DEPARTMENT OF LABOR AND INDUSTRY
CONSTRUCTION CODES AND LICENSING

2020 MN Plumbing Code in Single-Family Homes

Kara Topper and Zach Barnaal

Plumbing Code Representatives

Plumbing

Zach Barnaal

St. Cloud State University (SCSU) B.S. in Hydrology in 2014

University of Illinois (UIUC) M.S. in Civil Engineering in 2016

Over 5 years with MN DLI as plumbing code representative and plans examiner

- General Regulations
- Plumbing Fixtures, Pipe, & Fittings
- Water Supply & Distribution
- Sanitary Drainage
- Traps, Vents, & Sizing

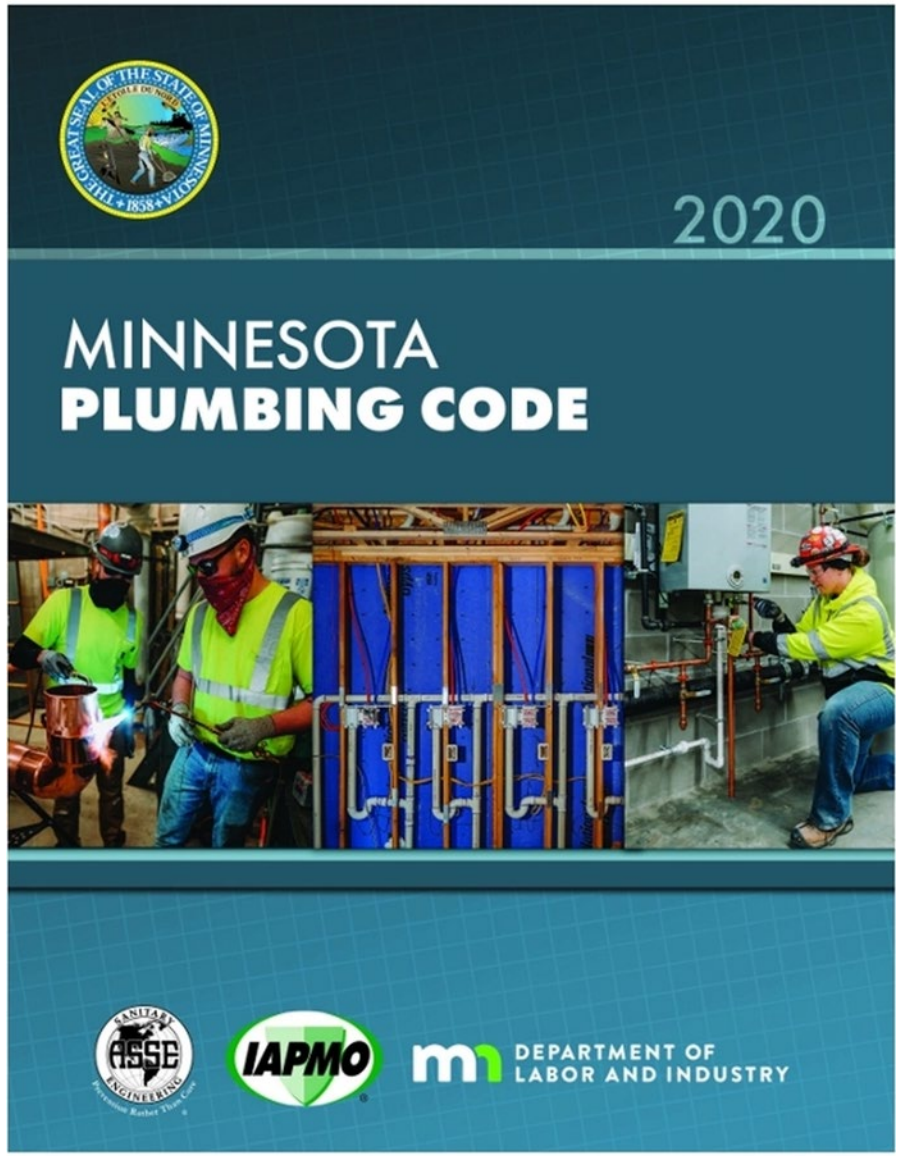
Plumbing Inspection

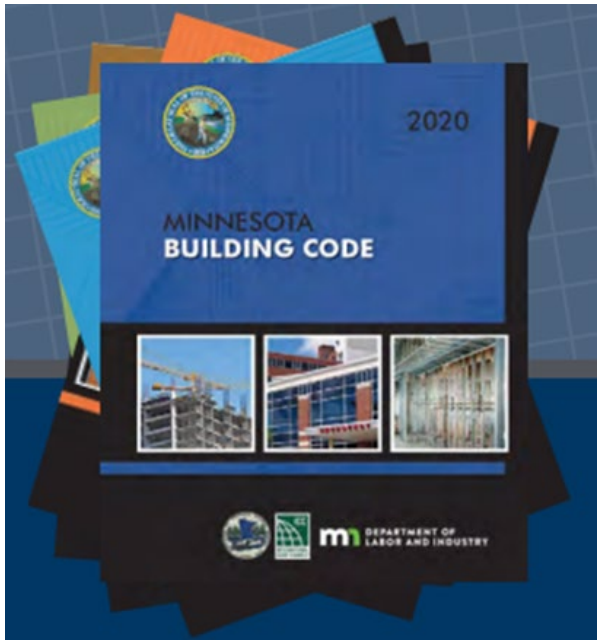
Kara Topper-

- What to look for in single-family home plumbing inspections
- Drain, waste and vent sizing example
- Photos & common issues in plumbing

Topics

Timing	Topic
30 min.	General Requirements
40 min.	Water Systems, Temperature and Backflow Protection
10 min.	Break
50 min.	Sewer, Drainage, and Vent Systems
20 min.	Residential DWV sizing example
10 min.	Break
20 min.	Inspections and Common Code Issues
30 min.	“What’s Wrong with this Picture”
20 min.	Wrap-up and Q/A





- Administration
- Special Provisions
- Commercial Building
- Mechanical and Fuel Gas
- **Plumbing**
- Elevators and Related
- Electrical
- Accessibility

- Residential Building
- Existing Buildings
- High Pressure Piping Systems
- Manufactured Homes
- Prefabricated Structures
- Industrialized/Modular Buildings
- Flood-proofing
- Energy Conservation
- Storm Shelters

2020 Minnesota Plumbing Code
In Effect as of Dec. 17, 2021

Plumbing Home Page

https://www.dli.mn.gov/business/plumbing-and-mechanical-contractors

2020 Minnesota Plumbing Code

https://epubs.iapmo.org/2020/MPC/

2020 MN Plumbing Code changes from 2015

The 2020 MN Plumbing Code book uses ***revision markings*** to help readers identify code changes throughout the old/new MN Plumbing Code, Uniform Plumbing Code, and MN amendments:

REVISION MARKINGS

	A single solid vertical line in the margins indicates a technical change from the requirements of the *2015 Minnesota Plumbing Code.*
	A black arrow in the margin indicates where an entire section, paragraph, or table has been deleted from the *2015 Minnesota Plumbing Code* due to deletions in the underlying *Uniform Plumbing Codes* (2015 and 2018 editions) and reflected in the *2020 Minnesota Plumbing Code.*
	A hollow arrow in the margin indicates where a section has been deleted by a Minnesota Plumbing Code amendment. Where a Minnesota Plumbing Code Amendment has deleted a 2018 UPC section or entire Chapter, the UPC section number and heading or Chapter title will be followed by the statement, "Deleted in its Entirety" with a hollow arrow in the margin.
	Italicized font indicates Minnesota Plumbing Code Amendments to the 2018 UPC.

2020 MN Plumbing Code changes from 2015

Revision Markings:

402.12 Future Fixtures. Where provisions are made for the future installation of fixtures, those provided for shall be considered in determining the required sizes of drain pipes. Construction for future installations shall be terminated with a plugged fitting or fittings. Where the plugged fitting is at the point where the trap of a fixture is installed, the plumbing system for such fixture shall be complete and be in accordance with the plumbing requirements of this code.

403.0 Water-Conserving Fixtures and Fittings.

2020 MN Plumbing Code 2015 MN Plumbing Code

2020 MN Plumbing Code changes from 2015

Revision Markings:

810.0 Steam and Hot Water Drainage Condensers and Sumps.

810.1 High Temperature Discharge. No steam pipe shall be directly connected to a plumbing or drainage system, nor shall water having a temperature above 140°F (60°C) be discharged under pressure directly into a drainage system. Pipes from boilers shall discharge by means of indirect waste piping, as determined by the

2020 MN Plumbing Code 2015 MN Plumbing Code

Plumbing Licensing Requirement

In MN anyone in the business of plumbing installations must be licensed plumbers or registered apprentices.

A person or business may only conduct plumbing plan, install, or deal in plumbing if a plumbing contractor, a licensed master plumber (or restricted master plumber pop. <5,000), who is responsible for proper installation, ***at all times*** oversees the plumbing work.

When a master or restricted master plumber designs plans, only they may use them for construction. If another plumber is contracted to install the plumbing, they must have their own plans for the project.

Licensing Exceptions

Certified pipelayers may perform sewer and water services installation only, outside of buildings and if properly bonded.

Licensed water conditioning contractors may only install appliances, equipment and fixtures designed for water treatment to alter, modify, add or remove mineral, chemical or bacterial content, with exceptions.

In any case or exception, all work must still meet the Code.

Licensing Exceptions

Waterproofing contractors may install in existing single-family dwellings a single sump pump, which receives subsoil drainage and discharges to grade.

Individuals as residents may do work which complies with the standards required by code on the premises that are actually owned and occupied by them as a residence, unless otherwise restricted by a local ordinance.

In any case or exception, all work must still meet the Code.

Chapter 2 Definitions

- Section 201.0 – For the purposes of this code, the terms throughout the code have meanings indicated in this chapter.
- Many terms and definition differ from the lingo used everyday. Its important to understand what exactly is referenced in the code.

Definitions

Plumbing System -

- Includes all potable water, building supply, and distribution pipes; all plumbing fixtures and traps; all drainage and vent pipes; all building drains and building sewers, including their respective joints and connections, devices, receptors, and appurtenances **within the property limits.**

Definitions

Cross-Connection -

- A connection or arrangement between a potable water supply system and some fixture, equipment, device, etc. which it may be possible for nonpotable/other water, waste, chemical, pollutant, substances, etc. to enter a part of the potable water system under any condition.

Fixture Unit -

- A quantity in terms of which the load-producing effects of the plumbing system for different kinds of plumbing fixtures. Drainage Fixture Units or **DFU** rate fixtures for their load on the sanitary drainage, waste and vent systems. Water Supply Fixture Units or **WSFU** rate fixtures for their load on the water supply and distribution pipes and system.

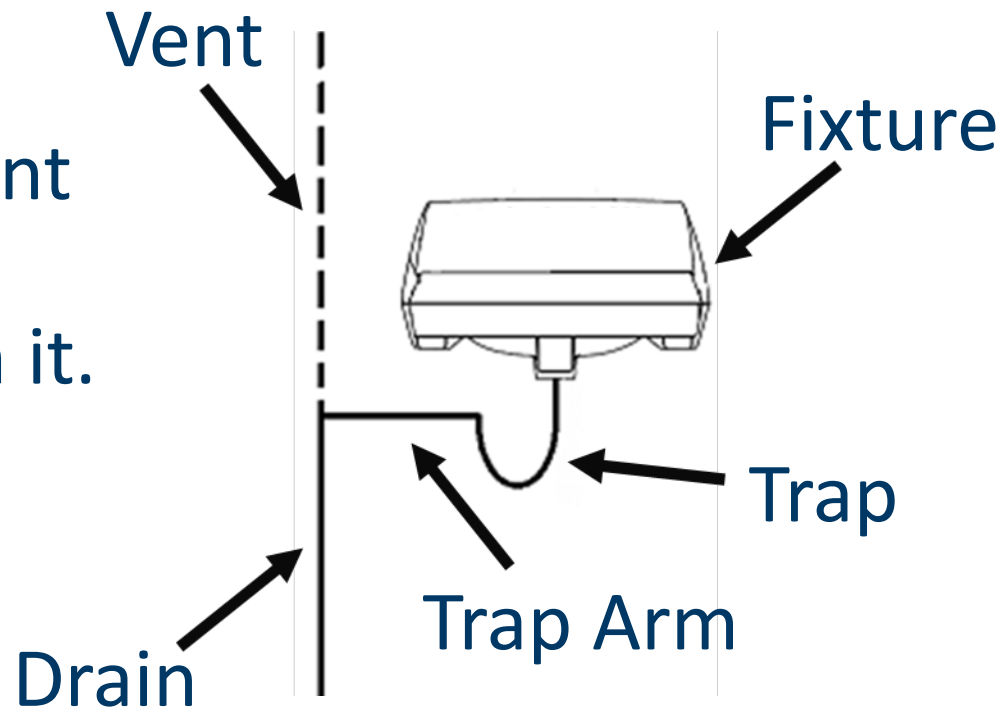
Definitions

Trap -

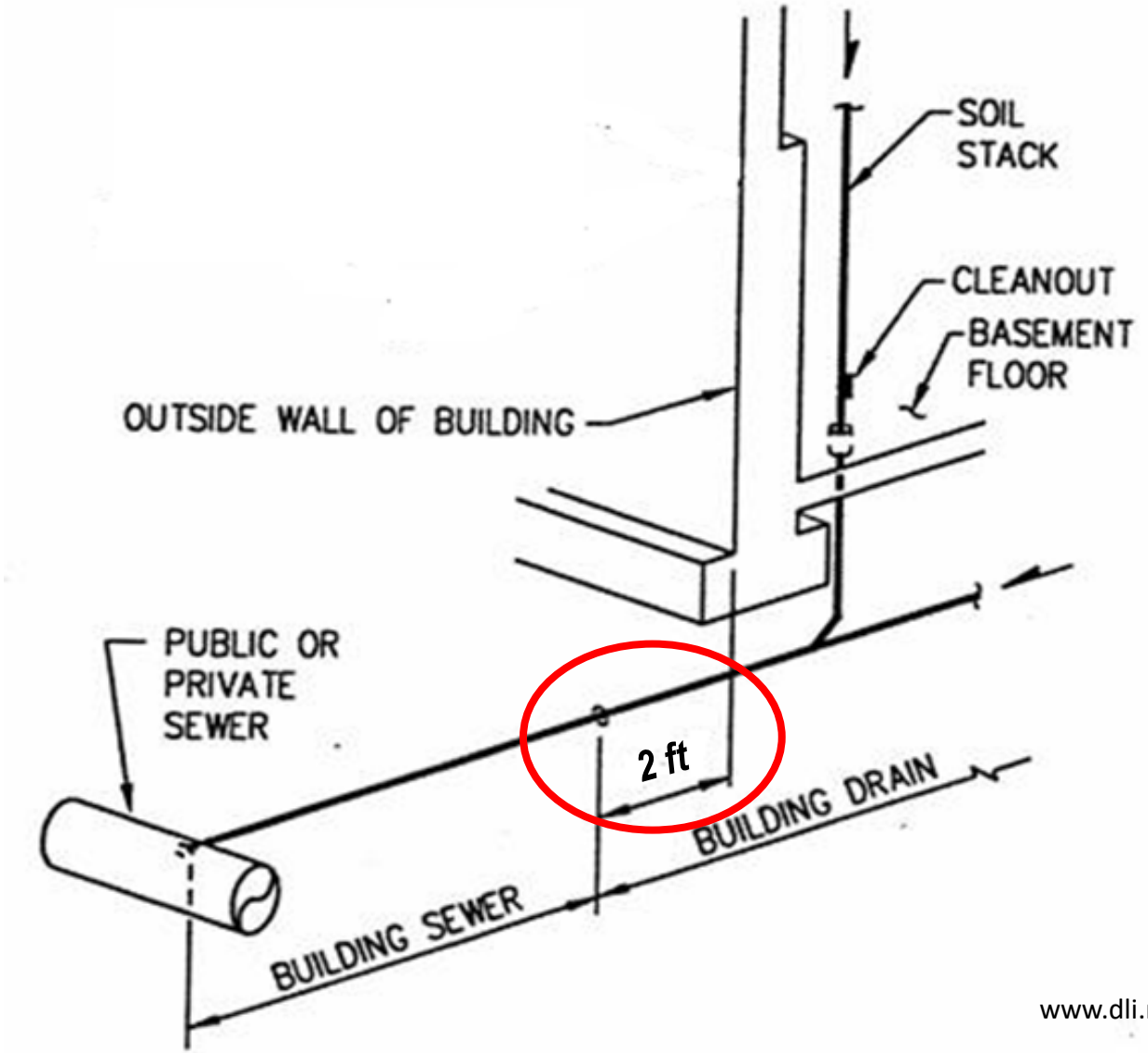
- A fitting or device designed to provide a liquid seal that will prevent the back passage of air without affecting the flow of waste through it.

Trap Arm -

- That portion of a fixture drain between the trap and the vent.



Definitions



Building Drain - The part of the lowest piping of a drainage system that receives the discharge from soil, waste, and other drainage pipes. The building drain carries it to the…

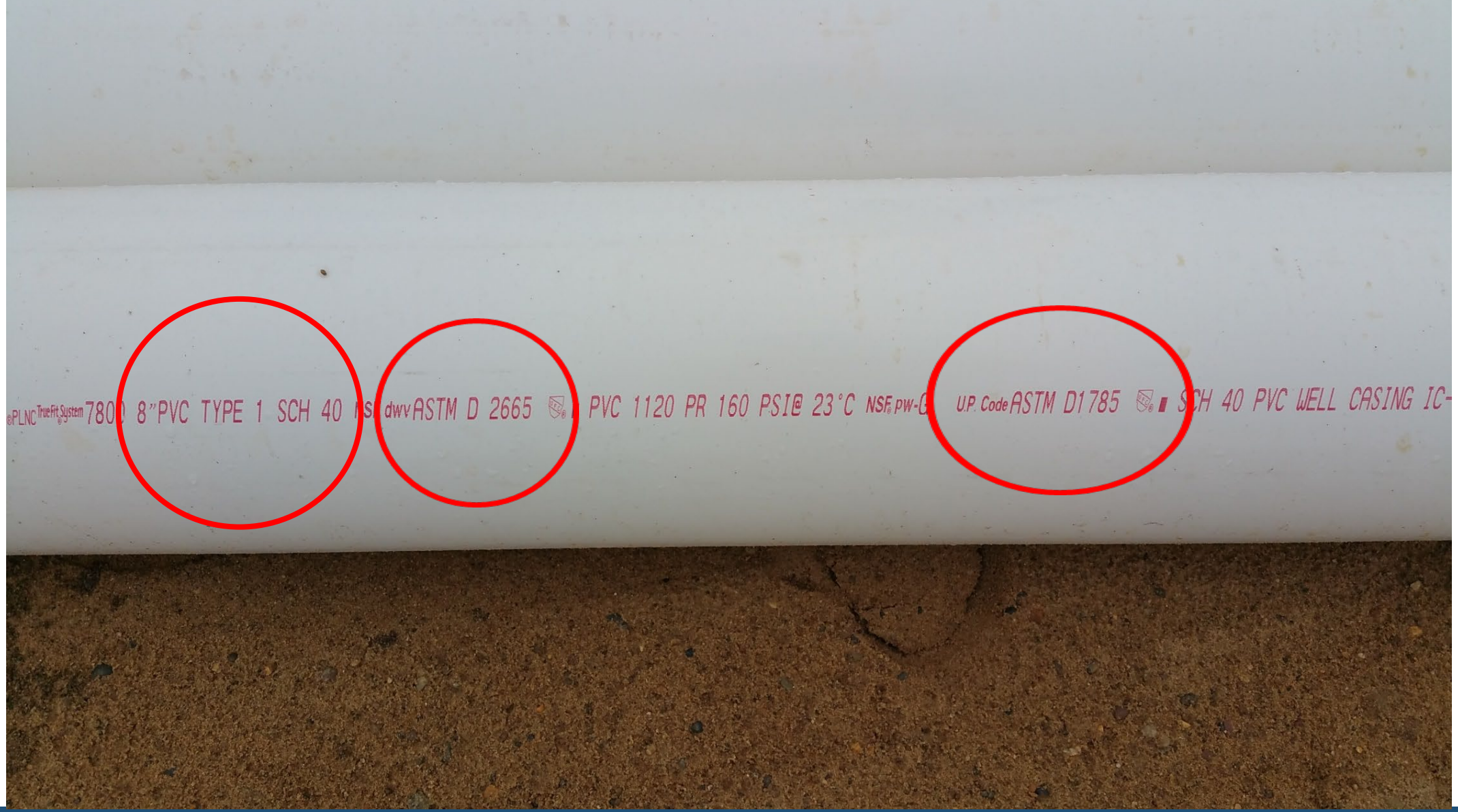
Building Sewer - beginning 2 feet outside the building wall.

301.2 Materials – Minimum Standards

- Pipe, pipe fittings, traps, fixtures, material, and devices used in a plumbing system shall be listed or labeled by a listing agency and shall comply with the approved applicable recognized standards referenced in this code and shall be free from defects.

301.2 Materials – Minimum Standards

- 301.2.1 Marking. Each pipe, fitting, trap, fixture, material, and device used in a plumbing system shall have cast, stamped, or be permanently marked with the manufacturer's mark or name, which shall readily identify the manufacturer to the end user of the product.


8" PVC TYPE 1 SCH 40
dwv ASTM D 2665
PVC 1120 PR 160 PSI @ 23°C
U.P. Code ASTM D1785

Marking

301.0 Materials – Standards and Alternates

- Table 1701.1. – A list of accepted plumbing material standards with other types plumbing applications
- Listed by type and reference number of the quality standard (AWWA, ASME, ASTM, ASSE, ANSI, CSA, IAPMO, NSF, UL, etc.)

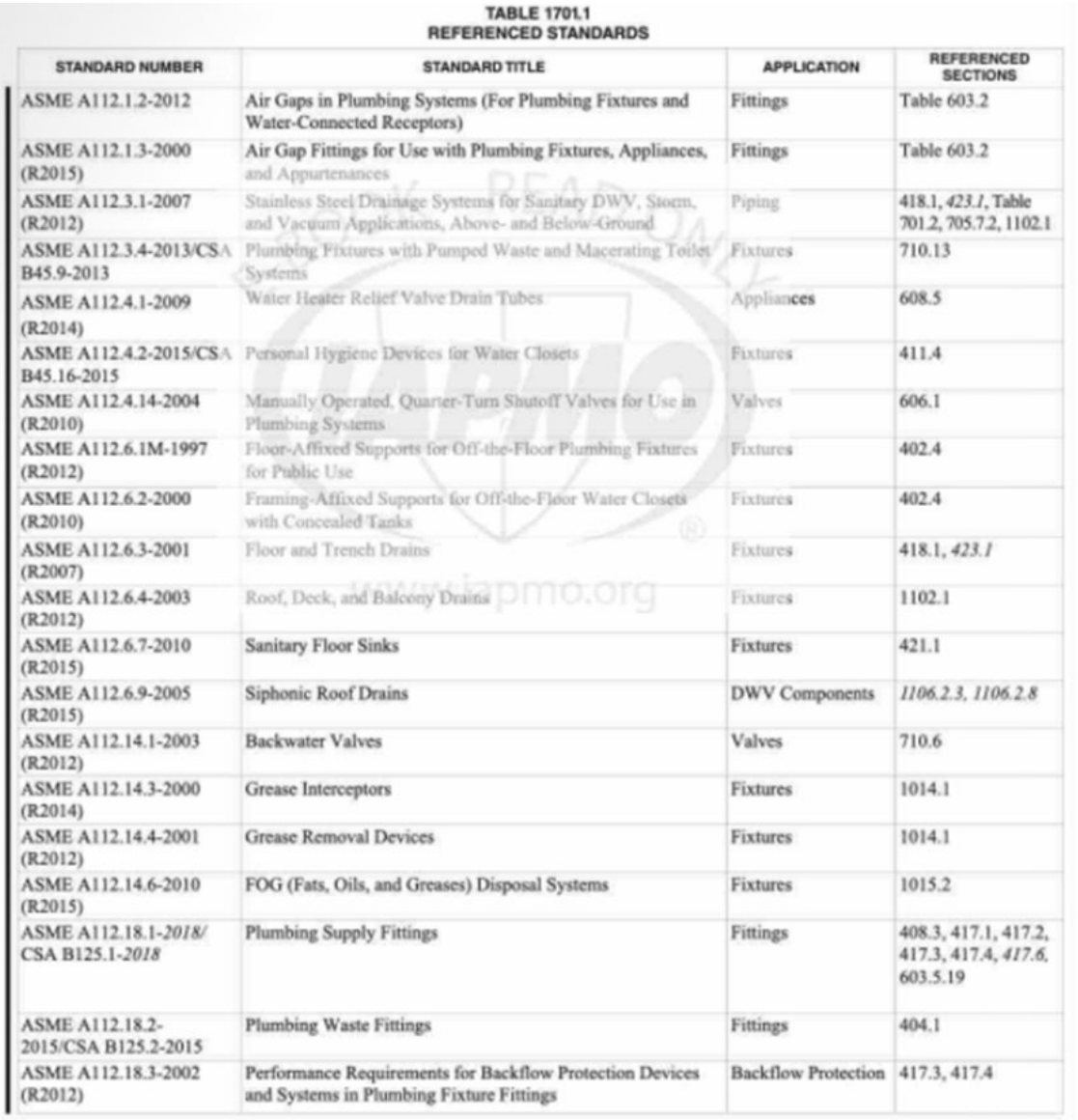


TABLE 1701.1
REFERENCED STANDARDS

STANDARD NUMBER	STANDARD TITLE	APPLICATION	REFERENCED SECTIONS
ASME A112.1.2-2012	Air Gaps in Plumbing Systems (For Plumbing Fixtures and Water-Connected Receptors)	Fittings	Table 603.2
ASME A112.1.3-2000 (R2015)	Air Gap Fittings for Use with Plumbing Fixtures, Appliances, and Appurtenances	Fittings	Table 603.2
ASME A112.3.1-2007 (R2012)	Stainless Steel Drainage Systems for Sanitary DWV, Storm, and Vacuum Applications, Above- and Below-Ground	Piping	418.1, *423.1*, Table 701.2, 705.7.2, 1102.1
ASME A112.3.4-2013/CSA B45.9-2013	Plumbing Fixtures with Pumped Waste and Macerating Toilet Systems	Fixtures	710.13
ASME A112.4.1-2009 (R2014)	Water Heater Relief Valve Drain Tubes	Appliances	608.5
ASME A112.4.2-2015/CSA B45.16-2015	Personal Hygiene Devices for Water Closets	Fixtures	411.4
ASME A112.4.14-2004 (R2010)	Manually Operated, Quarter-Turn Shutoff Valves for Use in Plumbing Systems	Valves	606.1
ASME A112.6.1M-1997 (R2012)	Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use	Fixtures	402.4
ASME A112.6.2-2000 (R2010)	Framing-Affixed Supports for Off-the-Floor Water Closets with Concealed Tanks	Fixtures	402.4
ASME A112.6.3-2001 (R2007)	Floor and Trench Drains	Fixtures	418.1, *423.1*
ASME A112.6.4-2003 (R2012)	Roof, Deck, and Balcony Drains	Fixtures	1102.1
ASME A112.6.7-2010 (R2015)	Sanitary Floor Sinks	Fixtures	421.1
ASME A112.6.9-2005 (R2015)	Siphonic Roof Drains	DWV Components	*1106.2.3, 1106.2.8*
ASME A112.14.1-2003 (R2012)	Backwater Valves	Valves	710.6
ASME A112.14.3-2000 (R2014)	Grease Interceptors	Fixtures	1014.1
ASME A112.14.4-2001 (R2012)	Grease Removal Devices	Fixtures	1014.1
ASME A112.14.6-2010 (R2015)	FOG (Fats, Oils, and Greases) Disposal Systems	Fixtures	1015.2
ASME A112.18.1-*2018*/ CSA B125.1-*2018*	Plumbing Supply Fittings	Fittings	408.3, 417.1, 417.2, 417.3, 417.4, *417.6*, 603.5.19
ASME A112.18.2-2015/CSA B125.2-2015	Plumbing Waste Fittings	Fittings	404.1
ASME A112.18.3-2002 (R2012)	Performance Requirements for Backflow Protection Devices and Systems in Plumbing Fixture Fittings	Backflow Protection	417.3, 417.4

A transition coupling a plumber was sold by a supplier and told to use for water service. The ASTM D2513 marking is for gas pressure pipe as in Chapter 12 of the UPC.

Standards and Alternates

312.0 Protection of Piping, Materials, and Structures

- 312.3 Building Sewer and Drainage Piping. No building sewer or other drainage piping or part thereof, constructed of materials other than those approved for use under or within a building, shall be installed under or within 2 feet of a building or structure, or <1 foot of the surface of the ground

Materials Approved Within a Building

Table 701.2 Materials For Drain, Waste, Vent Pipe And Fittings

Materials for use within a building

TABLE 701.2
MATERIALS FOR DRAIN, WASTE, VENT PIPE AND FITTINGS

	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 D2661, ASTM D2680*	ASTM D2661, ASTM D2680*
Cast-Iron	X	X	X	ASTM A74, ASTM A888, CISPI 301	ASME B16.12, ASTM A74, ASTM A888, CISPI 301
Co-Extruded ABS (Schedule 40)	X	X	X	ASTM F628	ASTM D2661, ASTM D2680*
Co-Extruded Composite (Schedule 40)	X	X	X	ASTM F1488	ASTM D2661, ASTM D2665, ASTM F794*, ASTM F1866
Co-Extruded PVC (Schedule 40)	X	X	X	ASTM F891, ASTM F1760	ASTM D2665, ASTM F794*, ASTM F1336*, ASTM F1866
Copper and Copper Alloys (Type DWV)	X	X	X	ASTM B43, ASTM B75, ASTM B251, ASTM B302, ASTM B306	ASME B16.23, ASME B16.29
Galvanized Malleable Iron	—	X	—	—	ASME B16.3
Galvanized Steel	—	X	—	—	—
Polyethylene	—	—	X	—	—
PVC (Schedule 40)	X	X	X	—	—
PVC (Sewer and Drain)	—	—	X	ASTM D2729	ASTM D2729
PVC PSM	—	—	X	ASTM D3034	ASTM D3034
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 C700	ASTM C700

* For building sewer applications.

Materials for building sewer

* For building sewer

Table 604.1 Materials For Building Supply and Water Distribution Piping and Fittings

Materials for water within a building

Materials for building supply

TABLE 604.1
MATERIALS FOR BUILDING SUPPLY AND WATER DISTRIBUTION PIPING AND FITTINGS

MATERIAL	BUILDING SUPPLY PIPE AND FITTINGS	WATER DISTRIBUTION PIPE AND FITTINGS	STANDARDS	
			PIPE	FITTINGS
Copper and Copper Alloys	X	X	ASTM B42, ASTM B43, ASTM B75, ASTM B88, ASTM B135, ASTM B251, ASTM B302, ASTM B447	ASME B16.15, ASME B16.18, ASME B16.22, ASME B16.26, ASME B16.50[2], ASME B16.51, ASSE 1061
CPVC	X	X	ASTM D2846, ASTM F441, ASTM F442, CSA B137.6	ASSE 1061, ASTM D2846, ASTM F437, ASTM F438, ASTM F439, ASTM F1970, CSA B137.6
CPVC-AL-CPVC	X	X	ASTM F2855	ASTM D2846
Ductile-Iron	X	X	AWWA C151	ASME B16.4, AWWA C110, AWWA C153
Galvanized Steel	X	X	ASTM A53	—
Malleable Iron	X	X		ASME B16.3
PE	X[1]	—	ASTM D2239, ASTM D2737, ASTM D3035, AWWA C901, CSA B137.1	ASTM D2609, ASTM D2683, ASTM D3261, ASTM F1055, CSA B137.1
PE-AL-PE	X	X	ASTM F1282, CSA B137.9	ASTM F1282, ASTM F1974, CSA B137.9
PE-AL-PEX	X	X	ASTM F1986	ASTM F1986
PE-RT	X	X	ASTM F2769, CSA B137.18	ASTM D3261, ASTM F1055, ASSE 1061, ASTM F1807, ASTM F2098, ASTM F2159, ASTM F2735, ASTM F2769, CSA B137.18
PEX	X	X	ASTM F876, ASTM F877, CSA B137.5, AWWA C904[1]	ASSE 1061, ASTM F877, ASTM F1807, ASTM F1960, ASTM F1961, ASTM F2080, ASTM F2159, ASTM F2735, CSA B137.5
	X	X	ASTM F1281, CSA B137.10, ASTM F2262	ASTM F1281, ASTM F1974, ASTM F2434, CSA B137.10
	X	X	ASTM F2389, CSA B137.11	ASTM F2389, CSA B137.11
	X[1]	—	ASTM D1785, ASTM D2241, AWWA C900	ASTM D2464, ASTM D2466, ASTM D2467, ASTM F1970, AWWA C907
Stainless Steel	X	X	ASTM A269, ASTM A312	—

Notes:
[1] For building supply or exterior cold-water applications, not for water distribution piping.
[2] For brazed fittings only.

- 310.0 Prohibited Fittings and Practices
  - 310.2 Drainage and Vent Piping. No drainage or vent piping shall be drilled and tapped for the purpose of making connections thereto, and no cast-iron soil pipe shall be threaded.
  - 310.4 Vent and Waste Pipes. Except for wet venting, no vent pipe shall be used as a soil or waste pipe, nor shall a soil or waste pipe be used as a vent.

- 310.0 Prohibited Fittings and Practices
  - 310.5 Obstruction of Flow. No fitting, fixture and piping connection, installation, etc. shall be used that obstructs or resists the flow exceeding the normal frictional resistance to flow.
  - 310.7 Direction of Flow. Valves, pipes, and fittings shall be installed in correct relationship to the direction of flow

312.0 Protection of Piping, Materials, and Structures

- 312.4 Corrosion, Erosion, and Mechanical Damage
- 312.5 Protectively Coated Pipe
- 312.6 Freezing Protection
- 312.7 Fire-Resistant Construction
- 312.8 Waterproofing of Openings
- 312.9 Steel Nail Plates
- 312.10 Sleeves
- 312.11 Structural Members
- 312.12 Rodent-proofing

313.0 Hangers and Supports

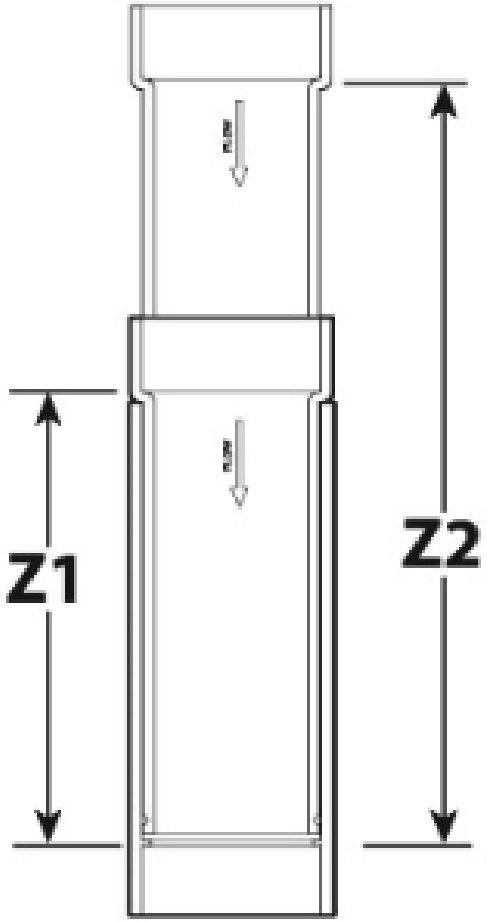
- Piping, fixtures, etc. must be supported in accordance with code, installation instructions, and the local. Sufficient to support weight of pipe and contents. Piping must be isolated from incompatible materials.
- Suspended piping shall be supported at intervals shown in Table 313.3. and in such a manner as to maintain its alignment and prevent sagging.

TABLE 313.3
HANGERS AND SUPPORTS

MATERIALS	TYPES OF JOINTS	HORIZONTAL	VERTICAL
Cast	Lead and Oakum	5 feet, except 10 feet where 10 foot lengths are installed[1, 2, 3]	Base and each floor, not to exceed 15 feet
	Compression Gasket	Every other joint, unless over 4 feet then support each joint[1, 2, 3]	Base and each floor, not to exceed 15 feet
Cast-Iron Hubless	Shielded Coupling	Every other joint, unless over 4 feet then support each joint[1, 2, 3, 4]	Base and each floor, not to exceed 15 feet
Copper & Copper Alloys	Soldered, Brazed, Threaded, or Mechanical	1½ inches and smaller, 6 feet; 2 inches and larger, 10 feet	Each floor, not to exceed 10 feet[5]
Steel Pipe for Water or DWV	Threaded or Welded	¾ inch and smaller, 10 feet; 1 inch and larger, 12 feet	Every other floor, not to exceed 25 feet[5]
Steel Pipe for Gas	Threaded or Welded	½ inch, 6 feet; ¾ inch and 1 inch, 8 feet; 1¼ inches and larger, 10 feet	½ inch, 6 feet; ¾ inch and 1 inch, 8 feet; 1¼ inches every floor level
Schedule 40 PVC and ABS DWV	Solvent Cemented	All sizes, 4 feet; allow for expansion every 30 feet[3, 6]	Base and each floor; provide mid-story guides; provide for expansion every 30 feet[6]
CPVC	Solvent Cemented	1 inch and smaller, 3 feet; 1¼ inches and larger, 4 feet	Base and each floor; provide mid-story guides
CPVC-AL-CPVC	Solvent Cemented	½ inch, 5 feet; ¾ inch, 65 inches; 1 inch, 6 feet	Base and each floor; provide mid-story guide
Lead	Wiped or Burned	Continuous Support	Not to exceed 4 feet
Steel	Mechanical	In accordance with standards acceptable to the Authority Having Jurisdiction	
PEX	Cold Expansion, Insert and Compression	1 inch and smaller, 32 inches; 1¼ inches and larger, 4 feet	Base and each floor; provide mid-story guides
PEX-AL-PEX	Metal Insert and Metal Compression	½ inch, ¾ inch, 1 inch } All sizes 98 inches	Base and each floor; provide mid-story guides
PE-AL-PE	Metal Insert and Metal Compression	½ inch, ¾ inch, 1 inch } All sizes 98 inches	Base and each floor; provide mid-story guides
PE-RT	Insert and Compression	1 inch and smaller, 32 inches; 1¼ inches and larger, 4 feet	Base and each floor; provide mid-story guides
Polypropylene (PP)	Fusion weld (socket, butt, saddle, electrofusion), threaded (metal threads only), or mechanical	1 inch and smaller, 32 inches; 1¼ inches and larger, 4 feet	Base and each floor; provide mid-story guides

Hangers and Supports

Table 313.3, the quality standards, manufacture's installation instructions all require expansion/contraction provisions



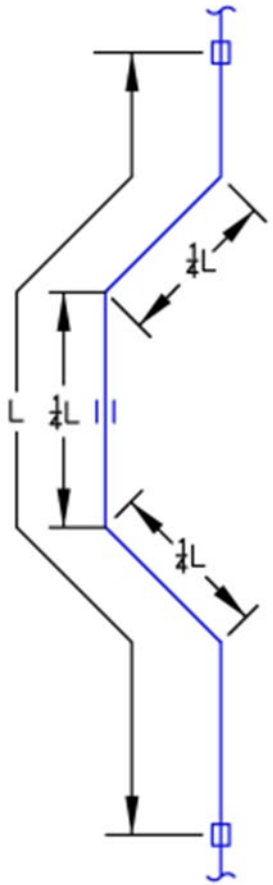
Expansion for ABS and PVC DWV and Storm Pipe per Table 313.3.1

INSIDE THE BUILDING THERMAL ENVELOPE			
	LENGTH OF RUN (FEET)		
	10 FT	20 FT	30 FT
PIPE SIZE (INCHES)	L = EXPANSION JOINT LENGTH (INCHES)		
1.5	20	28	34
2	22	31	38
3	27	38	46
4	30	43	52
6	37	52	63
8	42	59	72
10	47	66	80
12	51	72	88

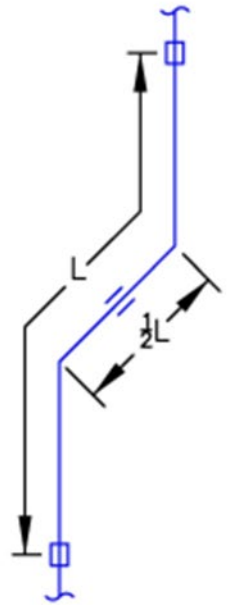
OUTSIDE THE BUILDING THERMAL ENVELOPE			
	LENGTH OF RUN (FEET)		
	10 FT	20 FT	30 FT
PIPE SIZE (INCHES)	L = EXPANSION JOINT LENGTH (INCHES)		
1.5	26	36	44
2	29	41	50
3	35	49	60
4	40	56	68
6	48	68	83
8	55	77	94
10	61	86	105
12	66	94	114

NOTE: MULTIPLE OFFSETS SHALL BE ALLOWED TO PROVIDE EXPANSION FOR EACH 30-FOOT DEVELOPED LENGTH OF RUN

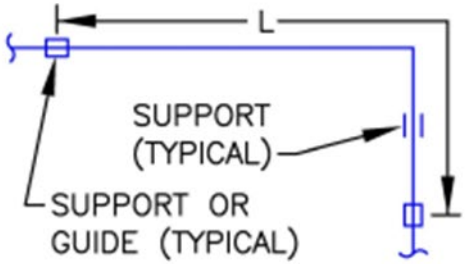
VERTICAL OR HORIZONTAL OFFSET



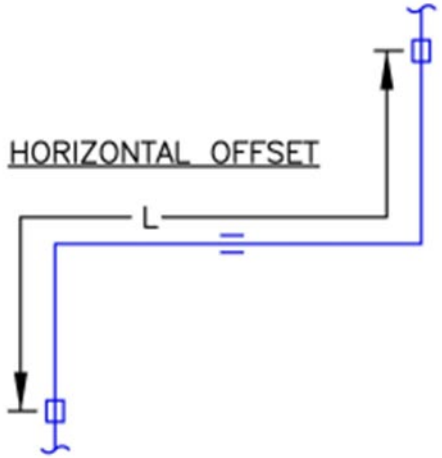
VERTICAL OR HORIZONTAL OFFSET



CHANGE OF DIRECTION



HORIZONTAL OFFSET



313.5 Underground Piping

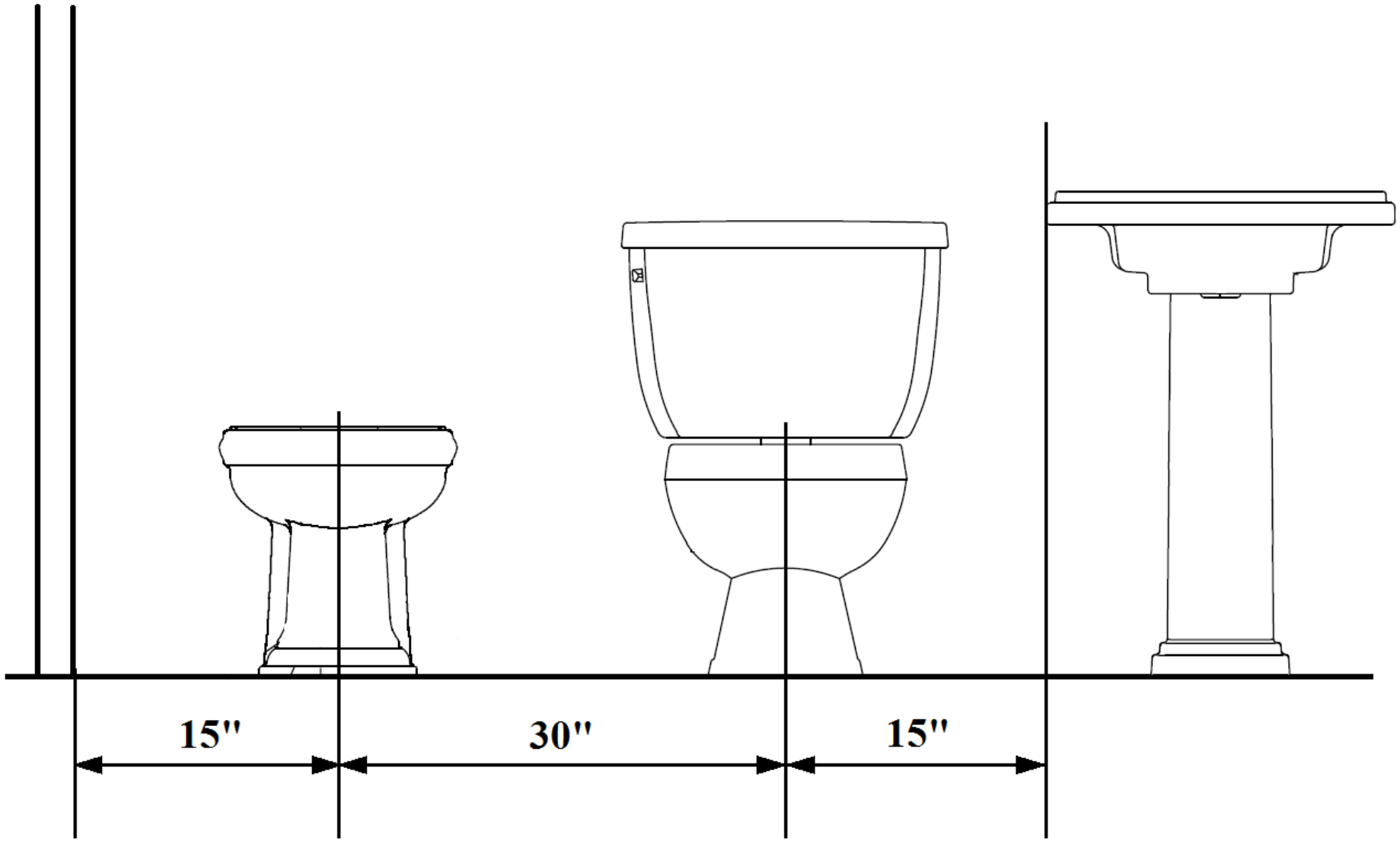
- Piping in the ground shall be laid on a firm bed for its entire length; where other support is otherwise provided, it shall be approved in accordance with Section 301.2.

