

Table 9.4.1 *Continued*

Materials	Reference Standards
<i>Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type</i>	ASSE 1019
<i>Plastic Toilet (Water Closet) Seats</i>	ANSI Z124.5
<i>Plastic Bathtub Units</i>	ANSI Z124.6
<i>Prefabricated Plastic Spa Shells</i>	ANSI Z124.7
<i>Plastic Bathtub Liners</i>	ANSI Z124.8
<i>Plastic Urinal Fixtures</i>	ANSI Z124.9
<i>Water Heater Relief Valve Drain Tubes</i>	ASME A112.4.1
<i>Flexible Water Connectors</i>	ASME A112.18.6
<i>Performance Requirements for Backflow Protection Devices and Systems in Plumbing Fixture Fittings</i>	ASME A112.18.3
<i>Non-Vitreous Ceramic Plumbing Fixtures</i>	ASME A112.19.9M
<i>Dual Flush Devices for Water Closets</i>	ASME A112.19.10
<i>Deck Mounted Bath/Shower Transfer Valves with Integral Backflow Protection</i>	ASME A112.18.7
<i>Plastic Fittings for Connecting Water Closets to the Sanitary Drainage System</i>	ASME A112.4.3

9.4.2 Where more than one standard is referenced for a particular material or component, compliance with only one of those standards shall be required.

Exception No. 1: Where one of the reference standards requires evaluation of chemical, toxicity, or odor properties that are not included in the other standard, then conformance to the applicable requirements of each standard shall be required.

Exception No. 2: Where a plastic material or component is not covered by the standards in Table 9.4.1, it shall be certified as nontoxic in accordance with ANSI/NSF 14, Plastic Piping Components and Related Materials.

9.5 Joints and Connections.

9.5.1 Tightness. Joints and connections in the plumbing system shall be gastight and watertight for the pressures required under testing procedures.

9.5.2 Assembling of Pipe. All joints and connections shall be correctly assembled for tightness. Pipe threads shall be fully engaged with the threads of the fitting. Plastic pipe and copper tubing shall be inserted to the full depth of the solder cup or welding sockets of each fitting. Pipe threads and slip joints shall not be wrapped with string, paper, putty, or similar fillers.

9.5.3 Threaded Joints. Threads for screw pipe and fittings shall conform to the approved or listed standard. Pipe ends shall be reamed out to size of bore. All burrs, chips, cutting oil, and foreign matter shall be removed. Pipe joint cement or thread lubricant shall be of approved type and applied to male threads only.

9.5.4 Solder Joints. Solder joints for tubing shall be made with approved or listed solder-type fittings. Surfaces to be soldered shall be cleaned bright. The joints shall be properly fluxed with noncorrosive paste-type flux and, for manufactured homes that are to be connected to a public water system, made with solder having not more than 0.2 percent lead.

9.5.5 Plastic Pipe, Fittings, and Joints. Plastic pipe and fittings shall be joined by installation methods recommended by the manufacturer or in accordance with the provisions of a recognized, approved, or listed standard.

9.5.6 Union Joints. Metal unions in water piping shall have metal-to-metal ground seats.

9.5.7 Flared Joints. Flared joints for soft-copper water tubing shall be made with approved or listed fittings. The tubing shall be expanded with a proper flaring tool.

9.5.8 Cast-Iron Soil Pipe Joints. Approved or listed cast-iron pipe shall be permitted to be joined as follows:

- (1) Approved or listed hubless pipe and fittings shall be permitted to be joined with listed couplings or adapters, per the manufacturer's recommendations.
- (2) Hub and plain-end soil pipe shall be permitted to be joined by compression fittings, per the manufacturer's recommendation.

9.6 Traps and Cleanouts.

9.6.1 Traps.

9.6.1.1 Traps Required. Each plumbing fixture shall be separately trapped by approved water seal "P" traps. All traps shall be effectively vented.

Exception: Listed toilets.

9.6.1.2 Combination Fixtures. A two- or three-compartment sink, up to three single sinks, or up to three lavatories, with waste outlets not more than 30 in. (760 mm) apart, in the same room, and flood level rims at the same level shall be permitted to be connected to one "P" trap and considered as a single fixture for the purposes of drainage and vent requirements.

9.6.1.3 Prohibited Traps. A trap that depends for its seal on concealed interior partitions shall not be used. Full "S" traps, bell traps, drum traps, crown-vented traps, and running traps shall not be permitted. Fixtures shall not be double-trapped.

9.6.1.4 Material and Design. Each trap shall be self-cleaning, with a smooth and uniform interior waterway. Traps shall be manufactured of cast iron, cast brass, or drawn brass tubing of not less than No. 20 Brown and Sharpe gauge, or of approved or listed plastic, or other approved or listed material. Union joints for a trap shall be beaded to provide a shoulder for the union nut. Each trap shall have the manufacturer's name stamped or cast in the body of the trap, and each tubing trap shall show the gauge of the tubing.

9.6.1.5 Trap Seal. Each “P” trap shall have a water seal of not less than 2 in. (50 mm) and not more than 4 in. (100 mm) and shall be set true to its seal.

9.6.1.6 Size. Traps shall be not less than 1¼ in. (32 mm) in diameter. A trap shall not be larger than the waste pipe to which it is connected.

9.6.1.7 Location. Each trap shall be located as close to its vent and fixture outlet as structural conditions will allow.

9.6.1.8 Length of Tailpiece. The vertical distance from a trap to the fixture outlet shall not exceed 24 in. (610 mm).

9.6.1.9 Installation.

9.6.1.9.1 Grade of Trap Arm. The piping between a “P” trap and the fixture tee or the vented waste line shall be graded ¼ in./ft (20 mm/m) toward the vent and in no case shall have a slope greater than its diameter. The vent opening at fixture tees shall not be below the weir of the “P” trap outlet.

9.6.1.9.2 Trap Arm Offset. The piping between the “P” trap and vent shall be permitted to change direction or be offset horizontally with the equivalent of no more than 180 degrees total change in direction, with a maximum of 90 degrees by any one fitting.

9.6.1.9.3 Concealed Traps. Traps with mechanical joints shall be accessible for repair and inspection.

9.6.1.9.4 Removability of Traps. Traps shall be designed and installed so the “U” bend is removable without removing the strainers from the fixture. Continuous waste and tailpieces that are permanently attached to the “U” bend also shall be removable without removing the strainer from the fixture.

9.6.2 Cleanout Openings.

9.6.2.1 Location of Cleanout Fittings.

9.6.2.1.1 Cleanouts shall be installed where the drainage system cannot be cleaned through fixtures, drains, or vents. Cleanouts also shall be provided where fittings of more than 45 degrees are used to effect an offset.

