

CHAPTER 7 SANITARY DRAINAGE

701 GENERAL

701.1 Scope

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

701.6 Frost Protection

No soil or waste pipe shall be installed or permitted outside of a building, or concealed in outside walls or in any place where they may be subjected to freezing temperatures, unless adequate provision is made to protect them from freezing.

701.7 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 1004 or an approved pretreatment system as directed by the plumbing official.

701.8 Individual or Private Sewage Disposal System

Where a public sewer is not available, an individual sewage disposal system shall be of a type that is acceptable and approved by the plumbing official or other governing authority having jurisdiction. See Appendix E.

701.9 Tests

The sanitary drainage system shall be tested in accordance with 311.

701.10 Engineered Systems

Engineered sanitary drainage and venting systems shall conform to the provisions of Chapter 12.

702 DEFINITIONS

The following definitions have been moved to Chapter 2: HORIZONTAL PIPE, UNSTABLE GROUND, VERTICAL PIPE.

703 MATERIALS

703.1 General

Pipe, tubing, and fittings for drainage systems shall conform to the standards listed in Table 703.

703.2 Specific Type

Standards listed in Table 703 apply to the specific materials approved for use and, as indicated in the various sections in this chapter, as they apply to the drainage system.

703.3 Aboveground Piping Within Buildings and Piping in Raceways or Tunnels

703.3.1 Soil and waste piping for drainage systems shall be of cast iron, galvanized steel, brass or copper pipe, type DWV copper tube, Schedule 40 plastic piping or borosilicate glass.

703.3.2 Vertical soil, waste and vent stacks shall be designed to control expansion and contraction, in accordance with accepted engineering practice, to the satisfaction of the plumbing official.

703.4 Underground Piping Within Buildings

All underground drains within buildings shall be cast iron soil pipe, ductile-iron pipe, type DWV copper, heavy schedule borosilicate glass, or Schedule 40 plastic piping. Materials subject to corrosion shall be protected when installed in corrosive soils.

Table 703 Drainage System Materials

MATERIALS	STANDARDS
NONMETALLIC PIPING	
Clay Drain Pipe	ASTM C 4
Clay Pipe Flexible Joint	ASTM C 425
Clay Sewer Pipe	ASTM C 700, Markings shall include ASTM number
Concrete Drain Tile	ASTM C 412
Concrete Perforated	ASTM C 444
Concrete Reinforced Culverts	ASTM C 76, For storm drains only
Concrete Reinforced Sewer Pipe	ASTM C 361, For storm drains only
Concrete Sewer Pipe	ASTM C 14, For storm drains only
Sewer Manholes	ASTM C 478
Concrete (Steel Cylinder Type)	FSSS-P-381
PLASTIC PIPE AND FITTINGS	
ABS-DWV Pipe and Fittings	ASTM D 2661, Listed, See 303.8.3
ABS Sewer Pipe and Fittings (for outside building sewers, storm drains and storm sewers)	ASTM D 2751, See 704.1, 1101.5, 1103.2, and 1103.4, Installation: ASTM D 2321
Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain Waste, and Vent Pipe with a Cellular Core	ASTM F 628, Listed
Coextruded Composite Pipe	ASTM F 1488, See 303.8.3, 303.8.5, 704.1, 1101.5, 1103.2, 1103.4.
Coextruded Composite Drain, Waste, and Vent Pipe (DWV)	ASTM F 1499, See 303.8.3, 303.8.5, 704.1, 1101.5, 1103.2, 1103.4.
Coextruded PVC Plastic Pipe	ASTM F 891, See 303.8.3, 303.8.5, 704.1, 1101.5, 1103.2, and 1103.4
Flexible Elastomeric Non-Pressure Joints	ASTM D 3212, See 303.8
Large Diameter Ribbed PVC Sewer Pipe and Fittings	CAN/CSA-B182.4
Polyolefin Laboratory Drainage Systems	CAN/CSA-B181.3
PVC-DWV Pipe and Fittings	ASTM D 2665, Listed, See 303.8.3
Type PS 46 and Type PS 115 Sewer Pipe (for outside building sewers, storm drains)	ASTM F 789, See 704.1, 1101.4, 1103.2 and 1103.4, ASTM D 2321, Installation
Type PSM PVC Sewer Pipe & Fittings (for outside building sewers, storm drains and storm sewers)	ASTM 3034, See 704.1, 1101.5, 1103.2, and 1103.4 ASTM D 2321, Installation
Type PSP PVC Sewer Pipe & Fittings (for outside building sewers, storm drains and storm sewers)	ASTM D 2321, Installation