ASTM D2321 requires open-trench installation on a continuous granular bed.

Underground Piping

Fixture Installation

- 308.1 General. Piping, fixtures, or equipment shall not be so located as to interfere with the normal use thereof or with the normal operation and use of windows, doors, or other required facilities.
- 402.5 Setting. Fixtures shall be set level and in proper alignment with reference to adjacent walls. No water closet or bidet shall be set closer than 15 inches from its center to a side wall or obstruction.



Fixture Installation

402.5 Installation

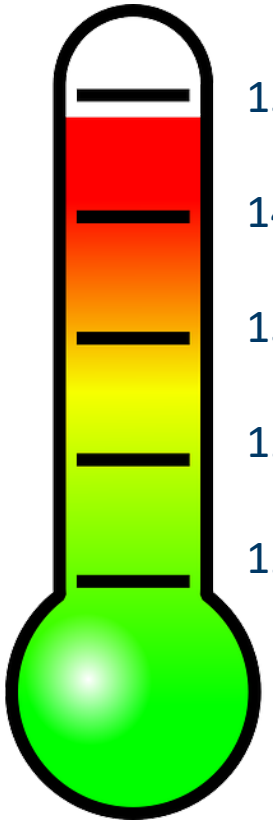
- The clear space in front of a water closet shall be not less than 24 inches

Thermostatic Mixing Valves

Chapter 4 and Scald Protection

- 408.3 Shower and Bath Combination Control Valves Provide individual control valves of the pressure balance, thermostatic, or combination mixing for scald protection for the flow rate. Valves shall be installed at the point of use meeting ASSE 1016, ASME A112.1016/CSA B125.16 or ASME A112.18.1/CSA B125.1 set to no more than 120°F.

Time for a 3rd degree burn:



155°F – 1 second

140°F – 5 seconds

133°F – 15 seconds

124°F – 3 minutes

120°F – 5 minutes

Data from the American Burn Association:
Community Fire & Burn Prevention Programs
Scald Injury Prevention Educator's Guide

Chapter 4 and Scald Protection

- 409.4 Limitation of Hot Water in Bathtubs and Whirlpool Bathtubs. Maximum hot water temperature from a bathtub and/or whirlpool tub filler shall be limited to 120°F by a device that is in accordance with ASSE 1070/ASME A112.1070/CSA B125.70, CSA B125.3, or a point of use water heater meeting ASSE 1084.
- 407.3 and 410.3 Limitations. The water temperatures for bidets and public lavatories must also be limited by a device with the same standard set to no more than 110°F.

Chapter 6 Water Distribution System

- The water distribution system is sized in water supply fixture units WSFU much like how the sanitary and vent system is sized in DFU
- The Section 610 and Table 610.4 determines sizing of the water system based on the total demand of fixtures/use of Table 610.3:

APPLIANCES, APPURTENANCES OR FIXTURES[2]	MINIMUM FIXTURE BRANCH PIPE SIZE[1,4] (inches)	PRIVATE	PUBLIC	ASSEMBLY[6]
Bathtub or Combination Bath/Shower (fill)	½	4.0	4.0	—
¾ inch Bathtub Fill Valve	¾	10.0	10.0	—
Bidet	½	1.0	—	—
Clothes Washer	½	4.0	4.0	—
Dental Unit, cuspidor	½	—	1.0	—
Dishwasher, domestic	½	1.5	1.5	—
Drinking Fountain or Water Cooler	½	0.5	0.5	0.75
Hose Bibb	½	2.5	2.5	—
Hose Bibb, each additional[8]	½	1.0	1.0	—

Water Distribution System

TABLE 610.4
FIXTURE UNIT TABLE FOR DETERMINING WATER PIPE AND METER SIZES

METER AND STREET SERVICE (inches)	BUILDING SUPPLY AND BRANCHES (inches)	MAXIMUM ALLOWABLE LENGTH (feet)														
		40	60	80	100	150	200	250	300	400	500	600	700	800	900	1000
PRESSURE RANGE – 30 to 45 psi[1]																
¾	½[2]	6	5	4	3	2	1	1	1	0	0	0	0	0	0	0
¾	¾	16	16	14	12	9	6	5	5	4	4	3	2	2	2	1
¾	1	29	25	23	21	17	15	13	12	10	8	6	6	6	6	6
1	1	36	31	27	25	20	17	15	13	12	10	8	6	6	6	6
¾	1¼	36	33	31	28	24	23	21	19	17	16	13	12	12	11	11
1	1¼	54	47	42	38	32	28	25	23	19	17	14	12	12	11	11
1½	1¼	78	68	57	48	38	32	28	25	21	18	15	12	12	11	11
1	1½	85	84	79	65	56	48	43	38	32	28	26	22	21	20	20
1½	1½	150	124	105	91	70	57	49	45	36	31	26	23	21	20	20
2	1½	151	129	129	110	80	64	53	46	38	32	27	23	21	20	20
1	2	85	85	85	85	85	85	82	80	66	61	57	52	49	46	43
1½	2	220	205	190	176	155	138	127	120	104	85	70	61	57	54	51
2	2	370	327	292	265	217	185	164	147	124	96	70	61	57	54	51
2	2½	445	418	390	370	330	300	280	265	240	220	198	175	158	143	133

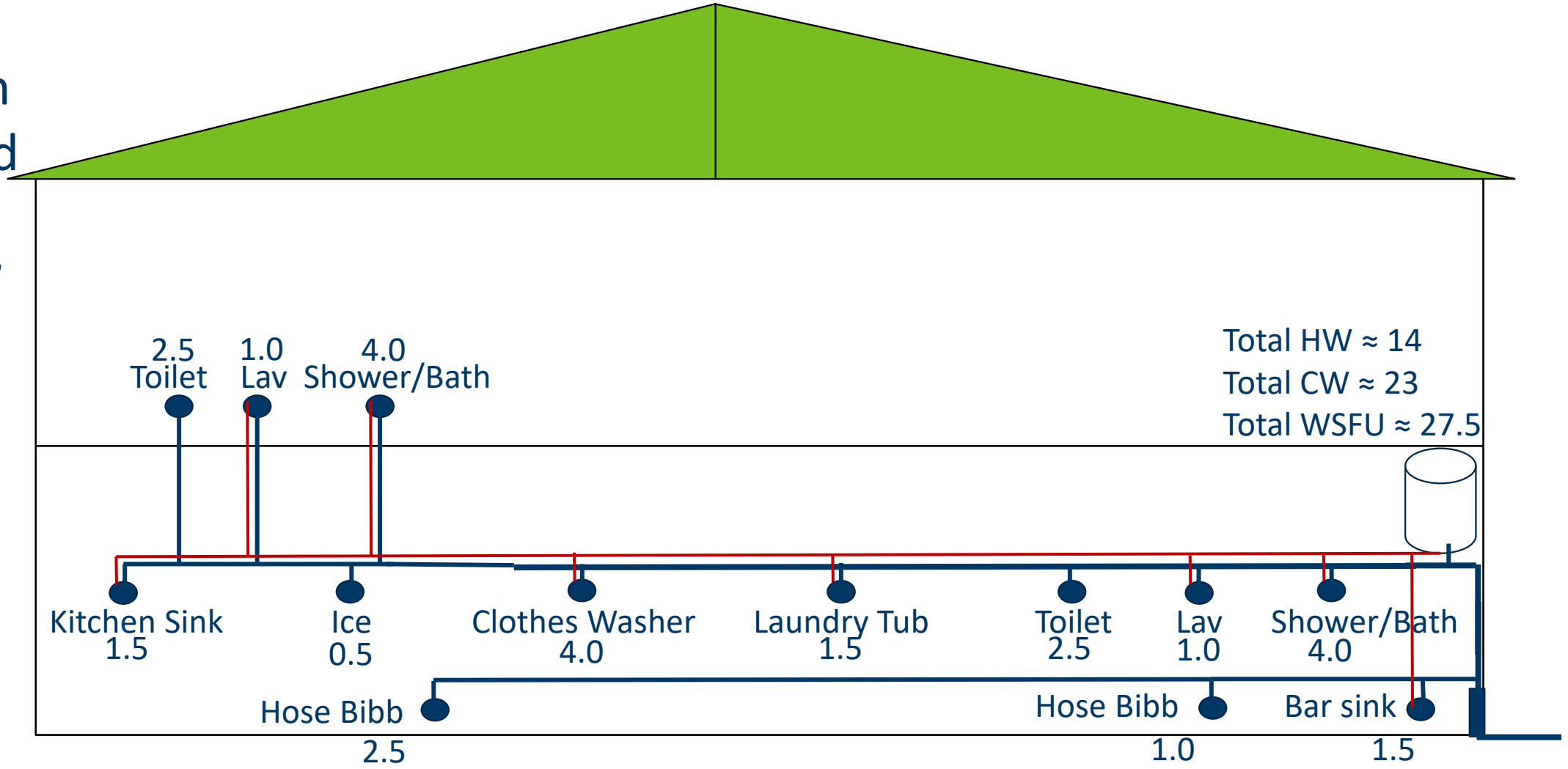
Water Distribution System

WATER SUPPLY FIXTURE UNITS (WSFU) AND MINIMUM FIXTURE BRANCH PIPE SIZES	TABLE 702.1	
PLUMBING APPLIANCES, APPURTENANCES, OR FIXTURES	MINIMUM FIXTURE BRANCH PIPE SIZE (inches)	PRIVATE WSFU
Bathtub or Combination Bath/Shower	1/2	4
Bidet	1/2	1
Clothes Washer, domestic	1/2	4
Dishwasher, domestic	1/2	1.5
Shower, per head	1/2	2
Lavatory (each basin), or hand sink	1/2	1
Hose Bibb	1/2	2.5
Hose Bibb, each additional	1/2	1
Bar Sink	1/2	1
Kitchen Sink, with or without dishwasher	1/2	1.5
Laundry Tub or Utility Sink	1/2	1.5
Water Closet	1/2	2.5

Water Distribution System

Maximum developed length of pipe = 97’

Water pressure at meter after losses = 52 psi



Water meter and main = ¾”

Water Distribution System

Maximum length = 97’

Pressure = 52 psi

HW ≈ 14 WSFU

CW ≈ 23 WSFU

Total ≈ 27.5 WSFU

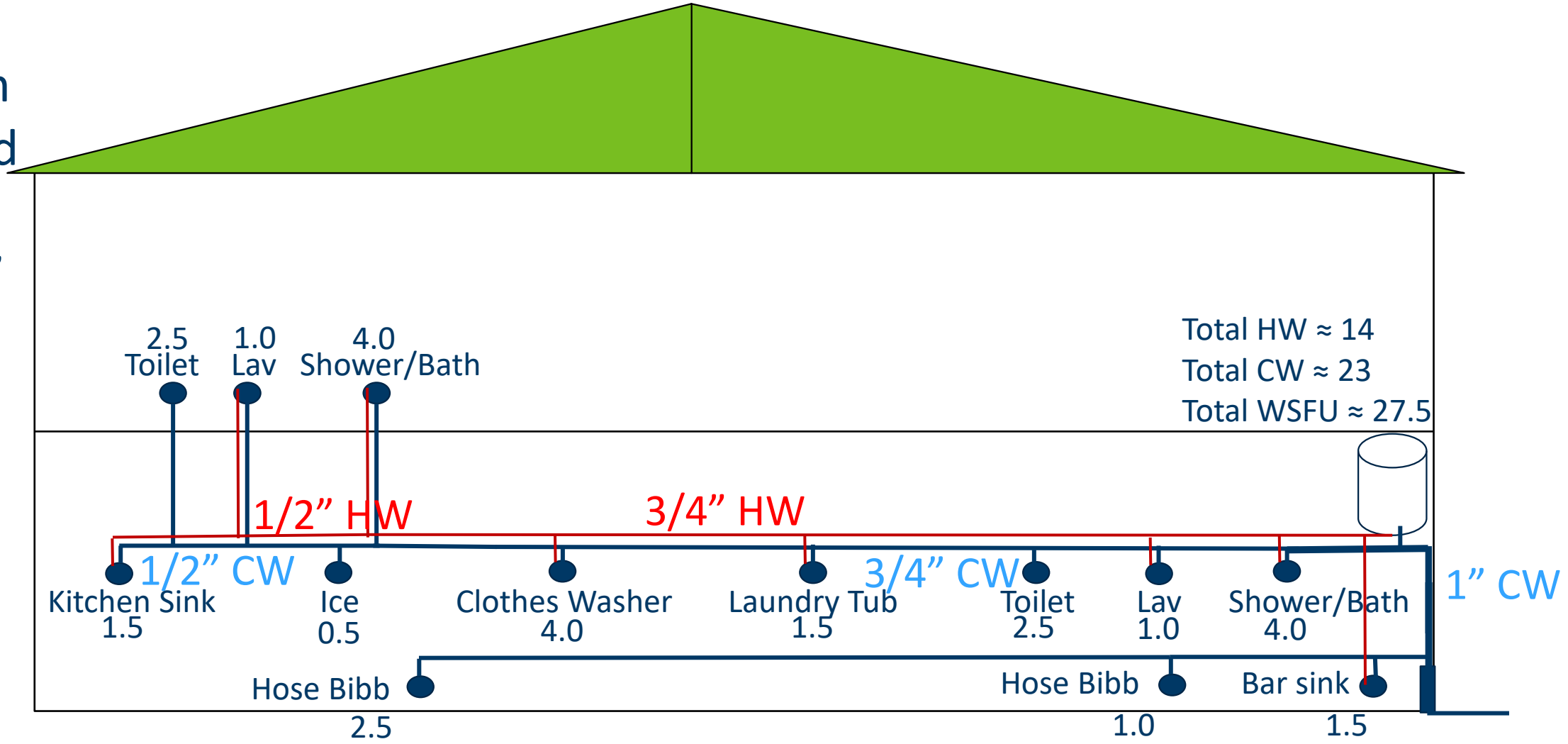
TABLE 610.4
FIXTURE UNIT TABLE FOR DETERMINING WATER PIPE AND METER SIZES

METER AND STREET SERVICE (inches)	BUILDING SUPPLY AND BRANCHES (inches)	MAXIMUM ALLOWABLE LENGTH (feet)										
		40	60	80	100	150	200	250	300	400	500	600
		PRESSURE RANGE – 46 to 60 psi[1]										
¾	½[2]	7	7	6	5	4	3	2	2	1	1	1
¾	¾	20	20	19	17	14	11	9	8	6	5	4
¾	1	39	39	36	33	28	23	21	19	17	14	12
1	1	39	39	39	36	30	25	23	20	18	15	12
¾	1¼	39	39	39	39	39	39	34	32	27	25	22
1	1¼	78	78	76	67	52	44	39	36	30	27	24
1½	1¼	78	78	78	78	66	52	44	39	33	29	24
1	1½	85	85	85	85	85	85	80	67	55	49	41
1½	1½	151	151	151	151	128	105	90	78	62	52	42

Water Distribution System

Maximum developed length of pipe = 97’

Water pressure at meter after losses = 52 psi



Chapter 6 and Potable Water.

- The safe drinking water act is Federal legislation central to how plumbing codes are written.
- NSF/ANSI 61 minimum requirements to anything in contact with drinking water, including domestic plumbing system.

Chapter 6 and Potable Water.

- 601.2 requires each fixture provided with an adequate supply of ***potable*** running water.
- All storage, piping, fixtures/outlets* must follow and meet the requirements in order to keep our drinking water as potable and separate from anything nonpotable

(Except listed fixtures that do not require water for operation and are not connected to the drinking water supply.)

602.0 Backflow Prevention.

- Any connection between a drinking water supply and a potential source of contamination is called a cross-connection. No plumbing fixture, device, or construction shall be connected to the domestic water supply if a possibility of polluting or cross-contamination would exist.
- Separation of potable and nonpotable water pipes unless backflow prevention device, assembly, or method is used for the potential hazard.
- 603.5.6 Protection from Lawn Sprinklers and Irrigation Systems

Backflow Prevention

One Of The First Documented Cases: Chicago World's Fair 1933

The ironic theme of the fair was “A Century of Progress”. Two main hotels for visitors had cross connections with waste systems that went unnoticed, but during the World’s Fair and more water use, the water supply became contaminated with Dysentery.

Estimated over 100 deaths and 2,000 cases, all traced back to the water supply of the two hotels. Backflow prevention is our first line of defense against cross connections.

Backflow Prevention

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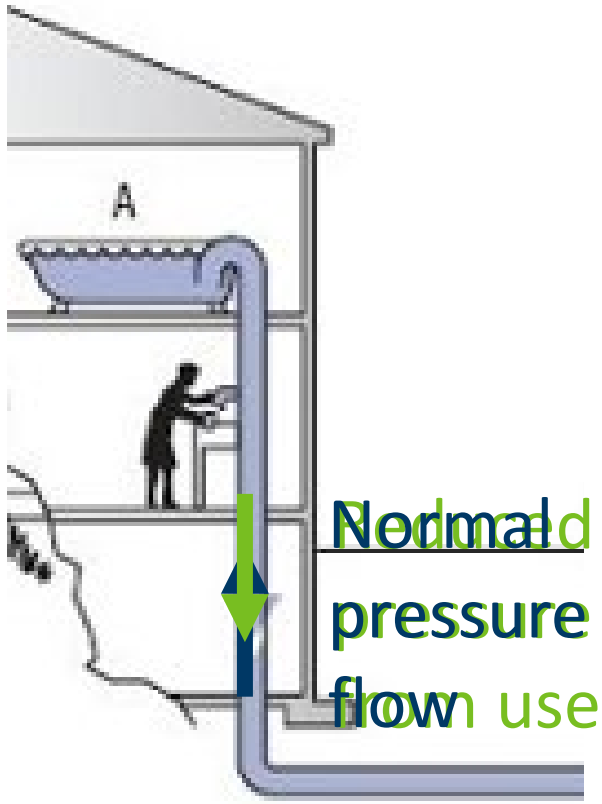
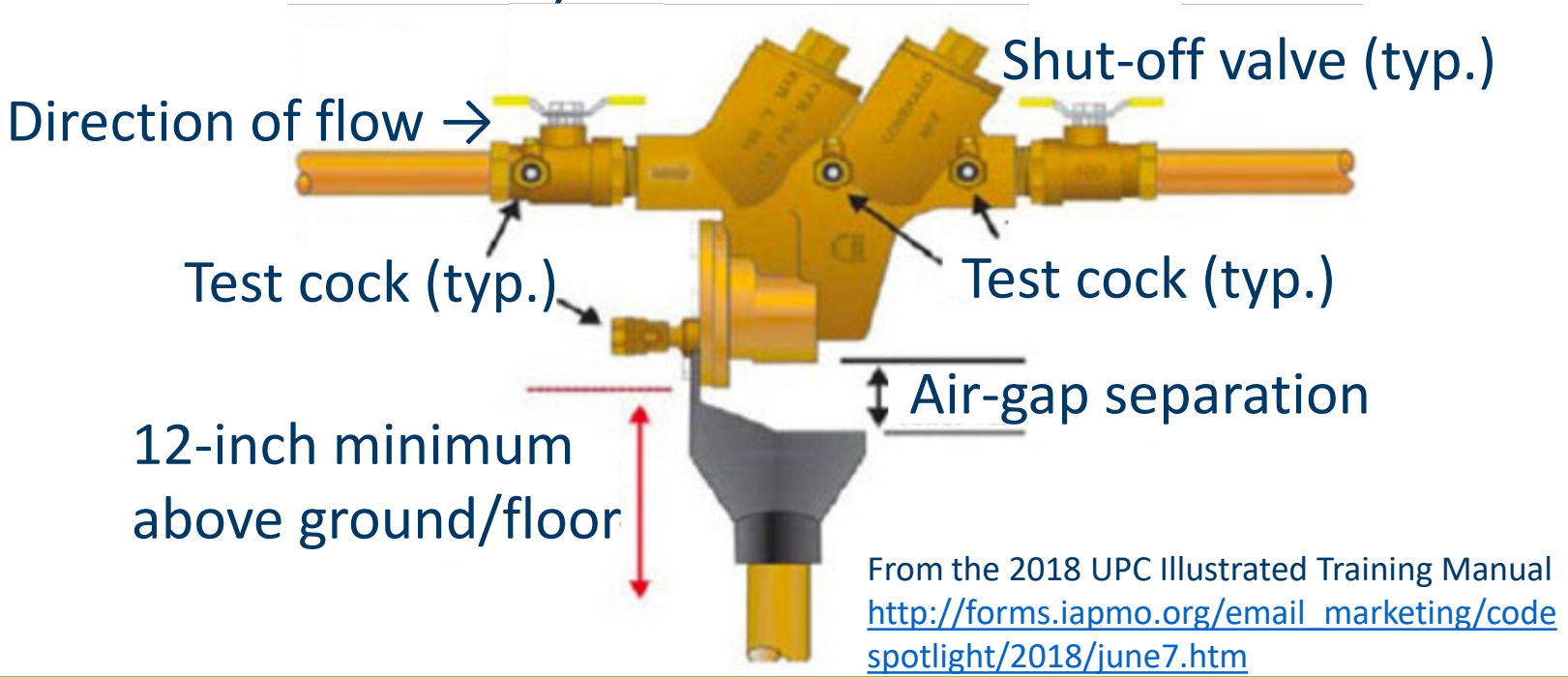


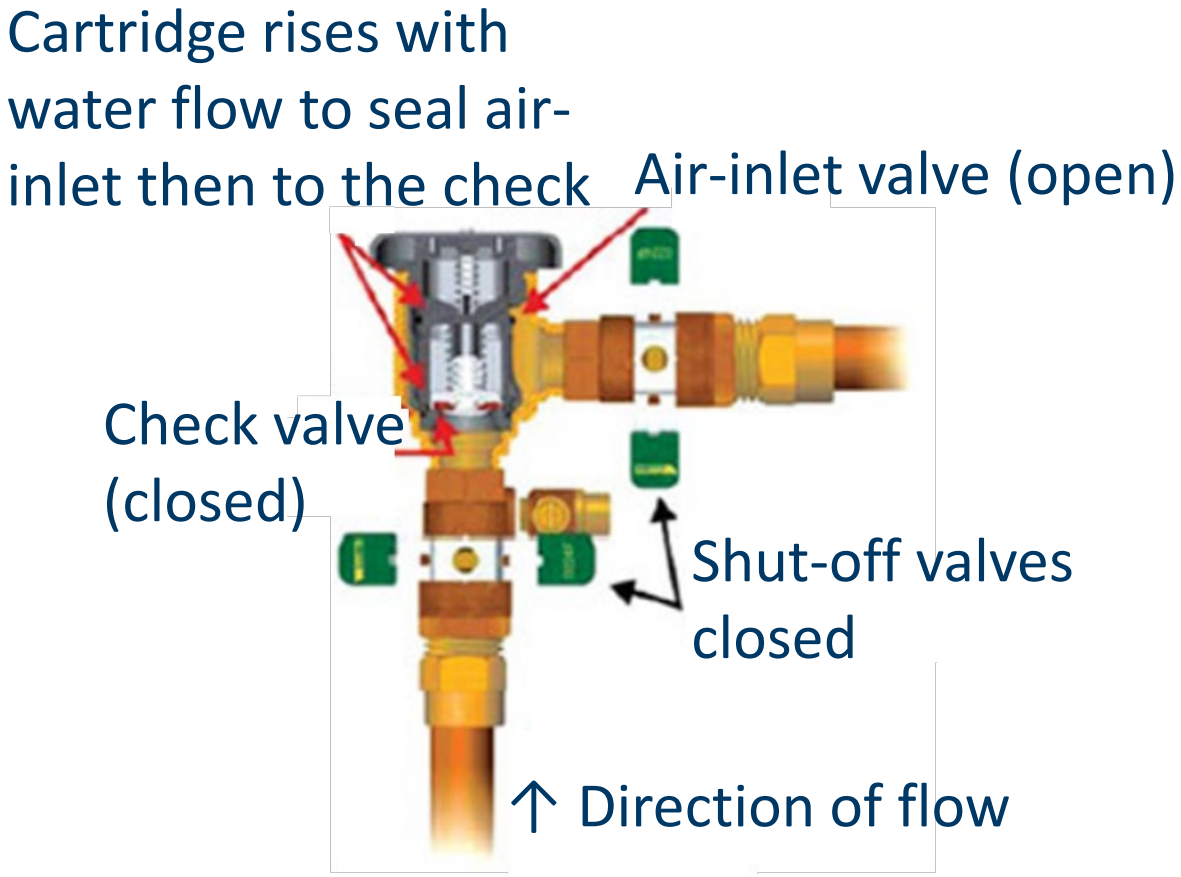
Irrigation systems with backpressure conditions, with pumps or connections for pumping equipment capable of creating backpressure, or systems that include a chemical injector or provisions for chemical injection must be protected by RPZ meeting ASSE 1013, AWWA C511, CSA B64.4 or B64.4.1 (see Section 603.3.7).



From the 2018 UPC Illustrated Training Manual
http://forms.iapmo.org/email_marketing/codespotlight/2018/june7.htm

Backflow prevention (lawn irrigation Section 603.5.6)

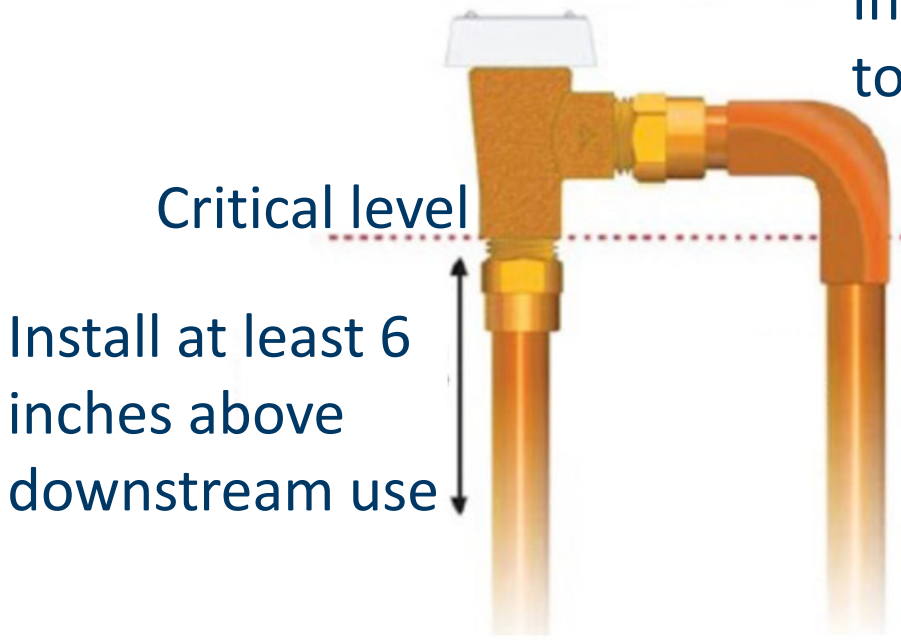
Lawn irrigation systems designed without backpressure conditions, no pumps, no connections for pumping equipment downstream of the backflow device, or chemical injection may be protected by a properly installed and listed pressure vacuum breaker meeting ASSE 1020 or CSA B64.1.2 or a spill-resistant pressure vacuum breaker meeting ASSE 1056.



From the 2018 UPC Illustrated Training Manual
http://forms.iapmo.org/email_marketing/codespotlight/2018/may3.htm

Backflow prevention (lawn irrigation Section 603.5.6)

An atmospheric vacuum breaker (ASSE 1001 or CSA B64.1.1) is only sufficient when not under “continuous pressure” and when shut-off controls are not installed downstream of the device that would keep the atmospheric vacuum breaker under constant pressure.



From the 2018 UPC Illustrated Training Manual
http://forms.iapmo.org/email_marketing/code spotlight/2017/Aug10.htm

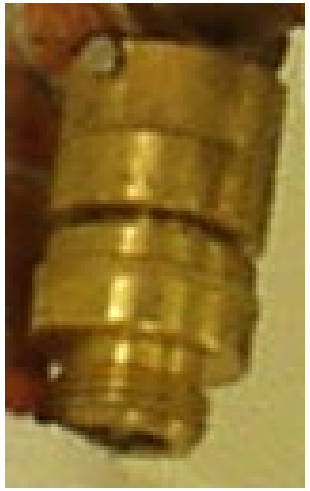
Section 603.5.1 - Atmospheric Vacuum Breaker

ASSE 1019 - Vacuum breaker wall hydrants, hose bibbs, freeze resistant with automatic draining.

Act as a permanent means to protect against backflow including an air inlet for preventing backsiphonage and a check valve for preventing backpressure backflow. These devices are terminal fittings that supply potable water to hose connections without danger of freezing.

Freeze-Resistant Hydrants

Sections 603.5.7 and 603.4.6 - Where permitted, non-removable ASSE 1052 double-check valve or non-removable ASSE 1011 vacuum breakers may be used where also protected from freezing.



Sections 603.3.2 - An ASSE 1001 atmospheric vacuum breaker as before could also used on the discharge side of the last control valve at least 6 inches above the highest point of usage.

Hydrant and Hose Connection Backflow Protection

Dishwasher connections and air gap

Sections 414.3 and 807.3 require domestic-type dishwashers to discharge indirectly to:

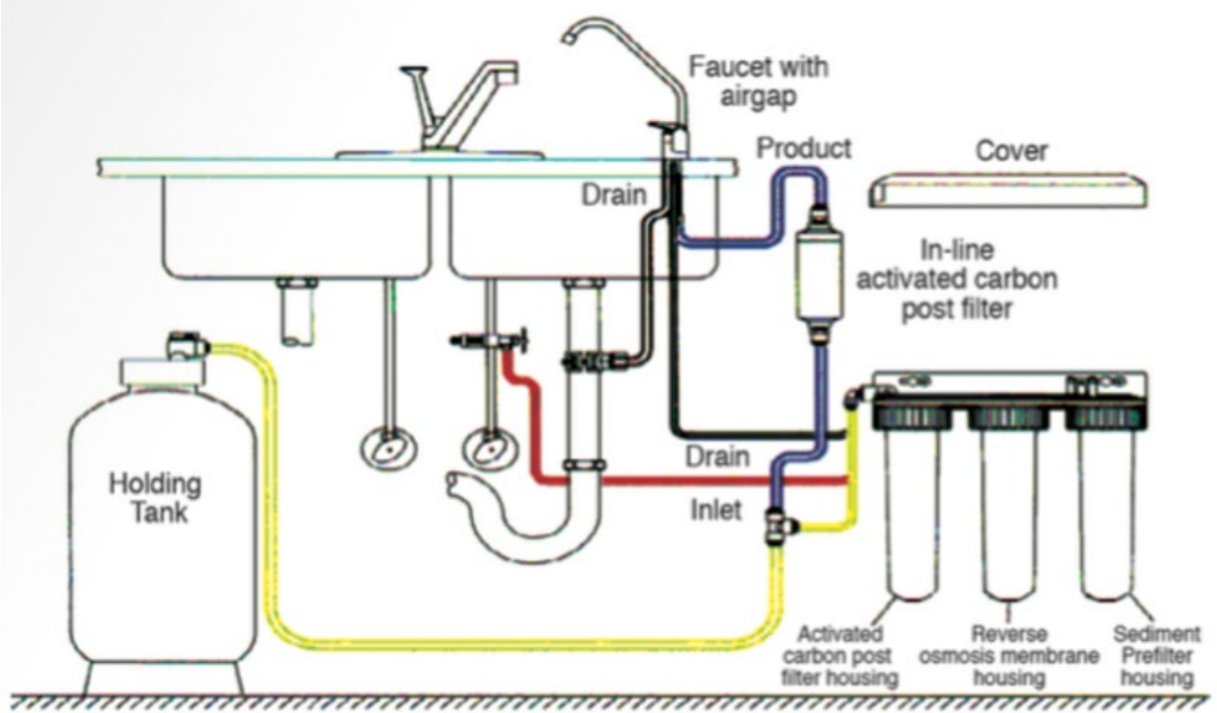
- a waste receptor
- a wye branch fitting of a kitchen sink tailpiece
- dishwasher connection of a food waste grinder

An air gap fitting may be used if approved by the administrative authority (see Section 301.3). The flood-level marking on the fitting must be at or above the flood level of the sink and/or drainboard.

or…

2020 MN Plumbing Code: The discharge line may be installed to run as high as possible under the countertop, securely fastened.

Reverse osmosis (RO) systems have concentrate waste lines. The waste line from a reverse osmosis unit must enter the sewer plumbing through an approved air gap or air gap device for cross-connection control.

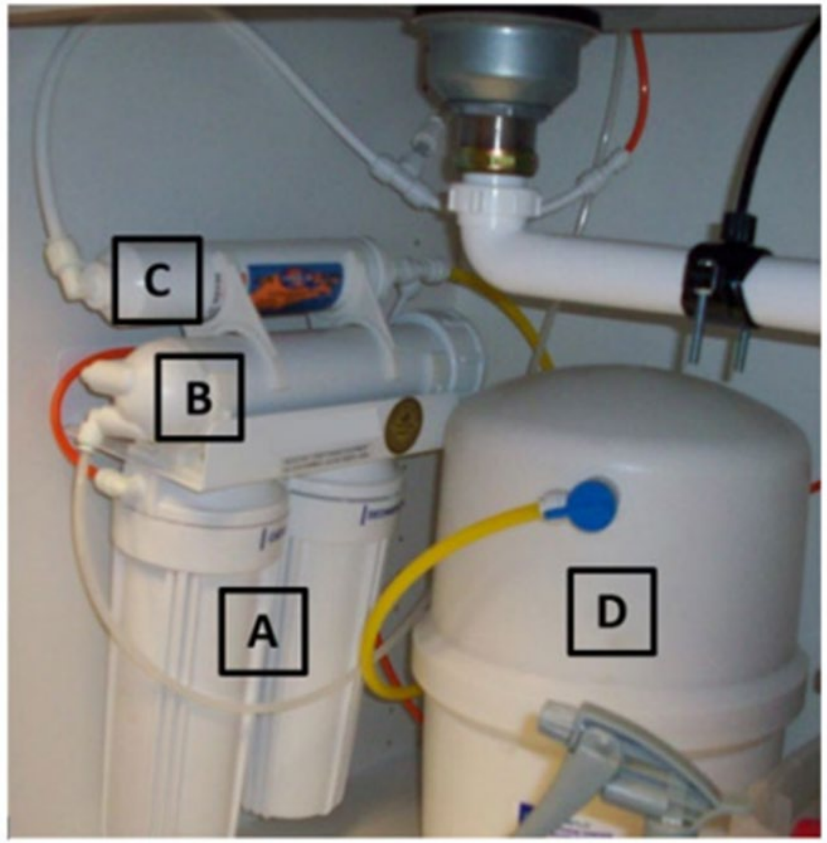


Drinking water treatment device with air gap. Image from 2018 UPC illustrated manual Figure 611.2B

Point-of-Use Reverse Osmosis and Cross Connection Control

Point-of-use RO system will typically contain the following components, along with some method of sending wastewater into the sewer:

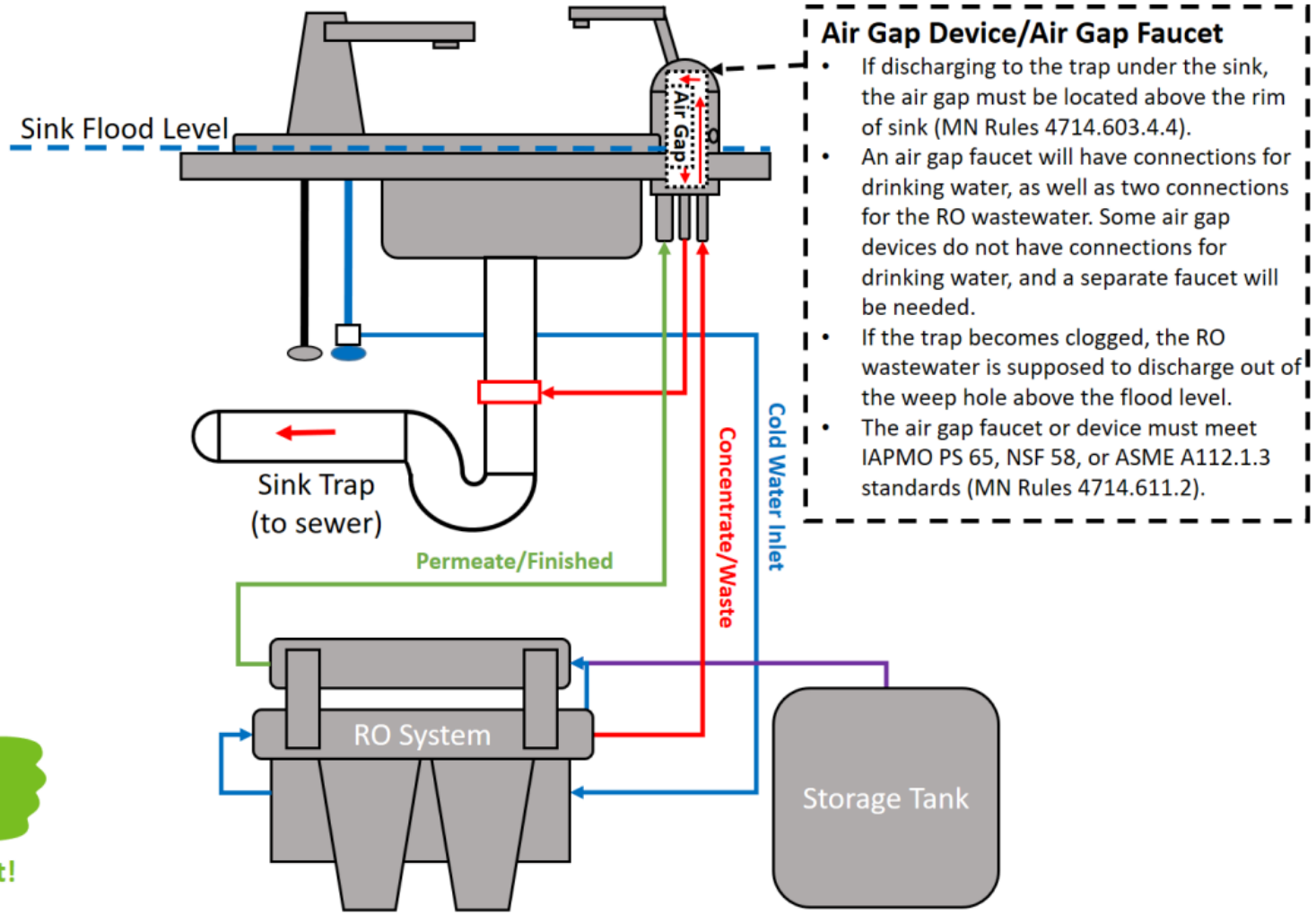
- [A] Carbon and/or sediment pre-filters
- [B] Membrane filter
- [C] Post-filter (optional)
- [D] Pneumatic bladder/storage tank (typically downstream of membrane)



POU RO system installation under a sink with air gap on countertop. Image from MN Dept. of Health: https://www.health.state.mn.us/communities/environment/water/docs/factsheet/pointofuse.pdf

Point-of-Use Reverse Osmosis and Cross Connection Control

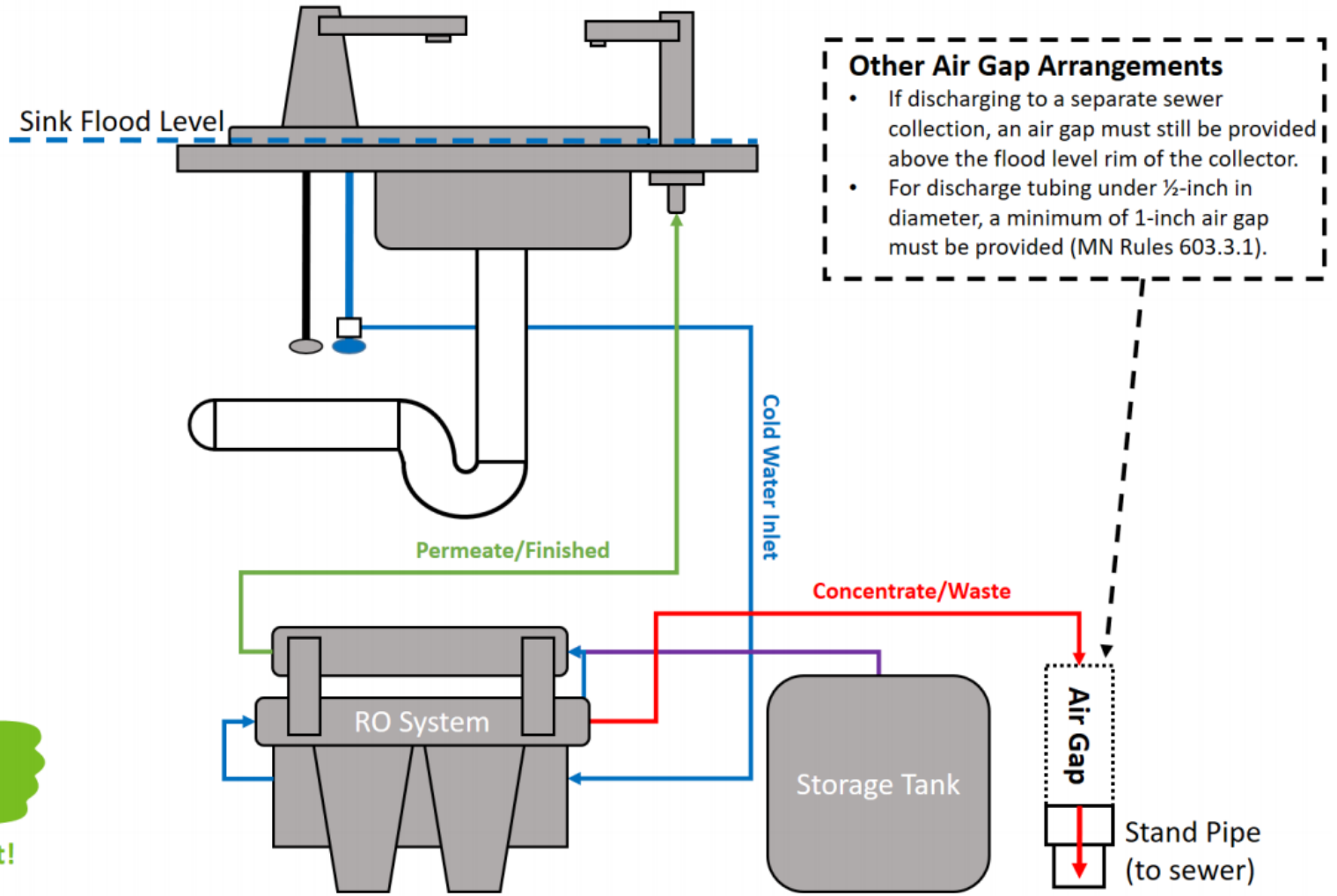
If the RO waste line is connected to the trap under a sink, the air gap (or air gap device) must be above the flood level rim of the sink.



