CHAPTER 9
TRAPS AND VENTS

A vent is a pipe or opening that brings outside air into the plumbing system and equalizes the pressure on both sides of a trap to prevent trap seal loss. A trap provides a water seal that keeps sewer gases from entering a building through a waste outlet.

Section I. Traps

A trap is a fitting or device that, when properly vented, provides a water seal to prevent the discharge of sewer gases without affecting the flow of sanitary drainage through it.

9-1. Use. Traps are used on some fixtures and floor drains inside buildings. The P-trap is used in a partition to connect a drain to a waste branch. A running trap is used in a building's drain line when the local plumbing code requires that the building drain be trapped.

9-2. Types. The types of water-seal traps are P-trap, S-trap, 3/4 S-trap, and drum trap (Figure 9-l). The most common type is a P-trap. (See also cast-iron traps in Figure 6-10, page 6-10.)

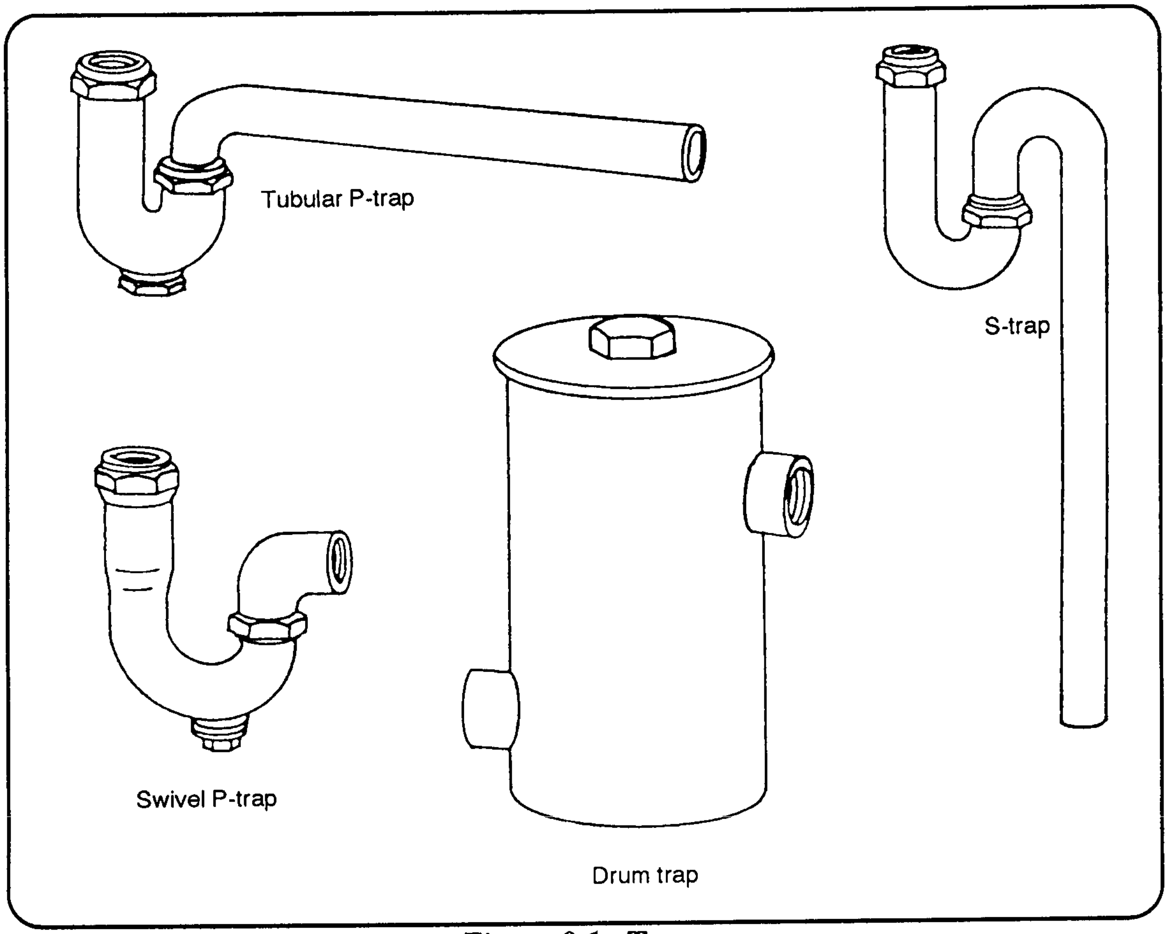

Figure 9-1. Traps

a. *P-Trap.* This trap is the most widely used for fixtures. It can be either plastic or chromed, tubular brass. The most common diameter sizes are 1 1/4 and 1 1/2 inches. Most P-traps have a cleanout plug, since the traps are subject to stoppage.

