member and atmospheric port) | ASSE 1001 or CSA B 64.1.1 | X | | X | | Upright position. No valve downstream. Minimum of six (6) inches (152 mm) or listed distance above all downstream piping and flood-level rim of receptor.[4,5] |
| Antisiphon fill valve (ballcocks) for gravity water closet flush tanks and urinal tanks | ASSE 1002 or CSA B 125.3 | X | | X | | Installation on gravity water closet flush tank and urinal tanks with the fill valve installed with the critical level not less than one (1) inch (25.4 mm) above the opening of the overflow pipe.[4,5] |
| Vacuum breaker wall hydrants, hose bibbs, frost resistant, automatic draining type | ASSE 1019 or CSA B 64.2.1.1 | X | | X | | Installation includes wall hydrants and hose bibbs. Such devices are not for use under continuous pressure conditions (means of shut-off downstream of device is prohibited).[4,5] |
| Backflow preventer for Carbonated Beverage Dispensers (two independent check valves with a vent to the atmosphere) | ASSE 1022 | X | | | | Installation includes carbonated beverage machines or dispensers. These devices operate under intermittent or continuous pressure conditions. |

**TABLE 6-2**
**Backflow Prevention Devices, Assemblies and Methods (continued)**

| Device, Assembly, or Method[1] | Applicable standards | Degree of Hazard: Pollution (Low Hazard) | | Contamination (High Hazard) | | Installation [2,3] |
|---|---|---|---|---|---|---|
| | | Back-Siphonage | Back-Pressure | Back-Siphonage | Back-Pressure | |
| Spill-Resistant Pressure-Type Backflow Prevention Assembly (single check valve with air inlet vent and means of field testing) | ASSE 1056 | X | | X | | Upright position. Minimum of six (6) inches (152 mm) or listed distance above all downstream piping and flood-level rim of receptor.[5] |
| Double Check Valve Backflow Prevention Assembly (two independent check valves and means of field testing) | ASSE 1015; AWWA C510; CSA B 64.5 or CSA B 64.5.1 | X | X | | | Horizontal unless otherwise listed. Requires one (1) foot (305 mm) clearance at bottom for maintenance. May need platform/ ladder for test and repair. Does not discharge water. |
| | ASSE 1048 | X | X | | | Horizontal unless otherwise listed. Requires one (1) foot (305 mm) clearance at bottom for maintenance. May need platform/ ladder for test and repair. Does not discharge water. Installation includes a fire protection system and is designed to operate under continuous pressure conditions. |
| Pressure Vacuum Breaker Backflow Prevention Assembly (loaded air inlet valve, internally loaded check valve and means of field testing) | ASSE 1020 or CSA B 64.1.2 | X | | X | | Upright position. May have valves downstream. Minimum of twelve (12) inches (305 mm) above all downstream piping and flood-level rim of receptor. May discharge water. |
| Reduced Pressure Principle Backflow Prevention Assembly (two independently acting loaded check valves, a pressure relief valve and means of field testing) | ASSE 1047 | X | X | X | X | Horizontal unless otherwise listed. Requires one (1) foot (305 mm) minimum clearance at bottom for maintenance. May need platform/ladder for test and repair. May discharge water. Installation includes a fire protection system and is designed to operate under continuous pressure conditions. |
| | ASSE 1013; AWWA C511; CSA B64.4 or CSA B 64.4.1 | X | X | X | X | Horizontal unless otherwise listed. Requires one (1) foot (305 mm) minimum clearance at bottom for maintenance. May need platform/ladder for test and repair. May discharge water. |

[1] See description of devices and assemblies in this chapter.
[2] Installation in pit or vault requires previous approval by the Authority Having Jurisdiction.
[3] Refer to general and specific requirement for installation.
[4] Not to be subjected to operating pressure for more than twelve (12) hours in any twenty-four (24) hour period.
[5] For deck-mounted and equipment-mounted vacuum breaker, see Section 603.4.15.

**TABLE 6-3**
**Minimum Airgaps for Water Distribution[4]**

| Fixtures | When not affected by sidewalls[1] | | When affected by sidewall[2] | |
|---|---|---|---|---|
| | Inches | (mm) | Inches | (mm) |
| Effective openings[3] not greater than one-half (1/2) inch (12.7 mm) in diameter | 1 | (25.4) | 1-1/2 | (38) |
| Effective openings[3] not greater than three-quarters (3/4) inch (19.1 mm) in diameter | 1-1/2 | (38) | 2-1/4 | (57) |
| Effective openings[3] not greater than one (1) inch (25.4 mm) in diameter | 2 | (51) | 3 | (76) |
| Effective openings[3] greater than one (1) inch (25.4 mm) in diameter | Two (2) times diameter of effective opening | | Three (3) times diameter of effective opening | |

[1] Sidewalls, ribs, or similar obstructions do not affect airgaps when spaced from the inside edge of the spout opening a distance exceeding three (3) times the diameter of the effective opening for a single wall, or a distance exceeding four (4) times the effective opening for two (2) intersecting walls.

[2] Vertical walls, ribs, or similar obstructions extending from the water surface to or above the horizontal plane of the spout opening other than specified in Note 1 above. The effect of three (3) or more such vertical walls or ribs has not been determined. In such cases, the airgap shall be measured from the top of the wall.

[3] The effective opening shall be the minimum cross-sectional area at the seat of the control valve or the supply pipe or tubing that feeds the device or outlet. If two (2) or more lines supply one outlet, the effective opening shall be the sum of the cross-sectional areas of the individual supply lines or the area of the single outlet, whichever is smaller.

[4] Airgaps less than one (1) inch (25.4 mm) shall be approved only as a permanent part of a listed assembly that has been tested under actual backflow conditions with vacuums of zero (0) to twenty-five (25) inches (635 mm) of mercury.

**602.4** No water piping supplied by any private water supply system shall be connected to any other source of supply without the approval of the Authority Having Jurisdiction, Health Department, or other department having jurisdiction.

### 603.0 Cross-Connection Control.

Cross-connection control shall be provided in accordance with the provisions of this chapter.

No person shall install any water-operated equipment or mechanism, or use any water-treating chemical or substance, if it is found that such equipment, mechanism, chemical, or substance causes pollution or contamination of the domestic water supply. Such equipment or mechanism shall be permitted only when equipped with an approved backflow prevention device or assembly.

**603.1 Approval of Devices or Assemblies.** Before any device or assembly is installed for the prevention of backflow, it shall have first been approved by the Authority Having Jurisdiction. Devices or assemblies shall be tested for conformity with recognized standards or other standards acceptable to the Authority Having Jurisdiction. Backflow prevention devices and assemblies shall comply with Table 6–2, except for specific applications and provisions as stated in Sections 603.4 through 603.4.22.

Devices or assemblies installed in a potable water supply system for protection against backflow shall be maintained in good working condition by the person or persons having control of such devices or assemblies. Such devices or assemblies shall be tested at the time of installation.

### 603.2 Backflow Prevention Devices, Assemblies, and Methods.

**603.2.1 Airgap.** The minimum airgap to afford backflow protection shall be in accordance with Table 6-3.

**603.2.2 Atmospheric Vacuum Breaker (AVB).** An atmospheric vacuum breaker consists of a body, a checking member, and an atmospheric port.

**603.2.3 Hose Connection Backflow Preventer.** A hose connection backflow preventer consists of two (2) independent check valves with an independent atmospheric vent between and a means of field testing and draining.

**603.2.4 Double Check Valve Backflow Prevention Assembly (DC).** A double check valve backflow prevention assembly consists of two (2) independently acting internally loaded check valves, four (4) properly located test cocks, and two (2) isolation valves.

**603.2.5 Pressure Vacuum Breaker Backflow Prevention Assembly (PVB).** A pressure vacuum breaker backflow prevention assembly consists of a loaded air inlet valve, an internally loaded check valve, two (2) properly located test cocks, and two (2) isolation valves. This device shall be installed indoors only if provisions for spillage are provided.