Air Gap Device Installation Example for Waste Connection to Sink Trap:
https://www.health.state.mn.us/communities/environment/water/docs/factsheet/pointofuse.pdf

Point-of-Use Reverse Osmosis and Cross Connection Control

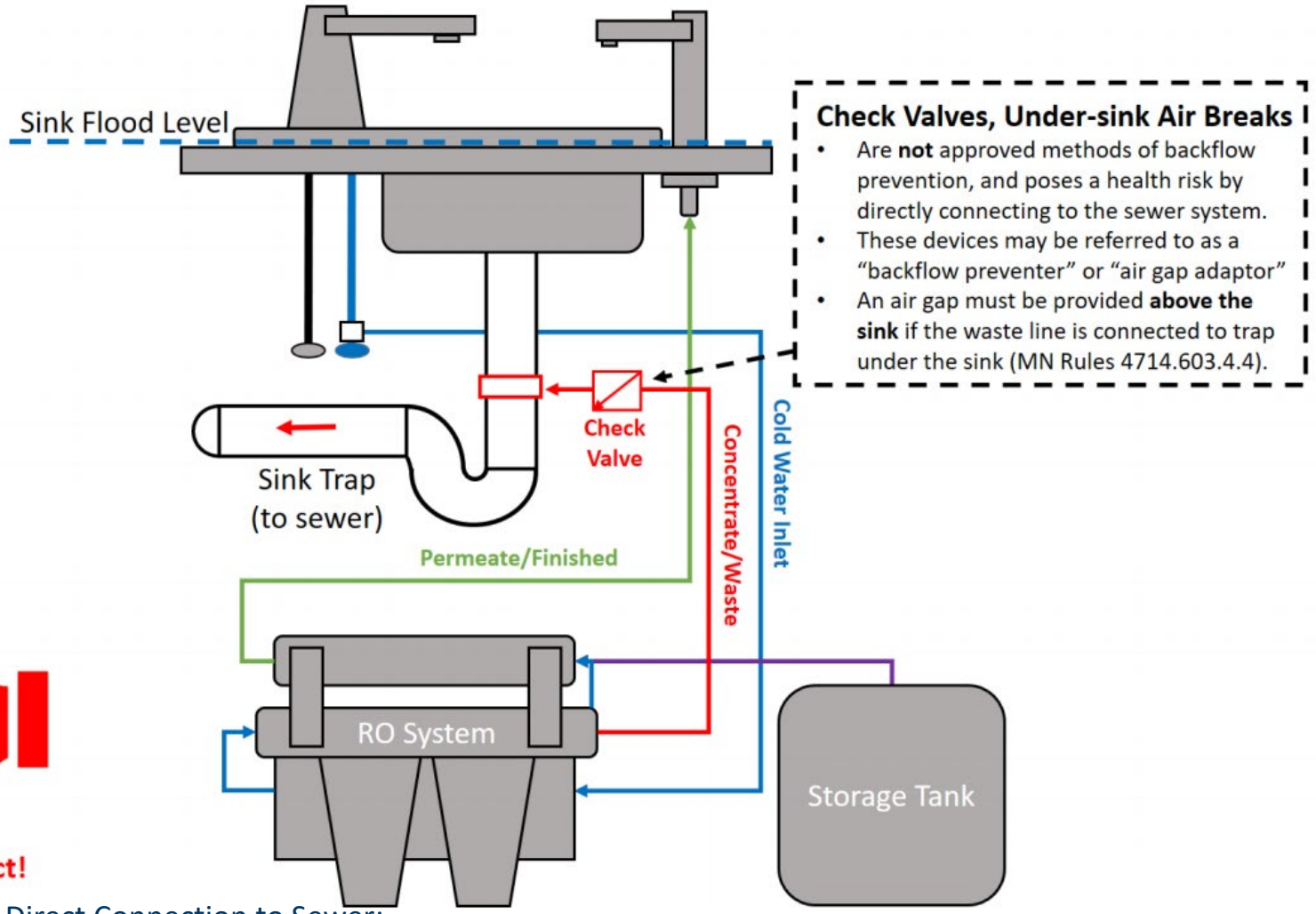
Another option is to discharge the waste line with an air gap into a receptor such as a floor drain, standpipe, or laundry tub.



Air Gap Installation Example for Separate Waste Connection
https://www.health.state.mn.us/communities/environment/water/docs/factsheet/pointofuse.pdf

Point-of-Use Reverse Osmosis and Cross Connection Control

Waste check valves or under sink air breaks are not approved methods for backflow prevention.



Incorrect Installation with Direct Connection to Sewer:
https://www.health.state.mn.us/communities/environment/water/docs/factsheet/pointofuse.pdf

RO not Protected with Cross Connection Control

Water Conditioning of Section 611

611.2 Air gap - Water conditioning equipment must discharge to the drainage system by an air gap per or approved air gap device.

611.5 Valves - A water softener must have a bypass valve permitting equipment service or removal without shutting off the water completely.

Readily accessible isolation valves installed by a licensed plumber are required for all water conditioning installations. Water conditioning contractors may not install isolation valves, pipes larger than 2-inch, or any connection to the existing drainage system without an air gap.

703.0 Size of Drainage Piping

- Table 701.2 Material standards for drain, waste, vent pipe and fittings
- Table 702.1 Drainage Fixture Unit (DFU) rating values.
- Table 702.2(1) Maximum drainage fixture units for trap and trap arm
- Table 702.2(2) Discharge capacity in gallons per minute for intermittent flow
- Table 703.2 Maximum DFU and length of drainage and vent piping

DRAINAGE FIXTURE UNIT VALUES (DFU)	TABLE 702.1	
PLUMBING APPLIANCES, APPURTENANCES, OR FIXTURES	MINIMUM SIZE TRAP AND TRAP ARM (inches)	RESIDENTIAL PRIVATE DFU
Bathtub or Combination Bath/Shower	1-1/2	2
Clothes Washer, domestic, standpipe	2	3
Dishwasher, domestic, with independent drain	1-1/2	2
Floor drain, non-emergency	2	2
Shower, single-head trap	2	2
Shower, each additional head	2	1
Lavatory, single	1-1/4	1
Lavatory, set of two or three on single-trap	1-1/2	2
Bar Sink	1-1/2	1
Kitchen Sink, with or without food grinder, dishwasher, or both	1-1/2	2
Laundry Tub, with or without discharge from clothes washer	1-1/2	2
Water Closet	3	3

Drain Waste & Vent
Table 702.1 Drainage Fixture Unit (DFU) rating values

Drain Waste & Vent
Table 703.2 Maximum DFU and length

TABLE 703.2: MAXIMUM DFU AND MAXIMUM LENGTH OF DRAINAGE AND VENT PIPING						
SIZE OF PIPE (inches)	1-1/4	1-1/2	2	2-1/2	3	4
Drainage Piping[1]						
Maximum DFU on Vertical	1	2[2]	16[3]	32[3]	48[4]	256
Maximum DFU on Horizontal	1	1	8[3]	14[3]	35[4]	216[5]
Maximum Length Vertical (feet)	45	65	85	148	212	300
Maximum Length Horizontal (unlimited)						
Vent Piping						
Maximum DFU either Horizontal or Vertical	1	8[3]	24	48	84	256
Maximum Length (feet)	45(15)	60(20)	120(40)	180(60)	212(70)	300(100)

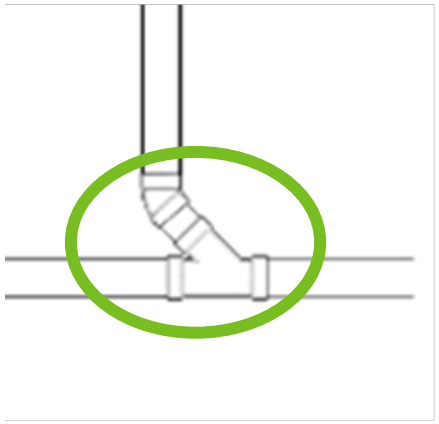
For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm

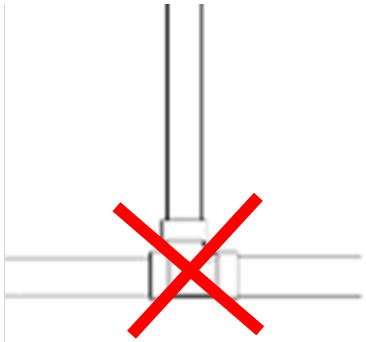
Notes:

1. Excluding trap arm.
2. Except sinks, urinals, and dishwashers – exceeding 1 fixture unit.
3. Except six-unit traps or water closets.
4. Only four water closets or six-unit traps allowed on a vertical pipe or stack; and not to exceed three water closets or six-unit traps on a horizontal branch or drain.
5. Based on ¼ inch per foot (20.8 mm/m) slope. For ⅛ of an inch per foot (10.4 mm/m) slope, multiply horizontal fixture units by a factor of 0.8.

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.
- 310.1 Fittings. No double hub fitting, single or double tee branch, single or double tapped tee branch, side inlet quarter bend, running thread, band, or saddle shall be used as a drainage fitting.



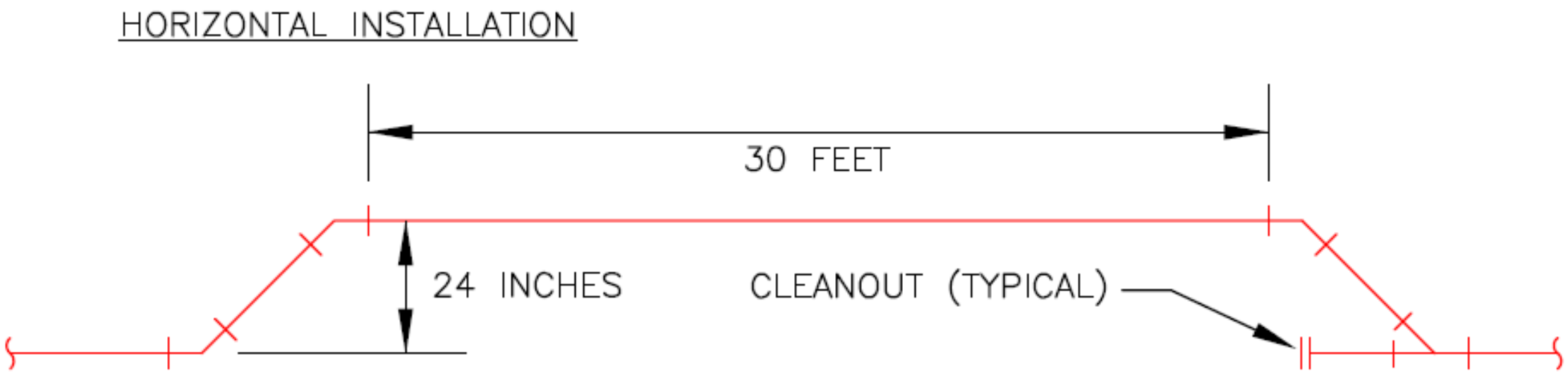


Horizontal to Horizontal

Cleanouts

707.0 Cleanouts.

- 707.4 location. Each horizontal drainage pipe shall be provided with a cleanout at its upper terminal, and each run of piping more than 100 feet in total developed length, shall be provided with a cleanout for at least every 100 feet in length.
- An additional cleanout shall be provided in a drainage line for each aggregate horizontal change of direction exceeding 135 degrees.



Cleanout on Horizontal Direction Over 135°

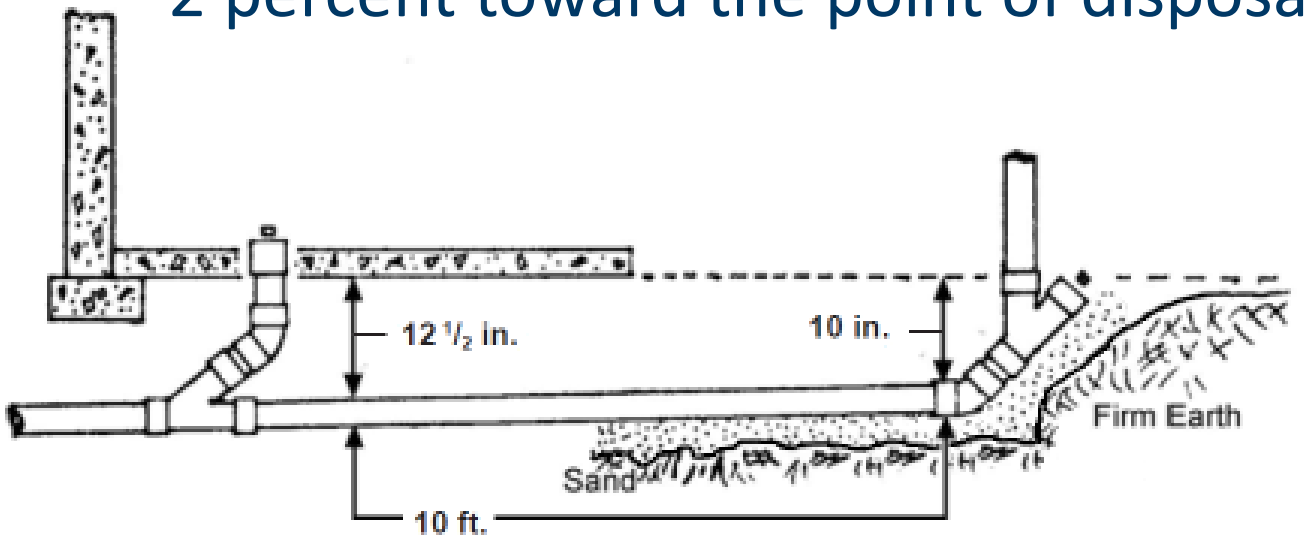
707.5 Cleaning

Each cleanout shall be installed so it opens to allow cleaning in the direction of flow of the waste or at right angles thereto, except in the case of wye branch and end-of-line cleanouts, shall be installed vertically above the flow line of the pipe.

Grade

708.0 Grade of Horizontal Drainage Piping.

- 708.1 General. Horizontal drainage piping shall be run in practical alignment and a uniform slope of not less than 1⁄4 inch per foot or 2 percent toward the point of disposal



Drain drops 2.5 inches over 10 feet = 2.5 inches / 10 feet = .25 inches / 1 foot = **1/4 inch per ft**

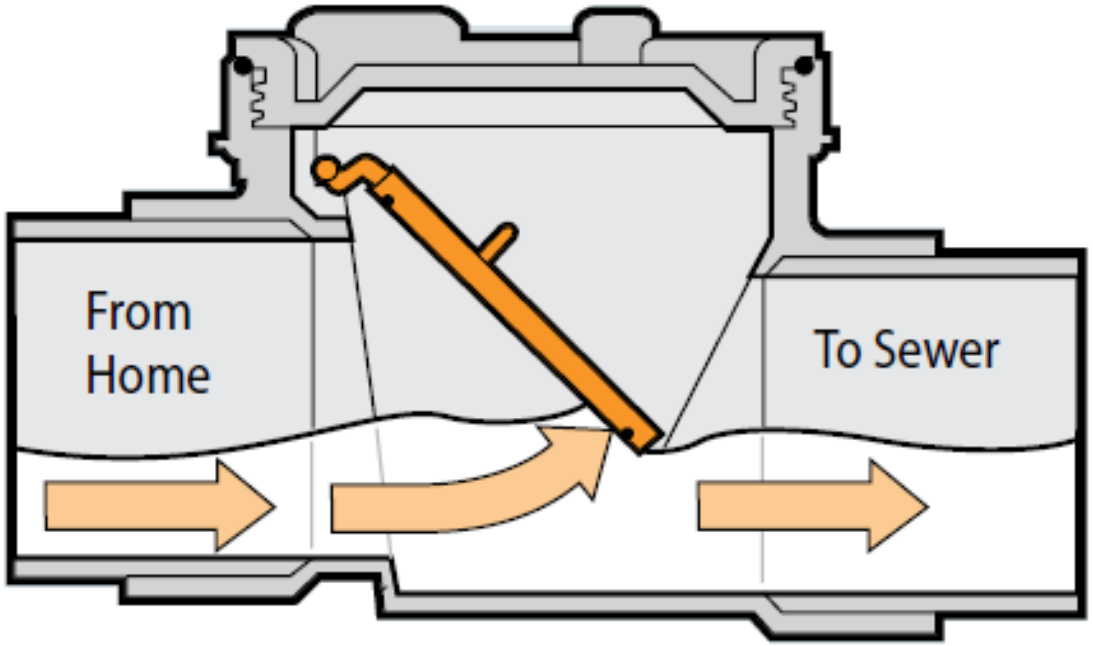
ONLY if a slope of 1⁄4 inch per foot is not obtainable due to the depth of the street sewer, structural features, or arrangement of a structure, pipes **4 inches or larger in diameter** shall be permitted to have a slope of not less than 1⁄8 inch per foot, where first approved before installation.

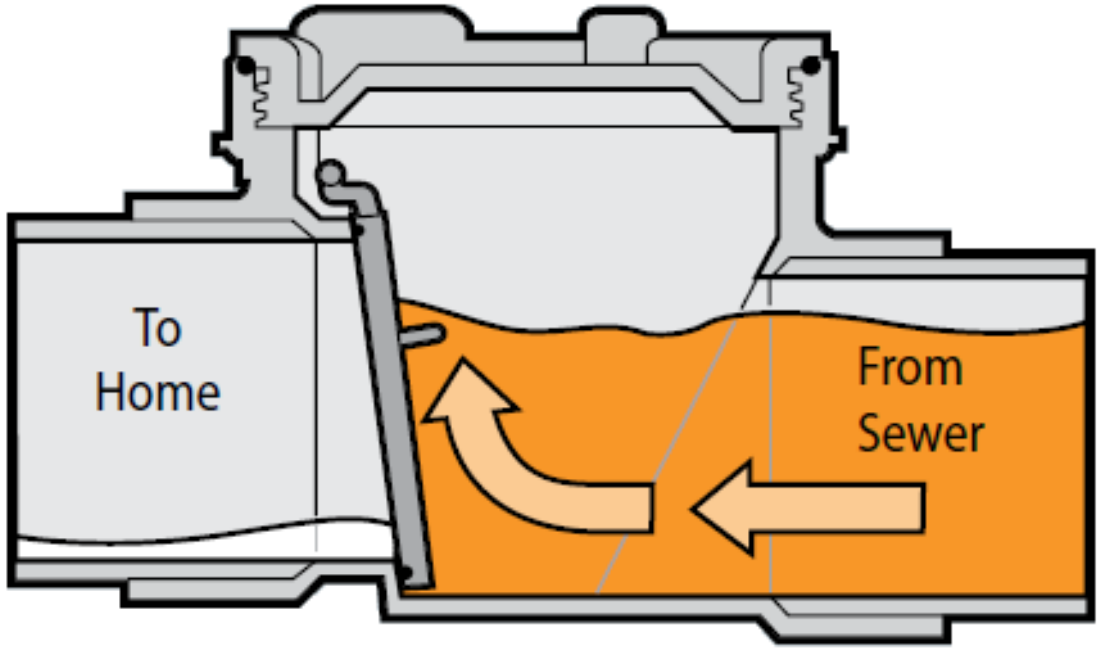
Water flows downhill, but that is only a one-inch drop every 8 feet. It is the absolute minimum allowed by code to keep waste moving out of the building.

Grade Exception

710.1 Backflow Protection.

- Fixtures installed on a floor level that is lower than the next upstream manhole cover of the public or private sewer shall be protected from backflow of sewage by installing an approved type of backwater valve.
- Cleanouts for drains that pass through a backwater valve shall be clearly identified with a permanent label stating “backwater valve downstream”.

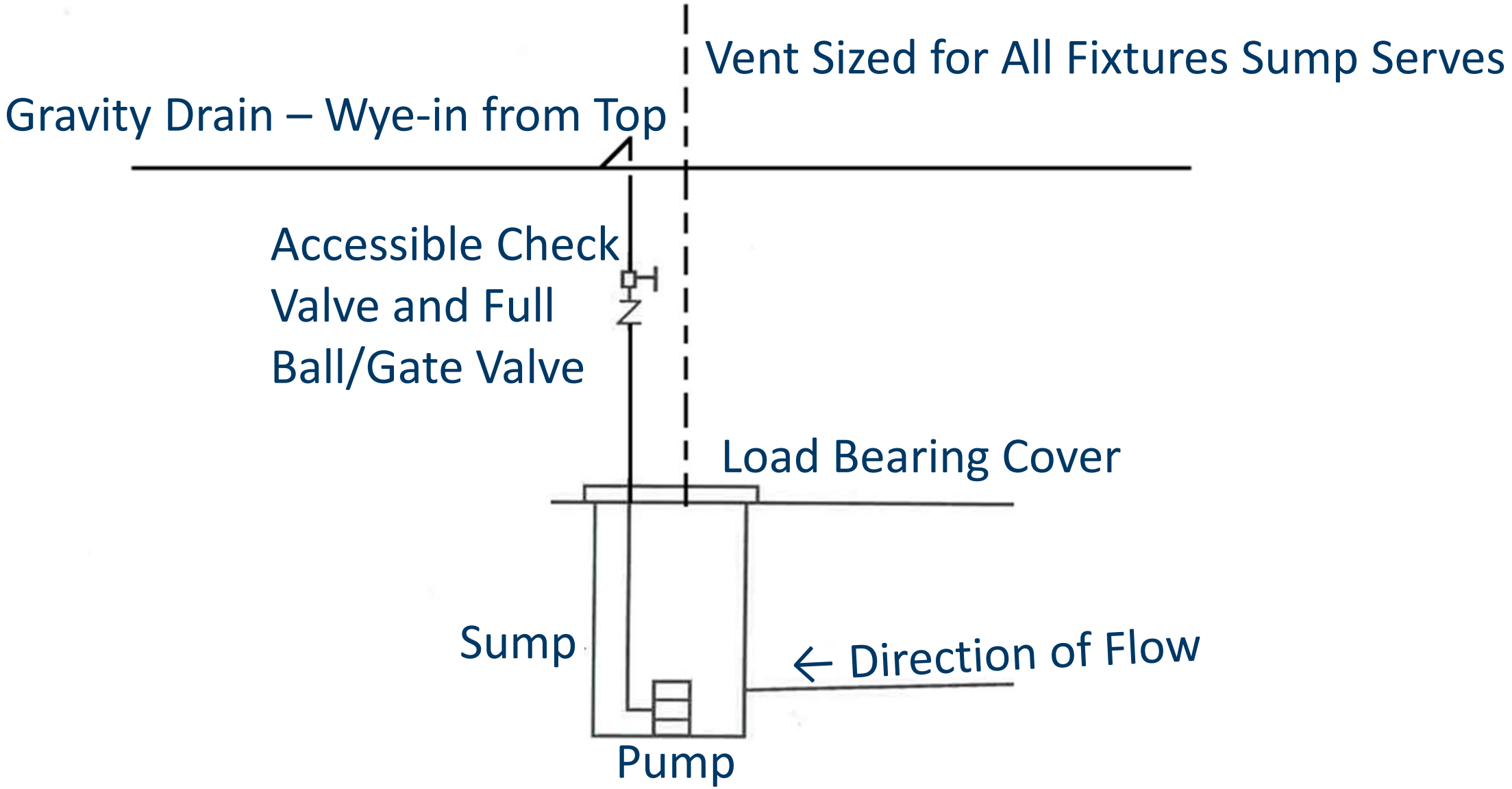




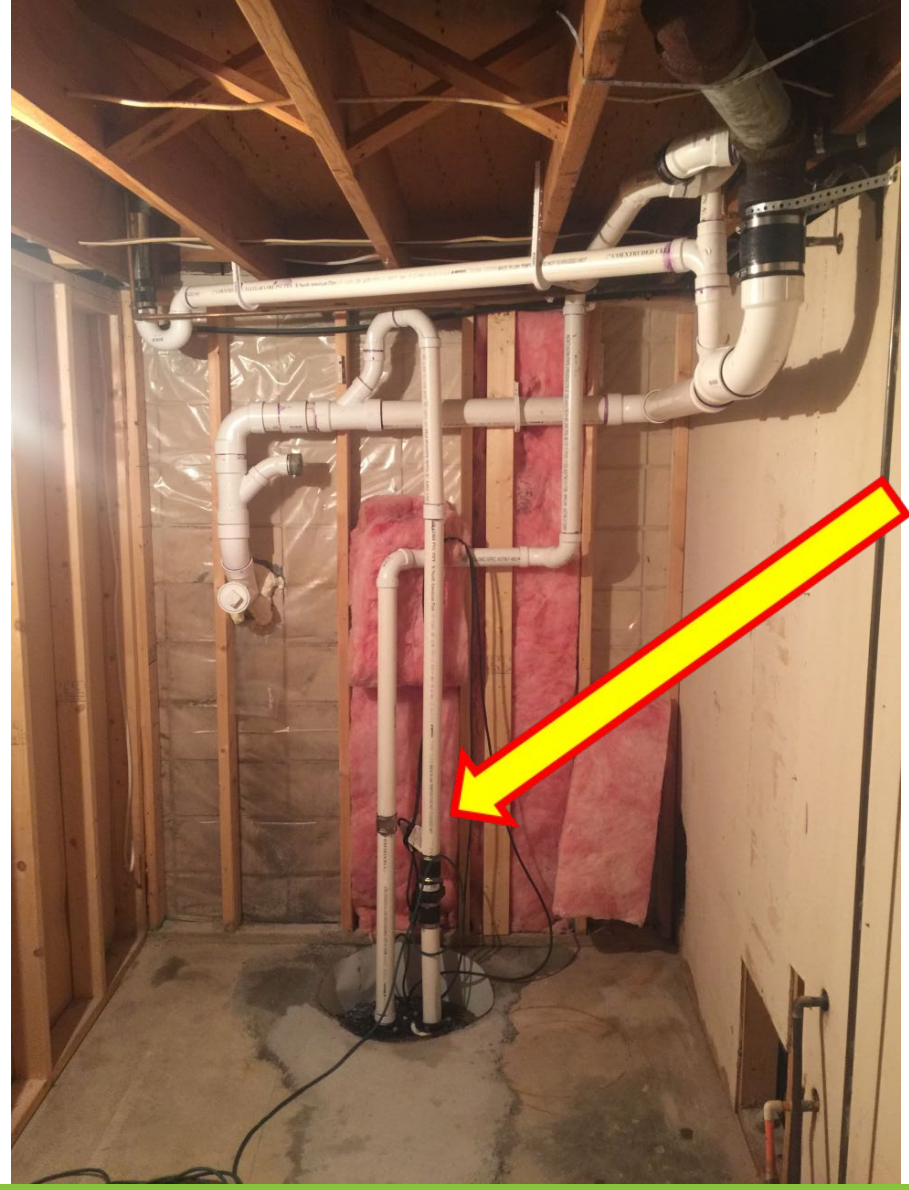
Backwater Valve

710.2 Sewage Discharge.

- Drainage piping serving fixtures that are located below the crown level of the main sewer shall discharge into an approved watertight sump or receiving tank, so located as to receive the sewage or wastes by gravity. From such sump or receiving tank, the sewage or other liquid wastes shall be lifted and discharged into the building drain or building sewer by approved ejectors, pumps, or other equally efficient approved mechanical devices.



Sanitary Sump Pump



Needs a full ball or gate valve

Sewage Discharge

Plumbing Vents Section 901

901.2 Vents Required.

- Each plumbing fixture trap shall be protected against siphonage and backpressure, and air circulation shall be ensured throughout all parts of the drainage system by means of vent pipes installed in accordance with this code.

903.3 Changes in Direction.

- Changes in direction of vent piping shall be made by the appropriate use of approved fittings, and no such pipe shall be strained or bent. Burred ends shall be reamed to the full bore of the pipe.

904.0 Size of Vents.

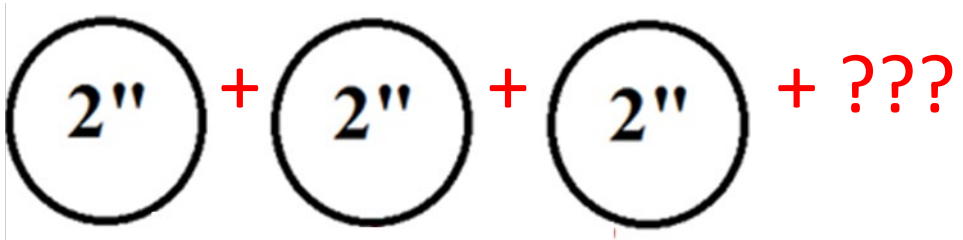
- 904.1 Size. The size of vent piping shall be determined from its length and the total number of fixture units connected thereto, in accordance with Table 703.2. The diameter of an individual vent shall be not less than 1-1⁄4 inches nor less than one-half the diameter of the drain to which it is connected.

Plumbing Vents

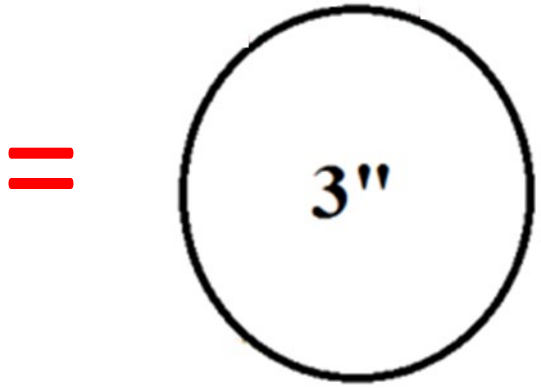
All drainage piping of each building and each connection to a public sewer or a private sewage disposal system shall be vented by means of one or more vent pipes.

Section 906.7 - Vent pipes shall be at least 2 inches in diameter through a roof and the aggregate cross-sectional area of which shall be not less than that of the largest required building sewer, as determined from Table 703.2.

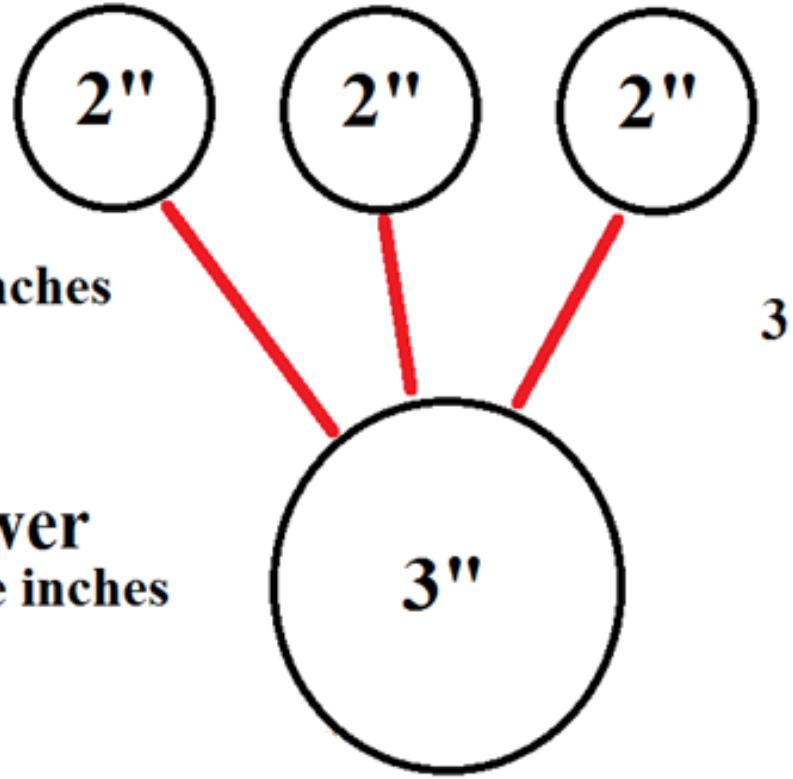
How many 2-inch vent pipes to have at least the equivalent area of a 3-inch pipe?



Area of a circle = πr^2



Aggregate Cross-sectional Area

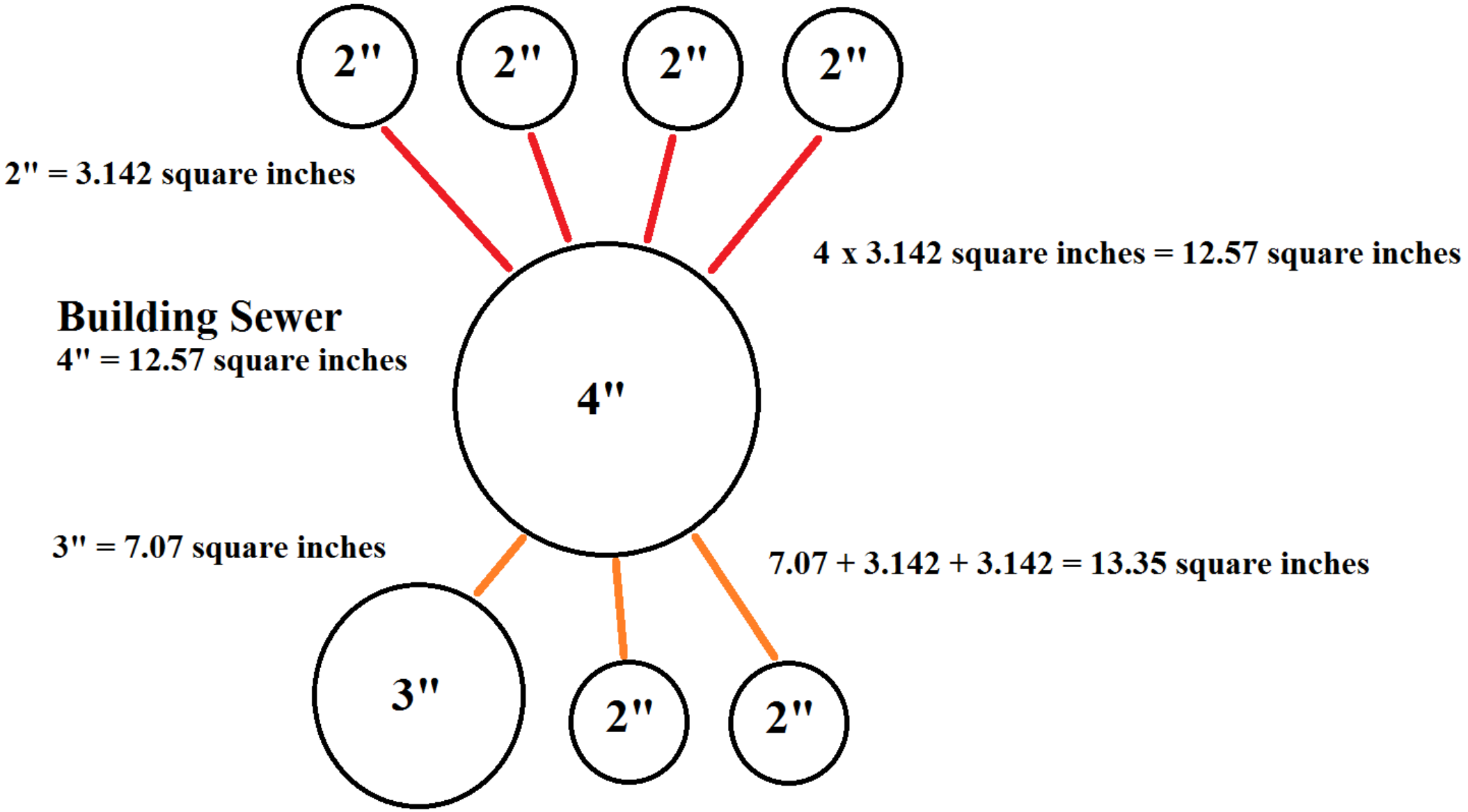


2" = 3.142 square inches

3 x 3.142 square inches = 9.426 square inches

Building Sewer
3" = 7.07 square inches

Aggregate Cross-sectional Area



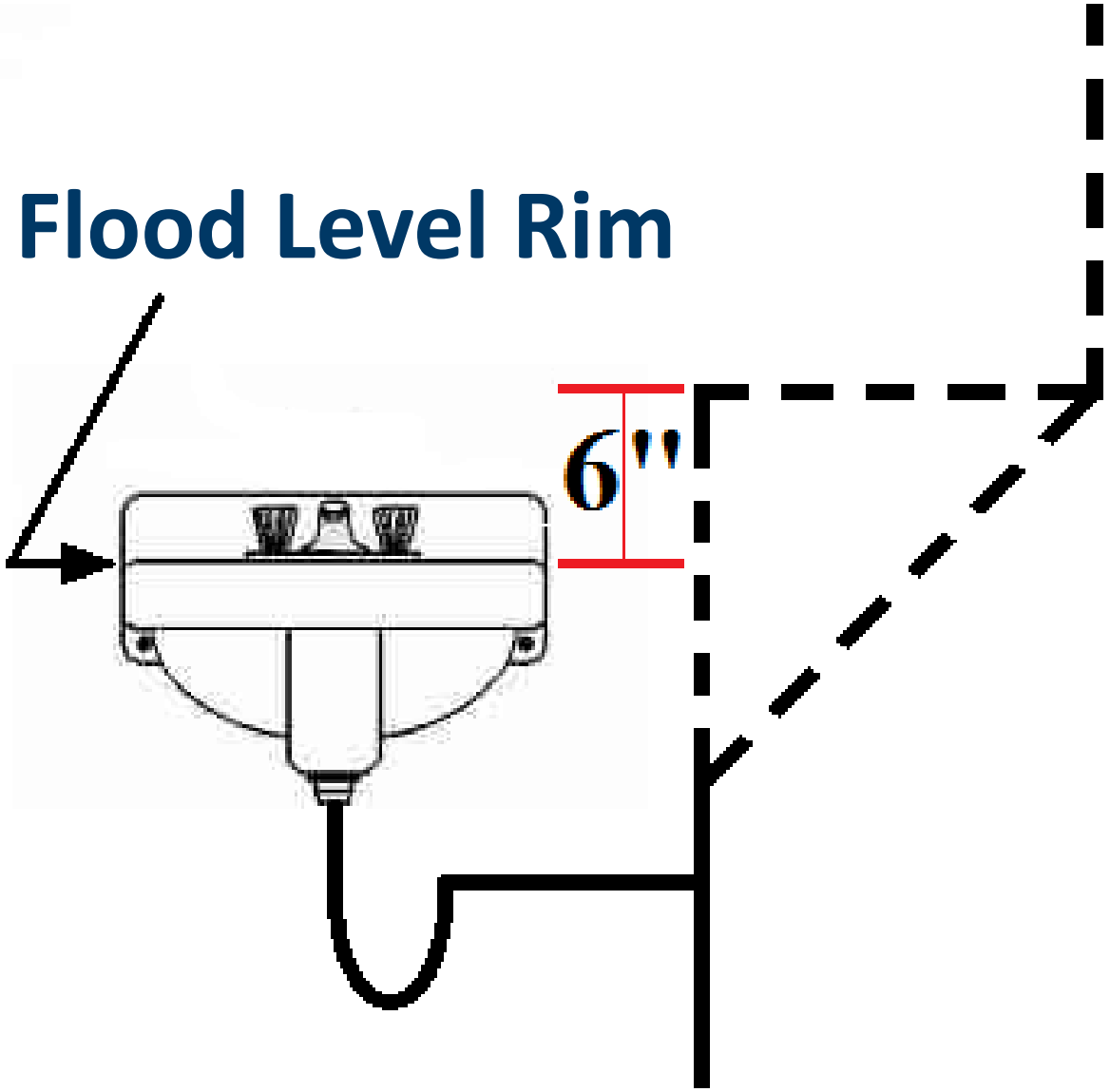
Aggregate Cross-sectional Area

905.0 Vent Pipe Grades and Connections.

- 905.1 Grade. Vent and branch vent pipes shall be free from drops or sags, and each such vent shall be level or shall be so graded and connected as to drip back by gravity to the drainage pipe it serves.

905.3 Vent Pipe Rise.

- Except as provided elsewhere in this code, each vent shall rise vertically to a point not less than 6 inches above the flood-level rim of the fixture served before offsetting horizontally.
- Where two or more vent pipes converge, each such vent pipe shall rise to a point not less than 6 inches in height above the flood-level rim of the plumbing fixture it serves before being connected to any other vent.



Flood-Level Rim

905.4 Roof Termination.

- Each vent pipe or stack shall extend through flashing and shall terminate vertically not less than 12 inches above the roof.

Air-admittance valve not allowed

Plumbing Vent Roof Termination

Plumbing Vent

906.2 Clearance.

- Each vent shall terminate not less than 10 feet from, or not less than 3 feet above, an openable window, door, opening, air intake, or vent shaft, or not less than 3 feet in every direction from a lot line, alley and street.

Plumbing Vent Roof Termination

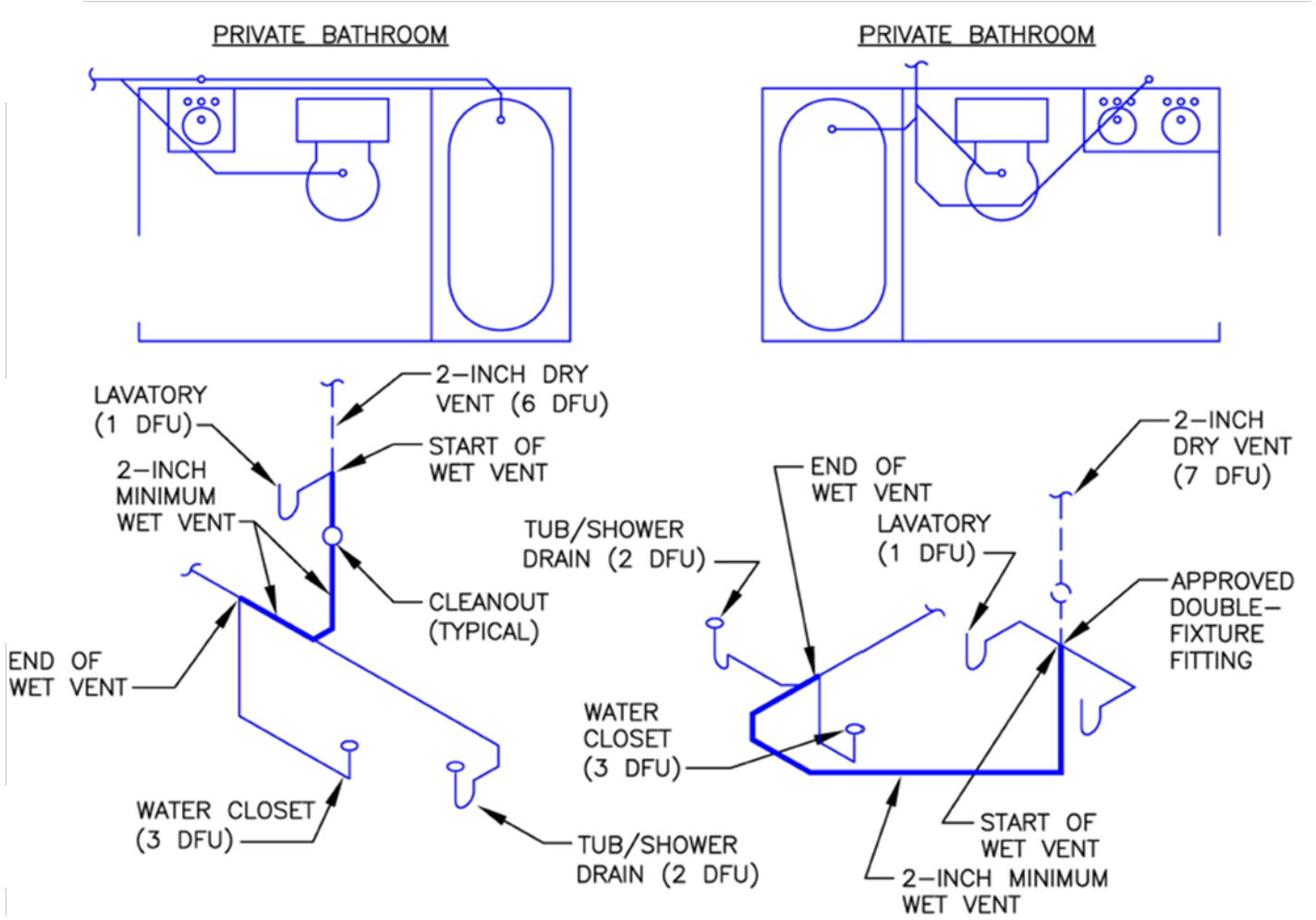
906.7 Frost or Snow Closure.

