CHAPTER 7
SANITARY DRAINAGE

Part I – Drainage Systems.

701.0 Materials.

701.1 Drainage Piping. Materials for drainage piping shall be in accordance with one of the referenced standards in Table 701.1 except that:

(1) No galvanized wrought-iron or galvanized steel pipe shall be used underground and shall be kept not less than 6 inches (152 mm) aboveground.

(2) ABS and PVC DWV piping installations shall be installed in accordance with applicable standards referenced in Table 1401.1 and Chapter 15 "Firestop Protection." Except for individual single-family dwelling units, materials exposed within ducts or plenums shall have a flame-spread index of a maximum of 25 and a smoke-developed index of a maximum 50, where tested in accordance with ASTM E 84 and UL 723.

(3) No vitrified clay pipe or fittings shall be used aboveground or where pressurized by a pump or ejector. They shall be kept not less than 12 inches (305 mm) belowground.

(4) Copper tube for drainage and vent piping shall have a weight of not less than that of copper drainage tube type DWV.

(5) Stainless steel 304 pipe and fittings shall not be installed underground and shall be kept not less than 6 inches (152 mm) aboveground.

(6) Cast-iron soil pipe and fittings shall be listed and tested in accordance with standards referenced in Table 1401.1. Such pipe and fittings shall be marked with country of origin and identification of the original manufacturer in addition to markings required by referenced standards.

701.2 Drainage Fittings. Materials for drainage fittings shall comply with the applicable standards referenced in Table 701.1 of the same diameter as the piping served, and such fittings shall be compatible with the type of pipe used.

701.2.1 Screwed Pipe. Fittings on screwed pipe shall be of the recessed drainage type. Burred ends shall be reamed to the full bore of the pipe.

701.2.2 Threads. The threads of drainage fittings shall be tapped so as to allow ⅟ inch per foot (20.8 mm/m) grade.

701.2.3 Type. Fittings used for drainage shall be of the drainage type, have a smooth interior water-way, and be constructed so as to allow ⅟ inch per foot (20.8 mm/m) grade.

701.3 Lead. (See Table 1401.1) Sheet lead shall be not less than the following:

(1) For safe pans – not less than 4 pounds per square foot lb/ft² (19 kg/m²) or 1/16 of an inch (1.6 mm) thick.

(2) For flashings or vent terminals – not less than 3 lb/ft² (15 kg/m²) or 0.0472 of an inch (1.1989 mm) thick.

(3) Lead bends and lead traps shall be not less than ⅛ of an inch (3.2 mm) wall thickness.

701.4 Caulking Ferrules. Caulking ferrules shall be manufactured from bronze or copper and shall be in accordance with Table 701.4.

701.5 Soldering Bushings. Soldering bushings shall be of bronze or copper in accordance with Table 701.5.

702.0 Fixture Unit Equivalents.

702.1 Trap Size. The unit equivalent of plumbing fixtures shown in Table 702.1 shall be based on the size of the trap required, and the unit equivalent of fixtures and devices not shown in Table 702.1 shall be based on the size of trap or trap arm.

Maximum drainage fixture units for a fixture trap and trap arm loadings for sizes up to 4 inches (100 mm) shall be in accordance with Table 702.2(a).

702.2 Intermittent Flow. Drainage fixture units for intermittent flow into the drainage system shall be computed on the rated discharge capacity in gallons per minute (gpm) (L/s) in accordance with Table 702.2(b).

702.3 Continuous Flow. For a continuous flow into a drainage system, such as from a pump, sump ejector, air conditioning equipment, or similar device, 2 fixture units shall be equal to each gallon per minute (gpm) (0.06 L/s) of flow.

TABLE 701.4
CAULKING FERRULES

PIPE SIZE (inches)	INSIDE DIAMETER (inches)	LENGTH (inches)	MINIMUM WEIGHT EACH	
			pounds	ounces
2	2⁄	4½	1	0
3	3⁄	4½	1	12
4	4⁄	4½	2	8

For SI un ts: nch 25 mm, pound 0 453 kg, ounce 0 02834 kg

TABLE 701.5
SOLDERING BUSHINGS

PIPE SIZE (inches)	MINIMUM WEIGHT EACH		PIPE SIZE (inches)	MINIMUM WEIGHT EACH	
	pounds	ounces		pounds	ounces
1⁄	0	6	2½	1	6
1½	0	8	3	2	0
2	0	14	4	3	8

