The Board of State Examiners of Plumbers & Gas Fitters

CMR 248	***Rules and Regulations*** **10.00: Uniform State Plumbing Code**

Top

10.14: **Water Supply and the Water Distribution System**

(1) Potable Water Supply.

(a) Buildings.

1. Every building equipped with plumbing fixtures and used for human occupancy or habitation shall be provided with a potable supply of cold water in the amounts and at the pressures specified in 248 CMR 10.14.

2. For permanent residences or buildings in which people are employed, hot water shall be provided.

(b) Use of Non-potable Water Prohibited. Only potable water shall be accessible to plumbing fixtures supplying water for:

1. drinking;
2. bathing;
3. culinary use; or
4. the processing of food, medical or pharmaceutical products.

(2) Water Service.

(a) The water service pipe shall be of sufficient size to furnish water to the building in the quantities and at the pressure required elsewhere in 248 CMR 10.00.

(b) It shall, in no case, be less than ¾ inch nominal pipe diameter.

(c) Recommended methods for sizing the water service pipe shall be the same as required in 248 CMR 10.14(4): Designing and Sizing the Building Water Distribution System.

(3) Conservation of Water.

(a) Conservation of Hot Water.

1. Showers. Showers used for other than safety reasons shall be equipped with flow control devices to limit total flow to a maximum of 2.5 G.P.M. per shower head.

2. Lavatory faucets in public toilet facilities shall:

a. Limit the delivery of water to a maximum of .5 G.P.M. unless a metering faucet is provided that limits delivery to a maximum of 0.25 gallons per metering cycle.

b. Be equipped or installed with devices which limit the outlet temperature to a maximum of 110EF.

c. Metering faucets of any type are not required for toilet facilities designated and used by employees only.

3. The maximum temperature of the domestic hot water in residential buildings shall not exceed 130EF. Plumbing fixtures requiring higher temperatures for their proper use and function, such as dishwashers and hot water dispensers shall be exempted from 248 CMR 10.14.

(b) Conservation of Cold Water for Toilets and Urinals.

1. Flushometer Toilets.

a. Flushometer toilets that are floor mounted or wall mounted shall be low consumption toilets which use a maximum of 1.6 gallons (six liters) per flush.

b. Flushometer type urinals shall discharge a maximum of one gallon (3.8 liters) per flush.

c. The Board may grant Product-approval to standard flushometer toilets and urinals which do not meet the specific standards when, in the opinion of the Board the configuration of the building drainage system requires a greater quantity of water to adequately flush the system.

2. Tank Type Toilets.

a. All two-piece toilets shall be low consumption toilets, which use a maximum of 1.6 gallons (six liters) per flush.

b. In satisfaction of the requirements of 248 CMR 10.14, the Board shall permit the installation of tank-type toilets equipped with devices which are found by the Board to meet applicable standards, in toilets having a tank capacity in excess of 1.6 gallons (six liters).

3. All other toilets not covered in 248 CMR 10.14(3)(b)1. and 2. shall be low consumption toilets that use a maximum of 1.6 gallons (six liters) per flush.

(4) Designing and Sizing the Building Water Distribution System.

(a) Methods to Be Used.

1. The design of the building’s hot and cold-water

distribution system shall conform to good engineering practices.

2. The methods used to determine pipe sizes shall be the procedure outlined in Appendix "D" of the United States Public Health Service publication #1038, or a system designed by a registered professional engineer, using the computation outlined in 248 CMR 10.14(4): Tables 1, 2, and 3. (An example of the use of these tables is shown following 248 CMR 10.14(4): Table 3: Capacity Values for Service, Mains, Risers and/or Branches).

3. The minimum size of a fixture supply pipe shall be in accordance with 248 CMR 10.14(4): Table 1.

4. The size of fixture supplies, the building main and branch distribution piping may be determined from 248 CMR 10.14 (4): Tables 1, 2, and 3.

5. To size the hot and cold water main or distribution branches for a building, they shall be computed on an individual basis.

6. A demand factor, as recognized in 248 CMR 10.14(4): Table 2 shall be applied to determine the minimum diameter pipe size for the building main and water distribution system piping.

7. Size of Fixture Supplies.

a. The minimum sizes of a fixture water supply pipe shall be as shown in 248 CMR 10.14(4): Table 1: Minimum Sizes of Fixture Water Supply Lines and Factor Values.

b. The fixture water supply pipe shall be extended to within at least 30 inches of the point of connection to the fixture.

TABLE 1
MINIMUM SIZES OF FIXTURE WATER SUPPLY LINES AND FACTOR VALUES

TYPE OF FIXTURE OR DEVICE	Nominal Pipe Size (inches)	Factor Value
Bathtub (with or without single shower head)	½	2
Bidet	d	1
Drinking fountain	d	1
Dishwasher (Domestic)	½	2
Dishwasher (Commercial)	¾	6

Kitchen sink, Residential	½	2
Kitchen sink, Commercial (Pot and Scullery)	¾	6
Vegetable Prep or Bar Sink (Residential)	½	2
Hand Wash Sinks	d	1
Shampoo Sinks	d	1
Lavatory	d	1
Utility Laundry Sinks 1, 2, or 3 compartments	½	2
Shower Valve (single head)	½	2
Shower Valve (Multiple heads)	¾	6
Sinks (service, slop)	½	2
Sinks flushing rim	¾	6
Laundry Valve	½	2
Urinal (flush valve type)	¾	6
Toilet (tank type)	d	1
Toilet (flush valve type)	1	12
Hose Connections/Sillcocks/Wall Hydrants	½	2

TABLE 2

OCCUPANCY USE	DEMAND FACTORS
RESIDENTIAL	
One or Two Family Dwelling	0.50
Multi-residential	0.35
Hotel	0.70
SCHOOL	
General	0.75
Shower Room	1.00
INSTITUTIONAL	
General	0.45
ASSEMBLY	
General	0.25
Restaurant, Café	0.70

Club House	0.60
BUSINESS AND MERCANTILE	
General	0.25
Laundry	1.00
INDUSTRIAL	
General, Exclusive of Process Piping	0.90

TABLE 3
CAPACITY VALUES FOR SERVICE, MAINS, RISERS AND/OR BRANCHES

Nominal Pipe or Tubing Sizes (inches)	Capacity Value		
d	1		
½	1.1	to	4
¾	4.1	to	9
1	9.1	to	16.5
1¼	16.6	to	28
1½	28.1	to	55
2	55.1	to	107.5
2½	107.6	to	182.5
3	182.6	to	287.5
3½	287.6	to	425
4	425.1	to	700
5	700.1	to	1100
6	1100.1	to	1300

8. Example: 248 CMR 10.14(4): Tables 1, 2 and 3 are used to determine the size of the cold water main for a one family residence having the following fixtures:

A Two Toilets (Tank type)

B Two Lavatories

C One Bathtub

D One Shower Stall

E One Utility Sink or Laundry Valve

F One Dishwasher (Domestic)

G One Kitchen Sink

H Two Wall Hydrants

FACTOR VALUES (248 CMR 10.14, from Table 1)

			HOT	COLD	
A	Two	Toilets (tank type) X 1		2	
B	Two	Lavatories X 1	2	2	
C	One	Bathtub	2	2	
D	One	Shower Stall	2	2	
E	One	Utility Sink or Laundry Valve	2	2	
F	One	Dishwasher (Domestic)	2		
G	One	Kitchen Sink	2	2	
H	One	Wall Hydrant		4	
		TOTAL	12	16	28

a. 248 CMR 10.14(4): Table 2 indicates a Demand Factor of 0.50 for a Single or Two family dwelling.

b. Multiplying the total Factor Value of 28 by the Demand Factor of 0.50 results in a Capacity Value of 14.0

c. A Capacity Value of 14 is between 9.1 and 16.5 in 248 CMR 10.14(4): Table 3 and the related pipe size is equals to a one-inch diameter pipe.

(b) Prevent Water Hammer.

1. Installation and Design requirements.

a. All building water supply systems in which quick acting valves and solenoid valves are installed shall be provided with devices to absorb high pressures resulting from the quick closing of these valves.

b. These pressure-absorbing devices shall be air chambers that are provided with a means for restoring the air to the device should the chambers become waterlogged, or other Product-approved mechanical devices.

c. Water pressure absorbers shall be placed as close as possible to the quick acting valves and shall be accessible for maintenance or replacement.

2. Pressure Absorbing Devices. A mechanical pressure absorbing device may be installed:

a. at the ends of long pipe runs of pipe; or

b. connected to piping serving batteries of fixtures.

3. Mechanical Devices. Where mechanical devices are used, the manufacturer's specifications shall be followed as to location and method of installation.

(c) Inadequate Water Pressure. Whenever water pressure from the street main, service or other source of supply is insufficient to provide flow pressures at fixture outlets as required under 248 CMR 10.14(4)(f), a booster pump and pressure tank or other means in compliance with 248 CMR 10.00 shall be installed on the building water supply system.

(d) Variable Street Pressures. Where street main pressures fluctuate, the building water distribution system shall be designed for the minimum pressure available.

(e) Supply Demand. The supply demand in gallons per minute in the building water distribution system shall be determined on the basis of the load in terms of supply fixture units and of the relationship between load and supply demand.

(f) Minimum Pressures Required in Water Distribution System.

1. Based on the minimum static water pressure available, pipe sizes shall be selected so that under conditions of peak demand a minimum flow pressure at the point of discharge shall not be less than that shown in 248 CMR 10.14(4): Table 4: Minimum Flow Pressure and Flow Rates.

1. In determining minimum pressures at the outlets, allowances shall be made for the pressure drop due to friction loss.

TABLE 4
MINIMUM FLOW PRESSURE AND FLOW RATES

FIXTURE OR DEVICE	FLOW PRESSURE P.S.I.	FLOW RATE G.P.M.
Ordinary basin faucet	8	2
Self closing basin faucet	8	2.5
Sink faucet, d inch	8	4.5
Sink faucet, ½ inch	8	4.5
Bathtub faucet	8	6

Laundry Valve, ½ inch	8	5
Shower valves	8	3
Ball-cock for toilet	8	3
Flush valves for toilets (Wide range due to variation in design and type of toilet)	15-20	15.35
Flush valves for urinal	15	15
Drinking fountains	15	0.75
Sillcock/wall-hydrant	10	5

(g) Excessive Water Pressure.

1. When the municipal service or other water service source provides water to a building that exceeds 80 P.S.I.G., a pressure reducing valve shall be installed in the water main pipe at the point of water service entrance to the building. This is to reduce the water pressure to a maximum of 80 P.S.I.G. or less. This requirement does not apply where the water service pipe supplies water directly to a water pressure booster system, an elevated water gravity tank, or to pumps provided in connection with a hydro-pneumatic or elevated gravity water supply tank system.

2. The Pressure at any fixture under no-flow conditions shall be limited to no more than 80 P.S.I.G.

(h) Return Circulation -- Where Required. Hot water supply systems in buildings where the developed length of hot water piping from the source of the hot water supply to the farthest fixture supply exceeds 100 feet shall be:

1. of the total return circulation type; or

2. shall be maintained at the design temperature using a self regulating heating cable.

(5) Installing The Building Water Distribution System.

(a) Meter Valve.

1. A gate valve or other full-port valve shall be installed in the water supply main on the discharge side of each water meter.

2. The valve shall be not less than the size of the building water service pipe.

(b) Riser Valves.

1. Except in single family dwellings, a valve shall be installed at the base of each water supply riser.

2. In multistory buildings, a valve shall be installed at the top of each water supply that is an upstream supply pipe from a booster system.

(c) Valves in Dwelling Units.

1. If individual fixture valves are not installed in two-family or multiple family dwelling units, one or more main control valves shall be provided so that the water to any unit may be shut off without stopping the flow of water to other units.

2. These valves shall be readily accessible inside the unit controlled.

(d) Individual Fixture Valves.

1. In buildings that are occupied other than residential dwellings, the water supply line to each fixture or other piece of equipment shall be provided with a valve or a fixture stop to shut off the water to the fixture.

2. All sillcocks, hose bibbs and wall hydrants shall be separately controlled by a shutoff valve inside the building.

(e) Tank Controls. Supply lines from pressure or gravity tanks shall be provided with valves at or near the tanks.

(f) Water Heating Equipment Valve. The cold-water branch to each hot water storage tank or water heater shall be provided with a valve located near the equipment and above the top of the tank.

(g) Valves to be Accessible.

1. All water supply main control valves shall be placed so as to be accessible for service and maintenance.

2. All concealed tub or shower valves shall be provided with renewable seats.

(h) Main Control Valve Design. Except for single fixture shutoffs, main control valves on all water mains and branches, shall, when fully opened, have a cross sectional area not less than the cross sectional area of the pipe (full-port) in which they are installed.

(i) Draining Systems. Drain cocks or valves should be provided at all low points of piping so that every portion of the water piping system can be drained. A drain valve shall be required near the meter or main control valve.

(j) Metering Devices with Check Valves.

1. Where water meters or metering devices with check valves are installed, which can create a potential hazard or nuisance due to thermal expansion, a thermal expansion tank shall be installed as close as possible to the water meter or metering devices.

2. The thermal expansion tank shall be of adequate size and constructed of materials approved in 248 CMR 10.06.

(k) Hose Connections.

1. Outside Hose connections, sillcocks or wall hydrants shall be installed in all residential buildings no more than 100-feet apart.

2. In all commercial buildings, sillcocks and hose connections shall only be required in:

a. mechanical rooms;
b. mechanical penthouses; or
c. mechanical areas of similar use and nature.

3. A backflow preventer or vacuum breaker shall be installed on all sillcocks, hose connections and wall hydrants including faucets that incorporate a hose thread outlet.

(l) Saddle Valves.

1. Saddle valves are prohibited in the water supply line.

2. No water supply line shall be tapped, burned, welded, or drilled, except that mechanical devices that have been Product-approved by the Board which are designed and engineered to create penetration in piping for specific joining methods may be used.

(6) Water-Pressure Booster Systems.

(a) Water Pressure Booster Systems Required. When water pressure in the public water main or individual water supply system is insufficient to supply the probable peak demand flow to all plumbing fixtures and other water needs freely and continuously with the minimum pressures and quantities, specified in 248 CMR 10.14(4)(f) or elsewhere in 248 CMR 10.00 and in accordance with good practice, the rate of supply shall be supplemented by:

1. a gravity water tank;

2. a hydro-pneumatic pressure booster system; or

3. A pressure tank installed in accordance with 248 CMR 10.14(4)(c).

(b) Support. All water supply tanks shall be supported in accordance with 780 CMR: The Massachusetts State Building Code or local building commissioner.

(c) Covers.

1. All water supply tanks shall be covered to keep out unauthorized persons, dirt, and vermin.

2. The covers of gravity tanks shall be vented with a return bend vent pipe having an area not less than the area of the down feed riser pipe.

3. The vent shall be screened with corrosion resistant screen of not less than 16 x 20 mesh.

(d) Overflows for Water Supply Tanks.

1. Each gravity or suction water supply tank shall be provided with an overflow having a diameter not less than shown in 248 CMR 10.14(6): Table 5: Sizes of Overflow Pipes for Water Supply Tanks.

2. The overflow outlet shall discharge above and within not less than six inches of a roof or roof drain, floor or floor drain or over an open water supplied fixture.

3. The overflow outlet shall be covered by a corrosion resistant screen of not less than 16 x 20 mesh to the inch and by ¼ inch hardware cloth or shall terminate in a horizontal angle seat check valve.

4. Drainage from overflow pipes shall be directed so as not to freeze on roof walkways.

TABLE 5
SIZES OF OVERFLOW PIPES FOR WATER SUPPLY TANKS

Maximum Capacity of Water Supply Line to Tank			Diameter of Overflow Pipe (inches ID)
0	–	50 G.P.M.	2
51	–	100 G.P.M.	2½
101	–	165 G.P.M	3
166	–	355 G.P.M.	4
356	–	640 G.P.M.	5
641	–	1,040 G.P.M.	6
OVER 1,040 G.P.M.			8

(e) Low Pressure Cut-off Required on Booster Pumps. When a booster pump is used on a water pressure booster system and the possibility exists that a positive pressure of ten P.S.I.G. or less may occur on the suction side of the pump, there shall be installed a low pressure cut-off on the

booster pump to prevent the creation of a vacuum or negative pressure on the suction side of the pump, thus cutting off water to other outlets.

(f) Potable Water Inlet Control and Location.

1. Potable water inlets to gravity tanks shall be controlled by a ball cock or other automatic supply valve so installed as to prevent the tank from overflowing.

2. The inlet shall be terminated so as to provide an accepted air gap but in no case less than four inches above the overflow.

(g) Tank Drain Pipes. Each tank shall be provided at its lowest point with a valve and pipe to permit emptying the tank which shall discharge as required for overflow pipes and not smaller in size than shown in 248 CMR 10.14(6): Table 6: Sizes of Drain Pipes for Water Tanks.

TABLE 6
SIZES OF DRAIN PIPES FOR WATER TANKS

TANK CAPACITY (Gallons)	DRAIN PIPE (Inches)
Up to 750	1
751 to 1,500	1½
1,501 to 3,000	2
3,001 to 5,000	2½
5,001 to 7,500	3
Over 7,500	4

(h) Prohibited Location of Potable Supply Tanks. Potable water gravity tanks or manholes of potable water pressure tanks shall not be located directly under any soil or waste piping.

(i) Pressure Tanks -- Vacuum Relief.

1. All potable water pressure tanks shall be provided with a vacuum relief valve at the top of the tank that will operate up to a maximum water pressure of 200 P.S.I.G and to a maximum water temperature of 200EF.

2. Vacuum relief valves shall be sized according to the following:

a. The relief valves shall have a cross sectional area at the valve seat that is not less than one pipe size smaller than the cold water supply or the tank drain, whichever is larger.

b. The minimum size of the vacuum relief valves shall be ½ inch.

c. Valves shall have a minimum ½ diameter orifice.

d. The air inlet opening on any vacuum relief valve shall not be smaller than the nominal pipe size of the valve.

3. Vacuum relief valves may be installed in multiples.

(j) Pumps and Other Appliances. Water pumps, filters, softeners, tanks and all other appliances and devices used to handle or treat potable water shall be protected against contamination.

(7) Protection of Potable Water Supply.

(a) General. A potable water supply system shall be designed, installed and maintained in such manner as to prevent contamination from non-potable liquids, solids, or gases from being introduced into the potable water supply through cross connections or any other piping connections to the system.

(b) Identification of Potable and Non-potable Water. In all buildings where dual water distribution systems are installed, one potable water and the other non-potable water each system shall be identified by color bands or metal tags.

1. Color Marking.

a. When color marking is employed, potable water lines shall be painted green and non-potable water lines shall be painted yellow.

b. This requirement may be accomplished by painting three inch wide bands of green or yellow at intervals of not more than 25 feet and at points where piping passes through walls, floors and roofs. The colored bands shall be applied to the piping on both sides of the walls and above and below the floor or roof penetrations. Outlet locations, (the point of use) for non-potable water systems shall be marked with a tag or color coded identification.

2. Metal Tags.

a. When tags are used, three-inch diameter metal tags bearing the legend SAFE WATER in letters not less than ½ inch in height shall identify potable water lines.

b. Firmly attached metal tags having the shape of a four-inch equilateral triangle bearing the legend WATER UNSAFE in letters not less than 7/16 inches in height shall identify non-potable water supply lines.

c. As in the use of color bands, tags shall be attached to pipes at intervals of not more than 25 feet and at either side of points where pipes pass through walls and above and below points where pipes pass through floors or roofs.

(c) Cross Connection Control.

1. Cross connections between potable water systems and other systems or equipment containing water or other

substances of unknown or questionable safety are prohibited; except when and where, as approved by the Massachusetts Department of Environmental Protection or its designee, suitable protective devices such as the Reduced Pressure Zone Backflow Preventer or equal are installed, tested, and maintained to insure proper operation on a continuing basis.

2. No plumbing permit shall be issued for cross connection installations that require Reduced Pressure Zone Backflow Preventers or Double Check Valve Assemblies until the application for a permit is accompanied by a letter of approval from the Massachusetts Department of Environmental Protection or its designee.

(d) Interconnections.

1. Individual Water Supplies. Cross connections between an individual water supply and a potable public supply shall not be made unless specifically approved by the Massachusetts Department of Environmental Protection.

2. Public Water Supplies. Interconnection between two or more public water supplies shall be permitted only with the approval of the health authority having jurisdiction.

(e) Toxic Materials.

1. Construction. Piping conveying potable water shall be constructed of nontoxic material.

2. Materials and Substances. No materials or substances that could produce either toxic conditions, taste, odor, or discoloration in a potable water system shall be introduced into or used in such systems.

3. Painting of Water Tanks. The interior surface of a potable water tank shall not be lined, painted, or repaired with any material that will affect the taste, odor, color, or potable condition of the water supply when the tank is placed into service or returned to service following maintenance.

(f) Used Piping. Piping which has been used for any other purpose than conveying potable water shall not be used for conveying potable water.

(g) Self Feeding Water Connections to Heating Boilers.

1. Potable water connections to a heating boiler shall be provided with an approved back flow preventer or air gap in the water line to prevent a cross connection.

2. Backflow preventers shall not be required on manually controlled water supply lines to residential type steam and/or gravity fed hot water space heating systems.

(h) Prohibited Connections to Fixtures and Equipment. Connection to the potable water supply system for the following shall be protected against backflow:

1. bidets;

2. operating, dissection, embalming, and mortuary tables or similar equipment -- in such installation, the hose used for water supply shall terminate at least 12 inches away from every point of the table or attachments;

3. pumps for non-potable water, chemicals or other substances; note that priming connections may be made only through an air gap;

4. building drainage, sewer or vent system; and

5. any other fixture of similar hazard.

(i) Refrigerating Unit Condensers and Cooling Jackets.

1. Except where potable water provided for a refrigerator condenser or cooling jacket is entirely outside the piping or tank containing a toxic refrigerant, with two separate thicknesses of metal separating the refrigerant from the potable water supply the inlet connection shall be provided with an approved double check valve installation.

2. Also adjacent to and at the outlet side of the check valve, an approved pressure relief valve set to relieve at five P.S.I.G. above the maximum water pressure at the point of installation shall be provided if the refrigeration units contain more than 20 pounds of refrigerants.

(j) Water Recycling Prohibited.

1. Water used for cooling of equipment or other processes shall be discharged into the drainage system through an air gapped indirect waste. Under conditions where water shortage may occur, the water used for cooling may be used for non-potable purposes. Water used for cooling of equipment or other processes shall not be returned to the potable water system.

2. Exceptions. Water recycling systems may be installed if Special-permission under 248 CMR 3.04(3) has been granted by the Board. Such systems include:

a. dedicated gray water systems;

b. black water systems; or

c. on site wastewater treatments systems.

(k) Protection Against Backflow and Backsiphonage.

1. Water Outlets. A potable water system shall be protected against backflow and backsiphonage in accordance with M.G.L. c. 111, § 160A, and 310 CMR (Department of Environmental Protection) relative to protection of the potable water supply).

a. Air Gap. An air gap as defined in 248 CMR 10.03: Air-Gap Water Distribution between the potable water outlet and the flood level rim of the fixture it supplies or between the outlet and any other source of contamination.

b. Backflow Preventer. A backflow preventing device or vacuum breaker to prevent the drawing of contamination into potable water system.

2. Minimum Required Air Gap.

a. How Measured. The minimum required air gap shall be measured vertically from the lowest end of a potable water outlet to the flood rim or line of the fixture or receptacle into which it discharges.

b. Size.

i. The minimum required air gap shall be twice the effective opening of a potable water outlet.

ii. If the outlet is found to be at a distance that is less than three times the effective opening away from a wall or similar vertical surface; the minimum required air gap shall be three times the effective opening of the outlet.

iii. In no case shall the minimum required air gap be less than shown in 248 CMR 10.14(7): Table 7: Minimum Air Gaps for Plumbing Fixtures:

(i) Side wall ribs or similar obstructions do not effect air gaps when they are spaced from the inside edge of a spout opening at a distance greater than three times the diameter of the effective opening for a single wall; or greater than four times the diameter of the effective opening for two intersecting walls.

(ii) Vertical wall, ribs, or similar obstructions extending from the water surface to or above the

horizontal plane of the spout opening require a greater air gap when spaced closer to the nearest inside edge of spout opening than specified in 248 CMR 10.14(7)(k) 2.b.iii.(i). The effect of three or more such vertical walls or ribs has not been determined. In such cases, the air gap shall be measured from the top of the wall.

TABLE 7
MINIMUM AIR GAPS FOR PLUMBING FIXTURES

MINIMUM AIR GAPS FOR PLUMBING FIXTURES	Minimum Air Gap	
	When not affected by near wall(INCHES)	When affected by near wall(INCHES)
Lavatories and other fixtures with effective openings not greater than ½ inch diameter.	1	1.50
Sink, laundry sinks, goose neck bath faucets and other fixtures with effective openings not greater than ¾ inch diameter	1.5	2.25
Over rim bath fillers and other fixtures with effective openings not greater than one inch diameter.	2	3.0
Drinking water fountains single orifice 7/16 (0.437) in. diameter or multiple orifices having total area of 0.150 sq. in. (area of circle 7/16 in. diameter)	1	1.50
Effective openings greater than one inch	2X diameter of effective opening	3X diameter of effective opening

3. Devices for the Protection of the Potable Water Supply. Approved backflow preventers or vacuum breakers shall be installed with any plumbing fixture or equipment, the potable water supply outlet of which may be submerged and which cannot be protected by a minimum air gap.

4. Certification of Devices.

a. Before any device for the prevention of backflow or backsiphonage is installed the following requirements shall be satisfied:

i. An Approved-testing-lab shall have first certified it as being acceptable.

ii. The Board has recognized it as being Product-approved.

iii. These backflow devices shall be maintain in compliance with 310 CMR 22.22: Cross Connections Distribution System Protection.

b. Labeling.

i. Piping after each device shall be labeled as "Water Subject to Questionable Safety", black lettering on yellow background, sizes of lettering and background determined by ANSI A13.1-85, Scheme for the Identification of Piping Systems.

ii. The labels shall be placed along the installation every 25 feet and at both penetration points where pipes pass through walls and both penetration points where pipes pass through floors or roofs.

5. Installation of Devices.

a. Vacuum Breakers.

i. Vacuum breakers shall be installed with the critical level at least six inches above the flood level rim of the fixture they serve and on the discharge side of the last control valve to the fixture.

ii. No shut-off valve or faucet shall be installed beyond the vacuum breaker.

iv. For closed equipment or vessels such as pressure sterilizers the top of the vessel shall be treated as the flood level rim but a check valve shall be installed on the discharge side of the vacuum breaker.

b. Reduced Pressure Zone Backflow. A reduced pressure zone type backflow preventer may be installed subject to full static pressure. Where damage may occur to the building or structure due to water discharge from the vent port precautions shall be taken.

c. Devices of All Types.

i. Backflow and backsiphonage preventing devices shall be accessibly located preferably in the same room with the fixture they serve.

ii. Installation in utility or service spaces, provided they are readily accessible, is also permitted.

6. Tanks and Vats -- Below Rim Supply.

a. Where a potable water outlet terminates below the rim of a tank or vat and the tank or vat has an overflow of diameter not less than given in 248 CMR 10.14(6): Table 5: Sizes of Overflow Pipes for Water Supply Tanks, the overflow pipe

shall be provided with an air gap as close to the tank as possible.

b. The potable water outlet to the tank or vat shall terminate a distance not less than 1½ times the height to which water can rise in the tank above the top of the overflow.

c. This level shall be established at the maximum flow rate of the supply to the tank or vat and with all outlets except the air gap, overflow outlet closed.

d. The distance from the outlet to the high water level shall be measured from the critical point of the potable water supply outlet.

7. Protective Devices Required. Approved devices to protect against backflow and backsiphonage shall be installed at all fixtures and equipment where backflow and/or back siphonage may occur and where a minimum air gap cannot be provided between the water outlet to the fixture or equipment and its flood level rim.

8. Connections Not Subject to Back Pressure.

a. Where a water connection is not subject to back pressure, a non-pressure type vacuum breaker shall be installed on the discharge side of the last valve on the line serving the fixture or equipment.

b. A list of some conditions requiring protective devices of this kind is given in in 248 CMR 10.14(7): Table 8: Cross Connections Where Protective Devices Are Required and Critical Level (C-L) Settings for Backflow Preventers.

9. Barometric Loop. Water connections not subject to back pressure where an actual or potential backflow or backsiphonage hazard exists may in lieu of devices specified in 248 CMR 10.14(7)(k)5., be provided with a 35 foot barometric loop. Barometric loops shall precede the point of connection.

10. Pressure Type Vacuum Breakers. Water connections not subject to backpressure where an actual or potential backflow or backsiphonage hazard exists may be protected by the installation of a pressure type vacuum breaker, provided that such device is installed with the critical level a minimum of 12 inches above the highest outlet or fixture served by the connection.

11. Anti-siphon or backpressure valves:

a. An anti-siphon or backpressure valve shall be installed on any chemical metering pump that pumps any chemical into a potable water supply to prevent back siphonage.

b. The anti-siphon or back-pressure valve must be spring loaded and set at a minimum of five-P.S.I.G. (An example

may be an anti-siphon or back-pressure valve installed on a positive displacement metering pump's discharge line and pumping sodium hypochlorite into a water main at a well house for disinfection purposed.)

TABLE 8
CROSS CONNECTIONS WHERE PROTECTIVE DEVICES ARE REQUIRED AND CRITICAL LEVEL (C-L) SETTINGS FOR BACKFLOW PREVENTERS

Fixture or Equipment	Method of Installation
Aspirators and ejectors	C-L at least six inches above flood level or receptacle.
Dental units	On models without built-in vacuum breakers -- C-L at least six inches above flood level rim of bowl.
Dishwashing machines	C-L at least six inches above flood level of machine. Install on both hot and cold water supply lines.
Flushometers (closet and urinal)	C-L at least six inches above top of fixture supplied.
Garbage can cleaning machine	C-L at least six inches above flood level of machine. Install on both hot and cold water supply lines.
Hose outlets	C-L at least six inches above highest point on hose line.
Laundry machines	C-L at least six inches above flood level of machine. Install on both hot and cold water supply lines.
Lawn sprinklers	C-L at least 12 inches above highest sprinkler or discharge outlet.
Steam tables	C-L at least six inches above flood level.
Tank and vats	C-L at least six inches above flood level rim or line.
Trough urinals	C-L at least six inches above perforated flush pipe.
Flush tanks	Must be equipped with approved ball cock. Where ball cocks contact tank water they must be equipped with a vacuum breaker at least one inch above the overflow outlets. Where a ball cock does not contact tank water install the ball cock outlet at least one inch above the overflow outlet or provide a vacuum breaker as specified above.