- Vent terminals shall be not less than 2 inches in diameter, but in not smaller than the required vent pipe. Any change in diameter shall be made inside the building not less than 12 inch below the roof in an insulated space and terminate not less than 12 inches above the roof.

Plumbing Vent

908.0 Wet Venting.

- 908.1 Vertical Wet Venting.
- 908.2 Horizontal Wet Venting a Bathroom Group.



The wet vent must be sized based on the fixture unit discharge into the wet vent. The wet vent must be at least 2 inches in size for 4 DFU or less, and not less than 3 inches in size for 5 DFU or more.

One bathroom group located on the same floor. The length of trap arms must not exceed the limits of Table 1002.2.

The water closet fixture drain connection must be downstream of all fixture drain connections to the horizontal wet vent.

Only one wet-vented fixture drain shall discharge upstream of the dry-vented fixture drain connection.

Additional fixtures must discharge downstream of the wet vent system and they must be conventionally vented.

The dry vent must be sized based on the total fixture units discharging into the wet vent.

Section 908.2 - Horizontal Wet Vent Requirements

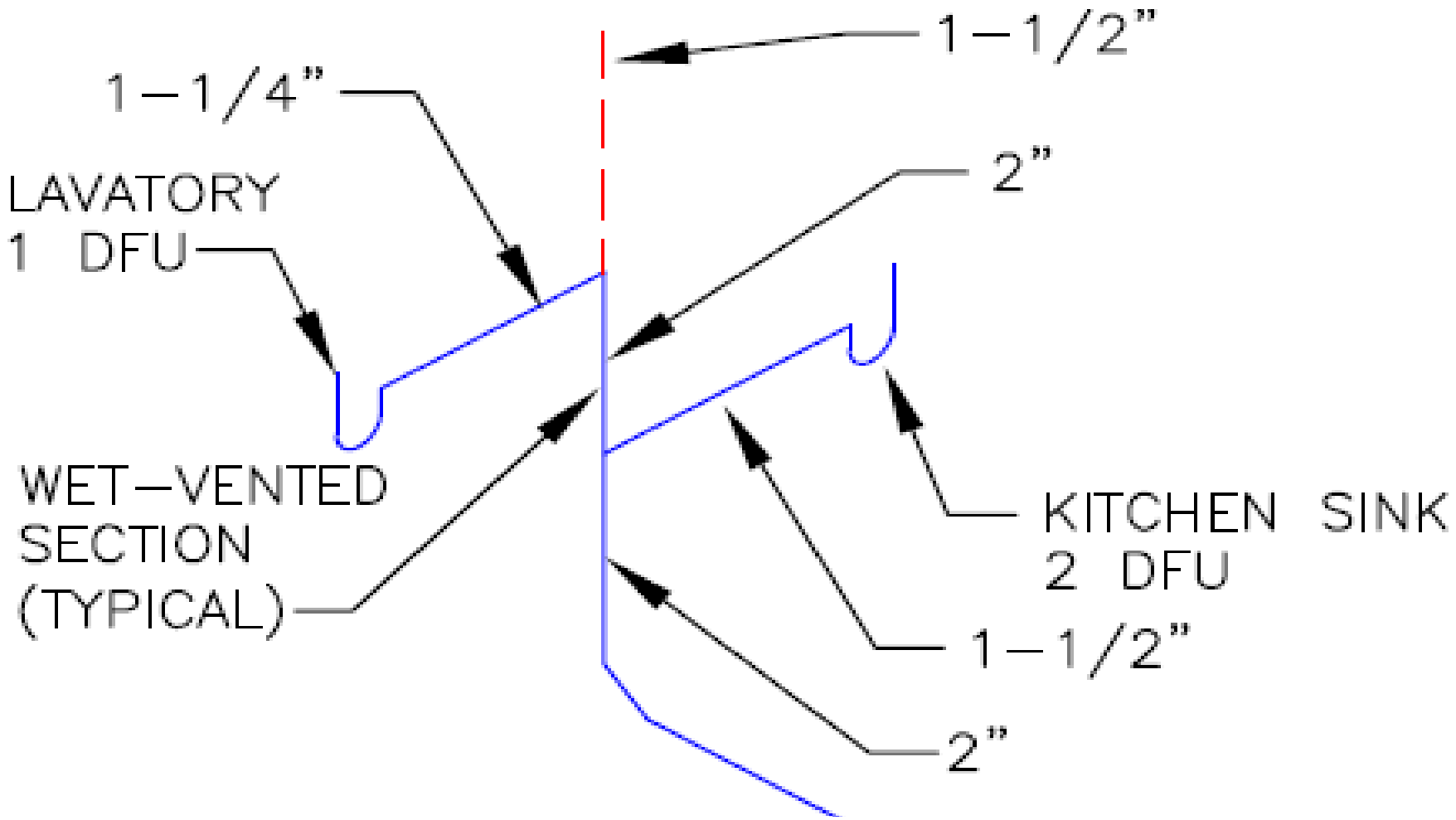
Limited to vertical drain receiving the trap of 1 or 2 DFU upper fixtures.

Limited to the same story and must not exceed 6 feet developed length.

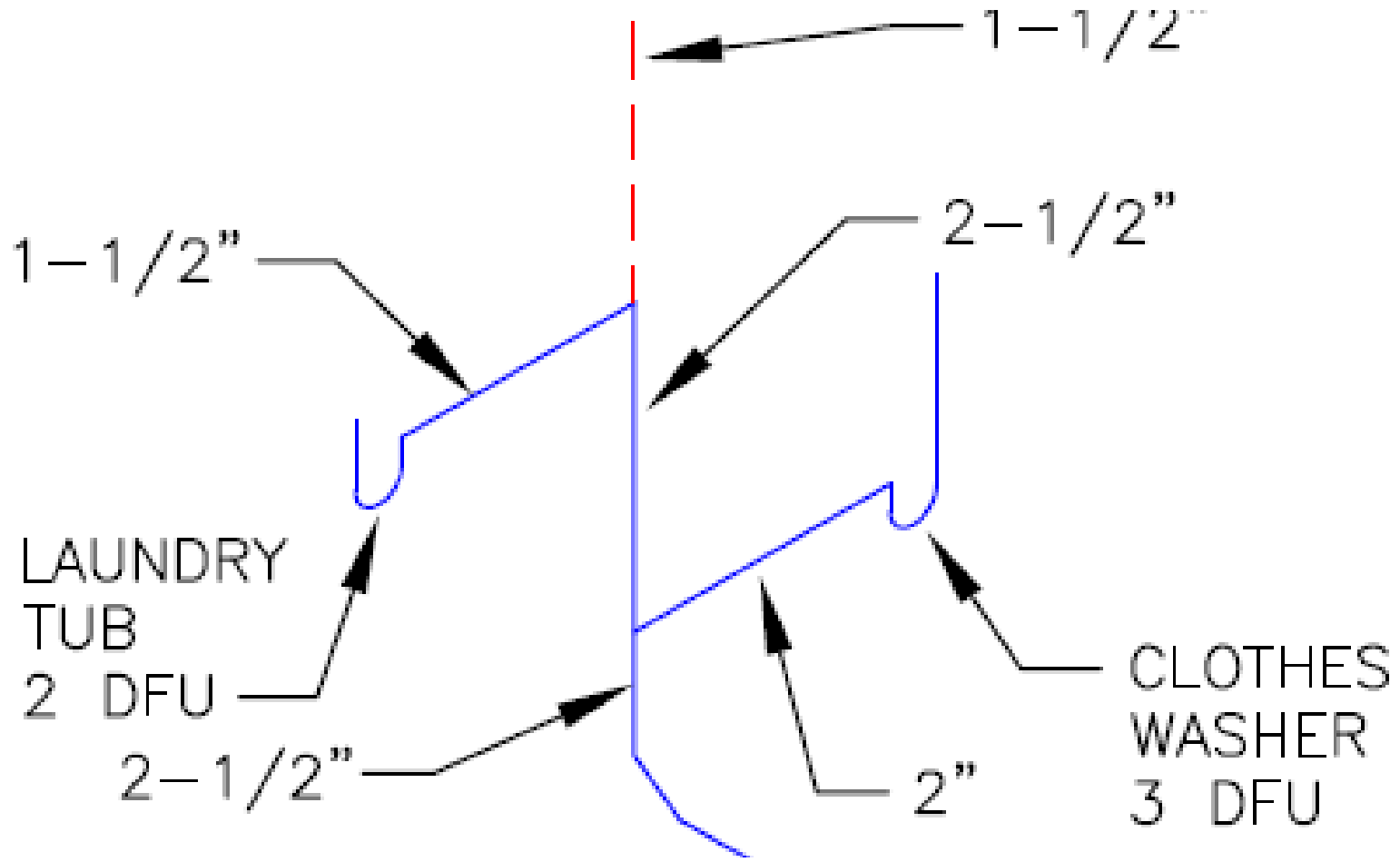
Each wet-vented section must be at least 2-inches, but at least one pipe size greater than the minimum required by upper fixture.

Wet vented section must also be at least one pipe size larger than required for the sum of the fixtures served by the wet-vented section.

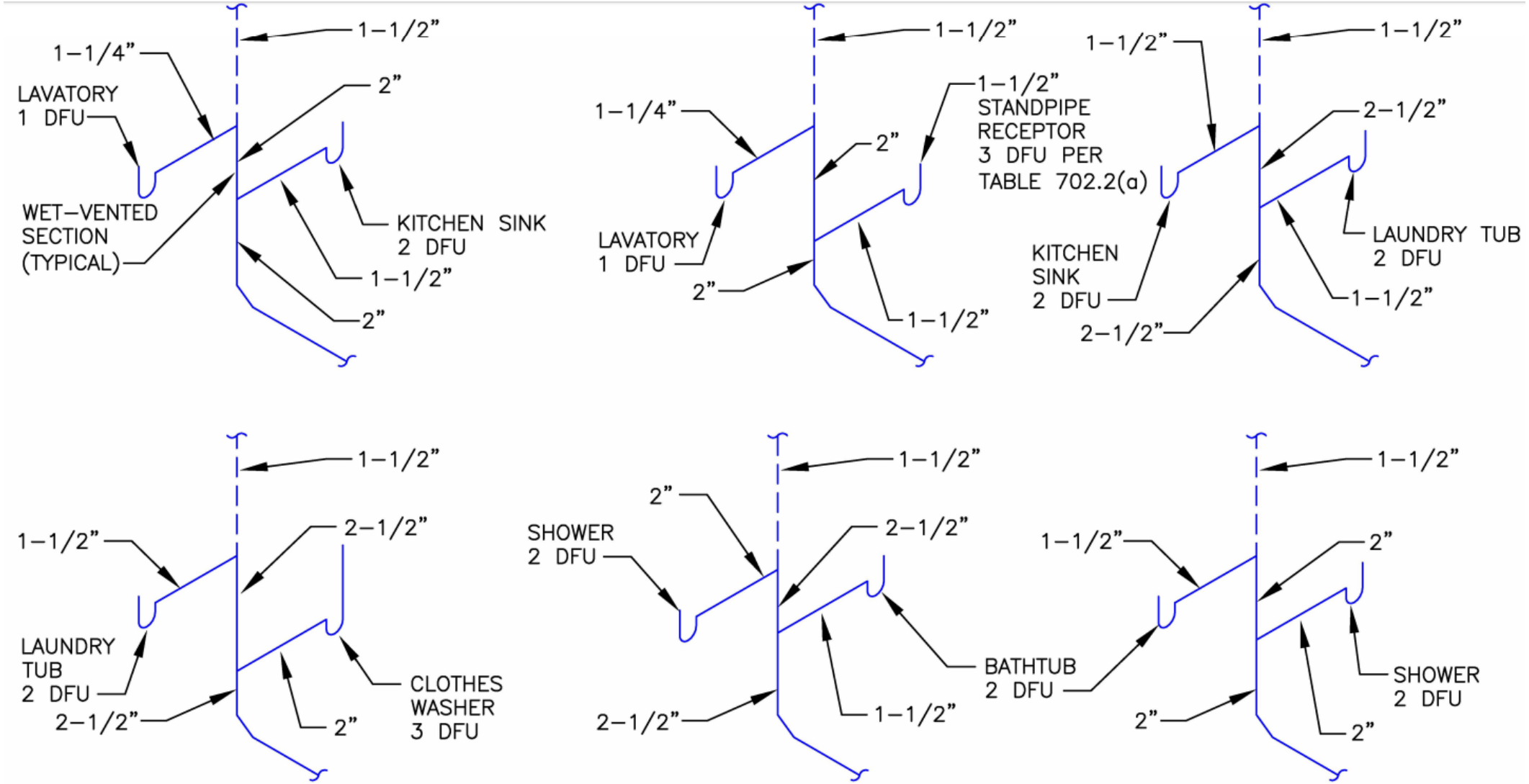
Section 908.1 - Vertical Wet Vent Requirements



Vertical Wet Venting



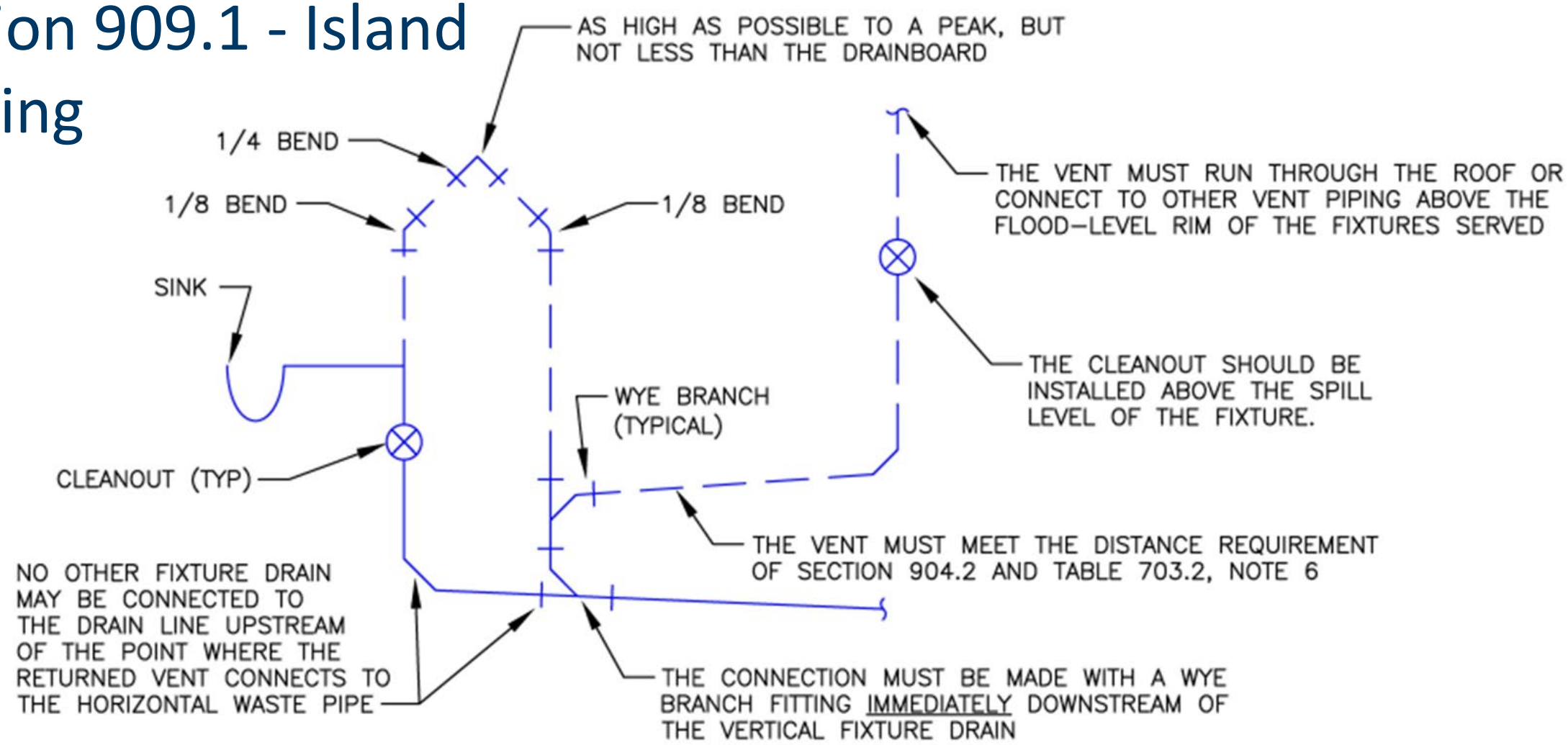
Vertical Wet Venting



NOTE: ALL FIXTURES SHOWN ARE PRIVATE USE, ALL PIPE SIZES SHOWN ARE MINIMUM PIPE SIZES REQUIRED, AND NOT ALL REQUIRED CLEANOUTS ARE SHOWN

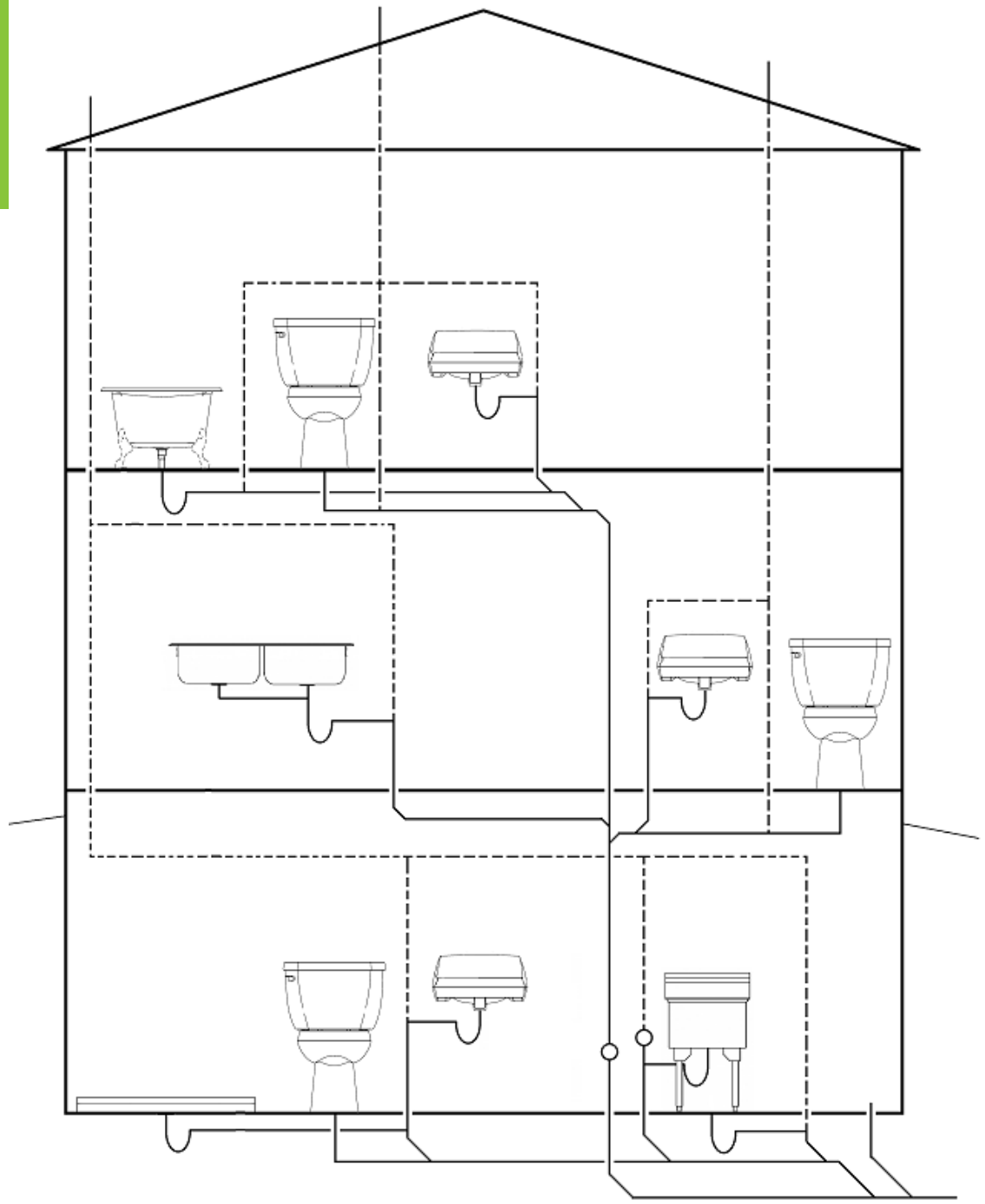
Vertical Wet Venting

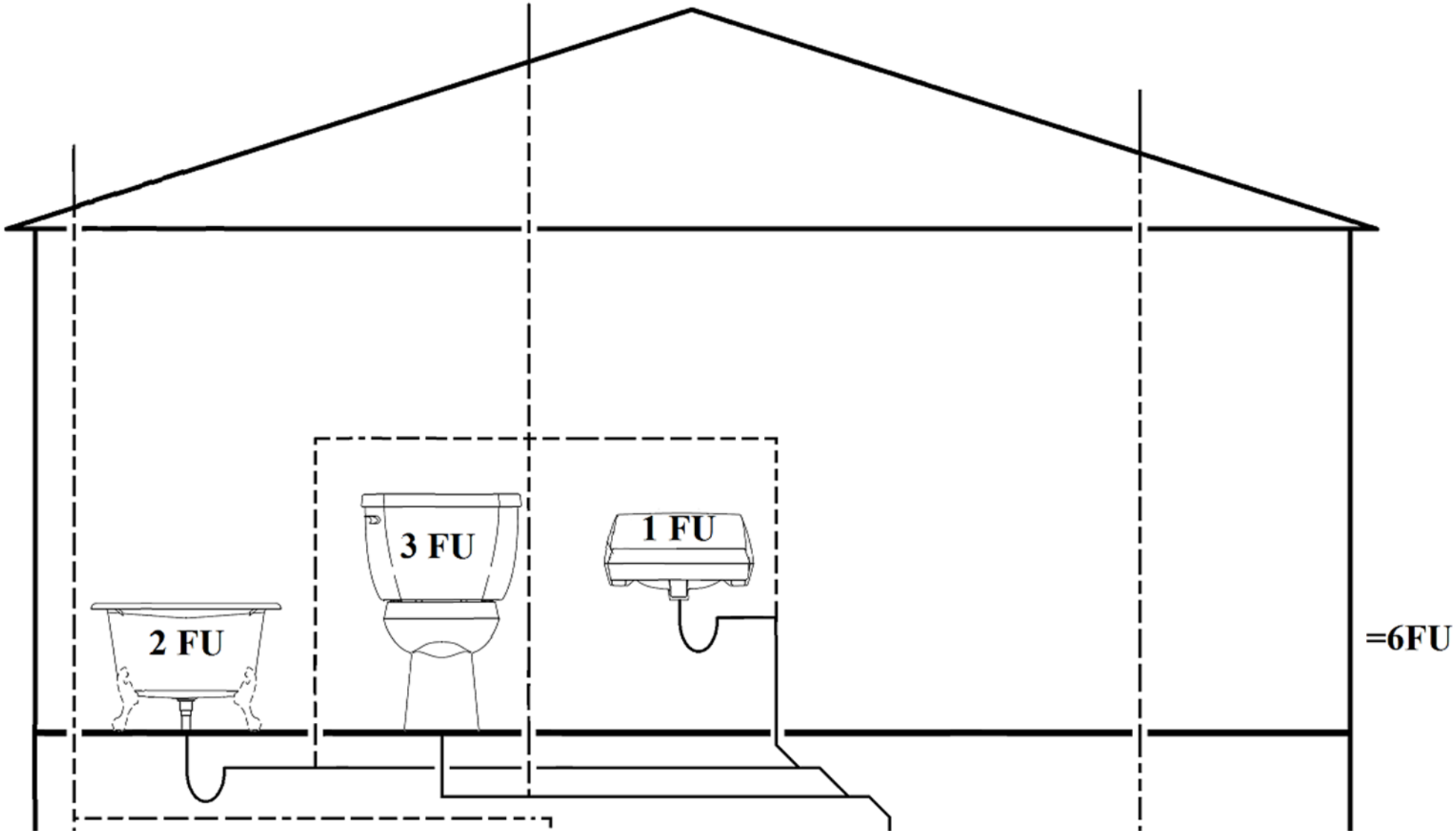
Section 909.1 - Island Venting



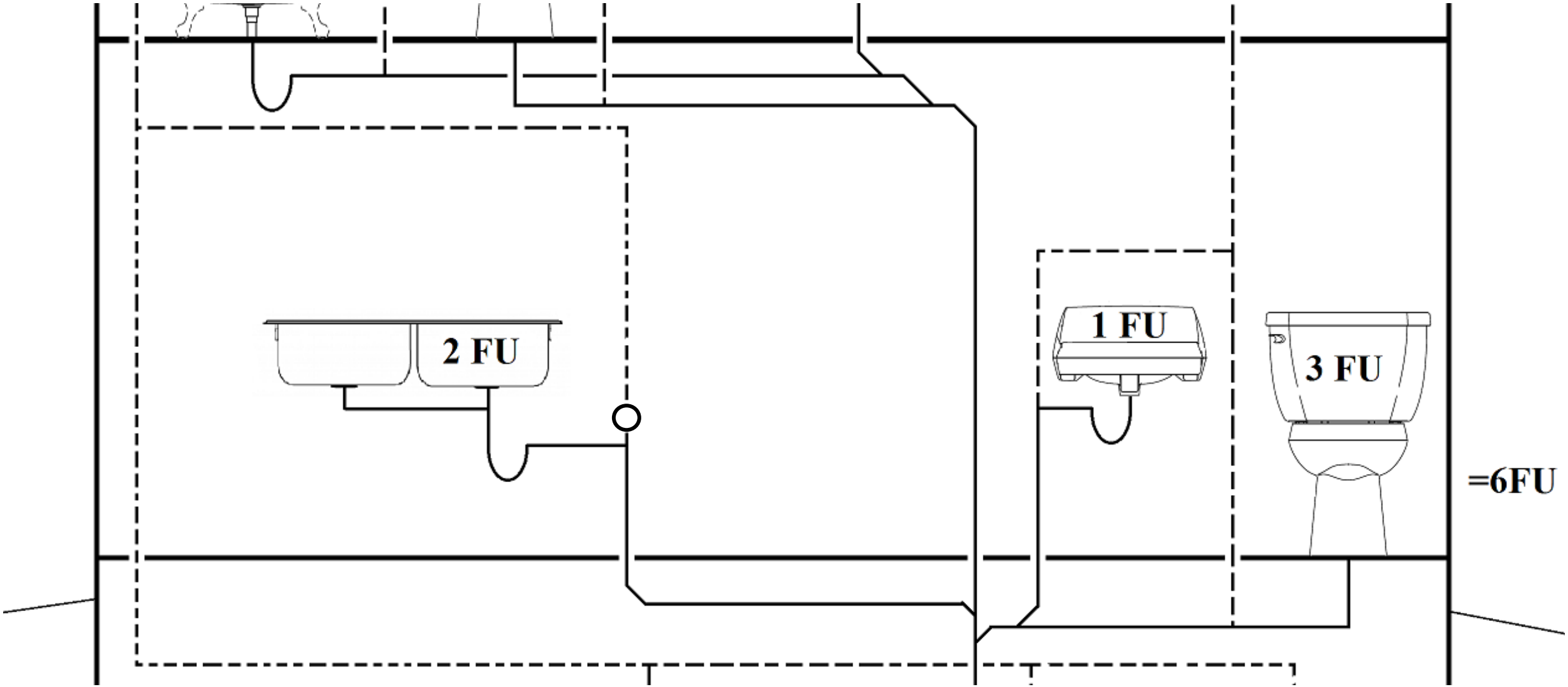
- Drainage fittings must be used for all portions located below the floor
- Horizontal drain and vent piping must be sloped at least 1/4-inch per foot
- Traps for island sinks must be roughed in above the floor

Drain, Waste & Vent Sizing

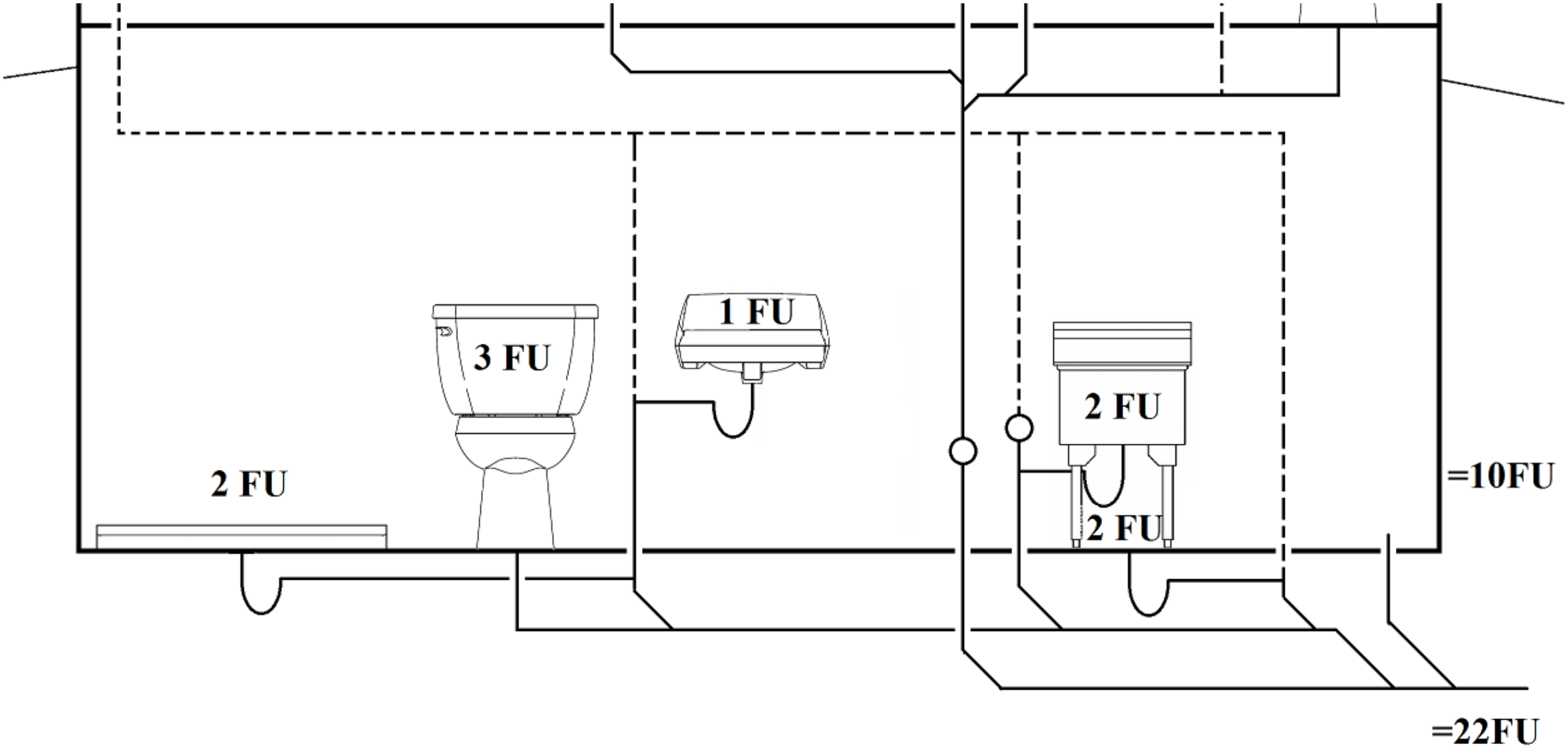




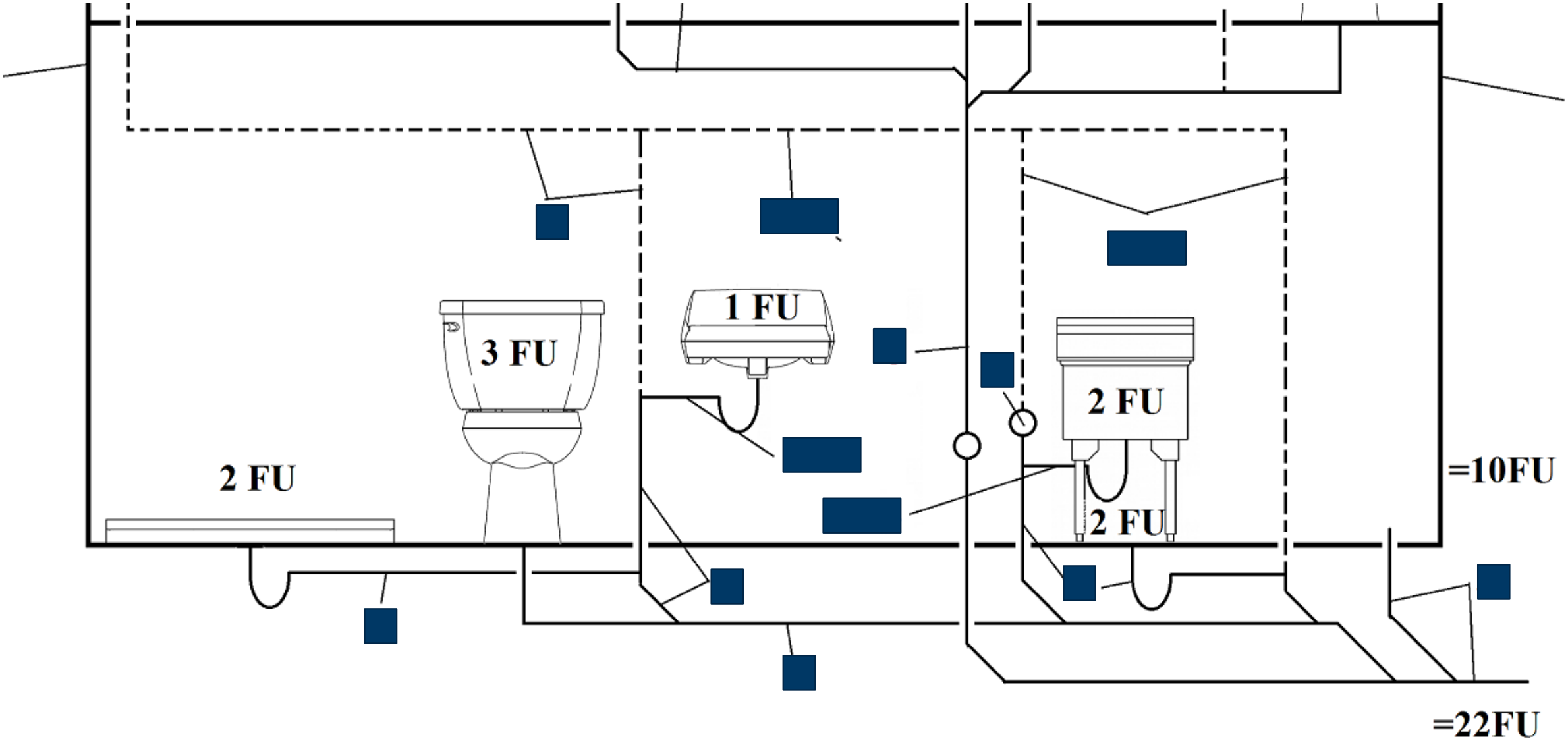
Drain, Waste & Vent Sizing



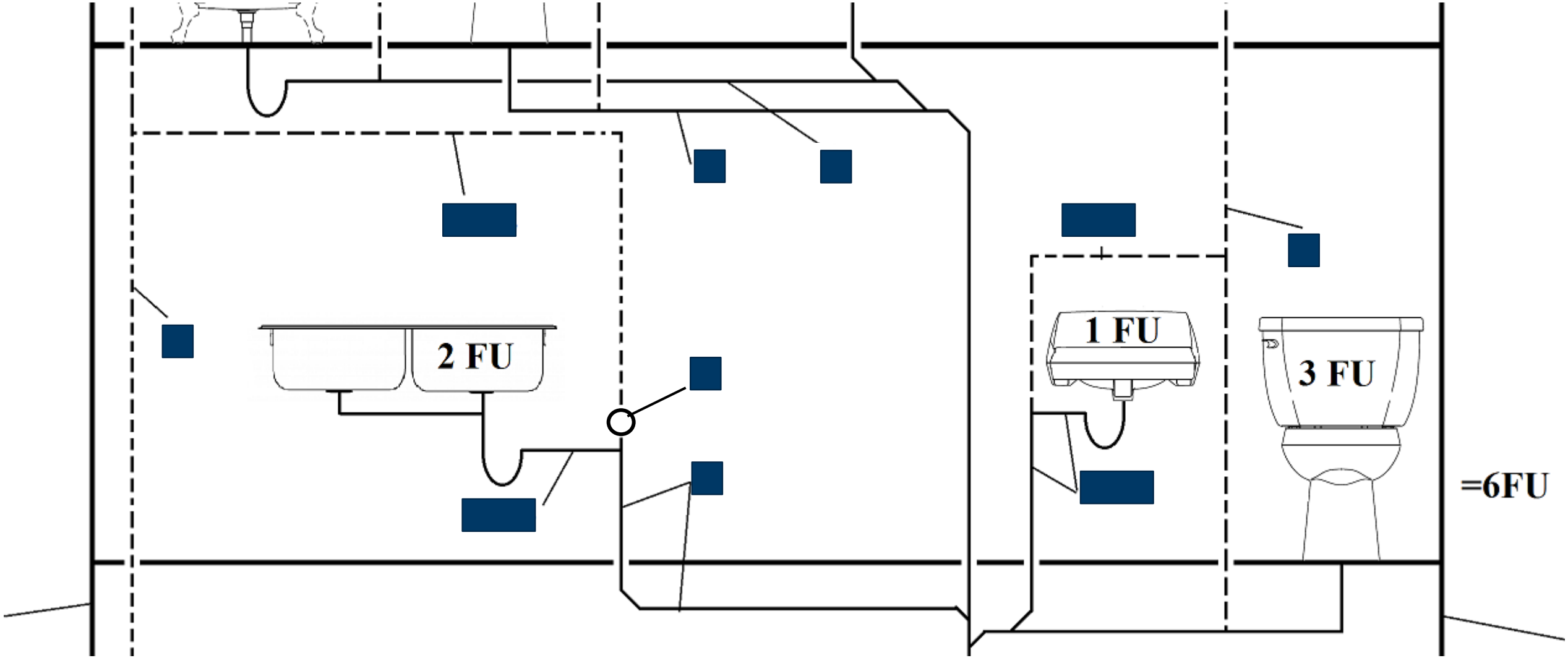
Drain, Waste & Vent Sizing



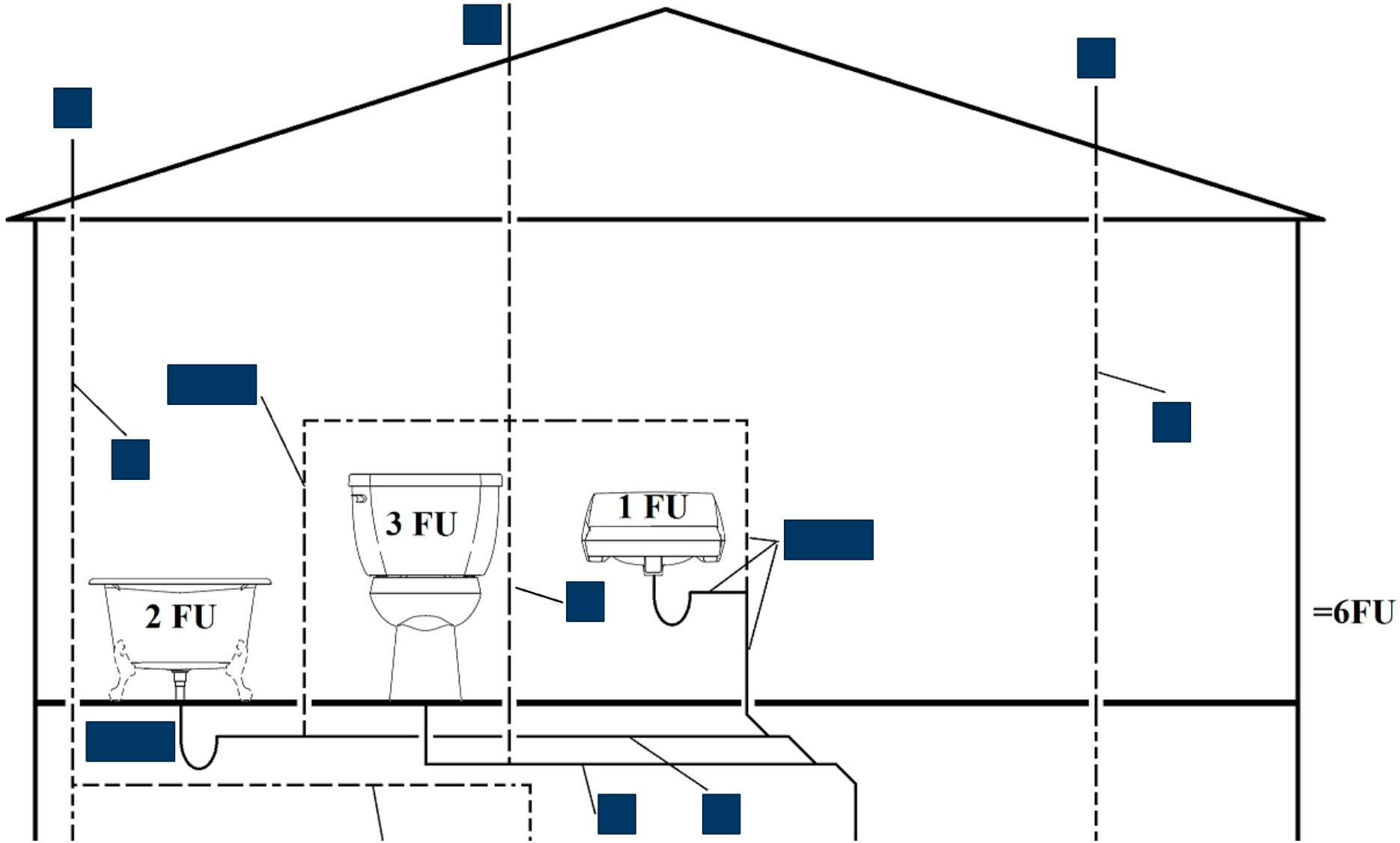
Drain, Waste & Vent Sizing



Drain, Waste & Vent Sizing

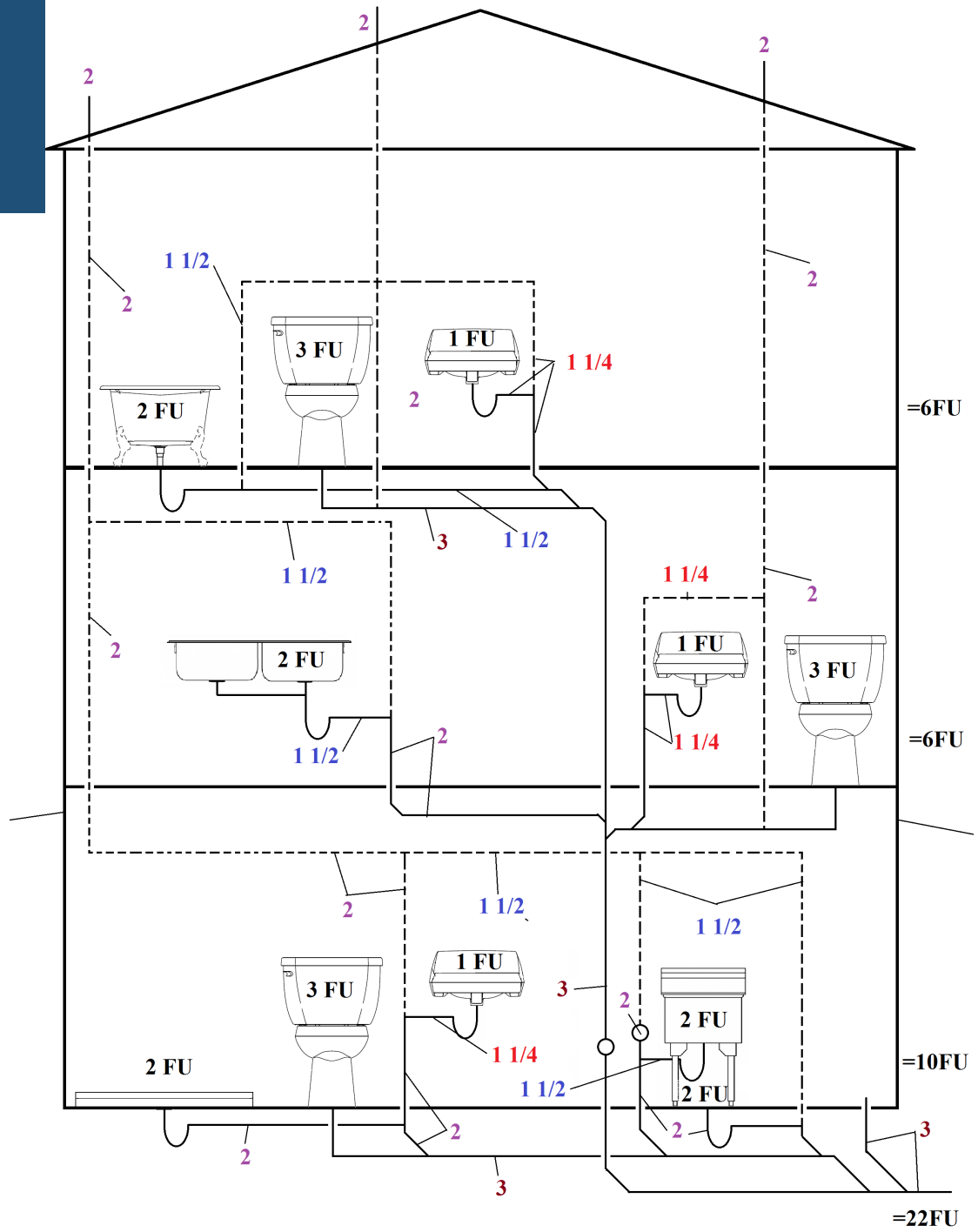


Drain, Waste & Vent Sizing



Drain, Waste & Vent Sizing

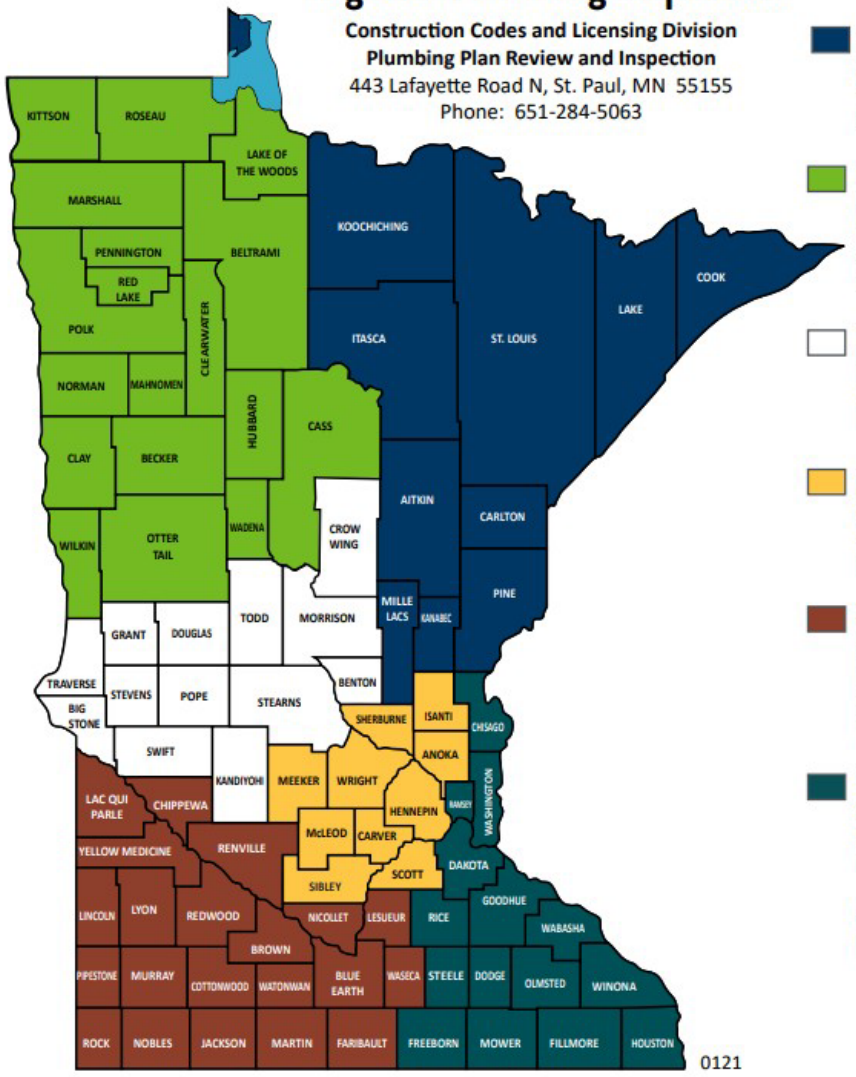
Drain, Waste & Vent Sizing



Minnesota Department of Labor & Industry

Regional Plumbing Inspectors

Construction Codes and Licensing Division
Plumbing Plan Review and Inspection
443 Lafayette Road N, St. Paul, MN 55155
Phone: 651-284-5063



0121

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Plumbing.

