

CHAPTER 7 SANITARY DRAINAGE

SECTION 701 GENERAL

701.1 Scope. The provisions of this chapter shall govern the materials, design, construction and installation of sanitary drainage systems.

701.2 Sewer required. Every building in which plumbing fixtures are installed and every premises having drainage piping shall be connected to a public sewer, where available, or an approved private sewage disposal system.

701.3 Separate sewer connection. Every building having plumbing fixtures installed and intended for human habitation, occupancy or use on premises abutting on a street, alley or easement in which there is a public sewer shall have a separate connection with the sewer. Where located on the same lot, multiple buildings shall not be prohibited from connecting to a common building sewer that connects to the public sewer.

701.4 Sewage treatment. Sewage or other waste from a plumbing system that is deleterious to surface or subsurface waters shall not be discharged into the ground or into any waterway unless it has first been rendered innocuous through subjection to an approved form of treatment.

701.5 Damage to drainage system or public sewer. Wastes detrimental to the public sewer system or detrimental to the functioning of the sewage-treatment plant shall be treated and disposed of in accordance with Section 1003 as directed by the code official.

701.6 Tests. The sanitary drainage system shall be tested in accordance with Section 312.

701.7 Connections. Direct connection of a steam exhaust, blowoff or drip pipe shall not be made with the building drainage system. Waste water when discharged into the building drainage system shall be at a temperature not higher than 140°F (60°C). When higher temperatures exist, approved cooling methods shall be provided.

701.8 Engineered systems. Engineered sanitary drainage systems shall conform to the provisions of Sections 714 of this code and Section 103.7 of the *Florida Building Code, Building*.

SECTION 702 MATERIALS

702.1 Above-ground sanitary drainage and vent pipe. Above-ground soil, waste and vent pipe shall conform to one of the standards listed in Table 702.1.

702.2 Underground building sanitary drainage and vent pipe. Underground building sanitary drainage and vent pipe shall conform to one of the standards listed in Table 702.2.

702.3 Building sewer pipe. Building sewer pipe shall conform to one of the standards listed in Table 702.3.

702.4 Fittings. Pipe fittings shall be approved for installation with the piping material installed and shall conform to the respective pipe standards or one of the standards listed in Table 702.4.

702.5 Chemical waste system. A chemical waste system shall be completely separated from the sanitary drainage system. The chemical waste shall be treated in accordance with Section 803.2 before discharging to the sanitary drainage system. Separate drainage systems for chemical wastes and vent pipes shall be of an approved material that is resistant to corrosion and degradation for the concentrations of chemicals involved.

TABLE 702.1
ABOVE-GROUND DRAINAGE AND VENT PIPE

MATERIAL	STANDARD
Acrylonitrile butadiene styrene (ABS) plastic pipe	ASTM D 2661; ASTM F 628; CSA B181.1
Brass pipe	ASTM B 43
Cast-iron pipe	ASTM A 74; CISPI 301; ASTM A 888
Copper or copper-alloy pipe	ASTM B 42; ASTM B 302
Copper or copper-alloy tubing (Type K, L, M or DWV)	ASTM B 75; ASTM B 88; ASTM B 251; ASTM B 306
Galvanized steel pipe	ASTM A 53
Glass pipe	ASTM C 1053
Polyolefin pipe	CSA CAN/CSA-B181.3
Polyvinyl chloride (PVC) plastic pipe (Type DWV)	ASTM D 2665; ASTM D 2949; ASTM F 891; CSA CAN/CSA-B181.2

TABLE 702.2
UNDERGROUND BUILDING DRAINAGE AND VENT PIPE

MATERIAL	STANDARD
Acrylonitrile butadiene styrene (ABS) plastic pipe	ASTM D 2661; ASTM F 628; CSA B181.1
Asbestos-cement pipe	ASTM C 428
Cast-iron pipe	ASTM A 74; CISPI 301; ASTM A 888
Copper or copper-alloy tubing (Type K or L)	ASTM B 75; ASTM B 88; ASTM B 251
Polyolefin pipe	CSA CAN/CSA-B181.3
Polyvinyl chloride (PVC) plastic pipe (Type DWV)	ASTM D 2665; ASTM D 2949; ASTM F 891; CSA CAN/CSA-B181.2

TABLE 702.3 — 705.1

TABLE 702.3
BUILDING SEWER PIPE

MATERIAL	STANDARD
Acrylonitrile butadiene styrene (ABS) plastic pipe	ASTM D 2661; ASTM D 2751; ASTM F 628
Asbestos-cement pipe	ASTM C 428
Cast-iron pipe	ASTM A 74; ASTM A 888; CISPI 301
Concrete pipe	ASTM C 14; ASTM C 76; CSA A257.1; CSA CAN/CSA A257.2
Copper or copper-alloy tubing (Type K or L)	ASTM B 75; ASTM B 88; ASTM B 251
Polyvinyl chloride (PVC) plastic pipe (Type DWV, SDR26, SDR35, SDR41, PS50 or PS100)	ASTM D 2665; ASTM D 2949; ASTM D 3034; ASTM F 891; CSA B182.2; CSA CAN/CSA-B182.4
Vitrified clay pipe	ASTM C 4; ASTM C 700

TABLE 702.4
PIPE FITTINGS

MATERIAL	STANDARD
Acrylonitrile butadiene styrene (ABS) plastic	ASTM D 3311, CSA B181.1
Cast iron	ASME B 16.4; ASME B16.12; ASTM A 74; ASTM A 888; CISPI 301
Copper or copper alloy	ASME B16.15; ASME B16.18; ASME B16.22; ASME B16.23; ASME B16.26; ASME B16.29; ASME B16.32
Glass	ASTM C 1053
Gray iron and ductile iron	AWWA C110
Malleable iron	ASME B16.3
Polyvinyl chloride (PVC) plastic	ASTM D 3311
Plastic, general	ASTM F 409
Steel	ASME B16.9; ASME B16.11; ASME B16.28

SECTION 703 BUILDING SEWER

703.1 Building sewer pipe near the water service. Where the building sewer is installed within 10 feet (3048 mm) of the water service, as provided for in Section 603.2, the building sewer pipe shall conform to one of the standards for ABS plastic pipe, cast-iron pipe, copper or copper-alloy tubing, or PVC plastic pipe listed in Table 702.3.