TABLE 8A
ACCEPTABLE TYPES OF BACKFLOW PREVENTERS FOR PREVENTION OF CROSS CONNECTIONS ON POTABLE WATER

AG	AIR GAP
RPBP	REDUCED PRESSURE BACKFLOW PREVENTER

DCVA	DOUBLE CHECK VALVE ASSEMBLY					
AVB	ATMOSPHERIC VACUUM BREAKER					
BFPAV	BACKFLOW PREVENTER WITH INTERMEDIATE ATMOSPHERIC VENT					
TYPE OF HAZARD ON PREMISES	ACCEPTABLE TYPES OF BACKFLOW PREVENTER					COMMENTS*
	AG	RPBP	DCVA	AVB	BFPAV	
1. Sewage Treatment Plant	X	X				
2. Sewage Pumping Stations	X	X				
3. Food Processing	X	X	X*			* If no health hazard exists
4. Laboratories	X	X	X*			* If no health hazard exists
5. Sinks with hose threads on inlets	X	X		X		
6. Hospitals, Mortuaries, Clinics	X	X				
7. Plating Facilities	X	X				
8. Irrigation Systems**	X	X		X*		Each case should be evaluated individually
						* If no back pressure is possible
						** Pressure Vacuum Breakers can be installed if no health hazard exists and back pressure is not possible.
9. Systems or Equipment Using Radioactive Material	X	X				
10. Submerged Inlets	X	X		X*		* If no health hazard exists and no back pressure is possible
11. Dockside Facilities	X	X				
12. Valved outlets or fixtures with hose attachments	X	X	X*	X**		Each case should be evaluated individually
						* If no health hazard exists
						** If no health hazard exists and no back pressure is possible
13. Commercial Laundries and Dry Cleaners	X	X				
14. Commercial Dishwashing Machines	X	X		X*		If no health hazard exists
15. High and Low Pressure Boilers	X	X				If chemicals are added

16. Low Pressure Heating Boilers					X	Residential and small commercial, having no chemicals added
17. Photo Processing Equipment	X	X				
18. Reservoirs-cooling Tower Recirculation Systems	X	X				
AG	AIR GAP					
RPBP	REDUCED PRESSURE BACKFLOW PREVENTER					
DCVA	DOUBLE CHECK VALVE ASSEMBLY					
AVB	ATMOSPHERIC VACUUM BREAKER					
BFPAV	BACKFLOW PREVENTER WITH INTERMEDIATE ATMOSPHERIC VENT					
TYPE OF HAZARD ON PREMISES	ACCEPTABLE TYPES OF BACKFLOW PREVENTER					COMMENTS*
	AG	RPBP	DCVA	AVB	BFPAV	
19. Fire Fighting Systems						
a. Any system which incorporates pumper connections into which chemical extinguishing agents or non-potable water may be pumped.	X	X	X			
b. Any system which incorporates storage tanks or fire pumps taking suction from covered tanks or reservoirs	X	X	X			
c. Any system incorporating connections to chemical extinguishing agents, anti-freeze, or auxiliary water supplies.	X	X				
20. Solar Energy Systems	X	X			X*	* Residential and small commercial having no chemicals or only USP Glycerin added to water
21. Single Jacketed Heat Exchangers	X	X				Each case should be evaluated individually

Source of Table 8A is Department of Environmental Protection (310 CMR 22.22)

(8) Hot Water Supply System.

(a) In residences and buildings intended for continuous occupancy, hot water shall be supplied to all plumbing fixtures and equipment used for bathing, washing, culinary purpose, cleansing, laundry, or building maintenance.

(b) Hot water storage systems shall be designed to adequately accommodate the fixtures being served.

(9) Hot Water Tanks or Heaters.

(a) Domestic Hot Water Storage Tanks and Tankless Heaters:

Performance Efficiency.

1. All automatic, electric, domestic hot water storage tanks shall have a stand-by loss not exceeding four W/ft.2 of tank's surface area; when tested in accordance with ANSI STANDARD C72-1 entitled Household Automatic Electric Storage Type Heaters.

2. All gas and oil fired, domestic hot water storage tanks shall have:

a. a recovery efficiency (Er) not less than 75%; and

b. a stand-by loss percentage (S) not exceeding: S = 2.3 + 67/V; where….V = rated volume in gallons when tested in accordance with ANSI Standard 221.10.3-74 Gas Water Heaters Volume III, circulating tank, instantaneous and large automatic storage type water heaters.

3. EXCEPTIONS: All gas and oil fired heaters over 80 gallons capacity are exempt from the requirement on recovery efficiency. When using Std. RE-7, oil fired units have a CF = 1.0; Q equals total gallons of oil consumed; and H equals total heating value of oil in Btu/gal.

a. All gas and oil fired heaters with a Btu/h input rate over 75,000 are exempt from the requirements on recovery efficiency.

b. When using ANSI Z21.10.3-74, oil fired units have a CF = 1.0; Q equals total gallons of oil consumed; and H equals total heating value of oil in Btu/gal.

4. Insulation.

a. Heat loss from unfired hot water storage tanks shall be limited to a maximum of 15 Btu/h/sq. ft. of external tank surface area.

b. The design ambient temperature shall be no higher than 65EF for calculating heat losses.

5. Combination Domestic Hot Water/Space Heating Boilers. Service water heating equipment shall not be dependent upon year round operation of space heating boilers (that is, boilers that have winter space heating as another function), except for the following system:

Domestic Hot Water/Space Heating Boilers having a stand-by loss in Btu/h less than:

3. Temperature Relief Valves. Temperature Relief Valves shall meet the requirements of M.G.L. c. 142, § 19 and Standard ANSI Z21.22 latest

issue.

a. Valves shall be minimum ¾-inch size except that for heaters with input of 15,000 BTU per hour or less, the valve can be ½-inch size.

b. The automatic Temperature Relief Valve shall be self-closing and be equipped with a testing lever.

c. The thermostatic relieving element shall extend not more than five inches into the top of the tank.

d. The temperature relief valve shall have a minimum discharge in BTU per hour at least equal to the heat source input.

e. When the water heater is furnished with a separate relief valve tapping in the side and within the top six inches of the tank, the valve installed in such tapping may be equipped with either an extension or short thermostatic element.

f. The official A.G.A. listed rating of an approved valve will be considered in compliance with the requirements of 248 CMR 10.14.

4. Combination Temperature & Pressure Relief Valves.

a. A combination temperature and pressure relief valve shall meet the requirements of both the temperature and pressure relief valves as provided in 248 CMR 10.14(11)(b) and 10.14 (11)(c).

b. For heaters over 200,000 BTU/Hr., input rating:

i. The valve shall have a minimum ASME temperature steam rating of 200,000 BTU;

ii. The valve shall comply with all construction and testing requirement of the current ANSI Standard Z21.22;

iii. The valve shall have minimum one-inch inlet and outlet pipe connections.

iv. The valve shall be ASME pressure steam rated; and

v. A temperature water rating, on the basis of 1250 BTU for each gallon per hour of water discharged at 30 lbs. working pressure and a maximum temperature of 210EF, will be acceptable for the temperature rating for heaters over 200,000 BTU/Hr. input rating. This rating must be certified by the valve manufacturer and

must not be more than the ASME rating shown.

vi The use of a Product-approved polypropylene homopolymer drain tube assembly that is designed to be vertically mounted in the downturned outlet of a horizontally mounted relief valve provided that the capacity of the relief valve served by the approved drain assembly does not exceed 100,000 BTU per hour.

5. Vacuum Relief Valves.

a. Water heaters and storage tanks shall be protected against loss of water from siphoning due to loss of supply pressure by a vacuum relief valve installed in the cold water supply line at a level above the top of the heater or tank.

b. Where heating equipment has a bottom supply, the cold water supply piping shall be carried above the top of the heater before dropping down to the supply connection and have a vacuum relief valve installed in it at a level above the top of the storage tank.

c. The vacuum relief valve shall be in compliance with the Standard ANSI Z21.22 at latest issue.

d. Valves marked with the A.G.A. symbol and listed by the American Gas Association Laboratories will be considered in compliance with 248 CMR 10.14. Valves shall have minimum ½-inch diameter orifice and the air inlet opening on any vacuum valve shall not be smaller than the nominal pipe size of the valve.

e. Vacuum relief valves shall be sized to have a cross sectional area equal to a pipe not less than one pipe diameter smaller than the tank supply or drain, whichever is larger.

f. Vacuum relief valves may be installed in multiples.

(12) Boiler Laws. See M.G.L. c. 142, §§ 17, 18, and 19.

(13) Disinfection of Potable Water System Piping. When necessary, the Inspector shall require that a potable water distribution system, or any part thereof, which has been installed or repaired may require disinfection in accordance with one of the following methods before it is placed in operation:

(a) The system, or part thereof, shall be filled with a water and chlorine solution which contains 50 parts per million of available chlorine; and the same shall then be allowed to stand six hours before the system, or part thereof, is flushed and returned to service.

(b) The system, or part thereof, shall be filled with a solution which

contains 100 parts per million of available chlorine; and the same shall then be allowed to stand two hours before the system, or part thereof, is flushed and returned to service.

(c) Where it is not possible to disinfect a potable water storage tank as provided by 248 CMR 10.14(13)(a) or (b), the entire interior of the tank shall be swabbed with a solution which contains 200 parts per million of available chlorine; and the solution shall then be allowed to stand two hours before the tank is flushed and returned to service. For a potable water filter or similar device, the Massachusetts Department of Environmental Protection shall determine the dosage.

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10.15: **Sanitary Drainage System**

(1) Materials. Pipe, tubing, fittings, and traps to be used on any part of the sanitary drainage system in a building or adjacent to a building shall comply with all relevant sections of 248 CMR, 3.00: through 10.00.

(2) Determining Size of Drainage System.

(a) Fixture Units for Drainage Piping. The waste discharge calculations for the drainage system piping shall be computed in terms of drainage fixture units in accordance with 248 CMR 10.15, Table 1: Fixture Unit Values for Various Plumbing Fixtures and 248 CMR 10.15(2)(b).

(b) Values for Continuous Flow. Fixture unit values for continuous or semi-continuous flow into a building sanitary drainage system, such as from a waste pump, sewage ejector pump, or similar device that discharges sewage waste shall be computed on the basis of two fixture units for each gallon per minute of flow.

(c) Clear water condensate waste that is produced in cumulative amounts of 12.5 gallons per hour or 300 gallons per day or less in buildings by air conditioning equipment, air compressor blow-down discharge (free of petroleum hydrocarbons) or other similar apparatus or appliances may be discharged to the sanitary drainage system in accordance with 248 CMR 10.12(1)(a)4. The clear water waste requirement is not withstanding any local ordinance, by-law, rule or regulation to the contrary.

(3) Selecting the Size of Drainage Piping. Pipe sizes shall be determined from 248 CMR 10.15(7): Tables 1, 2 and 3 on the basis of drainage fixture unit values calculated from 248 CMR 10.15(7): Table 1: Fixture Unit Valves for Various Plumbing Fixtures and 248 CMR 10.15(2)(b).

(4) Minimum Size of Soil and Waste Stacks. No soil or waste stack shall be smaller than the largest horizontal waste branch connected thereto,

(See 248 CMR 10.15(7): Table 1: Fixture Unit Values for Various Plumbing Fixtures and 248 CMR 10.15(7): Table 3: Maximum Loads in Fixture Units for Any One Branch Interval on Multistory Soil and Waste Stacks). Exception: a 4 x 3 toilet connection shall not be considered as a reduction in pipe size.

(5) Minimum Size of the Stack Vent or Vent Stack. Any structure, in which a building drain is installed, shall have as a minimum one stack vent or a vent stack not less than three inches in diameter, (See 248 CMR 10.16(7): Table 2: Size and Lengths of Vents for fixture unit values when determining appropriate stack vent or vent stack sizing) that shall be carried undiminished in size through the roof.

(6) Provision for the Installation of Future Fixtures.

(a) When future drainage provisions are employed for the potential installation of other fixtures, the drains provided shall be considered in determining the final required sizes of drains and vent pipes.

(b) The future drain installations, (if provided) shall be terminated with approved material(s) and fittings.

(7) Size of Underground Drainage Piping.

(a) Underground or Basement Floor. No portion of the drainage system installed underground or below a basement floor, shall be less than two inches in diameter.

(b) Sanitary Piping Installed Through the Foundation Wall.

1. Sanitary pipes that pass through an exterior foundation wall shall be no less than four inches in diameter, except:

a. When serving a Hazardous Waste System installed in accordance with (248 CMR 10.13).

b. When serving a *domestic laundry, wherein the laundry drain is conducted to a separate (Local Board of Health Authorized) dry-well disposal system and may be two inches in diameter.

c. When serving as the waste for a *church Sacrarium, wherein the church Sacrarium drain may be two inches in diameter (see 248 CMR 10.10(16)).

d. When serving exclusively as the discharge from a semi-positive displacement grinder pump, and if so, the following shall be satisfied:

i. The minimum pipe size for a semi-positive displacement grinder pump discharge shall be 1¼-inch and shall provide a self cleaning

velocity of no less than two feet per second.

ii. The velocity in the pipe shall not be more than seven feet per second.

iii. A full port discharge valve and check valve shall be provided and made accessible inside the building.

iv The waste discharge from semi-positive displacement grinder pumps shall be protected from freezing when the piping is installed less than four feet below grade in outside locations.

TABLE 1
FIXTURE UNIT VALUES FOR VARIOUS PLUMBING FIXTURES

Type of fixture or group of fixtures	Fixture Unit Value
Automatic clothes washer (1½-inch standpipe)	2
Automatic clothes washer (2-inch standpipe)	3
Bathroom group consisting of a toilet, lavatory and bathtub or shower stall:	
Flushometer valve closet	8
Tank type closet	6
Bathtub1 (with or without overhead shower)	2
Bidet	3
Combination sink and drain board with food waste grinder	4
Combination sink and drain board with one 1½-inch trap	2
Combination sink and drain board with separate 1½-inch traps	3
Vegetable Prep Sink (Residential or Commercial)	2
Dental chair unit or cuspidor	1
Dental lavatory	1
Drinking fountain	½
Dishwasher, commercial	6
Dishwasher, domestic	1

Trough or trench drain 3-inch	5
Trough or trench drain 4-inch	6
Floor drains2 with 2-inch waste	3
Kitchen sink, domestic, with one 1½-inch waste	2
Kitchen sink, domestic, with food waste grinder	2
Lavatory with 1¼-inch waste	1
Laundry Utility sink (1, 2 or 3 compartments)	2
Shower stall, domestic	2
Showers (group) per head	2
Sinks:	
Surgeons	3
Flushing rim (with valve)	6
Service (trap standard)	3
Service (P trap)	2
Commercial Pot, scullery, etc. (each section)	4
Shampoo	2
Toilet, tank operated	4
Toilet, valve operated	6
Urinal, pedestal, siphon jet blowout	6
Urinal, wall lip	4
Wash sink (circular or multiple) each 20 inches of usable length	1
Unlisted fixture drains or trap size:	
1¼ inch or less	1
1½ inches	2
2 inches	3
2½ inches	4
3 inches	5
4 inches	6

Note 1: A showerhead over a bathtub does not increase the fixture value.

Note 2: See 248 CMR 10.15(2)(b) for method of computing fixture unit

values of devices with continuous or semi-continuous flows.

Note 3: The size of floor drains shall be determined by the area of the floor surface to be drained in accordance with 248 CMR 10.10(10)(a).

TABLE 2
MAXIMUM LOADS IN FIXTURE UNITS FOR HORIZONTAL DRAINS (F.U.)

Diameter of drain (inches)	Horizontal fixture branch1 (F.U.)	Building drain or building sewer2		
		c in./ft. (F.U.)	¼ in./ft. (F.U.)	½ in./ft. (F.U.)
1½	3	---	---	---
2	6	---	---	---
2½	12	---	---	---
3	343-4	---	403-4	483-4
4	160	180	216	250
5	360	390	480	575
6	620	700	840	1,000
8	1,400	1,600	1,920	2,300
10	2,500	2,900	3,500	4,200
12	3,900	4,600	5,600	6,700
15	7,000	8,300	10,000	12,000

Note 1: Does NOT include fixture branches to the building drain.

Note 2: DOES include fixture branches to the building drain.

Note 3: No more than two toilets or bathroom groups on a horizontal fixture branch nor more than three toilets or bathroom groups on a fixture branch of the building drain.

Note 4: No more than three toilets or three bathroom groups on a three inch building drain.

TABLE 3
MAXIMUM LOADS IN FIXTURE UNITS FOR SOIL AND WASTE STACKS HAVING ONE OR TWO BRANCH INTERVALS

Diameter of Sack (inches)	Maximum Load on Stack (F.U.)

1½	4
2	8
2½	20
3	48 **
4	240
5	540
6	930
8	2,100
10	3,750
12	5,850
15	10,500

**Note 1: Not more than two toilets or bathroom groups within each branch interval nor more than three toilets or bathroom groups on the stack.

TABLE 4
MAXIMUM LOADS IN FIXTURE UNITS FOR ANY ONE BRANCH INTERVAL ON MULTISTORY SOIL AND WASTE STACKS1

Diameter of Stack	Number of Branch Intervals													Load Limit for all Stacks
	3	4	5	6	7	8	9	10	11	12	13	14	15	
2	3	----	----	----	----	----	----	----	----	----	----	----	----	10
2½	8	7	----	----	----	----	----	----	----	----	----	----	----	28
32	20	18	17	16	15	14	13	12	11	10	10	10	10	1023
4	100	90	84	80	77	75	73	72	71	70	69	68	68	530
5	225	205	190	180	175	170	165	162	159	157	156	154	153	1,400
6	385	350	325	310	300	290	285	280	275	271	268	266	263	2,900
8	875	785	735	700	675	655	640	630	620	612	606	600	594	7,600
10	1,560	1,405	1,310	1,250	1,205	1,170	1,140	1,125	1,110	1,095	1,080	1,075	1,062	15,000
12	2,435	2,195	2,045	1,950	1,875	1,825	1,790	1,755	1,730	1,705	1,685	1,670	1,655	26,000
15	4,375	3,935	3,675	3,500	3,380	3,280	3,210	3,150	3,110	3,060	3,030	3,000	2,975	50,000

1These limits are applicable only when the maximum load within any one branch interval is not greater than

where N= permissible load on a stack of one or two branch intervals, and
n = number of branch intervals on the stack under consideration

2 There shall not be more than two toilets or bathroom groups within each

branch interval nor more than three toilets or bathroom groups on the stack.

3The formula contained in footnote 1 does not apply to three inch stacks. For three inch stacks above 15 branch intervals, no single interval shall exceed more than ten fixture units.

E.G. Find the maximum number of fixture to the branch units which can be connected to a four inch stack at any branch interval.

(8) Sizing of Offsets on Drainage Piping.

(a) Offsets of 45E or Less.

1. An offset in a vertical stack with a change of direction of 45E or less from the vertical, may be sized as a straight vertical stack.

2. In the event of a horizontal branch connects to the stack within two feet above or below the offset, a relief vent shall be installed in accordance with 248 CMR 10.16(5)(c).

(b) Offsets of More than 45E. A stack with an offset of more than 45E from the vertical shall be sized as follows:

1. The portion of the stack above the offset shall be sized as for a regular stack based on the total number of fixture units above the offset.

2. The offset shall be sized as for a building drain as shown in 248 CMR 10.15(7): Table 2: Maximum Loads in Fixture Units for Horizontal Drains.

3. The portion of the stack below the offset shall be sized as for the offset or based on the total number of fixture units on the entire stack, whichever is the larger.

4. In buildings of five stories or more, a relief vent for the offset shall be installed as provided elsewhere in 248 CMR 10.16(5)(c) and in no case shall a horizontal branch connect to the offset or to the stack within two feet above or below the offset.

(c) Above Highest Branch. An offset above the highest horizontal branch is an offset in the stack-vent and shall be considered only as it affects the developed length of the vent.

(d) Below Lowest Branch. In the case of an offset in a soil or waste stack below the lowest horizontal branch, there shall be no change in diameter required if the offset is made at an angle of less than 45E. If such an offset is made at an angle greater than 45E to the vertical, the required diameter of the offset and the stack below it shall be determined as for a building drain in 248 CMR 10.15(7): Table 2.

(e) Open Parking Garages.

1. The drainage system of open parking garages which are subject to freezing temperatures including open parking garages in which floor drains are installed, may exclude the use of traps.

2. Traps and their associated vents may be eliminated however, stacks shall be installed in accordance with 248 CMR 10.16(6)(a).

3. The maximum distance between stacks shall not exceed 60 feet intervals.

(9) Drainage Piping Installations.

(a) See 248 CMR 10.05: General Regulations for the following:

1. Pitch of horizontal piping.

2. Fittings used to change direction.

3. Prohibited fittings.

4. Heel or side inlet bends.

5. Obstructions to flow.

6. Dead ends.

(b) Kitchen Sink Wastes (Domestic).

1. Not less than a 1½ inch branch waste or waste outlet shall be provided to receive the fixture drain from a kitchen sink, which shall connect independently to the sanitary drainage system.

2. A kitchen sink shall not waste into any horizontal drain line that receives the waste from a bathtub or similar flat bottom fixture that is smaller than three inches in diameter.

(c) Roughing -- Food Waste Disposer.

1. The fittings used in all sanitary drainage systems which receive the fixture waste from a kitchen sink, shall be installed at a height to permit the installation of a food waste disposer, (approximate height 12 inches through 15 inches above the finished floor).

2. The fitting shall be installed notwithstanding the installation of the food waste disposer.

(d) Kitchen Sink Clean-outs.

1. An end or dandy clean-out fitting the same size as the drain

to which it connects shall be installed under all kitchen sinks.

2. A two-piece trap that can be disassembled to clean this drain may be used in lieu of the clean-out.

(e) Laundries in Multi-Story Buildings.

1. Where laundries are installed in buildings with more than three Branch intervals, laundries shall be connected to an independent laundry stack.

2. The independent laundry stacks shall connect to a independent laundry main drain.

3. The independent laundry main drain shall connect to the building drain a minimum of 40 pipe diameters upstream and downstream of any soil or waste stack.

4. A suds relief vent shall connect to the laundry main drain a minimum of 40 pipe diameters downstream from the base of the laundry stack. The suds relief vent shall connect to a vent a minimum of two branch intervals above the base of the laundry stack. (See 248 CMR 10.22, Figure 19: Illustration of Laundries in Multi-story Buildings.)

5. The Inspector may permit a variation from the above requirements when conditions will not allow compliance.

(10) Sumps and Ejectors.

(a) Building Drains Below Building Sewer.

1. Building drains that cannot be discharged to the sewer by gravity flow shall be discharged into a tightly covered and vented sump, from which the contents shall be lifted and discharged into the building gravity drainage system by automatic pumping equipment or by any equally efficient method approved by the Inspector.

2. Only drains located below the building sewer or building drain shall discharge into sumps. All other drains shall be discharged by gravity.

(b) Design of Sumps and Ejectors. Sump and pumping equipment shall be so designed:

1. as to discharge all contents accumulated in the sump during the cycle of emptying operation; and

2. so that the storage of drainage in a sump or ejector does not exceed 12 hours.

(c) Duplex Equipment. Sumps or ejectors, in other than one or two family houses or residences, receiving the discharge of six or more toilets shall

be provided with duplex pumping equipment.

(d) Drainage Pipe Venting. The system of drainage piping below the sewer level shall be installed and vented in a like manner to that of the gravity system to conform with 248 CMR 10.16.

(e) Prohibited Connections to Discharge Pipe. No fixtures or drains shall be connected to the sewage discharge pipe from an ejector or pump between the ejector or pump and the point where it enters the building drainage system or sewer.

(f) Drainage Backflow Prevention.

1. All sumps and ejectors shall be protected against backflow and backpressure from the building sewer or building drain by installing a backwater or check valve in the discharge pipe from the ejector or sump pump.

2. This required backflow protection shall also comply with 248 CMR 10.15(11).

(g) Size of Sumps and Pumps.

1. All sumps shall have a holding capacity sufficient to meet the demand of a period not to exceed 12 hours.

2. In single-family dwellings, a sewage ejector sump receiving the discharge of toilets and other fixtures shall be equipped with a sewage ejector pump that provides a minimum discharge capacity of 20 gallons per minute.

3. In all installations other than single-family dwelling, sewage ejector pumps shall be sized in conformance with 248 CMR 10.15(10): Table 5: Determining Capacities of Sewage Ejections.

4. To calculate the capacities of pumps used in Sewage Ejectors, it is recommended that the following procedures be used in all types of building occupancies. The safety factors included in 248 CMR 10.15(10): Table 5: Determining Capacities of Sewage Ejections are sufficient for all installations. Any installation that does not meet the requirements of this Table shall require Special-permission from the Board.

TABLE 5
DETERMINING CAPACITIES OF SEWAGE EJECTORS

Number of toilets to be Served by each Ejector	G.P.M. Discharge of each Pump
1	20

2 - 3	75
4 - 5	100
6 - 7	125
8 - 10	150
11 - 15	200
16 - 20	250
21 - 25	300
26 - 30	350
31 - 35	375

a. Ejectors Handling Other Fixtures.

i. Generally, there will be a certain amount of fixtures other than toilets emptying into the ejector sump.

ii. If the total amount of these fixtures exceed four times the amount of toilets used, the G.P.M. of the ejector pump should be increased at the rate of three G.P.M. for each fixture in excess of four times the amount of toilets.

b. **EXAMPLE:**

GPM Pump Discharge of four Toilets	100 GPM
Number of additional fixtures to be handled	20
Excess Fixtures as calculated from above 20 - (4 x 4) = 4	4
Four @ 3 GPM	12 GPM
Correct Sewage Ejector Pump to use	112 GPM

(h) Individual Sink Fixture Pumps.

1. Individual fixtures other than toilets, urinals or similar fixtures may discharge directly into:

a. a fixture mounted pump; or

b. into sumps and receivers with ejectors or pumps.

2. The waste discharge piping from the individual fixture pump shall have a check valve to prevent the discharged waste from returning to the pump or receiver.

3. Individual fixture pumps may be used for sinks that are located below the building drain.

4. Individual fixture pumps may be used for sinks when unusual building structure conditions prevent the discharge of liquid waste by gravity.

5. Direct-mounted individual fixture pumps may be manually or automatically operated.

6. The individual fixture pumps shall be vented in accordance with the manufacturer's instructions. Individual fixture pumps may provide an adequate water seal in accordance with 248 CMR 10.03 additional traps may not be required.

(11) Backwater Valves.

(a) Fixture Subject to Backflow.

1. A backwater valve shall be installed in a branch of the building drain which receives the discharge from a fixture or group of fixtures that is subject to reverse flow or backpressure.

2. Back Water Valves on Storm Drain Systems. A back water valve shall be installed in a branch of the building storm drain that serves lower roof areas in accordance with 248 CMR. 10.22: Figure 23: Illustration of Combination of Upper and Lower Roof Drain Installations.

(b) Materials for Backwater Valves. Backwater valves shall have all bearing parts of corrosion-resistant material.

(c) Construction of Backwater Valves. Backwater valves shall be constructed so a mechanical seal against backflow will be provided.

(d) Diameter of Backwater Valves. Backwater valves, when fully opened shall have an effective opening not less than that of the pipes to which they are installed.

(e) Location of Backwater Valves. Backwater valves shall be installed so their working parts will be readily accessible for service and repairs.

(f) Approval of Backwater Valves. In lieu of an acceptable standard for backwater valves, substitutes may be used after being Product-approved by the Board under 248 CMR 3.04.

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10.16: **Vents and Venting**

(1) Materials.

(a) Above and Below Ground. All pipe and fittings to be used on the venting system, or any part thereof, shall comply with 248 CMR 10.06.

(b) Chemical Waste Systems. Vent piping on chemical and corrosive waste systems shall conform to that required for Hazardous Wastes under 248 CMR 10.13.

(2) Bow Vents.

(a) Bow vents are permitted for fixture installations in island cabinets and peninsula cabinets that cannot be vented in a conventional manner.

(b) The bow vent shall be sized in accordance with 248 CMR 10.16(16): Table 2: Size and Lengths of Vents.

(c) The installation should conform to 248 CMR 10.22: Figures 13(a), (b) or (c).

(3) Prohibited Venting.

(a) Combination Waste and Vent. A combination waste and vent system shall not be used unless no other system is possible or practicable, and only then after Special Permission is granted by the Board. See 248 CMR 10.16(15)(a)

(b) Crown Venting Limitation. No vent shall be installed within two pipe diameters of the trap weir.

(c) Extension of Horizontal Drain. The extension or continuation of a horizontal soil or waste drain pipe shall not serve as a vent, except:

1. when permitted under wet venting 248 CMR 10.16(7), or

2. when a fixture waste of not more than two fixture units is connected to the vertical extension of the extended horizontal piping.

(d) Below Trap Weir. The vent pipe opening from a soil or waste pipe, except for water closets and similar fixtures, shall not be below the weir of the trap.

(e) Use Other than Venting. The sanitary vent system shall not be used for purposes other than the venting of the plumbing system.

(4) Protection of Trap Seals. The protection of trap seals from siphonage, aspiration, momentum, oscillation, back pressure, evaporation, or

capillary action shall be accomplished by the appropriate use of soil or waste stacks, vents, re-vents, back vents, dry vents, wet vents, loop vents, circuit or continuous vents, or combinations thereof, installed in accordance with the requirements of 248 CMR 10.16, so that at no time shall the trap be subjected to a pressure differential of more than one inch of water.

(5) Vent Stacks and Stack Vents.

(a) Vent Stack Required.

1. Any structure, in which a building drain is installed, shall have as a minimum one full size main stack vent or a vent stack no less than three inches in diameter. Buildings that incorporate three or more branch intervals in which plumbing is installed shall have no less than one main vent stack, (See 248 CMR 10.15(5)) that shall run undiminished in size and as directly as possible, from the building drain through to the open air above the roof or connect back to a main stack vent six inches above the flood level rim of the highest fixture being served.

2. A vent stack or a main vent shall be installed with a soil or waste stack whenever back vents, relief vents, or other branch vents are required.

(b) Connections at Base and Top.

1. All main vents or vent stacks shall connect full size at their base to the drainage of the building or to the main soil or waste pipe, at or below the lowest fixture branch.

2. All vent pipes shall extend undiminished in size above the roof, or shall be reconnected with the main soil or waste stack above the highest fixture connection discharging into it. The minimum size of any vent through the roof shall be two inches in diameter.

(c) Offsets in Building Five or More Stories.

1. Except as provided in 248 CMR 10.15, offsets of more than 45E from the vertical in a soil or waste stack may be vented:

a. as two separate soil or waste stacks;

i. by installing a relief vent as a vertical continuation of the lower section of the stack; or

ii. as a side vent connected to the lower section between the offset and the next lower fixture or horizontal branch.

ii. The upper section of the offset shall be provided with a yoke vent.

iv. The diameter of the vents shall not be less than the diameter of the main vent, or of the soil and waste stack, whichever is the smaller.

(d) Vent Headers.

1. Where vent stacks and stack vents connect to a vent header, the connections shall be made at the top of the stacks.

2. The vent header shall connect to a vent extension through the roof.

3. When more than two four-inch soil or waste stacks are connected the vent header extension through the roof shall be five inches in diameter.

4. When more than four four-inch stacks are connected, the diameter shall be six inches.

(e) Relief Vents for Vents of More than Ten Branch Intervals.

1. Soil and waste stacks in buildings having more than ten branch intervals shall be provided with a relief vent at each tenth interval installed, beginning with the top floor.

2. The size of the relief vent shall be equal to the size of the vent stack to which it connects.

3. The lower end of each relief vent shall connect to the soil or waste stack through a wye below the horizontal branch serving the floor and the upper end shall connect to the vent stack through a wye not less than three feet above the floor level.

(6) Vent Terminals.

(a) Extension Above Roof.

1. The vent extension through a roof shall be no less than two inches in diameter and shall extend not more than 24 inches and not less than 18 inches through the roof.

2. If the roof area is used for gardening a parking deck, observation deck or similar purposes the vent shall extend no less than eight feet above the roof and be increased one pipe diameter.

3. Increaser. The change in the diameter of a vent terminal shall be made by the use of an increaser; and occur no less than one foot below the roof surface.

(b) Waterproof Flashings. Each vent terminal shall be made watertight with the roof by proper flashing.

(c) Flag Poling Prohibited. Vent terminals shall not be used for the purpose of flag poling, TV aerials, or similar purposes.

(d) Location of Vent Terminal.

1. No vent terminal shall be located:

a. directly beneath any door, window, or other ventilating opening of the building or of an adjacent building;

b. within ten feet horizontally of such an opening unless it is no less than two feet above the top of such opening.

2. Plumbing vent terminals shall be located no less than 25 feet horizontally from all fresh air intakes.

3. Plumbing vents that terminate no less than two feet above the top of the fresh air intake may be located as close as ten feet. 248 CMR 10.16(6)(a) does not apply in this case.