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

Plumbing System.

Includes all potable water, building supply, and distribution pipes; all plumbing fixtures and traps; all drainage and vent pipes; and all building drains and building sewers, including their respective joints and connections, devices, receptors, and appurtenances within the property lines of the premises and shall include potable water piping, potable water treating or using equipment, and nonpotable water piping serving plumbing fixtures.

What to look for in a Plumbing Inspection…

609.1 Installation.

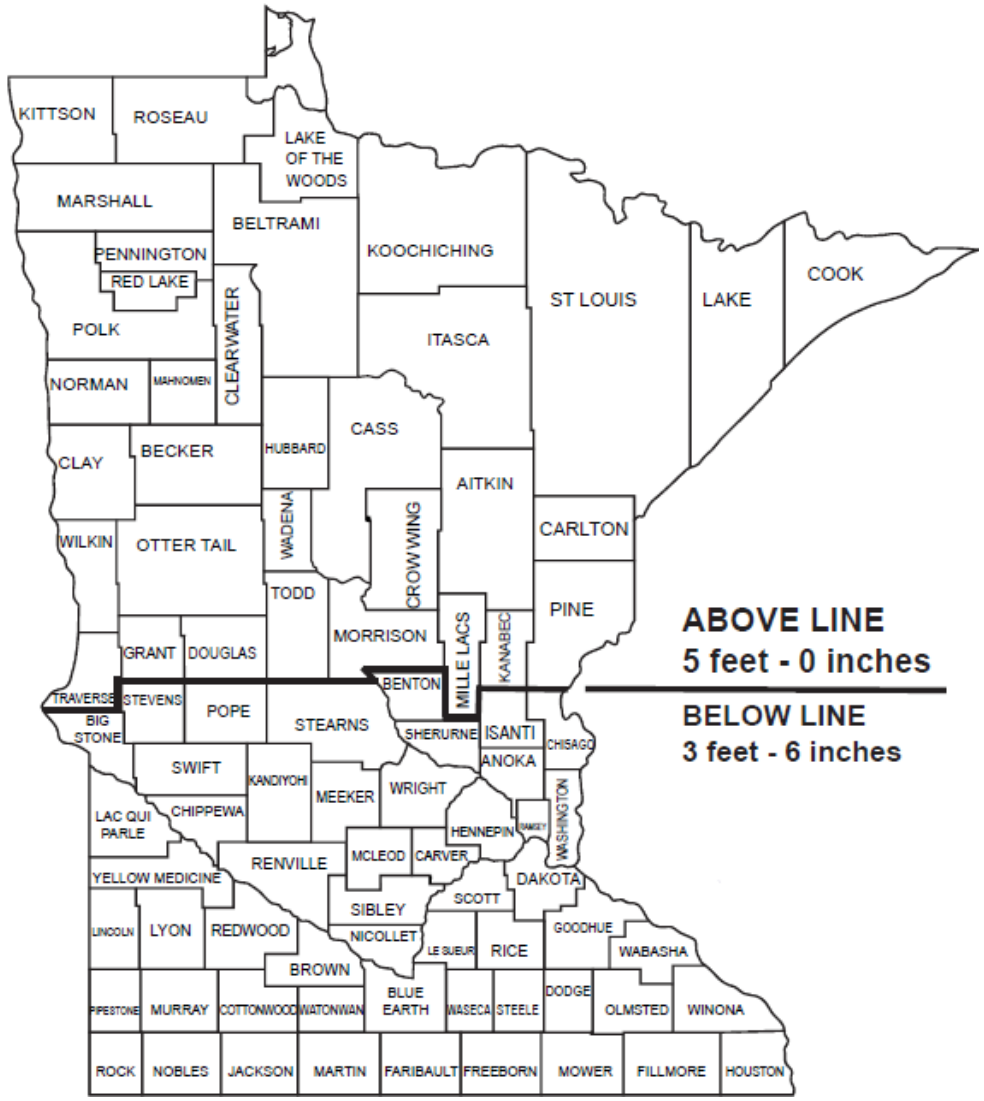
Building supply and yard piping shall be located not less than 12 inches (305 mm) below the maximum local frost depth, in accordance with Section 312.6, or an alternative approved by the Authority Having Jurisdiction. The cover shall be not less than 12 inches (305 mm) below finish grade.

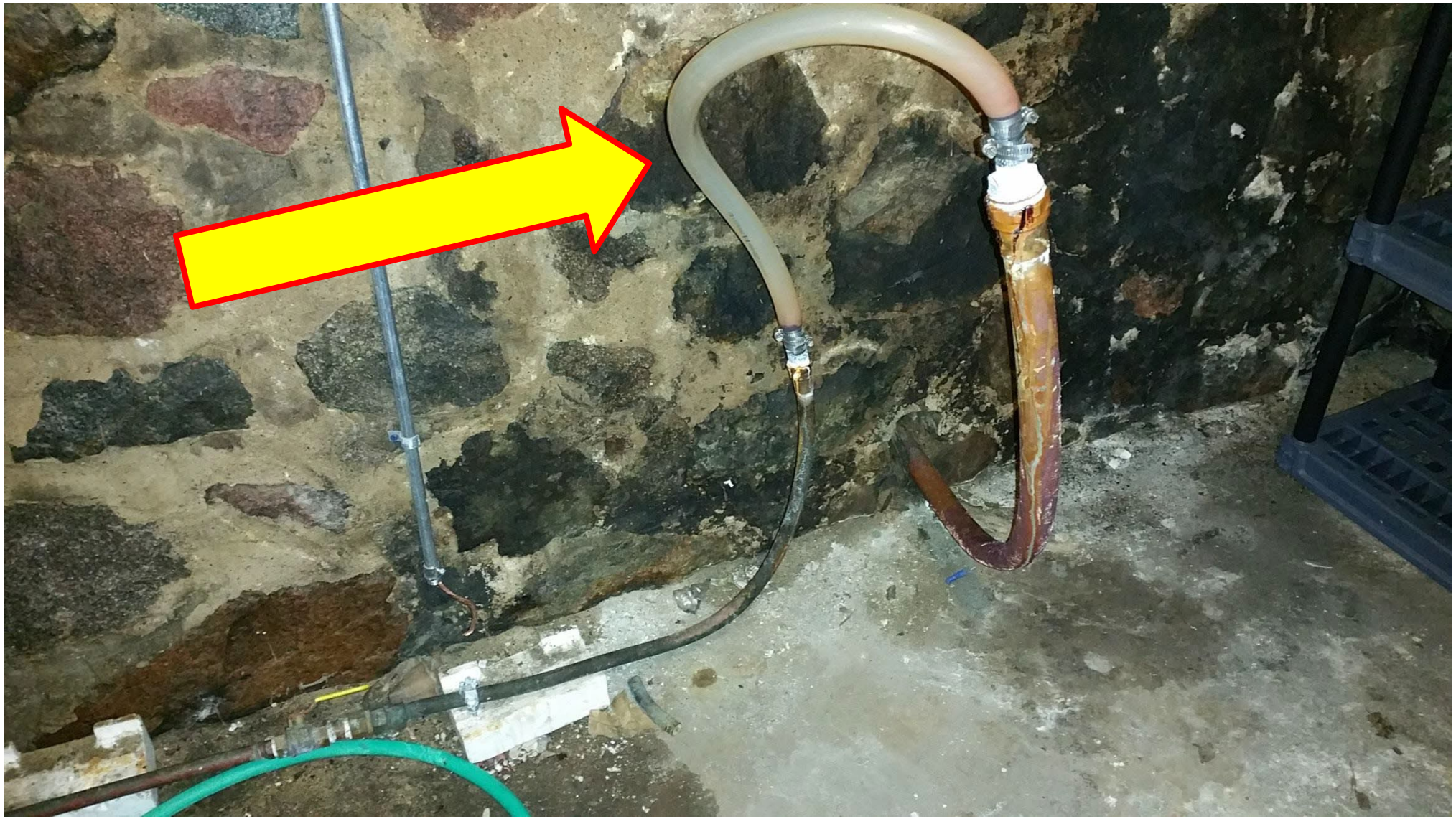
312.6 Freezing Protection.

No water, soil, or waste pipe shall be installed or permitted outside of a building, in attics or crawl spaces, or in an exterior wall unless, where necessary, adequate provision is made to protect such pipe from freezing.

FROST DEPTH

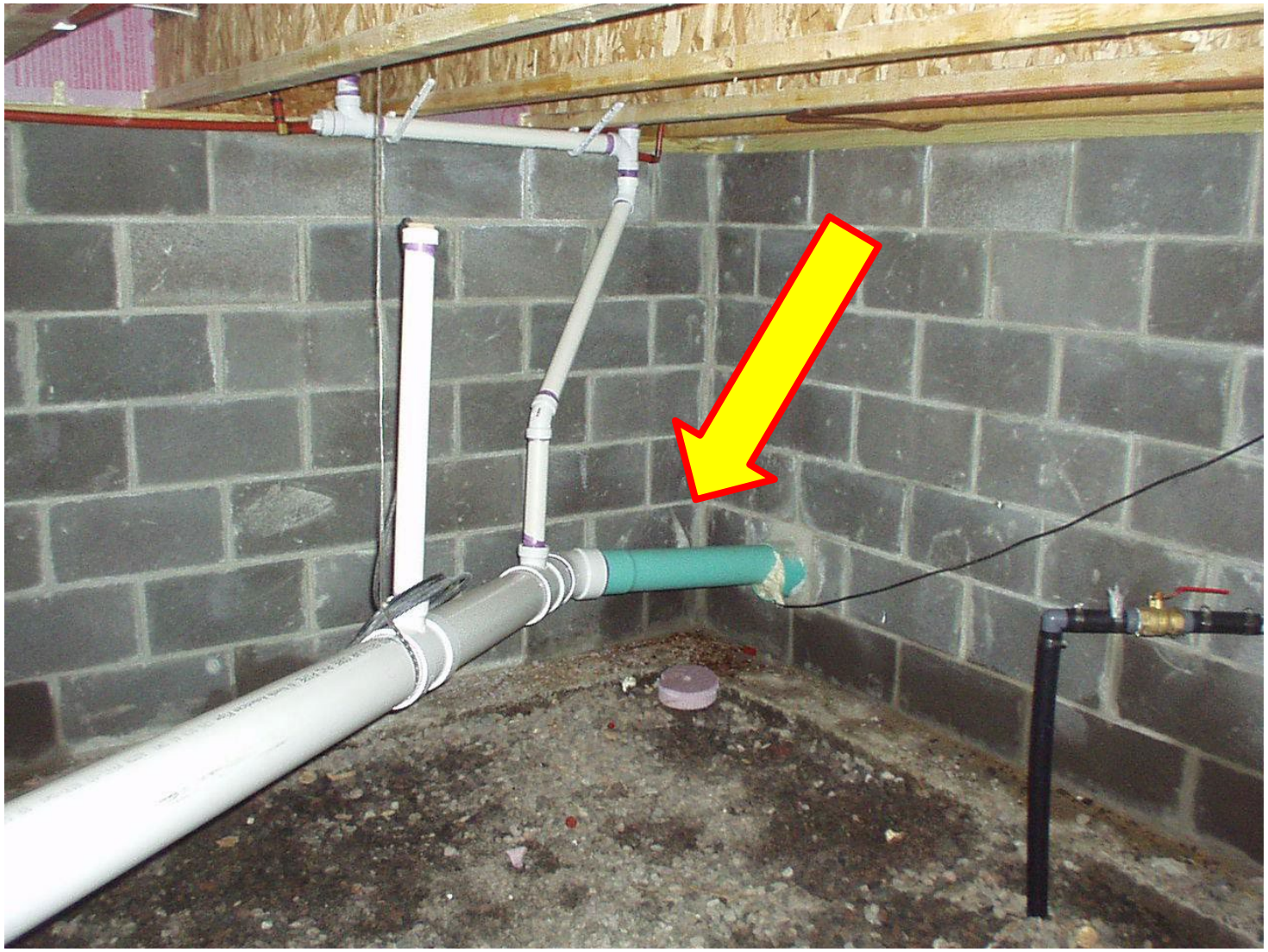
MSBC RULES 1303.1600





Water Service

Sanitary Sewer



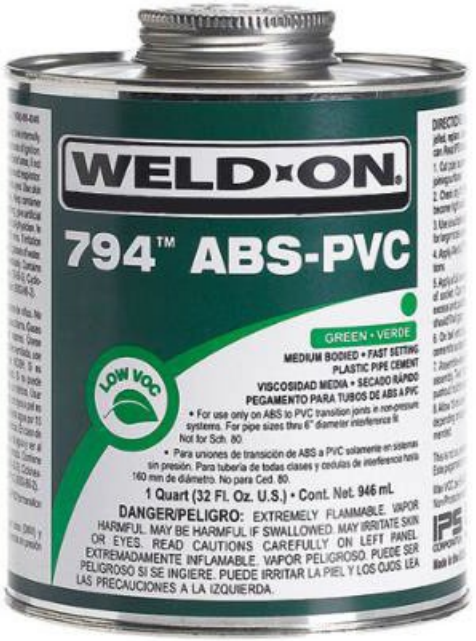
Materials

2020 Minnesota Plumbing Code, Chapter 4714

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

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

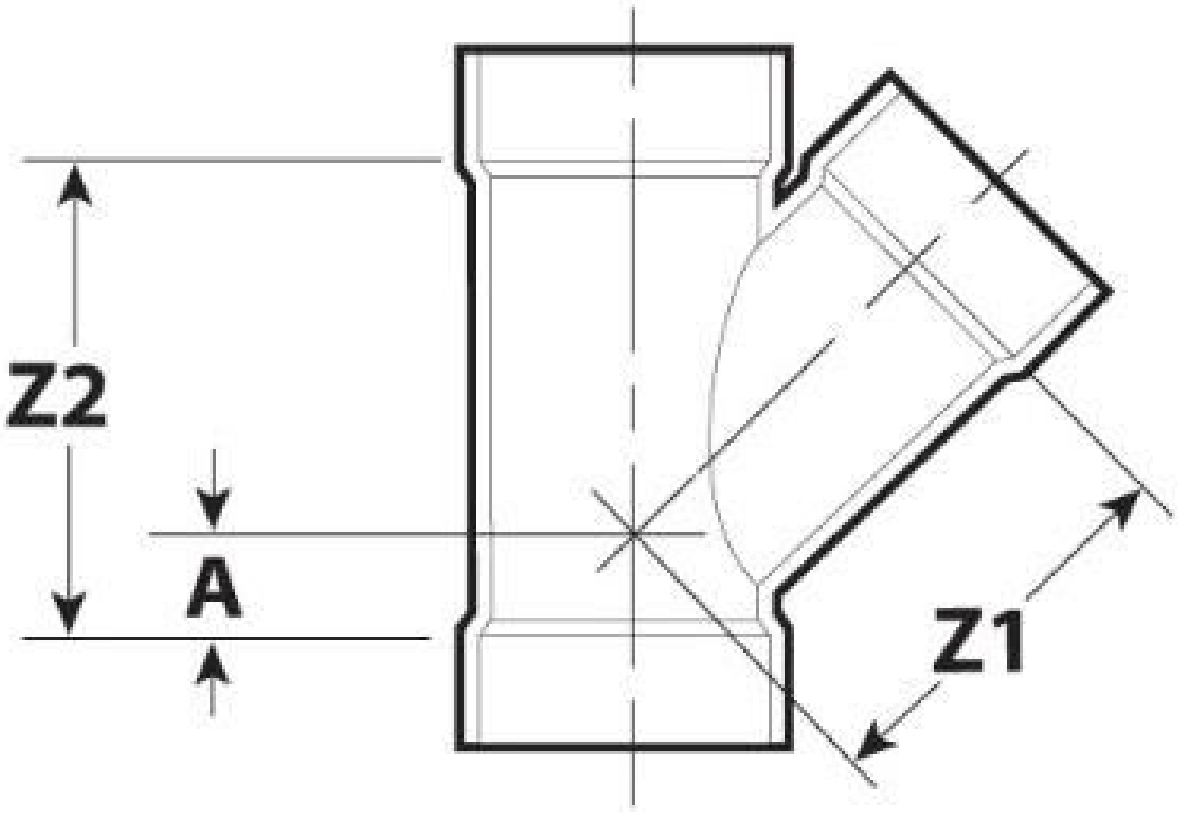
Glues & Primers



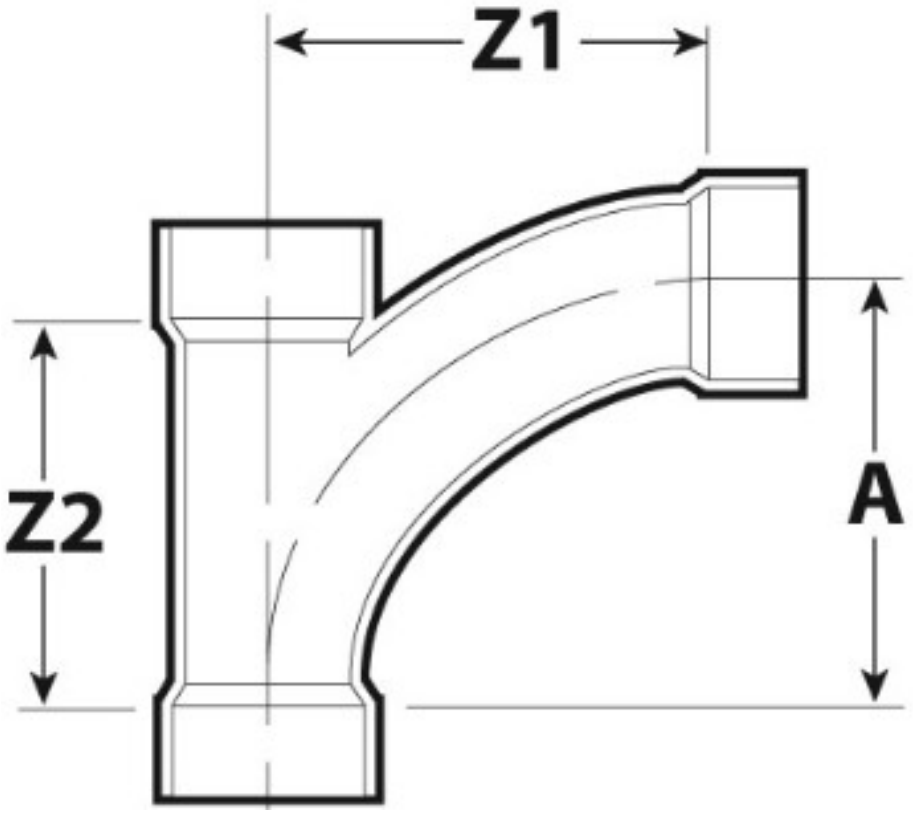
705.10.4 Transition Joint. A solvent cement transition joint between ABS and PVC building drain and building sewer shall be made using listed transition solvent cement.