703.2 Drainage pipe in filled ground. Where a building sewer or building drain is installed on filled or unstable ground, the drainage pipe shall conform to one of the standards for ABS plastic pipe, cast-iron pipe, copper or copper-alloy tubing, or PVC plastic pipe listed in Table 702.3.

703.3 Sanitary and storm sewers. Where separate systems of sanitary drainage and storm drainage are installed in the same property, the sanitary and storm building sewers or drains shall be permitted to be laid side by side in one trench.

703.4 Existing building sewers and drains. Existing building sewers and drains shall connect with new building sewer and drainage systems only where found by examination and test to conform to the new system in quality of material. The code official shall notify the owner to make the changes necessary to conform to this code.

703.5 Cleanouts on building sewers. Cleanouts on building sewers shall be located as set forth in Section 708.

SECTION 704 DRAINAGE PIPING INSTALLATION

704.1 Slope of horizontal drainage piping. Horizontal drainage piping shall be installed in uniform alignment at uniform slopes. The minimum slope of a horizontal drainage pipe shall be in accordance with Table 704.1.

TABLE 704.1
SLOPE OF HORIZONTAL DRAINAGE PIPE

SIZE (Inches)	MINIMUM SLOPE (inch per foot)
2½ or less	¼
3 to 6	⅛
8 or larger	⅟₁₆

For SI: 1 inch = 25.4 mm, 1 inch per foot = 0.0833 mm/m.

704.2 Change in size. The size of the drainage piping shall not be reduced in size in the direction of the flow. A 4-inch by 3-inch (102 mm by 76 mm) water closet connection shall not be considered as a reduction in size.

704.3 Connections to offsets and bases of stacks. Horizontal branches shall connect to the bases of stacks at a point located not less than 10 pipe diameters downstream from the stack. Except as prohibited by Section 711.2, horizontal branches shall connect to horizontal stack offsets at a point located not less than 10 pipe diameters downstream from the upper stack.

704.4 Future fixtures. Drainage piping for future fixtures shall terminate with an approved cap or plug.

704.5 Dead ends. In the installation or removal of any part of a drainage system, dead ends shall be prohibited. Cleanout extensions and approved future fixture drainage piping shall not be considered as dead ends.

SECTION 705 JOINTS

705.1 General. This section contains provisions applicable to joints specific to sanitary drainage piping.

705.2 ABS plastic. Joints between ABS plastic pipe or fittings shall comply with Sections 705.2.1 through 705.2.3.

705.2.1 Mechanical joints. Mechanical joints on drainage pipes shall be made with an elastomeric seal conforming to ASTM C 1173, ASTM D 3212 or CSA CAN/CSA-B602. Mechanical joints shall only be installed in underground systems unless otherwise approved. Joints shall be installed in accordance with the manufacturer's instructions.

705.2.2 Solvent cementing. Joint surfaces shall be clean and free from moisture. Solvent cement that conforms to ASTM D 2235 or CSA B181.1 shall be applied to all joint surfaces. The joint shall be made while the cement is wet. Joints shall be made in accordance with ASTM D 2235, ASTM D 2661, ASTM F 628 or CSA CAN/CSA-B181.1. Solvent-cement joints shall be permitted above or below ground.

705.2.3 Threaded joints. Threads shall conform to ASME B1.20.1. Schedule 80 or heavier pipe shall be permitted to be threaded with dies specifically designed for plastic pipe. Approved thread lubricant or tape shall be applied on the male threads only.

705.3 Asbestos-cement. Joints between asbestos-cement pipe or fittings shall be made with a sleeve coupling of the same composition as the pipe, sealed with an elastomeric ring conforming to ASTM D 1869.

705.4 Brass. Joints between brass pipe or fittings shall comply with Sections 705.4.1 through 705.4.4.

705.4.1 Brazed joints. All joint surfaces shall be cleaned. An approved flux shall be applied where required. The joint shall be brazed with a filler metal conforming to AWS A5.8.

705.4.2 Mechanical joints. Mechanical joints shall be installed in accordance with the manufacturer's instructions.

705.4.3 Threaded joints. Threads shall conform to ASME B1.20.1. Pipe-joint compound or tape shall be applied on the male threads only.

705.4.4 Welded joints. All joint surfaces shall be cleaned. The joint shall be welded with an approved filler metal.

705.5 Cast iron. Joints between cast-iron pipe or fittings shall comply with Sections 705.5.1 through 705.5.3.

705.5.1 Caulked joints. Joints for hub and spigot pipe shall be firmly packed with oakum or hemp. Molten lead shall be poured in one operation to a depth of not less than 1 inch (25 mm). The lead shall not recede more than 1/8 inch (3.2 mm) below the rim of the hub and shall be caulked tight. Paint, varnish or other coatings shall not be permitted on the jointing material until after the joint has

been tested and approved. Lead shall be run in one pouring and shall be caulked tight. Acid-resistant rope and acid-proof cement shall be permitted.

705.5.2 Compression gasket joints. Compression gaskets shall conform to ASTM C 564. Gaskets shall be compressed when the pipe is fully inserted.

705.5.3 Mechanical joint coupling. Mechanical joint couplings shall comply with CISPI 310 or ASTM C 1277. The elastomeric sealing sleeve shall conform to ASTM C 564 or CSA CAN/CSA-B602 and shall be provided with a center stop. Mechanical joint couplings shall be installed in accordance with the manufacturer's installation instructions.

705.6 Concrete joints. Joints between concrete pipe or fittings shall be made with an elastomeric seal conforming to ASTM C 443, ASTM C 1173, CSA-A257.3 or CSA CAN/CSA-B602.

705.7 Copper pipe. Joints between copper or copper-alloy pipe or fittings shall comply with Sections 705.7.1 through 705.7.5.

705.7.1 Brazed joints. All joint surfaces shall be cleaned. An approved flux shall be applied where required. The joint shall be brazed with a filler metal conforming to AWS A5.8.

705.7.2 Mechanical joints. Mechanical joints shall be installed in accordance with the manufacturer's instructions.

705.7.3 Soldered joints. Solder joints shall be made in accordance with the methods of ASTM B 828. All cut tube ends shall be reamed to the full inside diameter of the tube end. All joint surfaces shall be cleaned. A flux conforming to ASTM B 813 shall be applied. The joint shall be soldered with a solder conforming to ASTM B 32.