**603.2.6 Pressure Vacuum Breaker Spill-Resistant-Type Backflow Prevention Assembly (SVB).** A pressure-type vacuum breaker backflow prevention assembly consists of one (1) check valve force-loaded closed and an air inlet vent valve force-loaded open to atmosphere, positioned downstream of the check valve, and located between and including two (2) tightly closing shutoff valves and test cocks.

**603.2.7 Reduced-Pressure Principle Backflow Prevention Assembly (RP).** A reduced-pressure principle backflow prevention assembly consists of two (2) independently acting internally loaded check valves, a differential pressure-relief valve, four (4) properly located test cocks, and two (2) isolation valves.

**603.3 General Requirements.**

**603.3.1** Assemblies shall conform to listed standards and be acceptable to the Authority Having Jurisdiction, with jurisdiction over the selection and installation of backflow prevention assemblies.

**603.3.2** Where more than one (1) backflow prevention valve is installed on a single premise, and the valves are installed in one (1) location, each separate valve shall be permanently identified by the permittee in a manner satisfactory to the Authority Having Jurisdiction.

**603.3.3** The premise owner or responsible person shall have the backflow prevention assembly tested at the time of installation.

**603.3.4** Access and clearance shall be provided for the required testing, maintenance, and repair. Access and clearance shall require a minimum of one (1) foot (305 mm) between the lowest portion of the assembly and grade, floor, or platform. Installations elevated exceeding five (5) feet (1,524 mm) above the floor or grade shall be provided with a permanent platform capable of supporting a tester or maintenance person.

**603.3.5** Direct connections between potable water piping and sewer-connected wastes shall not be permitted to exist under any condition with or without backflow protection. Where potable water is discharged to the drainage system, it shall be by means of an approved airgap of two (2) pipe diameters of the supply inlet, but in no case shall the gap be less than one (1) inch (25.4 mm). Connection shall be permitted to be made to the inlet side of a trap provided that an approved vacuum breaker is installed not less than six (6) inches (152 mm), or the distance according to the device's listing, above the flood-level rim of such trapped fixture, so that at no time will any such device be subjected to any back-pressure.

**603.3.6** Backflow preventers for hot water exceeding 110°F (43.3°C) shall be a type designed to operate at temperatures exceeding 110°F (43.3°C) without rendering any portion of the assembly inoperative.

**603.3.7** Fixtures, appliances, or appurtenances with integral backflow preventers or integral airgaps manufactured as a unit shall be installed in accordance with their listing requirements and the manufacturer's instructions.

**603.3.8** In cold climate areas, backflow assemblies and devices shall be protected from freezing with an outdoor enclosure or by a method acceptable to the Authority Having Jurisdiction.

**603.3.9** Drain lines serving backflow devices or assemblies shall be sized in accordance with the discharge rates of the manufacturer's flow charts of such devices or assemblies.

**603.3.10 Design and Installation of Plumbing Fixtures.** Plumbing fixtures shall be installed such that fixture fittings, complying with the backflow prevention requirements of ASME A112.18.1/CSA B125.1, do not have these requirements compromised by the designated fixture fitting mounting surface.

**603.4 Specific Requirements.**

**603.4.1** Water closet and urinal flushometer valves shall be equipped with an atmospheric vacuum breaker. The vacuum breaker shall be installed on the discharge side of the flushometer valve with the critical level not less than six (6) inches (152 mm), or the distance according to its listing, above the overflow rim of a water closet bowl or the highest part of a urinal.

**603.4.2** Water closet and urinal tanks shall be equipped with a ballcock. The ballcock shall be installed with the critical level not less than one (1) inch (25.4 mm) above the full opening of the overflow pipe. In cases where the ballcock has no hush tube, the bottom of the water supply inlet shall be installed one (1) inch (25.4 mm) above the full opening of the overflow pipe.

**603.4.3** Water closet flushometer tanks shall be protected against backflow by an approved backflow prevention assembly, device, or method.

**603.4.4 Heat Exchangers.**

**603.4.4.1** Heat exchangers used for heat transfer, heat recovery, or solar heating shall protect the potable water system from being contaminated by the heat-transfer medium. Single-wall heat exchangers used in indirect-fired water heaters shall meet the requirements of Section 506.4.2. Double-wall heat exchangers shall separate the potable water from the heat-transfer medium by providing a space between the two (2) walls that are vented to the atmosphere.

**603.4.5** Water supply inlets to tanks, vats, sumps, swimming pools, and other receptors shall be protected by one of the following means:

(1) An approved airgap.

(2) A listed vacuum breaker installed on the discharge side of the last valve with the critical level not less than six (6) inches (152 mm) or in accordance with its listing.

(3) A backflow preventer suitable for the contamination or pollution, installed in accordance with the requirements for that type of device or assembly as set forth in this chapter.

**603.4.6 Protection from Lawn Sprinklers and Irrigation Systems.**

**603.4.6.1** Potable water supplies to systems having no pumps or connections for pumping equipment, and no chemical injection or provisions for chemical injection, shall be protected from backflow by one of the following devices:

(1) Atmospheric vacuum breaker

(2) Pressure vacuum breaker

(3) Spill-resistant pressure vacuum breaker

(4) Reduced-pressure backflow preventer

(5) Double check valve backflow preventer

**603.4.6.2** Where sprinkler and irrigation systems have pumps, connections for pumping equipment, or auxiliary air tanks, or are otherwise capable of creating back-pressure, the potable water supply shall be protected by the following type of device if the backflow device is located upstream from the source of back-pressure:

(1) Reduced-pressure backflow preventer

**603.4.6.3** Where systems have a backflow device installed downstream from a potable water supply pump or a potable water supply pump connection, the device shall be one of the following:

(1) Atmospheric vacuum breaker

(2) Pressure vacuum breaker

(3) Spill-resistant pressure vacuum breaker

(4) Reduced-pressure backflow preventer

(5) Double check valve backflow preventer

**603.4.6.4** Where systems include a chemical injector or any provisions for chemical injection, the potable water supply shall be protected by the following:

(1) Reduced-pressure backflow preventer

**603.4.7** Potable water outlets with hose attachments, other than water heater drains, boiler drains, and clothes washer connections, shall be protected by a nonremovable hose-bibb-type backflow preventer, a nonremovable hose bibb-type vacuum breaker, or by an atmospheric vacuum breaker installed not less than six (6) inches (152 mm) above the highest point of usage located on the discharge side of the last valve. In climates where freezing temperatures occur, a listed self-draining frost-proof hose bibb with an integral backflow preventer or vacuum breaker shall be used. External vertical yard hydrants shall be of the self-draining sanitary type ~~and~~ be provided with a dual check backflow preventer meeting the ASSE 1024 standard.

**603.4.8** Water-cooled compressors, degreasers, or any other water-cooled equipment shall be protected by a backflow preventer installed in accordance with the requirements of this chapter.

**Note:** Water-cooled equipment that produces back-pressure shall be equipped with the appropriate protection.

**603.4.9** Water inlets to water-supplied aspirators shall be equipped with a vacuum breaker installed in accordance with its listing requirements and this chapter. The discharge shall drain through an airgap. When the tailpiece of a fixture to receive the discharge of an aspirator is used, the airgap shall be located above the flood-level rim of the fixture.

**603.4.10** Potable water makeup connections to

steam or hot water boilers shall be provided with a listed backflow protection assembly.

**603.4.11 Nonpotable Water Piping.** In cases where it is impractical to correct individual cross-connections on the domestic waterline, the line supplying such outlets shall be considered a nonpotable water line. No drinking or domestic water outlets shall be connected to the non-potable waterline. Whenever possible, portions of the nonpotable waterline shall be exposed, and exposed portions shall be properly identified in a manner satisfactory to the Authority Having Jurisdiction. Each outlet on the nonpotable waterline that is permitted to be used for drinking or domestic purposes shall be posted: "Caution: Nonpotable water, do not drink."