Exception: Where long-turn ells provide sufficient “sweep” for cleaning.

9.6.2.1.2 A full-size cleanout shall be installed at the upper end of any section of drain piping that does not have the required minimum slope of ¼ in./ft (20 mm/m) grade.

9.6.2.1.3 A cleaning tool shall not be required to pass through more than 360 degrees of fittings, excluding removable “P” traps, to reach any part of the drainage system. Water closets shall be permitted to be removed for drainage system access.

9.6.2.2 Access to Cleanouts. Cleanouts shall be accessible through an unobstructed minimum clearance of 12 in. (305 mm) directly in front of the opening. Each cleanout fitting shall open in a direction opposite to the flow or at right angles to the pipe. Concealed cleanouts that are not provided with access covers shall be extended to a point above the floor or outside the manufactured home with pipe and fittings installed, as required, for drainage piping without sags and pockets.

9.6.2.3 Material. Plugs and caps shall be brass, or approved or listed plastic, with screw pipe threads.

9.6.2.4 Design. Cleanout plugs shall have raised heads. Plugs at floor level shall have countersunk slots.

9.7 Plumbing Fixtures.

9.7.1 General Requirements.

9.7.1.1 Quality of Fixtures. Plumbing fixtures shall have smooth, impervious surfaces, be free from defects and concealed fouling surfaces, be capable of resisting road shock and vibration, and conform in quality and design to listed standards. Fixtures shall be permanently marked with the manufacturer’s name or trademark.

9.7.1.2 Strainers. The waste outlet of all plumbing fixtures shall be equipped with a drain fitting that will provide an adequate unobstructed waterway.

Exception: Water closets.

9.7.1.3 Fixture Connections. Fixture tailpieces and continuous wastes in exposed or accessible locations shall be not less than No. 20 Brown and Sharpe gauge seamless drawn-brass tubing or other approved pipe or tubing materials. Inaccessible fixture connections shall be constructed according to the requirements for drainage piping. Each fixture tailpiece, continuous waste, or waste and overflow shall be not less than 1½ in. (40 mm) for sinks of two or more compartments, dishwashers, clothes washing machines, laundry tubs, bathtubs, and showers; and not less than 1¼ in. (32 mm) for lavatories and single-compartment sinks that have a 2 in. (50 mm) maximum drain opening.

9.7.1.4 Concealed Connections. Concealed slip joint connections shall be provided with adequately sized, unobstructed access panels and shall be accessible for inspection and repair.

9.7.1.5 Directional Fitting. An approved or listed “Y” or other directional-type branch fitting shall be installed in every tailpiece or continuous waste that receives the discharge from food waste disposal units, dishwashing, or other forced-discharge fixture or appliance. (*See also 9.7.2.4.2.*)

9.7.1.6 Water Conservation. All lavatory faucets, shower heads, and sink faucets shall not exceed a flow of 2.5 gpm (9.5 L/min).

9.7.2 Fixtures.

9.7.2.1 Spacing. All plumbing fixtures shall be located and installed so as to be reasonably accessible for their intended use.

9.7.2.2 Water Closets.

9.7.2.2.1 Water closets shall be designed and manufactured according to approved or listed standards and shall be equipped with a water-flushing device capable of adequately flushing and cleaning the bowl at each operation of the flushing mechanism.

9.7.2.2.2 Water closet flushing devices shall be designed to replace the water seal in the bowl after each operation. Flush valves, flushometer valves, flushometer tanks, and ball cocks shall automatically shut off at the end of each flush or when the tank is filled to operating capacity.

9.7.2.2.3 All water closets shall be low consumption [1.6 gpf (6 Lpf)] closets.

9.7.2.2.4 Flush tanks shall be fitted with an overflow pipe large enough to prevent flooding at the maximum flow rate of the ball cock. Overflow pipes shall discharge into the toilet through the tank.

9.7.2.2.5 Water closets that have fouling surfaces that are not thoroughly washed at each discharge shall not be permitted. Any water closet that allows the contents of the bowl to be siphoned back into the water system shall not be permitted.

9.7.2.2.6 Floor Connection. Water closets shall be securely bolted to an approved flange or other approved fitting that is secured to the floor by means of corrosion-resistant screws. The bolts shall be of solid brass or other corrosion-resistant material and shall be not less than $\frac{1}{4}$ in. (6 mm) in diameter. A watertight seal shall be made between the water closet and flange or other approved fitting by use of a gasket, sealing compound, or listed connector device.

9.7.2.3 Shower Compartment.

9.7.2.3.1 Each shower compartment shall be provided with an approved watertight receptor with sides and back extending at least 1 in. (25 mm) above the finished dam or threshold. In no case shall the depth of a shower receptor be less than 2 in. (50 mm) or more than 9 in. (230 mm) measured from the top of the finished dam or threshold to the top of the drain. The wall area shall be constructed of smooth, noncorrosive, and nonabsorbent waterproof materials to a height not less than 6 ft (2 m) above the bathroom floor level. Such walls shall form a watertight joint with each other and with the bathtub, receptor, or shower floor. The floor of the compartment shall slope uniformly to the drain at not less than $\frac{1}{4}$ in./ft (20 mm/m) nor more than $\frac{1}{2}$ in./ft (43 mm/m).

9.7.2.3.2 The joint around the drain connection shall be made watertight by a flange, clamping ring, or other approved, listed means.

9.7.2.3.3 Shower doors and tub and shower enclosures shall be constructed so as to be waterproof, and, if they are glazed, glazing shall comply with ANSI Z97.1, *Glazing Materials Used in Buildings, Safety Performance Used in Specifications and Methods of Test*.

9.7.2.3.4 Prefabricated plumbing fixtures shall be approved or listed.

9.7.2.3.5 Showers, bathtub, and bath-shower combinations shall be protected with individual control valves of the pressure-balancing, thermostatic, or combination pressure-balancing mixing valve type. The handle position or limit stops on such valves shall be set to deliver a maximum hot water setting of 120°F (49°C). The water heater thermostat shall not be considered a suitable control for adjusting the maximum hot water setting.

9.7.2.4 Dishwashing Machines.

9.7.2.4.1 A dishwashing machine shall discharge its waste through a fixed air gap installed above the machine; through a high loop as specified by the dishwashing machine manufacturer; or into an open standpipe-receptor with a height greater than the washing compartment of the machine. When a standpipe is used, it shall be at least 18 in. (457 mm), but not more than 30 in. (762 mm), above the trap weir. The drain connections from the air gap or high loop shall be permitted to connect to an individual trap; to a directional fitting installed in the sink tailpiece; or to an opening provided on the inlet side of a food waste disposal unit.