705.7.4 Threaded joints. Threads shall conform to ASME B1.20.1. Pipe-joint compound or tape shall be applied on the male threads only.

705.7.5 Welded joints. All joint surfaces shall be cleaned. The joint shall be welded with an approved filler metal.

705.8 Copper tubing. Joints between copper or copper-alloy tubing or fittings shall comply with Sections 705.8.1 through 705.8.3.

705.8.1 Brazed joints. All joint surfaces shall be cleaned. An approved flux shall be applied where required. The joint shall be brazed with a filler metal conforming to AWS A5.8.

705.8.2 Mechanical joints. Mechanical joints shall be installed in accordance with the manufacturer's instructions.

705.8.3 Soldered joints. Solder joints shall be made in accordance with the methods of ASTM B 828. All cut tube ends shall be reamed to the full inside diameter of the tube end. All joint surfaces shall be cleaned. A flux conforming to ASTM B 813 shall be applied. The joint shall be soldered with a solder conforming to ASTM B 32.

705.9 Borosilicate glass joints. Glass-to-glass connections shall be made with a bolted compression-type stainless steel (300 series) coupling with contoured acid-resistant elastomer compression ring and a fluorocarbon polymer inner seal ring; or with caulked joints in accordance with Section 705.9.1.

705.9.1 Caulked joints. Every lead-caulked joint for hub and spigot soil pipe shall be firmly packed with oakum or hemp and filled with molten lead not less than 1 inch (25 mm) deep and not to extend more than $\frac{1}{8}$ inch (3.2 mm) below the rim of the hub. Paint, varnish or other coatings shall not be permitted on the jointing material until after the joint has been tested and approved. Lead shall be run in one pouring and shall be caulked tight. Acid-resistant rope and acid-proof cement shall be permitted.

705.10 Steel. Joints between galvanized steel pipe or fittings shall comply with Sections 705.10.1 and 705.10.2.

705.10.1 Threaded joints. Threads shall conform to ASME B1.20.1. Pipe-joint compound or tape shall be applied on the male threads only.

705.10.2 Mechanical joints. Joints shall be made with an approved elastomeric seal. Mechanical joints shall be installed in accordance with the manufacturer's instructions.

705.11 Lead. Joints between lead pipe or fittings shall comply with Sections 705.11.1 and 705.11.2.

705.11.1 Burned. Burned joints shall be uniformly fused together into one continuous piece. The thickness of the joint shall be at least as thick as the lead being joined. The filler metal shall be of the same material as the pipe.

705.11.2 Wiped. Joints shall be fully wiped, with an exposed surface on each side of the joint not less than $\frac{3}{4}$ inch (19.1 mm). The joint shall be at least $\frac{3}{8}$ inch (9.5 mm) thick at the thickest point.

705.12 PVC plastic. Joints between PVC plastic pipe or fittings shall comply with Sections 705.12.1 through 705.12.3.

705.12.1 Mechanical joints. Mechanical joints on drainage pipe shall be made with an elastomeric seal conforming to ASTM C 1173, ASTM D 3212 or CSA CAN/CSA-B602. Mechanical joints shall not be installed in above-ground systems, unless otherwise approved. Joints shall be installed in accordance with the manufacturer's instructions.

705.12.2 Solvent cementing. Joint surfaces shall be clean and free from moisture. A purple primer that conforms to ASTM F 656 shall be applied. Solvent cement not purple in color and conforming to ASTM D 2564, CSA CAN/CSA-B137.3, CSA CAN/CSA-B181.2 or CSA CAN/CSA-B182.1 shall be applied to all joint surfaces. The joint shall be made while the cement is wet and shall be in accordance with ASTM D 2855. Solvent-cement joints shall be permitted above or below ground.

705.12.3 Threaded joints. Threads shall conform to ASME B1.20.1. Schedule 80 or heavier pipe shall be permitted to be threaded with dies specifically designed for plastic pipe. Approved thread lubricant or tape shall be applied on the male threads only.

705.13 Vitrified clay. Joints between vitrified clay pipe or fittings shall be made with an elastomeric seal conforming to ASTM C 425, ASTM C 1173 or CSA CAN/CSA-B602.

705.14 Joints between different materials. Joints between different piping materials shall be made with a mechanical joint of the compression or mechanical-sealing type, or as permitted in Sections 705.14.1 through 705.14.6. Connectors or adapters shall have an elastomeric seal conforming to ASTM C 425, ASTM C 443, ASTM C 564, ASTM C 1173, ASTM D 1869, ASTM F 477, CSA A257.3 or CSA CAN/CSA-B602. Joints shall be installed in accordance with the manufacturer's instructions.

705.14.1 Copper or copper-alloy tubing to cast-iron hub pipe. Joints between copper or copper-alloy tubing and cast-iron hub pipe shall be made with a brass ferrule or compression joint. The copper or copper-alloy tubing shall be soldered to the ferrule in an approved manner, and the ferrule shall be joined to the cast-iron hub by a caulked joint or a mechanical compression joint.

705.14.2 Copper or copper-alloy tubing to galvanized steel pipe. Joints between copper or copper-alloy tubing and galvanized steel pipe shall be made with a brass converter fitting or dielectric fitting. The copper tubing shall be soldered to the fitting in an approved manner, and the fitting shall be screwed to the threaded pipe.

705.14.3 Cast-iron pipe to galvanized steel or brass pipe. Joints between cast-iron and galvanized steel or brass pipe shall be made by either caulked or threaded joints or with an approved adapter fitting.

705.14.4 Plastic pipe or tubing to other piping material. Joints between different grades of plastic pipe or between plastic pipe and other piping material shall be made with an approved adapter fitting. Joints between plastic pipe and cast-iron hub pipe shall be made by a caulked joint or a mechanical compression joint.

705.14.5 Lead pipe to other piping material. Joints between lead pipe and other piping material shall be made

by a wiped joint to a caulking ferrule, soldering nipple, bushing or shall be made with an approved adapter fitting.

705.14.6 Borosilicate glass to other materials. Joints between glass pipe and other types of materials shall be made with adapters having a TFE seal and shall be installed in accordance with the manufacturer's instructions.

705.15 Drainage slip joints. Slip joints shall be made with an approved elastomeric gasket and shall only be installed on the trap outlet, trap inlet and within the trap seal. Slip joints installed in concealed locations shall conform to Section 405.8.