b. *Drum Trap.* This trap is used mostly for bathtubs, but it can also be used in kitchen sinks. Drum traps are designed in several styles, depending on the manufacturer and the material used. This trap has the advantage of containing a larger volume of water and discharging a greater volume of water than a P-trap. A drum trap is 3 or 4 inches in diameter with the trap screw one size less than the diameter.

c. *S-Trap and 3/4 S-Trap.* The full S-trap and 3/4 S-trap are not used in modern plumbing. If an S-trap or 3/4 S-trap is in place, remove it and replace it with a P-trap.

9-3. Trap Seal Loss. The trap seal (Figure 9-2) is a liquid content in the U-shaped part of the trap. The most common trap seal has a depth of 2 inches between the weir and the top dip. The deep-seal trap has a depth of 4 inches. If the trap's water seal is lost, dangerous sewer gases can enter the building through the fixture.

a. *Inadequate Venting.* Trap seal loss usually results from inadequate venting of the trap. Venting a plumbing system allows the atmosphere to enter the discharge side of a trap, preventing loss of water seal by siphonage. At sea level, atmospheric pressure is about 14.7 psi. This pressure varies only slightly on the fixture side of the water seal in a trap. Any difference between this pressure and the pressure on the discharge side forces the water seal in the direction of less pressure. Venting the discharge side of the trap to the atmosphere tends to equalize these pressures.

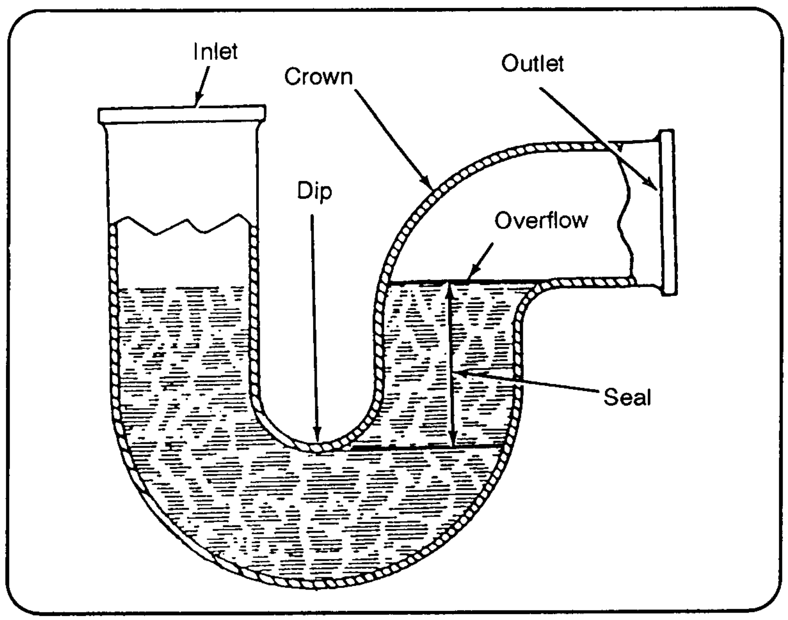

Figure 9-2. Trap seal

b. Direct Siphonage. Direct siphonage, or self-siphonage, as shown in Figure 9-3, occurs in unvented traps that serve oval bottom fixtures such as lavatories. Such fixtures discharge their contents rapidly and do not have the final small trickle of water needed to reseal the trap. When the plug is withdrawn, the water flows out fast and completely fills the waste pipe. The water displaces the air that normally fills the waste pipe, lowering the atmospheric pressure on the discharge side of the trap. Atmospheric pressure on the fixture side forces the water through the trap, and the seal is lost.

In a lavatory with a flat bottom, the last few ounces of water flowing into the trap come in a slow trickle, resealing the trap. Showers, laundry tubs, sinks, and bathtubs rarely lose trap seal by direct siphonage.

Fixture manufacturers have tried to combat siphonage by reducing the diameter of the lavatory outlet to 1 1/4 inches and recommending that it be connected to a 1 l/2-inch waste pipe. In such a connection, the water volume does not completely fill the waste pipe, and the air in the pipe maintains atmospheric pressure on the outlet side of the trap.