Glues & Primers

Fittings

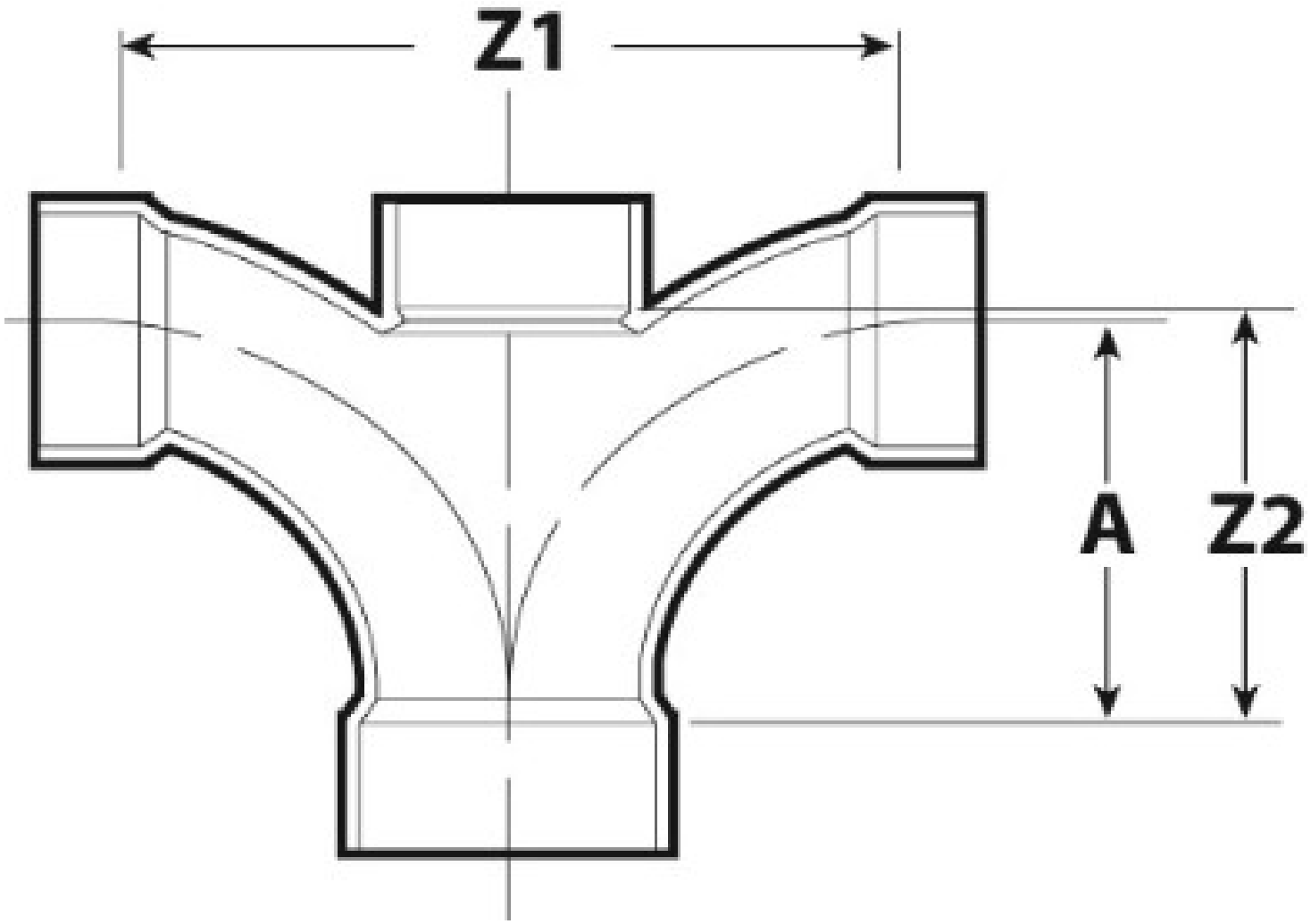


WYE

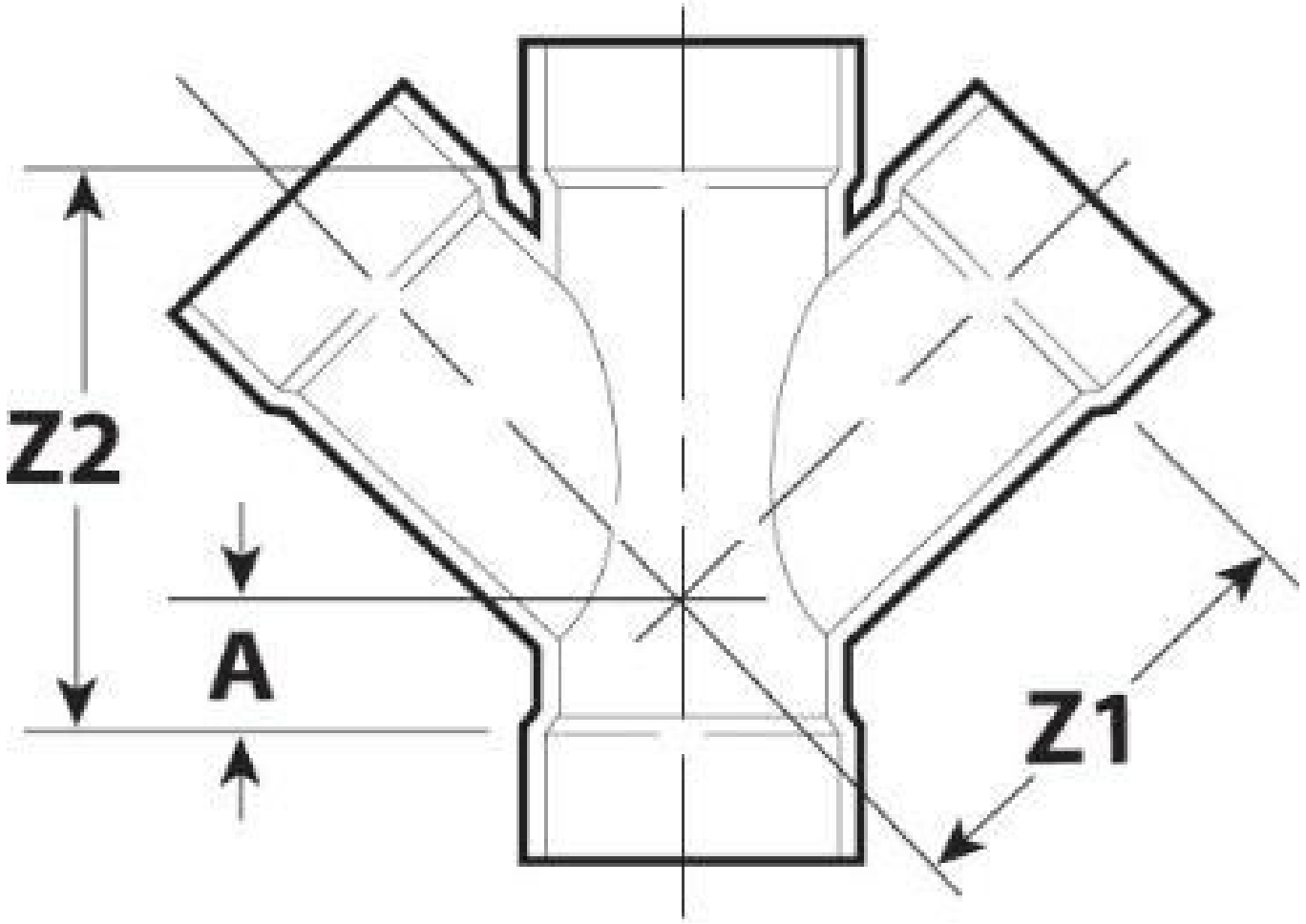


LONG TURN WYE

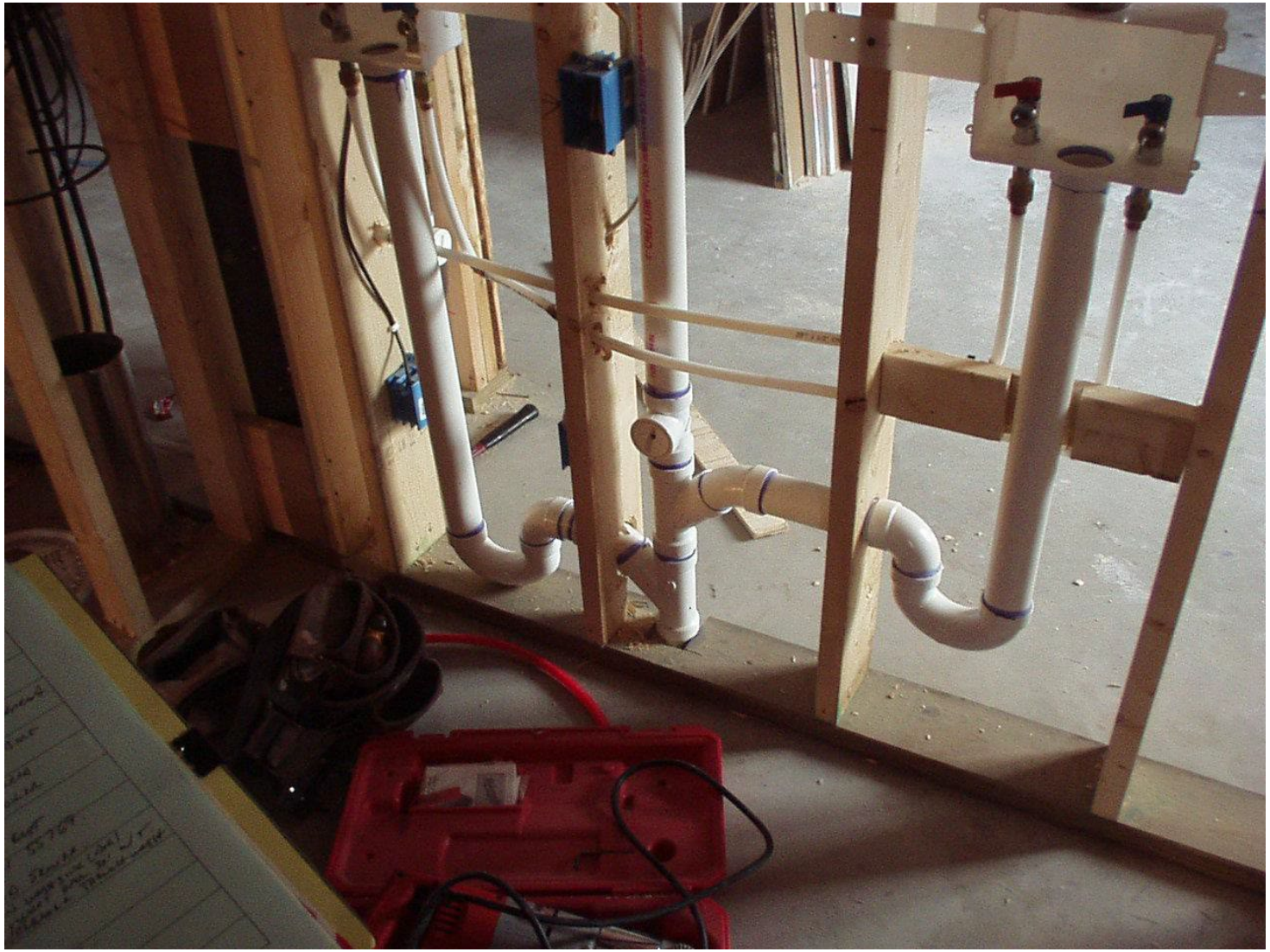
Fittings



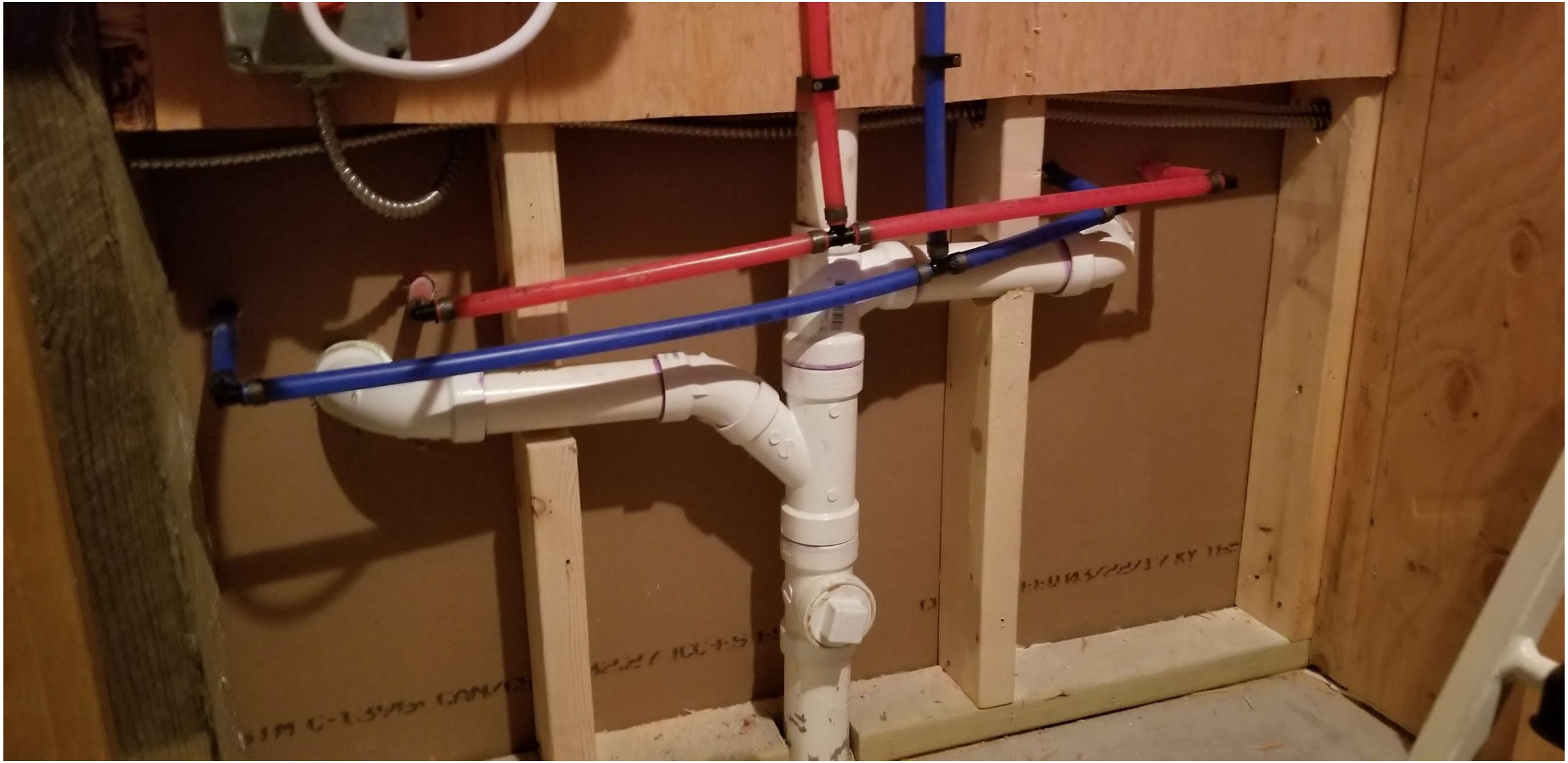
Double Fixture Fitting



Double WYE

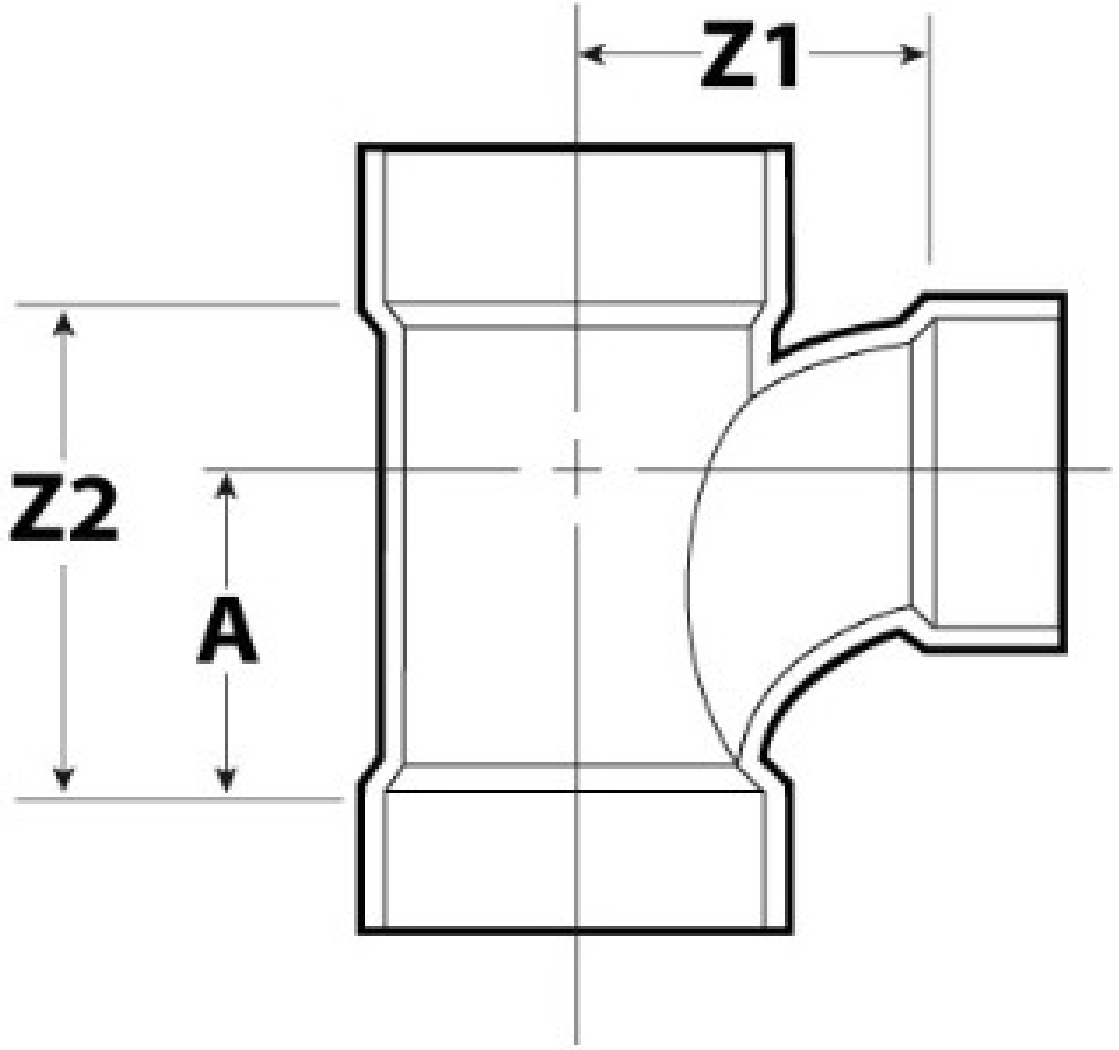


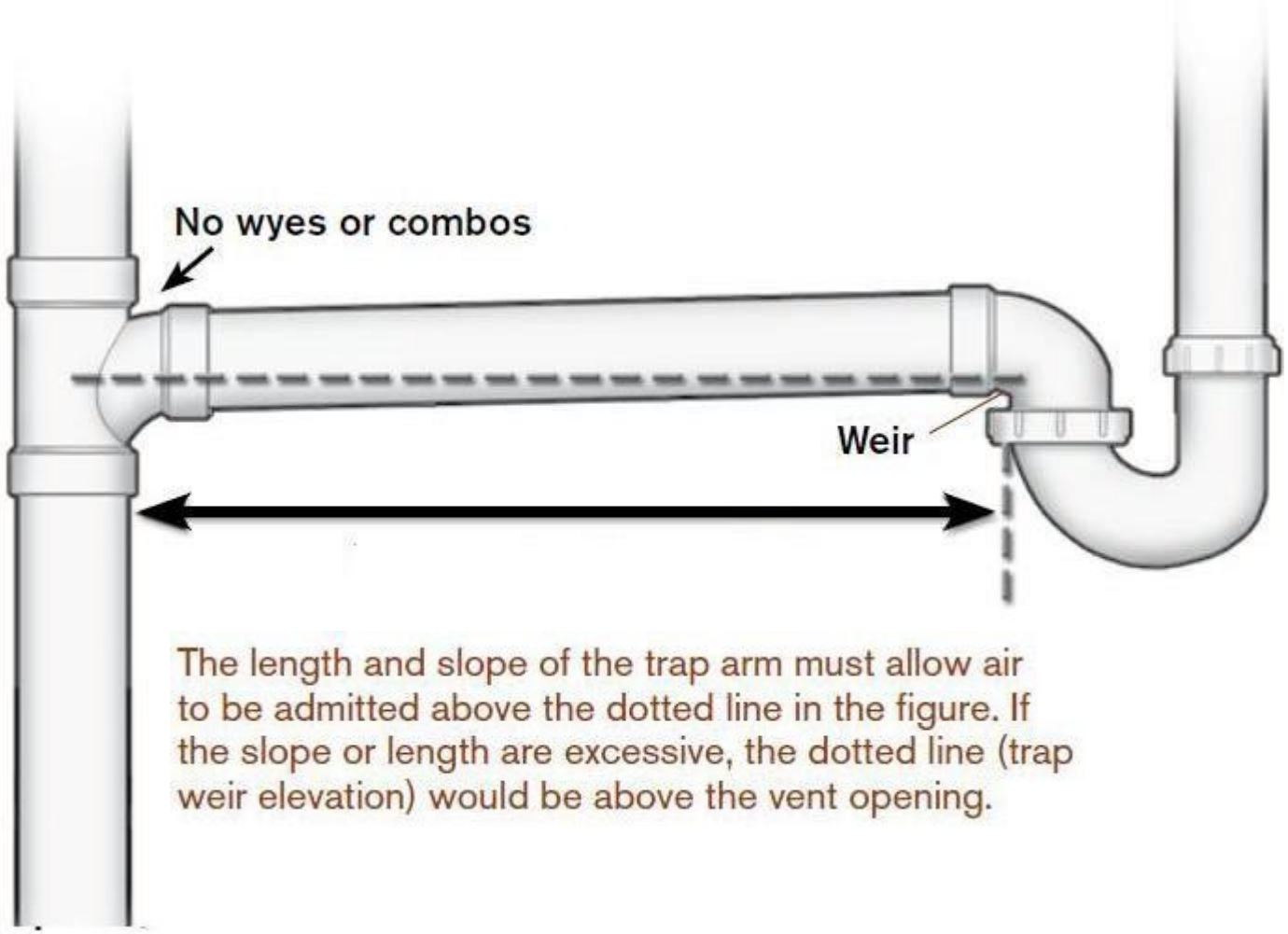
Fittings



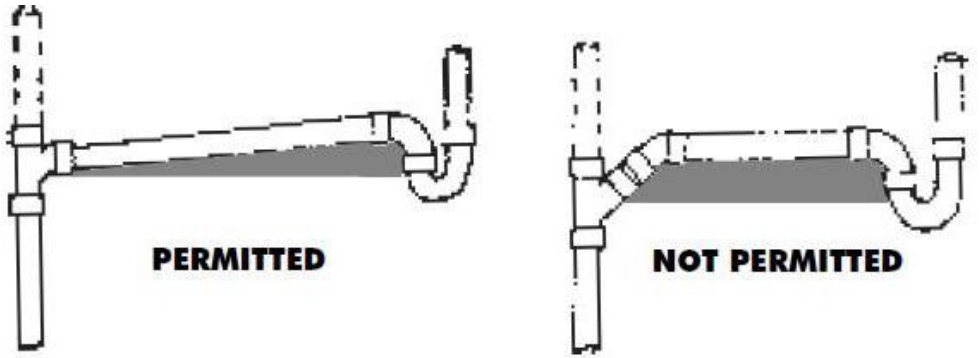
Fittings

Sanitary TEE



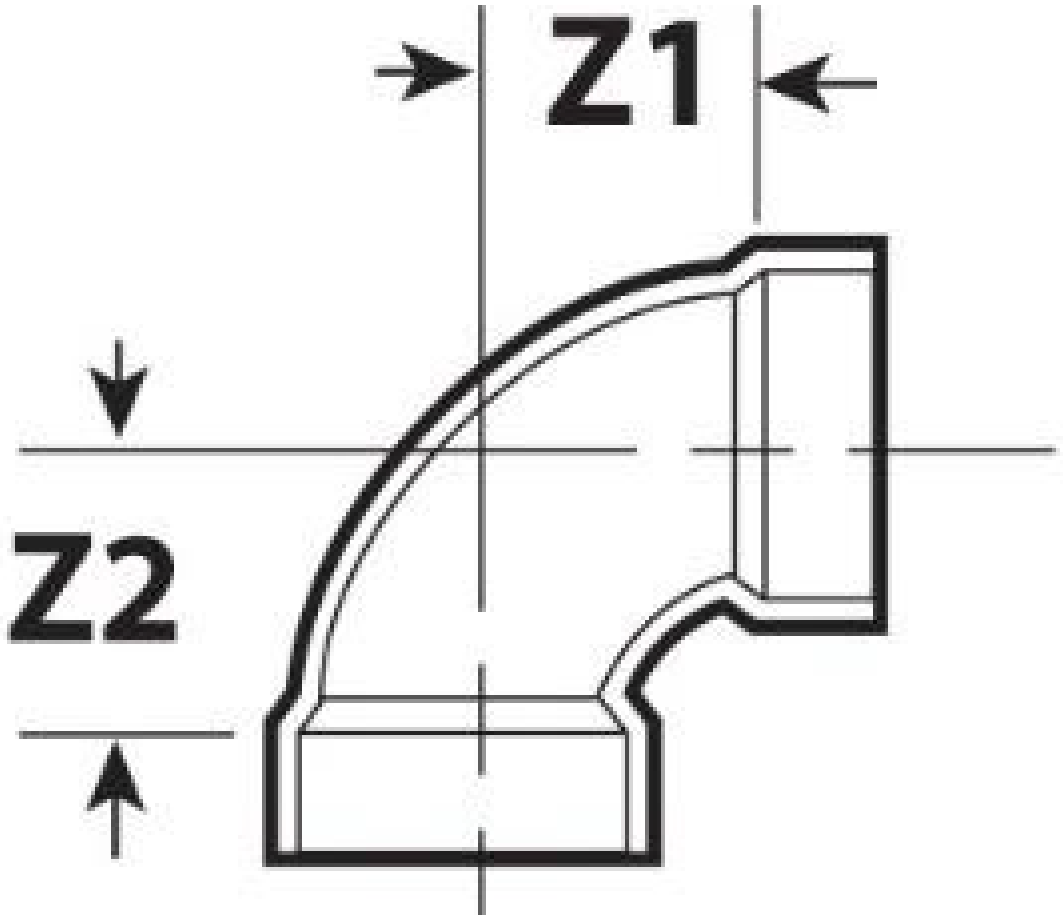


The length and slope of the trap arm must allow air to be admitted above the dotted line in the figure. If the slope or length are excessive, the dotted line (trap weir elevation) would be above the vent opening.

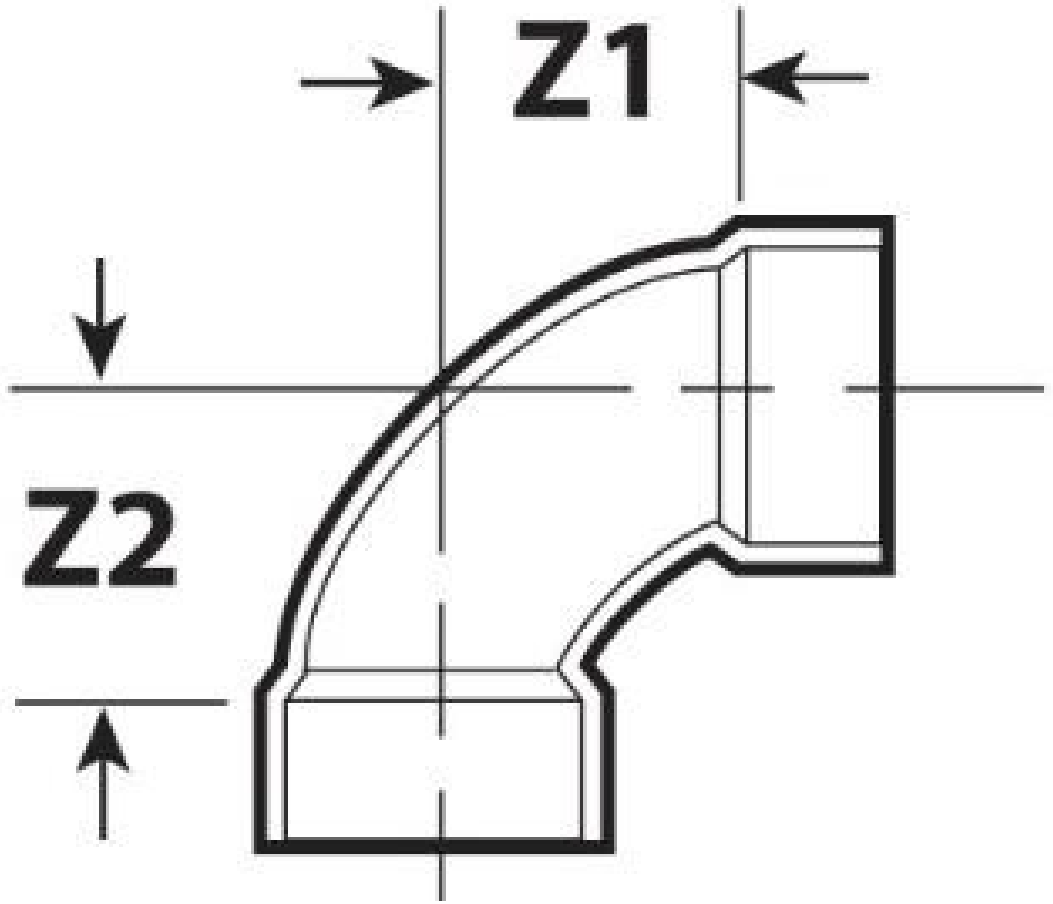


The "shaded area" that shows the fall must not be greater than the size of the fixture drain.

Trap Weir

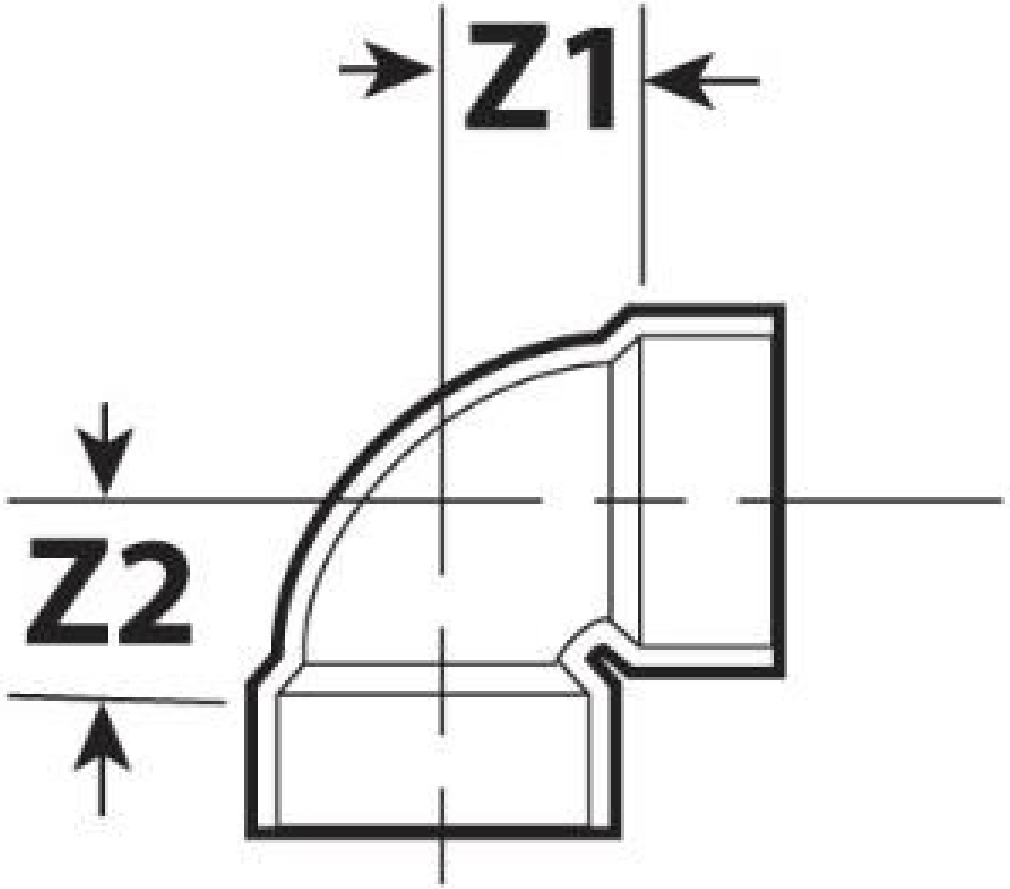


¼ BEND or 90

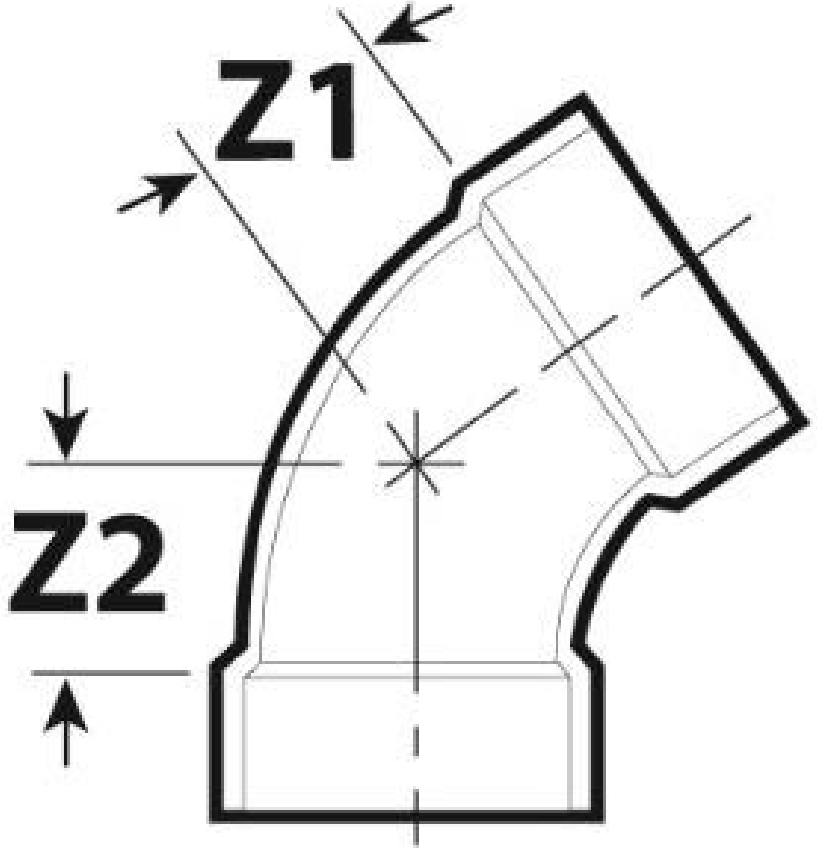


LONG SWEEP

Fittings

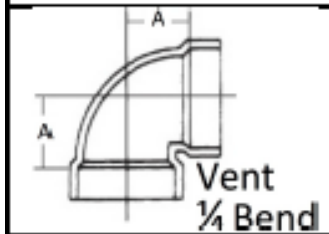
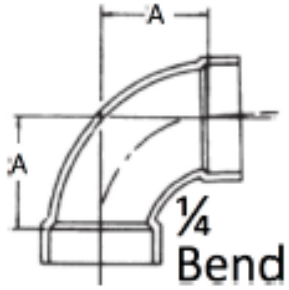
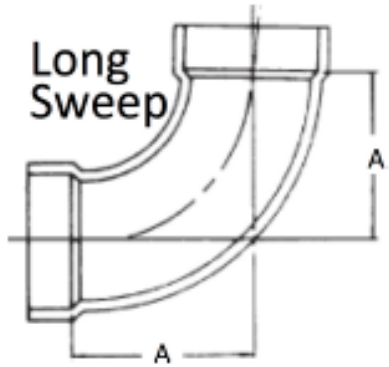


VENT ELL or VENT 90

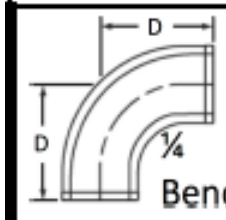
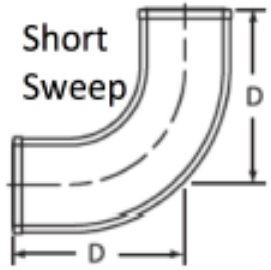
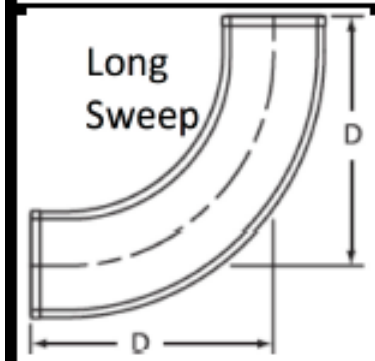


1/8 BEND or 45

Fittings

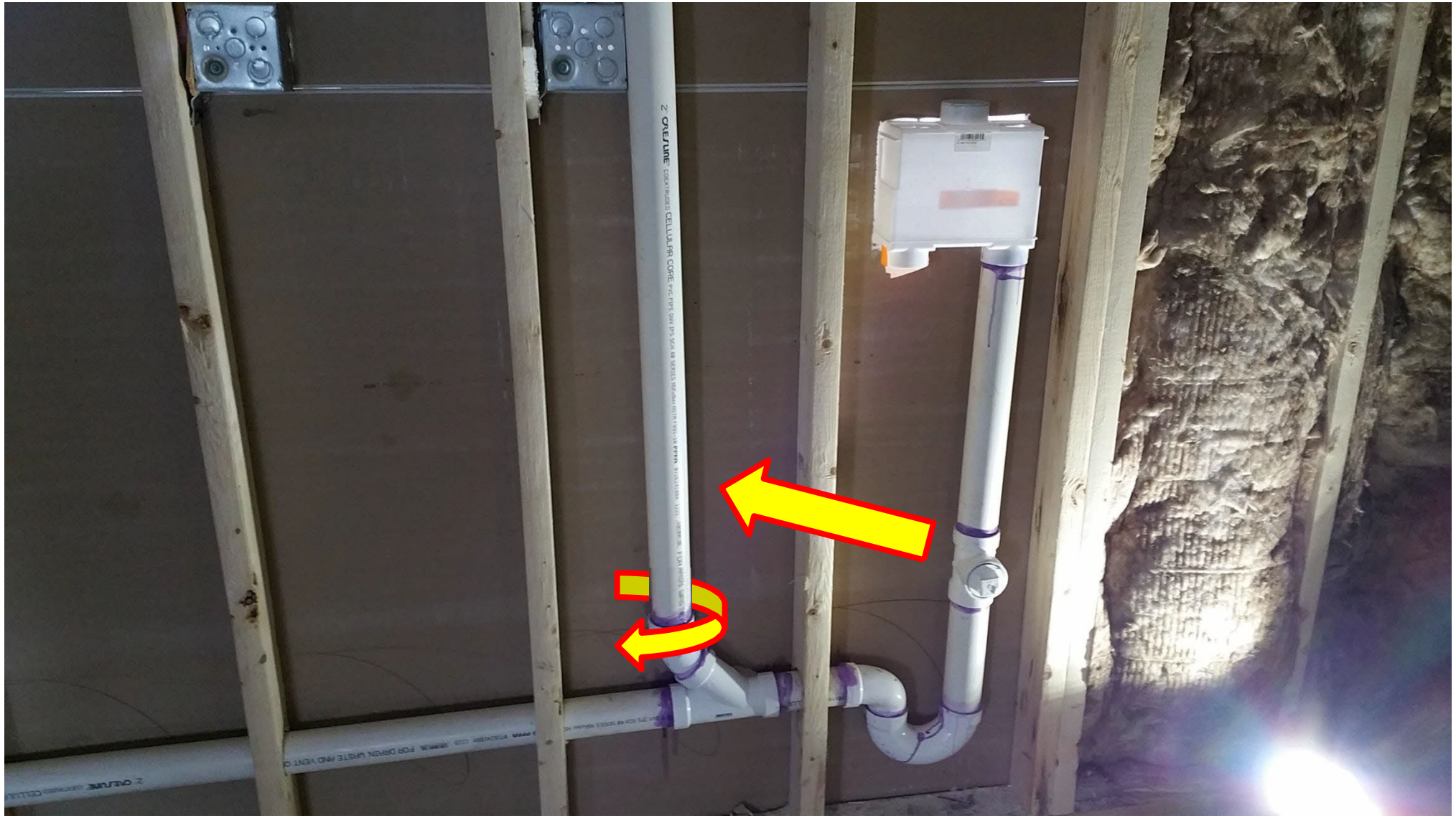
PVC/ABS	1-1/2"	2"	3"	4"	
					DWV Vents only
	1-3/16"	1-1/2"	1-7/8"		
					Minimum fitting for H to V Not for H to H or V to H
	1-3/4"	2-15/16"	3-1/16"	3-7/8"	
					Minimum fitting for H to H Minimum fitting for V to H May be used anywhere
	2-3/4"	3-1/4"	4-1/16"	4-15/16"	

Fittings

Hubless Cast Iron	1-1/2"	2"	3"	4"	5"	6	Uses
	4-1/4"	4-1/2"	5"	5-1/2"	6-1/2"	7"	Minimum fitting for H to V Not for H to H or V to H
	*	6-1/2"	7"	7-1/2"	8-1/2"	9"	Minimum fitting for H to H Minimum fitting for V to H May be used anywhere
	9-1/4"	9-1/2"	10"	10-1/2"	11-1/2"	12"	Not required in UPC May be used anywhere

Fittings

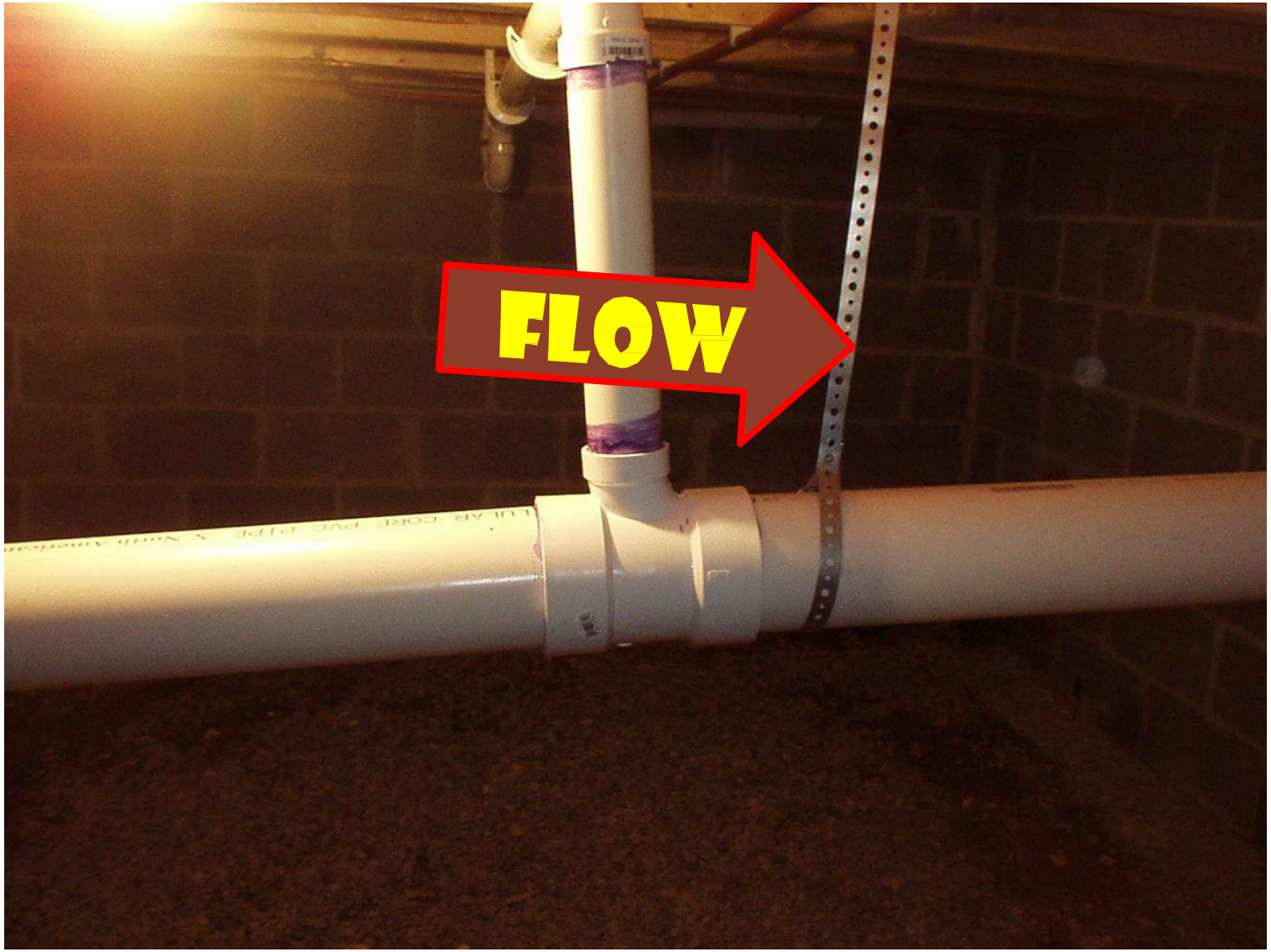
Fittings



Fittings

Fittings

Connections



Grade

Which one is vented?

312.11 Structural Members. A structural member weakened or impaired by cutting, notching, or otherwise shall be reinforced, repaired, or replaced so as to be left in a safe structural condition in accordance with the requirements of the building code.

Protection of Piping, Materials, and Structures

Protection of Piping, Materials, and Structures

Protection of Piping, Materials, and Structures

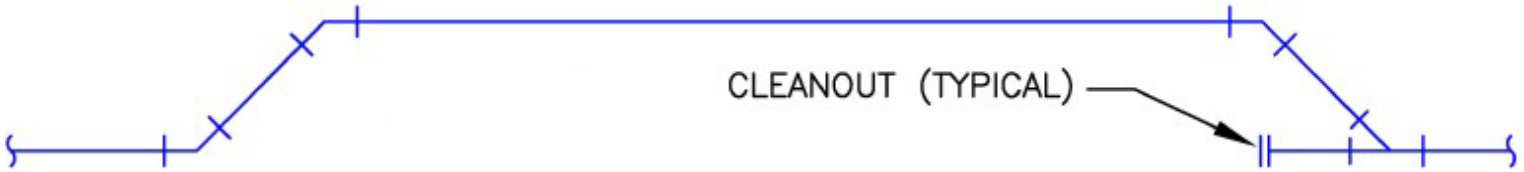
Protection of Piping, Materials, and Structures

707.5 Cleaning.

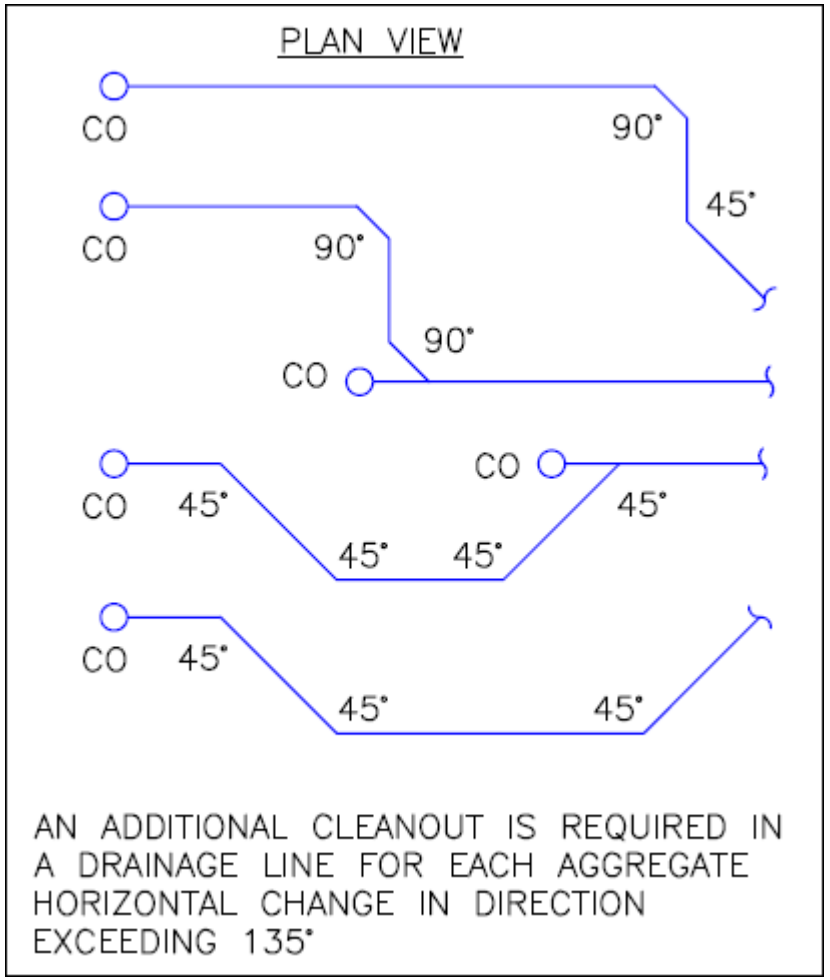
Each cleanout shall be installed so that it opens to allow cleaning in the direction of flow of the soil or waste or at right angles thereto and, except in the case of wye branch and end-of-line cleanouts, shall be installed vertically above the flow line of the pipe.

707.4 Location.

Each horizontal drainage pipe shall be provided with a cleanout at its upper terminal and each run of piping that is more than 100 feet in total developed length shall be provided with a cleanout for each 100 feet in length of such piping. An additional cleanout shall be provided in a drainage line for each aggregate horizontal change in direction exceeding 135 degrees. A cleanout shall be installed above the fixture connection fitting, serving each urinal, regardless of the location of the urinal in the building.



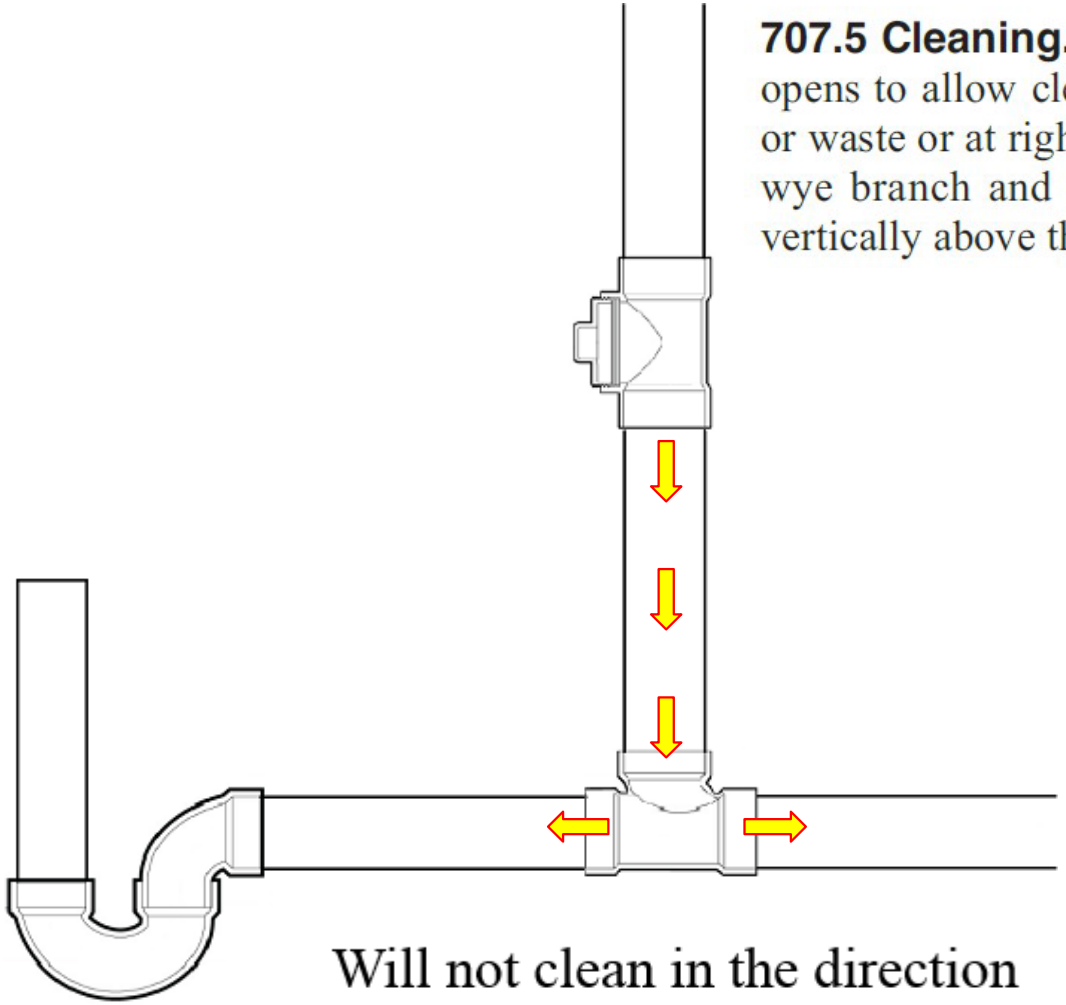
A CLEANOUT MUST BE PROVIDED IN A DRAINAGE PIPE FOR EACH AGGREGATE HORIZONTAL CHANGE OF DIRECTION EXCEEDING 135 DEGREES (SEE M.R., CHAPTER 4714, SECTION 707.4).



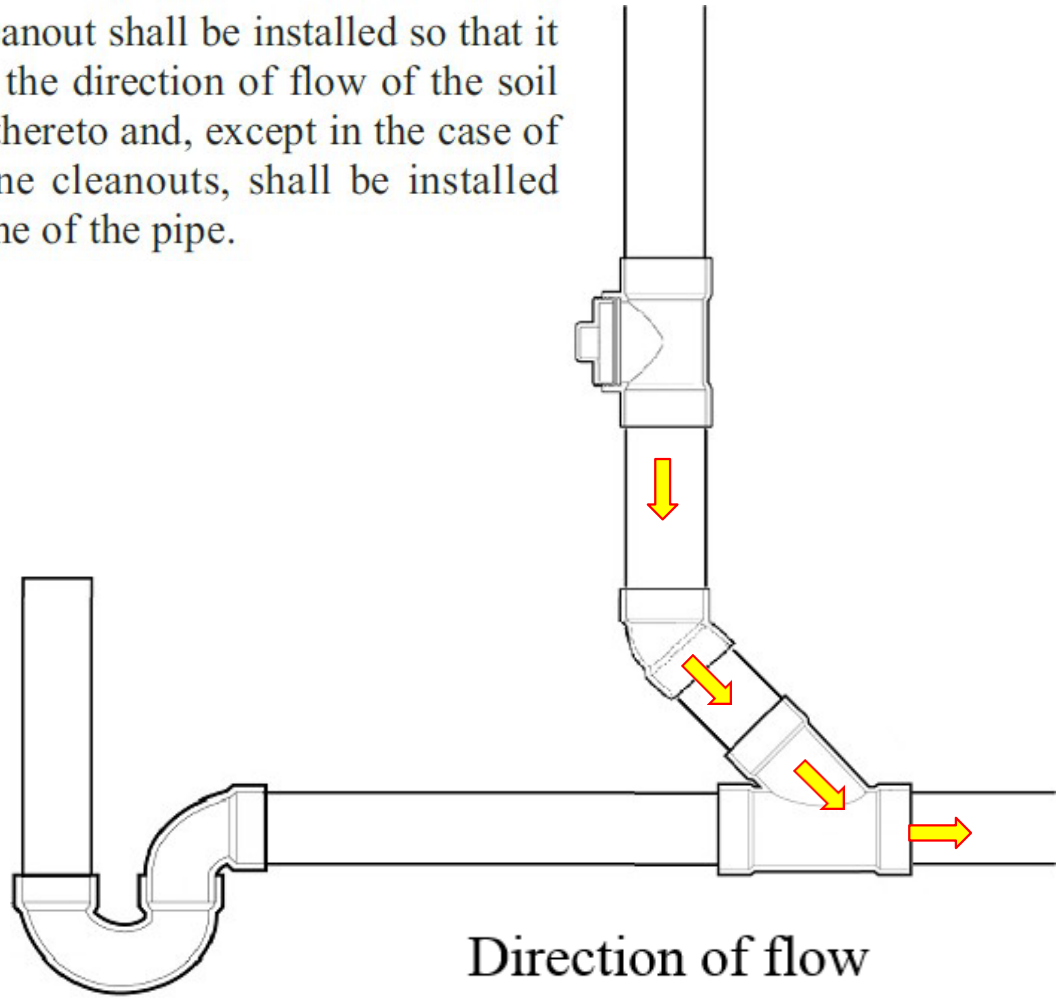
AN ADDITIONAL CLEANOUT IS REQUIRED IN A DRAINAGE LINE FOR EACH AGGREGATE HORIZONTAL CHANGE IN DIRECTION EXCEEDING 135°

Cleanouts

707.5 Cleaning. Each cleanout shall be installed so that it opens to allow cleaning in the direction of flow of the soil or waste or at right angles thereto and, except in the case of wye branch and end-of-line cleanouts, shall be installed vertically above the flow line of the pipe.