9.7.2.4.2 The drain from a dishwashing machine shall not be connected to a sink tailpiece, continuous waste line, or trap on the discharge side of a food waste disposal unit.

9.7.2.5 Clothes Washing Machines.

9.7.2.5.1 Clothes washing machines shall drain either into a properly vented trap, into a laundry tub tailpiece with watertight connections, into an open standpipe receptor, or over the rim of a laundry tub.

9.7.2.5.2 Standpipes shall be either $1\frac{1}{2}$ in. (40 mm) minimum nominal iron pipe size, $1\frac{1}{2}$ in. (40 mm) diameter nominal brass tubing not less than No. 20 Brown and Sharpe gauge, or $1\frac{1}{2}$ in. (40 mm) approved plastic materials. Receptors shall discharge into a vented trap or shall be connected to a laundry tub tailpiece by means of an approved or listed directional fitting. Each standpipe shall extend not less than 18 in. (457 mm) or more than 48 in. (1219 mm) above its trap and shall terminate in an accessible location no lower than the top of the clothes washing machine. A removable, tight-fitting cap or plug shall be installed on the standpipe when a clothes washing machine is not provided.

9.7.2.5.3 The clothes washing machine drain shall not be connected to the tailpiece, continuous waste, or trap of any sink or dishwashing machine.

9.7.2.6 Shower Valves. Shower and tub-shower combination valves shall be balanced pressure, thermostatic, or combination mixing valves that conform to the requirements of ASSE 1016, *Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations*. Such valves shall be equipped with handle position stops that are adjustable in accordance with the valve manufacturer's instructions to a maximum hot water setting of 120°F (49°C).

9.7.3 Installation.

9.7.3.1 Access. Each plumbing fixture and standpipe receptor shall be located and installed so as to be accessible for usage, cleaning, repair, and replacement. Access to diverter valves and other connections from the fixture hardware shall not be required.

9.7.3.2 Alignment. Fixtures shall be set level and in true alignment with adjacent walls. Where practical, piping from fixtures shall extend to the nearest wall.

9.7.3.3 Brackets. Wall-hung fixtures shall be rigidly attached to walls by metal brackets or supports without any strain being transmitted to the piping connections. Flush tanks shall be securely fastened to water closets or to the wall with corrosive-resistant materials.

9.7.3.4 Tub Supports. Bathtub rims at the wall shall be supported on metal hangers or on end-grain wood blocking attached to the wall unless otherwise recommended by the manufacturer of the tub.

9.7.3.5 Fixture Fittings. Faucets and diverters shall be installed so that the flow of hot water from the fittings corresponds to the left-hand side of the fitting.

9.7.3.6 Hydromassage Bathtub.

9.7.3.6.1 Access Panel. A door or panel of sufficient size shall be installed to provide access to the pump for repair and/or replacement.

9.7.3.6.2 Piping Drainage. The circulation pump shall be accessibly located above the crown weir of the trap. The pump drain line shall be properly sloped to drain the volute after fixture use.

9.7.3.6.3 Piping. Hydromassage bathtub circulation piping shall be installed so as to be self-draining.

9.7.3.6.4 Electrical. Electrical installations shall be in accordance with Article 680, Part VII, of *NFPA 70*.

9.8 Hangers and Supports.

9.8.1 Strains and Stresses. Piping in a plumbing system shall be installed without undue strains and stresses, and provisions shall be made for expansion, contraction, and structural settlement.

9.8.2 Piping Supports. Piping shall be secured at sufficiently close intervals to keep the pipe in alignment and carry the weight of the pipe and contents. Unless otherwise stated in the referenced standards in Table 9.4.1, or unless specified by the pipe manufacturer, horizontal plastic drainage piping shall be supported at intervals not to exceed 4 ft (1220 mm), and horizontal plastic water piping shall be supported at intervals not to exceed 3 ft (915 mm). Vertical drainage and water piping shall be supported at each story height.

9.8.3 Hangers and Anchors.

9.8.3.1 Hangers and anchors shall be of sufficient strength to support their proportional share of the pipe alignments and prevent rattling.

9.8.3.2 Piping shall be securely attached to the structure by hangers, clamps, or brackets that provide protection against motion, vibration, road shock, or torque in the chassis.

9.8.3.3 Hangers and straps supporting plastic pipe shall not compress, distort, cut, or abrade the piping and shall allow free movement of the pipe.

9.9 Water Distribution Systems.

9.9.1 Water Supply.

9.9.1.1 Supply Piping. Piping systems shall be sized to provide an adequate quantity of water to each plumbing fixture at a flow rate sufficient to keep the fixture in a clean and sanitary condition without any danger of backflow or siphonage (*see Table 9.9.6.1*). The manufacturer shall include in the written installation instructions that the manufactured home has been designed for an inlet water pressure of 80 psi (552 kPa) and a statement that when the manufactured home is to be installed in areas where the water pressure exceeds 80 psi (552 kPa), a pressure-reducing valve shall be installed.

9.9.1.2 Hot Water Supply. Each manufactured home equipped with a kitchen sink, bathtub, and/or shower shall be provided with a hot water supply system, including a listed water heater.

9.9.2 Water Outlets and Supply Connections.

9.9.2.1 Water Connection. Each manufactured home with a water distribution system shall be equipped with a $\frac{3}{4}$ in. (20 mm) threaded inlet connection. This connection shall be tagged or marked "Fresh Water Connection" (or "Fresh Water Fill"). A matching cap or plug shall be provided to seal the water inlet when it is not in use and shall be permanently attached to the manufactured home or water supply piping. Where a master cold water shutoff full-flow valve is not installed on the main feeder line in an accessible location, the manufacturer's installation instructions shall indicate that such a valve is to be installed in the water supply line adjacent to the home.

Where a manufactured home includes expandable rooms or is composed of two or more units, fittings or connectors designed for such purpose shall be provided to connect any water piping. Where not connected, the water piping shall be protected by means of matching threaded caps or plugs.

9.9.2.2 Prohibited Connections.

9.9.2.2.1 The installation of potable water supply piping or fixture or appliance connections shall be made in a manner that prevents the possibility of backflow.

9.9.2.2.2 No part of the water system shall be connected to any drainage or vent piping.

9.9.2.3 Rim Outlets. The outlets of faucets, spouts, and similar devices shall be spaced at least 1 in. (25 mm) above the flood level of the fixture.