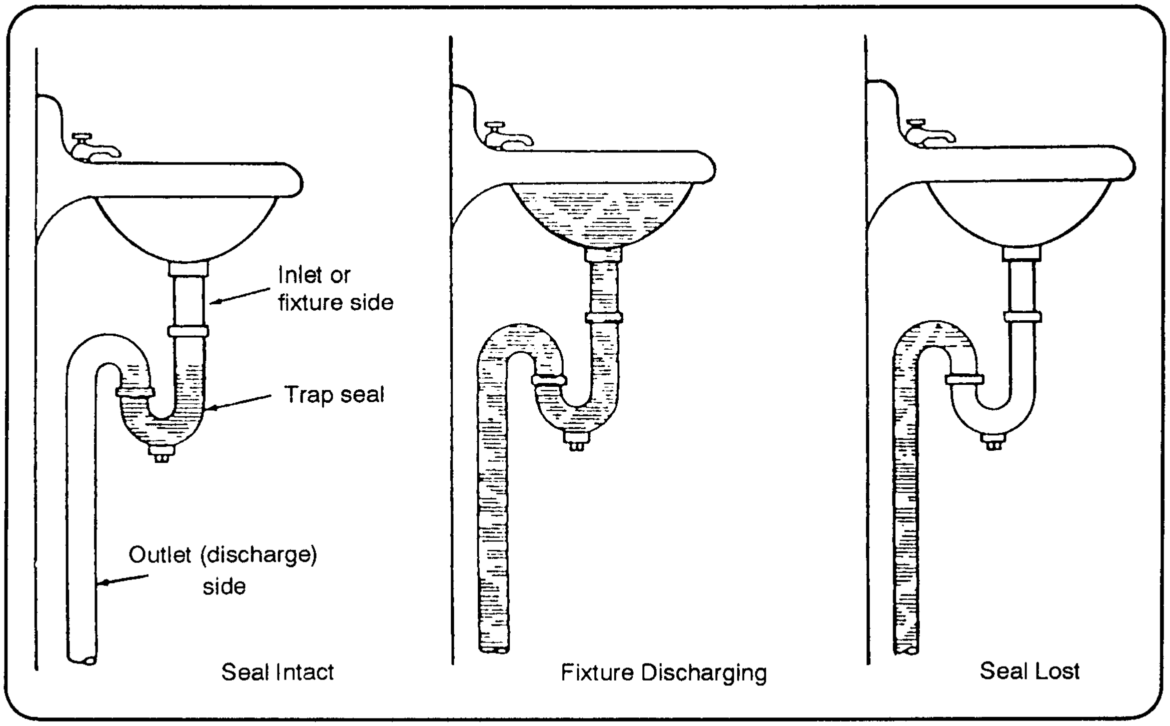

Figure 9-3. Direct siphonage

c. *Indirect or Momentum Siphonage.* Indirect siphonage (Figure 9-4, page 9-4) is caused by a large discharge of water from a fixture installed one or more floors above the affected fixture. This large discharge tends to form a slug in the stack; and as this slug passes the takeoff of the fixture below it, air is pulled out of the waste line on the lower fixture. This reduces the pressure on the discharge side of the trap. There is no reseal until there is a discharge from the lower fixture.

d. *Back Pressure.* Back pressure within a sanitary drainage system is caused by simultaneous fixture use that overtaxes the plumbing system, causing a positive pressure that affects the water seal of a trap. A large flow may completely fill the pipe, causing the compressed atmospheric gases to offer resistance because they cannot slip past the flow of the water and exhaust at a roof terminal. As the water falls, the pressure increases and compresses the air, and the trap seal blows out of the fixture (Figure 9-5, page 9-4).