(e) Vent Extensions Outside of the Building.

1. All soil, waste or vent pipe extensions shall be installed inside the building.

2. For remodeling and alteration work only, vents may be installed outside the building with prior permission of the Inspector and when all other means of venting have been eliminated or are not practical.

(f) Frost Closure. Where frost closure is likely to occur, each vent extension through a roof shall be at least three inches in diameter.

(7) Vent Grades and Connections.

(a) Vent Grade. All vent and branch vent pipes shall be uniformly graded in accordance with 248 CMR 10.05(2) and connected as to drain back to a soil or waste pipe by gravity.

(b) Vertical Rise.

1. Where vent pipes connect to a horizontal soil or waste pipe:

a. The vent shall be taken off above the center line of the soil or waste pipe drain.

b. The vent pipe shall rise vertically, or at an angle of 45E from the vertical, to a point at least six inches above the flood-level rim of the fixture it is venting, before it may offset horizontally.

2. If it is not possible or practical to vent the fixture trap as required in 10.16(7)(b)1.:

a. A vent serving a floor drain, floor sink, or similar floor mounted fixture may be extended horizontally above the centerline of the drain of the fixture to the nearest practical location where it can rise vertically.

b. The vent shall connect to soil or waste pipe above the centerline of the drain not less than 45E from the horizontal before running in a horizontal position.

(c) Height Above Fixtures.

1. All connection between a vent pipe and a vent stack or stack-vent shall be made at least six inches above the flood-level rim of the highest fixture served by the vent.

2. Horizontal vent pipes forming branch vents, relief vents, or loop vents shall be installed at least six inches above the flood-level rim of the highest fixture served.

(8) Wet Venting.

(a) Wet venting of fixture traps as hereinafter described may be used provided that the entire sanitary waste and vent piping system meet all other code requirements of 248 CMR 3.00 through 10.00.

(b) Bathtub or Shower Wet Vent. In a single bathroom having a common horizontal waste for a lavatory and bathtub, a two inch waste and vent for the lavatory may serve as a wet vent for the bathtub or shower.

(c) Double or Back to Back Bath Installations. In a double bathroom having a common horizontal waste for lavatories and baths, a two inch waste and vent for the lavatory may serve as a wet vent for the baths.

(d) Miscellaneous Wet Venting.

1. A two inch or larger waste pipe installed with drainage fittings may serve as a wet vent.

2. The lowest portion of this horizontal pipe serving as the wet vent shall be above the top or above the center line of the horizontal drain it serves except as specifically prohibited in 248 CMR 10.16(8)(e).

3. Toilets in a bathroom below the top floor need not be individually vented if the two inch wet vented waste, serving the lavatories and bath tubs or showers connect directly to the horizontal portion of the fixture branch for the toilet by breaking the centerline or connect above the centerline of the horizontal fixture drain servicing the toilet.

(e) Piping Not to Serve as Wet Vents. A waste and vent that serves a kitchen sink, a garbage disposal, a dish washer, or other fixture installed for culinary use, or one that receives the discharge from a clothes washing machine may not serve as a wet vent for any other fixture.

(9) Stack Venting.

(a) Plumbing Fixtures at the Top Interval of a Stack.

1. Plumbing fixtures at the highest level may enter into a three-inch soil or waste stack.

2. The continuations of the three-inch soil or waste stack as a vent through the roof or re-vented into the vent system above the highest fixture shall be accepted, provided that:

a. all such fixtures shall enter said stack independently;

b. the waste pipe from all fixtures shall have a pitch of not more than ¼-inch pitch per foot;

c. the toilet and bathtub or shower drain connect to the stack at the same level; and

d. the traps from all fixtures shall be placed in compliance with 248 CMR 10.16(12): Table 1: Distance of Fixture Trap from Vent.

(b) Stack Venting. Provided there is a soil and/or waste stack in a building as required under 248 CMR 10.16(5)(a), the continuation in an upwards direction of the vertical waste for a toilet may be reduced to two inch and serve as the vent for the toilet and the waste for a lavatory, bath tub or shower stall, and a kitchen sink.

(c) Back to Back Installation (Stack Vented). Bathroom groups installed back to back shall be permissible provided they comply with the provisions of 248 CMR 10.16(9)(a).

(10) Common Vents.

(a) Individual Vent as Common Vent. An individual vent,

installed vertically, may be used as a common vent for two fixture traps when both fixture drains connect with a vertical drain at the same level.

(b) Side by Side. If two bathtubs or similar flat bottom fixtures are installed back to back or side by side, a common vent may be used in a vertical position to serve as the vent for both fixtures.

(c) Different Levels. A vertical vent may be used for two fixtures that are located in the same branch interval but connected to the stack at different levels, not exceeding ten inches center to center, provided:

1. The vertical drain is one pipe diameter larger than the upper fixture drain but is not smaller than the lower fixture drain, whichever is the larger.

2. That both wastes for said fixtures conform to 248 CMR 10.16(12): Table 1: Distance of Fixture Trap from Vent.

(d) Fixtures Back-to-back. Two fixtures set back-to-back, within the distance allowed between a trap and its vent, may be served with one continuous soil or waste vent pipe, provided that each fixture wastes separately into a double sanitary drainage tee fitting having inlet openings at the same level.

(e) Horizontal Waste Branch.

1. Two lavatories or similar fixtures installed adjacent or back-to-back within six feet of a main vented stack, proper wet vent, or continuous waste and vent, may be installed on a two inch horizontal waste branch without re-venting, provided:

a. the horizontal waste branch is not less than two inches throughout its entire length; and

b. the fixture wastes are connected into the side center of the branch.

2. Back-to-back waste connections shall be through fittings with sufficient directional flow design to assure separate entrance of each waste into the horizontal branch.

3. The branch waste shall connect with its stack at a grade of not more than ¼-inch per foot.

(11) Circuit and Loop Venting.

(a) Battery Venting.

1. A horizontal branch drain soil or waste pipe may be vented by a circuit or loop vent that shall be installed downstream of the last fixture connection of the battery if the horizontal branch drain soil or waste pipe:

a. is uniformly sized; and

b. has connected to it two, but not more than eight floor outlet toilets, pedestal urinals, trap standard to floor fixtures, shower stalls, shower bases or floor drains, or any combination thereof, that are connected in battery and, discharge into the side and center of the horizontal battery branch drain.

2. In addition, lower floor branches serving fixtures as described above in 248 CMR 10.16(1)(b), shall be provided with a relief vent installed downstream of the first fixture connection of the battery and shall connect at the top of the horizontal battery branch drain to the circuit or loop vent.

3. Where only two fixtures that are battery waste and vented are installed on the same branch, a relief vent as described above shall not be required.

4. When wall hung or wall outlet fixtures such as urinals, lavatories or similar fixtures discharge into the horizontal battery branch, the fixture waste from these fixtures shall be individual or common vented. (See 248 CMR 10.22: Figure 8: Illustration of Battery Circuit Vent Multiple Floors and 248 CMR 10.22: Figure 9: Illustration of Battery Loop Vent Multiple Floors).

5. Batteries of more than eight fixtures as described in 248 CMR 10.16 (11)(a)1.b. may be installed, providing a vent as described above is installed for each eight or less of the fixtures so connected.

(b) Dual Branches. When parallel branches serve fixtures as described in 248 CMR 10.16(11)(a) all of the provisions and requirements of 248 CMR 10.16(11)(a) shall prevail, except that the fixture connections to each parallel horizontal branch shall be limited to 50% of the fixture connection permitted on a horizontal branch in 248 CMR 10.16(11)(a).

(c) Vent Connections. When the circuit, loop or relief vent connections are taken off the horizontal branch, the vent branch connection shall be taken off at a vertical angle above the centerline of the drain or from the top of the horizontal branch.

(d) Fixtures Back-to-back in Battery. When fixtures are connected to one horizontal branch through a sanitary tee installed in a vertical position:

1. A common vent for each two fixtures back-to-back or double connection shall be considered acceptable.

2. The common vent shall be installed in a vertical position as a continuation of the double fixture connection.

(12) Fixture Vents.

(a) Distance of Trap from Vent. Each fixture trap shall have a protecting

vent so located that the slope and the developed length in the fixture drain from the trap weir to the vent fitting are within the requirements set forth in 248 CMR 10.16(12): Table 1: Distance of Fixture Trap from Vent.

TABLE 1
DISTANCE OF FIXTURE TRAP FROM VENT

Size of Fixture Drain, Inches	Distance Trap to Vent, Feet
1½	5'
2	6'
3	8'
4	10'
slope not to exceed ¼-inch per foot	

(b) Venting of Fixture Drain Below Trap.

1. The vent pipe openings from a soil or waste pipe, except for toilets and similar fixtures, shall not be below the top weir of the trap.

2. An exception to 248 CMR 10.16(12)(b) will be permitted if the following requirements are satisfied:

a. The fixture has a flat bottom with a minimum area of 144 square inches.

b. The horizontal section of the fixture waste must comply with 248 CMR 10.16(12): Table 1: Distance of Fixture Trap from Vent and the vertical section shall be at least one pipe size larger than the fixture trap and waste arm.

c. The vent opening shall be as high and close to the fixture as possible and the vent piping shall be installed to comply with 248 CMR 10.16(7).

(c) Floor-mounted Fixture Outlet.

1. When installing the piping for a floor outlet type toilet or similar fixture, the vertical piping distance shall not exceed 20 inches from the finish floor of the fixture served to the center line of the horizontal drain serving such fixture.

2. If the vertical distance exceeds 20 inches the fixture shall be individually vented.

(13) Size and Length of Vents.

(a) Size of Individual Vents. The minimum diameter of an individual vent shall be not less than 1¼-inch nor less than ½ the diameter of the drain to which it connects.

(b) Size of Relief Vents. The diameter of a relief vent shall be not less than ½ the diameter of the soil or waste branch to which it connects when fixtures are battery connected.

(c) Size of Circuit or Loop Vents. The diameter of a circuit or loop vent shall be not less than ½ the diameter of the soil or waste branch to which it connects when fixtures are battery connected.

(d) Length and Size of Vent Stacks. The length and size of the vent stack or main vent shall be based on the total fixture units and its developed length from the lowest connection of the vent system with the soil stack, waste stack, or building drain, to the vent stack terminal to the open air.

(e) Size of Vents. The vent pipe sizes shall be determined from their developed length and the total number of fixture units connected thereto, as listed in 248 CMR 10.16(16): Table 2: Size and Lengths of Vents. This table shall be used to size all vents, except for those vents that are specifically sized elsewhere in 248 CMR 1.00 through 10.00.

(14) Future Venting.

(a) In the basement of every building there shall be an accessible future vent connection.

(b) Buildings that require a main vent stack shall have a future vent connection full size of the vent stack. In all other buildings (including residential) there shall be a minimum of a two inch future vent connection.

(c) All future vent connections shall be drip connected identified and labeled "Future Vent".

(15) Combination Waste-and-vent System. Special Permission Required. See 248 CMR 3.04(3)(b).

(a) A combination waste-and-vent system is limited to the installation of floor drains and sinks.

(b) A combination waste-and-vent system consists of a wet vented installation of waste piping in which fixture drains are not individually vented.

(c) Every drainage pipe in a combination waste-and-vent system shall be not less than two pipe sizes larger than the size required in 248 CMR 10.15.

(16) Venting of Sumps and Ejectors.

(a) Size of Vents. The size and length of all vent pipes serving building sanitary sumps and ejectors shall be determined from, and in accordance with 248 CMR 10.16 (16): Table 3: Size and Lengths of Sump Vents.

(b) Pneumatic Ejector.

1. The air pressure relief pipe from a pneumatic ejector shall not be connected to the regular venting system, but shall be vented independently to the atmosphere through the roof.

2. The relief pipe shall be of sufficient size to relieve air pressure inside ejector atmospheric pressure within ten seconds, but shall be not less than one inch in diameter.

(c) Automatic Vent Fittings.

1. The automatic vent fitting shall be installed in the vertical position not less than six inches above the crown of the trap it serves.

2. The piping distance from the trap outlet to the automatic vent fitting shall not be more than 12 inches.

3. The tailpiece from the fixture to trap shall not be longer than 12 inches.

4. The automatic vent fitting shall be installed on the run of a T-Y in the vertical or branch of a T-Y in the horizontal with the T-Y installed so the direction of flow is with the flow of waste.

5. The automatic vent fitting shall be installed in a location readily accessible for inspection and replacement. It shall never be installed in a concealed location.

6. Automatic vent fittings are not permitted, except with Special-permission from the Board.

(d) Air Admittance Valves.

1. Air Admittance Valves are not permitted, except with Special-permission from the Board.

2. An individual vent, branch vent, wet vent, circuit vent, vent stack, or stack vent shall be permitted to terminate with a connection to an air admittance valve. Air admittance valves shall be installed in accordance with the manufacturer’s installation instructions.

TABLE 2
SIZE AND LENGTHS OF VENTS

Diameter of Soil or Waste Stack or Branch in Inches	Total Fixture Units Connected to Stack or Branch in Fixture Units										
		1¼	1½	2	2½	3	4	5	6	8	10
1½	4	50	150								
2	10	25	50	150							
2½	28		30	100	300						
3	7		42	150	360	1040					
3	21		32	110	270	810					
3	53		27	94	230	680					
3	102		25	86	210	620					
4	43			35	85	250	980				
4	140			27	65	200	750				
4	320			23	55	170	640				
4	530			21	50	150	580				
5	190				28	82	320	990			
5	490				21	63	250	760			
5	940				18	53	210	640			
5	1,400				16	49	190	590			
6	500					33	130	400	1,000		
6	1,100					26	100	310	780		
6	2,000					22	84	260	660		
6	2,900					20	77	240	600		
8	1,800						31	95	240	940	
8	3,400						24	73	190	720	
8	5,600						20	62	160	610	
8	7,600						18	56	140	560	
10	4,000							31	78	310	960
10	7,200							24	60	240	740
10	11,000							20	51	200	630
10	15,000							18	46	180	570

Note 1: Table 2 shall also apply to the sizing of vents for branch soil and waste lines.

To determine size of vent, use the following procedure:

a. Compute total number of fixture units, using 248 CMR 10.15(7): Table 1: Fixture Unit Values for Various Plumbing Fixtures and 248 CMR 10.15(2)(b).

b. Knowing total fixture unit load, refer to 248 CMR 10.15(7): Table 3: Maximum Loads in Fixture Units for Soil and Waste Stacks Having One

or Two Branch Intervals or 248 CMR 10.15(7): Table 4: Maximum Loads in Fixture Units for any One Branch Interval on Multistory Soil and Waste Stacks depending on number of intervals, to determine size of stack.

c. With selected stack size and total fixture unit load refer to 248 CMR 10.16(16): Table 2: Size and Lengths of Vents and determine size of vent. Follow same procedure to determine size of vents for branch soil and waste lines.

TABLE 3
SIZE AND LENGTHS OF SUMP VENTS2

Diameter of Drain to Sump1	Diameter of Vent (inches)										
	1¼	1½	2	2½	3	4	5	6	8	10	12
2	23	52	290								
2½	5	13	89	290							
3		2	30	110	290						
4			1	17	57	280					
5					10	80	280				
6						20	97	280			
8							3	41	270		
10								1	53	250	
12										61	230

Note 1: Where more than one drain connects to the sump, size vent on the basis of a drain diameter having a cross sectional area equal to the sum of the areas of the multiple drains.

Note 2: The above values provide for a maximum of one inch pressure drop in the system

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10.17: **Storm Drains**

(1) Storm Water Drainage to Sewer Prohibited. Storm water shall not be drained into sewers intended for sewage only.

(2) Size of Building Storm Drain. The size of the building storm drainage system including all horizontal branches having a slope of ½ inch or less per foot, shall be based upon the maximum projected roof or paved surface area to be handled according to 248 CMR 10.17(2): Table 1: Size

of Horizontal Storm Drains.

TABLE 1
SIZE OF HORIZONTAL STORM DRAINS

Diameter of Drain, Inches	Maximum Projected Roof Area for Storm Drains of Various Slopes		
	c inch Slope	¼ inch Slope	½ inch Slope
	Square Feet	Square Feet	Square Feet
3		1,160	1,644
4	1,880	2,650	3,760
5	3,340	4,720	6,680
6	5,350	7,550	10,700
8	11,500	16,300	23,000
10	20,700	29,200	41,400
12	33,300	47,000	66,600
15	59,500	84,000	119,000

Note 1: Table 1 is based upon a maximum rate of rainfall four inches per hour.

(a) Vertical Storm Conductor. A vertical storm conductor shall be based upon the maximum projected roof area to be drained according to 248 CMR 10.17(2): Table 2: Size of Vertical Storm Drain Conductors and Outside Leaders.

TABLE 2
SIZE OF VERTICAL STORM DRAIN CONDUCTORS AND OUTSIDE LEADERS

Maximum Projected Roof Area (Square Feet)	Diameter of Storm Conductor or Outside Leader (Inches)	Maximum Projected Roof Area (Square Feet)	Diameter of Storm Conductor or Outside Leader (Inches)
720	2	8,650	5
1,300	2½	13,500	6
2,200	3	29,000	8
4,600	4		

(3) Values for Continuous Flow. Where there is a continuous or semi-continuous discharge into the building storm drain or building storm sewer, as from a condensate pump, ejector, air conditioning equipment, or similar device discharging clear water waste, each gallon per minute of such discharge shall be computed as being equivalent to 24 square feet of roof area, (based upon a four-inch rainfall.)

(4) Building Sub-drains.

(a) Building sub-drains located inside the building below the public gravity storm sewer level shall discharge into a sump or receiving tank.

(b) The contents of the sump or receiving tank shall be automatically lifted and discharged into the storm drainage system as required for building sumps.

(5) Sub-soil Drains.

(a) When a subsoil drain for a building is subject to backwater:

1. An accessibly located backwater valve shall protect the subsoil drain.

2. Sub-soil drains may discharge into a properly trapped area drain or sump.

3. Such sumps do not require vents.

4. Piping used for sub-soil drains shall not be less than four inches in diameter.

(b) Materials for sub-soil drains shall comply with 248 CMR 10.06 and the following requirements shall be satisfied.

1. Piping may be either perforated or installed with open joints.

2. Spigot end lengths shall have joints protected with screens securely fastened to pipes.

3. Screens and fastenings shall be non-ferrous or other approved corrosion resisting material.

4. Perforated piping shall be installed with sealed joints.

5. All sub-soil drain piping shall be installed with sufficient pea stone or similar aggregate to permit the flow of ground water to the piping.

(c) Area Drains.

1. All area drains shall be connected to the storm water drainage system.

2. They shall be provided with a trap and back-water valve in an accessible location that is not subject to freezing.

(d) Size of Area Drains.

1. Area drains shall be of size to serve efficiently the square

foot area for which they are intended to drain in accordance with 248 CMR 10.17(2): Table 1: Size of Horizontal Storm Drains.

2. The outlet pipe shall not be less than three inches in nominal diameter.

(6) Traps on Storm Drains and Leaders.

(a) Where Required. Conductors and storm drains serving low roofs when connected to a combined sewer shall be trapped.

(b) Where Not Required. No traps shall be required for storm-water drains that are connected to a sewer carrying storm water exclusively.

(c) Trap Material. Storm water traps, when required, shall be of cast iron.

(d) Trap Size. Traps for individual conductors shall be the same size as the horizontal drain to which they are connected.

(e) Method of Installation.

1. Individual storm-water traps shall be installed on the storm-water drain branch serving each conductor, or a single trap shall be installed in the main storm drain just before its connection with the combined building, sewer main, drain, or public sewer.

2. Conductor traps shall be located so that an accessible cleanout may be installed on the building side of the trap.

(7) Conductors/Leaders and Connections.

(a) Not to be Used Improperly.

1. Conductor pipes shall not be used as soil, waste, or vent pipes.

2. Sanitary drainage or vent pipes shall not be used as conductors.

(b) Protection of Rain Water Leaders. Rain water leaders installed along alley ways, driveways, or other locations where they may be exposed to damage shall be:

1. protected by metal guards; or

2. recessed into the wall.

(c) Combining Storm with Sanitary Drainage.

1. The sanitary and storm drainage system of a building shall be entirely separate.

2. Where a combined sewer is available, the building storm sewer may be connected to the building sanitary sewer in the same horizontal plane through a single wye fitting to form a combined building sewer at least ten feet outside the inside face of the foundation wall.

(d) Offsets.

1. Offsets of 45E or less from the vertical, and offsets of more than 45E from the vertical that do not exceed ten feet in length, shall be sized according to 248 CMR 10.17(2): Table 2: Size of Vertical Storm Drain Conductors and Outside Leaders.

2. Offsets of more than 45° from the vertical in excess of ten feet shall be sized according to 248 CMR 10.17(2): Table 1: Size of Horizontal Strom Drains.

(8) Roof Drains.

(a) Material of Roof Drains. Roof drains shall be of cast iron, copper, or other approved corrosion-resisting material.

(b) Roof Drain Strainers.

1. General Use.

a. All roof areas, except those draining to hanging scuppers and gutters, shall be equipped with roof drain assemblies having strainers that extend not less than four inches above the surface of the roof that is immediately adjacent to the roof drain assembly.

b. Strainers shall have an available inlet area, that lays upon the roof level, of not less than 1½ times the area of the conductor to which the roof drain assembly is connected.

c. Roof drain assemblies that serve vehicle parking decks or that serve the outside top level of open parking garages shall convey storm discharge to a independent gas, oil and sand interceptor/separator in accordance with 248 CMR 10.09(1)(b) and shall discharge to the storm drainage system or other approved method of disposal.

2. Flat Decks. Roof drain strainers for use on sun decks, parking decks, and similar areas, normally serviced and maintained, may be of the flat surface type, level with the deck and shall have an available inlet area not less than two times the area of the conductor to which the drain is

connected.

3. Roof Drain Flashings Required. The connection between roofs and roof drains which pass into the interior of the building shall be made watertight by the use of proper flashing methods and material.

(9) Expansion Joints Required. Expansion joints or sleeves shall be provided where warranted by temperature variations or physical conditions.

(10) Sanitary and Storm Sewers. Where separate systems of sanitary drainage and storm water are installed in the same property, the storm and sanitary building sewers and drains may be laid side by side in the same trench.

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10.18: **Hospital Fixtures**

(1) General. The plumbing system in a hospital shall conform to the following requirements.

(a) It shall meet the criteria of 248 CMR 10.18.

(b) It shall conform to all other requirements contained in the body of 248 CMR 3.00 through 10.00.

(c) It shall conform to the requirements of the Massachusetts Department of Environmental Protection.

(2) Definitions.

The following definitions shall be used for 248 CMR 10.18.

Aspirator. An aspirator is a fitting or device supplied with water or other fluid under positive pressure which passes through an integral orifice or "constriction" causing a vacuum. Aspirators are often referred to as "suction" apparatus, and are similar in operation to an ejector.

Autopsy Table. An autopsy table is a fixture or table used for the post-mortem examination of a body.

Bedpan Hopper (Clinic Sink). A bedpan hopper is a fixture meeting the design requirements of fixture, sometimes called a clinic sink.

Bedpan Steamer. A bedpan steamer is a fixture used for scalding bedpans or urinals by direct application of steam.

Bedpan Washer. A bedpan washer is a fixture designed to wash bedpans and to flush the contents into the soil drainage system. It may also be provided for steaming the utensils with steam or hot water.

Bedpan Washer Hose. A bedpan washer hose is a device supplied with hot and/or cold water and located adjacent to a toilet or clinic sink to be used for cleansing bedpans.

Clinic Sink. See Bedpan Hopper and 248 CMR 10.18(3)(b).

Flushing Type Floor Drain. A flushing type floor drain is a floor drain which is equipped with an integral water supply, enabling flushing of the drain receptor and trap.

Local Vent Stack. A local vent stack is a vertical pipe to which connections are made from the fixture side of traps and through which vapor and/or foul air may be removed from the fixture or device used on bedpan washers.

Sterilizer, Boiling Type. A boiling type "sterilizer" is a fixture (non-pressure type) used for boiling instruments, utensils, and/or other equipment (used for disinfection). Some devices are portable, others are connected to the plumbing system.

Sterilizer Instrument. See Sterilizer, Boiling Type.

Sterilizer, Pressure Instrument Washer-Sterilizer. A pressure instrument washer-sterilizer is a fixture (pressure vessel) designed to both wash and sterilize instruments during the operating cycle of the fixture.

Sterilizer, Pressure (Autoclave). A pressure sterilizer is a fixture (pressure vessel) designed to use steam under pressure for sterilizing. A pressure sterilizer is also called an Autoclave.

Sterilizer, Utensil. See Sterilizer, Boiling Type.

Sterilizer Vent. A sterilizer vent is a separate pipe or stack, indirectly connected to the building drainage system at the lower terminal, which receives the vapors from non-pressure sterilizers, or the exhaust vapors from pressure sterilizers, and conducts the vapors directly to the outer air, sometimes called vapor, steam, atmospheric or exhaust vent.

Sterilizer Water. A water sterilizer is a device for sterilizing water and storing sterile water.

Still. A still is a device used in distilling liquids.

(3) Fixtures.

(a) General. Product-approved flush rim bedpan hoppers (clinic sinks), bedpan washers, and/or other acceptable fixtures and equipment shall be provided for:

1. the disposing of bedpan contents; and

2. the cleansing and disinfection of bedpans in soiled utility (hopper) rooms.

(b) Clinic Sink.

1. A clinic sink shall have an integral trap in which the upper portion of a visible trap seal provides a water surface.

2. The fixture shall be so designed as to permit complete removal of the contents by siphon and/or blowout action, and to reseal the trap.

3. A flushing rim shall provide water to cleanse the interior surface.

4. The fixtures shall have flushing and cleansing characteristics similar to a toilet.

(c) Prohibited Use of Clinic Sinks and Service Sinks.

1. A clinic sink serving a soiled utility room shall not be considered as a substitute for, nor shall it be used as a janitor's service sink.

2. A janitor's service sink shall not be used for the disposal of urine, fecal matter, or other human wastes.

(d) Ice Prohibited in Soiled Utility Rooms.

1. No machine for manufacturing ice, or any device for the handling or storage of ice shall be located in a soiled utility room.

2. Machines for manufacturing ice, or devices for handling or storage of ice intended for either human consumption or packs, may be located in clean utility room, floor pantry, or diet kitchen.

(4) Sterilizer Equipment Requirements.

(a) De-scaling of Equipment Prohibited. It shall be unlawful to de-scale or otherwise submit the interior of water sterilizers, stills, or similar equipment to acid or other chemical solutions while the equipment is connected to the water and/or drainage system.

(b) ASME Standard. New pressure sterilizers and pressure instruments washer-sterilizers hereafter installed, shall display in a location to be clearly visible at all times, the ASME Standard symbol and data plate.

(c) Sterilizer Piping. All sterilizer piping and/or devices necessary for the operation of sterilizers shall be accessible for inspection and maintenance.

(d) Condensers.

1. Pressure sterilizers shall be equipped with an acceptable means of condensing and cooling the exhaust steam vapors.

2. Non-pressure sterilizers should be equipped with an acceptable device which shall automatically control the vapors in a manner to confine them within the vessel, or equipped with an acceptable means of condensing and cooling of vapors.

(e) Gas Fired Equipment. Gas fired equipment or apparatus shall be installed in accordance with the requirements of the Massachusetts Fuel Gas Code 248 CMR 4.00 through 7.00.

(5) Special Elevations.

(a) Control valves, vacuum outlets, and devices which protrude from a wall of an operating, emergency, recovery, examining, or delivery room, or a corridor and/or other locations where patients may be transported on a wheeled stretcher, shall be located at an elevation which will preclude bumping the patient or stretcher against the device.

(b) When necessary to install at a lower elevation, safety precautions should be taken to protect the personnel.

(6) Plumbing in Hospitals for the Psychologically Impaired.

(a) In hospitals/facilities for the psychologically impaired exceptional consideration should be given to piping, controls, and fittings of plumbing fixtures given the nature of the patients.

(b) No pipes or traps shall be exposed and fixtures shall be substantially secured to walls.

(7) Drainage and Venting.

(a) Ice Storage Chest Drains.

1. Any drain serving an ice chest or box shall discharge over an indirect waste receptor separate from all other fixture wastes.

2. Each terminal shall discharge through an air gap above the receptor.

3. The end shall be covered with a removable screen of not less than ten-mesh per inch, and if discharging vertically, the terminal shall be cut at an angle of 45E.

(b) Bedpan Washers and Clinic Sinks. Bedpan washers and clinic sinks shall be:

1. connected to the soil pipe system; and

2. vented following the requirements as applied to toilets, except that bedpan washers require additional local vents.

(8) Sterilizer Wastes.

(a) Indirect Wastes Required.

1. All sterilizers shall be provided with individual and separate indirect wastes, with air gaps of not less than two diameters of the waste tailpiece.

2. The upper rim of the receptor, funnel, or basket type waste fitting shall be not less than two inches below the vessel or piping, whichever is lower.

3. Except as provided in 248 CMR 10.18(8)(c) and 10.18(8)(e) a "P" trap shall be installed on the discharge side of, and immediately below, the indirect waste connection serving each sterilizer.

(b) Floor Drain Required. In all recess rooms containing the recessed, or concealed portions of sterilizers, not less than one acceptable floor drain, connecting to the drainage system, shall be installed in a manner to drain the entire floor area.

(c) Recess Room Floor Drains, Trap Seal Maintenance.

1. The recess room floor drain waste and trap shall be a minimum diameter of three inches.

2. It shall receive the drainage from at least one sterilizer within the recess room to assure maintenance of the floor drain trap seal.

3. The sterilizer drain shall be installed on a branch taken off between the floor drain trap and the drain head.

4. No individual sterilizer waste trap shall be required on this type of installation.

(d) Prohibited Connections.

1. Branch funnel and branch basket type fittings, except as provided in 248 CMR 10.18(8)(e) are prohibited on any new installation or when relocating existing equipment.

2. Existing branch funnel or branch basket type installations shall be provided with an acceptable indirect waste below the branch connections.

(e) Battery Assemblies. A battery assembly of not more than three sterilizer wastes may drain to one trap, provided:

1. The trap and waste are sized according to the combined fixture unit rating.

2. The trap is located immediately below one of the indirect waste connections.

3. The developed distance of a branch does not exceed eight feet.

4. The branches change direction through a tee-wye or wye pattern fitting.

(f) Bedpan Steamers, Additional Trap Required. A trap with a minimum seal of three inches shall be provided in a bedpan steamer drain located between the fixture and the indirect waste connection.

(g) Pressure Sterilizer.

1. Except when an exhaust condenser is used a pressure sterilizer chamber drain may be connected to the exhaust drip tube before terminating at the indirect waste connection.

2. If a vapor trap is used, it shall be designed and installed to prevent moisture being aspirated into the sterilizer chamber.

3. The jacket steam condensate return, if not connected to a gravity steam condensate return, shall be separately and indirectly wasted.

4. If necessary to cool a high temperature discharge, a cooling receiver, trapped on its discharge side, may serve as the fixture trap.

(h) Pressure Sterilizer Exhaust Condensers.

1. The drain from the condenser shall be installed with an indirect waste as prescribed in 248 CMR 1.00 through 10.00.

2. If condensers are used on pressure sterilizers, the chamber drain shall have a separate indirect waste connection.

(i) Water Sterilizer. All water sterilizer drains, including tank, valve leakage, condenser, filter and cooling, shall be installed with indirect waste or according to 248 CMR 10.18(8)(b).

(j) Pressure Instrument Washer-sterilizer.

1. The pressure instrument washer-sterilizer chamber drain and overflow may be

interconnected. They also may be interconnected with the condenser.

2. The indirect waste shall follow the provision set forth in 248 CMR 3.00 through 10.00.

(k) Aspirators.