705.16 Caulking ferrules. Ferrules shall be of red brass and shall be in accordance with Table 705.16.

705.17 Soldering bushings. Soldering bushings shall be of red brass and shall be in accordance with Table 705.17.

**TABLE 705.16
CAULKING FERRULE SPECIFICATIONS**

PIPE SIZES (inches)	INSIDE DIAMETER (inches)	LENGTH (inches)	MINIMUM WEIGHT EACH
2	2 ¹ / ₄	4 ¹ / ₂	1 pound
3	3 ¹ / ₄	4 ¹ / ₂	1 pound 12 ounces
4	4 ¹ / ₄	4 ¹ / ₂	2 pounds 8 ounces

For SI: 1 inch = 25.4 mm, 1 ounce = 28.35 g, 1 pound = 0.454 kg.

**TABLE 705.17
SOLDERING BUSHING SPECIFICATIONS**

PIPE SIZES (inches)	MINIMUM WEIGHT EACH
1 ¹ / ₄	6 ounces
1 ¹ / ₂	8 ounces
2	14 ounces
2 ¹ / ₂	1 pound 6 ounces
3	2 pounds
4	3 pounds 8 ounces

For SI: 1 inch = 25.4 mm, 1 ounce = 28.35 g, 1 pound = 0.454 kg.

SECTION 706 CONNECTIONS BETWEEN DRAINAGE PIPING AND FIXTURES

706.1 Connections and changes in direction. All connections and changes in direction of the sanitary drainage system shall be made with approved drainage fittings. Connections between drainage piping and fixtures shall conform to Section 405.

706.2 Obstructions. The fittings shall not have ledges, shoulders or reductions capable of retarding or obstructing flow in the piping. Threaded drainage pipe fittings shall be of the recessed drainage type.

706.3 Installation of fittings. Fittings shall be installed to guide sewage and waste in the direction of flow. Change in direction shall be made by fittings installed in accordance with Table 706.3. Change in direction by combination fittings, side inlets or increasers shall be installed in accordance with Table 706.3 based on the pattern of flow created by the fitting. Double sanitary tee patterns shall not receive the discharge of back-to-back water closets and fixtures or appliances with pumping action discharge.

**TABLE 706.3
FITTINGS FOR CHANGE IN DIRECTION**

TYPE OF FITTING PATTERN	CHANGE IN DIRECTION		
	Horizontal to vertical	Vertical to horizontal	Horizontal to horizontal
Sixteenth bend	X	X	X
Eighth bend	X	X	X
Sixth bend	X	X	X
Quarter bend	X	X ^a	X ^a
Short sweep	X	X ^{a,b}	X ^a
Long sweep	X	X	X
Sanitary tee	X ^c		
Wye	X	X	X
Combination wye and eighth bend	X	X	X

For SI: 1 inch = 25.4 mm.

^a The fittings shall only be permitted for a 2-inch or smaller fixture drain.

^b Three inches and larger.

^c For a limitation on double sanitary tees, See Section 706.3.

SECTION 707 PROHIBITED JOINTS AND CONNECTIONS

707.1 Prohibited joints. The following types of joints and connections shall be prohibited:

1. Cement or concrete joints.
2. Mastic or hot-pour bituminous joints.
3. Joints made with fittings not approved for the specific installation.
4. Joints between different diameter pipes made with elastomeric rolling O-rings.
5. Solvent-cement joints between different types of plastic pipe.
6. Saddle-type fittings.

SECTION 708 CLEANOUTS

708.1 Scope. This section shall govern the size, location, installation and maintenance of drainage pipe cleanouts.

708.2 Cleanout plugs. Cleanout plugs shall be of brass, plastic or other approved materials. Brass cleanout plugs shall be utilized with metallic drain, waste and vent piping only, and shall conform to ASTM A 74. Plastic cleanout plugs shall conform to the requirements of Section 702.4. Plugs shall

have raised square or countersunk square heads. Countersunk heads shall be installed where raised heads are a trip hazard. Cleanout plugs with borosilicate glass systems shall be of borosilicate glass.

708.3 Where required. Cleanouts shall be located in accordance with Sections 708.3.1 through 708.3.5.

708.3.1 Horizontal drains within buildings. All horizontal drains shall be provided with cleanouts located not more than 100 feet (30 480 mm) apart.

708.3.2 Building sewers. All building sewers shall be provided with cleanouts located not more than 100 feet (30 480 mm) apart measured from the upstream entrance of the cleanout.

708.3.3 Changes of direction. Cleanouts shall be installed at each change of direction of the building drain or horizontal waste or soil lines greater than 45 degrees (0.79 rad). Where more than one change of direction occurs in a run of piping, only one cleanout shall be required for each 40 feet (12 192 mm) of developed length of the drainage piping.

708.3.4 Base of stack. A cleanout shall be provided at the base of each waste or soil stack.

708.3.5 Building drain and building sewer junction. There shall be a cleanout near the junction of the building drain and the building sewer. The cleanout shall be either inside or outside the building wall and shall be brought up to the finished ground level or to the basement floor level. An approved two-way cleanout is allowed to be used at this location to serve as a required cleanout for both the building drain and building sewer. The cleanout at the junction of the building drain and building sewer shall not be required if the cleanout on a 3-inch (76 mm) or larger diameter soil stack is located within a developed length of 10 feet (3048 mm) of the building drain and building sewer connection.

708.3.6 Manholes. Manholes serving a building drain shall have secured gas-tight covers and shall be located in accordance with Section 708.8.

708.4 Concealed piping. Cleanouts on concealed piping or piping under a floor slab or piping in a crawl space of less than 24 inches (610 mm) in height or a plenum shall be extended through and terminate flush with the finished wall, floor or ground surface or shall be extended to the outside of the building. Cleanout plugs shall not be covered with cement, plaster or any other permanent finish material. Where it is necessary to conceal a cleanout or to terminate a cleanout in an area subject to vehicular traffic, the covering plate, access door or cleanout shall be of an approved type designed and installed for this purpose.

708.5 Opening direction. Every cleanout shall be installed to open to allow cleaning in the direction of the flow of the drainage pipe or at right angles thereto.

708.6 Prohibited installation. Cleanout openings shall not be utilized for the installation of new fixtures or floor drains, except where approved and where another cleanout of equal access and capacity is provided.