9.9.2.4 Appliance Connections. Water supplies connected to clothes washing or dishwashing machines shall be protected by an approved or listed fixed air gap provided within the appliance by the manufacturer.

9.9.2.5 Flushometer Valves or Manually Operated Flush Valves. An approved or listed vacuum breaker shall be installed and maintained in the water supply line on the discharge side of a water closet flushometer valve or manually operated flush valve. Vacuum breakers shall have a minimum clearance of 6 in. (152 mm) above the flood level of the fixture to the critical level mark unless otherwise permitted in their approval.

9.9.2.6 Flush Tanks. Water closet flush tanks shall be equipped with an approved or listed antisiphon ball cock that shall be installed and maintained with its outlet or critical level mark not less than 1 in. (25 mm) above the full opening of the overflow pipe.

9.9.2.7 Hose Bibbs. Where provided, all exterior hose bibbs and laundry sink hose connections shall be protected by a listed nonremovable backflow prevention device. This provision shall not be applicable to hose connections provided for automatic washing machines with built-in backflow prevention or water heater drain valves.

9.9.2.8 Flushometer Tanks. Flushometer tanks shall be equipped with an approved air gap or vacuum breaker assembly that is located above the flood level rim above the fixture.

9.9.3 Water Heater Safety Devices.

9.9.3.1 Relief Valves. All water heaters shall be installed with approved and listed fully automatic valve(s) designed to provide temperature and pressure relief.

9.9.3.1.1 Any temperature relief valve or combined pressure and temperature relief valve installed for this purpose shall have the temperature-sensing element immersed in the hottest water within the upper 6 in. (152 mm) of the tank. It shall be set to start relieving at a pressure of 150 psi (1034 kPa) or the rated working pressure of the tank, whichever is lower, and at or below a water temperature of 210°F (99°C).

9.9.3.1.2 Relief valves shall be provided with full-sized drains, with cross-section areas equivalent to that of the relief valve outlet. The outlet of a pressure relief valve, temperature relief valve, or combination thereof shall not be directly connected to the drainage system. The discharge for the relief valve shall be piped full size separately to the outside of the dwelling unit or to an approved location inside the dwelling unit. Drain lines

shall be of a material listed for hot water distribution and shall drain fully by gravity, shall not be trapped, and shall not have their outlets threaded. The end of the drain shall be visible for inspection.

9.9.4 Materials.

9.9.4.1 Water distribution pipe and fittings shall be of brass copper, copper, cast iron, chlorinated polyvinyl chloride (CPVC), galvanized malleable iron, galvanized wrought iron, galvanized steel, cross-linked polyethylene (PEX), PEX-AL-PEX, or other listed or approved materials. PE-AL-PE water pipe and fittings shall be used only for cold-water distribution systems. All materials used in the water supply system, except valves and similar devices, shall be of a like material, except where listed or approved.

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

9.9.4.3 All hard-drawn copper tubing, in addition to the required incised marking, shall be marked in accordance with 19.3.1 and 19.3.2 of ASTM B88, *Standard Specification for Seamless Copper Water Tube*. The colors shall be Type K, green; Type L, blue; Type M, red; and Type DWV, yellow.

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

9.9.4.5 Cast iron fittings up to and including 2 in. (51 mm) in size, where used in connection with potable water piping, shall be galvanized.

9.9.4.6 All malleable iron water fittings shall be galvanized.

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

9.9.4.8 Solder shall conform to the requirements of 9.5.4.

9.9.4.9 Water pipe and fittings with a lead content that exceeds 8 percent shall be prohibited in piping systems used to convey potable water.

9.9.4.10 PEX. PEX tubing shall be marked with the appropriate standard designation(s) listed in Table 9.4.1 for which the tubing has been approved.

9.9.4.10.1 PEX Fittings. Metal insert fittings, metal compression fittings, and cold expansion fittings used with PEX tubing shall be manufactured to and marked in accordance with the standards for the fittings in Table 9.4.1.

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

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

- (1) Water heater connectors — 24 in. (609 mm)
- (2) Fixture connectors — 30 in. (762 mm)
- (3) Washing machine connectors — 72 in. (1827 mm)
- (4) Dishwasher and icemaker connectors — 120 in. (3048 mm)

9.9.4.12 PEX-AL-PEX and PE-AL-PE. PEX-AL-PEX and PE-AL-PE composite pipe shall be marked with the appropriate standard designations listed in Table 9.4.1 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 9.9.4.12 and 9.9.4.12.1.

9.9.4.12.1 PEX-AL-PEX and PE-AL-PE. Fittings used with PEX-AL-PEX and PE-AL-PE piping shall be manufactured and marked in accordance with the standards for fittings listed in Table 9.4.1.

9.9.5 Installation of Piping.

9.9.5.1 Minimum Requirement. All piping equipment, appurtenances, and devices shall be installed in a workmanlike manner and shall conform with the provisions and intent of this standard.

9.9.5.2 Screw Pipe. Iron pipe-size brass or galvanized iron or steel pipe fittings shall be joined with approved or listed standard pipe threads fully engaged in the fittings. Pipe ends shall be reamed to the full bore of the pipe. Pipe-joint compound shall be insoluble in water, nontoxic, and applied to male threads only.

9.9.5.3 Solder Fittings. Joints in copper water tubes shall be made by the appropriate use of approved cast brass or wrought copper fittings and shall be properly soldered together. The surface to be soldered shall be thoroughly cleaned bright by mechanical means. The joints shall be properly fluxed and made with a solder that contains no more than 0.2 percent lead.

9.9.5.4 Flared Fittings. A flaring tool shall be used to shape the ends of flared tubing to match the flare of fittings.

9.9.5.5 Plastic Pipe and Fittings. Plastic pipe and fittings shall be joined by installation methods recommended by the manufacturer or in accordance with provisions of a listed standard.

9.9.5.5.1 CPVC Solvent Cement Plastic Pipe Joints. CPVC pipe and fittings shall be cleaned and then joined with listed primer(s) and solvent cement(s).

9.9.5.5.2 Listed solvent cements that do not require the use of primer shall be permitted for use with CPVC pipe and fittings, manufactured in accordance with ASTM D2846M, *Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems*, ½ in. through 2 in. in diameter. [IAPMO UPC:316.1.6]

9.9.6 Size of Water Supply Piping.

9.9.6.1 Minimum Size. The size of water supply piping and branch lines shall not be less than the sizes shown in Table 9.9.6.1.