For SI un ts: nch 25 mm, pound 0 453 kg, ounce 0 02834 kg

TABLE 701.1
MATERIALS FOR DRAIN, WASTE, VENT PIPE AND FITTINGS

MATERIAL	UNDERGROUND DRAIN, WASTE, VENT PIPE AND FITTINGS	ABOVEGROUND DRAIN, WASTE, VENT PIPE AND FITTINGS	BUILDING SEWER PIPE AND FITTINGS	REFERENCED STANDARD(S) PIPE	REFERENCED STANDARD(S) FITTINGS
ABS (Schedule 40)	X	X	X	ASTM D 1527, ASTM D 2661, ASTM D 2680*, ASTM F 628	ASTM D 2661, ASTM D 2680*
Asbestos Cement			X	ASTM C 14*, ASTM C 428*	
Brass		X		ASTM B 43	
Cast Iron	X	X	X	ASTM A 74, ASTM A 888, CISPI 301	ASME B16.12, ASTM A 74, ASTM A 888, CISPI 301
Co Extruded ABS (Schedule 40)	X	X	X	ASTM F 1488	ASTM D 2661, ASTM D 2680*
Co Extruded PVC (Schedule 40)	X	X	X	ASTM F 891, ASTM F 1488	ASTM D 2665, ASTM F 794*, ASTM F 1866
Copper (Type DWV)	X	X	X	ASTM B 75, ASTM B 251, ASTM B 302, ASTM B 306	ASME B16.23, ASME B16.29
Galvanized Malleable Iron		X			ASME B16.3
Galvanized Steel		X		ASTM A 53	
Polyethylene			X	ASTM F 714	ASTM D 2683, ASTM D 3261, ASTM F 1055, ASTM F 2206
PVC (Schedule 40)	X	X	X	ASTM D 1785, ASTM D 2665, ASTM F 794*	ASTM D 2665, ASTM F 794*, ASTM F 1866
Stainless Steel 304		X		ASME A112.3.1	ASME A112.3.1
Stainless Steel 316L	X	X	X	ASME A112.3.1	ASME A112.3.1
Vitrified Clay (Extra strength)			X	ASTM C 700	ASTM C 700

* For bu d ng sewer app cat ons

TABLE 702.1
DRAINAGE FIXTURE UNIT VALUES (DFU)

PLUMBING APPLIANCES, APPURTENANCES, OR FIXTURES	MINIMUM SIZE TRAP AND TRAP ARM[7] (inches)	PRIVATE	PUBLIC	ASSEMBLY[8]
Bathtub or Combination Bath/Shower	1½	2.0	2.0	
Bidet	1¼	1.0		
Bidet	1½	2.0		
Clothes Washer, domestic, standpipe[5]	2	3.0	3.0	3.0
Dental Unit, cuspidor	1¼		1.0	1.0
Dishwasher, domestic, with independent drain[2]	1½	2.0	2.0	2.0
Drinking Fountain or Water Cooler	1¼	0.5	0.5	1.0
Food Waste Grinder, commercial	2		3.0	3.0
Floor Drain, emergency	2		0.0	0.0
Floor Drain (for additional sizes see Section 702.0)	2	2.0	2.0	2.0
Shower, single head trap	2	2.0	2.0	2.0
Multi head, each additional	2	1.0	1.0	1.0
Lavatory, single	1¼	1.0	1.0	1.0
Lavatory, in sets of two or three	1½	2.0	2.0	2.0
Washfountain	1½		2.0	2.0
Washfountain	2		3.0	3.0
Mobile Home, trap	3	12.0		
Receptor, indirect waste[1,3]	1½	See footnote[1,3]		
Receptor, indirect waste[1,4]	2	See footnote[1,4]		
Receptor, indirect waste[1]	3	See footnote[1]		
Sinks				
Bar	1½	1.0		
Bar[2]	1½		2.0	2.0
Clinical	3		6.0	6.0
Commercial with food waste[2]	1½		3.0	3.0
Special Purpose[2]	1½	2.0	3.0	3.0
Special Purpose	2	3.0	4.0	4.0
Special Purpose	3		6.0	6.0
Kitchen, domestic[2] (with or without food waste grinder, dishwasher, or both)	1½	2.0	2.0	
Laundry[2] (with or without discharge from a clothes washer)	1½	2.0	2.0	2.0
Service or Mop Basin	2		3.0	3.0
Service or Mop Basin	3		3.0	3.0
Service, flushing rim	3		6.0	6.0
Wash, each set of faucets			2.0	2.0
Urinal, integral trap 1.0 GPF[2]	2	2.0	2.0	5.0
Urinal, integral trap greater than 1.0 GPF	2	2.0	2.0	6.0
Urinal, exposed trap[2]	1½	2.0	2.0	5.0
Water Closet, 1.6 GPF Gravity Tank[6]	3	3.0	4.0	6.0
Water Closet, 1.6 GPF Flushometer Tank[6]	3	3.0	4.0	6.0
Water Closet, 1.6 GPF Flushometer Valve[6]	3	3.0	4.0	6.0
Water Closet, greater than 1.6 GPF Gravity Tank[6]	3	4.0	6.0	8.0
Water Closet, greater than 1.6 GPF Flushometer Valve[6]	3	4.0	6.0	8.0