708.7 Minimum size. Cleanouts shall be the same nominal size as the pipe they serve up to 4 inches (102 mm). For pipes larger than 4 inches (102 mm) nominal size, the minimum size of the cleanout shall be 4 inches (102 mm).

Exception: "P" trap connections with slip joints or ground joint connections, or stack cleanouts that are no more than one pipe diameter smaller than the drain served, shall be approved.

708.8 Pipes 12 inches (305 mm) and larger nominal size. For building sewers 12 inches (305 mm) and larger, manholes shall be provided and located at each change in direction and at intervals of not more than 400 feet (121.9 m). Manholes and manhole covers shall be of an approved type.

708.9 Clearances. Cleanouts on 6-inch (153 mm) and smaller pipes shall be provided with a clearance of not less than 18 inches (457 mm) for rodding. Cleanouts on 8-inch (203 mm) and larger pipes shall be provided with a clearance of not less than 36 inches (914 mm) for rodding.

708.10 Access. Access shall be provided to all cleanouts.

SECTION 709 FIXTURE UNITS

709.1 Values for fixtures. Drainage fixture unit values as given in Table 709.1 designate the relative load weight of different kinds of fixtures that shall be employed in estimating the total load carried by a soil or waste pipe, and shall be used in connection with Tables 710.1(1) and 710.1(2) of sizes for soil, waste and vent pipes for which the permissible load is given in terms of fixture units.

709.2 Fixtures not listed in Table 709.1. Fixtures not listed in Table 709.1 shall have a drainage fixture unit load based on the outlet size of the fixture in accordance with Table 709.2. The minimum trap size for unlisted fixtures shall be the size of the drainage outlet but not less than 1 1/4 inches (32 mm).

709.3 Values for continuous flow. Drainage fixture unit values for continuous flow into a drainage system shall be computed on the basis that 1 gpm (0.06 L/s) of flow is equivalent to two fixture units.

709.4 Values for semicontinuous flow. Drainage fixture unit values for semicontinuous flow into a drainage system shall be computed on the basis that 1 gpm (0.06 L/s) of flow is equivalent to one fixture unit.

TABLE 709.1
DRAINAGE FIXTURE UNITS FOR FIXTURES AND GROUPS

FIXTURE TYPE	DRAINAGE FIXTURE UNIT VALUE AS LOAD FACTORS	MINIMUM SIZE OF TRAP (Inches)
Automatic clothes washers, commercial ^a	3	2
Automatic clothes washers, residential	2	2
Bathroom group (with 3.5 gpf water closet) consisting of water closet, lavatory, bidet and bathtub or shower	6	—
Bathroom group (with 1.6 gpf water closet)	5	—
Bathroom group (with 1.6 gpf flushometer tank with water closet)	5.5	—
Bathtub ^b (with or without overhead shower or whirlpool attachments)	2	1 1/2
Bidet	2	1 1/4
Combination sink and tray	2	1 1/2
Dental lavatory	1	1 1/4
Dental unit or cuspidor	1	1 1/4
Dishwashing machine, ^c domestic	2	1 1/2
Drinking fountain	1/2	1 1/4
Emergency floor drain	0	2
Floor drains	2	2
Kitchen sink, domestic	2	1 1/2
Kitchen sink, domestic with food waste grinder and/or dishwasher	2	1 1/2
Laundry tray (1 or 2 compartments)	2	1 1/2
Lavatory	1	1 1/4
Shower compartment, domestic	2	2
Sink	2	1 1/2
Urinal	4	Footnote d
Urinal, 1 gallon per flush or less	2 ^e	Footnote d
Wash sink (circular or multiple) each set of faucets	2	1 1/2
Water closet, flushometer tank, public or private	4 ^e	Footnote d
Water closet, private installation	4	Footnote d
Water closet, public installation	6	Footnote d
Water closet (1.6 gpf), public installation	4	Footnote d
Water closet (1.6 gpf), private installation	3	Footnote d
Water closet (1.6 gpf) flushometer tank, private installation	3.5	Footnote d
Water closet (3.5 gpf), public installation	6	Footnote d
Water closet (3.5 gpf), private installation	4	Footnote d

For SI: 1 inch = 25.4 mm, 1 gallon = 3.785 L.

^a For traps larger than 3 inches, use Table 709.2.

^b A showerhead over a bathtub or whirlpool attachments does not increase the drainage fixture unit value.

^c See Sections 709.2 through 709.4 for methods of computing unit value of fixtures not listed in Table 709.1 or for rating of devices with intermittent flows.

^d Trap size shall be consistent with the fixture outlet size.

^e For the purpose of computing loads on building drains and sewers, water closets or urinals shall not be rated at a lower drainage fixture unit unless lower values are confirmed by testing.

TABLE 709.2
DRAINAGE FIXTURE UNITS FOR FIXTURE DRAINS OR TRAPS

FIXTURE DRAIN OR TRAP SIZE (Inches)	DRAINAGE FIXTURE UNIT VALUE
1 1/4	1
1 1/2	2
2	3
1/2	4
3	5
4	6

For SI: 1 inch = 25.4 mm.

709.5 Values for indirect waste receptor. The drainage fixture unit load of an indirect waste receptor receiving the discharge of indirectly connected fixtures shall be the sum of the drainage fixture unit values of the fixtures that discharge to the receptor. If this drainage fixture value is less than the indirect waste receptor drainage fixture value given in Table 709.1 or Table 709.2, then the values in the referenced tables shall be used.

SECTION 710 DRAINAGE SYSTEM SIZING

710.1 Maximum fixture unit load. The maximum number of drainage fixture units connected to a given size of building sewer, building drain or horizontal branch of the building drain shall be determined using Table 710.1(1). The maximum number of drainage fixture units connected to a given size of horizontal branch or vertical soil or waste stack shall be determined using Table 710.1(2).

710.1.1 Horizontal stack offsets. Horizontal stack offsets shall be sized as required for building drains in accordance with Table 710.1(1), except as required by Section 711.4.

710.1.2 Vertical stack offsets. Vertical stack offsets shall be sized as required for straight stacks in accordance with Table 710.1(2), except when required to be sized as a building drain in accordance with Section 711.1.1.