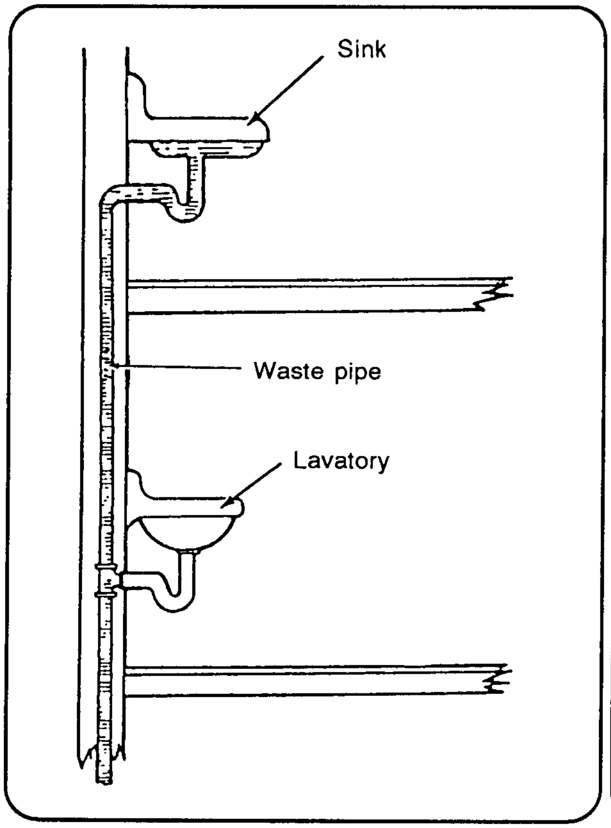

Figure 9-4. Indirect siphonage

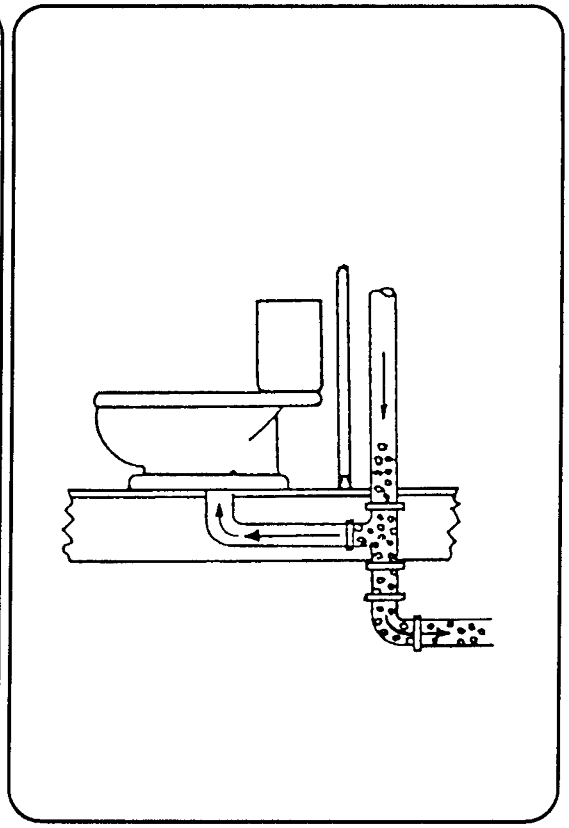

Figure 9-5. Trap seal loss by back pressure

e. *Capillary Action.* Loss of trap seal by capillary action is caused by a foreign object lodged in the trap. The object acts as a wick and carries the water from the trap over the outlet side into the waste pipe until the seal is ineffective (Figure 9-6). Rags, string, lint, and hair commonly cause this problem.

f. *Evaporation.* Loss of trap seal from evaporation only occurs when a fixture is not used for a long time. The rate of evaporation in a trap depends on the humidity and temperature of the atmosphere. A trap in a warm, dry place will lose water seal by evaporation more rapidly than one in a cool, damp place. Ventilation does not solve the problem. The use of a deep-seal trap is the best solution. One disadvantage is that solid wastes collect in the bottom of the trap and clog the pipe

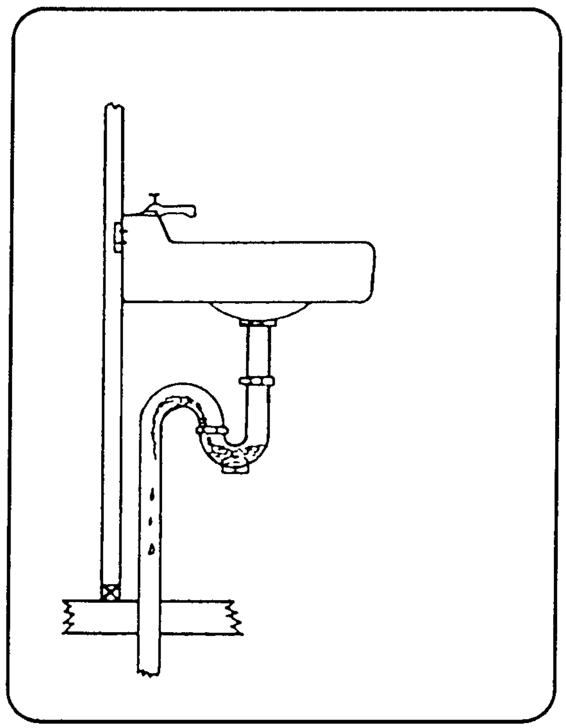

Figure 9-6. Trap seal loss by capillary action

Section II. Vents

The main vent is a vertical pipe connecting fixture vents to the main soil-and-waste vent or directly to the atmosphere. In a building of three or more stories, the main vent should be connected to the bottom of the soil stack to prevent pressure on the lower branches.