For SI un ts: nch 25 mm

Notes:

1 Ind rect waste receptors sha be s zed based on the tota dra nage capac ty of the f xtures that dra n there n to, n accordance w th Tab e 702 2(b)

2 Prov de a 2 nch (50 mm) m n mum dra n

3 For refr gerators, coffee urns, water stat ons, and s m ar ow demands
For commerc a s nks, d shwashers, and s m ar moderate or heavy demands

5 Bu d ngs hav ng a c othes-wash ng area w th c othes washers n a battery of three or more c othes washers sha be rated at 6 f xture un ts each for purposes of s z ng common hor zonta and vert ca dra nage p p ng

6 Water c osets sha be computed as 6 f xture un ts where determ n ng sept c tank s zes based on Append x H of th s code

7 Trap s zes sha not be ncreased to the po nt where the f xture d scharge s capab e of be ng nadequate to ma nta n the r se f-scour ng propert es

8 Assemb y [Pub c Use (see Tab e 422)]

TABLE 702.2(a)
MAXIMUM DRAINAGE FIXTURE UNITS FOR A TRAP AND TRAP ARM*

SIZE OF TRAP AND TRAP ARM (inches)	DRAINAGE FIXTURE UNIT VALUES (DFU)
1/	1 unit
1/2	3 units
2	4 units
3	6 units
4	8 units

For SI Un ts: nch 25 mm
* **Exception:** On sc f-sc v ce aundr es

TABLE 702.2(b)
DISCHARGE CAPACITY IN GALLONS PER MINUTE FOR INTERMITTENT FLOW ONLY*

GPM	FIXTURE UNITS
Up to 7/2	Equals 1 Fixture Unit
Greater than 7/2 to 15	Equals 2 Fixture Units
Greater than 15 to 30	Equals 4 Fixture Units
Greater than 30 to 50	Equals 6 Fixture Units

For SI un ts: ga on per m nute 0 06 L/s
* D scharge capac ty exceed ng 50 ga ons per m nute (3 5 L/s) sha be determ ned by the Author ty Hav ng Jur sd ct on

703.0 Size of Drainage Piping.

703.1 Minimum Size. The minimum sizes of vertical, horizontal, or both drainage piping shall be determined from the total of fixture units connected thereto, and additionally, in the case of vertical drainage pipes, in accordance with their length.

703.2 Maximum Number of Fixture Units. Table 703.2 shows the maximum number of fixture units allowed on a vertical or horizontal drainage pipe, building drain, or building sewer of a given size; the maximum number of fixture units allowed on a branch interval of a given size; and the maximum length (in feet and meters) of a vertical drainage pipe of a given size.

703.3 Sizing per Appendix C. For alternate method of sizing drainage piping, see Appendix C.

704.0 Fixture Connections (Drainage).

704.1 Inlet Fittings. Drainage piping shall be provided with approved inlet fittings for fixture connections, correctly located according to the size and type of fixture proposed to be connected.

704.2 Single Vertical Drainage Pipe. Two fixtures set back-to-back, or side-by-side, within the distance allowed between a trap and its vent shall be permitted to be served by a single vertical drainage pipe provided that each fixture wastes separately into an approved double-fixture fitting having inlet openings at the same level.

704.3 Commercial Dishwashing Machines and Sinks. Pot sinks, scullery sinks, dishwashing sinks, silverware sinks, commercial dishwashing machines, silverware-washing machines, and other similar fixtures shall be connected directly to the drainage system. A floor drain shall be provided adjacent to the fixture, and the fixture shall be connected on the sewer side of the floor drain trap, provided that no other drainage line is connected between the floor drain waste connection and the fixture drain. The fixture and floor drain shall be trapped and vented in accordance with this code.