1. In operating rooms, emergency rooms, recovery rooms, delivery rooms, examining rooms, autopsy rooms, and other locations except laboratories where aspirators are installed for removing blood, pus and/or other fluids, the discharge from any aspirator shall be indirectly connected to the drainage system.

2. The suction line of an aspirator shall be provided with a bottle or similar trap to protect the water supply.

(9) Central Vacuum and/or Disposal Systems.

(a) Wastes. The waste from a central vacuum (fluid suction) system of the disposal type and/or which is connected to the drainage system whether the disposal be by barometric leg, collecting tanks, or bottles, shall be directly connected to the sanitary drainage system through a trapped waste.

(b) Piping.

1. The piping of a central vacuum (fluid suction) system shall be of corrosion resistant material having a smooth interior surface.

2. No branches shall be less than one inch for one outlet and sized according to the number of vacuum outlets, and no main shall be less than one inch.

3. The pipe sizing shall be increased according to the manufacturer's recommendation as stations are increased.

4. All piping shall be provided with adequate and accessible clean-out facilities on mains and branches, and shall be accessible for inspection, maintenance, and replacements.

(c) Water Systems for Space Cooling and Heating Condensate Drains.

1. The lowest point of a condensate riser or risers shall be trapped and discharged over an indirect waste sink.

2. The trap may be either "P" or a "running trap" with a cleanout.

3. A branch shall be installed upstream from the condensate drain trap for flushing and resealing purposes.

4. The condensate drain and trap shall be located above the lowest floor level of the building.

(10) Vent Material. Material for local vents serving bedpan washers and sterilizer vents serving sterilizers, shall be sufficiently rust proof, erosion and corrosion resistant to withstand:

(a) intermittent wetting and drying from steam vapors;

(b) the distilled water solvent action of the steam vapors; and

(c) frequent and immediate changes of temperatures.

(11) Vent Connections Prohibited.

(a) Connections between local vents serving bedpan washers, sterilizer vents serving sterilizing apparatus, and/or normal sanitary plumbing systems, are prohibited.

(b) Only one type of apparatus shall be served by a given vent.

(12) Local Vents and Stacks. Bedpan Washers.

(a) Bedpan washers shall be vented to the outer atmosphere above the roof by means of one or more local vents.

(b) The local vent for a bedpan washer shall be not less than a two-inch diameter pipe.

(c) A local vent serving a single bedpan washer may drain to the fixture served.

(13) Multiple Installations.

(a) Where bedpan washers are located above each other on more than one floor, a local vent stack may be installed to receive the local vent on the various floors.

(b) Not more than three bedpan washers shall be connected to a two-inch local vent stack, six to a three-inch local vent stack, and 12 to a four-inch local vent stack.

(c) In multiple installations, the connections between a bedpan washer local vent and local vent stack shall be made by use of the tee or tee-wye sanitary pattern drainage fittings, installed in an upright position.

(d) Trap Required.

1. The bottom of the local vent stack, except when serving only one bedpan washer, shall be drained by means of a trapped and vented waste connection to the plumbing sanitary drainage system.

2. The trap and waste shall be the same size as the local vent stack.

(14) Trap Seal Maintenance.

(a) A water supply of not less than ¼-inch minimum tubing shall be taken from the flush supply of each bedpan washer on the discharge or fixture side of the vacuum breaker, trapped to form not less than a three-inch seal, and connected to the local vent stack on each floor.

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

(15) Sterilizer, Vents and Stacks.

(a) Connections.

1. Multiple installations of pressure and non-pressure sterilizers shall have their vent connections to the sterilizer vent stack made by means of inverted wye fittings.

2. Such vent connections shall be accessible for inspection and maintenance.

(b) Drainage.

1. The connection between the sterilizer vent stack shall be designed and installed to drain to the funnel or basket-type waste fitting.

2. In multiple installations, the sterilizer vent stack shall be drained separately to the lowest sterilizer funnel or basket-type waste fitting or receptor.

(16) Sterilizer Vent Stack Sizes.

(a) Bedpan Steamers.

1. The minimum size of a sterilizer vent serving a bedpan steamer shall be 1½ inches in diameter.

2. Multiple installations shall be sized according to 248 CMR 10.18(16): Table 1: Stack Sizes for Bedpan Steamers and Boiling Type Sterilizers, (number of connections of various sizes sterilizer vent stacks).

TABLE 1
STACK SIZES FOR BEDPAN STEAMERS AND BOILING TYPE STERILIZERS

Stack Size	Connection Size		
	1½ inches		2 inches
1½ - inch1	1	or	0
2 - inch1	2	or	1
2 - inch2	1	and	1
3 - inch1	4	or	2
3 - inch2	2	and	2
4 - inch1	8	or	4
4 - inch2	4	and	4

Note 1: Total of each size

Note 2: Combination of sizes

(b) Boiling Type Sterilizers.

1. The minimum size of a sterilizer vent stack shall be two inches in diameter when serving a utensil sterilizer, and one inch in diameter when serving an instrument sterilizer.

2. Combinations of building type sterilizer vent connections shall be based on 248 CMR 10.18(16): Table 1: Stack Sizes for Bedpan Steamers and Boiling Type Sterilizers.

(c) Pressure Sterilizers. Sterilizer vent stacks shall be 2½ inches minimum; those serving combinations of pressure sterilizer exhaust connections shall be sized according to 248 CMR 10.18(16): Table 2: Stack Sizes for Pressure Sterilizers.

(d) Pressure Instrument Washer-Sterilizer Sizes.

1. The minimum size of a sterilizer vent stack serving an instrument washer-sterilizer, shall be two inches in diameter.

2. Not more than two sterilizers shall be installed on a two-

inch stack, and not more than four on a three-inch stack.

TABLE 2
STACK SIZES FOR PRESSURE STERILIZERS

Number of Connections of Various Sizes Permitted to Various Size Vent Stacks							
	Stack Size			Connection Size			
	¾		1 inch		1¼ inch		1½ inch
1½ - inch1	3	or	2	or	1		
1½ - inch2	2	and	1				
2 - inch1	6	or	3	or	2	or	1
2 - Inch2	3	and	2				
2 - inch2	2	and	1	and	1		
2 - inch2	1	and	1	and	1		
3 - inch1	15	or	7	or	5	or	3
3 - inch2			1	and	2	and	2
3 - inch2	1	and	5	and			1

Note 1: Combination of sizes
Note 2: Total of each size

(17) Radioactive Materials.

(a) All radioactive materials shall be disposed of in a manner so as to create no hazard to operation and maintenance personnel of the institution or to the public.

(b) Specific permission shall be secured from the State Department of Public Health to dispose of any radioactive material to the drainage system.

(18) Water Supply.

(a) Water Service. All hospitals shall have dual services installed in a manner to provide an uninterrupted supply of water in case of a water main break.

(b) Hot Water Heater and Tanks.

1. The hot water equipment shall have sufficient capacity to supply water at 125EF for hospital fixtures; water at 180EF for kitchens; and water at 180EF for laundry.

2. Where direct fired hot water heaters are used, they shall be of an approved high pressure type.

3. Submerged steam heating coils should be of copper. Storage tanks shall be fabricated of non-corrosive metal or be lined with non-corrosive material.

(c) Hot Water Supply System.

1. Hot water circulating mains and risers should be run from the hot water storage tank to a point directly below the highest fixture at the end of each branch main.

2. Where the building is higher than three stories, each riser shall be circulated.

3. Each main, branch main, riser and branch to a group of fixtures of the water system shall be provided with valves.

(19) Vacuum Breaker Installation.

(a) Hose Connections. For ordinary hose connections the maximum height at which any hose is to be used shall be treated at its flood level.

(b) Low Volume Flows.

1. Where low volume flows might cause leaking or spitting at the vacuum breaker parts, back pressure may be developed by installing an acceptable minimum orifice valve on the discharge side of the vacuum breaker. This shall be in addition to the regular control valve.

2. Low volume flow installation shall be subject to review and acceptance by the Inspector.

(c) Prohibited Toilet and Clinic Sink Supply.

1. No jet or water supplied orifices, except those supplied by the flush connection, shall be located in and/or connected with a toilet bowl or clinic sink.

2. 248 CMR 10.18 shall not prohibit an acceptable bidet installation.

(d) Special Equipment, Water Supply Protection. 248 CMR 10.18(19): Table 3: Hospital Fixtures and Their Water Supply Protection, sets forth the requirements which shall be followed in protecting the water supply for hospital fixtures against backflow or backsiphonage.

TABLE 3
HOSPITAL FIXTURES AND THEIR WATER SUPPLY PROTECTION

Fixtures	Type of Protection1	Remarks
Aspirators:		
Laboratory	Vacuum breaker	
Portable	Vacuum breaker	
Vacuum system	Vacuum breaker	
Bedpan:		
Washers	Vacuum breaker	
Washer hose	Vacuum breaker	Locate five feet above floor.
Boiling type sterilizer	Air gap	Not less than twice the effective opening of the water supply.
Exhaust condenser	Vacuum breaker	
Flush floor drain	Vacuum breaker	
Hose connection	Vacuum breaker	Locate six feet above floor.
Pressure instrument washer-sterilizer	Vacuum breaker	
Pressure Sterilizer	Vacuum breaker	
(rubber Tube Testers-Washers)	Vacuum breaker	
Vacuum systems		
Cleaning	Air gap or vacuum breaker	
Fluid suction	Air gap or vacuum breaker	

Note 1: Where vacuum breakers are used, they shall be installed after the last control valve.

(20) Clinical, Hydrotherapeutic and Radiological Equipment. All clinical, hydrotherapeutic, radiological, or any equipment, whether mentioned or not, which is water supplied and/or discharges to the waste system, shall meet the requirements of 248 CMR 10.18 and the regulations covering cross-connections, air gaps, vacuum breakers, and check valves.

Special Equipment and Devices Found Under These Classes Include:

Clinical	Hydrotherapeutic	Radiological	Other
Dental cuspidors	Control units	Violet X-Ray	
Surgical cuspidors	Arm bath	Diagnostic X-Ray	
Dental (flush rim) lavatories	Leg bath	Therapy X-Ray	
Colonic irrigation	Foot bath	X-Ray target	

Sitz bath	Tub bath	X-Ray transformers	
Emergency bath	Immersion bath	X-Ray oil tank	
Receiving bath	Shower bath	Diffraction	
Prenatal bath	Needle bath	X-Ray developing	
Infant bath	Tank	Photographic developing	
Prophylaxis	Pool	Film developing	
Shampoo	Hose	Microscopic	
Massage	Syringe		
	Douche		

(21) Condensate Drain Trap Seal.

(a) A water supply shall be provided for cleaning, flushing, and resealing the condensate trap.

(b) The source of the water supply shall be a refrigerator condenser discharge, a drinking fountain waste, or other acceptable method of flushing and resealing the trap.

(c) The water supply shall be not less than ½ inch diameter pipe.

(d) The water supply shall discharge through an air gap not less than twice the diameter of the supply pipe.

(22) Valve Leakage Diverter. Each water sterilizer which may be filled with water through directly connected piping, shall be equipped with an acceptable leakage diverter and/or bleed-line on the water supply control valve to indicate and conduct any leakage of unsterile water away from the sterile zone.

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10.19: **Plumbing in Manufactured Homes and Construction Trailers**

(1) Definitions. The following definitions shall apply to 248 CMR 10.19.

Manufactured Home. Manufactured Home shall mean a structure, built in conformance to the National Manufactured Home Construction and Safety Standards which is transportable in one or more sections which in the traveling mode, is eight body feet or more in width or 40 body feet or more in length, or when erected on site, is 320 or more square feet, and which is built on a permanent chassis and designed to be used as a dwelling unit with or without a permanent foundation when connected to the required utilities, and includes the plumbing, heating, air conditioning, and electrical systems contained therein.

Label. Label means the adhesive-back aluminum foil decal which is permanently affixed to each transportable section of each manufactured home manufactured for sale in the United States and which serves as the certification by the manufacturer of conformance with the rules made under the Federal Manufactured Home Construction and Safety Standard in effect on the date of manufacture.

Temporary Construction Trailer. A temporary construction trailer when supplied with toilet facilities that would be used during construction of a building or structure only.

(2) Scope.

(a) Plumbing in manufactured homes shall comply to the latest Rules and Regulations established by the Secretary of the Department of Housing and Urban Development authorized by the National Manufactured Home Construction and Safety Standards.

(b) Such rules are to be effective as of June 15, 1976.

(c) These rules and regulations supersede all State Plumbing and/or Gas Codes.

(d) Additions or renovations made to the Plumbing and/or Gas Systems of such units shall be made in compliance with all provisions of M.G.L. c. 142 and 248 CMR 1.00 through 10.00.

(3) Temporary Construction Trailers. Temporary construction trailers are exempt from the material provisions of 248 CMR. 10.06.

(a) The temporary water and sewer connection to a temporary construction trailer shall be the same material as supplied with the trailer by the manufacturer.

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10.20: **Public and Semi-public Swimming Pools**

(1) General.

(a) All Public and Semi-public swimming pools must be installed in full compliance with all provisions of 105 CMR 435.000: Minimum Standards for Swimming Pools (State Sanitary Code: Chapter V).

(b) The issuing of permits, payment of fees, inspection, approval and installation of all swimming pools must also conform to all provisions of 248 CMR 1.00 through 10.00.

(2) Definitions.

Public Swimming Pool means and includes every artificial pool of water having a depth of two feet or more at any point and used for swimming or

bathing, located indoors or outdoors, together with the bathhouses, equipment, and appurtenances used in connection with the pool. It does not include any residential pool as herein defined nor does it include any pool used primarily for baptismal purposes or the healing arts.

Public Swimming Pool also means every swimming or wading pool admission to which may be gained by the general public with or without the payment of a fee.

Semi-public Pool:

(a) A semi-public pool is a swimming or wading pool on the premises of, or used in connection with a hotel, motel, trailer court, apartment house, country club, youth club school, camp, condominium or similar establishment where the primary purpose of the establishment is not the operation of the swimming facilities, and where admission to the use of the pool is included in the fee or consideration paid or given for the primary use of the premises.

(b) Semi-public pool shall also mean a pool constructed and maintained by groups for the purposes of providing bathing facilities for members and guests only.

Residential Pool means a swimming or wading pool established or maintained by an individual for his own or family's use or for the use of personal guests of his household.

Wading Pool means a pool of water in a basin having a maximum depth of less than two feet intended chiefly as a wading place for children. It does not include any residential pool as herein defined.

Operator means any person who:

(a) alone or jointly or severally with others owns a public or semi-public swimming pool or wading pool regulated by 248 CMR 10.00; or

(b) has case, charge or control of such a pool as agent or lessee of the owner or as an independent contractor.

Person means every individual, partnership, corporation, firm, association or group, including a city, town, county, or other governmental unit.

Board of Health means the appropriate and legally designated health authority of the city, town or other legally constituted governmental unit within the Commonwealth having the usual powers and duties of the board of health of a city or town, or his or its authorized agent or representative.

(3) Plan Approval.

(a) No person shall construct or install a Public or Semi-public swimming or wading pool or expand, remodel, or otherwise make any change which may affect the compliance of an existing Public or Semi-public swimming

or wading pool with the requirements of 248 CMR 10.00 until the plans and specifications for the construction or change have been approved in writing by the Board of Health.

(b) Nothing in 248 CMR 10.00 shall affect the authority of any person acting under appropriate sections of an applicable building, plumbing or electrical code, ordinance or regulation.

(4) Conformance.

(a) All work shall conform to plans and specifications as approved by the Massachusetts Department of Public Health or the Board of Health. 105 CMR 435.000: Minimum Standards for Swimming Pools (State Sanitary Code: Chapter V).

(b) Changes to Plans or Specifications.

1. Any revision or change in the plans and specifications, as originally approved by the Massachusetts Department of Public Health or the Board of Health, which may affect the capacity or the health or safety features of the swimming or wading pool shall be submitted to the Board of Health for review.

2. Approval from the Board of Health of said change or revision of plans shall be obtained in writing before the work affected by the change is undertaken.

(5) Notification.

(a) The Board of Health shall be notified when a newly constructed, expanded, or remodeled swimming or wading pool is ready for use.

(b) Notification shall be given at least one week prior to the completion of the project so that a date can be arranged for a final inspection.

(c) Use of such pool shall not commence before a final inspection has been made and approval, in writing, to operate has been given by the Board of Health.

(6) Prohibited Connections.

(a) Under no circumstances shall piping systems be designed and constructed as to permit pool water to enter a potable-water-supply system nor waste water or sewage to enter the pool through backflow connections or interconnections.

(b) Cross-connections or interconnections in the pool piping system whereby pool water may under some conditions enter a potable-water-supply system should be avoided using the following means:

1. by providing for the admission of make-up water above the overflow elevation of the pool or by pumping from a pump suction well; or

2. where filters are installed and filter washing with the recirculation pump is not feasible, a wash-water pump of proper capacity should be installed and a suction well or small elevated tank used to supply water to the pump, the discharge to the suction well or tank being above the flow line.

(c) In no case should valved cross-connections, whereby water from a potable-water-supply may be admitted directly to the recirculation system for the purpose of filter washing, be permitted.

(d) No pool drains or drains from filters, where the re-circulating system is used, should be directly connected to sewers.

1. Such drains should discharge by an indirect connection to a properly trapped sump.

2. Where such indirect connections are not possible, pumping of pool and filter-wash drainage may be necessary.

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10.21: **Boiler Blow-off Tank**

(1) Boiler Blow-off Tank. (See 248 CMR 10.22: Figure 1: Illustration of Boiler Blow Off Tank). A vessel designed to receive the discharge from a boiler blow-out outlet and to cool the discharge to a temperature of 150EF or less which permits its safe discharge to the drainage system.

(a) Shall be in full accordance with the recommendations of the National Board of Boiler and Pressure Vessel Inspectors for Boiler Blow-off Equipment, Columbus, Ohio.

(b) The temperature of water entering drainage piping from discharge of blow-off equipment shall not exceed 150EF.

(c) The pressure of the blow-down leaving any type of blow-off equipment shall not exceed five P.S.I.G.

(d) The blow-off piping and fitting between the boiler and the blow-off tank shall comply with the ASME Power Boiler Code, Paragraphs P-307 through 312.

(e) All materials used in the fabrication of boiler blow-off equipment shall comply with material section of the ASME

Boiler Code, Section II .

(f) All blow-off equipment shall be fitted with openings to facilitate cleaning and inspection.

(g) The blow-off tank shall be designed in accordance with the ASME Boiler Construction Code, Section VIII for a working pressure of at least one fourth of maximum working pressure of the boiler to which it is connected. In no case, however, shall the plate thickness be less than d inch.

(2) Direct Connections of Steam Exhaust, Blow-offs and Drip Pipes.

(a) Discharge into Building Drainage System:

1. A steam exhaust, blow-off, or drip pipe shall not be directly connected to a building, drainage system but shall first pass through a blow-off tank as shown in 248 CMR 10.22: Figure 1: Illustration of Boiler Blow Off Tank.

2. Such waste water when it is discharged into a building drainage system shall have a temperature of not more than 150EF.

(b) Automatic Cooling Facilities:

1. Steam condensate which is to be discharged to the drainage system shall be provided with automatic cooling facilities to reduce the temperature of the water to a maximum temperature of 150EF.

2. Automatic cooling facilities shall include storage so that heat may be dissipated and cooling water when required shall be added by use of a thermostatically controlled device and only that portion of condensate about to be discharged to the drainage system shall be cooled.

3. The requirements of 248 CMR 10.21(2)(b) apply particularly to systems of steam supply in which the steam condensate is discharged to waste rather than being returned to the steam generating plant such as steam supplied from street mains or from remote central steam generating plants.

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10.22: **Figures**

Notes for Figures: The following applies for the figures in 248 CMR 10.22.

(1) All figures are general schematics for illustrative purposes only. The figures are not meant to show every fitting, change of direction or every

situation. Deviations from the illustrave figures may be acceptable so long as the workmanship is in compliance with the relevant portion of 248 CMR.

(2) All fixture waste and traps, as represented in the figures, shall be in compliance with Table 248 CMR 10.15(2)(a).

(3) All cleanouts and locations, as represented in the figures, shall be in compliance with 248 CMR 10.08(2)(a) through 10.08(2)(n).

(4) All vents through the roof, as represented in the figures, shall be in compliance with 248 CMR 2.16(4)(a) through 2.16(5)(f).

(5) All branches and building drain sizes as per table 248 CMR 2.15(3)(a).

(6) All sizes of vents, vent stacks, branches etc. as represented in the figures, shall be in compliance with Table 248 CMR 2.16(12)(a).

(7) Symbols used in the figures in 248 CMR 10.22 have the following meanings. Note, for plans and specifications, these symbols may be used.

U.G.	Under Ground
A.G.	Above Ground
W&T	Waste and Trap
S.S.	Service Sink Trap Standard; Sanitary Sewer; or Storm Sewer (depending on context)
M.R.	Mop Receptor
F.D.	Floor Drain
F.V.	Future Vent
K.S.	Kitchen Sink (Single Compartment)
W.C.	Water Closet/Toilet
LAV.	Lavatories with 1¼ inch waste
V.T.R.	Vent through roof
C.I.	Cast iron
A.W.	Acid Waste

(8) All trap distances from vents as represented in the figures are in compliance with 248 CMR 10.16(11)(a): Table 1: Distance of Fixture Trap from Vent.

(9) See 248 CMR 10.13: Piping and Treatment of Special Hazardous Wastes before installation of any special hazardous waste system, Figure 16.

(10) Figures are not to scale.

FIGURE 1: **Illustration of Boiler Blow Off Tank.**

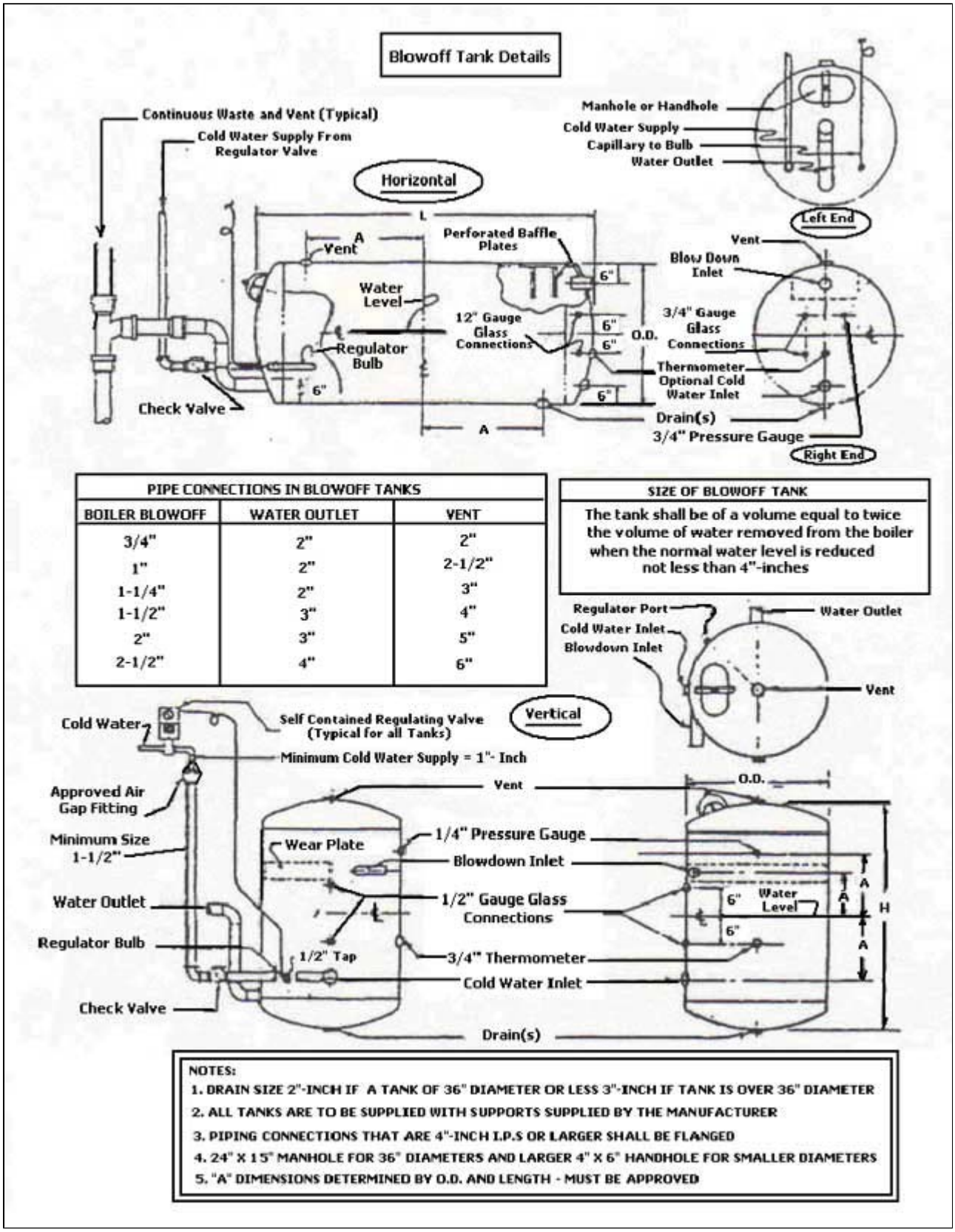
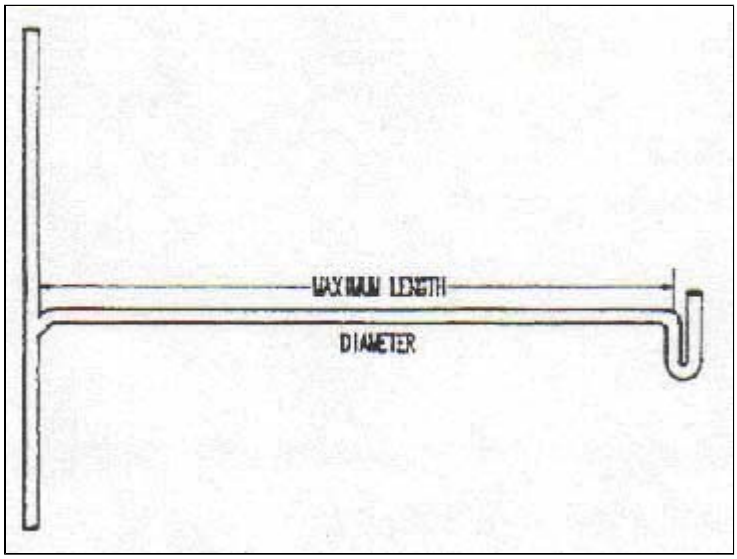


FIGURE 2:
Illustration of Maximum Distance from Trap to Vent in Compliance with 248 CMR 10.16(12)(a): Table 1: Distance of Fixture Trap from

Vent



Note: These dimensions are from the vent to the weir of the trap along the developed length and the slope of the pipe in this distance is not greater than ¼ inch per foot.

Diameter of Pipe	Maximum Developed Length of the Pipe
1½ inch waste and trap	Five feet
2 inch waste and trap	Six feet
3 inch waste and trap	Eight feet
4 inch waste and trap	Ten feet

FIGURE 3: **Illustration of Miscellaneous Common Venting 248 CMR 10.16(9).**

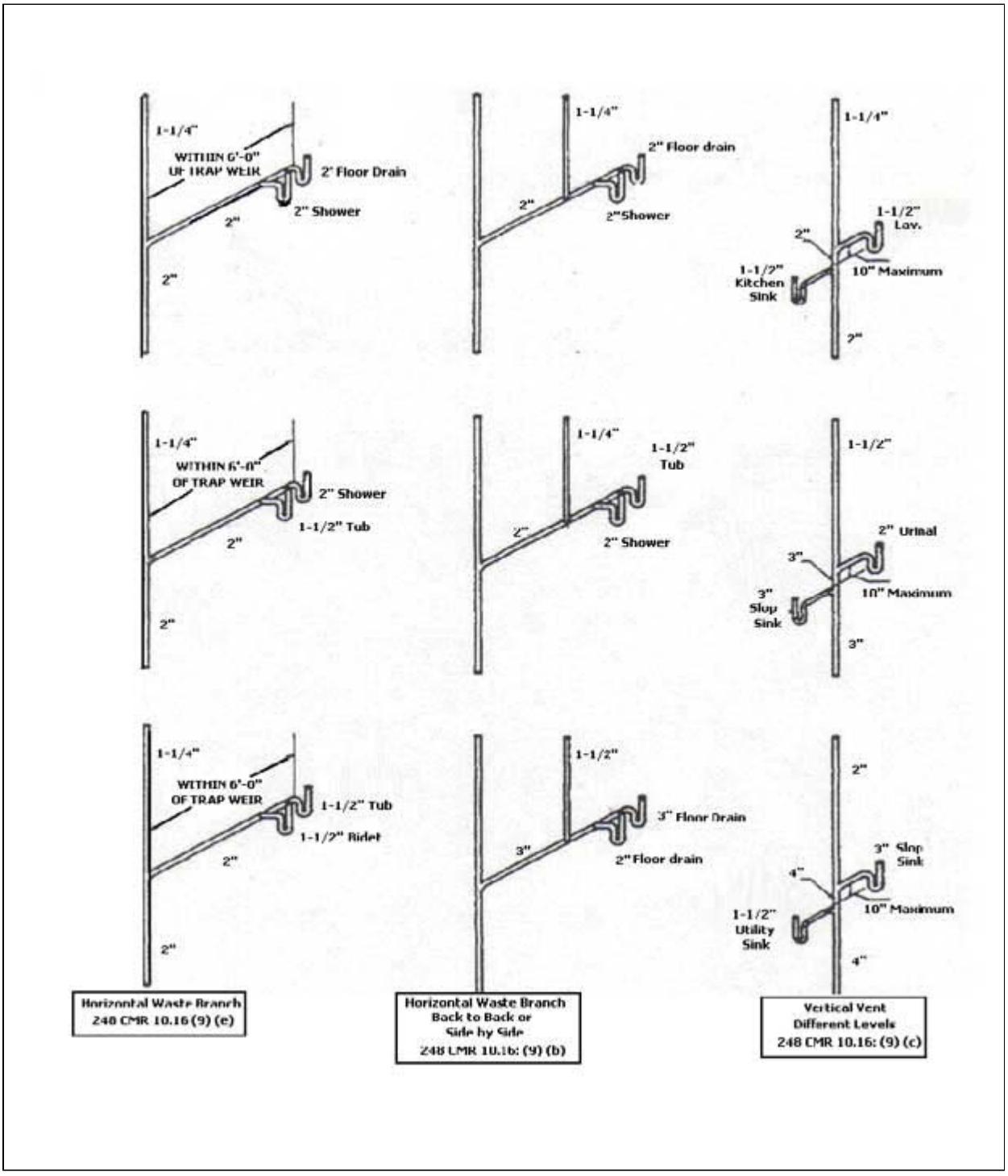


FIGURE 4: **Illustration of Stack Venting in Compliance with 248 CMR 10.16(8)(a) and (b).**