(continued)

**TABLE 703 (continued)
DRAINAGE SYSTEM MATERIALS**

MATERIALS	STANDARDS
FERROUS PIPE AND FITTINGS	
Cast Iron Soil Pipe and Fittings	ASTM A 74, CISPI HS
CI NO-HUB Pipe and Fittings	CISPI Std. 301 ASTM A 888
Ductile-Iron Gravity Sewer Pipe	ASTM A 746
Hubless Cast Iron Sanitary System	CISPI Std. 310
Manhole Top Frames and Covers	ASTM A 48
NONFERROUS PIPE & FITTINGS	
Cast Copper Alloy Solder-Joint Drainage Fittings	ASME B 16.23, For Plumbing Drainage Waste and Vents
Cast Copper Alloy Solder Joint Fittings for Solvent Drainage Systems	ANSI B 16.32
Copper Drainage Tube DWV	ASTM B 306
Lead Pipe, Bends and Traps	FS WW-P-325
Welded Copper and Copper Alloy Heat Exchanger Tube	ASTM B 543
Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings For Plumbing Drainage Waste and Vents	ASME B 16.29
Wrought Copper and Copper Alloy Solder-Joint Fittings for Solvent Drainage Systems	ANSI B 16.43
GLASS PIPE	
Borosilicate Glass Pipe and Fittings for DWV Applications	ASTM C 1053

703.5 Fittings

Fittings on the drainage system shall be compatible to the type of piping used. Fittings on threaded pipe shall be of the recessed drainage type. See 307.

703.6 Acid Soil and Waste Piping

Acid soil and waste piping for drainage systems shall be of a high silicon cast iron, borosilicate glass or other materials approved by the plumbing official. Fittings shall conform to the type of piping used. Acid soil and waste piping shall not be connected to the conventional plumbing system.

704 BUILDING SEWER

704.1 Separate Trenches

The building sewer, when installed in a separate trench from the water service pipe, shall be cast iron sewer pipe, vitrified clay sewer pipe, or plastic piping (minimum SDR 35 or heavier). Joints shall be watertight and rootproof and all material shall be installed according to the manufacturer's recommendations. (See Appendix I.) All pipe and fittings shall bear the manufacturer's name or trademark.

704.2 Sewer in Filled Ground

A building sewer or building drain installed in unstable fill or unstable ground shall be of cast iron pipe, except that nonmetallic drains may be laid upon an approved continuous supporting system if installed in accordance with 704.1.

704.3 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 may be laid side by side in one trench.

704.4 Old House Sewers and Drains

Old building sewers and building drains may be used in connection with new building or new plumbing and drainage work only when they are found, on examination and test, to conform in all respects to the requirements governing new house sewers. The plumbing official shall notify the owner to make the changes necessary to conform to this code.

704.5 Cleanouts on Building Sewers

Cleanouts on building sewers shall be located as set forth in 710.2.

704.6 Minimum Size Building Sewer

No building sewer shall be less than 4 inches in size with the exception of force lines.

704.7 Backwater Valves

704.7.1 Fixture Branches

Backwater valves shall be installed in the branch of the building drain which receives only the discharge from fixtures located below grade. Where fixtures are located below the level of the top of the first upstream manhole, said fixtures shall be protected by a backwater valve.

704.7.2 Material

Backwater valves shall have all bearing parts of corrosion resistant material. Backwater valves shall comply with ASME A 112.14.1 or CAN/CSA B181.1, CAN/CSA B181.2.

704.7.3 Seal

Backwater valves shall be so constructed as to insure a mechanical seal against backflow.