**TABLE 710.1(1)
BUILDING DRAINS AND SEWERS**

DIAMETER OF PIPE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS CONNECTED TO ANY PORTION OF THE BUILDING DRAIN OR THE BUILDING SEWER, INCLUDING BRANCHES OF THE BUILDING DRAIN ^a			
	Slope per foot			
	1/16 inch	1/8 inch	1/4 inch	1/2 inch
1 1/4			1	1
1 1/2			3	3
2			21	26
2 1/2			24	31
3		36	42	50
4		180	216	250
5		390	480	575
6		700	840	1,000
8	1,400	1,600	1,920	2,300
10	2,500	2,900	3,500	4,200
12	2,900	4,600	5,600	6,700
15	7,000	8,300	10,000	12,000

For SI: 1 inch = 25.4 mm, 1 inch per foot = 0.0833 mm/m.

^a The minimum size of any building drain serving a water closet shall be 3 inches.

**TABLE 710.1(2)
HORIZONTAL FIXTURE BRANCHES AND STACKS^a**

DIAMETER OF PIPE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)			
	Total for a horizontal branch	Stacks ^b		
		Total discharge into one branch interval	Total for stack of three branch intervals or less	Total for stack greater than three branch intervals
1 1/2	3	2	4	8
2	6	6	10	24
2 1/2	12	9	20	42
3	20	20	48	72
4	160	90	240	500
5	360	200	540	1,100
6	620	350	960	1,900
8	1,400	600	2,200	3,600
10	2,500	1,000	3,800	5,600
12	3,900	1,500	6,000	8,400
15	7,000	Footnote c	Footnote c	Footnote c

For SI: 1 inch = 25.4 mm.

- ^a Does not include branches of the building drain. Refer to Table 710.1(1).
- ^b Stacks shall be sized based on the total accumulated connected load at each story or branch interval. As the total accumulated connected load decreases, stacks are permitted to be reduced in size. Stack diameters shall not be reduced to less than one-half of the diameter of the largest stack size required.
- ^c Sizing load based on design criteria.

710.2 Future fixtures. When provision is made for the future installation of fixtures, those provided for shall be considered in determining the required sizes of drain pipes. Construction to provide for such future installation shall be terminated with an approved cap or plug.

710.3 Underground drainage piping. Any portion of the drainage system installed underground or below a basement or cellar shall not be less than 2 inches (51 mm) in diameter.

SECTION 711 OFFSETS IN DRAINAGE PIPING IN BUILDINGS OF FIVE STORIES OR MORE

711.1 Horizontal branch connections above or below vertical stack offsets. If a horizontal branch connects to the stack within 2 feet (610 mm) above or below a vertical stack offset, and the offset is located more than four branch intervals below the top of the stack, the offset shall be vented in accordance with Section 915.

711.1.1 Omission of vents for vertical stack offsets. Vents for vertical offsets required by Section 711.1 shall not be required where the stack and its offset are sized as a building drain (See Table 710.1(1), Column 5).

711.2 Horizontal branch connections to horizontal stack offsets. When a horizontal stack offset is located more than four branch intervals below the top of the stack, a horizontal

branch shall not connect within the horizontal stack offset or within 2 feet (610 mm) above or below such offset.

711.3 Horizontal stack offsets. A stack with a horizontal offset located more than four branch intervals below the top of the stack shall be vented in accordance with Section 914 and sized as follows:

1. The portion of the stack above the offset shall be sized as for a vertical stack based on the total number of drainage fixture units above the offset.
2. The offset shall be sized in accordance with Section 710.1.1.
3. The portion of the stack below the offset shall be sized as for the offset or based on the total number of drainage fixture units on the entire stack, whichever is larger [see Table 710.1(2), Column 4].

711.3.1 Omission of vents for horizontal stack offsets.

Vents for horizontal stack offsets required by Section 711.3 shall not be required where the stack and its offset is one pipe size larger than required for a building drain (See Table 710.1(1), Column 5) and the entire stack and offset is not less in cross-sectional area than that required for a straight stack plus the area of an offset vent as provided for in Section 915. Omission of offset vents in accordance with this section shall not constitute approval of horizontal branch connections within the offset or within 2 feet (610 mm) above or below the offset.

711.4 Offsets below lowest branch. Where a vertical offset occurs in a soil or waste stack below the lowest horizontal branch, change in diameter of the stack because of the offset shall not be required. If a horizontal offset occurs in a soil or waste stack below the lowest horizontal branch, the required diameter of the offset and the stack below it shall be determined as for a building drain in accordance with Table 710.1(1).

SECTION 712 SUMPS AND EJECTORS

712.1 Building drains below sewer. Building drains that cannot be discharged to the sewer by gravity flow shall be discharged into a tightly covered and vented sump from which the liquid shall be lifted and discharged into the building gravity drainage system by automatic pumping equipment or other approved method.

712.2 Check and gate valve required. A gate valve located on the discharge side of the check valve shall be installed in the pump or ejector discharge piping between the pump or ejector and the gravity drainage system. Access shall be provided to such valves. Such valves shall be located above the sump cover required by Section 712.1 or, when the discharge pipe from the ejector is below grade, the valves shall be accessibly located outside the sump below grade in an access pit with a removable access cover.

Exception: In residential buildings, only a check valve shall be required, located on the discharge piping from the sewage pump or ejector.

712.3 Sump design. The sump pump, pit and discharge piping shall conform to the requirements of Sections 712.3.1 through 712.3.5.

712.3.1 Sump pump. The sump pump capacity and head shall be appropriate to anticipated use requirements.

712.3.2 Sump pit. The sump pit shall be not less than 18 inches (457 mm) in diameter and 24 inches (610 mm) deep, unless otherwise approved. The pit shall be accessible and located such that all drainage flows into the pit by gravity. The sump pit shall be constructed of tile, concrete, steel, plastic or other approved materials. The pit bottom shall be solid and provide permanent support for the pump. The sump pit shall be fitted with a gas-tight removable cover adequate to support anticipated loads in the area of use. The sump pit shall be vented in accordance with Chapter 9.

712.3.3 Discharge piping. Discharge piping shall meet the requirements of Section 712.2.

712.3.4 Maximum effluent level. The effluent level control shall be adjusted and maintained to at all times prevent the effluent in the sump from rising to within 2 inches (51 mm) of the invert of the gravity drain inlet into the sump.