**603.4.12** Potable water supply to carbonators shall be protected by either an airgap or a vented backflow preventer for carbonated beverage dispensers installed within the carbonated beverage dispenser. The carbonated beverage dispenser shall bear the label of an approved testing agency, certifying and attesting that such equipment has been tested and inspected and meets the requirements of the approved applicable standard. Carbonated beverage dispensers without an approved internal airgap or vented backflow preventer for carbonated beverage dispensers and carbonated beverage dispensing systems shall have the water supply protected with a vented backflow preventer for carbonated beverage dispensers.

**603.4.13 Water Treatment Units.** Reverse osmosis drinking water treatment units shall meet the requirements of the applicable standards referenced in Table 14-1. Waste or discharge from reverse osmosis or other types of water treatment units shall enter the drainage system through an airgap.

**603.4.14** Backflow preventers shall not be located in any area containing fumes that are toxic, poisonous, or corrosive.

**603.4.15** Deck-mounted or equipment-mounted vacuum breakers shall be installed in accordance with their listing and the manufacturer's instructions, with the critical level not less than one (1) inch (25.4 mm) above the flood-level rim.

**603.4.16 Protection from Fire Systems.**

**603.4.16.1** Except as provided under Sections 603.4.16.2 and 603.4.16.3, potable water supplies to fire protection systems that are normally under pressure, including but not limited to standpipes and automatic sprinkler systems, except in one- or two-family residential sprinkler systems, piped in materials approved for potable water distribution systems shall be protected from back-pressure and back-siphonage by one of the following testable devices:

(1) Double check valve assembly

(2) Double check detector assembly

(3) Reduced pressure backflow preventer

(4) Reduced pressure detector assembly

Potable water supplies to fire protection systems that are not normally under pressure shall be protected from backflow and shall meet the requirements of the appropriate standards referenced in Table 14-1.

**603.4.16.2** Where fire protection systems supplied from a potable water system include a fire department (siamese) connection that is located less than seventeen-hundred (1,700) feet (518 m) from a nonpotable water source that could be used by the fire department as a secondary water supply, the potable water supply shall be protected by one of the following:

(1) Reduced pressure backflow preventer

(2) Reduced pressure detector assembly

**Note:** Nonpotable water sources include fire department vehicles carrying water of questionable quality or water that is treated with antifreeze, corrosion inhibitors, or extinguishing agents.

**603.4.16.3** Where antifreeze, corrosion inhibitors, or other chemicals are added to a fire protection system supplied from a potable water supply, the potable water system shall be protected by one of the following:

(1) Reduced pressure backflow preventer

(2) Reduced pressure detector assembly

**603.4.16.4** Whenever a backflow device is installed in the potable water supply to a fire protection system, the hydraulic design of the system shall account for the pressure drop through the backflow device. If such devices are retrofitted for an existing fire protection system, the hydraulics of the sprinkler system design shall be checked to verify that there will be sufficient water pressure available for satisfactory operation of the fire sprinklers.

**603.4.16.5 Residential Sprinkler Systems.** When residential sprinkler systems are installed using the potable water system, they shall be installed in accordance with the standards listed in Table 14-1.

**603.4.17 Special Equipment, Water Supply Protection.** Vacuum breakers for washer-hose bedpans shall be located not less than five (5) feet (1,524 mm) above the floor. Hose connections in health care or laboratory areas shall be not less than six (6) feet (1,829 mm) above the floor.

**603.4.18** Portable cleaning equipment, dental vacuum pumps, and chemical dispensers shall be protected from backflow by an airgap, an atmospheric vacuum breaker, a spill-resistant vacuum breaker, or a reduced pressure principle backflow preventer.

**603.4.19** Combination stop-and-waste valves or cocks shall not be installed underground.

**603.4.20 Pure Water Process Systems.** The water supply to a pure water process system, such as dialysis water systems, semiconductor washing systems, and similar process piping systems, shall be protected from back-pressure and back-siphonage by a reduced-pressure principle backflow preventer.

**603.4.20.1 Dialysis Water Systems.** The individual connections of the dialysis related equipment to the dialysis pure water system shall not require additional backflow protection.

**603.4.21 Plumbing Fixture Fittings.** Plumbing fixture fittings with integral backflow protection shall comply with ASME A112.18.1/CSA B 125.1.

**603.4.22** Potable water supply to swimming pools, spas and hot tubs shall be protected by an airgap or a reduced pressure principle backflow preventer in accordance with the following:

(1) The unit is equipped with a submerged fill line; or

(2) The potable water supply is directly connected to the unit circulation system.

**604.0 Materials.**

**604.1** Pipe, tube, and fittings carrying water used in potable water systems intended to supply drinking water shall meet the requirements of NSF 61 as found in Table 14-1. Materials used in the water supply system, except valves and similar devices, shall be of a like material, except where otherwise approved by the Authority Having Jurisdiction.

Materials for building water piping and building supply piping shall be in accordance with the applicable standards referenced in Table 6-4.

**604.2** Copper tube for water piping shall have a weight of not less than Type L.

Exception: Type M copper tubing shall be permitted to be used for water piping when piping is above ground in, or on, a building or underground outside of structures.

**604.3** Hard-drawn copper tubing for water supply and distribution in addition to the required incised marking, shall be marked in accordance with ASTM B 88 *Seamless Copper Water Tube* as referenced in Table 14-1. The colors shall be: Type K, green; Type L, blue; Type M, red.

**604.4** Listed flexible copper water connectors shall be installed in readily accessible locations, unless otherwise listed.

**604.5** Cast-iron fittings up to and including two (2) inches (51 mm) in size, when used in connection with potable water piping, shall be galvanized.

**604.6** Malleable iron water fittings shall be galvanized.

**604.7** Piping and tubing that has previously been used for any purpose other than for potable water systems shall not be used.

**604.8** Approved plastic materials shall be permitted to be used in water service piping, provided that where metal water service piping is used for electrical grounding purposes, replacement piping therefore shall be of like materials.

**Exception:** Where a grounding system acceptable to the Authority Having Jurisdiction is installed, inspected, and approved, metallic pipe shall be permitted to be replaced with nonmetallic pipe. Plastic materials for water service piping outside underground shall have a blue insulated copper tracer wire or other approved conductor installed adjacent to the piping. Access shall be provided to the tracer wire or the tracer wire shall terminate above ground at each end of the nonmetallic piping. The tracer wire size shall be not less than 18 AWG and the insulation type shall be suitable for direct burial.

**604.9** Solder shall conform to the requirements of Section 316.1.3.

**604.10** Water pipe and fittings with a lead content which exceeds eight (8) percent shall be prohibited in piping systems used to convey potable water.

**604.11 PEX.** Cross-linked polyethylene (PEX) tubing conforming to ASTM F877 shall be marked with the appropriate standard designation(s) for the fittings specified for use with the tubing. Such marking shall not be required for PEX tubing conforming to only ASTM F876. PEX tubing shall be installed in compliance with the provisions of this section.

**604.11.1 PEX Fittings.** Fittings used with PEX tubing shall be manufactured to and marked in

**TABLE 6-4**
**Materials for Building Supply and Water Distribution Piping and Fittings**

| Material | Building Supply Pipe and Fittings | Water Distribution Pipe and Fittings | Referenced Standard(s) Pipe | Referenced Standard(s) Fittings |
|---|---|---|---|---|
| Asbestos-Cement | X[1] | | ASTM C296, AWWA C400 | |
| Brass | X | X | ASTM B43, ASTM B135 | |
| Copper | X | X | ASTM B42, ASTM B75, ASTM B88, ASTM B251, ASTM B302, ASTM B447 | ASME B16.15, ASME B16.18, ASME B16.22, ASME B16.26 |
| CPVC | X | X | ASTM D2846, ASTM F441, ASTM F442 | ASTM D2846, ASTM F437, ASTM F438, ASTM F439, ASTM F1970 |
| Ductile-Iron | X | X | AWWA C151 | ASME B16.4, AWWA C110, AWWA C153 |
| Galvanized Steel | X | X | ASTM A53 | |
| Malleable Iron | X | X | | ASME B16.3 |
| PE | X[1] | | ASTM D2239, ASTM D2737, ASTM D3035, AWWA C901, CSA B137.1 | ASTM D2609, ASTM D2683, ASTM D3261, ASTM F1055, CSA B137.1 |
| PE-AL-PE | X | X | ASTM F1282, CSA B137.9 | ASTM F1282, ASTM F1974, CSA B137.9 |
| PEX | X | X | ASTM F876 , ASTM F877, CSA B137.5 | ASTM F877, ASTM F1807, ASTM F1960, ASTM F1961, ASTM F2080, ASTM F2159, CSA B137.5 |
| PEX-AL-PEX | X | X | ASTM F1281, CSA B137.10, ASTM F2262 | ASTM F1281, ASTM F1974, ASTM F2434, CSA B137.10 |
| PP | X | X | ASTM F2389 | ASTM F2389 |
| PVC | X[1] | | ASTM D1785, ASTM D2241, AWWA C900 | ASTM D2464, ASTM D2466, ASTM D2467, ASTM F1970 |
| Stainless Steel | X | X | ASTM A269, ASTM A312 | |

[1] For Building Supply or cold-water applications.

accordance with the standards for the fittings referenced in Table 14-1.