704.7.4 Diameter

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

704.7.5 Location

Backwater valves shall be so installed to be accessible for service and repair.

705 DRAINAGE PIPING INSTALLATION

705.1 Horizontal Drainage Piping

Horizontal drainage piping shall be installed at a uniform slope but at slopes not less than permitted in 705.2, 705.3 and 705.4.

705.2 Small Piping

Horizontal building drainage piping less than 3-inch diameter shall be installed with a fall of not less than 1/4 inch per ft (21 mm per meter).

705.3 Large Piping

Horizontal building drains 3-inch diameter or larger shall be installed with a fall of not less than 1/8 inch per ft (10 mm per meter).

705.4 Minimum Velocity

Where conditions do not permit building drains and sewers to be laid with a fall as great as that specified, then a lesser slope may be permitted provided the computed velocity will be not less than 2 fps (0.61 m/s).

706 JOINTS

706.1 General

This section contains provisions applicable to joints specific to sanitary drainage piping. Provisions for those joining methods which are applicable to more than one piping system are contained in Chapter 3.

706.2 Caulked Joints

Caulked joints for cast-iron hub-and-spigot soil pipe shall be firmly packed with oakum or hemp and filled with molten lead not less than 1 inch (25.4 mm) deep and extending not more than 1/8 inch (3.18 mm) below rim of hub. No paint, varnish, or other coatings shall be permitted on the jointing material until after the joint has been tested and approved.

706.3 Joints for Plastic Pipe and Fittings

Refer to Section 308.8 for ABS and PVC joints. Joints for a polyolefin laboratory drainage system shall be in accord with CAN/CSA-B181.3-M86.



706.4 Elastomeric Compression Gasket for Cast Iron Soil Pipe

706.4.1 A positive-seal one piece elastomeric compression type gasket may be used for joining hub and spigot cast iron soil pipe as an alternate for lead or oakum joints. The joint is formed by inserting an approved gasket in the hub. The inside of the gasket is lubricated and the spigot end of the pipe is pushed into the gasket until seated, thus effecting a positive seal.

706.4.2 A positive-seal one piece elastomeric compression-type gasket for joining hub and spigot cast iron soil pipe may be used for drainage and waste systems above and below ground.

Compression gaskets for cast iron soil pipe shall be neoprene, marked as such, with ASTM C 564.

706.5 Hubless Cast Iron Soil Pipe System

706.5.1 Joints for hubless cast iron soil pipe shall be made with an approved gasket and stainless steel retaining sleeve.

706.5.2 Stainless steel couplings and gaskets complying with standards listed in Table 303 shall have identifying markers to indicate compliance.

706.5.3 Installation of the hubless cast iron soil pipe system shall be in accordance with CISPI 310 or the manufacturer's recommendation.

706.6 Borosilicate Glass Joints

706.6.1 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.

706.6.2 Joints between glass pipe and other types of piping material shall be made with adapters having a TFE seal and according to manufacturer's recommendations.

706.6.3 Caulked joints shall conform with 706.2 except that acid resistant rope and acid proof cement may be used.

706.7 Joints for Ductile-Iron Gravity Sewer Pipe (bell and spigot)

Joints in ductile-iron gravity sewer pipe shall be of the push-on joint type using a single oil resistant gasket joint. The gasket and the annular recess in the bell end of the pipe will be designed and shaped so that the gasket is locked in place against displacement. The oil resistant gaskets shall conform to ANSI/AWWA C111-A21.11 and shall comply with the performance requirements of the standard.

707 USE OF JOINTS

707.1 Clay Sewer Pipe

Joints in vitrified clay pipe or between such pipe and other pipe shall be formed as provided in 308.4, 308.5, or 707.4.

707.2 Concrete Sewer Pipe (for storm drains only)

Joints in concrete sewer pipe or between such pipe and metal pipe shall be formed as prescribed in 308.4, 308.5, or 707.4.

707.3 Cast Iron Soil Pipe

Joints in cast iron pipe shall be either caulked, positive-seal elastomeric compression gasket or a neoprene gasket and stainless steel retaining sleeve, as provided in 308.2, 706.2, 706.4, and 706.5.