9.9.6.2 Sizing Procedure. Both hot and cold water piping systems shall be computed by the following method:

- (1) *Size of Branch.* Start at the most remote outlet on any branch of the hot or cold water piping and progressively count toward the water service connection, computing the total number of fixtures supplied along each section of piping. Where branches are joined together, total the number of fixtures on each branch so that no fixture is counted twice. Following down the first column of Table 9.9.6.1, find the number of fixtures. The required pipe or tubing size is indicated in the other columns on the same line.

Table 9.9.6.1 Minimum Size Tubing and Pipe for Water Distribution Systems

Number of Fixtures	Tubing (nominal)				Iron Pipe Size	
	Diameter		Outer Diameter (OD)			
	in.	mm	in.	mm	in.	mm
1	¼*	8	⅜	10	½	15
2	⅜	10	½	15	½	15
3	½	15	⅝	18	½	15
4	½	15	⅝	18	½	15
5 or more	¾	20	⅞	22	¾	20

*6 ft (1830 mm) maximum length.

Exceptions: 3/8 in. (10 mm) nominal diameter or 1/2 in. (15 mm) OD minimum size for clothes washing or dishwashing machines, unless larger size is recommended by the fixture manufacturer; 1/2 in. (15 mm) nominal diameter or 5/8 in. (16 mm) OD minimum size for flushometer or metering-type valves unless otherwise specified in their listing. No galvanized screw piping shall be less than 1/2 in. (15 mm) iron pipe size.

- (2) **Non-Water-Using Fixtures.** A water heater, food waste disposal unit, evaporative cooler, or ice maker shall not be counted as a water-using fixture when computing pipe sizes.

9.9.7 Line Valves. Valves, when installed in the water supply distribution system and fully opened, shall have a cross-sectional area of the smallest orifice or opening through which the water flows at least equal to the cross-sectional area of the nominal size of the pipe in which the valve is installed.

Exception: Those valves immediately controlling a one-fixture supply.

9.10 Drainage Systems.

9.10.1 General.

9.10.1.1 Each fixture directly connected to the drainage system shall be installed with a water seal trap. (See 9.6.1.)

9.10.1.2 The drainage system shall be designed to provide an adequate circulation of air in all piping, with no danger of siphonage, aspiration, or forcing of trap seals under conditions of ordinary use.

9.10.2 Materials.

9.10.2.1 Pipe. Drainage piping shall be standard weight galvanized steel, brass, copper tube DWV, listed Schedule 40 ABS plastic, listed Schedule 40 PVC plastic, cast iron, or other listed or approved materials.

9.10.2.2 Fittings. Drainage fittings shall be of a recessed drainage pattern with smooth interior waterways of the same diameter as the piping and of a material conforming to the type of piping used. Drainage fittings shall be designed to provide for a 1/4 in./ft (20 mm/m) grade in horizontal piping.

9.10.2.2.1 Fittings for screw pipe shall be cast iron, malleable iron, brass, or listed plastic and shall have standard pipe threads.

9.10.2.2.2 Fittings for copper tubing shall be cast brass or wrought copper.

9.10.2.2.3 Socket-type fittings for plastic piping shall comply with those standards listed in Table 9.4.1.

9.10.2.2.4 Brass or bronze adapter or wrought copper fittings shall be used to join copper tubing to threaded pipe.

9.10.3 Drain Outlets.

9.10.3.1 General. Each manufactured home shall have only one drain outlet.

9.10.3.2 Clearance from Drain Outlet. The drain outlet shall be provided with a minimum clearance of 3 in. (76 mm) in any direction from all parts of the structure or appurtenances, and with not less than 18 in. (457 mm) unrestricted clearance directly in front of the drain outlet.

9.10.3.3 Drain Connector. The drain connector shall not be smaller than the piping to which it is connected and shall be equipped with a watertight cap or plug matching the drain outlet. The cap or plug shall be permanently attached to the manufactured home or drain outlet.

9.10.3.4 Pipe Size. The drain outlet and drain connector shall not be less than 3 in. (75 mm) inside diameter.

9.10.3.5 Preassembly of Drain Lines. Section(s) of the drain system that are designed to be located underneath the manufactured home or between stories of a manufactured home shall not be required to be factory installed when the manufacturer designs the system for site assembly and also provides all materials and components, including piping, fittings, cement, supports, and instructions necessary for proper site installation.

9.10.4 Fixture Connections. Drainage piping shall be provided with approved or listed inlet fittings for fixture connections that are correctly located according to the size and type of fixture to be connected.

9.10.4.1 Water Closet Connection. The drain connection for each water closet shall be 3 in. (76 mm) minimum inside diameter and shall be fitted with an iron, brass, or listed plastic floor flange adapter ring securely screwed, soldered, or otherwise permanently attached to the drain piping in an approved manner and shall be securely fastened to the floor.

9.10.5 Size of Drainage Piping — Fixture Load. Drain pipe sizes shall be determined by the type of fixture and the total number of fixtures connected to each drain.

Exception: As provided by 9.11.4.

9.10.5.1 Fixture drains shall be sized as follows:

- (1) Fixture drains serving a single lavatory shall be 1¼ in. (32 mm) minimum.
- (2) Fixture drains serving other fixtures or multiple fixtures up to three shall be 1½ in. (40 mm) minimum.
- (3) Fixture drains shall not be smaller than the sizes specified in 9.7.2.

9.10.5.2 Piping that has a 2 in. (50 mm) minimum diameter shall be required for four or more individually vented fixtures.

9.10.5.3 Piping that has a 3 in. (76 mm) minimum diameter shall be required for water closets.

9.10.6 Wet-Vented Drainage System. Plumbing fixture traps shall be permitted to connect into a wet-vented drainage system designed and installed to accommodate the passage of air and waste in the same pipe.

9.10.6.1 Horizontal Piping. All parts of a wet-vented drainage system, including the connected fixture drains, shall be horizontal. Where required by structural design, wet-vented drain piping shall be permitted to be offset vertically where other vented fixture drains or relief vents are connected to the drain piping at or below the vertical offsets.

Exception: Wet-vented vertical risers shall terminate with a 1½ in. (40 mm) minimum diameter continuous vent.

9.10.6.2 Size. A wet-vented drain pipe shall be 2 in. (50 mm) minimum diameter and at least one pipe size larger than the largest connected trap or fixture drain. No more than three fixtures shall be permitted to connect to a 2 in. (50 mm) diameter wet-vented drain system.

9.10.6.3 Length of Trap Arm. Fixture traps shall be located within the distance given in 9.11.3.5. No more than one trap shall connect to a trap arm.