**604.11.2 Water Heater Connections.** PEX tubing shall not be installed within the first eighteen (18) inches (457 mm) of piping connected to a water heater.

**604.12 Flexible Corrugated Connectors.** Flexible corrugated connectors of copper or stainless steel shall be limited to the following connector lengths:

**Water Heater Connectors** – twenty-four (24) inches (610 mm).

**Fixture Connectors** – thirty (30) inches (762 mm).

**Washing Machine Connectors** – seventy-two (72) inches (1,829 mm).

**Dishwasher and Icemaker Connectors** – one-hundred and twenty (120) inches (3,048 mm).

**604.13 PEX-AL-PEX and PE-AL-PE.** Crosslinked polyethylene-aluminum-crosslinked polyethylene (PEX-AL-PEX) and polyethylene-aluminum-polyethylene (PE-AL-PE) composite pipe shall be marked with the applicable standard referenced in Table 14-1 for which the piping has been listed or approved. PEX-AL-PEX and PE-AL-PE piping shall be installed in compliance with the provisions of this section.

**604.13.1 PEX-AL-PEX and PE-AL-PE.** Fittings used with PEX-AL-PEX and PE-AL-PE piping shall be manufactured to and marked in accor-

dance with the standard for the fittings referenced in Table 14-1.

**604.13.2 Water Heater Connections.** PEX-AL-PEX or PE-AL-PE tubing shall not be installed within the first eighteen (18) inches (457 mm) of piping connected to a water heater.

**604.14 Water Heater Connectors.** Flexible metallic water heater connectors or reinforced flexible water heater connectors connecting water heating to the piping system shall be in compliance with the applicable standards referenced in Table 14-1.

### 605.0 Valves.

**605.1** Valves up to and including two (2) inches (51 mm) in size shall be brass or other approved material. Sizes exceeding two (2) inches (51 mm) shall be permitted to have cast-iron or brass bodies. Each gate or ball valve shall be a fullway type with working parts of non-corrosive material. Valves carrying water used in potable water systems intended to supply drinking water shall meet the requirements of NSF 61 as referenced in Table 14-1.

**605.2** A fullway valve controlling outlets shall be installed on the discharge side of each water meter and on each unmetered water supply. Water piping supplying more than one (1) building on any one (1) premises shall be equipped with a separate fullway valve to each building, so arranged that the water supply can be turned on or off to any individual or separate building provided; however, that supply piping to a single-family residence and building accessory thereto shall be permitted to be controlled on one (1) valve. Such shutoff valves shall be accessible at all times. A fullway valve shall be installed on the discharge piping from water supply tanks at or near the tank. A fullway valve shall be installed on the cold water supply pipe to each water heater at or near the water heater.

**605.3** In multidwelling units, one (1) or more shutoff valves shall be provided in each dwelling unit so that the water supply to any plumbing fixture or group of fixtures in that dwelling unit can be shut off without stopping water supply to fixtures in other dwelling units. These valves shall be accessible in the dwelling unit that they control.

**605.4** Valves used to control two (2) or more openings shall be fullway gate valves, ball valves, or other approved valves designed and approved for the service intended.

**605.5** A control valve shall be installed immediately ahead of each water-supplied appliance and immediately ahead of each slip joint or appliance supply.

Parallel water distribution systems shall provide a control valve either immediately ahead of each fixture being supplied or installed at the manifold and shall be identified with the fixture being supplied.

**605.6** Required shutoff or control valves shall be accessible.

**605.7** A single control valve shall be installed on a water supply line ahead of any automatic metering valve that supplies a battery of fixtures.

### 606.0 Joints and Connections.

#### 606.1 Types of Joints.

**606.1.1 Flared Joints.** Flared joints for soft copper water tubing shall be made with fittings meeting approved standards. The tubing shall be reamed to the full bore, resized to round, and expanded with a proper flaring tool.

**606.1.2 Mechanical Joints.** Mechanical joints for cast-iron water pipe shall conform to nationally recognized standards.

**606.1.3 Mechanically Formed Tee Fittings.** Mechanically extracted collars shall be formed in a continuous operation consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height not less than three (3) times the thickness of the branch tube wall.

The branch tube shall be notched to conform with the inner curve of the run tube and shall have two (2) dimple/depth stops to ensure that penetration of the branch tube into the collar is of sufficient depth for brazing and that the branch tube does not obstruct the flow in the main line tube. Dimple/depth stops shall be in line with the run of the tube. The second dimple shall be one-quarter (1/4) inch (6.4 mm) above the first and shall serve as a visual point of inspection.

Joints shall be brazed in accordance with Section 316.1.7. Soldered joints shall not be allowed.

#### 606.2 Use of Joints.

**606.2.1 Copper Water Tube.** Joints in copper tubing shall be made by the appropriate use of approved fittings properly soldered or brazed together as provided in Section 316.1.3 or 316.1.7 or by means of approved flared or compression fittings in Sections 606.1.1 or 316.1.5. Solder and soldering flux shall conform to the requirements of Section 316.1.3. Mechanically formed tee fittings shall be made by brazing only and shall conform to the requirements of Sections 316.1.7 and 606.1.3.

**606.2.2 Plastic Fittings.** Female PVC screwed fittings for water piping shall be used with

plastic male fittings and plastic male threads only.

**606.2.3 Slip Joints.** In water piping, slip joints shall be permitted to be used only on the exposed fixture supply.

### 607.0 Gravity Supply Tanks.

Gravity tanks for potable water shall be tightly covered, and have not less than a sixteen (16) square inch (10,323 $mm^2$) overflow screened with copper screen having not less than fourteen (14) nor exceeding eighteen (18) openings per linear inch (25.4 mm).

### 608.0 Water Pressure, Pressure Regulators, Pressure Relief Valves, and Vacuum Relief Valves.

**608.1 Inadequate Water Pressure.** Whenever the water pressure in the main or other source of supply will not provide a residual water pressure of not less than fifteen (15) pounds per square inch (103 kPa), after allowing for friction and other pressure losses, a tank and a pump or other means that will provide said fifteen (15) pound (103 kPa) pressure shall be installed. Whenever fixtures and/or fixture fittings are installed that require residual pressure exceeding fifteen (15) pounds per square inch (103 kPa), that minimum residual pressure shall be provided.

**608.2 Excessive Water Pressure.** Where static water pressure in the water supply piping is exceeding eighty (80) pounds per square inch (552 kPa), an approved-type pressure regulator preceded by an adequate strainer shall be installed and the static pressure reduced to eighty (80) pounds per square inch (552 kPa) or less. Such regulator(s) shall control the pressure to all water outlets in the building unless otherwise approved by the Authority Having Jurisdiction. Each such regulator and strainer shall be accessibly located above ground or in a vault equipped with adequate means to provide drainage and shall be protected from freezing, and shall have the strainer readily accessible for cleaning without removing the regulator or strainer body or disconnecting the supply piping. Pipe size determinations shall be based on 80 percent of the reduced pressure when using Table 6-6. An approved expansion tank shall be installed in the cold water distribution piping downstream of each such regulator to prevent excessive pressure from developing due to thermal expansion and to maintain the pressure setting of the regulator. The expansion tank shall be properly sized and installed in accordance with the manufacturer's instructions and listing. Systems designed by registered engineers shall be permitted to use approved pressure relief valves in lieu of expansion tanks provided such relief valves have a maximum pressure relief setting of one-hundred (100) pounds per square inch (689 kPa) or less.