707.4 PVC Transition Fittings for Dissimilar Pipe in Building Sewers

707.4.1 PVC transition fittings for dissimilar pipe in building sewers shall be installed according to manufacturers' instructions.

707.4.2 Joint Sealer Adapter - To adapt cast iron, plastic, fiber, asbestos cement, clay or copper pipe to all makes of dissimilar drain pipes with PVC joint.

707.4.3 Flexible Coupling - To adapt any two of the following pipe of the same O.D. or reducing sizes of any combination of two: clay, concrete, cast iron, steel, copper (DWV), asbestos, cement, fiber drain and sewer pipe, plastic drain and sewer pipe.

707.5 Ductile Iron Pipe Without Push-On-Joints (plain end)

Joints in ductile iron pipe for the building sewer without push-on-joints shall be made with a flexible coupling assembly in accordance with 308.4 or in accordance with the manufacturer's instructions.

708 CONNECTIONS BETWEEN DRAINAGE PIPING AND FIXTURES

708.1 Connections between drainage piping and floor outlet plumbing fixtures shall be made by means of an approved flange which is attached to the drainage piping in accordance with the provisions of this chapter. The 4 x 3 closet flange shall be attached to the outside diameter and not to the inside diameter of the drainage piping. The floor flange shall be set on and securely anchored to the building structure.

708.2 Connections between drainage piping and wall hung water closets shall be made by means of an approved extension nipple or horn adapter.

708.3 The connection shall be bolted to the flange or carrier using corrosion resisting bolts, screws or assemblies recommended by the manufacturer.

708.4 An approved gasket, washer, or setting compound shall be used between the fixture and the connection. Use of commercial putty or plaster shall be prohibited as the setting compound.

709 PROHIBITED JOINTS AND CONNECTIONS

709.1 Drainage System

Any fitting or connection which has an enlargement, chamber, or recess with a ledge, shoulder, or reduction of pipe area, that offers an obstruction to flow through the drain, is prohibited, except as stated in 715.

709.2 Prohibited Fittings or Connections

Fittings or connections that offer abnormal obstruction to flow shall not be used. The enlargement of a 3-inch closet bend or stub to 4 inches shall not be considered an obstruction.

710 CLEANOUTS

710.1 Material and Design

The bodies of cleanout ferrules shall conform in thickness to that required for pipe and fittings of the same material, and they shall extend not less than 1/4 inch (6.35 mm) above the hub. For new work, the cleanout plug shall be of heavy brass or plastic not less than 1/8-inch (3.18 mm) thick and shall be provided with a raised nut or a recessed socket for removal. Both ferrule and plug shall have ASME standard tapered pipe threads. Heavy lead plugs may be used for repairing a cleanout where necessary. Nylon plastics may be used as an alternate material.

710.2 Location

710.2.1 Each horizontal drainage pipe shall be provided with a cleanout at the upstream end of the pipe and in changes of direction over 45° (0.785 rad):

EXCEPTIONS: The following plumbing arrangements are acceptable in lieu of the upstream cleanout.

1. "P" traps connected to the drainage piping with slip joints or ground joint connections.
2. "P" traps into which floor drains, shower drains or tub drains with removable strainers discharge.
3. "P" traps into which the straight through type waste and overflow discharge with the overflow connecting to the branch of the tee.
4. "P" traps into which residential washing machines discharge.
5. Test tees or cleanouts in a vertical pipe above the flood-level rim of the fixtures that the horizontal pipe serves and not more than 4 ft (1219 mm) above the finish floor.
6. Cleanout within 6 ft (1829 mm) of the junction of the building drain and the building sewer which may be rodded both ways.
7. Water closets for the water closet fixture branch only.

710.2.2 Each building drain shall be provided with a cleanout within 6 ft (1829 mm) of the junction of the building drain and building sewer.

710.2.3 Cleanouts when installed in accordance with 710.2.2 may be either outside the building or when inside the building they shall be above the flood-level rim of the fixtures that the horizontal pipe serves when installed on a soil or waste stack.