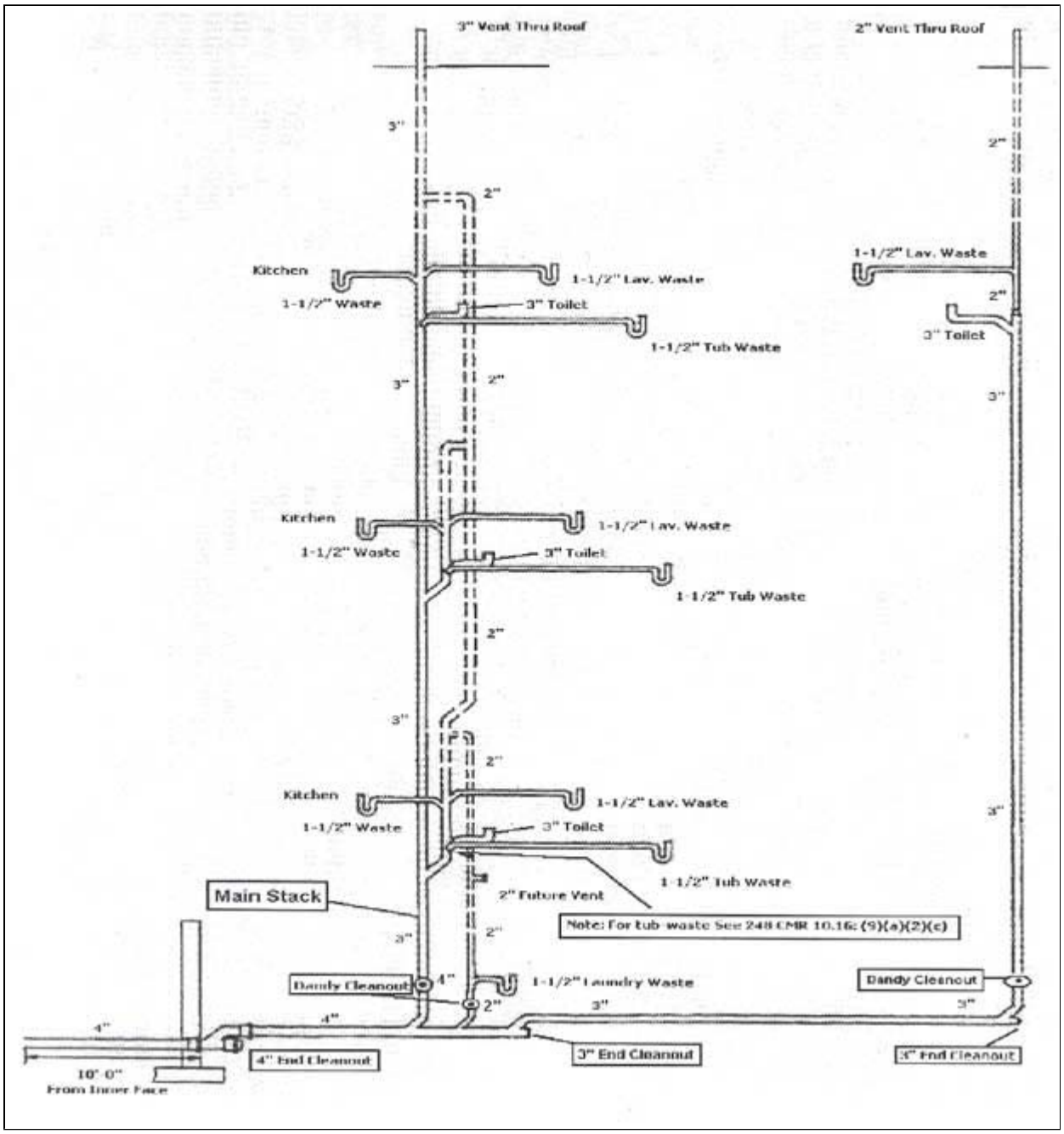


FIGURE 5: **Illustration of Wet Venting.**

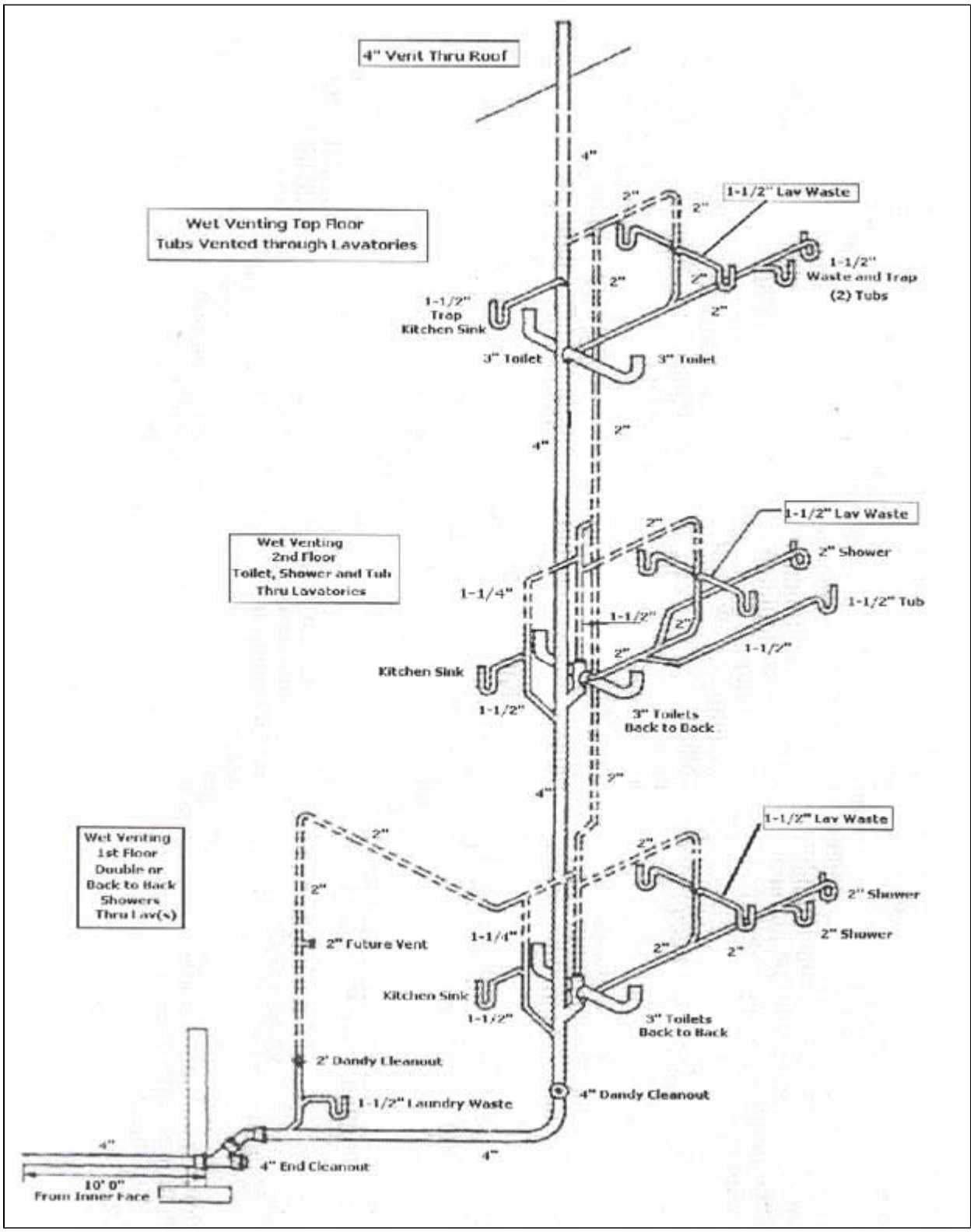


FIGURE 6: **Illustration of Individual Vent First Floor, Wet Vent Second Floor,and Stack Vent Third Floor.**

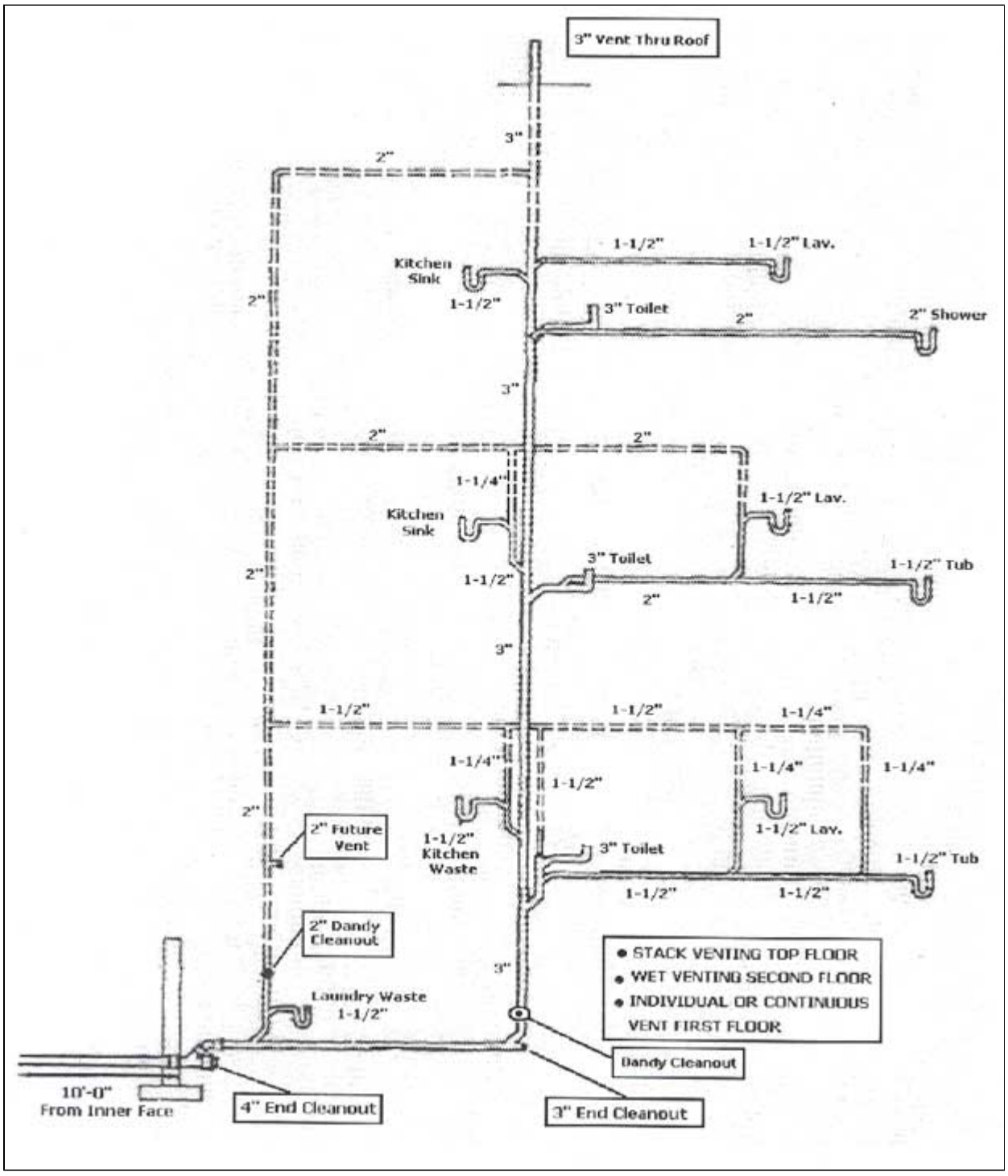


FIGURE 7: **Illustration of Battery Circuit Vent, First Floor and Battery Loop Vent Second Floor.**

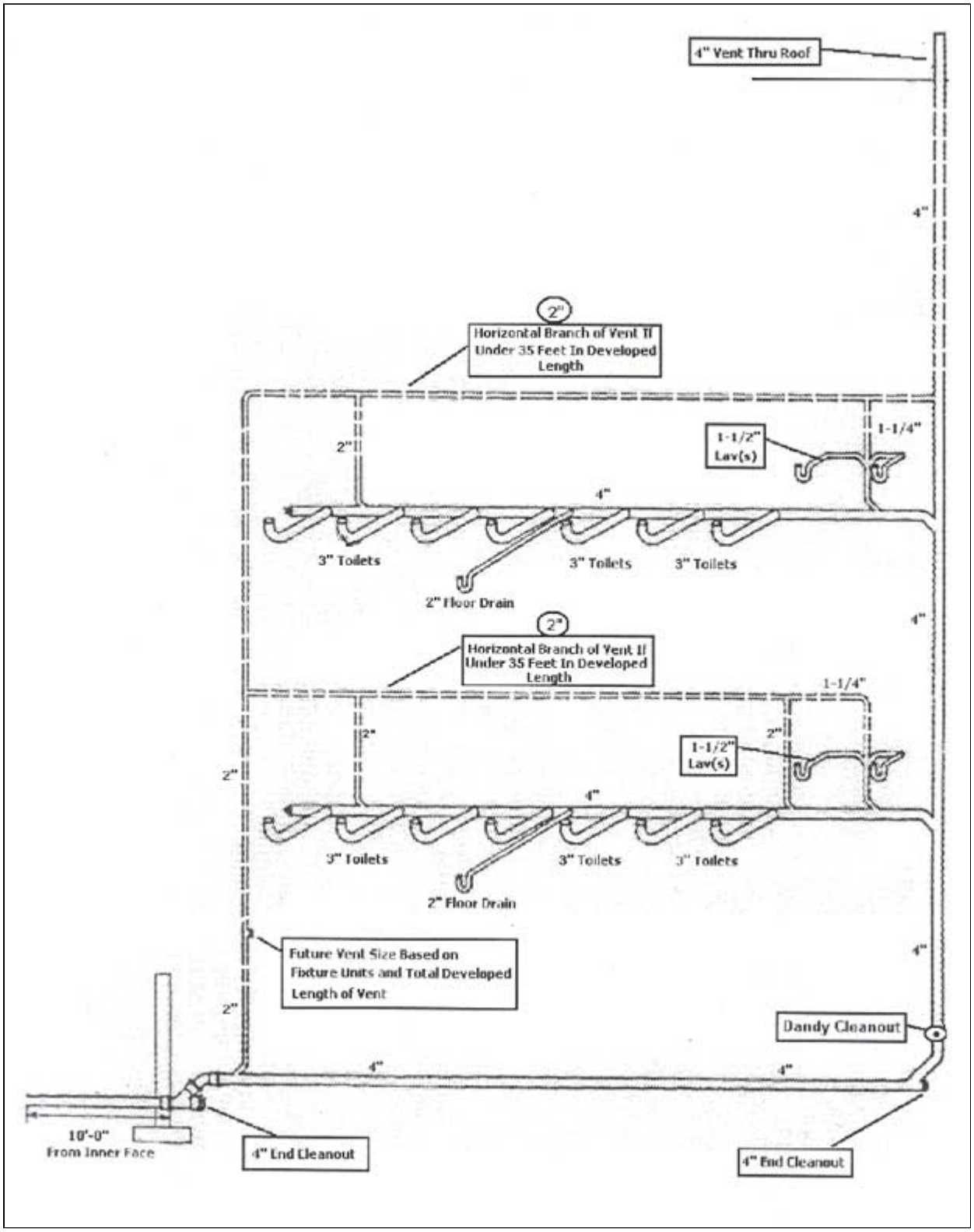


FIGURE 8: **Illustration of Battery Circuit, Vent Multiple Floors.**

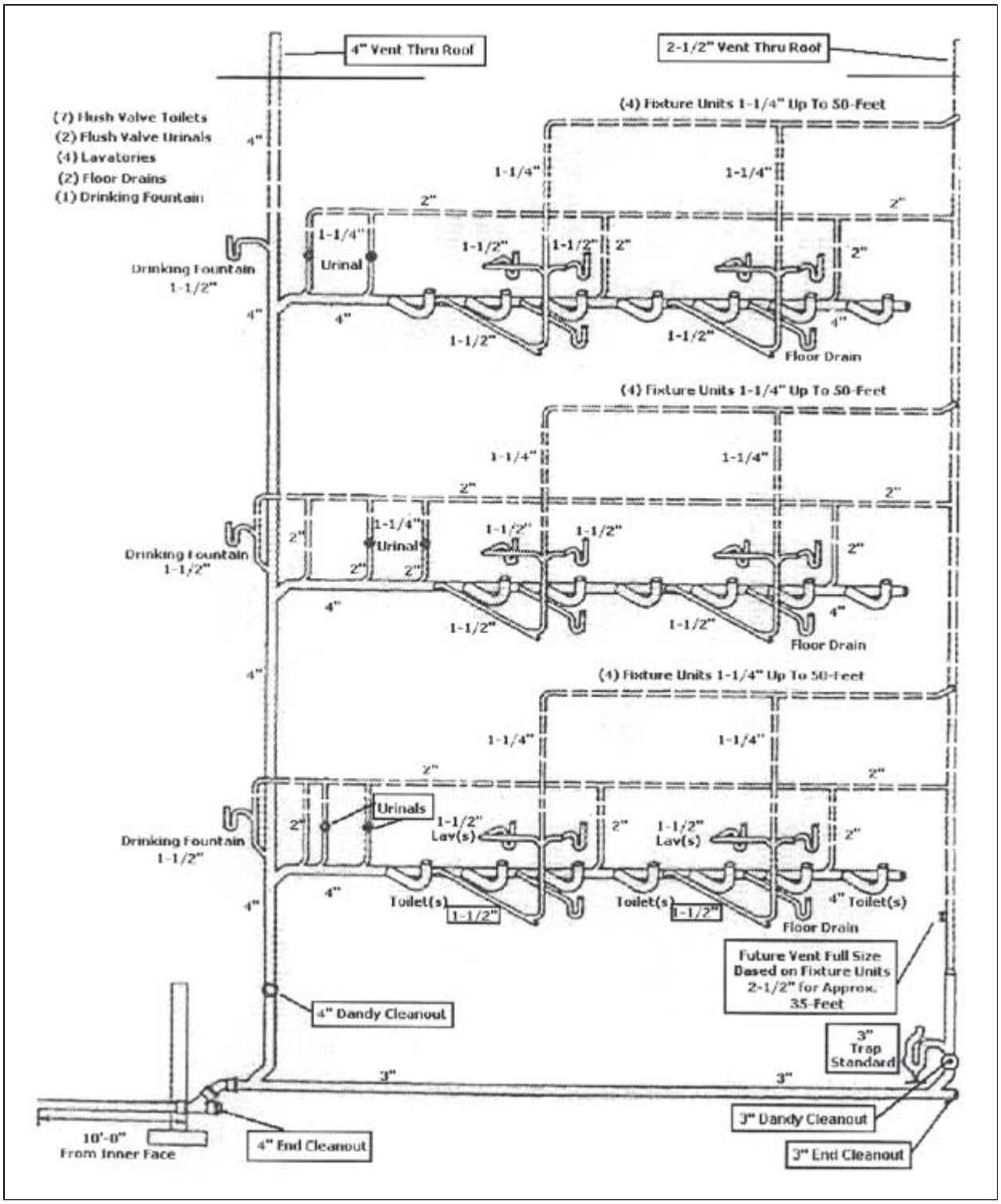


FIGURE 9: **Illustration of Battery Loop Vent, Multiple Floors.**

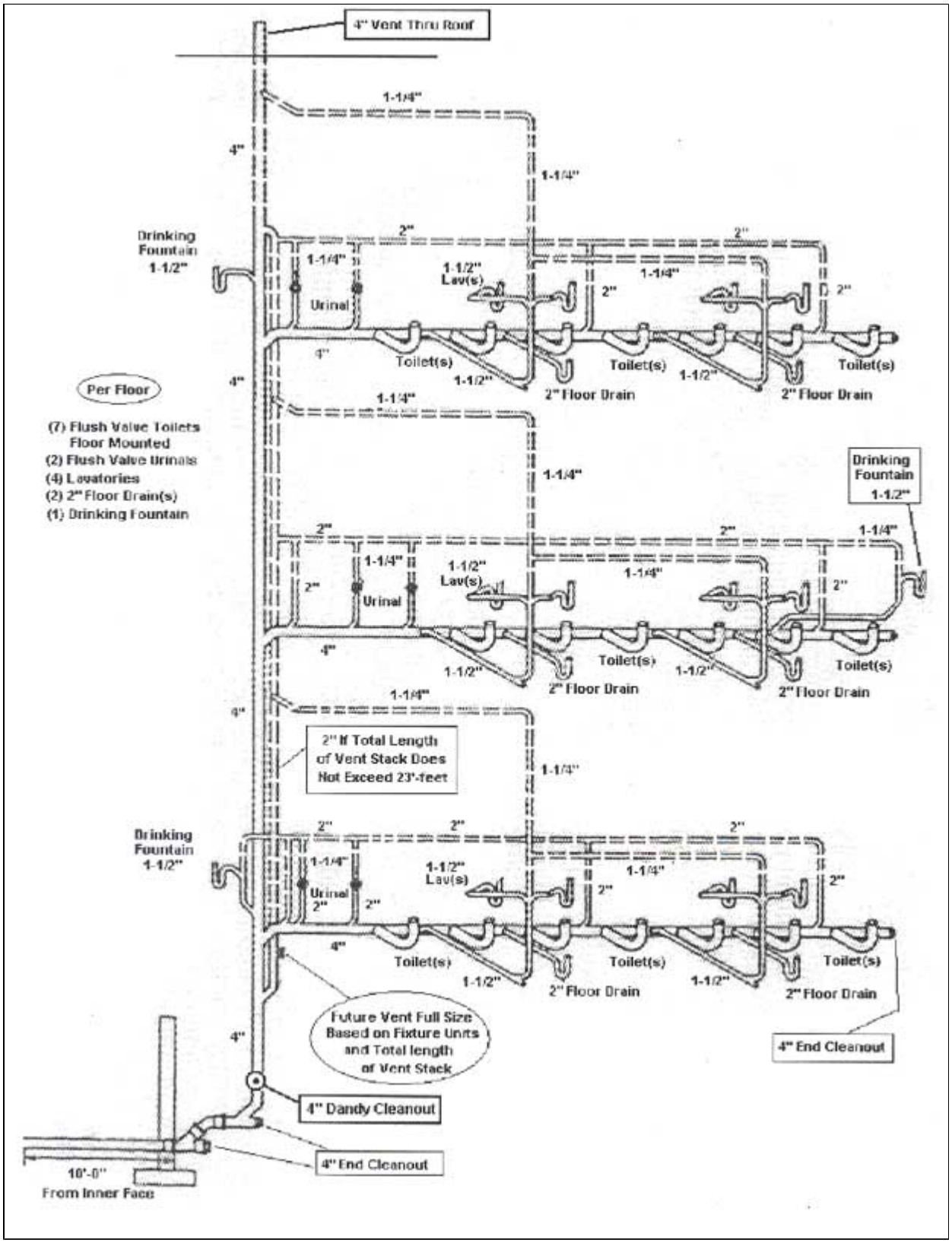


FIGURE 10: **Illustration of Below the Floor Hazardous Waste Battery Venting.**

See 248 CMR 10.13(5)(d).

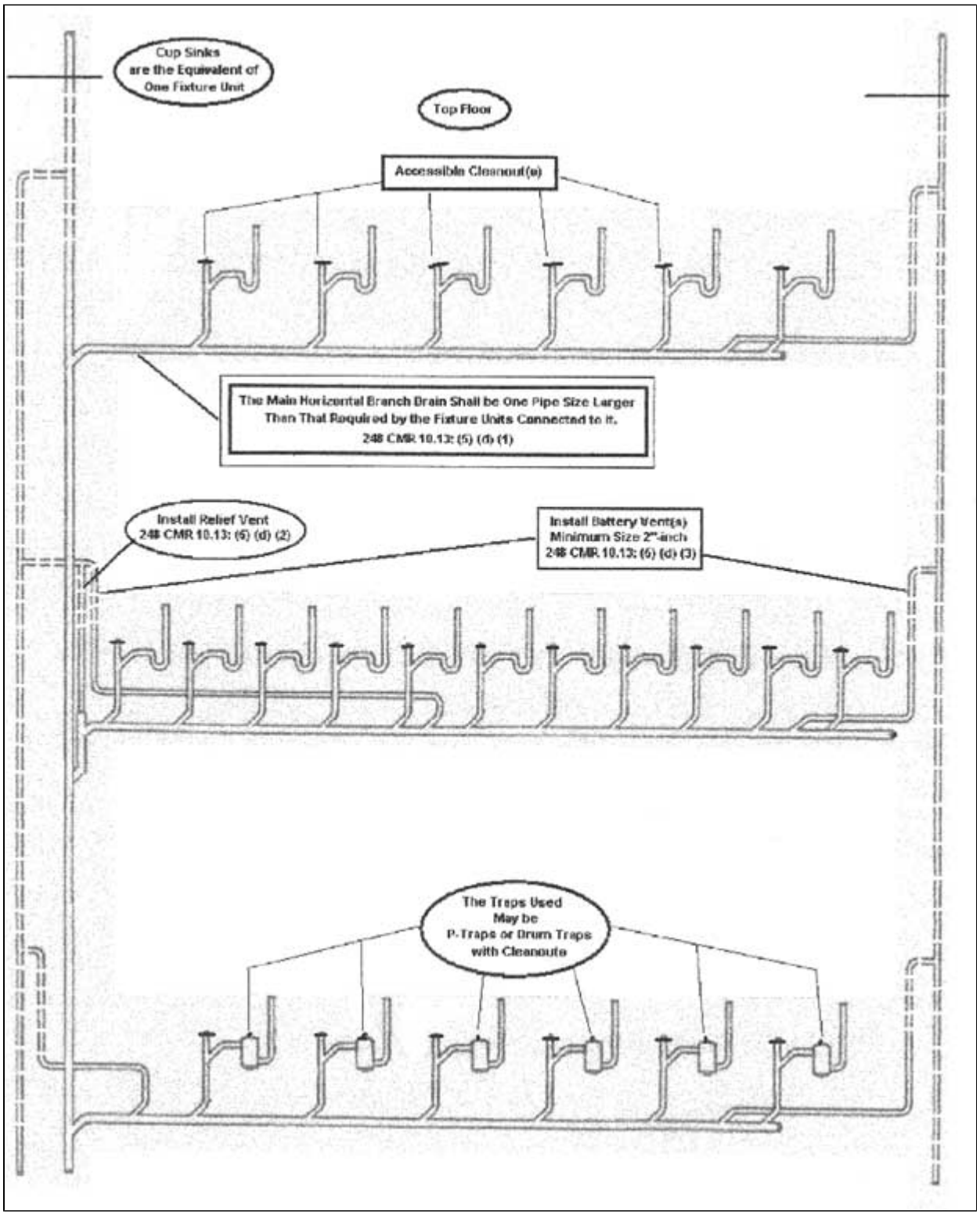
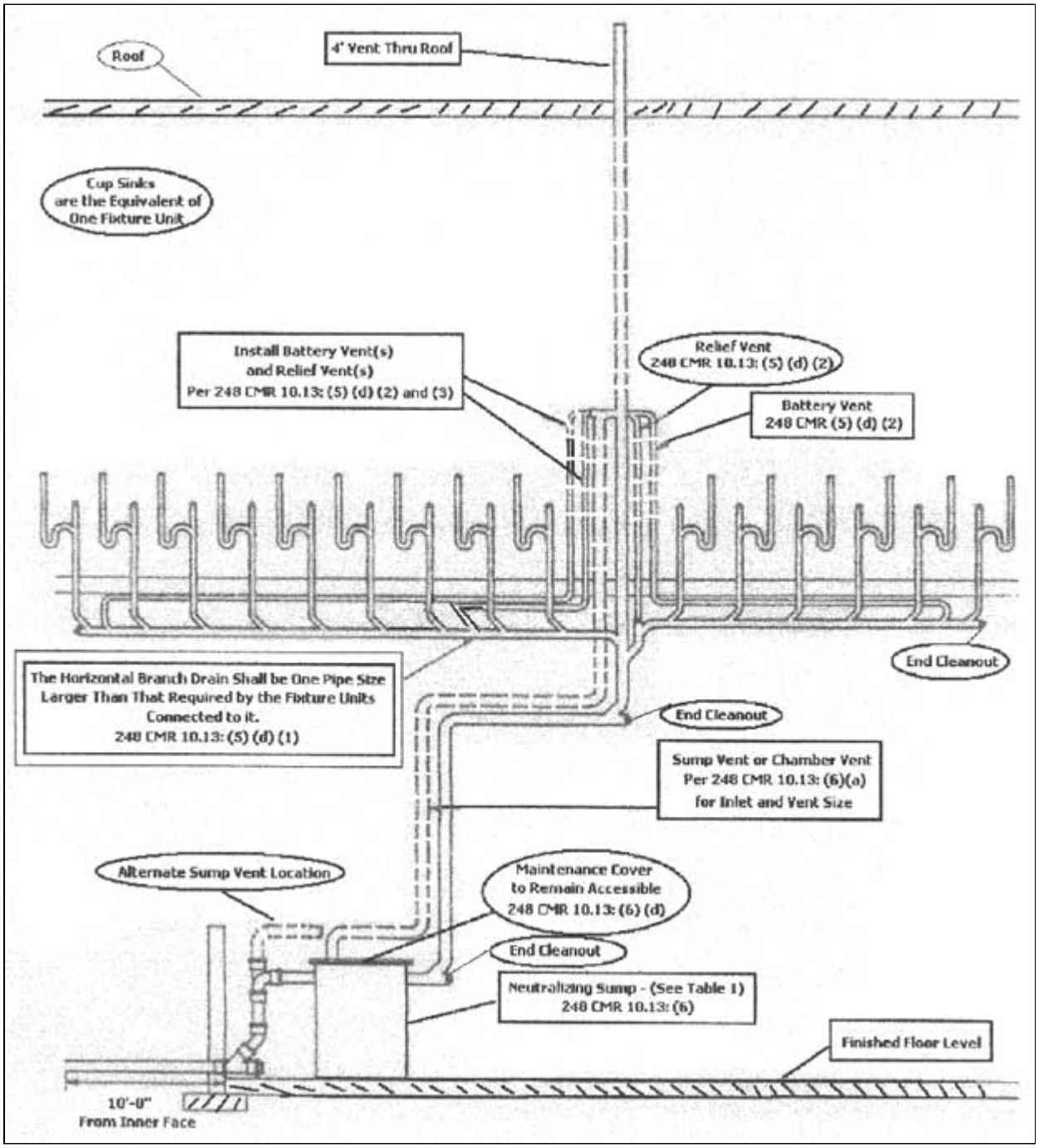


FIGURE 11: **Illustration of Hazardous Waste Battery Vented Below Floor Level, in Compliance with 248 CMR 10.13.**



(FIGURE 12: Reserved)
FIGURE 13a: **Illustration of Bow Vent Single Installations.**