712.3.5 Ejector connection to the drainage system.

Pumps connected to the drainage system shall connect to the building sewer or shall connect to a wye fitting in the building drain a minimum of 10 feet (3048 mm) from the base of any soil stack, waste stack or fixture drain. Where the discharge line connects into horizontal drainage piping, the connector shall be made through a wye fitting into the top of the drainage piping.

712.4 Sewage pumps and sewage ejectors. A sewage pump or sewage ejector shall automatically discharge the contents of the sump to the building drainage system.

712.4.1 Capacity. A sewage pump or sewage ejector shall have the capacity and head for the application requirements. Pumps or ejectors that receive the discharge of water closets shall be capable of handling spherical solids with a diameter of up to and including 2 inches (51 mm). Other pumps or ejectors shall be capable of handling spherical solids with a diameter of up to and including 1 inch (25 mm). The minimum capacity of a pump or ejector based on the diameter of the discharge pipe shall be in accordance with Table 712.4.1.

Exception: Grinder pumps or grinder ejectors that receive the discharge of water closets shall have a minimum discharge opening of 1¹/₄ inches (32 mm).

TABLE 712.4.1 — 713.9.3

TABLE 712.4.1
MINIMUM CAPACITY OF SEWAGE PUMP
OR SEWAGE EJECTOR

DIAMETER OF THE DISCHARGE PIPE (inches)	CAPACITY OF PUMP OR EJECTOR (gpm)
2	21
2½	30
3	46

For SI: 1 inch = 25.4 mm, 1 gpm = 3.785 L/m.

SECTION 713 HEALTH CARE PLUMBING

713.1 Scope. This section shall govern those aspects of health care plumbing systems that differ from plumbing systems in other structures. Health care plumbing systems shall conform to this section in addition to the other requirements of this code. The provisions of this section shall apply to the special devices and equipment installed and maintained in the following occupancies: nursing homes, homes for the aged, orphanages, infirmaries, first aid stations, psychiatric facilities, clinics, professional offices of dentists and doctors, mortuaries, educational facilities, surgery, dentistry, research and testing laboratories, establishments manufacturing pharmaceutical drugs and medicines, and other structures with similar apparatus and equipment classified as plumbing.

713.2 Bedpan washers and clinical sinks. Bedpan washers and clinical sinks shall connect to the drainage and vent system in accordance with the requirements for a water closet. Bedpan washers shall also connect to a local vent.

713.3 Indirect waste. All sterilizers, steamers and condensers shall discharge to the drainage through an indirect waste pipe by means of an air gap. Where a battery of not more than three sterilizers discharges to an individual receptor, the distance between the receptor and a sterilizer shall not exceed 8 feet (2438 mm). The indirect waste pipe on a bedpan steamer shall be trapped.

713.4 Vacuum system station. Ready access shall be provided to vacuum system station receptacles. Such receptacles shall be built into cabinets or recesses and shall be visible.

713.5 Bottle system. Vacuum (fluid suction) systems intended for collecting, removing and disposing of blood, pus or other fluids by the bottle system shall be provided with receptacles equipped with an overflow prevention device at each vacuum outlet station.

713.6 Central disposal system equipment. All central vacuum (fluid suction) systems shall provide continuous service. Systems equipped with collecting or control tanks shall provide for draining and cleaning of the tanks while the system is in operation. In hospitals, the system shall be connected to the emergency power system. The exhausts from a vacuum pump serving a vacuum (fluid suction) system shall discharge separately to open air above the roof.

713.7 Central vacuum or disposal systems. Where the waste from a central vacuum (fluid suction) system of the barometric-lag, collection-tank or bottle-disposal type is connected to the drainage system, the waste shall be directly connected to the sanitary drainage system through a trapped waste.

713.7.1 Piping. The piping of a central vacuum (fluid suction) system shall be of corrosion-resistant material with a smooth interior surface. A branch shall not be less than ½-inch (12.7 mm) nominal pipe size for one outlet and shall be sized in accordance with the number of vacuum outlets. A main shall not be less than 1-inch (25.4 mm) nominal pipe size. The pipe sizing shall be increased in accordance with the manufacturer's instructions as stations are increased. For the purposes of inspection, maintenance and replacement, all piping shall have cleanout facilities on mains and branches. Access shall be provided to such cleanout facilities.

713.7.2 Velocity. The velocity of airflow in a central vacuum (fluid suction) system shall be less than 5,000 feet per minute (25 m/s).

713.8 Vent connections prohibited. Connections between local vents serving bedpan washers or sterilizer vents serving sterilizing apparatus and normal sanitary plumbing systems are prohibited. Only one type of apparatus shall be served by a local vent.

713.9 Local vents and stacks for bedpan washers. Bedpan washers shall be vented to open air above the roof by means of one or more local vents. The local vent for a bedpan washer shall not be less than a 2-inch-diameter (51 mm) pipe. A local vent serving a single bedpan washer is permitted to drain to the fixture served.

713.9.1 Multiple installations. Where bedpan washers are located above each other on more than one floor, a local vent stack is permitted to be installed to receive the local vent on the various floors. Not more than three bedpan washers shall be connected to a 2-inch (51 mm) local vent stack, not more than six to a 3-inch (76 mm) local vent stack and not more than 12 to a 4-inch (102 mm) local vent stack. In multiple installations, the connections between a bedpan washer local vent and a local vent stack shall be made with tee or tee-wye sanitary pattern drainage fittings installed in an upright position.

713.9.2 Trap required. The bottom of the local vent stack, except where serving only one bedpan washer, shall be drained by means of a trapped and vented waste connection to the sanitary drainage system. The trap and waste shall be the same size as the local vent stack.

713.9.3 Trap seal maintenance. A water supply pipe not less than ¼ inch (6.4 mm) in diameter shall be taken from the flush supply of each bedpan washer on the discharge or fixture side of the vacuum breaker, shall be trapped to form not less than a 3-inch (76 mm) water seal, and shall be connected to the local vent stack on each floor. The water sup-

ply shall be installed so as to provide a supply of water to the local vent stack for cleansing and drain trap seal maintenance each time a bedpan washer is flushed.

713.10 Sterilizer vents and stacks. Multiple installations of pressure and nonpressure sterilizers shall have the vent connections to the sterilizer vent stack made by means of inverted wye fittings. Access shall be provided to vent connections for the purpose of inspection and maintenance.