710.2.4 In addition to the upstream cleanout and the cleanout of the junction of the building drain and building sewer, cleanouts shall be located along the horizontal piping so that:

1. In pipe 3-inch nominal diameter or less, cleanouts shall be located at not more than 50 ft (15.2 m) intervals.
2. In pipe 4 inches nominal diameter through 6 inches nominal diameter, cleanouts shall be located at not more than 80 ft (24.4 m) intervals.

710.3 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) or a plenum of any depth shall be extended through and terminate flush with the finished wall, floor or grade or may be extended to the outside of the building. 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 the approved type designed and installed for this purpose.

710.4 Direction of Flow

Cleanouts shall be installed to permit cleaning in the direction of flow. Line cleanouts which may be rodded both ways shall be used whenever practical.

710.5 Use for New Fixtures Prohibited

Cleanout plugs shall not be used for the installation of new fixtures or floor drains, except where approved in writing by the plumbing official and where another cleanout of equal access and capacity is provided.

710.6 Trap Cleanouts

710.6.1 Each fixture trap, except those cast integrally or in combination with fixtures in which the trap seal is accessible, or except when a portion of the trap is readily removable for cleaning purposes, shall have an accessible brass trap screw of ample size. Cleanout plugs or caps shall be watertight and gastight. Nylon plastics may be used as an alternate material.

710.6.2 Cleanouts on the seal of a trap shall be made tight with threaded cleanout plug and approved washer. Where glass traps are required, slip joints or couplings must have a TFE seal.

710.7 Manholes

Sewer manholes shall be waterproofed, constructed of poured-in-place concrete or precast concrete pipe sections conforming to ASTM C 478. Bottoms shall be concrete poured on stabilized soil or aggregate subbase with inside surfaces sloped a minimum of 2 inches per foot to the pipe flow channel. All pipe connections and joints shall be sealed with approved waterstop or gasket materials and grouted. Manhole top frames and covers shall be Class 30 gray cast iron conforming to ASTM A 48, machined for proper fit of covers in frame, coated with coal-tar pitch varnish and not less than 93% of the specified weight for each casting. Covers shall have the word "SEWER" cast in large letters. Similar, sealed covers with gaskets and cap screws or bolts shall be used where subject to flooding. (See Appendix J, Figure 13.)

711 SIZE OF CLEANOUTS

711.1 Pipes Less Than 8-inch Nominal Size

Cleanouts shall be the same nominal size as the pipe to which they are connected.

Exceptions:

1. Pipes larger than 4-inch nominal size may be served by a 4-inch cleanout.
2. A 1 1/4-inch "P" trap connected with slip joints or ground joint connections may be used to serve 1 1/2-inch pipe.
3. A 1 1/2-inch "P" trap connected with slip joints or ground joint connections may be used to serve a 2-inch pipe.

711.2 Pipes 8 Inches and Larger Nominal Size

711.2.1 Building drains may be served with a 4-inch cleanout.

711.2.2 For building sewers 8 inches and larger, manholes shall be provided and located at each change in direction and at intervals of not more than 400 ft (121.9 m). Manholes and manhole covers shall conform to 710.7.

711.2.3 Building drains 8-inch nominal size and larger shall have cleanouts located at intervals of not more than 100 ft (30.5 m) and at each change of direction over 45° (0.785 rad).

712 CLEANOUT CLEARANCES

712.1 Small Pipe

Cleanouts smaller than 3 inches shall be so installed that there is a clearance of not less than 12 inches (305 mm) for the purpose of rodding.

712.2 Large Pipe

Cleanouts on 3 inch or larger pipes shall be so located that there is a clearance of not less than 18 inches (457 mm) for the the purpose of rodding.

713 FIXTURE UNITS

713.1 Values for Fixtures

Fixture unit values as given in Table 713.1 designate the relative load weight of different kinds of fixtures which shall be employed in estimating the total load carried by a soil or waste pipe and shall be used in connection with the tables of sizes for soil, waste, and vent pipes for which the permissible load is given in terms of fixture units.