**608.3** Any water system provided with a check valve, backflow preventer, or any other normally closed device that prevents dissipation of building pressure back into the water main shall be provided with an approved, listed, and adequately sized expansion tank or other approved device having a similar function to control thermal expansion. Such expansion tank or other approved device shall be installed on the building side of the check valve, backflow preventer, or other device and shall be sized and installed in accordance with the manufacturer's recommendation.

**Exception:** Non-storage instantaneous water heaters without a recirculation system.

Any water system containing storage water heating equipment shall be provided with an approved, listed, adequately sized combination pressure and temperature relief valve, except for listed nonstorage instantaneous heaters having an inside diameter of not more than three (3) inches (80 mm). Each such approved combination temperature and pressure relief valve shall be installed on the water-heating device in an approved location based on its listing requirements and the manufacturer's instructions. Each such combination temperature and pressure relief valve shall be provided with a drain as required in Section 608.5.

**608.4** Each pressure relief valve shall be an approved automatic type with drain, and each such relief valve shall be set at a pressure of not more than one-hundred and fifty (150) pounds per square inch (1,034 kPa). No shutoff valve shall be installed between the relief valve and the system or in the drain line.

**608.5** Relief valves shall be provided with a full sized drain, not smaller than the relief valve outlet, of galvanized steel or hard drawn copper, CPVC piping and fittings and shall extend from the valve to a discharge location which will avoid the hazard to persons or damage to property. Discharge locations outside of the building shall be not less than 6 inches (152 mm) above the ground or the flood level of the area receiving the discharge, and shall not terminate between 2 feet (610 mm) and 16 feet (4880 mm) above the ground or above any other area where persons may normally be present. No valve shall be installed on the discharge side of any relief valve. The termination end of the drain pipe shall not be threaded and no part of such drain pipe shall be trapped.

Other approved locations shall include:

(1) To a water heater drip pan of approved design, provided the pan is drained with pipe and

fittings of the same size and material as required for the relief valve or with PVC Schedule 40 pipe and fittings.

(2) To an approved, properly installed clothes washer standpipe receptor, laundry tray, floor drain, floor sink, hub drain, area drain or catch basin.

(3) On grade concrete garage floors at not less than 6 inches (30 mm) nor more than 12 inches (152 mm) above the floor.

(4) Other locations meeting the requirements of this section or as approved by the Authority Having Jurisdiction.

**Note:** There shall be no requirement to provide the pan or fixtures described in (1) or (2) above only for the purpose of receiving discharge from a relief valve.

Relief valve drains shall not terminate in a building's crawl space.

**608.6** Any water-heating device connected to a separate storage tank and having valves between said heater and tank shall be provided with an approved water pressure relief valve.

**608.7 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.

### 609.0 Installation, Testing, Unions, and Location.

**609.1 Installation.** Water piping shall be adequately supported in accordance with Section 314.0. Burred ends shall be reamed to the full bore of the pipe or tube. Changes in direction shall be made by the appropriate use of fittings, except that changes in direction in copper tubing may be made with bends, provided that such bends are made with bending equipment that does not deform or create a loss in the cross-sectional area of the tubing. Changes in direction are allowed with flexible pipe and tubing without fittings in accordance with the manufacturer's installation instructions. Provisions shall be made for expansion in hot-water piping. Piping, equipment, appurtenances, and devices shall be installed in a workmanlike manner in conformity with the provisions and intent of the code. Water service yard piping shall be not less than twelve (12) inches (305 mm) below the average local frost depth. The cover shall be not less than twelve (12) inches (305 mm) below finish grade.

**609.2** Water pipes shall not be run or laid in the same trench as building sewer or drainage piping constructed of clay or materials that are not approved for use within a building unless both of the following conditions are met:

**609.2.1** The bottom of the water pipe, at all points, shall be not less than twelve (12) inches (305 mm) above the top of the sewer or drain line.

**609.2.2** The water pipe shall be placed on a solid shelf excavated at one (1) side of the common trench with a clear horizontal distance of not less than twelve (12) inches (305 mm) from the sewer or drain line.

Water pipes crossing sewer or drainage piping constructed of clay or materials that are not approved for use within a building shall be laid not less than twelve (12) inches (305 mm) above the sewer or drain pipe.

**609.3** Water piping installed within a building and in or under a concrete floor slab resting on the ground shall be installed in accordance with the following requirements:

**609.3.1** Ferrous piping shall have a protective coating of an approved type, machine applied and conforming to recognized standards. Field wrapping shall provide equivalent protection and shall be restricted to those short sections and fittings necessarily stripped for threading. Zinc coating (galvanizing) shall not be deemed adequate protection for piping or fittings. Approved nonferrous piping shall not be required to be wrapped.

**609.3.2** Copper tubing shall be installed without joints where possible. Where joints are permitted, they shall be brazed, and fittings shall be wrought copper.

**Note:** For the purpose of this section, "within the building" shall mean within the fixed limits of the building foundation.

**609.4 Testing.** Upon completion of a section or of the entire hot and cold water supply system, it shall be tested and proved tight under a water pressure not less than the working pressure under which it is to be used. The water used for tests shall be obtained from a potable source of supply. A fifty (50) lb./in.$^2$ (345 kPa) air pressure shall be permitted to be substituted for the water test. In either method of test, the piping shall withstand the test without leaking for a period of not less than fifteen (15) minutes.

**609.5 Unions.** Unions shall be installed in the water supply piping not more than twelve (12) inches (305 mm) of regulating equipment, water heating, conditioning tanks, and similar equipment that requires service by removal or replacement in a manner that will facilitate its ready removal.

**609.6 Location.** Except as provided in Section 609.7, no building supply shall be located in any lot other than the lot that is the site of the building or structure served by such building supply.

**609.7** Nothing contained in this code shall be construed to prohibit the use of all or part of an abutting lot to:

**609.7.1** Provide access to connect a building supply to an available public water service when proper cause and legal easement not in violation of other requirements have been first established to the satisfaction of the Authority Having Jurisdiction.

**609.7.2** Provide additional space for a building supply when proper cause, transfer of ownership, or change of boundary not in violation of other requirements have been first established to the satisfaction of the Authority Having Jurisdiction. The instrument recording such action shall constitute an agreement with the Authority Having Jurisdiction, which shall clearly state and show that the areas so joined or used shall be maintained as a unit during the time they are so used. Such an agreement shall be recorded in the office of the County Recorder as a part of the conditions of ownership of said properties, and shall be binding on heirs, successors, and assigns to such properties. A copy of the instrument recording such proceedings shall be filed with the Authority Having Jurisdiction.

**609.8 Low-Pressure Cutoff Required on Booster Pumps for Water Distribution Systems.** When a booster pump (excluding a fire pump) is connected to a water service or underground water pipe, a low-pressure cutoff switch on the inlet side of the pump shall be installed not more than five (5) feet (1,524 mm) of the inlet. The cutoff switch shall be set for not less than ten (10) psi (69 kPa). A pressure gauge shall be installed between the shutoff valve and the pump.

**609.9 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 it, the following:

**609.9.1** The pipe system shall be flushed with clean, potable water until only potable water appears at the points of outlet.

**609.9.2** The system or parts thereof shall be filled with a water-chlorine solution containing not less than fifty (50) parts per million of chlorine, and the system or part thereof shall be valved-off and allowed to stand for twenty-four (24) hours; or, the system or part thereof shall be filled with a water-chlorine solution containing not less than two-hundred (200) parts per million of chlorine and allowed to stand for three (3) hours.

**609.9.3** Following the allowed standing time, the system shall be flushed with clean, potable water until the chlorine residual in the water coming from the system does not exceed the chlorine residual in the flushing water.