9.10.7 Offsets and Branch Fittings.

9.10.7.1 Changes in Direction. Changes in the direction of drainage piping shall be made by the appropriate use of approved or listed fittings and shall be of the following angles: 11¼ degrees, 22½ degrees, 45 degrees, 60 degrees, or 90 degrees, or other approved or listed fittings or combinations of fittings with equivalent radius or sweep.

9.10.7.2 Horizontal to Vertical. Horizontal drainage lines connecting with a vertical pipe shall enter through 45-degree "Y" branches, 60-degree "Y" branches, long-turn "TY" branches, sanitary "T" branches, or other approved or listed fittings or combination of fittings having equivalent sweep. Fittings having more than one branch at the same level shall not be used unless the fitting is constructed so that the discharge from any one branch cannot readily enter any other branch. However, a double sanitary "T" shall be permitted to be used when the drain line is increased not less than two pipe sizes.

9.10.7.3 Horizontal-to-Horizontal and Vertical-to-Horizontal. Horizontal drainage lines connecting with other horizontal drainage lines or vertical drainage lines connecting with horizontal drainage lines shall enter through 45-degree "Y" branches, long-turn "TY" branches, or other approved or listed fittings or combination of fittings having equivalent sweep.

9.10.8 Grade of Horizontal Drainage Piping. Horizontal drainage piping shall be run in practical alignment and shall have a uniform grade of not less than ¼ in./ft (20 mm/m)

toward the manufactured home drain outlet. Where it is impractical, due to the structural features or arrangement of any manufactured home, to obtain a grade of ¼ in./ft (20 mm/m), the pipe or piping shall be permitted to have a grade of not less than ⅛ in./ft (10 mm/m) where a full-size cleanout is installed at the upper end.

Exception: Fixture connections on the inlet side of the trap.

9.11 Vents and Venting.

9.11.1 General. Each plumbing fixture trap shall be protected against siphonage and back pressure. Air circulation shall be ensured throughout all parts of the drainage system by means of vents installed in accordance with the requirements of Section 9.11 and as otherwise required by this standard.

9.11.2 Materials.

9.11.2.1 Pipe. Vent piping shall be standard weight galvanized steel, brass, copper tube DWV, listed Schedule 40 ABS plastic, listed Schedule 40 PVC plastic, cast iron, or other listed or approved materials.

9.11.2.2 Fittings. Appropriate fittings shall be used for all changes in direction or size and at the location where pipes are joined. The material and design of vent fittings shall conform to the type of piping used.

9.11.2.2.1 Fittings for screw pipe shall be cast iron, malleable iron, plastic, or brass and shall have standard pipe threads.

9.11.2.2.2 Fittings for copper tubing shall be cast brass or wrought copper.

9.11.2.2.3 Fittings for plastic piping shall be made in accordance with approved applicable standards.

9.11.2.2.4 Brass adapter fittings or wrought copper shall be used to join copper tubing to threaded pipe.

9.11.2.2.5 Listed rectangular tubing shall be permitted to be used for vent piping only, provided it has an open cross section at least equal to the circular vent pipe required. Listed transition fittings shall be used.

9.11.3 Size of Vent Piping.

9.11.3.1 Main Vent. The drain piping for each water closet shall be vented by a 1½ in. (40 mm) minimum diameter vent or by a rectangular vent of venting cross section equivalent to or greater than the venting cross section of a 1½ in. (40 mm) diameter vent. The vent shall be connected to the water closet drain by one of the following methods:

- (1) A 1½ in. (40 mm) minimum diameter individual vent pipe or equivalent that is directly connected to the water closet drain piping within the distance allowed in Table 9.11.3.5 for 3 in. (75 mm) trap arms undiminished in size through the roof.
- (2) A 1½ in. (40 mm) minimum diameter continuous vent or equivalent that is indirectly connected to the water closet drain piping within the distance allowed in Table 9.11.3.5 for 3 in. (75 mm) trap arms through a 2 in. (50 mm) wet-vented drain that carries the waste of not more than one fixture. Sections of the wet vented drain that is 3 in. (75 mm) diameter shall be permitted to carry the waste of an unlimited number of fixtures.
- (3) Two or more vented drains, where at least one is wet-vented or 2 in. (50 mm) minimum diameter and each

drain is separately connected to the water closet drain. At least one of the drains shall connect within the distance allowed in Table 9.11.3.5 for 3 in. (75 mm) trap arms.

9.11.3.2 Vent Pipe Areas. Each individually vented fixture with a 1½ in. (40 mm), or smaller, trap shall be provided with a vent pipe equivalent in area to a ¼ in. (32 mm) nominal pipe size. The main vent, water closet vent, relief vent, and continuous vent of wet-vented systems shall have an area equivalent to 1½ in. (40 mm) nominal pipe size.

9.11.3.3 Common Vent. Where two fixture traps located within the distance allowed from their vent have their trap arms connected separately at the same level into an approved double fitting, an individual vent pipe shall be permitted to serve as a common vent without any increase in size.

9.11.3.4 Intersecting Vents. Where two or more vent pipes are joined together, no increase in size shall be required; however, the largest vent pipe shall extend full-size through the roof.

9.11.3.5 The distance of the fixture trap from the vent shall not exceed the values given in Table 9.11.3.5.

9.11.4 Mechanical Vents. Where mechanical vents are used as a secondary vent system for plumbing fixtures that are protected by traps, they shall comply with 9.11.4.1 or 9.11.4.2.

9.11.4.1 Spring-operated mechanical (antisiphon) vents shall comply with 9.11.4.1.1 through 9.11.4.1.5.

9.11.4.1.1 No more than two fixtures individually protected by the spring-operated mechanical vent shall be drained by a common 1½ in. (40 mm) drain.

9.11.4.1.2 Minimum drain size for three or more fixtures individually protected by the spring-operated mechanical vent shall be 2 in. (50 mm).

9.11.4.1.3 Spring-operated mechanical vents shall be restricted to venting fixtures with 1½ in. (40 mm) traps.

9.11.4.1.4 A spring-operated mechanical vent shall be installed in a location that allows a free flow of air and shall be accessible for inspection, maintenance, and replacement. The sealing function shall be at least 6 in. (152 mm) above the top of the trap arm.