Table 713.1 Fixture Units Per Fixture or Group

Fixture Type	Fixture-Unit Value As Load Factors	Minimum Size of Trap (in)
Bathroom group consisting of water closet, lavatory, and bathtub or shower	6	
Bathtub ¹ (with or without overhead shower) or whirlpool attachments	2	1 1/2
Bidet	2	Nominal 1 1/2
Combination sink and tray	3	1 1/2
Combination sink and tray with food disposal unit	4	Separate traps 1 1/2
Dental unit or cuspidor	1	1 1/4
Dental lavatory	1	1 1/4
Drinking fountain	1/2	1
Dishwashing machine ² domestic.	2	1 1/2
Floor drains ⁵	1	2
Kitchen sink, domestic	2	1 1/2
Kitchen sink, domestic with food waste grinder and/or dishwasher	3	1 1/2
Lavatory ⁴	1	Small P.O. 1 1/4
Lavatory ⁴	2	Large P.O. 1 1/2
Lavatory, barber, beauty parlor	2	1 1/2
Lavatory, surgeon's	2	1 1/2
Laundry tray (1 or 2 compartments)	2	1 1/2
Shower stall, domestic	2	2
Showers (group) per head ²	3	
Sinks		
Surgeon's	3	1 1/2
Flushing rim (with valve)	8	3
Service (trap standard)	3	3
Service ("p" trap)	2	2
Pot, scullery, etc. ²	4	1 1/2
Urinal, pedestal, siphon jet, blowout	8	Note 6
Urinal, wall lip	4	Note 6
Urinal, Washout	4	Note 6
Washing machines (commercial) ³		
Washing machine (residential)	3	2
Wash sink (circular or multiple) each set of faucets	2	Nominal 1 1/2
Water closet, flushometer tank, public or private	3	Note 6
Water closet, private installation	4	Note 6
Water closet, public installation	6	Note 6

1 in = 25.4 mm

Notes:

1. A showerhead over a bathtub or whirlpool bathtub attachments does not increase the fixture value.
2. See 713.2 and 713.3 for methods of computing unit value of fixtures not listed in Table 713.1 or for rating of devices with intermittent flows.
3. See Table 713.2.
4. Lavatories with 1 1/4 or 1 1/2-inch trap have the same load value; larger P.O. plugs have greater flow rate.
5. Size of floor drain shall be determined by the area of the floor to be drained. The drainage fixture unit value need not be greater than 1 unless the drain receives indirect discharge from plumbing fixtures, air conditioner or refrigeration equipment.
6. Trap size shall be consistent with fixture type as defined in industry standards.

713.2 Fixtures Not Listed

Fixtures not listed in Table 713.1 shall be estimated in accordance with Table 713.2.

Table 713.2 Fixtures Not Listed

Fixture Drain or Trap Size (in)	Fixture-Unit Value
1 1/4 and smaller	1
1 1/2	2
2	3
3	5
4	6

1 in = 25.4 mm.

713.3 Values for Continuous Flow

For a continuous or semicontinuous flow into a drainage system, such as from a pump, pump ejector, air conditioning equipment, or similar device, two fixture units shall be allowed for each gpm of flow (31.7 fixture units for each liter per second of flow).

713.4 Air Conditioning Units

The condensate or waste from an air conditioning unit shall be classified as a plumbing fixture only if connected to the plumbing system.

714 DRAINAGE SYSTEM SIZING

714.1 Maximum Fixture Unit Load

The maximum number of fixture units that may be connected to a given size of building sewer, building drain, horizontal branch, or vertical soil or waste stack is given in Tables 714.1 and 714.2.

Table 714.1 Building Drains and Sewers

(Maximum Number of Fixture-Units that may be Connected to Any Portion¹ of the Building Drain or the Building Sewer²)

Diameter of Pipe (in.)	Fall in Inches Per Foot			
	1/16	1/8	1/4	1/2
2	-		21	26
3	-	20 ³	273	36 ³
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	3,900	4,600	5,600	6,700
15	7,000	8,300	10,000	2,000

1 in = 25.4 mm.