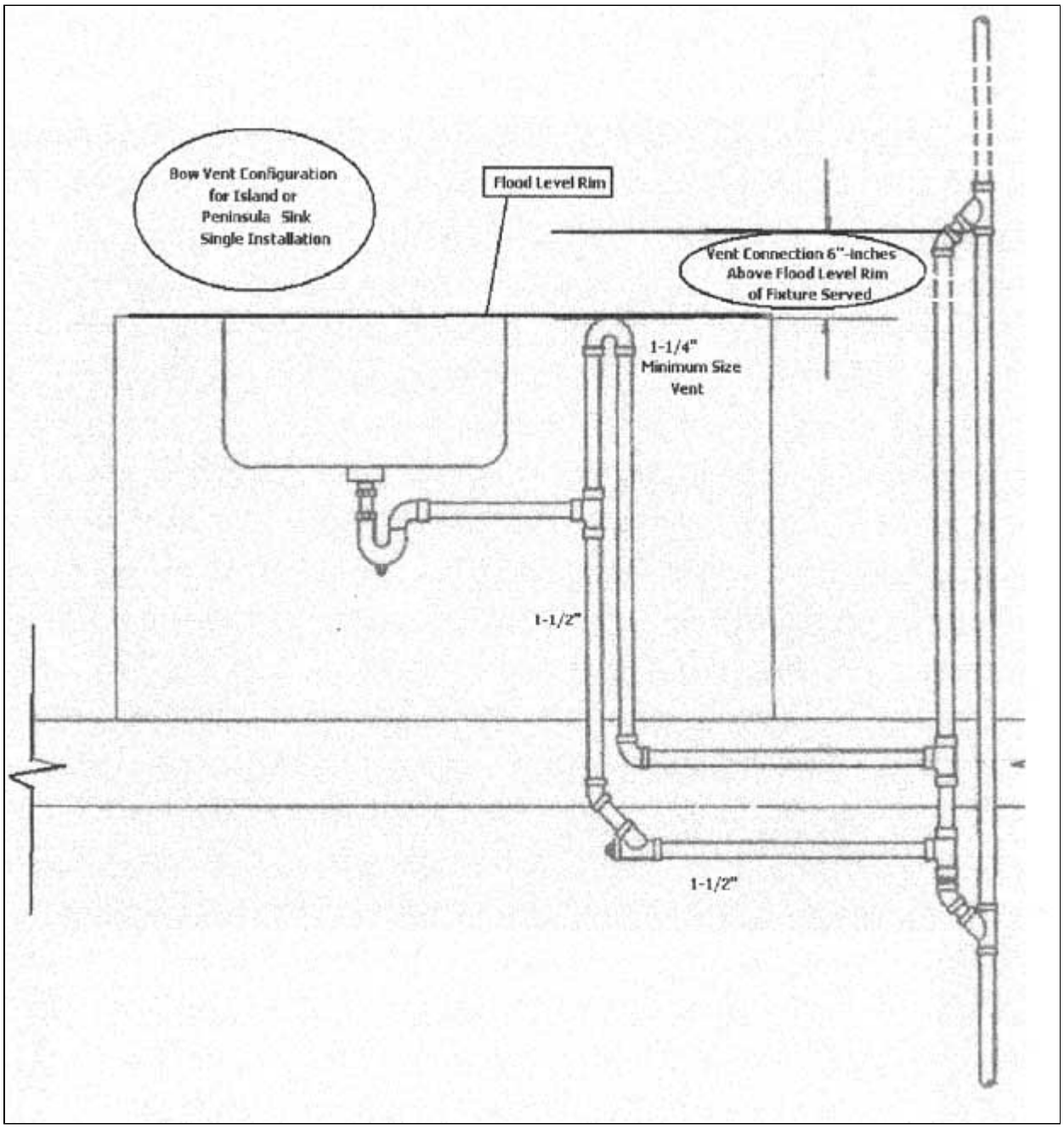


FIGURE 13b: **Illustration of Bow Vent connection at Intermediate Floor.**

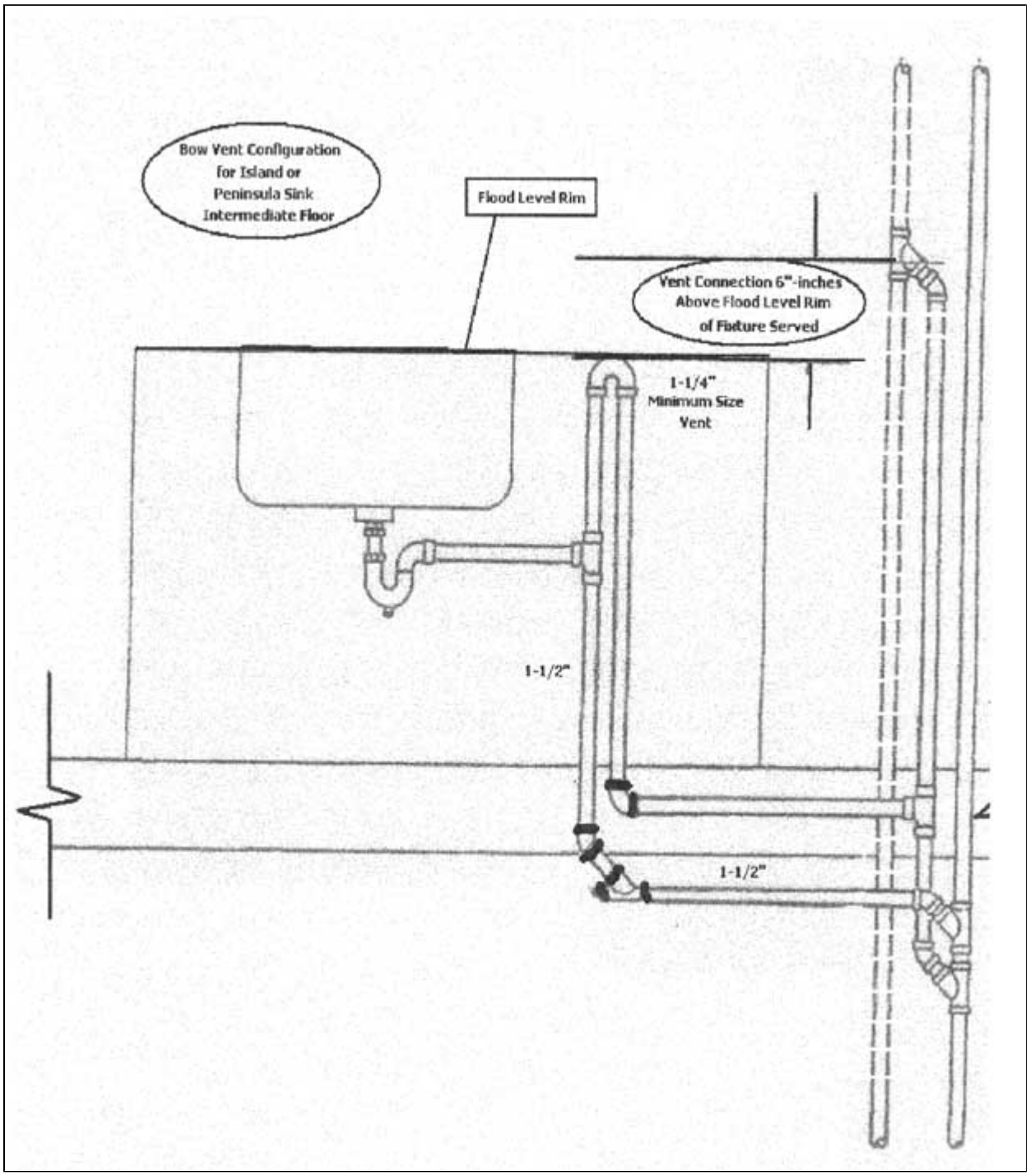


FIGURE 13c: **Illustration of Bow Vent Connection to Horizontal.**

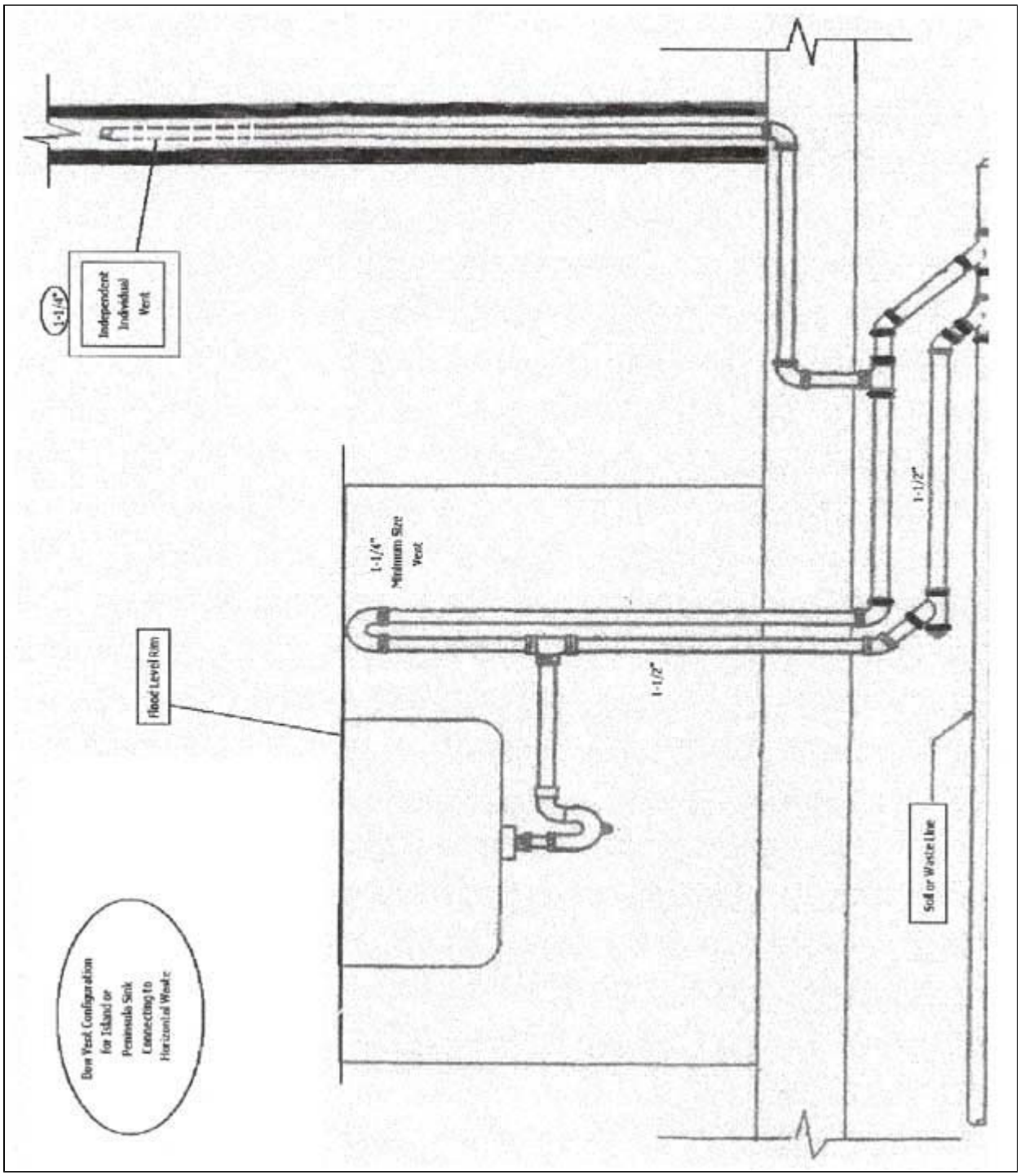
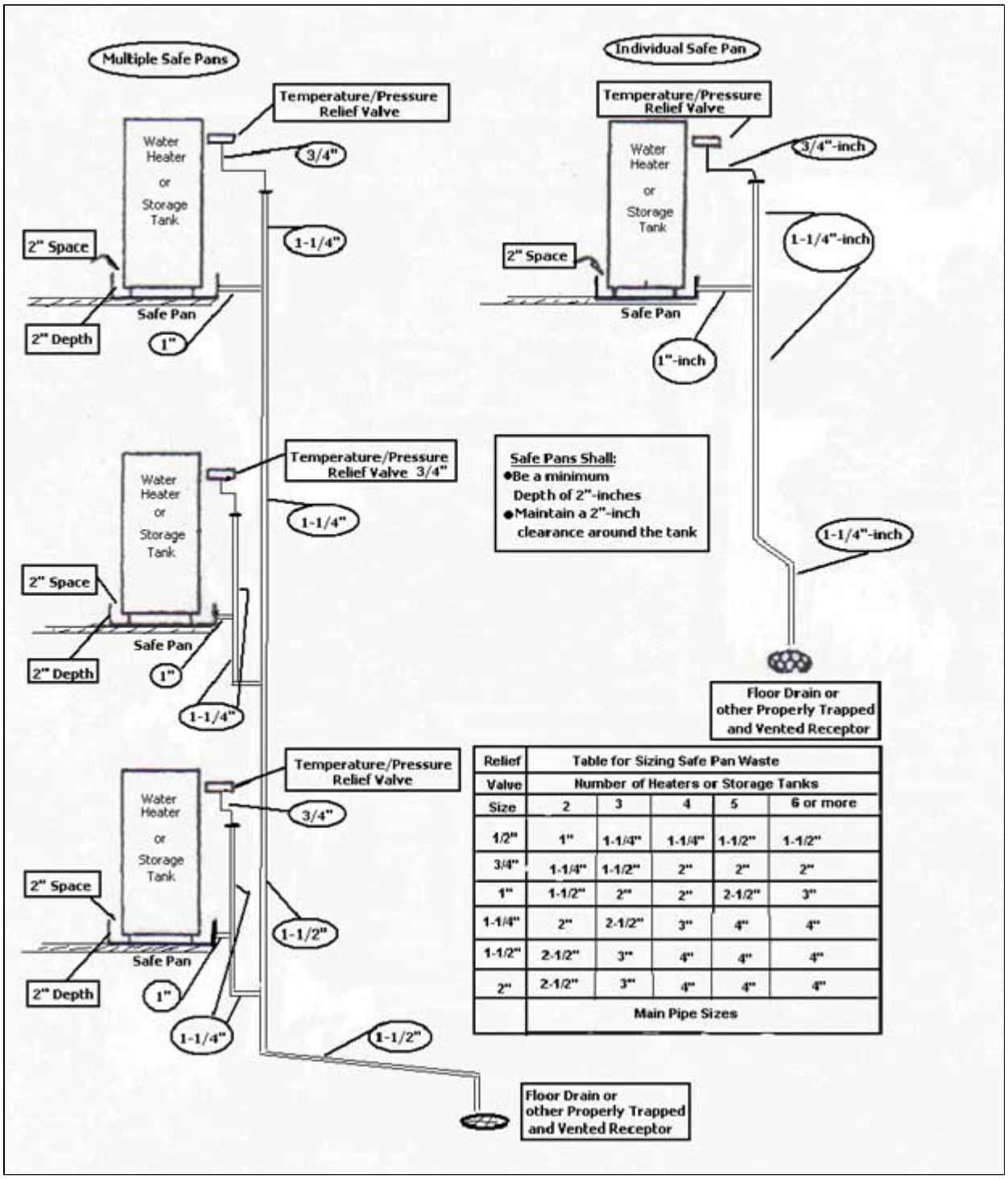
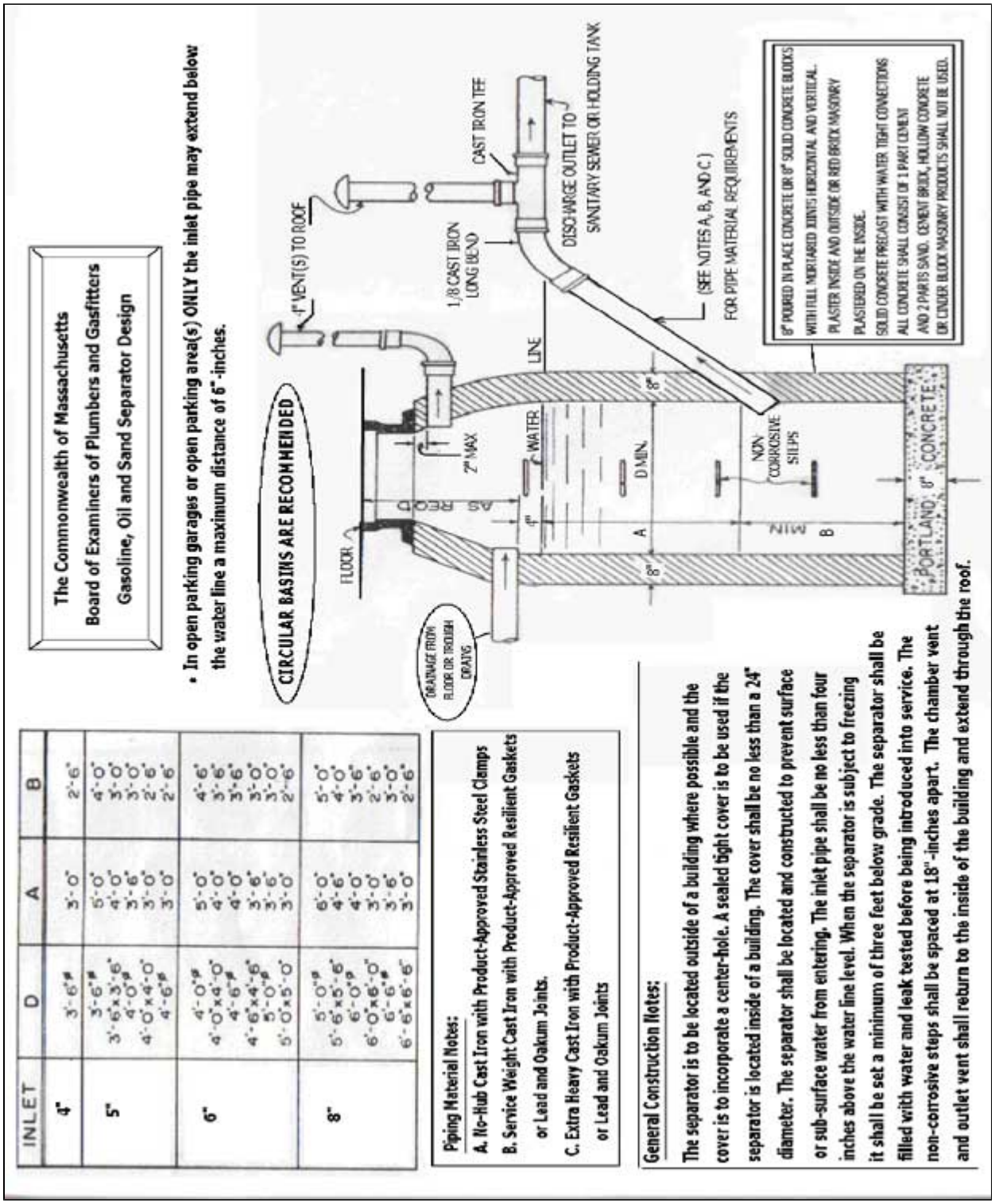


FIGURE 14: **Illustration of Sizing for Safe Waste Pan Drains or Water Heaters. 248 CMR 10.12(1)(h)**



Relief Valve Size	Table for Sizing Safe Pan Waste — Number of Heaters or Storage Tanks				
	2	3	4	5	6 or more
1/2"	1"	1-1/4"	1-1/4"	1-1/2"	1-1/2"
3/4"	1-1/4"	1-1/2"	2"	2"	2"
1"	1-1/2"	2"	2"	2-1/2"	3"
1-1/4"	2"	2-1/2"	3"	4"	4"
1-1/2"	2-1/2"	3"	4"	4"	4"
2"	2-1/2"	3"	4"	4"	4"
	Main Pipe Sizes				

FIGURE 15: **Illustration of Gasoline, Oil and Sand Separator**



INLET	D	A	B
4"	3'-6"ø	3'-0"	2'-6"
5"	3'-6"ø 3'-6"x3'-6" 4'-0"ø 4'-0"x4'-0" 4'-6"ø	5'-0" 4'-0" 3'-6" 3'-0" 3'-0"	4'-0" 3'-0" 3'-0" 2'-6" 2'-6"
6"	4'-0"ø 4'-0"x4'-0" 4'-6"ø 4'-6"x4'-6" 5'-0"ø 5'-0"x5'-0"	5'-0" 4'-0" 4'-0" 3'-6" 3'-6" 3'-0"	4'-6" 3'-6" 3'-6" 3'-0" 3'-0" 2'-6"
8"	5'-0"ø 5'-6"x5'-6" 6'-0"ø 6'-0"x6'-0" 6'-6"ø 6'-6"x6'-6"	6'-0" 4'-6" 4'-0" 3'-6" 3'-6" 3'-0"	5'-0" 4'-0" 3'-6" 2'-6" 3'-0" 2'-6"

FIGURE 16: **Illustration of Horizontal to Horizontal Change of Direction**

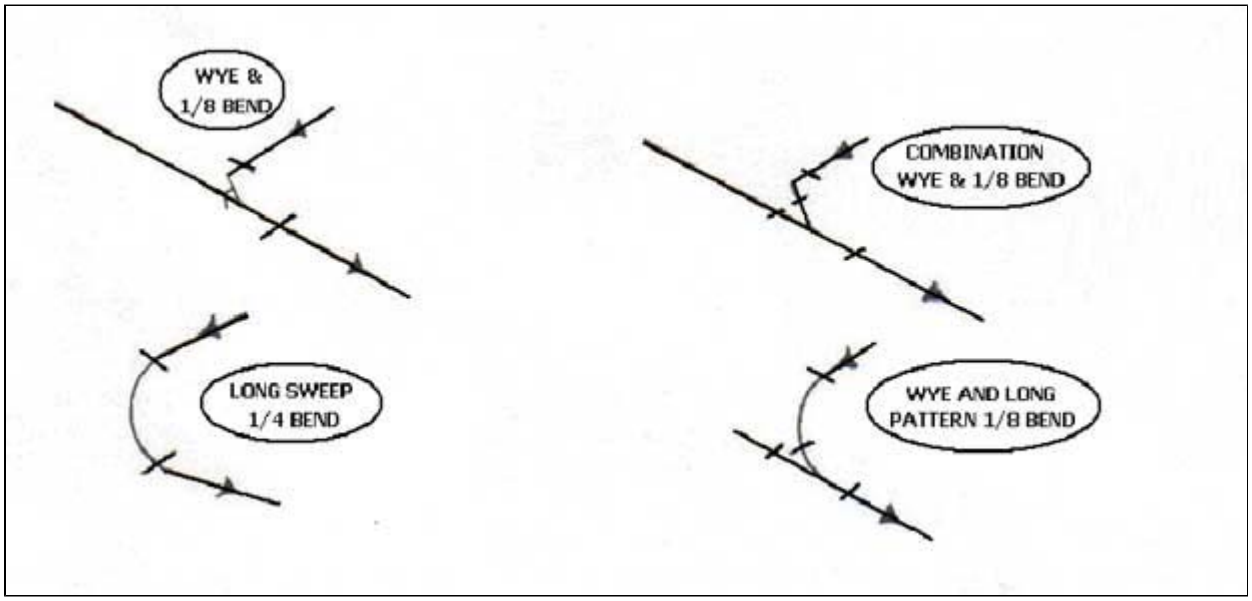


FIGURE 17: **Illustration of Vertical to Horizontal Change of Direction**

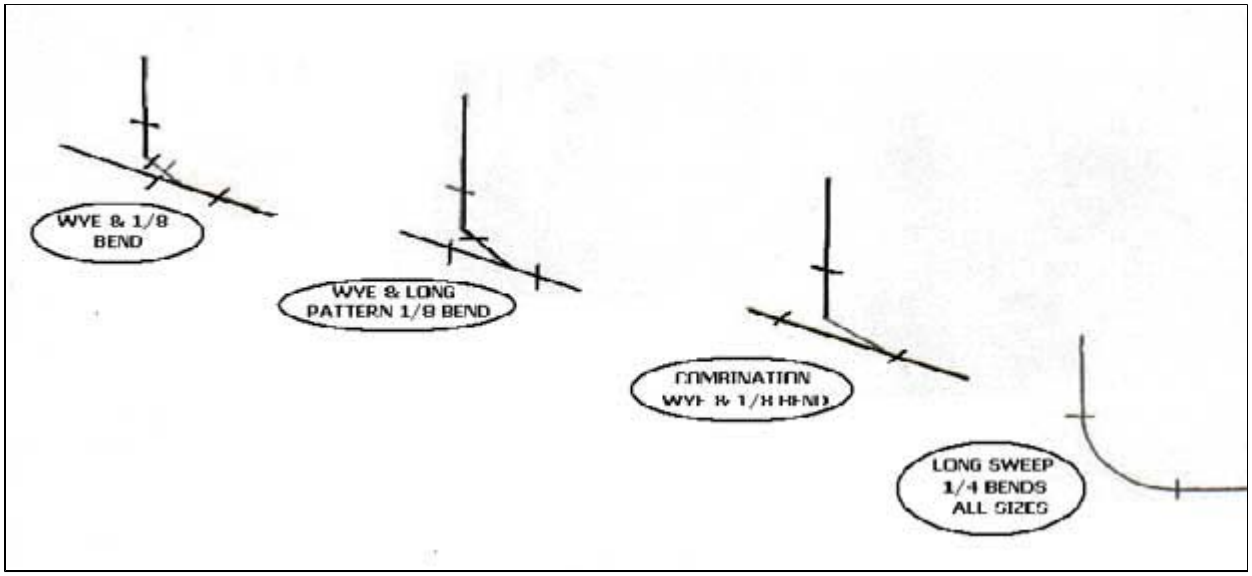
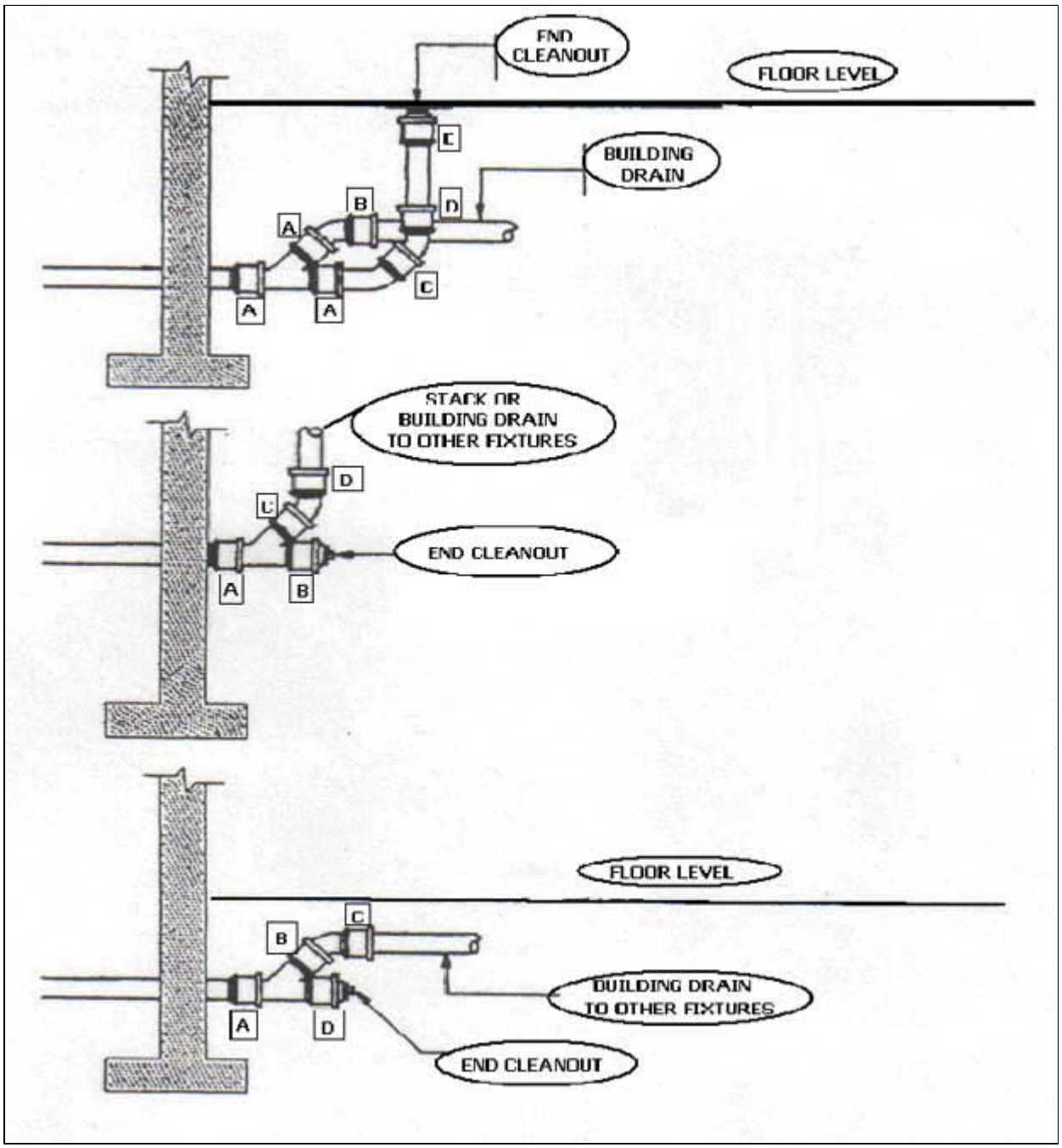


FIGURE 18: **Illustrations of Building Drainage Foundation Wall.**



Note: A, B, C, D & E on each figure shall be in compliance with 248 CMR 10.07(1)(c) (Lead & oakum joints).