705.0 Joints and Connections.

705.1 ABS and ABS Co-Extruded Plastic Pipe and Joints. Joining methods for ABS plastic pipe and fittings shall be installed in accordance with the manufacturer's installation instructions and shall comply with Section 705.1.1 through Section 705.1.3.

705.1.1 Mechanical Joints. Mechanical joints shall be designed to provide a permanent seal and shall be of the mechanical or push-on joint. The push-on joint shall include an elastomeric gasket in accordance with ASTM D 3212 and shall provide a compressive force against the spigot and socket after assembly to provide a permanent seal.

705.1.2 Solvent Cement Joints. Solvent cement joints for ABS pipe and fittings shall be clean from dirt and moisture. Pipe shall be cut square and shall be deburred. Where surfaces to be joined are cleaned and free of dirt, moisture, oil, and other foreign material, solvent cement in accordance with ASTM D 2235 shall be applied to all joint surfaces. Joints shall be made while both the inside socket surface and outside surface of pipe are wet with solvent cement. Hold joint in place and undisturbed for 1 minute after assembly.

705.1.3 Threaded Joints. Threads shall comply with ASME B1.20.1. A minimum of Schedule 80 shall be permitted to be threaded. Molded threads on adapter fittings for transition to threaded joints shall be permitted. Thread sealant compound shall be applied to male threads, insoluble in water, and nontoxic. The joint between the pipe and transition fitting shall be of the solvent cement type. Caution shall be used during assembly to prevent over tightening of the ABS components once the thread sealant compound has been applied.

705.2 Asbestos Cement Pipe and Joints. Joining methods for asbestos cement pipe and fittings shall be installed in accordance with the manufacturer's installation instructions and shall comply with Section 705.2.1.

705.2.1 Mechanical Joints. Mechanical joints shall be of the same composition as the pipe and sealed with an approved elastomeric gasket or joined by a listed compression type coupling. Elastomeric gaskets shall comply with ASTM D 1869. The coupling grooves, pipe ends, and elastomeric gaskets shall be cleaned. Elastomeric gaskets shall be positioned in the grooves. Lubricant recommended by the manufacturer shall be applied to the machined end of the pipe. Lubricant shall not be applied to the elastomeric gasket or groove, unless specifically recommended by the manufacturer.

TABLE 703.2
MAXIMUM UNIT LOADING AND MAXIMUM LENGTH OF DRAINAGE AND VENT PIPING

SIZE OF PIPE (inches)	1¼	1½	2	2½	3	4	5	6	8	10	12
Maximum Units											
Drainage Piping[1]											
Vertical	1	2[2]	16[3]	32[3]	48[4]	256	600	1380	3600	5600	8400
Horizontal	1	1	8[3]	14[3]	35[4]	216[5]	428[5]	720[5]	2640[5]	4680[5]	8200[5]
Maximum Length											
Drainage Piping										—	—
Vertical, (feet)	45	65	85	148	212	300	390	510	750		
Horizontal (unlimited)											
Vent Piping										—	—
Horizontal and Vertical[6]											
Maximum Units	1	8[3]	24	48	84	256	600	1380	3600		
Maximum Lengths, (feet)	45	60	120	180	212	300	390	510	750		

For SI un ts: nch 25 mm, foot 304 8 mm

Notes:

[1] Exc ud ng trap arm

[2] Except s nks, ur na s, and d shwashers exceed ng f xture un t

[3] Except s x-un t traps or water c osets
On y four water c osets or s x-un t traps a owed on a vert ca p pe or stack; and not to exceed three water c osets or s x-un t traps on a hor zonta branch or dra n

[5] Based on ⁄4 nch per foot (20 8 mm/m) s ope For ⁄8 of an nch per foot (0 4 mm/m) s ope, mu t p y hor zonta f xture un ts by a factor of 0 8

[6] The d ameter of an nd v dua vent sha be not ess than ⁄4 nches (32 mm) nor ess than one-ha f the d ameter of the dra n to wh ch t s connected F xture un t oad va ues for dra nage and vent p p ng sha be computed from Tab e 702 and Tab e 702 2(b) Not to exceed one-th rd of the tota perm tted ength of a vent sha be perm tted to be nsta ed n a hor zonta pos t on Where vents are ncreased one p pe s ze for the r ent re ength, the max mum ength m tat ons spec f ed n th s tab e do not app y Th s tab e s n accordance w th the requ rements of Sect on 90 2

705.3 Brass Pipe and Joints. Joining methods for brass pipe and fittings shall be installed in accordance with the manufacturer's installation instructions and shall comply with Section 705.3.1 through Section 705.3.3.