9.11.4.1.5 Materials for the spring-operated mechanical vents shall be as follows:

- (1) Cap and housing shall be listed acrylonitrile-butadiene-styrene, DWV grade.
- (2) Stem shall be DWV grade nylon or acetal.
- (3) Spring shall be stainless steel wire, Type 302.
- (4) Sealing disc shall be either of the following:
 - (a) Neoprene, conforming to CISPI HSN-85, *Specification for Neoprene Rubber Gaskets for HUB and Spigot*

Cast Iron Soil Pipe and Fittings, and ASTM C564, *Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings*

- (b) Joint sealants conforming to ASTM C920, *Standard Specification for Elastomeric Joint Sealants*, and ASTM D4635, *Specification for Low-Density Polyethylene Films for General Use and Packaging Applications*

9.11.4.2 Gravity-operated mechanical (air admittance valves) vents shall comply with 9.11.4.2.1 and 9.11.4.2.2.

9.11.4.2.1 Where installed to vent any fixture, the drain system shall have a minimum 1½ in. (40 mm) diameter vent that terminates outside the manufactured home.

9.11.4.2.2 Where gravity-operated mechanical vent devices terminate in the attic cavity, the following shall apply:

- (1) The attic cavity is accessible as described in 9.11.4.1.4.
- (2) The sealing device is installed a minimum of 6 in. (152 mm) above building insulation materials.
- (3) The attic is vented in accordance with 8.4.4.1.

9.11.4.3 Mechanical vents shall be installed in accordance with the manufacturer's installation instructions.

9.11.5 Grade and Connections — Horizontal Vents. Each vent shall extend vertically from its fixture "T" or point of connection with the waste piping to a point not less than 6 in. (152 mm) above the extreme flood level of the fixture it is venting before offsetting horizontally or being connected with any other vent pipe. Vents for horizontal drains shall connect above the centerline of the drain piping ahead (downstream) of the trap. Where required by structural conditions, vent piping shall be permitted to offset below the rim of the fixture at the maximum angle or height possible.

9.11.6 Vent Terminal. Vents shall terminate through the roof, through a wall, or in accordance with 9.11.4, to a mechanical vent device.

9.11.6.1 Roof Extension. Each vent pipe shall extend through its flashing and terminate vertically. Vents that extend through the roof shall extend undiminished in size, not less than 2 in. (50 mm) above the roof. Vent openings shall not be less than 3 ft (914 mm) away from any motor-driven air intake that opens into habitable areas.

9.11.6.2 Wall Vent Extensions. Extensions through exterior walls shall terminate downward, shall have a screen to prevent entrance of birds and rodents, and shall be located as follows:

- (1) Extensions shall not be located beneath a door.
- (2) Extensions shall be a minimum of 10 ft (3 m) above the finished floor.
- (3) Extensions shall not be located beneath a window or other opening.
- (4) Extensions shall be located a minimum of 2 ft (0.6 m) above any building opening within 5 ft (1.5 m) horizontally.

9.11.6.3 Flashing. The opening around each roof vent pipe shall be made watertight by flashing or flashing material. Wall vent pipe penetrations shall be made watertight.

9.11.7 Vent Caps. Vent caps, if provided, shall be of the removable type (without removing the flashing from the roof). When vent caps are used for roof space ventilation and the caps are identical to vent caps used for the plumbing system,

Table 9.11.3.5 Maximum Distance of Fixture Traps from Vent

Size of Fixture Drain		Distance of Trap from Vent	
in.	mm	ft	mm
1 ¼	32	4 ½	1372
1½	40	4½	1372
2	50	5	1525
3	75	6	1830

plumbing system caps shall be identified with permanent markings.

9.12 Tests and Inspection.

9.12.1 Water System. All water piping in the water distribution system shall be subjected to a pressure test. The test shall be made by subjecting the system to air or water at 80 psi + 5 psi (552 kPa + 35 kPa) for 15 minutes without loss of pressure. The water used for the test shall be obtained from a potable source of supply.

9.12.2 Waste and Vent System and Plumbing Fixtures. The waste and vent system shall be tested by one of the following three methods for evidence or indication of leakage:

- (1) *Water Test.* Before plumbing fixtures are connected, all of the openings into the piping shall be plugged and the entire piping system subjected to a static water test for 15 minutes by filling it with water to the top of the highest vent opening. There shall be no evidence of leakage.
- (2) *Air Test.* After all fixtures have been installed, the traps filled with water, and the remaining openings securely plugged, the entire system shall be subjected to a 2 in. (50 mm) (manometer) water column air pressure test. If the system loses pressure, smoke shall be permitted to be pumped into the system to locate the leaks, or soap suds shall be permitted to be spread on the exterior of the piping (bubble test).
- (3) *Flood Level Test.* The manufactured home shall be in a level position, all fixtures shall be connected, and the entire system shall be filled with water to the rim of the water closet bowl. (Tub and shower drains shall be plugged.) After all trapped air has been released, the test shall be sustained for not less than 15 minutes without evidence of leaks. Then the system shall be unplugged and emptied. The waste piping above the level of the water closet bowl shall then be tested. There shall be no indication of leakage when the high fixtures are filled with water and emptied simultaneously to obtain the maximum possible flow in the drain piping.

9.12.3 Fixture Test. The plumbing fixtures and connections shall be subjected to a flow test by filling them with water and checking for leaks and retarded flow while they are being emptied.

9.12.4 Shower Compartments. Shower compartments and receptors shall be tested for leaks prior to being covered by finish material. Each pan shall be filled with water to the top of the dam for not less than 15 minutes without evidence of leakage.

Chapter 10 Heating, Cooling, and Fuel-Burning Systems

10.1 Scope. This chapter shall cover the heating, cooling, and fuel-burning equipment installed within, on, or external to a manufactured home.

10.2 Definitions. The following definitions shall apply to Chapter 10 only. (See also Section 5.2.)

10.2.1 Accessible. Able to approach, access a fixture, connection, appliance, or equipment. Access shall be permitted to require the removal of an access panel, door, or similar obstruction.

10.2.2 Air Conditioner Blower Coil System. A comfort cooling appliance where the condenser section is placed external to the manufactured home and the evaporator section with circulating blower is attached to the manufactured home air supply duct system. Provision must be made for a return air system to the evaporator/blower section. Refrigerant connection between the two parts of the system is accomplished by tubing.

10.2.3 Air Conditioner Split System. A comfort cooling appliance where the condenser section is placed external to the manufactured home and the evaporator section is incorporated into the heating appliance or with a separate blower/coil section within the manufactured home. Refrigerant connection between the two parts of the system is accomplished by tubing.

10.2.4 Air-Conditioning Condenser Section. That portion of a refrigerated air cooling or, in the case of a heat pump, heating system that includes the refrigerant pump (compressor) and the external heat exchanger.

10.2.5 Air-Conditioning Evaporator Section. A heat exchanger used to cool or, in the case of a heat pump, heat air for use in comfort cooling, or heating, the living space.