Notes:

1. Includes branches of the building drain. The minimum size of any building drain serving a water closet shall be 3".
2. No building sewer shall be less than 4 inches in size.
3. Not over two water closets.

**Table 714.2
Horizontal Fixture Branches and Stacks**

DIAMETER OF PIPE ⁵ (IN)	ANY HORIZONTAL FIXTURE BRANCH ^{1,4}	MAXIMUM NO. OF FIXTURE UNITS THAT MAY BE CONNECTED TO:		
		ONE STACK OF 3 STORIES OR 3 INTERVALS MAXIMUM	MORE THAN 3 STORIES IN HEIGHT	
			TOTAL FOR STACK	TOTAL AT ONE STORY OR BRANCH INTERVAL
1 ¼	1	2	2	1
1 ½	3	4	8	2
2	6	10	24	6
3	20 ²	30 ³	60 ³	16 ²
4	160	240	500	90
5	360	540	1100	200
6	620	960	1900	350
8	1400	2200	3600	600
10	2500	3800	5600	1000
12	3900	6000	8400	1500
15	7000	---	---	---

1 in = 25.4 mm

Notes:

1. Does not include branches of the building drain.
2. Not over two water closets.
3. Not over six water closets.
4. 50% less for battery vented fixture branches, no size reduction permitted for battery vented branches throughout the entire branch length.
5. The minimum size of any branch or stack serving a water closet shall be 3".

714.2 Minimum Size of Soil and Waste Stacks

No soil or waste stack shall be smaller than the largest horizontal branch connected thereto except that a 4x3 water closet connection shall not be considered as a reduction in pipe size. The soil or waste stack shall run undiminished in size from its connection to the building drain to its connection to the stack vent.

714.3 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 a plugged fitting or fittings at the stack so as to form no dead end.

714.4 Underground Drainage Piping

Any portion of the drainage system installed underground or below a basement or cellar shall not be less than 2-inch diameter. In addition, any portion of the drainage system installed underground which is located upstream from a grease trap or grease interceptor as well as the underground horizontal branch receiving the discharge therefrom shall not be less than 3-inch diameter.

715 OFFSETS IN DRAINAGE PIPING IN BUILDINGS OF FIVE STORIES OR MORE

715.1 Offsets of 45 Degrees or Less

An offset in a vertical stack, with a change of direction of 45° (0.785 rad) or less from the vertical, may be sized as a straight vertical stack. In case a horizontal branch connects to

the stack within 2 ft (610 mm) above or below the offset, a relief vent shall be installed in accordance with 917.3, except that when the offset stack is sized for a building drain (see Table 714.1, Column 5) the relief vent may be omitted.

715.2 Above Highest Branch

An offset above the highest horizontal branch is an offset in the stack vent and shall be considered only as it affects the developed length of the vent.

715.3 Below Lowest Branch

In the case of an offset in a soil or waste stack below the lowest horizontal branch, no change in diameter of the stack because of the offset shall be required if it is made at an angle of not greater than 45° (0.785 rad) from the vertical. If such an offset is made at an angle greater than 45° (0.785 rad) from the vertical, the required diameter of the offset and the stack below it shall be determined as for a building drain (Table 714.1).

715.4 Offsets of More Than 45 Degrees

A stack with an offset of more than 45° (0.785 rad) from the vertical shall be sized as follows:

1. The portion of the stack above the offset shall be sized as for a regular stack based on the total number of fixture units above the offset.
2. The offset shall be sized as for a building drain (Table 714.1, Column 5).
3. The portion of the stack below the offset shall be sized as for the offset or based on the total number of fixture units on the entire stack, whichever is larger (See Table 714.2, Column 4).
4. A relief vent for the offset shall be installed as provided in Chapter 9 and in no case shall a horizontal branch connect within the offset or within 2 ft (610 mm) above or below the offset.