705.3.1 Brazed Joints. Brazed joints between brass pipe and fittings shall be made with brazing alloys having a liquid temperature above 1000°F (538°C). The joint surfaces to be brazed shall be cleaned bright by either manual or mechanical means. Pipe shall be cut square and reamed to full inside diameter. Brazing flux shall be applied to the joint surfaces where required by manufacturer's recommendation. Brazing filler metal in accordance with AWS A5.8 shall be applied at the point where the pipe or tubing enters the socket of the fitting.

705.3.2 Mechanical Joints. Mechanical joints shall be of the compression type using an elastomeric gasket to form a seal.

705.3.3 Threaded Joints. Threaded joints shall be made with pipe threads in accordance with ASME B1.20.1. Thread sealant tape or compound shall be applied only on male threads, and such material shall be of approved types, insoluble in water, and nontoxic.

705.4 Cast-Iron Pipe and Joints. Joining methods for cast-iron pipe and fittings shall be installed in accordance with the manufacturer's installation instructions and shall comply with Section 705.4.1 and Section 705.4.2.

705.4.1 Caulked Joints. Caulked joints shall be firmly packed with oakum or hemp and filled with molten lead to a depth of not less than 1 inch (25.4 mm) in one continuous pour. The lead shall be caulked thoroughly at the inside and outside edges of the joint. After caulking, the finished joint shall not exceed ⅛ of an inch (3.2 mm) below the rim of the hub. No paint, varnish, or other coatings shall be permitted on the joining material until after the joint has been tested and approved.

705.4.2 Mechanical Joints. Mechanical joints for cast-iron pipe and fittings shall be of the compression or mechanical joint coupling type. Compression type joints with an elastomeric gasket for cast-iron hub and spigot pipe shall comply with ASTM C 564. Hub and spigot shall be clean and free of dirt, mud, sand, and foreign materials. Cut pipe shall be free from sharp edges. Fold and insert gasket into hub. Lubricate the joint following manufacturer's instructions. Insert spigot into hub until the spigot end of the pipe bottom out in the hub. Use the same procedure for the installation of fittings.

A mechanical joint shielded coupling type for hubless cast-iron pipe and fittings shall have a metallic shield where installed aboveground, and shall comply with ASTM A 1056, ASTM C 1277, ASTM C 1540, or CISPI 310. The elastomeric gasket shall comply with ASTM C 564. Hubless cast-iron pipe and fittings shall be clean and free of dirt, mud, sand, and foreign materials. Cut pipe shall be free from sharp edges. Gasket shall be placed on the end of the pipe or fitting and the stainless steel shield and clamp assembly on the end of the other pipe or fitting. Pipe or fittings shall be seated against the center stop inside the elastomeric

sleeve. Slide the stainless steel shield and clamp assembly into position centered over the gasket and tighten. Bands shall be tightened using an approved calibrated torque wrench specifically set by the manufacturer of the couplings.

705.5 Copper Pipe (DWV) and Joints. Joining methods for copper pipe and fittings shall be installed in accordance with the manufacturer's installation instructions and shall comply with Section 705.5.1 through Section 705.5.4.

705.5.1 Brazed Joints. Brazed joints between copper pipe and fittings shall be made with brazing alloys having a liquid temperature above 1000°F (538°C). The joint surfaces to be brazed shall be cleaned bright by either manual or mechanical means. Piping shall be cut square and reamed to full inside diameter. Brazing flux shall be applied to the joint surfaces where required by manufacturer's recommendation. Brazing filler metal in accordance with AWS A5.8 shall be applied at the point where the pipe or tubing enters the socket of the fitting.

705.5.2 Mechanical Joints. Mechanical joints in copper piping shall be made with a mechanical coupling with grooved end piping or approved joint designed for the specific application.