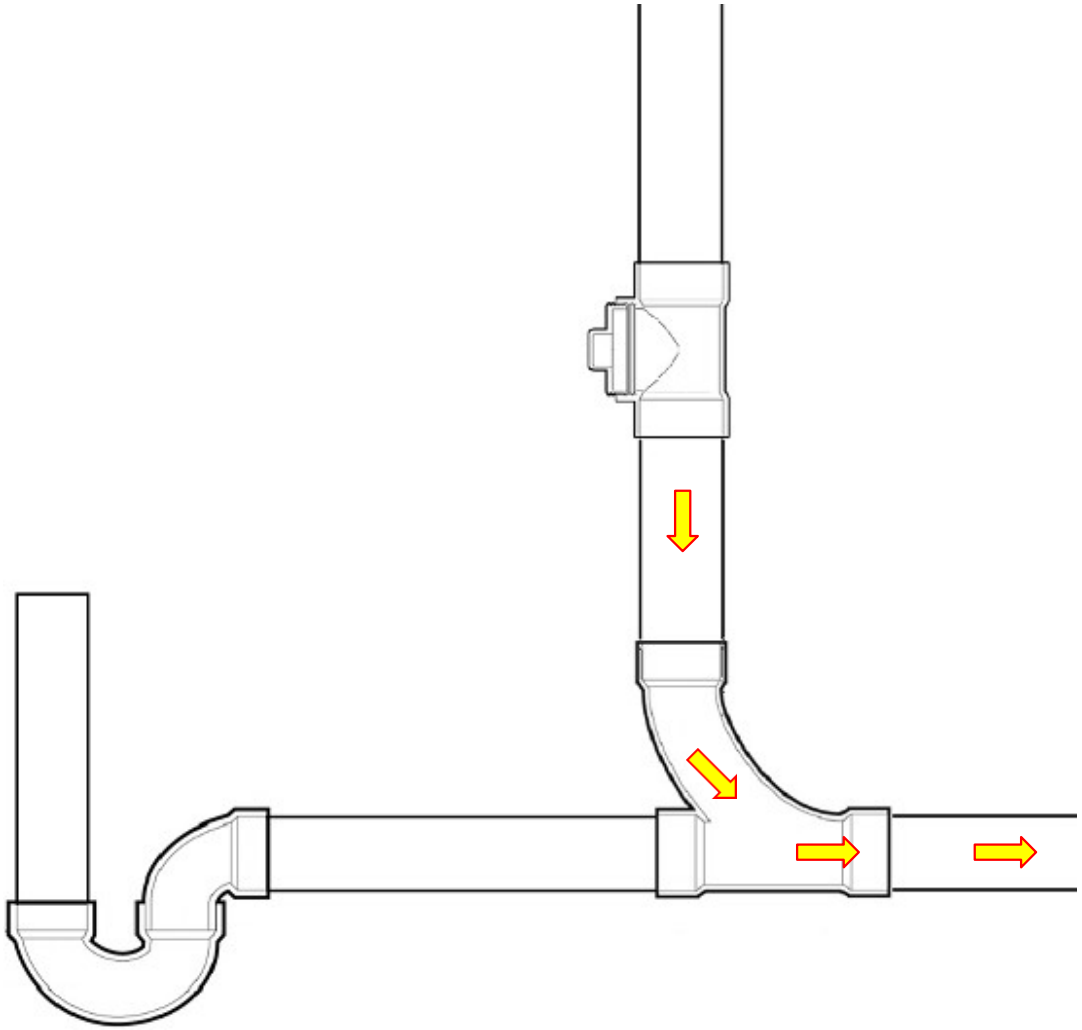


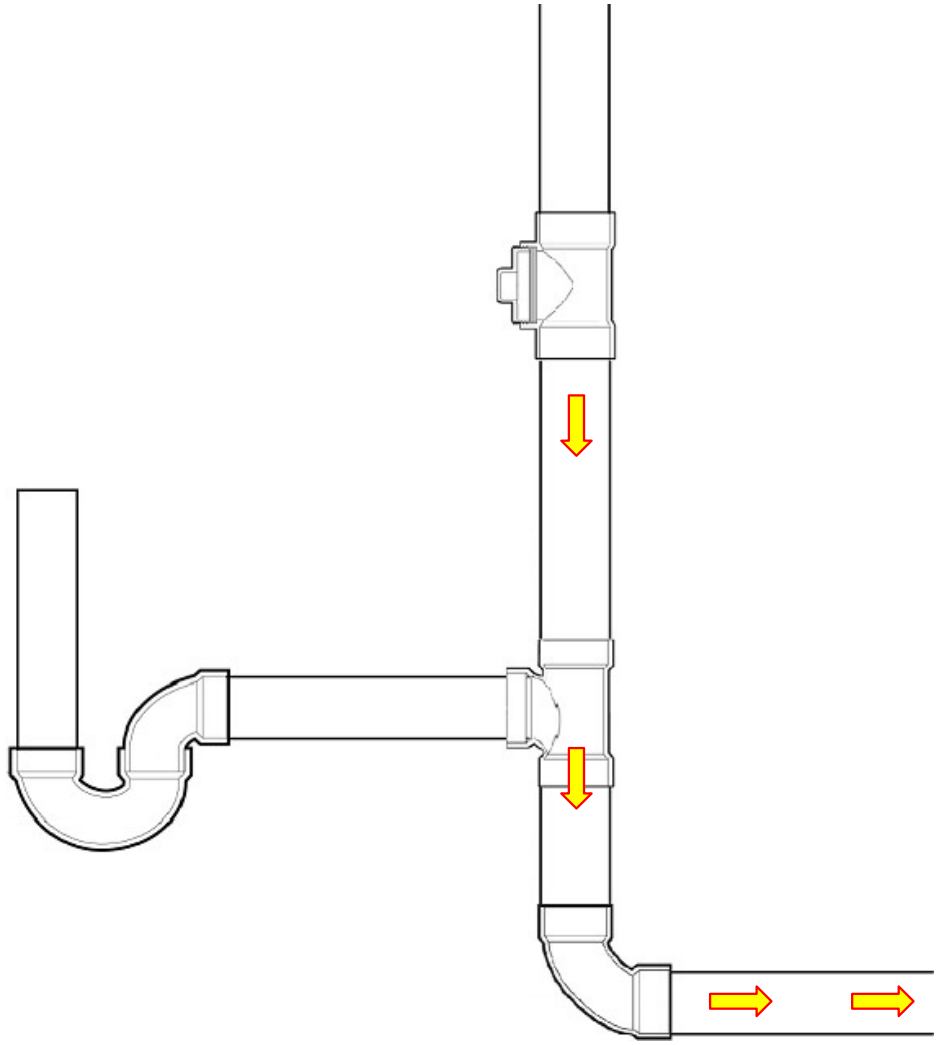
Will not clean in the direction of flow



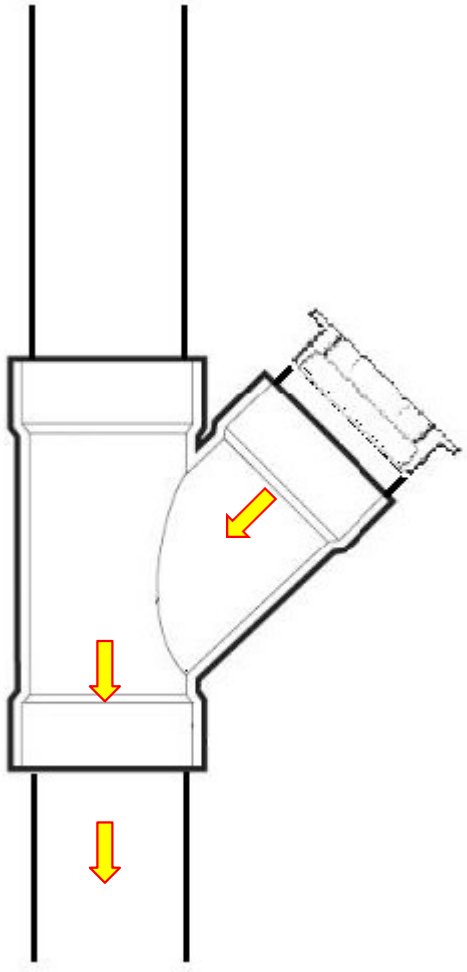
Direction of flow

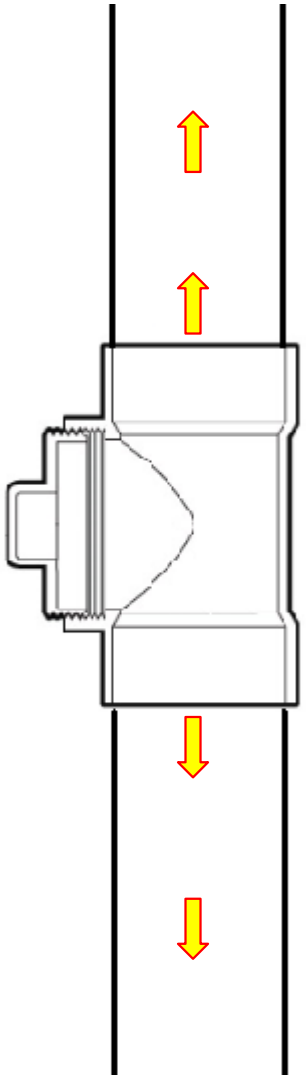
Cleanouts

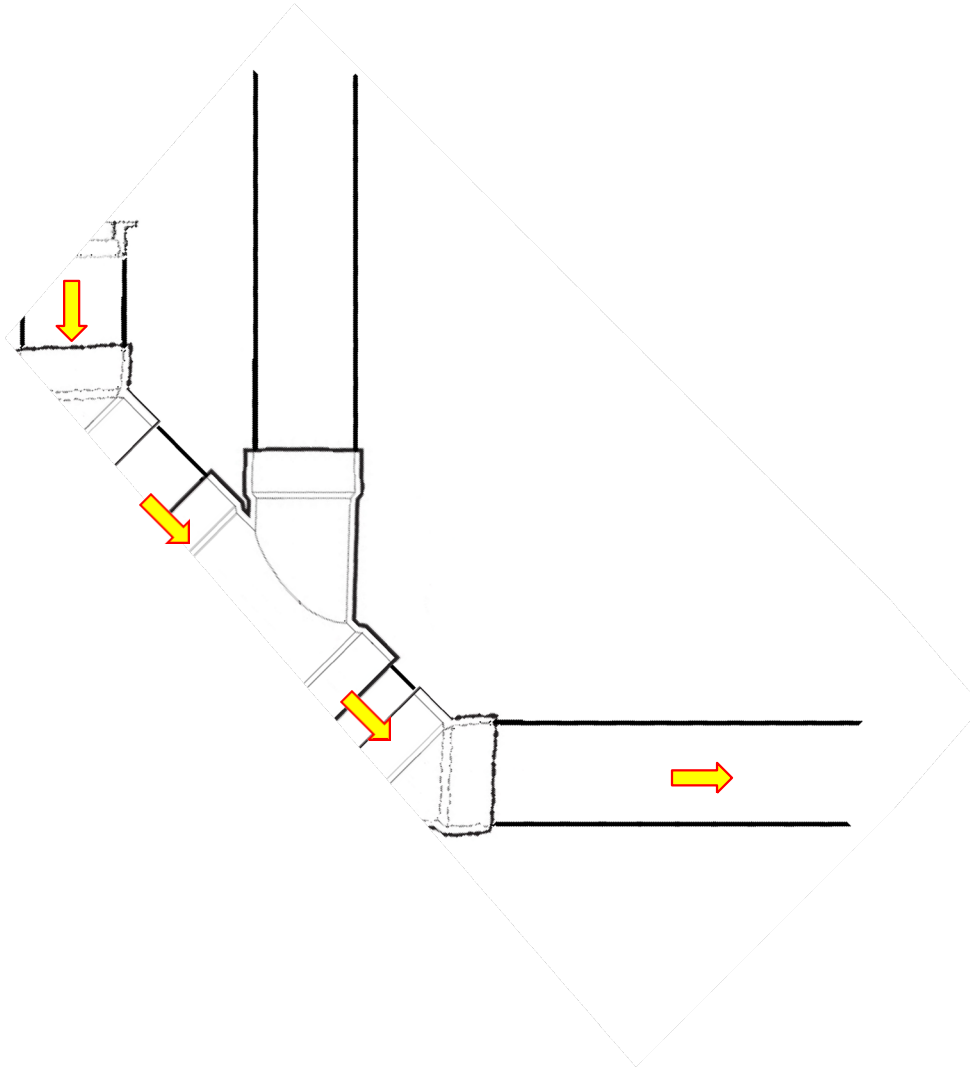




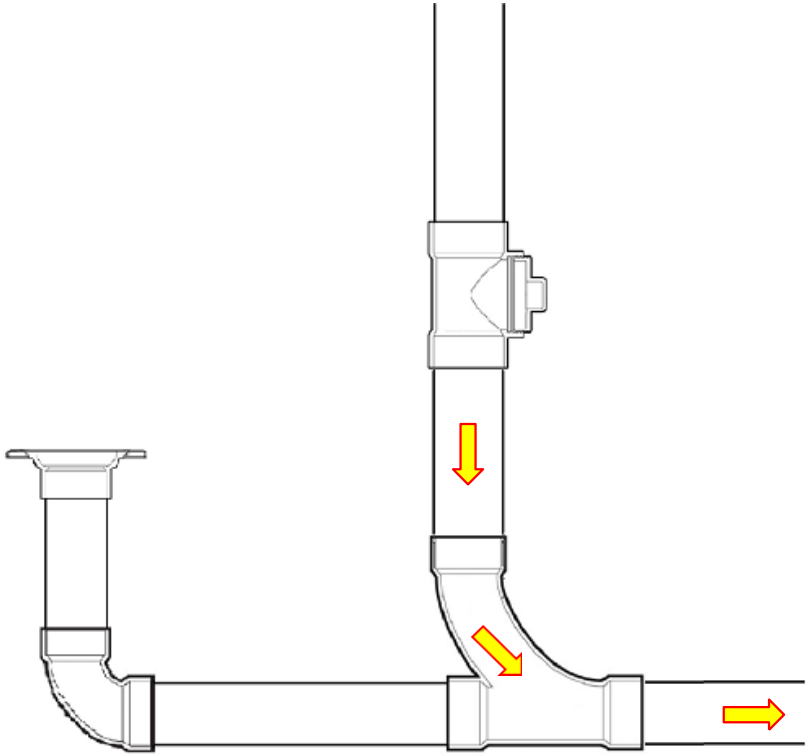
Cleanouts

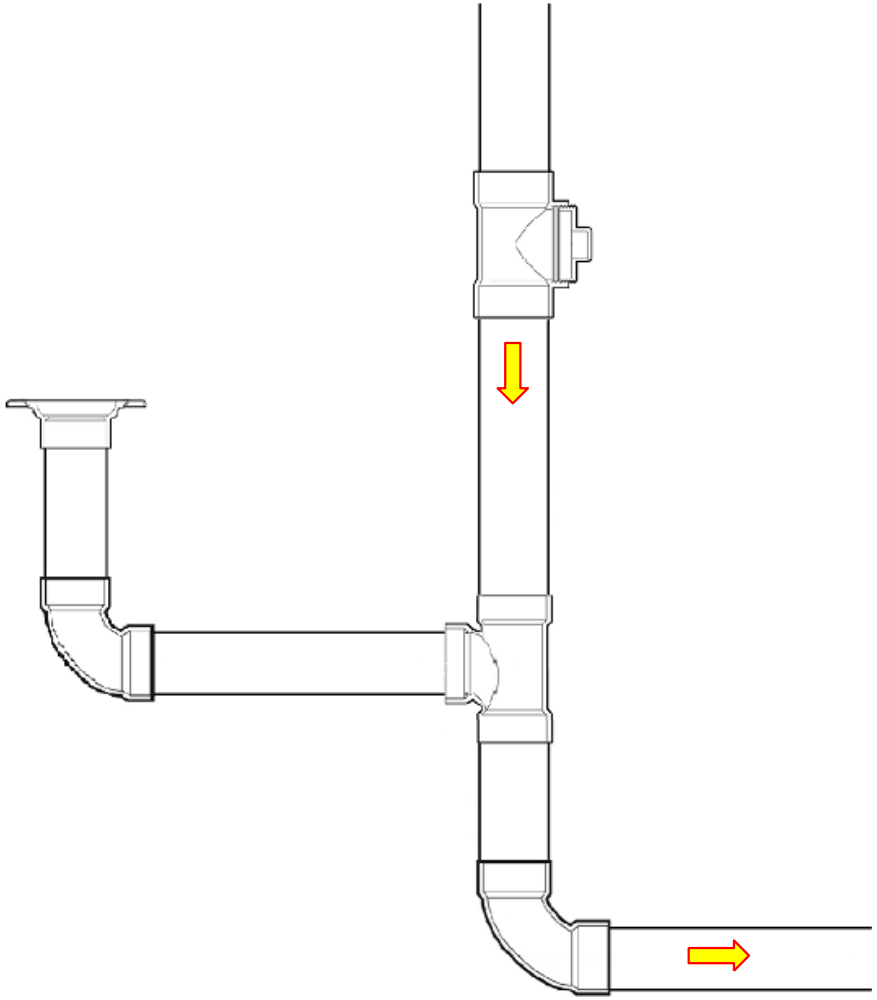




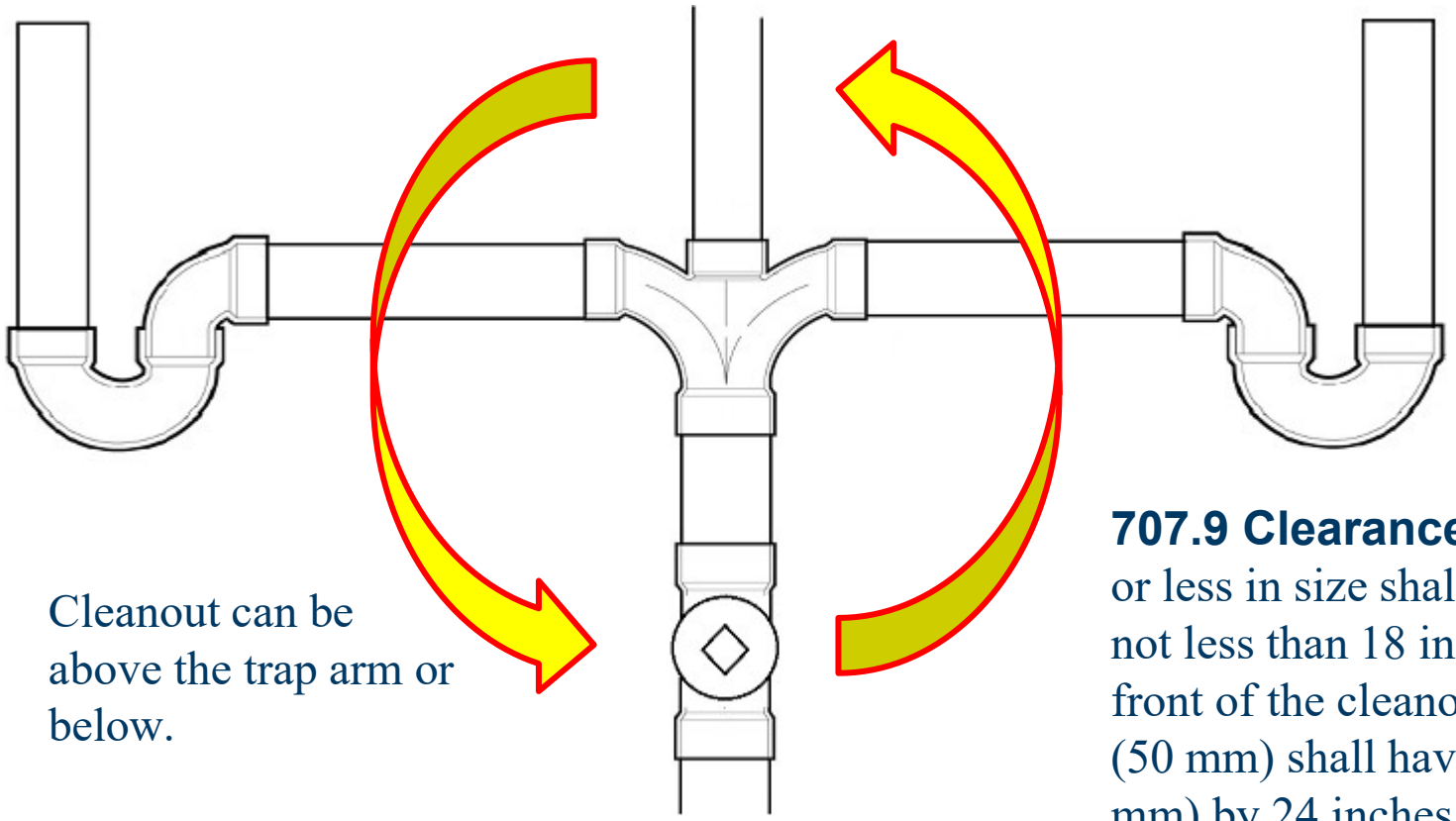


Cleanouts





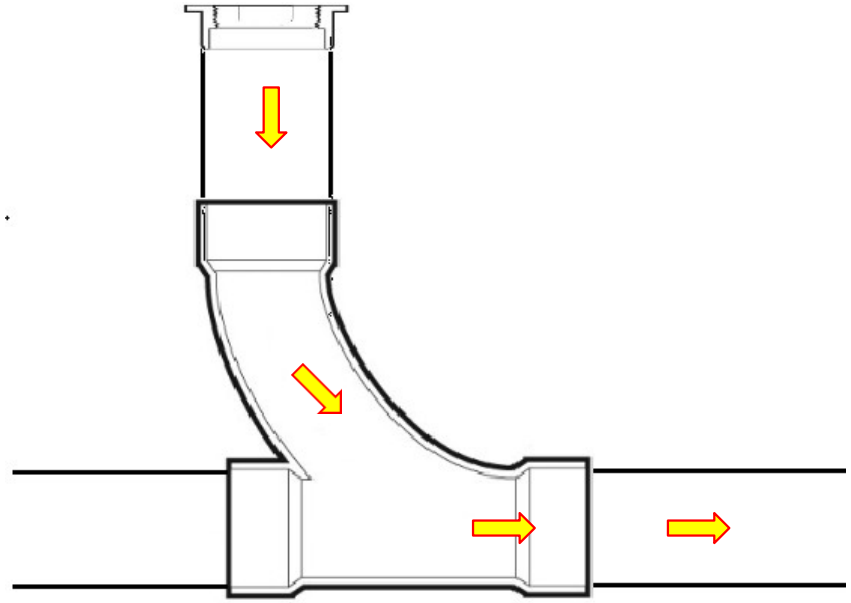
Cleanouts



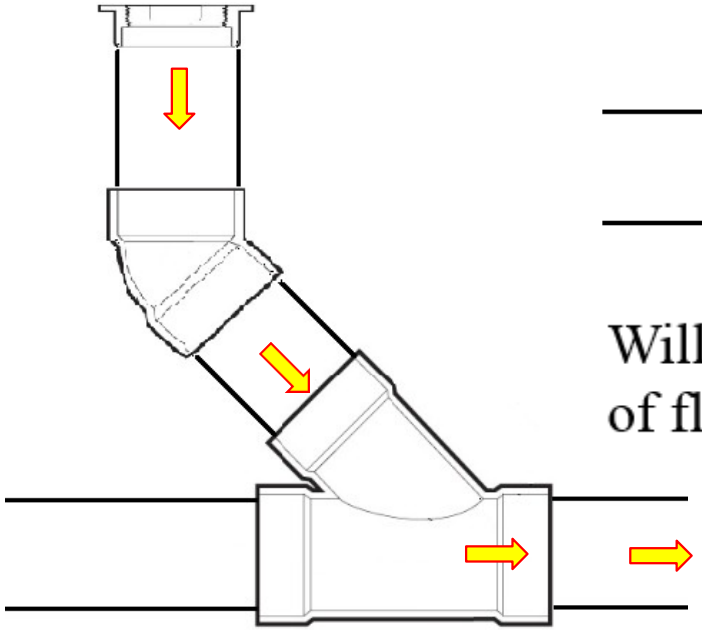
Cleanout can be above the trap arm or below.

707.9 Clearance. Each cleanout in piping 2 inches (50 mm) or less in size shall be so installed that there is a clearance of not less than 18 inches (457 mm) by 18 inches (457 mm) in front of the cleanout. Cleanouts in piping exceeding 2 inches (50 mm) shall have a clearance of not less than 24 inches (610 mm) by 24 inches (610 mm) in front of the cleanout.

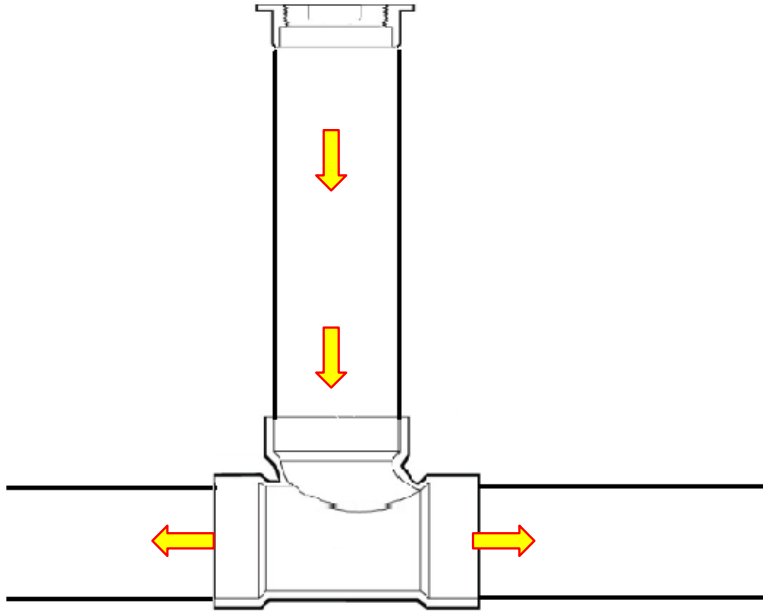
Cleanouts



Direction of flow

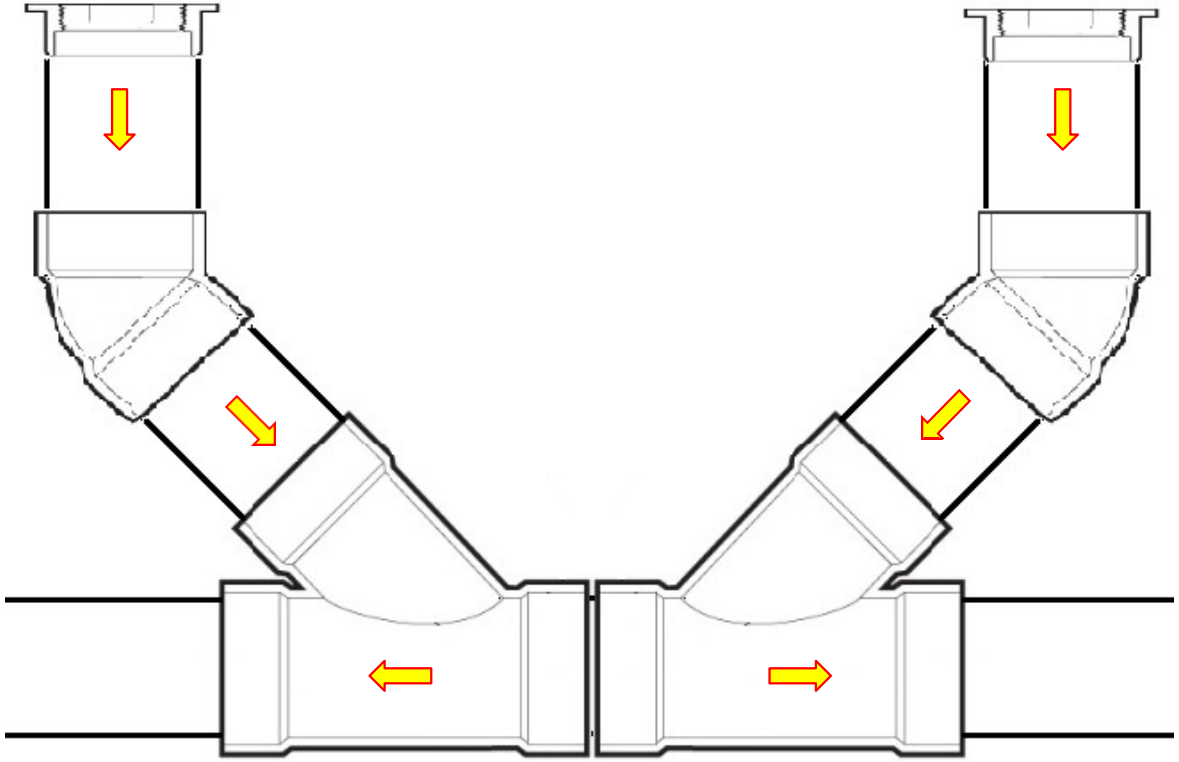


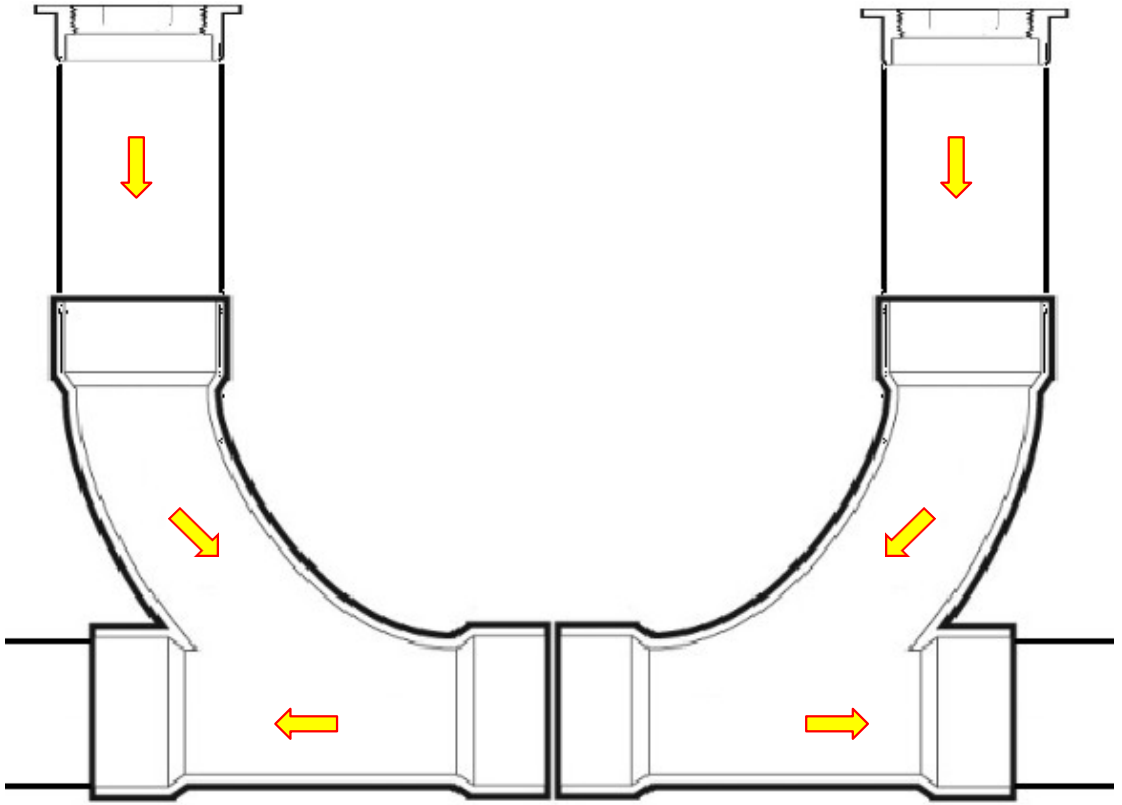
Direction of flow



Will not clean in the direction of flow

Cleanouts





Cleanouts

Floor Drains.

Exception: Emergency floor drains, tell tale floor drains, and **floor drains not used as waste receptors** installed within 25 feet of a vented branch or main.

Rough-In

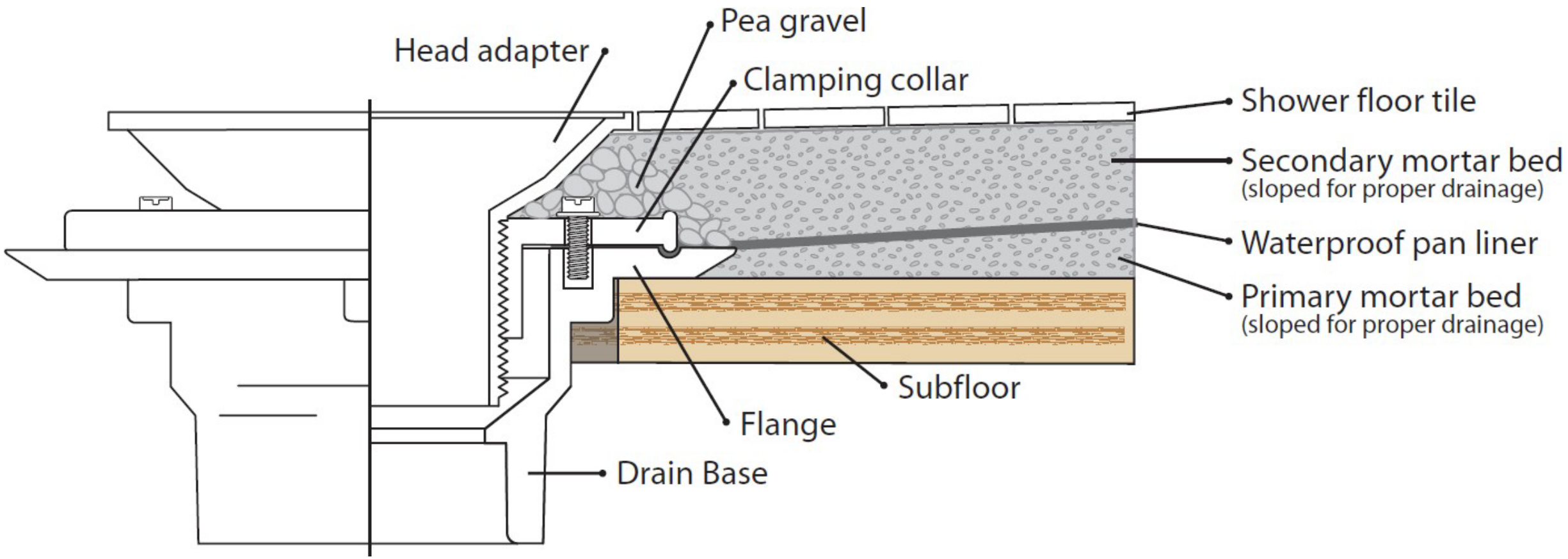
- Emergency Floor Drain.
  - Means **floor drains that do not serve as a receptor**, are located in restrooms, are under emergency eyewash/shower equipment, or are in laundry rooms.

Rough-In

Emergency floor drains, tell tale floor drains, and floor drains not used as waste receptors installed within 25 feet of a vented branch or main are exempted because they do not have a drainage fixture unit value or are not intended to receive indirect waste discharges. They are unlikely to siphon the trap seals and do not need to be individually vented because the quantity and frequency in which these drains would be used is small.

408.7 Lining for Showers and Receptors.

Shower receptors built on-site shall be watertight and shall be constructed from approved-type dense, nonabsorbent, and noncorrosive materials. Each such receptor shall be adequately reinforced, shall be provided with an approved flanged floor drain designed to make a watertight joint in the floor, and shall have smooth, impervious, and durable surfaces.



408.7 Lining for Showers and Receptors

408.7 Lining for Showers and Receptors.

Unless the shower receptor is poured on the ground as part of a slab, an approved shower liner must be provided in accordance with the requirements of this section.

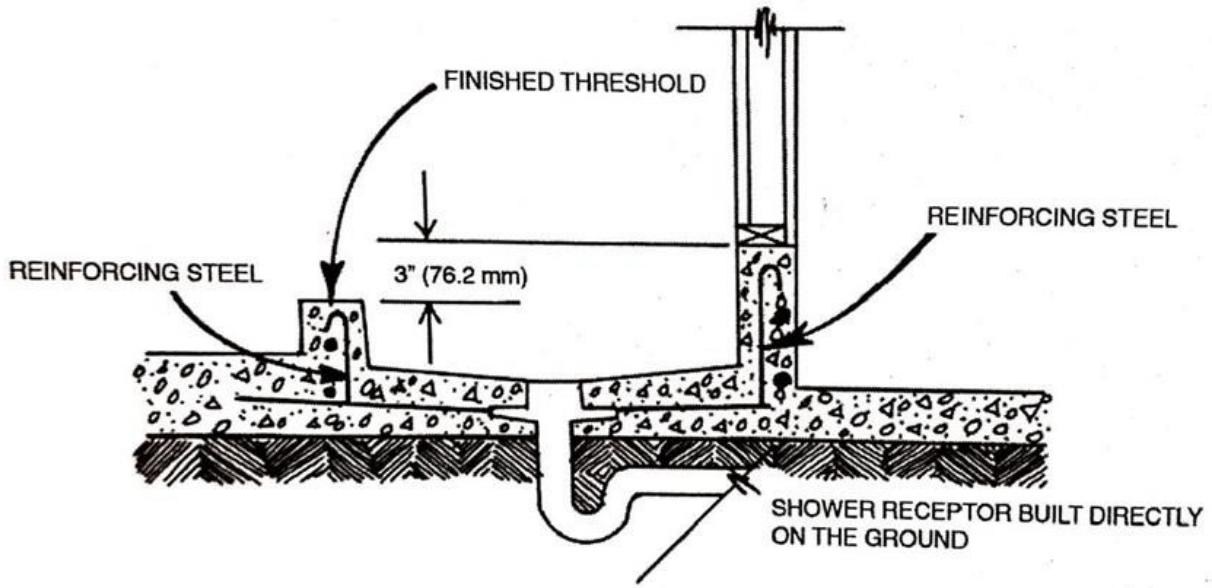


FIGURE 408.7A
SHOWER RECEPTOR BUILT UPON THE GROUND

Piping Materials

604.0 Materials.

604.2 Lead Content.

The maximum allowable lead content in pipes, pipe fittings, plumbing fittings, and fixtures intended to convey or dispense water for human consumption shall be not more than a weighted average of 0.25% with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures. For solder and flux, the lead content shall be not more than 0.2 percent where used in piping systems that convey or dispense water for human consumption.

Final Inspection

Exceptions:

(1) Pipes, pipe fittings, plumbing fittings, fixtures, or backflow preventers used for nonpotable services such as manufacturing, industrial processing, irrigation, outdoor watering, or any other uses where the water is not used for human consumption.

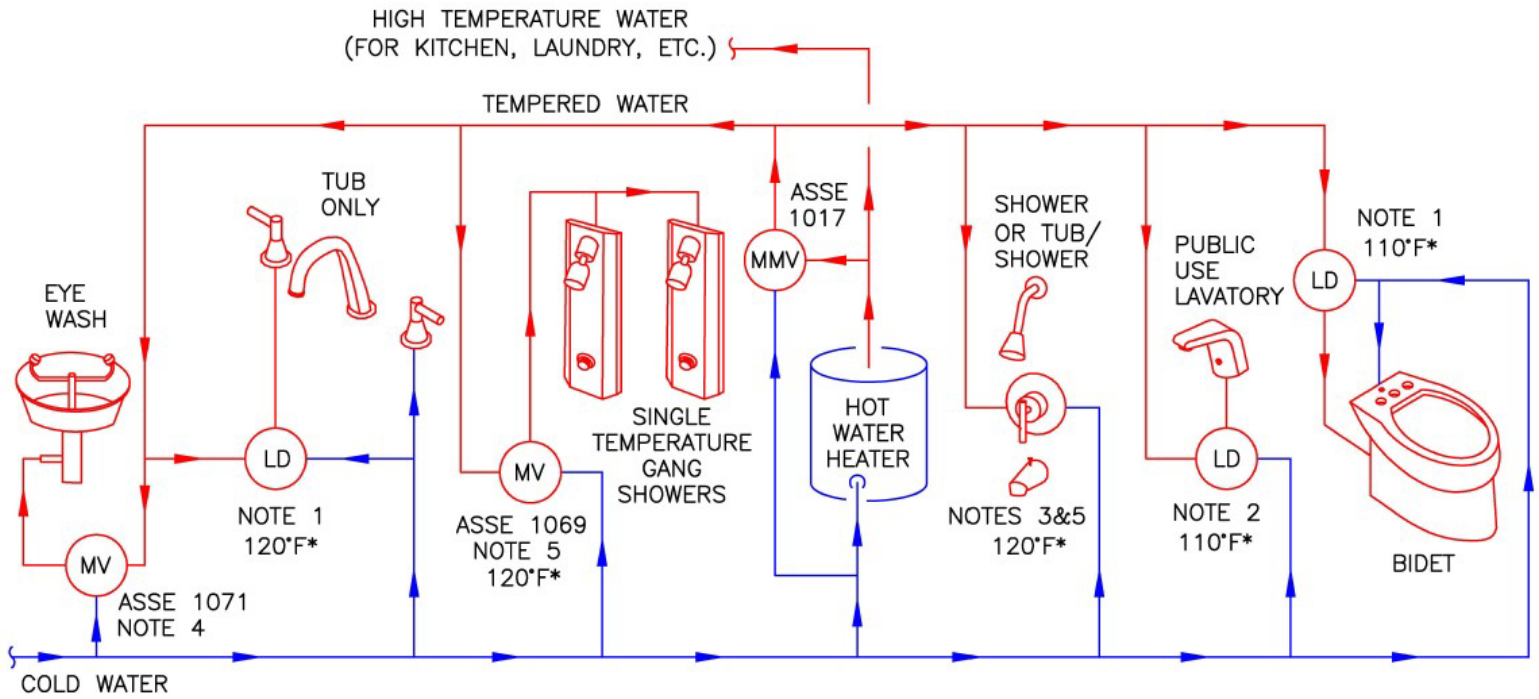
Final Inspection

Exceptions:

(2) Flush valves, fill valves, flushometer valves, tub fillers, shower valves, service saddles, or water distribution main gate valves that are 2 inches (50 mm) in diameter or larger.

Pipes, pipe fittings, valves, and faucets utilized in the water supply system for non-drinking water applications shall have a maximum of 8 percent lead content.

MINNESOTA RULES, CHAPTER 4714, SECTIONS 407.3, 408.3 409.4, 410.3, AND 416.2



MMV = MASTER MIXING VALVE * = MAXIMUM TEMPERATURE ALLOWED BY CODE
LD = LIMITING DEVICE MV = MIXING VALVE

NOTE 1: MAXIMUM TEMPERATURE REGULATED BY: (1) A LIMITING DEVICE CONFORMING TO ASSE 1070/ASME A112.1070/CSA B125.70 OR CSA B125.3, OR (2) A WATER HEATER CONFORMING TO ASSE 1084.

NOTE 2: MAXIMUM TEMPERATURE REGULATED BY: (1) A LIMITING DEVICE CONFORMING TO ASSE 1070/ASME A112.1070/CSA B125.70 OR (2) A WATER HEATER CONFORMING TO ASSE 1084.

NOTE 3: MAXIMUM TEMPERATURE REGULATED BY POINT OF USE CONTROL VALVE COMPLYING WITH ASSE 1016/ASME A112.1016/CSA B125.16 OR ASME A112.18.1/CSA B125.1. THE CONTROL VALVE MUST PROVIDE SCALD AND THERMAL SHOCK PROTECTION FOR THE RATED FLOW RATE OF THE INSTALLED SHOWERHEAD.

NOTE 4: WHEN WATER IS SUPPLIED DIRECTLY TO EMERGENCY FIXTURES FROM A WATER HEATER, THE WATER HEATER MUST COMPLY WITH ASSE 1085.

NOTE 5: WATER HEATER THERMOSTATS ARE NOT CONSIDERED A SUITABLE CONTROL.

Water Supply & Distribution

609.11 Pipe Insulation.

Insulation of Domestic Hot Water piping shall be in accordance with Section 609.11.1 and Section 609.11.2.

Domestic Hot 609.11.1 Insulation Requirements. water piping shall be insulated.

Hot Water 609.11.2 Pipe Insulation Wall Thickness. pipe insulation shall have a minimum wall thickness of not less than the diameter of the pipe for a pipe up to 2 inches (50 mm) in diameter. Insulation wall thickness shall be not less than 2 inches (51 mm) for a pipe of 2 inches (50 mm) or more in diameter.

Exceptions:

(1)Piping that penetrates framing members shall not be required to have pipe insulation for the distance of the framing penetration.

(2)Hot water piping between the fixture control valve or supply stop and the fixture or appliance shall not be required to be insulated.

609.11 Pipe Insulation.

DELETED…FOUND IN THE ENERGY CODE.

Testing

Drain Waste & Vent Inspection

- 712.0 Testing.
  - 712.1 Media. The piping of the plumbing, drainage, and venting systems shall be tested with water or air.

Drain Waste & Vent Inspection

- 712.2 Water Test.
  - The water test shall be applied to the drainage and vent systems either in its entirety or in sections. Where the test is applied to the entire system, openings in the piping shall be tightly closed, except the highest opening, and the system filled with water to point of overflow. Where the system is tested in sections, each opening shall be tightly plugged, except the highest opening of the section under test, and each section shall be filled with water, but no section shall be tested with less than a 10 foot head of water.
  - The water shall be kept in the system, or in the portion under test, for not less than 15 minutes before inspection starts. The system shall then be tight at points.

Drain Waste & Vent Inspection

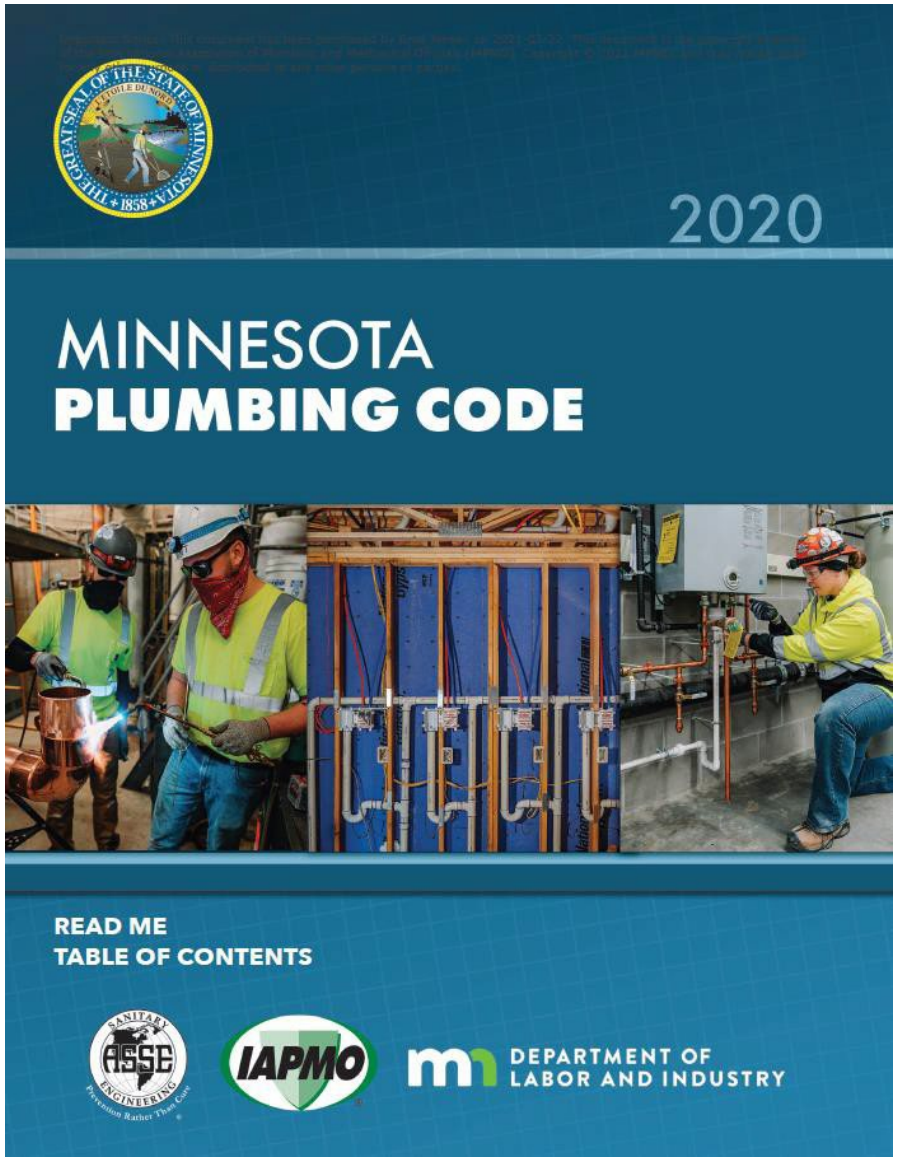
- 712.3 Air Test.
  - The air test shall be made by attaching an air compressor testing apparatus to a suitable opening and, after closing all other inlets and outlets to the system, forcing air into the system until there is a uniform gauge pressure of 5 pounds-force per square inch (psi). The pressure shall be held without introduction of additional air for a period of not less than 15 minutes.