**609.9.4** The procedure shall be repeated if it is shown by bacteriological examination made by an approved agency that contamination persists in the system.

**609.10 Water Hammer.** Building water supply systems where flushometers or quick-acting valves are installed shall be provided with water hammer arrester(s) to absorb high pressures resulting from the quick closing of these valves. Water hammer arrestors shall be approved mechanical devices in accordance with the applicable standard(s) referenced in Table 14-1 and shall be installed as close as possible to quick-acting valves.

**Exception:** Residential structures within the scope of the Oregon Residential Structures Specialty Code.

**609.10.1 Mechanical Devices.** When listed mechanical devices are used, the manufacturer's specifications as to location and method of installation shall be followed.

**610.0 Size of Potable Water Piping.**

**610.1** The size of each water meter and each potable water supply pipe from the meter or other source of supply to the fixture supply branches, risers, fixtures, connections, outlets, or other uses shall be based on the total demand and shall be determined according to the methods and procedures outlined in this section. Water piping systems shall be designed to ensure that the maximum velocities allowed by the code and the applicable standard are not exceeded.

**610.2** Whenever a water filter, water softener, backflow prevention device or similar device is installed in any water supply line, the pressure loss through such devices shall be included in the pressure loss calculations of the system, and the water supply pipe and meter shall be adequately sized to provide for any such pressure loss.

No water filter, water softener, backflow prevention device, or similar device regulated by this code shall be installed in any potable water supply piping when the installation of such device produces an

excessive pressure drop in any such water supply piping. In the absence of specific pressure drop information, the diameter of the inlet or outlet of any such device or its connecting piping shall be not less than the diameter of such water distribution piping to the fixtures served by the device.

Such devices shall be of a type approved by the Authority Having Jurisdiction and shall be tested for flow rating and pressure loss by an approved laboratory or recognized testing agency to standards consistent with the intent of this chapter.

**610.3** The quantity of water required to be supplied to every plumbing fixture shall be represented by fixture units, as shown in Table 6-5. Equivalent fixture values shown in Table 6-5 include both hot and cold water demand.

**610.4** Systems within the range of Table 6-6 shall be permitted to be sized from that table or by the method set forth in Section 610.5.

Listed parallel water distribution systems shall be installed in accordance with their listing, but at no time shall any portion of the system exceed the maximum velocities allowed by the code.

**610.5** Except as provided in Section 610.4, the size of each water piping system shall be determined in accordance with the procedure set forth in Appendix A. For alternate methods of sizing water supply systems, see Appendix L.

**610.6** Except where the type of pipe used and the water characteristics are such that no decrease in capacity due to length of service (age of system) is expected, friction-loss data shall be obtained from the "Fairly Rough" or "Rough" charts in Appendix A of this code. Friction or pressure losses in water meter, valve, and fittings shall be obtained from the same sources. Pressure losses through water-treating equipment, backflow prevention devices, or other flow-restricting devices shall be computed as required by Section 610.2.

**610.7** On any proposed water piping installation sized using Table 6-6, the following conditions shall be determined:

(1) Total number of fixture units as determined from Table 6-5, Equivalent Fixture Units, for the fixtures to be installed.

(2) Developed length of supply pipe from meter to most remote outlet.

(3) Difference in elevation between the meter or other source of supply and the highest fixture or outlet.

(4) Pressure in the street main or other source of supply at the locality where the installation is to be made.

(5) In localities where there is a fluctuation of pressure in the main throughout the day, the water piping system shall be designed on the basis of the minimum pressure available.

**610.8 Size of Meter and Building Supply Pipe Using Table 6-6.** The size of the meter and the building supply pipe shall be determined as follows:

(1) Determine the available pressure at the water meter or other source of supply.

(2) Subtract one-half (1/2) pound per square inch pressure (3.4 kPa) for each foot (305 mm) of difference in elevation between such source of supply and the highest water supply outlet in the building or on the premises.

(3) Use the "pressure range" group within which this pressure will fall using Table 6-6.

(4) Select the "length" column that is equal to or longer than the required length.

(5) Follow down the column to a fixture unit value equal to or exceeding the total number of fixture units required by the installation.

(6) Having located the proper fixture unit value for the required length, sizes of meter and building supply pipe as found in the two (2) left-hand columns shall be applied.

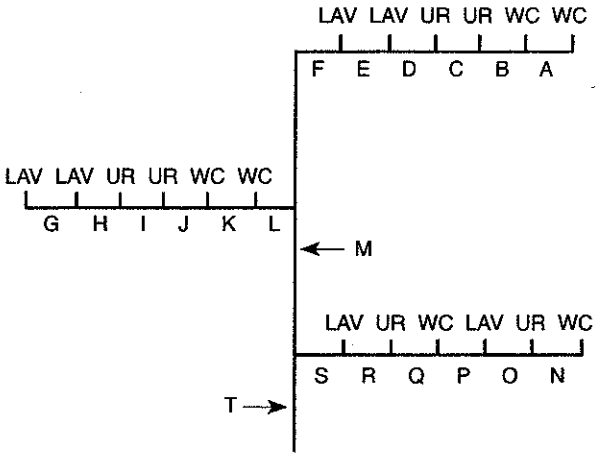
No building supply pipe shall be less than three-quarters (3/4) of an inch (20 mm) in diameter.

**610.9 Size of Branches.** When Table 6-6 is used, the minimum size of each branch shall be determined by the number of fixture units to be served by that branch, the total developed length of the system, and the meter and street service size as per Section 610.8. No branch piping is required to be larger in size than that required by Table 6-6 for the building supply pipe.

**610.10 Sizing for Flushometer Valves.** When using Table 6-6 to size water supply systems serving flushometer valves, the number of flushometer fixture units assigned to every section of pipe, whether branch or main, shall be determined by the number and category of flushometer valves served by that section of pipe, in accordance with Table 6-7. Piping supplying a flushometer valve shall be not less in size than the valve inlet.

When using Table 6-7 to size water piping, care must be exercised to assign flushometer fixture units based on the number and category of fixtures served.

**Sizing Method**
**Example Using Table 6-7**
**Public Use Fixtures**




In the example below, fixture units assigned to each section of pipe are computed as follows: Note: Each capital letter refers to the section of pipe above it, unless otherwise shown.

A: 1 WC = 40 F.U.
B: 2 WC = 70 F.U.
C: 2 WC (70) + 1 UR (20) = 90 F.U.
D: 2 WC (70) + 2 UR (35) = 105 F.U.
E: 2 WC (70) + 2 UR (35) + 1 LAV (1) = 106 F.U.
F: 2 WC (70) + 2 UR (35) + 2 LAV (2) = 107 F.U.
G: 1 LAV = 1 F.U.
H: 2 LAV = 2 F.U.
I: 2 LAV (2) + 1 UR (20) = 22 F.U.
J: 2 LAV (2)+ 2 UR (35) = 37 F.U.
K: 2 LAV (2) + 2 UR (35) + 1 WC (40) = 77 F.U.
L: 2 LAV (2) + 2 UR (35) + 2 WC (70) = 107 F.U.
M: 4 WC (105) + 4 UR (53) + 4 LAV (4) = 162 F.U.
N: 1 WC = 40 F.U.
O: 1 WC (40) + 1 UR (20) = 60 F.U.
P: 1 WC (40) + 1 UR (20) + 1 LAV (1) = 61 F.U.
Q: 2 WC (70) + 1 UR (20) + 1 LAV (1) = 91 F.U.
R: 2 WC (70) + 2 UR (35) + 1 LAV (1) = 106 F.U.
S: 2 WC (70) + 2 UR (35) + 2 LAV (2) = 107 F.U.
T: 6 WC (125) + 6 UR (63) + 6 LAV (6) = 194 F.U.

**610.11 Sizing Systems for Flushometer Tanks.** The size of branches and mains serving flushometer tanks shall be consistent with the sizing procedures for flush tank water closets.

**610.12 Sizing for Velocity.** Water piping systems shall not exceed the maximum velocities listed in this section or Appendix A.