715.5 Omission of Offset Reliefs

Offset relief vents required by 715.4 may be omitted by sizing the stack and its offset one pipe size larger than required for a building drain (see Table 714.1, Column 5) but in no case shall the entire stack and offset be of less cross-sectional area than that required for a straight stack plus the area of an offset relief vent as provided in 917.2. Omission of relief vents in accordance with this section shall not constitute approval of horizontal branch connections within the offset or within 2 ft (610 mm) above or below the offset. See 715.1 for offsets of 45° (0.785 rad) or less.

716 WASTE STACKS SERVING KITCHEN SINKS

In a one or two family dwelling only in which the waste stack or vent receives the discharge of a kitchen sink and also serves as a vent for fixtures connected to the horizontal portion of the branch served by the waste stack, the minimum size of the waste stack up to the highest sink branch connection shall be 2-inch diameter. Above that point the size of the stack shall be governed by the total number of fixture units vented by the stack.

717 SUMPS AND EJECTORS

717.1 Building Drains Below Sewer

Building drains which 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 by any equally efficient method approved by the plumbing official.

717.2 Check and Gate Valve Required

A check valve and a gate valve shall be installed in the pump or ejector discharge piping between the pump or ejector and the gravity drainage system. Such valve shall be accessibly located above the sump cover required by 717.1, or when the discharge pipe from the ejector is below grade, the valves may be accessibly located outside the sump below grade in an access pit with removable access cover.

717.3 Sewage Ejector Sump Construction

Sumps may be constructed of cast iron or monolithically poured reinforced concrete. When concrete sumps are used, a cover attachment ring shall be embedded in the concrete in such a way as to be watertight and gastight. The attachment ring shall be designed to fit the sump cover and allow a gastight and watertight seal to be made. Other engineered sump construction and materials may be accepted by the plumbing official when designed to be watertight and gastight and otherwise meet the requirements of this section.

717.4 Venting

The system of drainage piping below the sewer level shall be installed and vented in a manner similar to that of the gravity system.

717.5 Duplex Equipment

Sumps receiving the discharge of more than six water closets shall be provided with duplex pumping equipment.

717.6 Vent Sizes

Building sump vents shall be sized in accordance with Table 920 but shall in no case be sized less than 1 1/2 inches.

717.7 Separate Vents

Vents from pneumatic ejectors or similar equipment may be carried separately to the open air as a vent terminal (see 915).

717.8 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, proper cooling methods shall be provided.

717.9 Pumping Station

717.9.1 A pumping system shall include the sump pump, pit and discharge piping as defined below:

1. Sump Pump: An automatic water pump for the removal of drainage from a sump, pit or low point in

a residential, commercial or industrial property. Capacity and head shall be appropriate to anticipated use requirements.

2. Sump Pit: The sump pit shall be not less than 18 inches (457 mm) diameter and 24 inches (610 mm) deep, unless approved by the plumbing official. The pit shall be accessible and located such that all drainage flows into the pit due to gravity. The sump pit may 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 removable cover adequate to support anticipated loads in the area of use and to prevent refuse from entering the pit.
3. Discharge piping: Discharge piping shall meet the requirements of 717.2.

717.9.2 Electrical service outlet when required shall meet the requirements of the NFPA 70 or local codes.

717.9.3 Sumps which receive and discharge liquid wastes or raw sewage from plumbing fixtures shall meet the applicable requirements of 717.3.

717.10 Maximum Effluent Level

The effluent level control etc. 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.

717.11 Ejector Connection to the Drainage System

Pumps when 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 ft (3048 mm) from the base of any soil stack, waste stack or fixture drain.

717.12 Macerating Systems

Macerating toilet systems shall be installed per the manufacturer's instructions. The outlet piping from the grinder pump shall not be less than 3/4 inch and shall be fitted with a check valve and a full-flow gate or ball valve.

718 APPENDIX REFERENCES

Additional provisions for sanitary drainage are found in the following appendices: Appendix B - Travel Trailers and Travel Trailer Parks; Appendix C - Mobile/Manufactured Homes and Mobile/Manufactured Home Parks; Appendix E - Private Sewage Disposal; Appendix G - Medical Facilities Plumbing Systems; and Appendix I - Installation of Building Sewers. These provisions are applicable only when they are referenced in the body of the code sections or when included in the adopting ordinance.