Pressure Range

Pressure Range

Not a Good Test

Why won’t it hold 5 psi

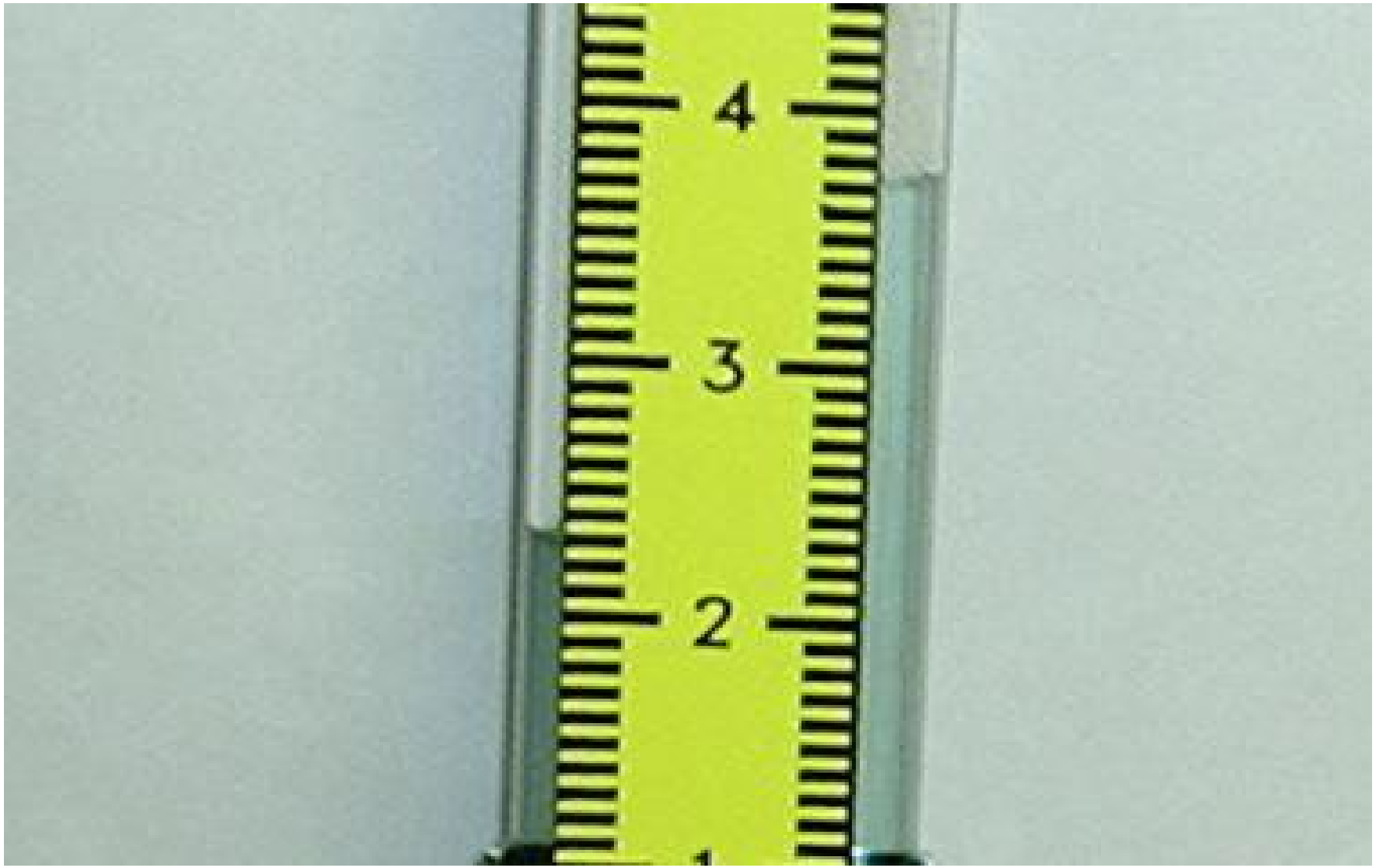


Final Inspection

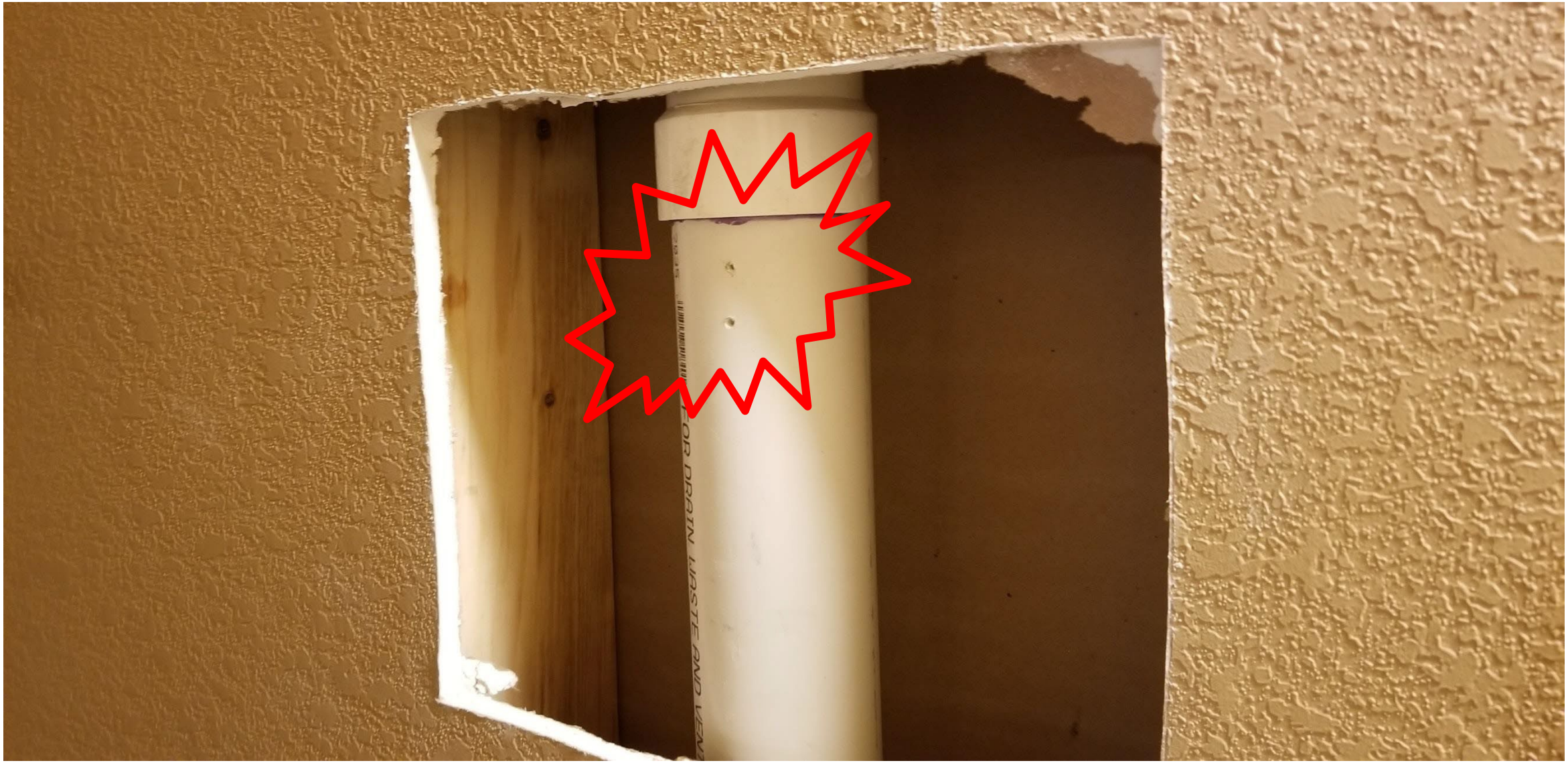
What to Check for on a Final Inspection…

Final Inspection

- Check Manometer
- Check Water Closets & Urinals
- Check Sink Waste and Traps
- Check Water Heater
- Check Backflow Protection
- Check Storm Drains, Primary & Overflows



Final Inspection



Why We Do the Manometer Test

Passed Manometer Test

301.2 Minimum Standards.

Pipe, pipe fittings, traps, fixtures, material, and devices used in a plumbing system shall be listed (third-party certified) by a listing agency (accredited conformity assessment body) as complying with the approved applicable recognized standards referenced in this code, and shall be free from defects.

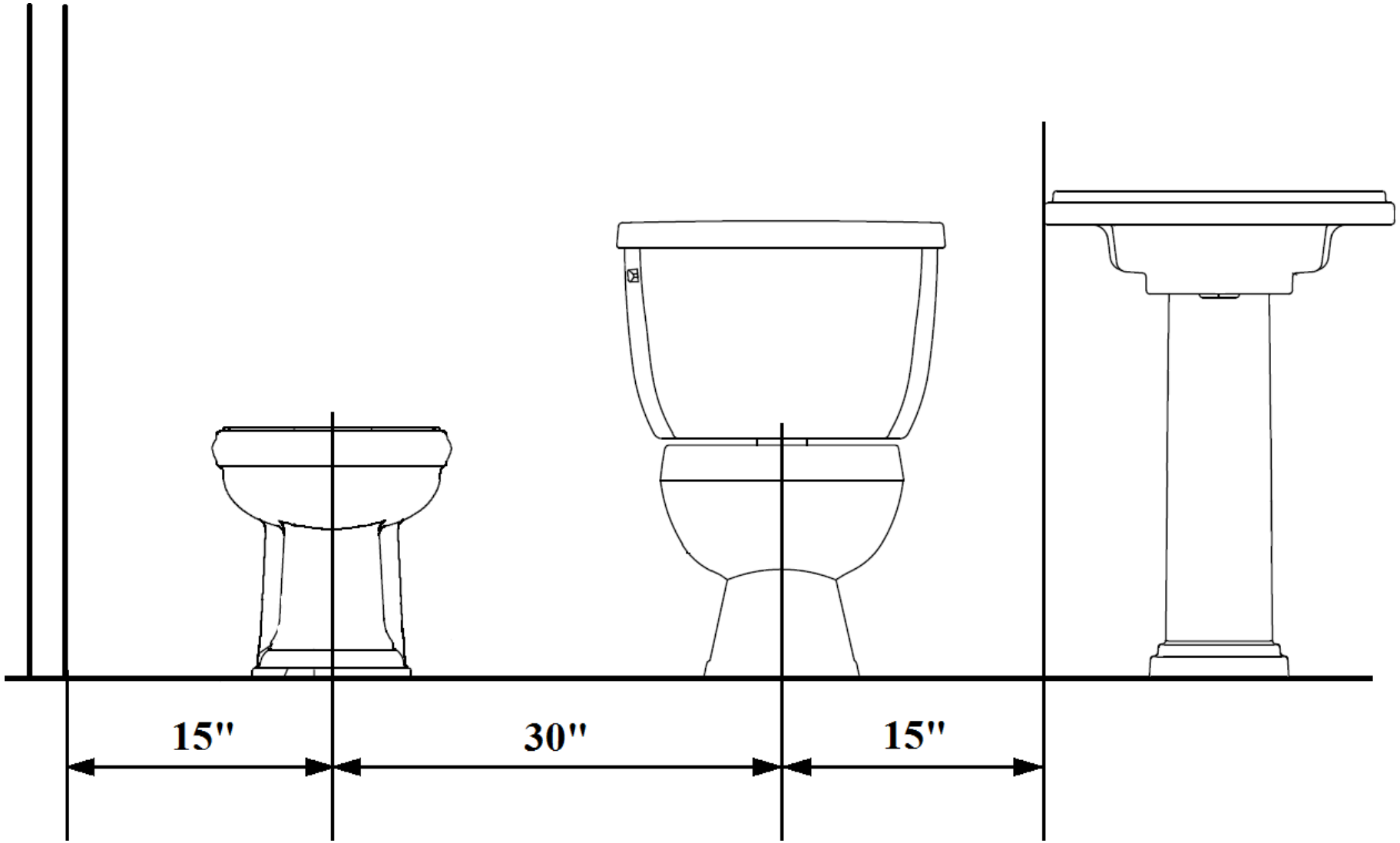
401.2 Quality of Fixtures.

Plumbing fixtures shall be constructed of dense, durable, non-absorbent materials and shall have smooth, impervious surfaces, free from unnecessary concealed fouling surfaces.

Final Inspection

Final Inspection

- PLUMBING FIXTURES AND FIXTURE FITTINGS
  - 402.5 Setting. Fixtures shall be set level and in proper alignment with reference to adjacent walls.
  - No water closet or bidet shall be set closer than 15 inches from its center to a side wall or obstruction nor closer than 30 inches center to center to a similar fixture.
  - The clear space in front of a water closet, lavatory or bidet shall be not less than 24 inches.



Final Inspection

Final Inspection

Final Inspection

- 1001.0 Traps Required.
  - 1001.1 Where Required. Each plumbing fixture, shall be separately trapped by an approved type of liquid seal trap.
  - Not more than one trap shall be permitted on a trap arm.

Final Inspection

TABLE 1002.2
HORIZONTAL LENGTHS OF TRAP ARMS
(EXCEPT FOR WATER CLOSETS AND SIMILAR FIXTURES)[1, 2]

TRAP ARM PIPE DIAMETER (inches)	DISTANCE TRAP TO VENT MINIMUM (inches)	LENGTH MAXIMUM (inches)
1¼	2½	30
1½	3	42
2	4	60
3	6	72
4	8	120
Exceeding 4	2 x Diameter	120

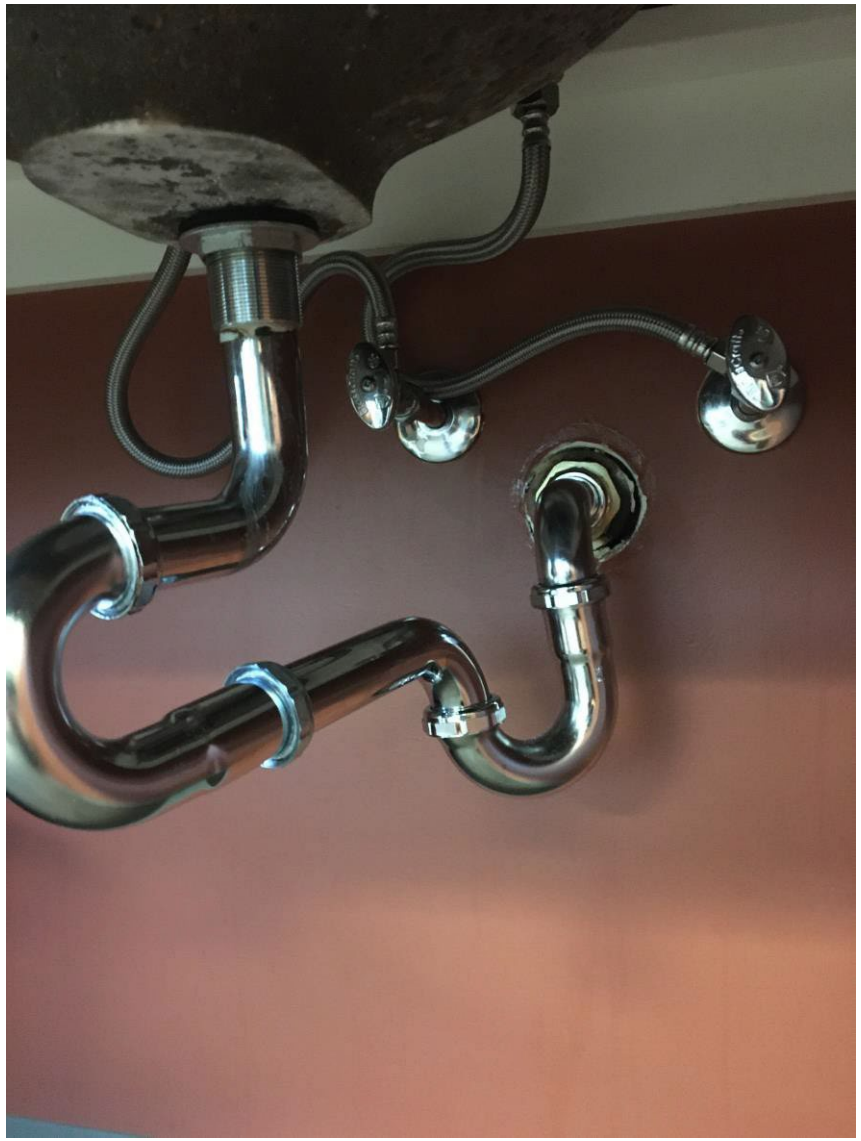
For SI units: 1 inch = 25.4 mm

Notes:

1 Maintain ¼ inch per foot slope (20.8 mm/m).

2 The developed length between the trap of a water closet or similar fixture (measured from the top of the closet flange to the inner edge of the vent) and its vent shall not exceed 6 feet (1829 mm).

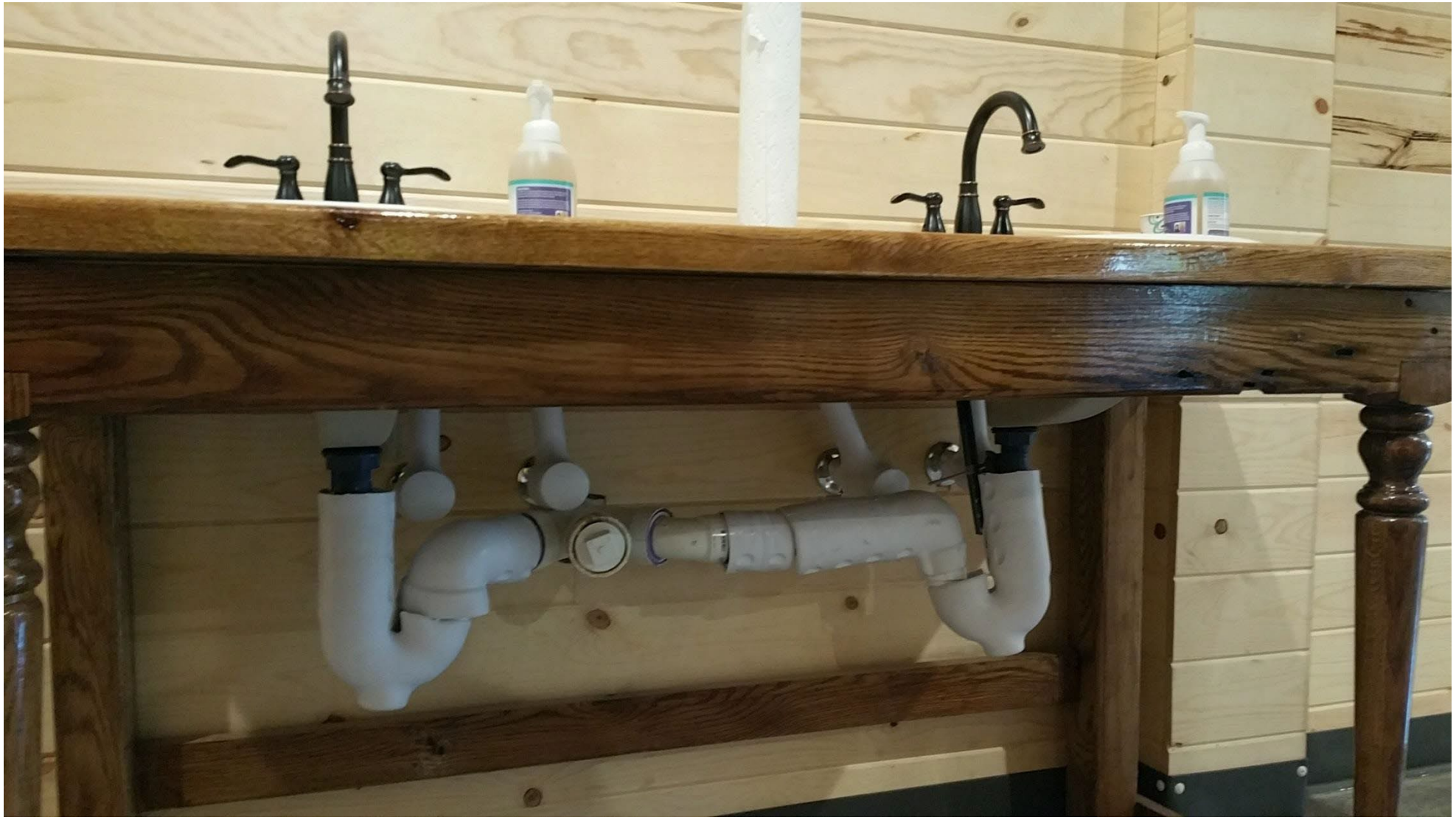
Traps Required



Traps Required

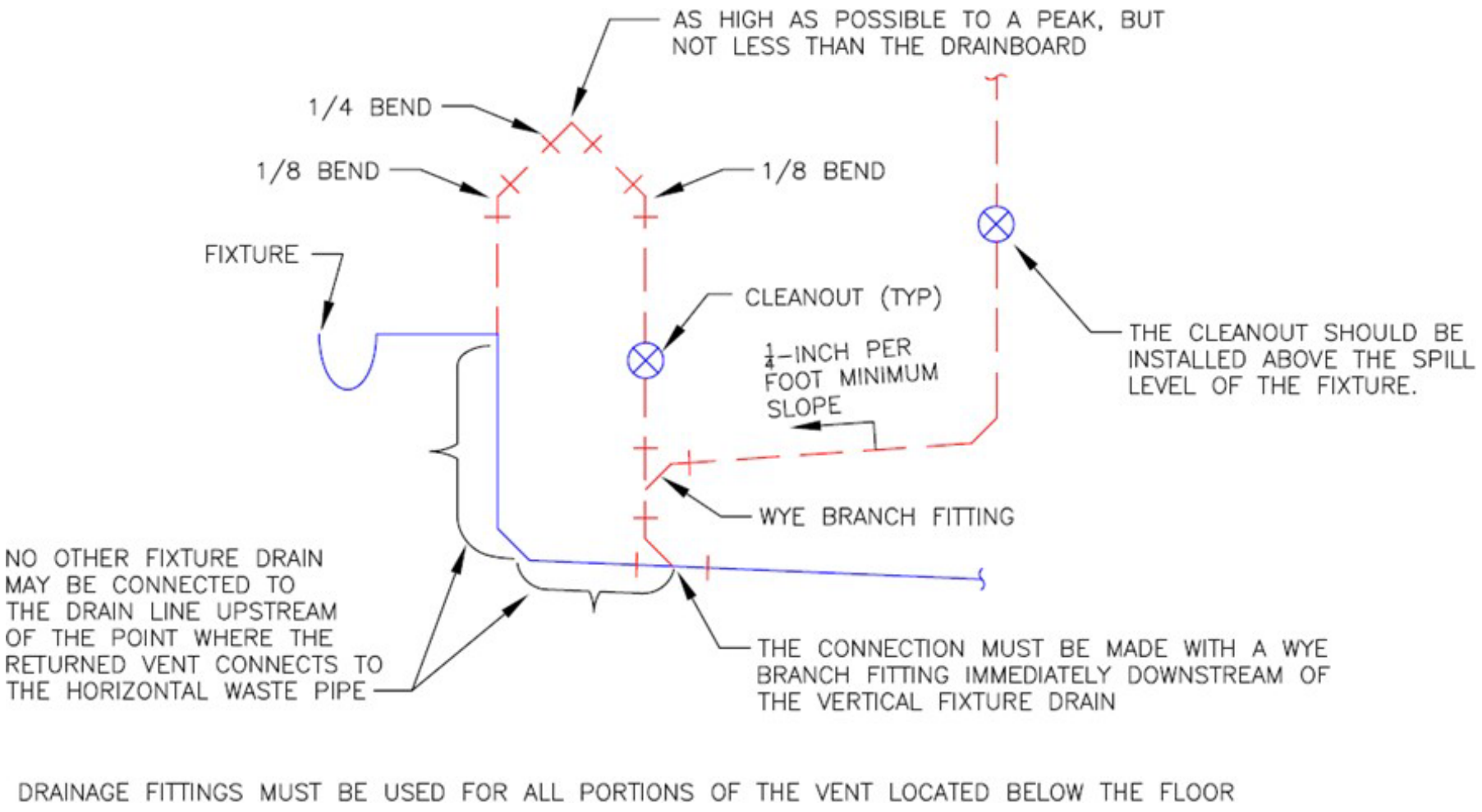
Final Inspection

- The vertical distance between a fixture outlet and the trap weir shall be as short as practicable, but in no case shall the tailpiece from a fixture exceed 24 inches (610 mm) in length.
- One trap shall be permitted to serve a set of not more than three single compartment sinks or laundry tubs of the same depth or three lavatories immediately adjacent to each other and in the same room where the waste outlets are not more than 30 inches apart and the trap is centrally located where three compartments are installed.



Traps Required

Final Inspection

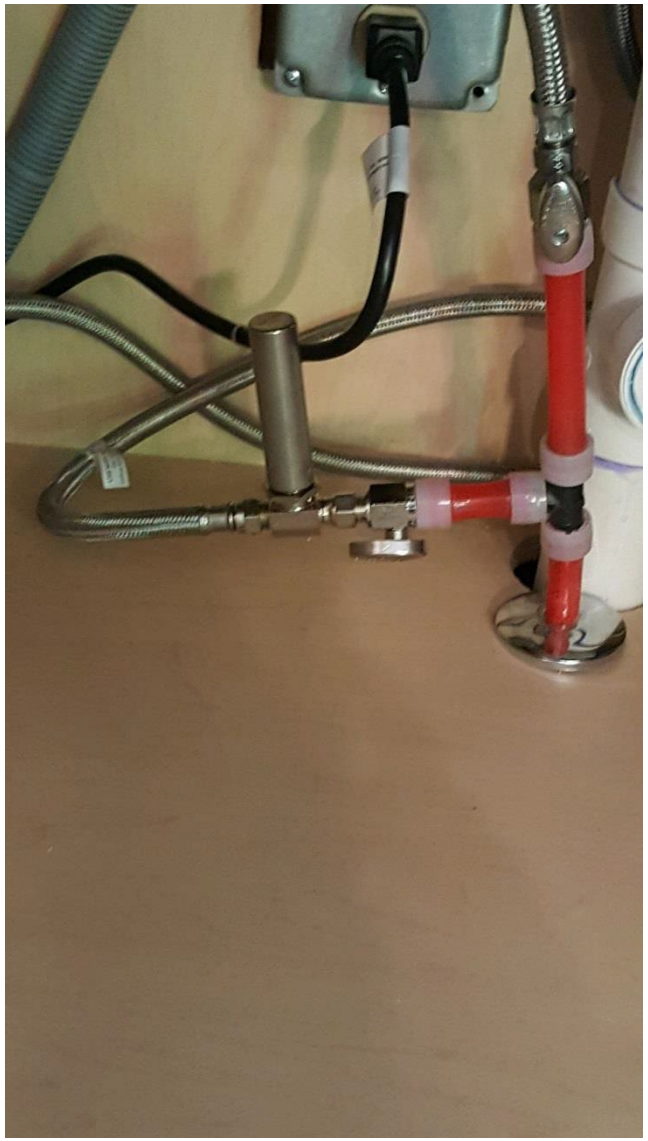

AS HIGH AS POSSIBLE TO A PEAK, BUT NOT LESS THAN THE DRAINBOARD
1/4 BEND
1/8 BEND
1/8 BEND
FIXTURE
CLEANOUT (TYP)
1/4-INCH PER FOOT MINIMUM SLOPE
THE CLEANOUT SHOULD BE INSTALLED ABOVE THE SPILL LEVEL OF THE FIXTURE.
WYE BRANCH FITTING
NO OTHER FIXTURE DRAIN MAY BE CONNECTED TO THE DRAIN LINE UPSTREAM OF THE POINT WHERE THE RETURNED VENT CONNECTS TO THE HORIZONTAL WASTE PIPE
THE CONNECTION MUST BE MADE WITH A WYE BRANCH FITTING IMMEDIATELY DOWNSTREAM OF THE VERTICAL FIXTURE DRAIN
DRAINAGE FITTINGS MUST BE USED FOR ALL PORTIONS OF THE VENT LOCATED BELOW THE FLOOR

Island Vent

Not an Island Vent

609.10 Water Hammer.

Building water supply systems where quick-acting valves are installed shall be provided with water hammer arrester(s) to absorb high pressures resulting from the quick closing of these valves. Water hammer arresters shall be approved mechanical devices in accordance with the applicable standard(s) referenced in Table 1401.1 and shall be installed as close as possible to quick-acting valves.



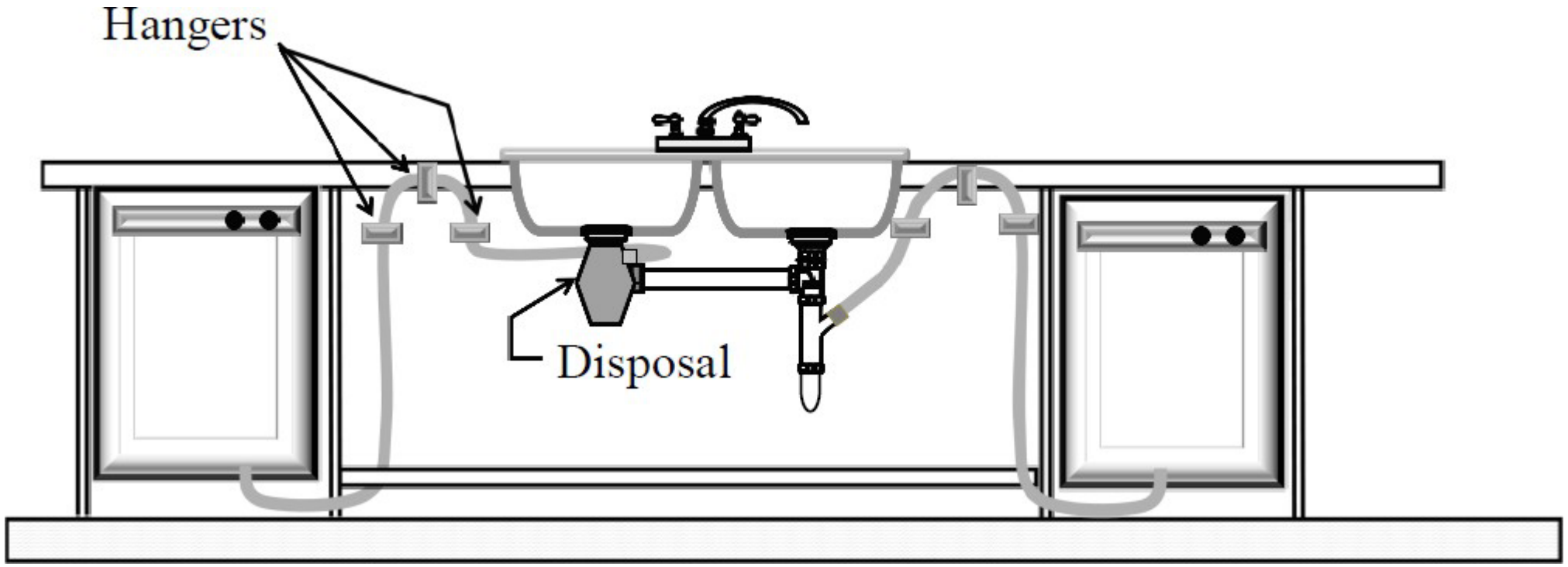
Water Hammer Arresters

604.13 Water Heater Connectors.

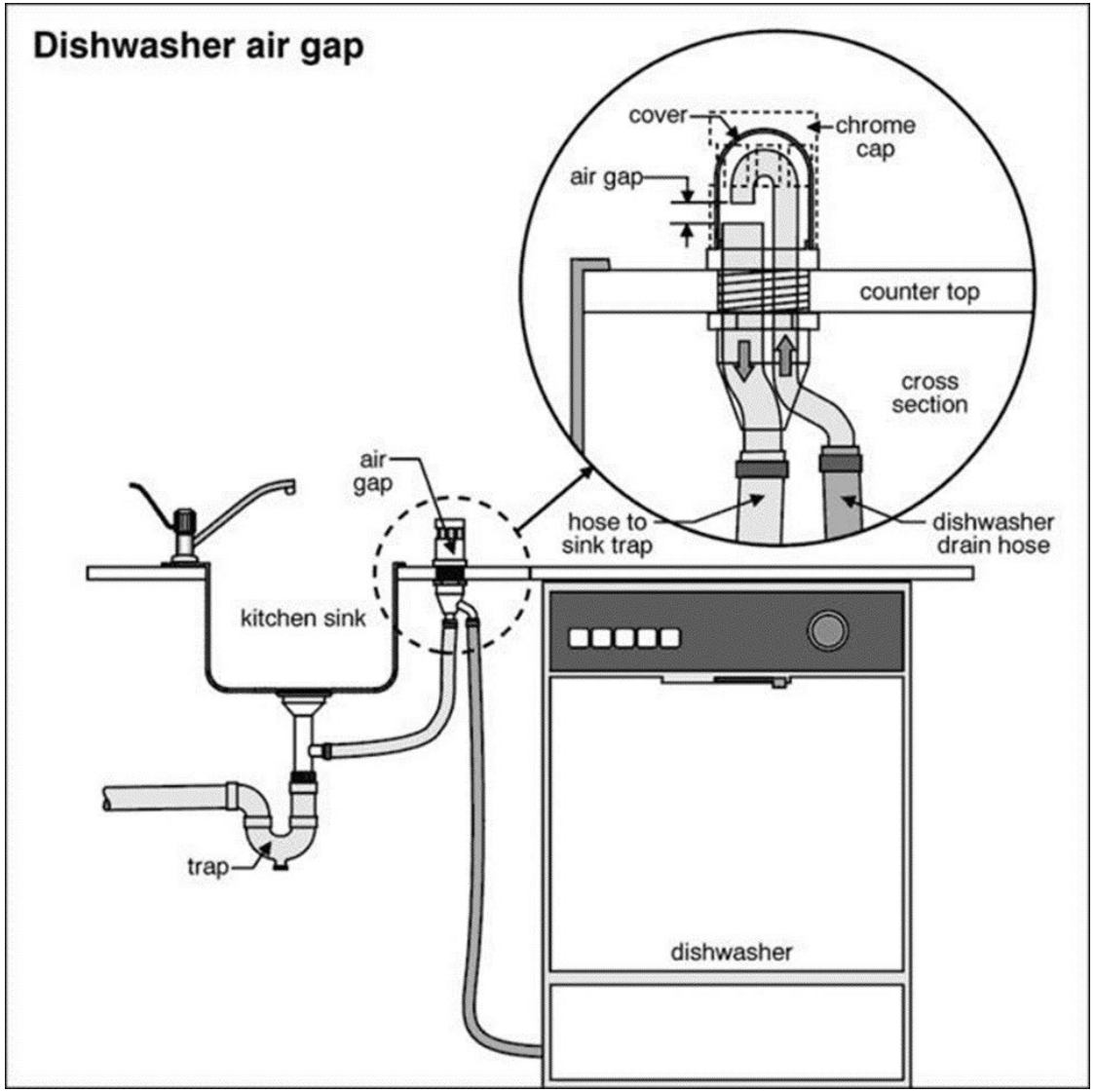
Flexible metallic (copper and stainless steel), reinforced flexible, braided stainless steel, or polymer braided with EPDM core connectors that connect a water heater to the piping system shall comply with ASME A112.18.6/CSA B125.6. Copper, copper alloy, or stainless-steel flexible connectors shall not exceed 24 inches (610 mm). PEX, PEX-AL-PEX, PE-AL-PE, or PE-RT tubing shall not be installed within the first 18 inches (457 mm) of piping connected to a water heater.

807.3 Domestic Dishwashing Machine.

No domestic dishwashing machine shall be directly connected to a drainage system or food waste disposer without the use of an approved dishwasher air gap fitting on the discharge side of the dishwashing machine **or run the discharge line as high as possible under the countertop, securely fastened**. Listed air gaps shall be installed with the flood level (FL) marking at or above the flood level of the sink or drainboard, whichever is higher.



Domestic Dishwashing Machine



Domestic Dishwashing Machine

409.4 Limitation of Hot Water in Bathtubs and Whirlpool Bathtubs.

The maximum hot water temperature discharging from the bathtub and whirlpool bathtub filler shall be limited to 120 degrees Fahrenheit (49 degrees Celsius). The maximum temperature shall be regulated by one of the following means:

(1) a limiting device conforming to either ASSE 1070/ASME A112.1070 /CSA B125.70 or CSA B125.3; or

(2) a water heater conforming to ASSE 1084.

410.3 Limitation of Water Temperature in Bidets.

The maximum hot water temperature discharging from a bidet shall be limited to 110 degrees Fahrenheit (43 degrees Celsius). The maximum temperature shall be regulated by one of the following means:

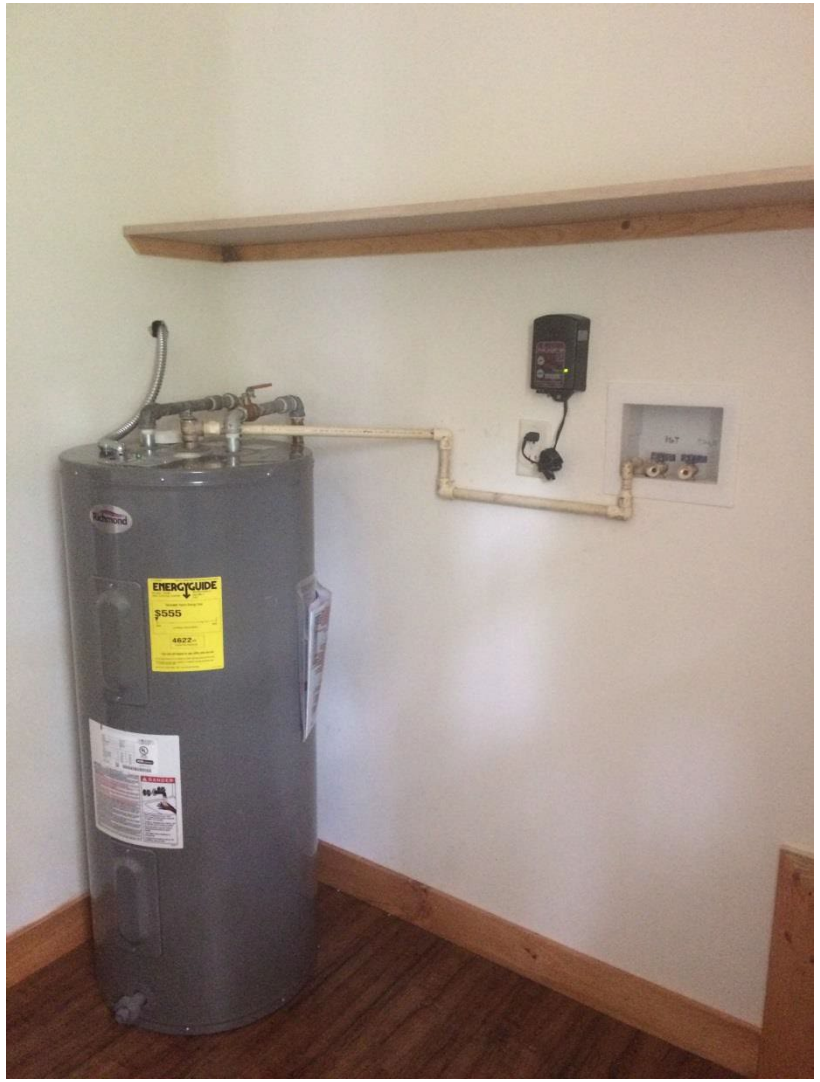
(1) a limiting device conforming to either ASSE 1070/ASME A112.1070 /CSA B125.70 or CSA B125.3; or

(2) a water heater conforming to ASSE 1084.

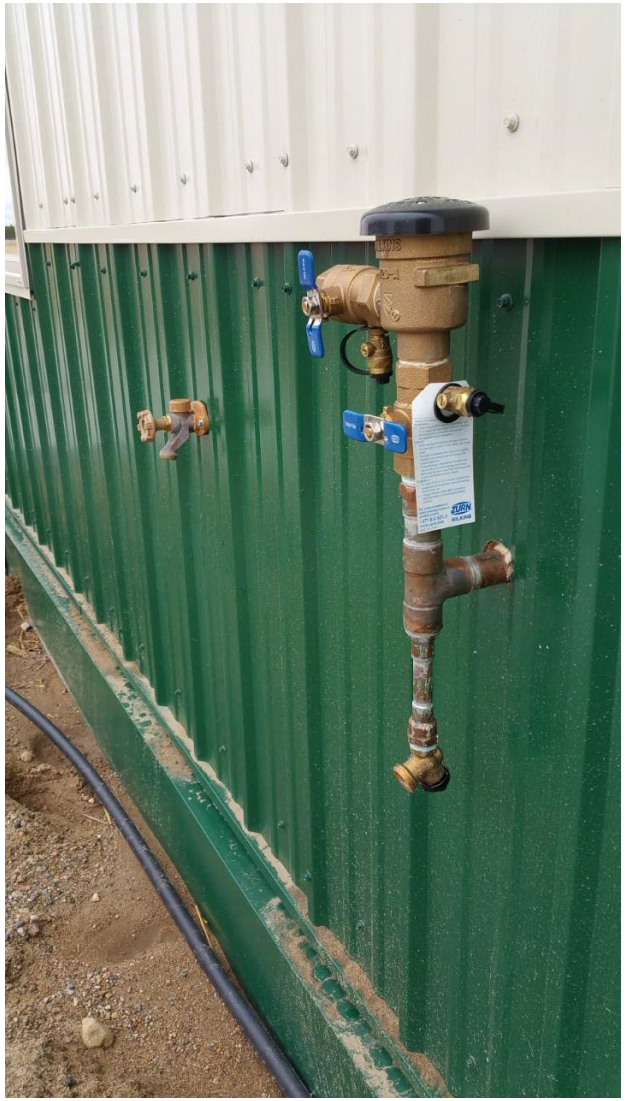
The Importance of a Relief Valve

Relief Valve

Relief Valve



Relief Valve



Final Inspection

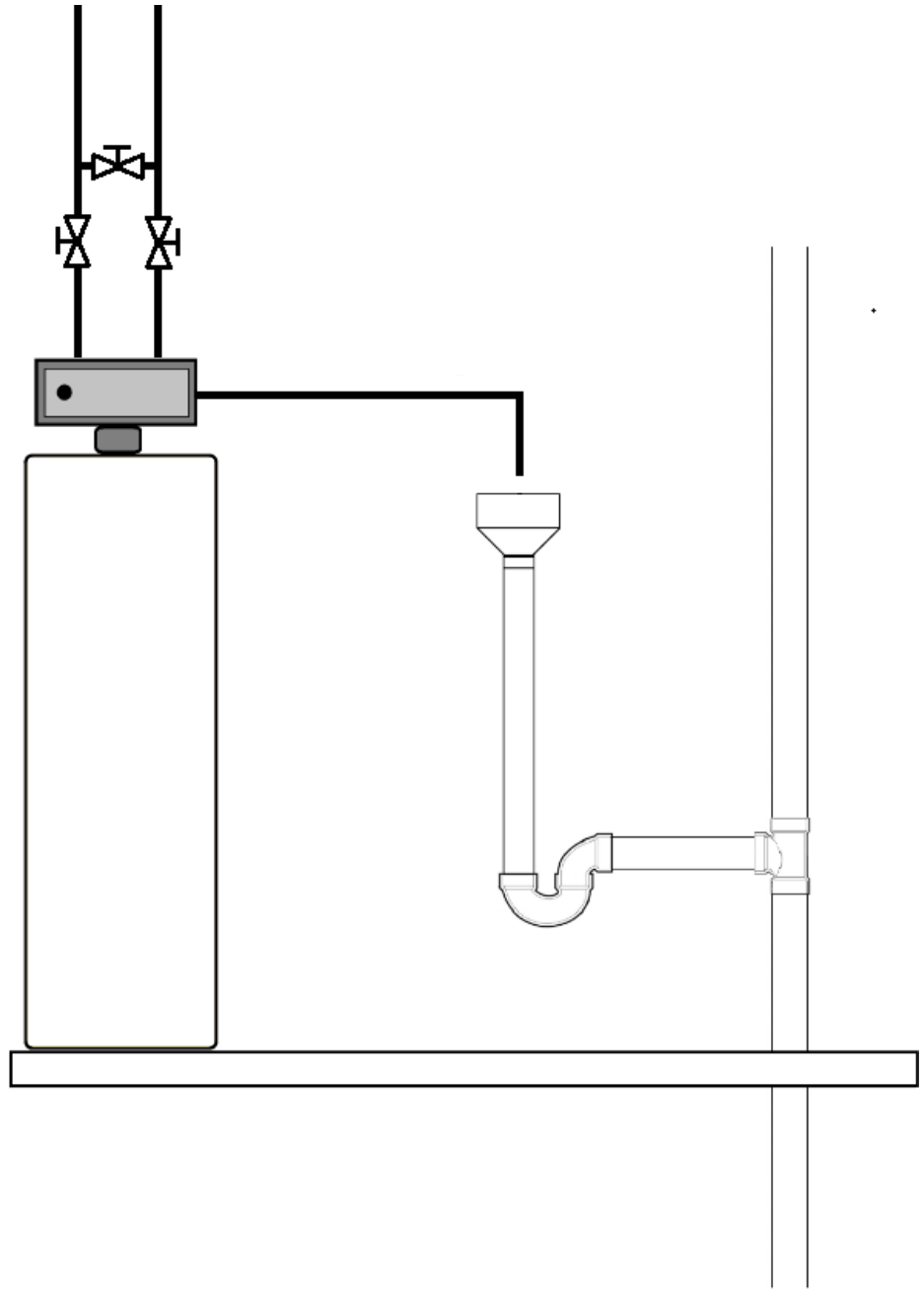
Final Inspection

Final Inspection

611.0 Water Conditioning Equipment.

611.5 Isolation and Bypass.

Every water conditioning installation shall include the installation of isolation valves and a bypass valve which would allow the equipment to be serviced or removed without the need for shutting off the water service completely



Final Inspection

Watch Your Workers!

Watch Your Workers!

Chumming for Deer

The End

Kara Topper| Plumbing Standards Representative
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Thank You!

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