705.5.3 Soldered Joints. Soldered joints between copper pipe and fittings shall be made in accordance with ASTM B 828 with the following sequence of joint preparation and operation as follows: measuring and cutting, reaming, cleaning, fluxing, assembly and support, heating, applying the solder, cooling, and cleaning. Pipe shall be cut square and reamed to the full inside diameter including the removal of burrs on the outside of the pipe. Surfaces to be joined shall be cleaned bright by manual or mechanical means. Flux shall be applied to pipe and fittings and shall be in accordance with ASTM B 813, and shall become noncorrosive and nontoxic after soldering. Insert pipe into the base of the fitting and remove excess flux. Pipe and fitting shall be supported to ensure a uniform capillary space around the joint. Heat shall be applied using an air or fuel torch with the flame perpendicular to the pipe using acetylene or an LP gas. Preheating shall depend on the size of the joint. The flame shall be moved to the fitting cup and alternate between the pipe and fitting. Solder in accordance with ASTM B 32 shall be applied to the joint surfaces until capillary action draws the molten solder into the cup. Joint surfaces shall not be disturbed until cool and any remaining flux residue shall be cleaned.

705.5.4 Threaded Joints. Threaded joints for copper pipe shall be made with pipe threads in accordance with ASME B1.20.1. Thread sealant tape or compound shall be applied only on male threads, and such material shall be approved types, insoluble in water, and nontoxic.

705.6 Galvanized Steel Pipe and Joints. Joining methods for galvanized steel pipe and fittings shall be installed in accordance with the manufacturer's installation instructions and shall comply with Section 705.6.1 and Section 705.6.2.

705.6.1 Mechanical Joints. Mechanical joints shall be made with an elastomeric gasket.

705.6.2 Threaded Joints. Threaded joints shall be made with pipe threads in accordance with ASME B1.20.1. Thread sealant tape or compound shall be applied only on male threads, and such material shall be of approved types, insoluble in water, and nontoxic.

705.7 PVC and PVC Co-Extruded Plastic Pipe and Joining Methods. Joining methods for PVC plastic pipe and fittings shall be installed in accordance with the manufacturer's installation instructions and shall comply with Section 705.7.1 through Section 705.7.3.

705.7.1 Mechanical Joints. Mechanical joints shall be designed to provide a permanent seal and shall be of the mechanical or push-on joint type. The push-on joint shall include an elastomeric gasket in accordance with ASTM D 3212 and shall provide a compressive force against the spigot and socket after assembly to provide a permanent seal.

705.7.2 Solvent Cement Joints. Solvent cement joints for PVC pipe and fittings shall be clean from dirt and moisture. Pipe shall be cut square and pipe shall be deburred. Where surfaces to be joined are cleaned and free of dirt, moisture, oil, and other foreign material, apply primer purple in color, in accordance with ASTM F 656. Primer shall be applied until the surface of the pipe and fitting is softened. Solvent cements in accordance with ASTM D 2564 shall be applied to all joint surfaces. Joints shall be made while both the inside socket surface and outside surface of pipe are wet with solvent cement. Hold joint in place and undisturbed for 1 minute after assembly.

705.7.3 Threaded Joints. Threads shall comply with ASME B1.20.1. A minimum of Schedule 80 shall be permitted to be threaded. Molded threads on adapter fittings for transition to threaded joints shall be permitted. Thread sealant compound that is compatible with the pipe and fitting, insoluble in water, and nontoxic shall be applied to male threads. The joint between the pipe and transition fitting shall be of the solvent cement type. Caution shall be used during assembly to prevent over tightening of the PVC components once the thread sealant has been applied. Female PVC threaded fittings shall be used with plastic male threads only.

705.8 Stainless Steel Pipe and Joints. Joining methods for stainless steel pipe and fittings shall be installed in accordance with the manufacturer's installation instructions and shall comply with Section 705.8.1 and Section 705.8.2.

705.8.1 Mechanical Joints. Mechanical joints between stainless steel pipe and fittings shall be of the compression, grooved coupling, hydraulic pressed fittings, or flanged.

705.8.2 Welded Joints. Welded joints between stainless steel pipe and fittings shall comply with ASME A112.3.1 and shall be welded autogenously. Pipe shall be cleaned, free of scale and contaminating particles. Pipe shall be cut with a combination cutting and beveling tool that provides a square cut, and free of burrs. Mineral oil lubricant shall be used during the cutting and beveling process.

705.9 Vitrified Clay Pipe and Joints. Joining methods for vitrified clay pipe and fittings shall be installed in accordance with the manufacturer's installation instructions and shall comply with Section 705.9.1.