**610.12.1 Copper Tube Systems.** Maximum velocities in copper and copper alloy tube and fitting systems shall not exceed eight (8) feet per second (fps) (2.4 mps) in cold water and five (5) fps in hot water (1.5 mps).

**610.12.2 Tubing Systems Using Copper Alloy Fittings.** Maximum velocities through copper alloy fittings in tubing other than copper shall not exceed eight (8) feet per second (fps) (2.4 mps) in cold water and five (5) fps in hot water (1.5 mps).

**610.13 Exceptions.** The provisions of this section relative to size of water piping shall not apply to the following:

(1) Water supply piping systems designed in accordance with recognized engineering procedures acceptable to the Authority Having Jurisdiction.
(2) Alteration of or minor additions to existing installations, provided the Authority Having Jurisdiction finds that there will be an adequate supply of water to operate all fixtures.
(3) Replacement of existing fixtures or appliances.
(4) Piping that is part of fixture equipment.
(5) Unusual conditions where, in the judgment of the Authority Having Jurisdiction, an adequate supply of water is provided to operate fixtures and equipment.
(6) Nonpotable waterlines as defined in Sections 601.2.2 and 601.2.4.
(7) The size and material of irrigation water piping installed outside of any building or structure and separated from the potable water supply by means of an approved airgap or backflow prevention device is not regulated by this code. The potable water piping system supplying each such irrigation system shall be adequately sized as required elsewhere in this chapter to deliver the full connected demand of both the domestic use and the irrigation systems.

**611.0 Drinking Water Treatment Units.**

**611.1 Compliance with Standard.** Drinking water treatment units shall meet the requirements of the appropriate standard referenced in Table 14-1.

**611.2 Airgap Discharge.** Discharge from drinking water treatment units shall enter the drainage system through an airgap or an airgap device that meets the requirements of the appropriate standards referenced in Table 14-1.

**611.3 Connection Tubing.** The tubing to and from drinking water treatment units shall be of a size and material as recommended by the manufacturer. The tubing shall comply with the requirements of the appropriate standards referenced in Table 14-1.

**611.4 Sizing of Residential Softeners.** Residential-use water softeners shall be sized per Table 6-8.

| Inch | mm |
|---|---|
| 1/2 | 15 |
| 3/4 | 20 |
| 1 | 25 |

## TABLE 6-5

### Water Supply Fixture Units (WSFU) and Minimum Fixture Branch Pipe Sizes[3]

| Appliances, Appurtenances or Fixtures[2] | Minimum Fixture Branch Pipe Size[1,4] | Private | Public | Assembly[6] |
|---|---|---|---|---|
| Bathtub or Combination Bath/Shower (fill) | 1/2" | 4.0 | 4.0 | |
| 3/4" Bathtub Fill Valve | 3/4" | 10.0 | 10.0 | |
| Bidet | 1/2" | 1.0 | | |
| Clothes washer | 1/2" | 4.0 | 4.0 | |
| Dental Unit, cuspidor | 1/2" | | 1.0 | |
| Dishwasher, domestic | 1/2" | 1.5 | 1.5 | |
| Drinking Fountain or Water Cooler | 1/2" | 0.5 | 0.5 | 0.75 |
| Hose Bibb | 1/2" | 2.5 | 2.5 | |
| Hose Bibb, each additional[8] | 1/2" | 1.0 | 1.0 | |
| Lavatory | 1/2" | 1.0 | 1.0 | 1.0 |
| Lawn Sprinkler, each head[5] | | 1.0 | 1.0 | |
| Mobile Home, each (minimum) | | 12.0 | | |
| *Sinks* | | | | |
| Bar | 1/2" | 1.0 | 2.0 | |
| Clinic Faucet | 1/2" | | 3.0 | |
| Clinic Flushometer Valve with or without faucet | 1" | | 8.0 | |
| Kitchen, domestic | 1/2" | 1.5 | 1.5 | |
| Laundry | 1/2" | 1.5 | 1.5 | |
| Service or Mop Basin | 1/2" | 1.5 | 3.0 | |
| Washup, each set of faucets | 1/2" | | 2.0 | |
| Shower, per head | 1/2" | 2.0 | 2.0 | |
| Urinal, 1.0 GPF Flushometer Valve | 3/4" | See Footnote[7] | | |
| Urinal, greater than 1.0 GPF Flushometer Valve | 3/4" | See Footnote[7] | | |
| Urinal, flush tank | 1/2" | 2.0 | 2.0 | 3.0 |
| Wash Fountain, circular spray | 3/4" | | 4.0 | |
| Water Closet, 1.6 GPF Gravity Tank | 1/2" | 2.5 | 2.5 | 3.5 |
| Water Closet, 1.6 GPF Flushometer Tank | 1/2" | 2.5 | 2.5 | 3.5 |
| Water Closet, 1.6 GPF Flushometer Valve | 1" | See Footnote[7] | | |
| Water Closet, greater than 1.6 GPF Gravity Tank | 1/2" | 3.0 | 5.5 | 7.0 |
| Water Closet, greater than 1.6 GPF Flushometer Valve | 1" | See Footnote[7] | | |

Notes:

1 Size of the cold branch pipe, or both the hot and cold branch pipes.

2 Appliances, Appurtenances or Fixtures not included in this Table may be sized by reference to fixtures having a similar flow rate and frequency of use.

3 The listed fixture unit values represent their load on their cold water service. The separate hot water fixture unit value for fixtures having both hot and cold water connections may each be taken as three-quarter (3/4) of the listed total value of the fixture.

4 The listed minimum supply branch pipe sizes for individual fixtures are the nominal (I.D.) pipe size.

5 For fixtures or supply connections likely to impose continuous flow demands, determine the required flow in gallons per minute (GPM), and add it separately to the demand (in GPM) for the distribution system or portions thereof.

6 Assembly [Public Use (See Table 4-1)].

7 When sizing flushometer systems, see Section 610.10.

8 Reduced fixture unit loading for additional hose bibbs is to be used only when sizing total building demand and for pipe sizing when more than one (1) hose bibb is supplied by a segment of water-distributing pipe. The fixture branch to each hose bibb shall be sized on the basis of two and one-half (2.5) fixture units.

## TABLE 6-6
## Fixture Unit Table for Determining Water Pipe and Meter Sizes

| Inch | mm |
|---|---|
| 1/2 | 15 |
| 3/4 | 20 |
| 1 | 25 |
| 1-1/4 | 32 |
| 1-1/2 | 40 |
| 2 | 50 |
| 2-1/2 | 65 |