FIGURE 19: **Illustration of Laundries in Multi-story Buildings**

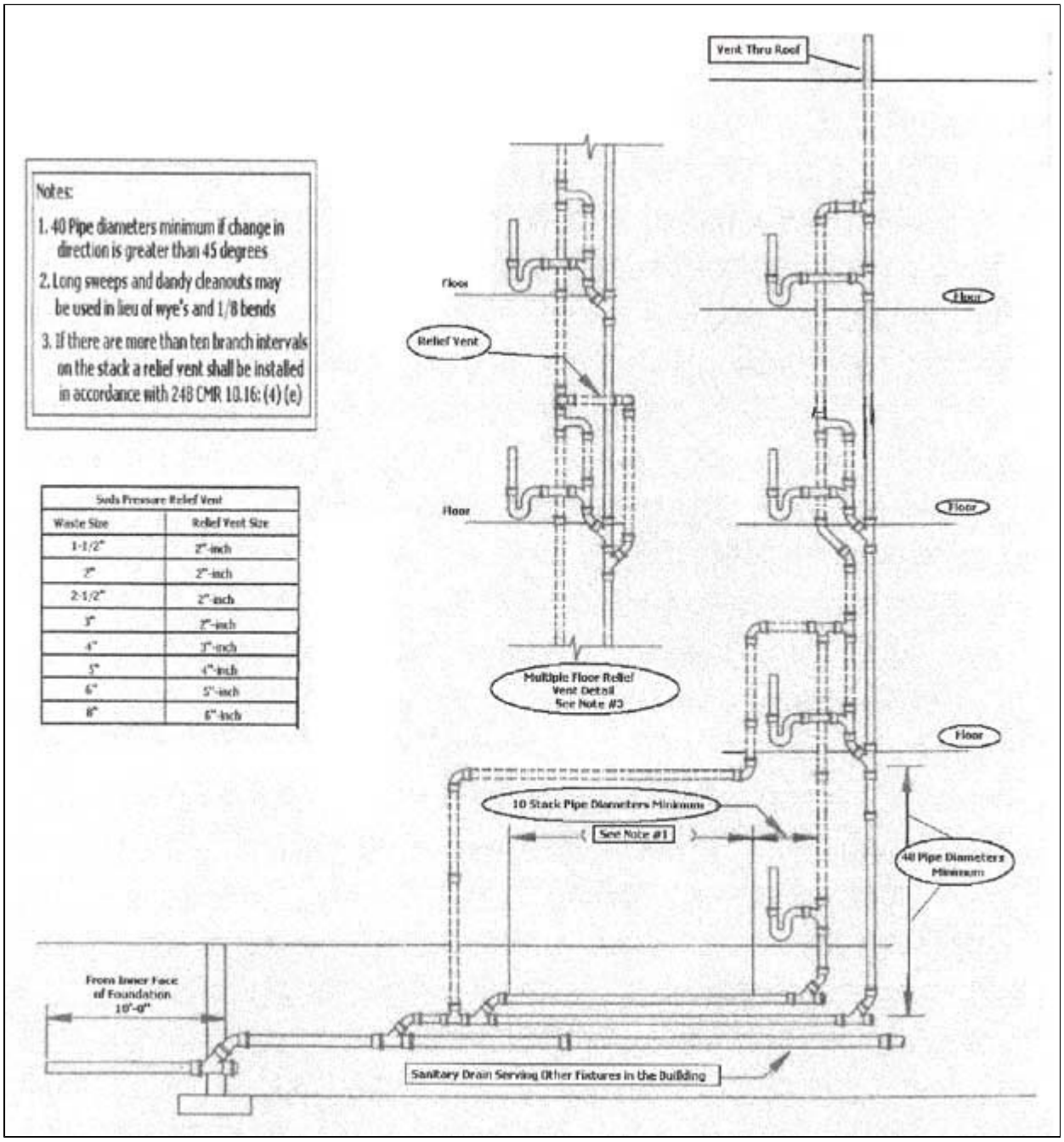


FIGURE 20: **Illustration of Offsets of More than 45? in Buildings of Five Stories or More in Compliance with 248 CMR 10.15(8)(b) and 10.16(4)(c).**

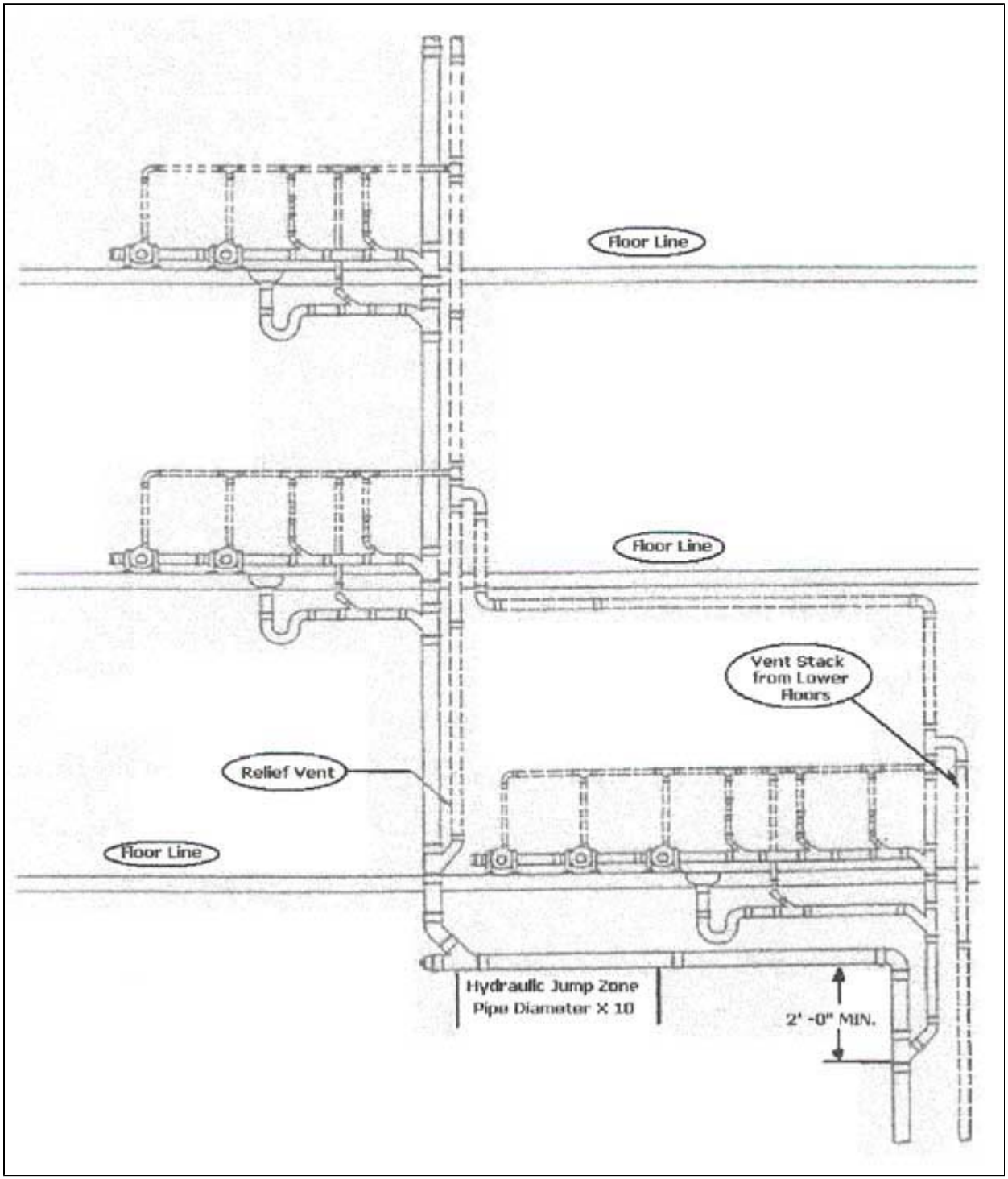


FIGURE 21: **Illustration of Multiple Clear Water Waste Stack**

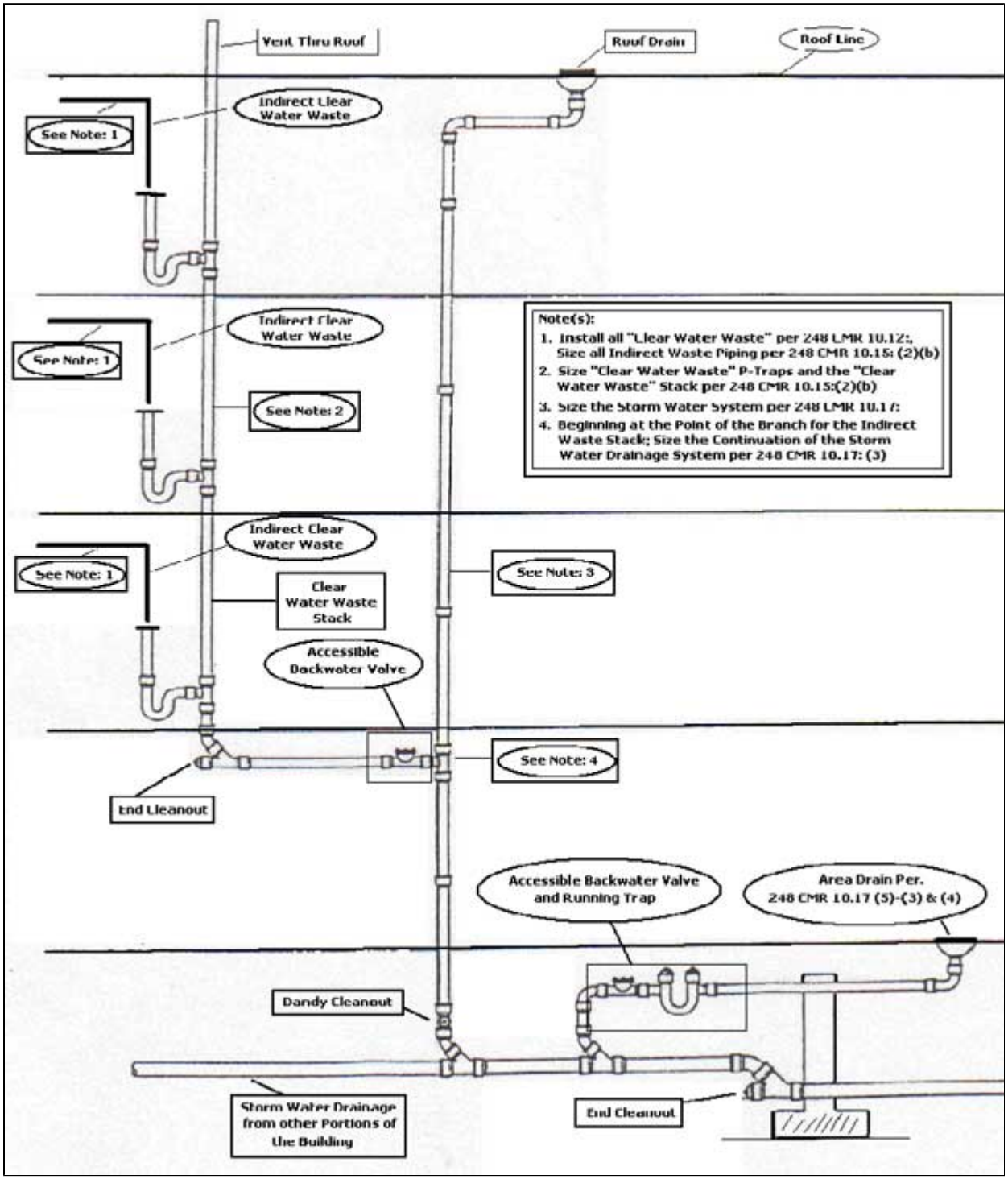


FIGURE 22: **Illustrations of Installation of Grease Interceptors.**

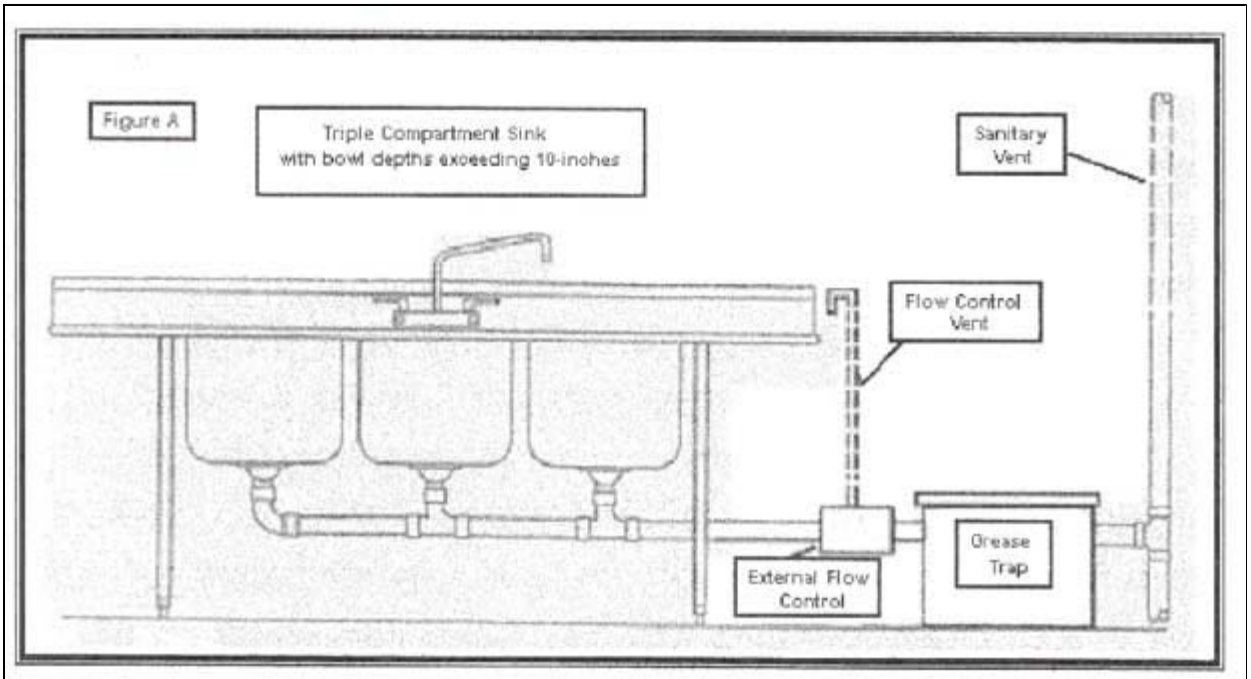


Figure A
Triple Compartment Sink
with bowl depths exceeding 10-inches
Sanitary
Vent
Flow Control
Vent
Grease
Trap
External Flow
Control

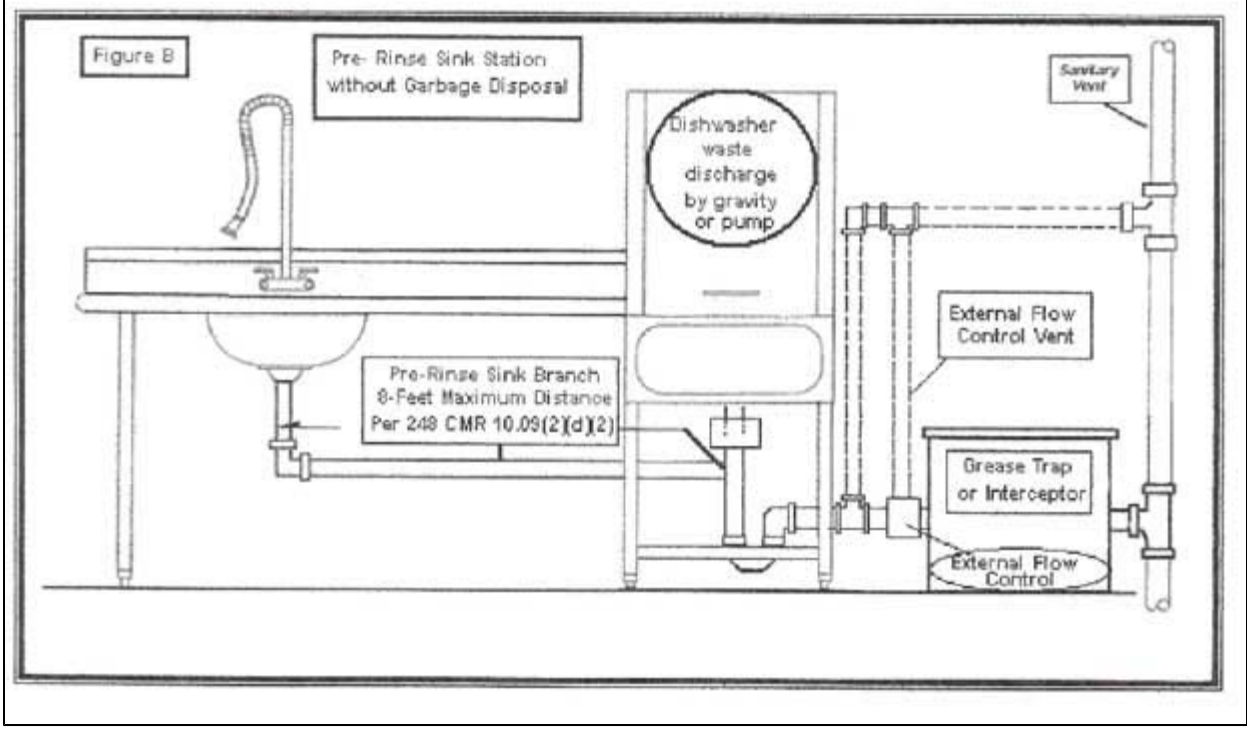


Figure B
Pre- Rinse Sink Station
without Garbage Disposal
Dishwasher
waste
discharge
by gravity
or pump
Sanitary
Vent
External Flow
Control Vent
Pre-Rinse Sink Branch
8-Feet Maximum Distance
Per 248 CMR 10.09(2)(d)(2)
Grease Trap
or Interceptor
External Flow
Control

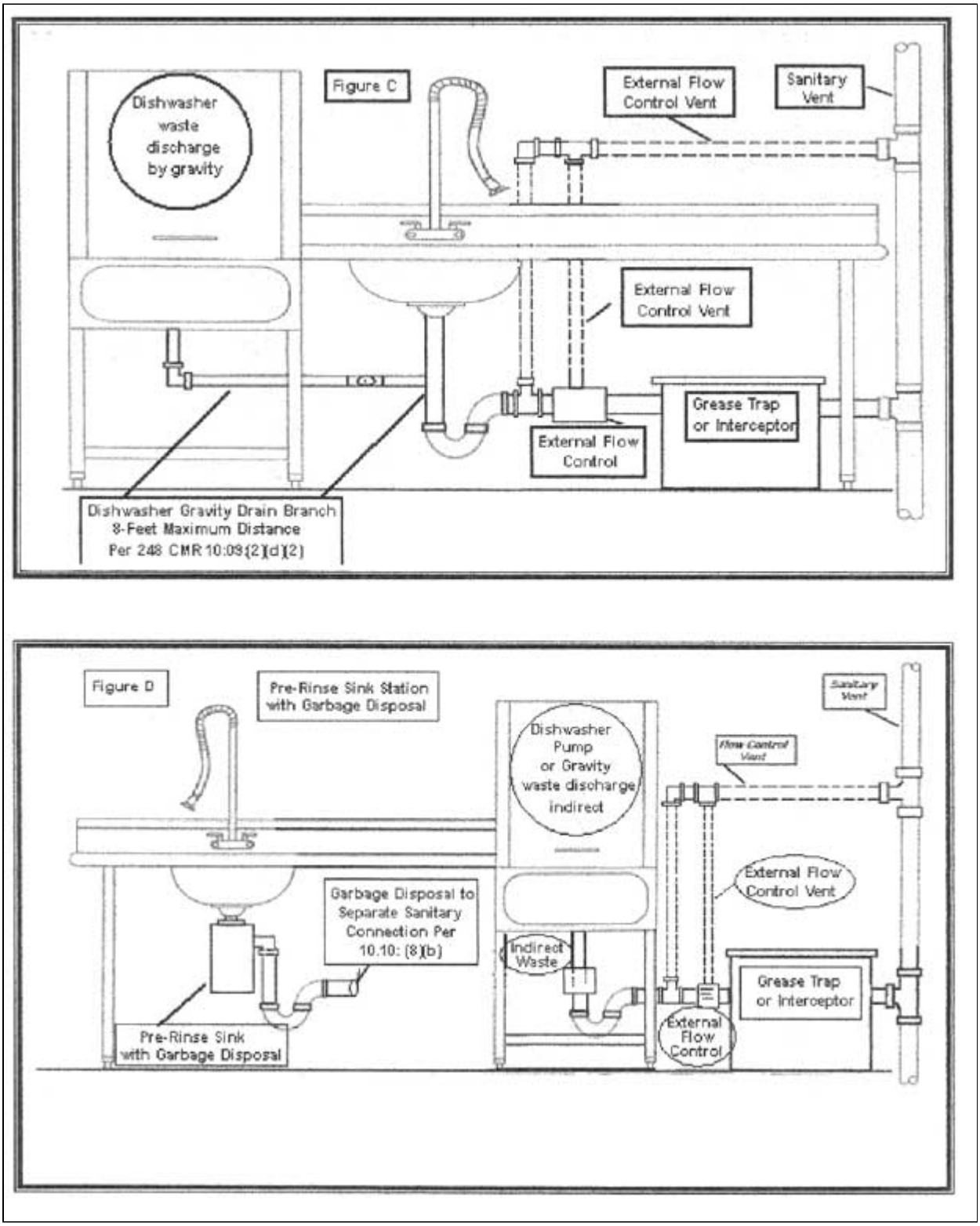
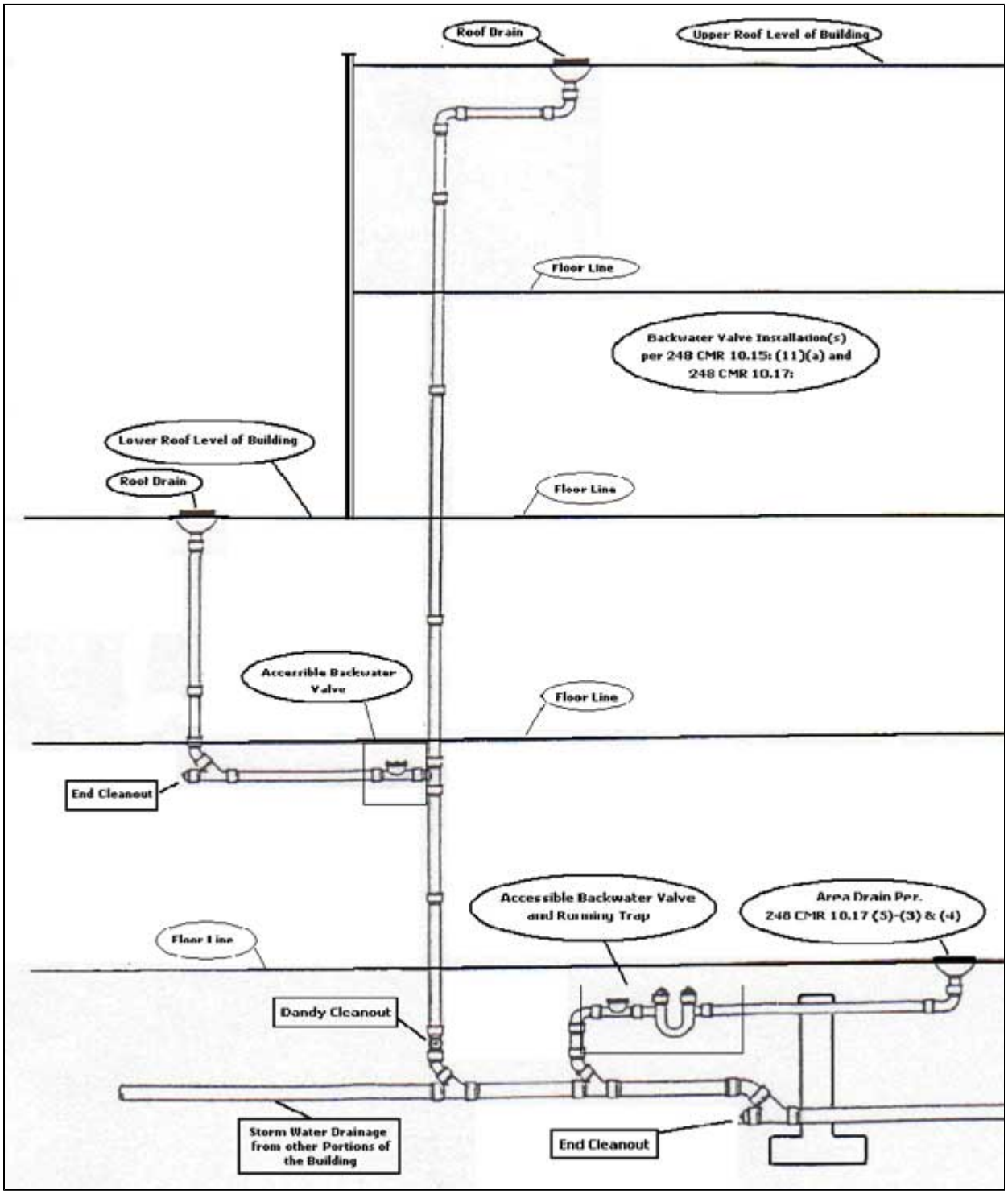


FIGURE 23: **Illustration of Combination Upper and Lower Roof Drain Installations.**



Top

10.23: **Vacuum Drainage Systems**

(1) **General**.

(a) The purpose of 248 CMR 10.23 is to provide guidance to the Inspector in the evaluation as a proposed alternate and the requirements for the installation of vacuum powered sanitary drainage systems.
(b) The scope of 248 CMR 10.23 includes the fixtures, piping,

connections, vacuum equipment, associated tanks and the method of receiving discharge from or discharging to a conventional drainage system as regulated in 248 CMR 10.15: Sanitary Drainage System.
(c) The Inspector may require the plans, specification, calculations and operating instructions to be reviewed and approved prior to the issuance of a permit for installation. The costs for such review shall be borne by the applicant.

(2) **Fixtures**.

(a) General. All provisions and prohibitions of 248 CMR 10.10: Plumbing Fixtures shall be compiled with.
(b) Special Fixtures. Special fixtures designed and intended for connection to vacuum drainage systems shall be listed and approved for such use and shall be connected only to such systems.
(c) Conventional Fixtures. Conventional Fixtures designed and intended for use and connection to the gravity sanitary drainage systems may be connected to a vacuum drainage systems provided that all of the following conditions are met:

1. The fixtures discharge into a gravity sanitary drainage and vent system complying with 248 CMR 10.15: Sanitary Drainage System and 248 CMR 10.16: Vents and Venting;
2. The fixture shall be served by a trap complying with 248 CMR 10.08: Traps and Cleanouts; and
3. The gravity drainage system is connected to the vacuum drainage system by an interface device.

(3) **Fixture Units**.

(a) Vacuum Toilet Fixture Units. Vacuum drainage system sizing and design:
1. shall be determined from the manufacturer's data and engineering calculations; and
2. shall be approved by the Manufacturer.
(b) Conventional Fixture Units. Fixture units for gravity drainage systems discharging into or receiving discharge from vacuum drainage systems shall be determined as in 248 CMR 10.15(7): Table 1.
(c) Water Pipe Sizing. Factor Values for the purposes of water pipe sizing shall be in accordance with 248 CMR 10.14(4): Table 1: Minimum Sizes of Fixture Water Supply Lines and Factor Values as normal. In addition to Table 1, "Vacuum Toilets" shall be listed with a fixture unit value of one and shall be based upon ½ gallon consumption per flush.

(4) **Traps and Vents**.

(a) Conventional Traps. Conventional fixtures shall be provided with traps as in 248 CMR 10.23(2)(c)2.
(b) Conventional Venting. Conventional fixtures shall be provided with vents as in 248 CMR 10.23(2)(c)1.
(c) Special Venting.
1. A vent shall be installed where a vacuum interface device is installed for interfacing to a gravity drainage system to prevent clearing of the gravity traps.

2. The vent shall be no less than two inches in diameter and shall be sized in accordance with manufacturer's recommendations.

(5) **Vacuum Drainage Piping**.

(a) General. Detailed and fully dimensioned plans at a scale of not less than c-inch equal one foot shall be submitted with all necessary data and engineering calculations for review and approval.
(b) (b) Material.
1. Vacuum drainage piping materials shall be composed of materials suitable for waste handling and shall have a smooth and uniform bore.
2. Joints and fittings shall provide a smooth interior transition.
(c) Fixture Connection. Vacuum drainage piping shall be connected to fixtures or gravity drainage systems by Product-Approved devices as required by 248 CMR 10.23(2)(c).
(d) Vertical Lifts.
1. The sum total of vertical piping used to lift discharges in a single system shall not exceed 20 feet unless documented by detailed engineering calculations.
2. There shall be no offsets in the vertical piping and the diameter of the lift piping shall not change throughout its height.
(e) Changes in Direction.
1. Changes of Direction in vacuum drainage systems shall be made by the appropriate use of fittings having no internal obstructions to flow.
2. The radius of such changes in direction whether by a single fitting or combination of fittings shall not be less than that formed by a long sweep ¼ bend of long radius 90E elbow.
(f) Horizontal Runs.
1. Horizontal piping shall be installed with a pitch of not less than 0.2% in the direction of flow.
2. A reforming pocket shall be installed in horizontal runs at intervals of no more than 150 feet or as indicated on the approved plans.
(g) Reforming Pockets.
1. When required to re-establish the waste slug, reforming pockets shall be installed. Reforming pockets shall consist of a wye and three c bends or 45's arranged such that the discharge enters the branch of the wye, is pocketed in a trap formed by the three bends and exits at an elevation equal to the entrance.
2. The depth of the trap formed shall be at least 1½ times the diameter of the piping. (See Figure F-1.) A cleanout plug shall be installed on the wye.
(h) Trapped Sections. Offsets to pass under obstructions in horizontal runs may be installed provided that such offsets are constructed as reforming pockets and do not exceed three feet in length, except that Offsets may exceed three feet in length if a second reforming pocket is installed at the terminus of the offset. (See Figure F-2.)
(i) Piping Connections. Vacuum Drainage system piping connections shall be as follows:
1. Horizontal piping connecting to horizontal piping shall enter from the top of the line by way of a wye fitting. (See Figure F-3.)
2. Vertical lift piping connecting to horizontal piping shall enter from the top of the line by way of a wye fitting. Where design drawings show a check valve to be installed in the horizontal piping between the lift piping and the branch inlet of the wye, such check valve shall be approved for use in vacuum waste drainage systems by the manufacturer of the system.

The volume of the horizontal piping in direction of flow shall be at least ten times the volume of the vertical lift piping. (See Figure F-4.)
3. Horizontal piping connecting to vertical lift piping shall be by way of a reforming pocket. (See Figure F-5.)
4. Horizontal piping connection to vertical drop piping shall be by way of single wye branches. Multiple connections shall be at staggered levels. Double wyes or divided flow fittings are prohibited. (See Figure F-6.)
5. Vertical Drop piping connection to horizontal runs shall be by way of a combination wye and c bend. (See Figure F-7.)
(j) Pipe Sizing.
1. Vacuum drainage piping shall be sized in accordance with engineering principles.
2. The installation of piping shall be in conformance with the sizes and layouts shown on the approved plans.
3. The plans shall contain a statement attesting to review and acceptance of the proposed installation by the Product-Approved manufacturer of the system.
4. EXCEPTION: When approved by the Inspector, minor installations, additions or relocations may be permitted without the submission of additional plans when provisions for such were clearly made in the original approved plans.
(k) Cleanouts. Cleanouts shall be provided in the following locations:
1. Start of horizontal runs;
2. Top of stacks;
3. Reforming pockets;
4. Horizontal changes in direction equal to or greater than 90E;
5. Intervals of 50 feet in horizontal runs.
(l) Tank Connections. Vacuum drainage piping shall enter the vacuum tank at its top. A full-port valve shall be installed at the connection.
(m) Supports and Bracing.
1. Vacuum Drainage piping shall be supported every six feet on its vertical portions and every four feet on its horizontal portions.
2. The vacuum piping shall be braced to prevent any movement in the vertical and horizontal planes.
3. Piping shall not rely on fixtures, collection tank or pumps for any portion of its support. Seismic restraint shall be installed as required by 780 CMR: The Massachusetts State Building Code.
(n) Access. Service access shall be provided to cleanouts check valves and interface valves.

(6) **Vacuum Collection Tank Assembly**.

(a) General. A vacuum collection tank assembly shall be provided of sufficient capacity to maintain the required vacuum pressure when the collection tank is 75% filled with system discharge fluids. Size shall be calculated based on engineering principles and drawings shall contain a statement attesting to review and acceptance of the proposed installation by the approved manufacturer of the systems.
(b) Location. A vacuum collection tank assembly located within a building shall be in a well ventilated room and to which access is restricted to authorized personnel. Vacuum collection tanks shall be protected from freezing.
(c) Materials.
1. Vacuum collection tanks shall be constructed of vacuum tight, welded steel construction or other Product-approved materials and capable of

withstanding a sustained vacuum pressure of 29 inches of mercury.
2. The interior of the tanks shall be treated to retard corrosion, the method of treatment shall be submitted with documentation for review and approval.
(d) Access Hatch.
1. A gas tight, bolted access hatch not less than 14 inches in diameter shall be provided. The cover of the hatch shall bear a permanently affixed warning label indicating the presence within of toxic and flammable gases.
2. The warning label shall contain directions regarding safety procedures to be observed when opening or entering the tank.
3. A clear pathway not less than three feet in width shall be maintained from the exit of the room to the access hatch.
(e) Vacuum Pumps.
1. The assembly shall be equipped with automatically operated, duplex vacuum pumps capable of drawing down to 19 inches of mercury, vacuum.
2. Pumps shall have the capacity to maintain an operating vacuum in the system of 16 inches of mercury.
(f) Sewage Discharge Pumps.
1. The assembly shall be equipped with automatically operated, duplex sewage discharge pumps each sized to accommodate the calculated flow.
2. Discharge to the gravity drainage system or sewer shall be as required for sewage ejector's.
(g) Vacuum Pump Discharge Piping.
1. Vacuum pump discharge piping shall be extended full size without creating traps to the exterior of the building.
2. The termination of the piping shall be direction downward to avoid entry of rain or debris.
3. The termination shall be located at least two feet above a roof surface or 15 feet above a pedestrian surface and no closer than ten feet to any opening into a building.
4. Discharge terminations may be horizontal through a wall. (See Figure F-8.)
(h) Indication and Alarm.
1. Vacuum tank assemblies shall provide separate indication and alarm of low vacuum conditions and high sewage level.
2. Alarm conditions may be in two or more stages.
3. Early stage alarm may be transmitted for alerting service personnel to potential problems.
4. Failure stage alarm shall automatically shut down the system and annunciate the problem.
5. Alarm indicator shall be at a location that has the approval of the Inspector.

(7) **Tests and Demonstrations**.

(a) General. Recorded proof of all required tests and demonstrations shall be submitted to the plumbing inspector.
(b) Vacuum Drainage Piping.
1. Prior to installation of any special fixtures or gravity to vacuum interface devices, the entire vacuum drainage piping system shall be pressurized to not less than 15 psig and shall show no loss in gauge pressure for at least ten minutes.
2. EXCEPTION: When approved by the inspector minor additions,

alterations or repairs to an existing complying system may be done without the 15 psig air pressure test.
(c) Gravity Drainage Piping. Conventional waste and vent piping shall be tested as required by 248 CMR 10.15: Sanitary Drainage Systems and 248 CMR 10.16: Vents and Venting.
(d) Functional Test.
1. After completion of the entire system installation, the system shall be subjected to a vacuum pressure of 19 inches of mercury and shall be demonstrated to function as required by operating each device.
2. Such demonstration shall be conducted in the presence of the manufacturers authorized representative.