10.2.6 Air-Conditioning Self-Contained System. A comfort cooling appliance that combines the condenser section, evaporator, and air circulating blower into one unit with connecting ducts for the supply and return air systems.

10.2.7 Air Duct. Conduit or passageway for conveying air to or from heating, cooling, air-conditioning, or ventilation equipment, but not including the plenum.

10.2.8 Automatic Pump (Oil Lifter). A pump that is not an integral part of the oil-burning appliance and that automatically pumps oil from the supply tank and delivers the oil under a constant head to an oil-burning appliance.

10.2.9 Btu (British Thermal Unit). The quantity of heat required to raise the temperature of 1 lb of water 1°F.

10.2.10 Btu/hr. British thermal units per hour.

10.2.11 Burner. A device used for the final conveyance of fuel or a mixture of fuel and air to the combustion zone.

10.2.12 Central Air-Conditioning System. Either an air-conditioning split system or an external combination heating/cooling system.

10.2.13 Class 0 Air Ducts and Air Connectors. Air ducts and air connectors having a fire hazard classification of zero when tested in accordance with ANSI/UL 181, *Standard for Safety Factory-Made Air Ducts and Air Connectors*.

10.2.14 Class 1 Air Ducts and Air Connectors. Air ducts and air connectors having a flame spread index of not over 25 without evidence of continued progressive combustion and a smoke-developed index of not over 50 when tested in accordance with ANSI/UL 181, *Standard for Safety Factory-Made Air Ducts and Air Connectors*.

10.2.15 Clearance. The distance between the appliance, chimney vent, chimney, or vent connector or plenum and the nearest surface.

10.2.16 Combination Space Heating and Water Heating Appliance. A listed unit that is designed to provide space heating and water heating from a single primary energy source.

10.2.17 Connector-Gas Appliance. A flexible or semirigid connector used to convey fuel gas between a gas outlet and a gas appliance.

10.2.18 Direct-Vent System. A system or method of construction where all air for combustion is derived directly from the outside atmosphere and all flue gases are discharged to the outside atmosphere.

10.2.19 Direct-Vent System Appliance. An appliance that is installed with a direct-vent system.

10.2.20 External Combination Heating/Cooling System. A comfort conditioning system placed external to the manufactured home with connecting ducts to the manufactured home for the supply and return air systems.

10.2.21 Factory-Built Fireplace. A hearth, fire chamber, and chimney assembly composed of listed factory-built components assembled in accordance with the terms of listing to form a complete fireplace.

10.2.22 Fireplace Stove. A chimney-connected solid fuel-burning stove having part of its fire chamber open to the room.

10.2.23 Fuel Gas Piping System. The arrangement of piping, tubing, fittings, connectors, valves, and devices designed and intended to supply or control the flow of fuel gas to the appliance(s).

10.2.24 Fuel Oil Piping System. The arrangement of piping, tubing, fittings, connectors, valves, and devices designed and intended to supply or control the flow of fuel oil to the appliance(s).

10.2.25 Gas Clothes Dryer. A device used to dry wet laundry by means of heat derived from the combustion of fuel gases.

10.2.26 Gas Refrigerator. A gas-burning appliance designed to extract heat from a suitable chamber.

10.2.27 Gas Supply Connection. The terminal end or connection to which a gas supply connector is attached.

10.2.28 Gas Supply Connector, Manufactured Home. A listed, flexible connector designed to connect the manufactured home to the gas supply source.

10.2.29 Gas Vents. Factory-built vent piping and vent fittings, listed by an approved testing agency, that are assembled and used in accordance with the terms of their listings for conveying flue gases to the outside atmosphere.

10.2.29.1 Gas Vent, Type B. A gas vent for venting gas appliances with draft hoods and other gas appliances listed for use with Type B gas vents.

10.2.29.2 Gas Vent, Type BW. A gas vent for venting listed gas-fired vented wall furnaces.

10.2.30 Heating Appliance. An appliance for comfort heating, domestic water heating, or a combination of comfort heating and domestic water heating.

10.2.31 Heat-Producing Appliance. All heating and cooking appliances and fuel-burning appliances.

10.2.32 Liquefied Petroleum Gases. The terms *liquefied petroleum gases*, *LPG*, and *LP-Gas*, as used in this standard, shall mean and include any material that is composed predominantly of any of the following hydrocarbons or mixtures of hydrocarbons: propane, propylene butanes (normal butane or isobutane), and butylenes.

10.2.33 Plenum. An air compartment that is part of an air-distributing system, to which one or more ducts or outlets are connected.

10.2.33.1 Furnace Return Plenum. A plenum that is attached directly to, or is an integral part of, the return inlet of the furnace.

10.2.33.2 Furnace Supply Plenum. A plenum that is attached directly to, or is an integral part of, the air supply outlet of the furnace.

10.2.34 Quick-Disconnect Device. A hand-operated device that provides a means for connecting and disconnecting a gas supply or for connecting gas systems and that is equipped with an automatic means to shut off the gas supply when the device is disconnected.

10.2.35 Readily Accessible. Direct access without the necessity of removing any panel, door, or similar obstruction.

10.2.36 Roof Jack. That portion of a manufactured home heater flue or vent assembly, including the cap, insulating means, flashing, and ceiling plate, located in and above the roof of a manufactured home.

10.2.37 Sealed Combustion System Appliance. An appliance that by its inherent design is constructed so that all air supplied for combustion, the appliance's combustion system, and all products of combustion are completely isolated from the atmosphere of the space where it is installed.

10.2.38 Water Heater. An appliance for heating water for domestic purposes.

10.3 Minimum Standards. Heating, cooling, and fuel-burning appliances and systems in manufactured homes shall be free of defects and conform to applicable standards in Table 10.3 unless otherwise specified in this standard (*see Section 1.4*). When more than one standard is referenced, compliance with any one such standard shall meet the requirements of this standard.

10.4 Gas Piping Systems.

10.4.1 General. The requirements of Section 10.4 shall govern the installation of all fuel-gas piping attached to any manufactured home. The gas piping supply system shall be designed for a pressure no more than 14 in. (3.4 kPa) water column ($\frac{1}{2}$ psi) and no less than 7 in. (1.7 kPa) water column ($\frac{1}{4}$ psi). The manufacturer shall indicate in its written installation instructions the design pressure limitations for safe and effective operation of the gas piping system. None of the requirements listed in Section 10.4 shall apply to the piping supplied as a part of an appliance. All exterior openings around piping, ducts, plenums, or vents shall be sealed to resist the entrance of rodents.