705.9.1 Mechanical Joints. Mechanical joints shall be designed to provide a permanent seal and shall be of the mechanical or push-on joint type. The push-on joint shall include an elastomeric gasket in accordance with ASTM C 425 and shall provide a compressive force against the spigot and socket after assembly to provide a permanent seal.

705.10 Special Joints.

705.10.1 Slip Joints. In fixture drains and traps, slip joints of approved materials shall be permitted to be used in accordance with their approvals.

705.10.2 Expansion Joints. Expansion joints shall be accessible, except where in vent piping or drainage stacks, and shall be permitted to be used where necessary to provide for expansion and contraction of the pipes.

705.10.3 Ground Joint, Flared, or Ferrule Connections. Brass or copper ground joint, flared, or ferrule-type connections that allow adjustment of tubing, but provide a rigid joint where made up, shall not be considered as slip joints.

705.10.4 Transition Joint. A solvent cement transition joint between ABS and PVC building drain and building sewer shall be made using listed transition solvent cement.

705.11 Joints Between Various Materials. Joints between various materials shall be installed in accordance with the manufacturer's installation instructions and shall comply with Section 705.11.1 through Section 705.11.4.

705.11.1 Copper Pipe to Cast-Iron Pipe. Joints from copper pipe or tubing to cast-iron pipe shall be made with a listed compression type joint or brass ferrule. The copper pipe or tubing shall be soldered or brazed to the ferrule and the ferrule shall be joined to the cast-iron hub by a compression or caulked joint.

705.11.2 Copper Pipe to Threaded Pipe Joints. Joints from copper pipe or tubing to threaded pipe shall be made by the use of a listed brass adapter or dielectric fitting. The joint between the copper pipe and the fitting shall be a soldered or brazed, and the connection between the threaded and the fittings shall be made with a standard pipe size threaded joint.

705.11.3 Plastic Pipe to Other Materials. Where connecting plastic pipe to other types of plastic or other types of piping material; approved listed adapter or transition fittings and listed for the specific transition intended shall be used.

705.11.4 Stainless Steel Pipe to Other Materials. Where connecting stainless steel pipe to other types of piping, listed mechanical joints of the compression type and listed for the specific transition intended shall be used.

706.0 Changes in Direction of Drainage Flow.

706.1 Approved Fittings. Changes in direction of drainage piping shall be made by the appropriate use of approved fittings and shall be of the angles presented by a one-sixteenth bend, one-eighth bend, or one-sixth bend, or other approved fittings of equivalent sweep.

706.2 Horizontal to Vertical. Horizontal drainage lines, connecting with a vertical stack, shall enter through 45 degree (0.79 rad) wye branches, 60 degree (1.05 rad) wye branches, combination wye and one-eighth bend branches, sanitary tee or sanitary tapped tee branches, or other approved fittings of equivalent sweep. No fitting having more than one inlet at the same level shall be used unless such fitting is constructed so that the discharge from one inlet cannot readily enter any other inlet. Double sanitary tees shall be permitted to be used where the barrel of the fitting is not less than two pipe sizes larger than the largest inlet, (pipe sizes recognized for this purpose are 2 inches, 2½ inches, 3 inches, 3½ inches, 4 inches, 4½ inches, 5 inches, 6 inches, etc.) (50, 65, 80, 90, 100, 115, 125, 150 mm, etc.).

706.3 Horizontal to Horizontal. Horizontal drainage lines connecting with other horizontal drainage lines shall enter through 45 degree (0.79 rad) wye branches, combination wye and one-eighth bend branches, or other approved fittings of equivalent sweep.

706.4 Vertical to Horizontal. Vertical drainage lines connecting with horizontal drainage lines shall enter through 45 degree (0.79 rad) wye branches, combination wye and one-eighth bend branches, or other approved fittings of equivalent sweep. Branches or offsets of 60 degrees (1.05 rad) shall be permitted to be used where installed in a true vertical position.

707.0 Cleanouts.

707.1 Plug. Each cleanout fitting for cast-iron pipe shall consist of a cast-iron or brass body and an approved plug. Each cleanout for galvanized wrought-iron, galvanized steel, copper, or brass pipe shall consist of a brass plug as specified in Table 707.1, or a standard weight brass cap, or an approved ABS or PVC plastic plug, or an approved stainless steel cleanout or plug. Plugs shall have raised square heads or approved countersunk rectangular slots.