(8) **Instructions**.
(a) Operation and Maintenance. Prior to final approval, the Inspector shall satisfy himself that written instructions on the operation and maintenance of the entire system has been delivered to the owner and that the owner has received on site instruction from the installer and manufacturer.

FIGURE F-1 **REFORMING POCKETS**

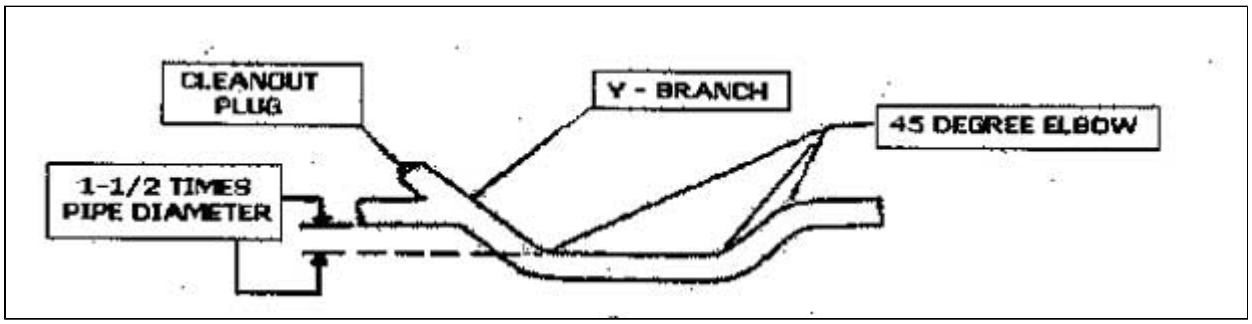


FIGURE F-2 **TRAPPED SECTIONS**

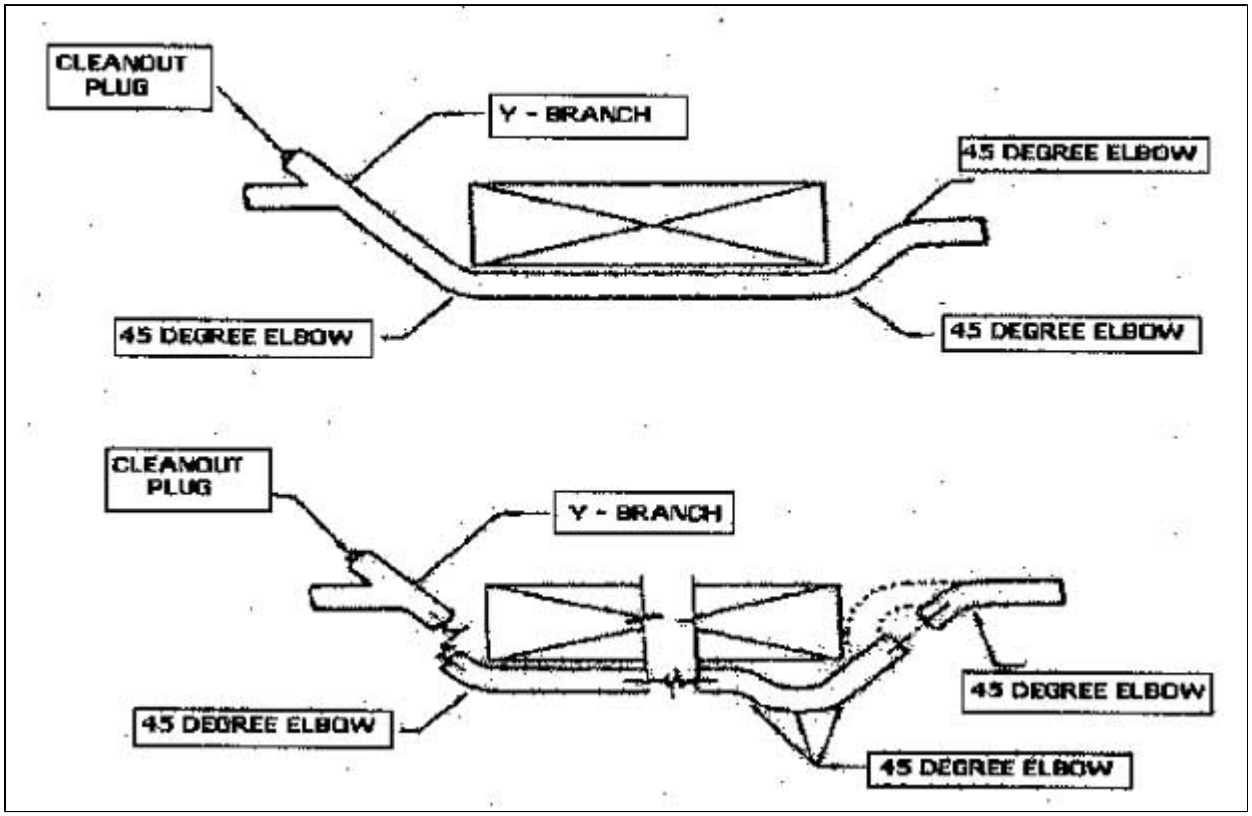


FIGURE-3 **HORIZONTAL TO HORIZONTAL CONNECTION**

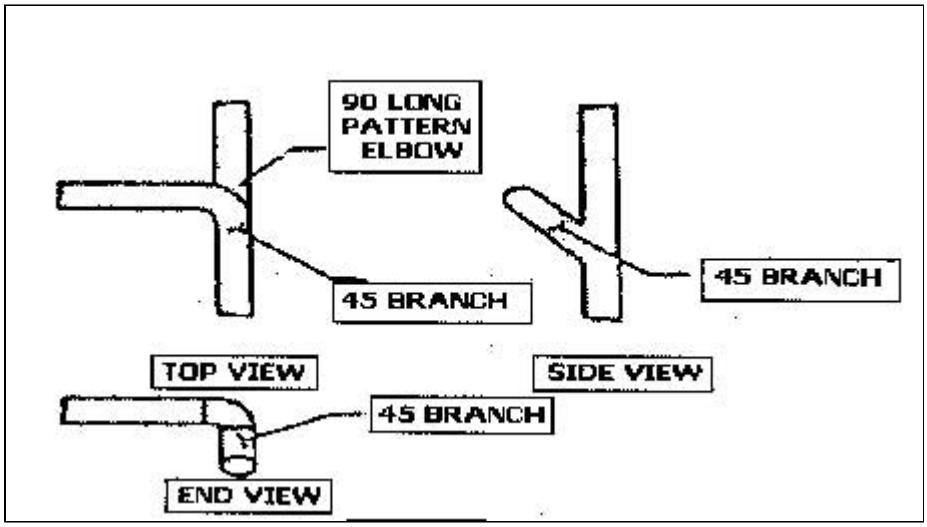


FIGURE F-4 **VERTICAL LIFT TO HORIZONTAL CONNECTION**

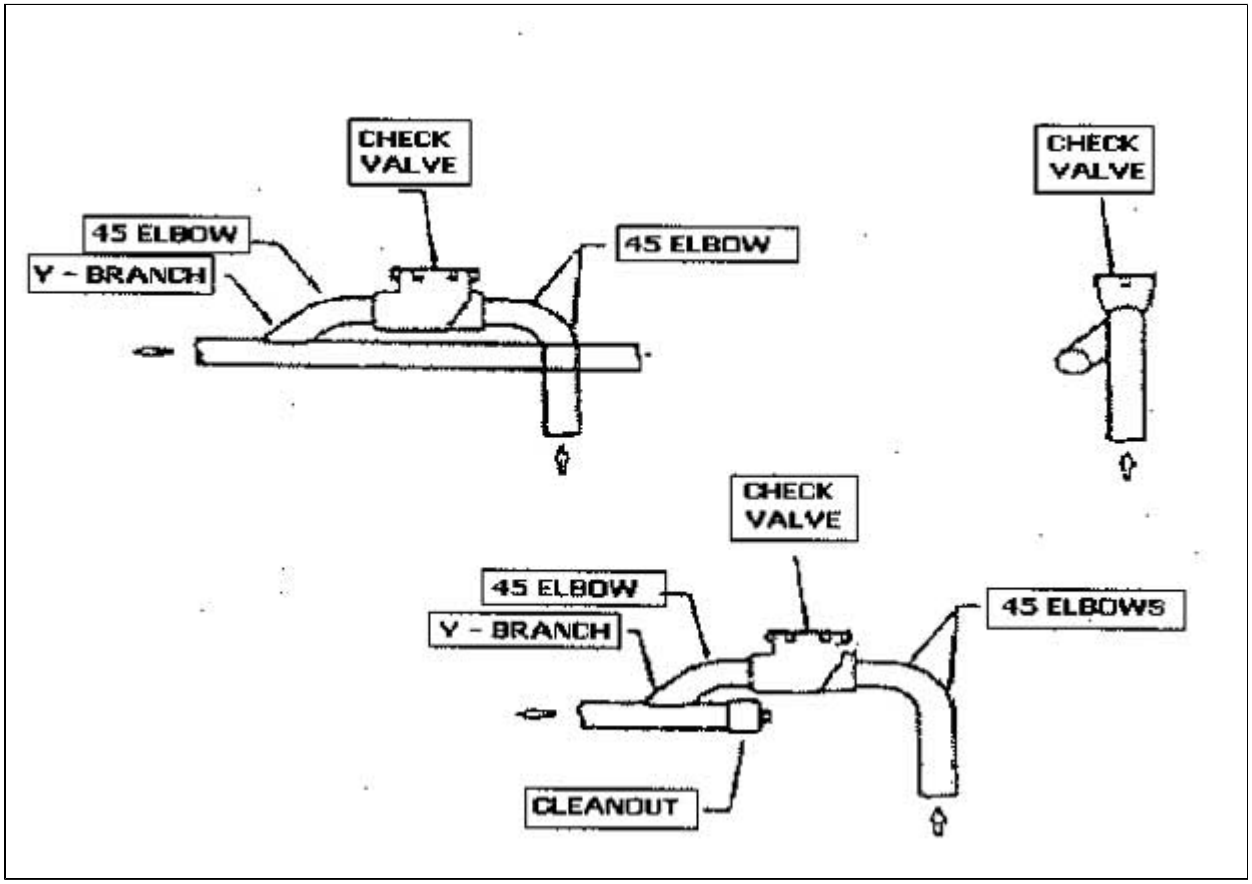


FIGURE F-5 **HORIZONTAL TO VERTICAL LIFT CONNECTION**

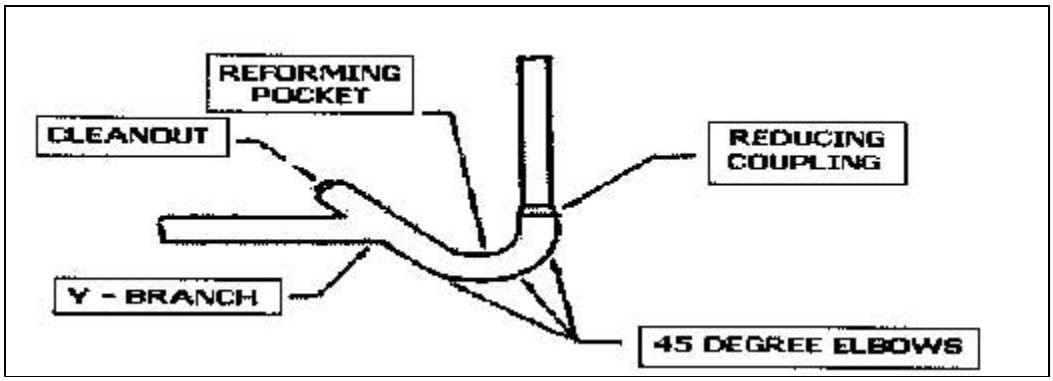


FIGURE F-6 **HORIZONTAL TO VERTICAL DROP CONNECTION**

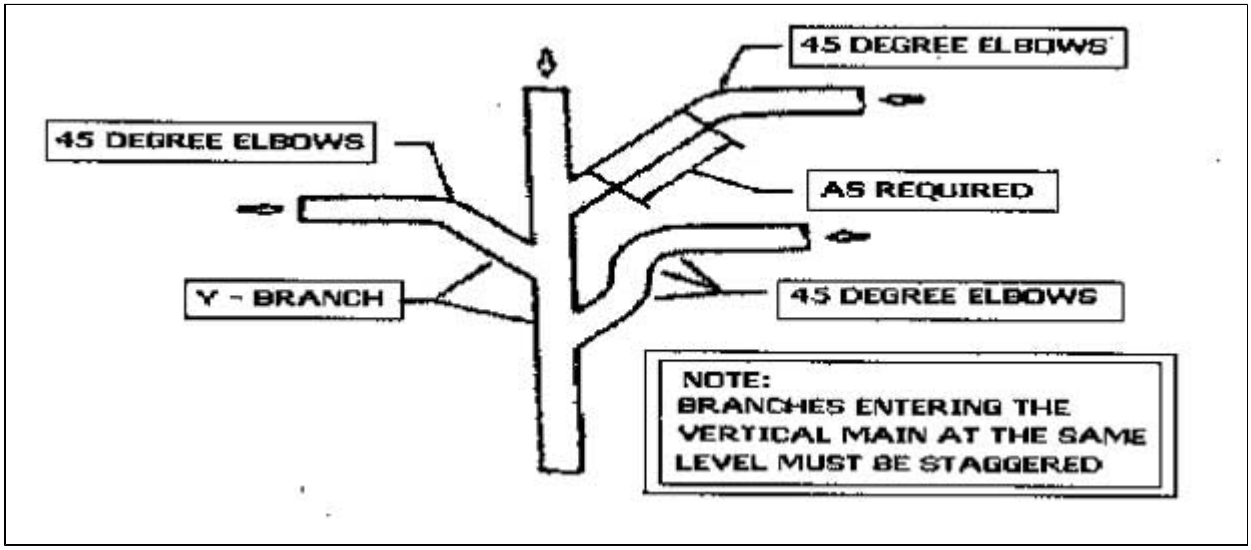


FIGURE F-7 **VERTICAL DROP TO HORIZONTAL CONNECTION**

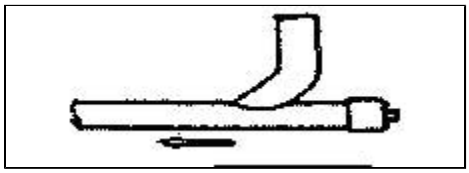


FIGURE F-8 **VACUUM PUMP DISCHARGE PIPE TERMINATION**

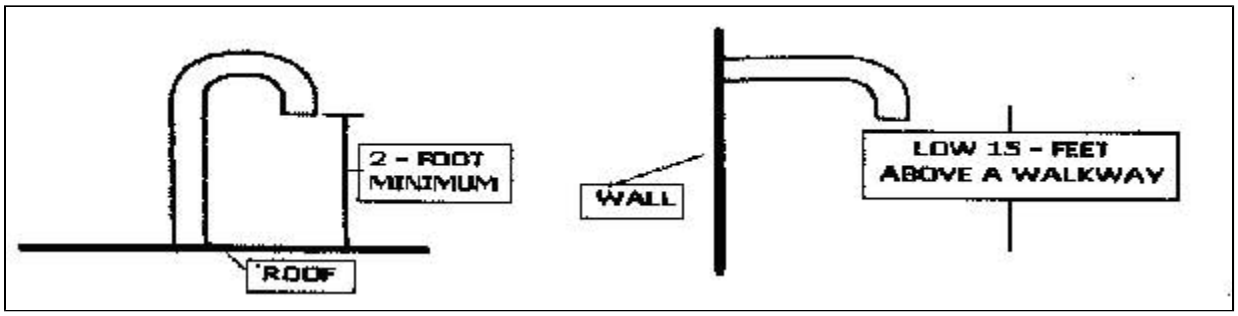


FIGURE F-9 **TYPICAL VACUUM FIXTURE INSTALLATION**

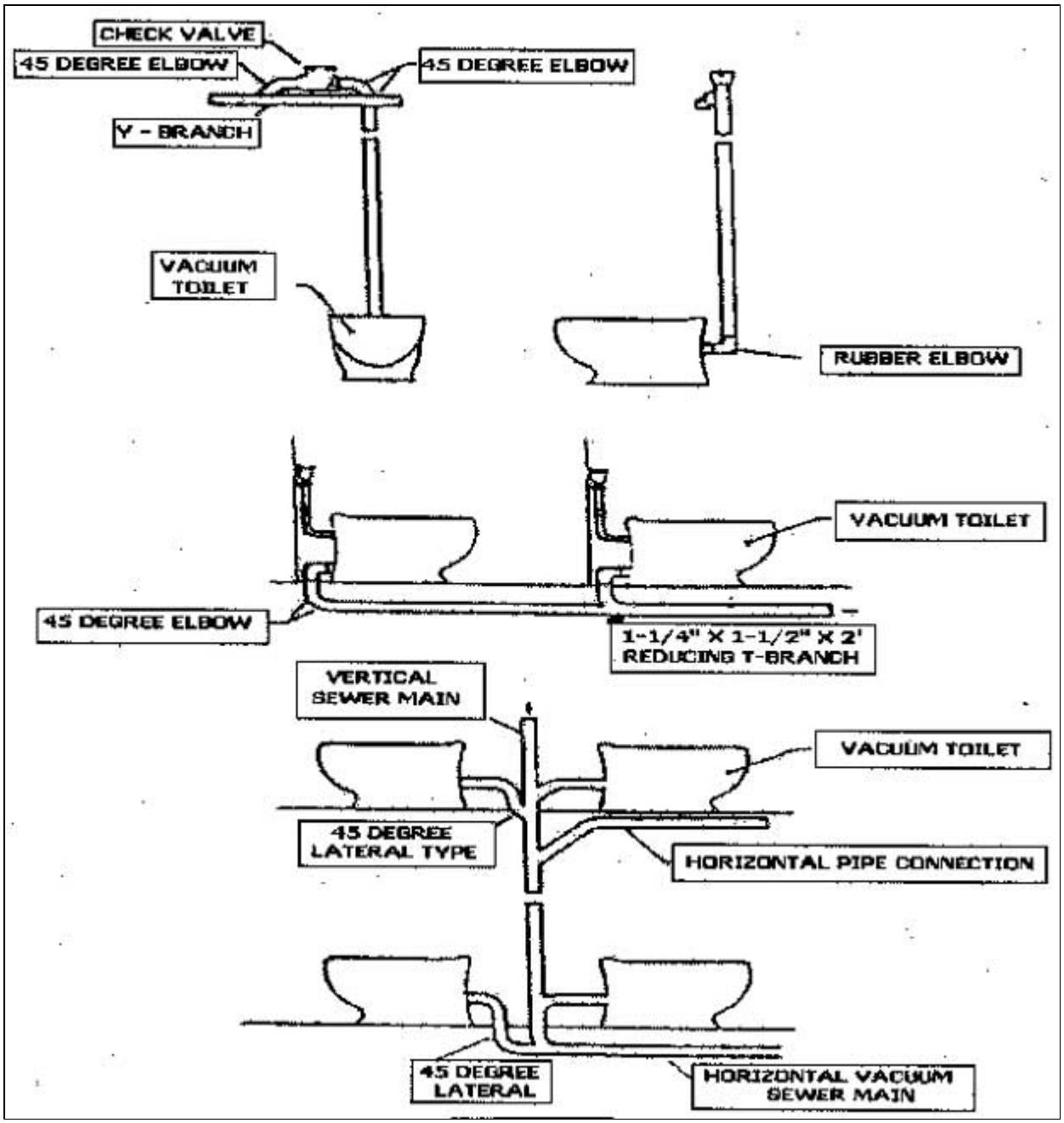


FIGURE F-9 **TYPICAL VACUUM FIXTURE INSTALLATION** (CONTINUED)

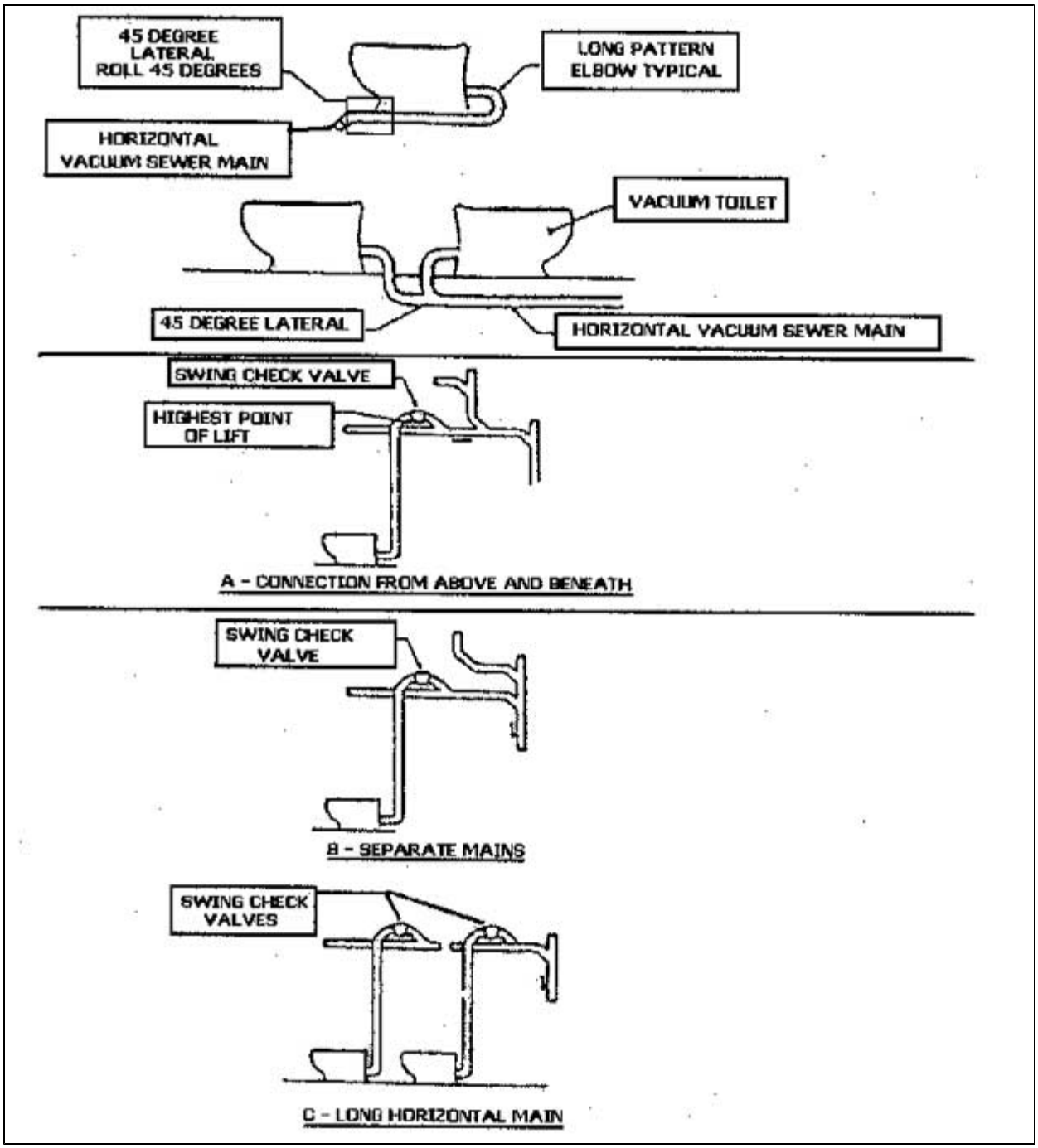


FIGURE F-10m **TYPICAL CLEANOUT LOCATIONS**

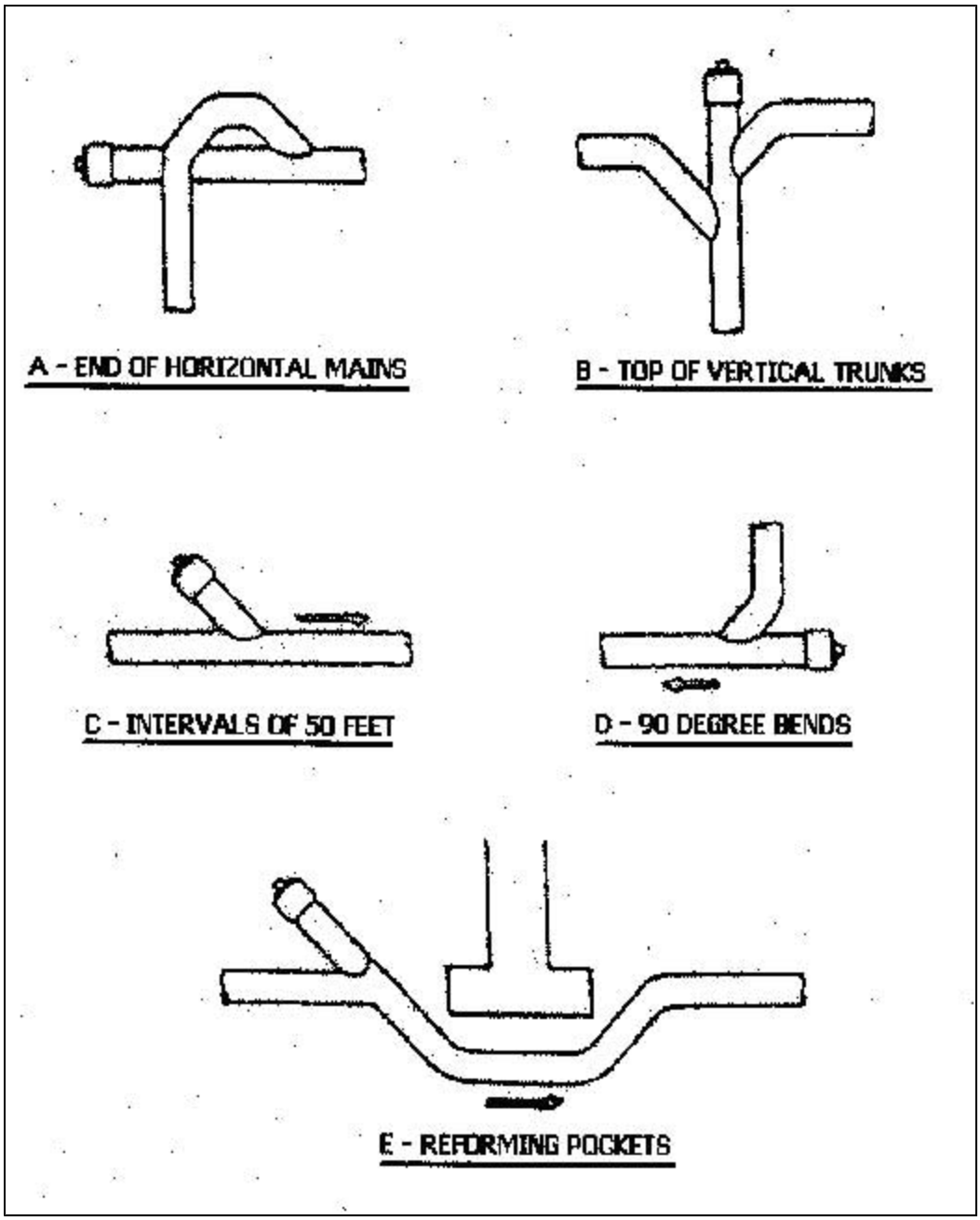


FIGURE F-11 **VERTICAL LIFT RESTRICTIONS**

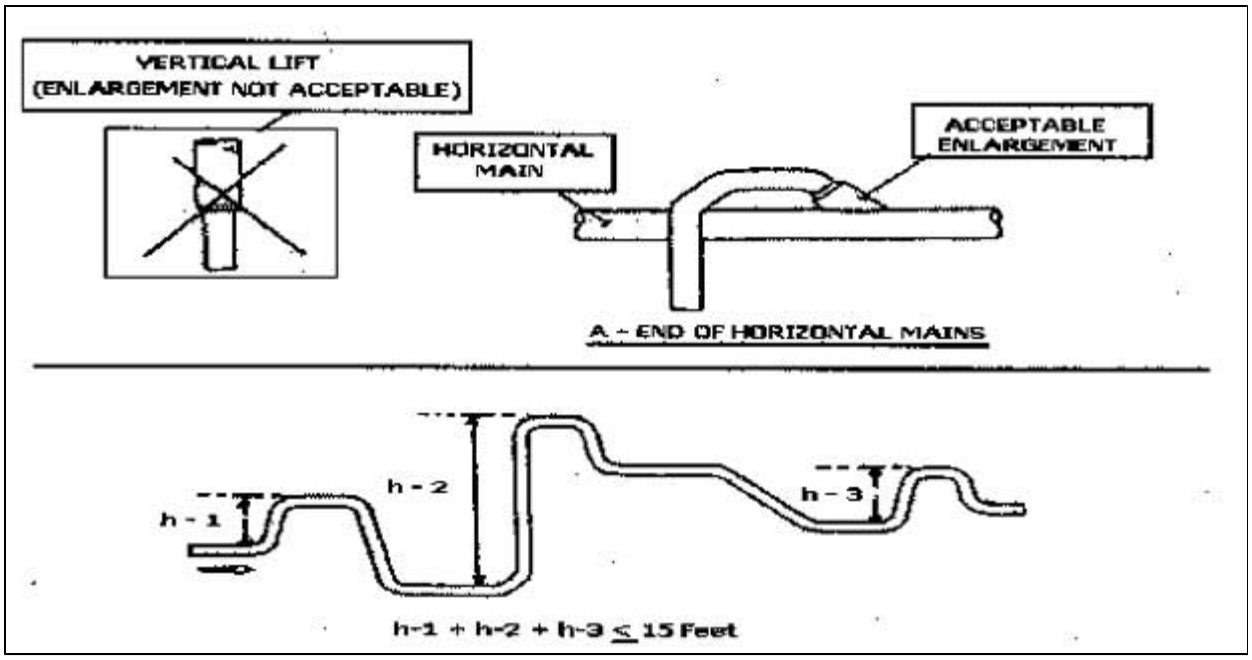
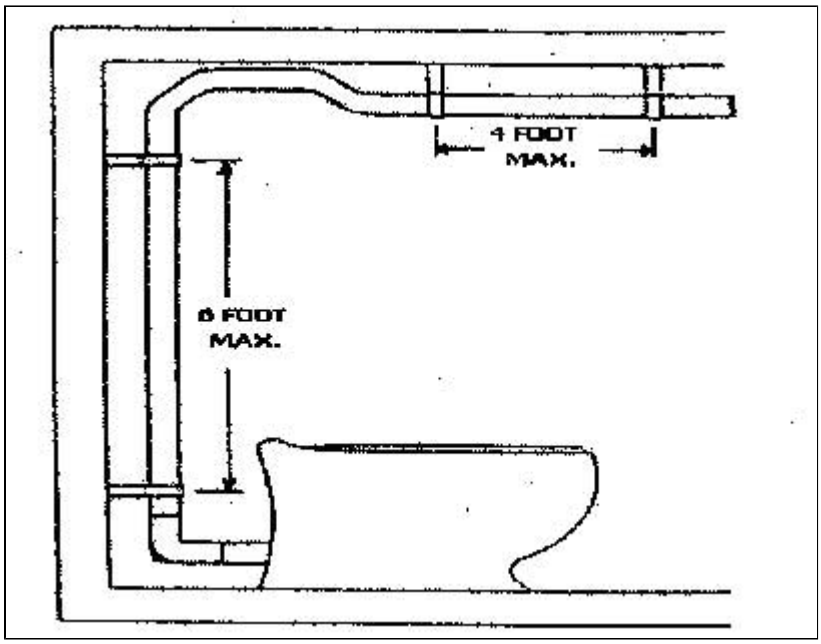


FIGURE F-12 **PIPING SUPPORT REQUIREMENTS**



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REGULATORY AUTHORITY
248 CMR 10.00: M.G.L. c. 112, § 61; M.G.L. c. 142, §§ 13 and 21.

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