| Meter and Street Service, Inches | Building Supply and Branches, Inches | Maximum Allowable Length in Feet (meters) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 40 (12) | 60 (18) | 80 (24) | 100 (30) | 150 (46) | 200 (61) | 250 (76) | 300 (91) | 400 (122) | 500 (152) | 600 (183) | 700 (213) | 800 (244) | 900 (274) | 1000 (305) |
| **Pressure Range – 30 to 45 psi (207 to 310 kPa)**** | | | | | | | | | | | | | | | | |
| 3/4 | 1/2*** | 6 | 5 | 4 | 3 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3/4 | 3/4 | 16 | 16 | 14 | 12 | 9 | 6 | 5 | 5 | 4 | 4 | 3 | 2 | 2 | 2 | 1 |
| 3/4 | 1 | 29 | 25 | 23 | 21 | 17 | 15 | 13 | 12 | 10 | 8 | 6 | 6 | 6 | 6 | 6 |
| 1 | 1 | 36 | 31 | 27 | 25 | 20 | 17 | 15 | 13 | 12 | 10 | 8 | 6 | 6 | 6 | 6 |
| 3/4 | 1-1/4 | 36 | 33 | 31 | 28 | 24 | 23 | 21 | 19 | 17 | 16 | 13 | 12 | 12 | 11 | 11 |
| 1 | 1-1/4 | 54 | 47 | 42 | 38 | 32 | 28 | 25 | 23 | 19 | 17 | 14 | 12 | 12 | 11 | 11 |
| 1-1/2 | 1-1/4 | 78 | 68 | 57 | 48 | 38 | 32 | 28 | 25 | 21 | 18 | 15 | 12 | 12 | 11 | 11 |
| 1 | 1-1/2 | 85 | 84 | 79 | 65 | 56 | 48 | 43 | 38 | 32 | 28 | 26 | 22 | 21 | 20 | 20 |
| 1-1/2 | 1-1/2 | 150 | 124 | 105 | 91 | 70 | 57 | 49 | 45 | 36 | 31 | 26 | 23 | 21 | 20 | 20 |
| 2 | 1-1/2 | 151 | 129 | 129 | 110 | 80 | 64 | 53 | 46 | 38 | 32 | 27 | 23 | 21 | 20 | 20 |
| 1 | 2 | 85 | 85 | 85 | 85 | 85 | 85 | 82 | 80 | 66 | 61 | 57 | 52 | 49 | 46 | 43 |
| 1-1/2 | 2 | 220 | 205 | 190 | 176 | 155 | 138 | 127 | 120 | 104 | 85 | 70 | 61 | 57 | 54 | 51 |
| 2 | 2 | 370 | 327 | 292 | 265 | 217 | 185 | 164 | 147 | 124 | 96 | 70 | 61 | 57 | 54 | 51 |
| 2 | 2-1/2 | 445 | 418 | 390 | 370 | 330 | 300 | 280 | 265 | 240 | 220 | 198 | 175 | 158 | 143 | 133 |
| **Pressure Range – 46 to 60 psi (317 to 414 kPa)**** | | | | | | | | | | | | | | | | |
| 3/4 | 1/2*** | 7 | 7 | 6 | 5 | 4 | 3 | 2 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 3/4 | 3/4 | 20 | 20 | 19 | 17 | 14 | 11 | 9 | 8 | 6 | 5 | 4 | 4 | 3 | 3 | 3 |
| 3/4 | 1 | 39 | 39 | 36 | 33 | 28 | 23 | 21 | 19 | 17 | 14 | 12 | 10 | 9 | 8 | 8 |
| 1 | 1 | 39 | 39 | 39 | 36 | 30 | 25 | 23 | 20 | 18 | 15 | 12 | 10 | 9 | 8 | 8 |
| 3/4 | 1-1/4 | 39 | 39 | 39 | 39 | 39 | 39 | 34 | 32 | 27 | 25 | 22 | 19 | 19 | 17 | 16 |
| 1 | 1-1/4 | 78 | 78 | 76 | 67 | 52 | 44 | 39 | 36 | 30 | 27 | 24 | 20 | 19 | 17 | 16 |
| 1-1/2 | 1-1/4 | 78 | 78 | 78 | 78 | 66 | 52 | 44 | 39 | 33 | 29 | 24 | 20 | 19 | 17 | 16 |
| 1 | 1-1/2 | 85 | 85 | 85 | 85 | 85 | 85 | 80 | 67 | 55 | 49 | 41 | 37 | 34 | 32 | 30 |
| 1-1/2 | 1-1/2 | 151 | 151 | 151 | 151 | 128 | 105 | 90 | 78 | 62 | 52 | 42 | 38 | 35 | 32 | 30 |
| 2 | 1-1/2 | 151 | 151 | 151 | 151 | 150 | 117 | 98 | 84 | 67 | 55 | 42 | 38 | 35 | 32 | 30 |
| 1 | 2 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 83 | 80 |
| 1-1/2 | 2 | 370 | 370 | 340 | 318 | 272 | 240 | 220 | 198 | 170 | 150 | 135 | 123 | 110 | 102 | 94 |
| 2 | 2 | 370 | 370 | 370 | 370 | 368 | 318 | 280 | 250 | 205 | 165 | 142 | 123 | 110 | 102 | 94 |
| 2 | 2-1/2 | 654 | 640 | 610 | 580 | 535 | 500 | 470 | 440 | 400 | 365 | 335 | 315 | 285 | 267 | 250 |
| **Pressure Range – Over 60 psi (414 kPa)**** | | | | | | | | | | | | | | | | |
| 3/4 | 1/2*** | 7 | 7 | 7 | 6 | 5 | 4 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 0 |
| 3/4 | 3/4 | 20 | 20 | 20 | 20 | 17 | 13 | 11 | 10 | 8 | 7 | 6 | 6 | 5 | 4 | 4 |
| 3/4 | 1 | 39 | 39 | 39 | 39 | 35 | 30 | 27 | 24 | 21 | 17 | 14 | 13 | 12 | 12 | 11 |
| 1 | 1 | 39 | 39 | 39 | 39 | 38 | 32 | 29 | 26 | 22 | 18 | 14 | 13 | 12 | 12 | 11 |
| 3/4 | 1-1/4 | 39 | 39 | 39 | 39 | 39 | 39 | 39 | 39 | 34 | 28 | 26 | 25 | 23 | 22 | 21 |
| 1 | 1-1/4 | 78 | 78 | 78 | 78 | 74 | 62 | 53 | 47 | 39 | 31 | 26 | 25 | 23 | 22 | 21 |
| 1-1/2 | 1-1/4 | 78 | 78 | 78 | 78 | 78 | 74 | 65 | 54 | 43 | 34 | 26 | 25 | 23 | 22 | 21 |
| 1 | 1-1/2 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 81 | 64 | 51 | 48 | 46 | 43 | 40 |
| 1-1/2 | 1-1/2 | 151 | 151 | 151 | 151 | 151 | 151 | 130 | 113 | 88 | 73 | 51 | 51 | 46 | 43 | 40 |
| 2 | 1-1/2 | 151 | 151 | 151 | 151 | 151 | 151 | 142 | 122 | 98 | 82 | 64 | 51 | 46 | 43 | 40 |
| 1 | 2 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 |
| 1-1/2 | 2 | 370 | 370 | 370 | 370 | 360 | 335 | 305 | 282 | 244 | 212 | 187 | 172 | 153 | 141 | 129 |
| 2 | 2 | 370 | 370 | 370 | 370 | 370 | 370 | 370 | 340 | 288 | 245 | 204 | 172 | 153 | 141 | 129 |
| 2 | 2-1/2 | 654 | 654 | 654 | 654 | 654 | 650 | 610 | 570 | 510 | 460 | 430 | 404 | 380 | 356 | 329 |

** Available static pressure after head loss.

*** Building supply, not less than three-quarter (3/4) inch (20 mm) nominal size.

**Table 6-7**
**Flushometer Fixture Units for Water Sizing Using Table 6-5**

| Fixture Category: Water Closet w/ Flushometer Valves | | |
|---|---|---|
| Number of Flushometer Valves | Individual Fixture Units Assigned in Decreasing Value | Fixture Units Assigned for Water Closets and Similar 10-Unit Fixtures in Accumulative Values |
| 1 | 40 | 40 |
| 2 | 30 | 70 |
| 3 | 20 | 90 |
| 4 | 15 | 105 |
| 5 or more | 10 each | 115 plus 10 for each additional fixture in excess of 5 |

| Fixture Category: Urinals w/ Flushometer Valves | | |
|---|---|---|
| Number of Flushometer Valves | Individual Fixture Units Assigned in Decreasing Value | Fixture Units Assigned for Urinals and Similar 5-Unit Fixtures in Accumulative Values |
| 1 | 20 | 20 |
| 2 | 15 | 35 |
| 3 | 10 | 45 |
| 4 | 8 | 53 |
| 5 or more | 5 each | 58 plus 5 for each additional fixture in excess of 5 |

**TABLE 6-8**
**Sizing of Residential Water Softeners**

| Required Size of Softener Connection | Number of Bathroom Groups Served[1] |
|---|---|
| 3/4 in. | up to 2[2] |
| 1 in. | up to 4[3] |

[1] Installation of a kitchen sink and dishwasher, laundry tray, and automatic clothes washer permitted without additional size increase.

[2] An additional water closet and lavatory permitted.

[3] Over four (4) bathroom groups, the softener size shall be engineered for the specific installation.

*See also Appendix A, Recommended Rules for Sizing the Water Supply System, and Appendix L, Alternate Plumbing Systems, for alternate methods of sizing water supply systems.*

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