713.10.1 Drainage. The connection between sterilizer vent or exhaust openings and the sterilizer vent stack shall be designed and installed to drain to the funnel or basket-type waste fitting. In multiple installations, the sterilizer vent stack shall be drained separately to the lowest sterilizer funnel or basket-type waste fitting or receptor.

713.11 Sterilizer vent stack sizes. Sterilizer vent stack sizes shall comply with Sections 713.11.1 through 713.11.4.

713.11.1 Bedpan steamers. The minimum size of a sterilizer vent serving a bedpan steamer shall be 1 1/2 inches (38 mm) in diameter. Multiple installations shall be sized in accordance with Table 713.11.1.

TABLE 713.11.1
STACK SIZES FOR BEDPAN STEAMERS
AND BOILING-TYPE STERILIZERS
(Number of Connections of Various Sizes Permitted to Various-sized Sterilizer Vent Stacks)

STACK SIZE (inches)	CONNECTION SIZE	
	1 1/2"	2"
1 1/2 ^a	1	0
2 ^a	2	1
2 ^b	1	1
3 ^a	4	2
3 ^b	2	2
4 ^a	8	4
4 ^b	4	4

For SI: 1 inch = 25.4 mm.

^a Total of each size.

^b Combination of sizes.

713.11.2 Boiling-type sterilizers. The minimum size of a sterilizer vent stack shall be 2 inches (51 mm) in diameter where serving a utensil sterilizer and 1 1/2 inches (38 mm) in diameter where serving an instrument sterilizer. Combinations of boiling-type sterilizer vent connections shall be sized in accordance with Table 713.11.1.

713.11.3 Pressure sterilizers. Pressure sterilizer vent stacks shall be 2 1/2 inches (64 mm) minimum. Those serving combinations of pressure sterilizer exhaust connections shall be sized in accordance with Table 713.11.3.

TABLE 713.11.3
STACK SIZES FOR PRESSURE STERILIZERS
(Number of Connections of Various Sizes Permitted to Various-sized Vent Stacks)

STACK SIZE (inches)	CONNECTION SIZE			
	3/4"	1"	1 1/4"	1 1/2"
1 1/2 ^a	3 or	2 or	1	
1 1/2 ^b	2 and	1		
2 ^a	6 or	3 or	2 or	1
2 ^b	3 and	2		
2 ^b	2 and	1 and	1	
2 ^b	1 and	1 and		1
3 ^a	15 or	7 or	5 or	3
3 ^b		1 and	2 and	2
	1 and	5 and		1

For SI: 1 inch = 25.4 mm.

^a Total of each size.

^b Combination of sizes.

713.11.4 Pressure instrument washer sterilizer sizes. The minimum diameter of a sterilizer vent stack serving an instrument washer sterilizer shall be 2 inches (51 mm). Not more than two sterilizers shall be installed on a 2-inch (51 mm) stack, and not more than four sterilizers shall be installed on a 3-inch (76 mm) stack.

SECTION 714 COMPUTERIZED DRAINAGE DESIGN

714.1 Design of drainage system. The sizing requirements for plumbing drainage systems shall be determined by approved computer program design methods.

714.2 Load on drainage system. The load shall be computed from the simultaneous or sequential discharge conditions from fixtures, appurtenances and appliances or the peak usage design condition.

714.2.1 Fixture discharge profiles. The discharge profiles for flow rates versus time from fixtures and appliances shall be in accordance with the manufacturer's specifications.

714.3 Selections of drainage pipe sizes. Pipe shall be sized to prevent full-bore flow.

714.3.1 Selecting pipe wall roughness. Pipe size calculations shall be conducted with the pipe wall roughness factor (k_s), in accordance with the manufacturer's specifications and as modified for aging roughness factors with deposits and corrosion.

714.3.2 Slope of horizontal drainage piping. Horizontal drainage piping shall be designed and installed at slopes in accordance with Table 704.1.

714.4 Alternative engineered design. The design, documentation, inspection, testing and approval of an alternative engineered design plumbing system shall comply with Sections 714.4.1 through 714.4.6.

714.4.1 Design criteria. An alternative engineered design shall conform to the intent of the provisions of this code and shall provide an equivalent level of quality, strength, effectiveness, fire resistance, durability and safety. Material, equipment or components shall be designed and installed in accordance with the manufacturer's installation instructions.

714.4.2 Submittal. The registered design professional shall indicate on the permit application that the plumbing system is an alternative engineered design. The permit and permanent permit records shall indicate that an alternative engineered design was part of the approved installation.

714.4.3 Technical data. The registered design professional shall submit sufficient technical data to substantiate the proposed alternative engineered design and to prove that the performance meets the intent of this code.

714.4.4 Construction documents. The registered design professional shall submit to the code official two complete sets of signed and sealed construction documents for the alternative engineered design. The construction documents shall include floor plans and a riser diagram of the work. Where appropriate, the construction documents shall indicate the direction of flow, all pipe sizes, grade of horizontal piping, loading, and location of fixtures and appliances.

714.4.5 Design approval. Where the code official determines that the alternative engineered design conforms to the intent of this code, the plumbing system shall be approved. If the alternative engineered design is not approved, the code official shall notify the registered design professional in writing, stating the reasons therefor.

714.4.6 Inspection and testing. The alternative engineered design shall be tested and inspected in accordance with the requirements of Section 312.

715.3 Material. All bearing parts of backwater valves shall be of corrosion-resistant material. Backwater valves shall comply with ASME A112.14.1, CSA CAN/CSA-B181.1 or CSA CAN/CSA-B181.2.

715.4 Seal. Backwater valves shall be so constructed as to provide a mechanical seal against backflow.

715.5 Diameter. Backwater valves, when fully opened, shall have a capacity not less than that of the pipes in which they are installed.

715.6 Location. Backwater valves shall be installed so that access is provided to the working parts for service and repair.

SECTION 715 BACKWATER VALVES

715.1 Sewage backflow. A backwater valve shall be installed only for plumbing fixtures where the overflow rim of the lowest plumbing fixtures are below the next upstream manhole in the public sewer. Plumbing fixtures with flood rims above the next upstream manhole shall not discharge through the backwater valve.

715.2 Fixture branches. Backwater valves shall be installed in the branch of the building drain that receives only the discharge from fixtures located within such branch and shall be located below ground.