9-4. Installation. A typical stack and vent installation is shown in Figure 9-7. Usually the main vent is within several feet of (parallel to) the main soil-and-waste stack, but it may be offset where there are space problems. Branches from the main vent are used in installations.

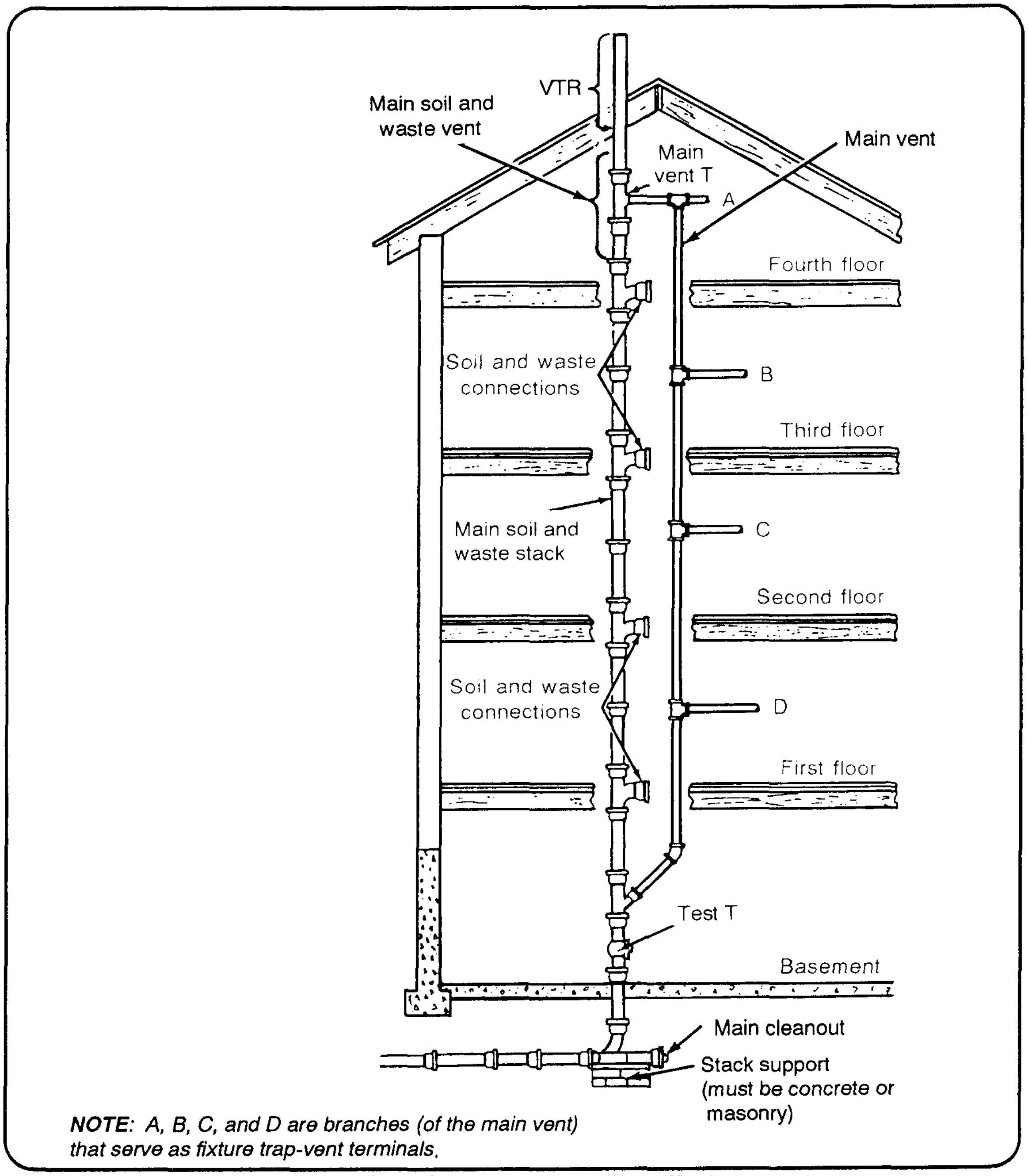

Figure 9-7. Stack and vent installation

a. *Single-Fixture Vent.* The individual vent (also referred to as a *back vent* or *continuous vent)* shown in Figure 9-8 is most common. This vent can be adapted to all fixtures. It prevents both direct and indirect siphonage. Assuming a drop of 1/4 inch per foot, the maximum distances between fixture trap and vent are listed in Table 9-1.

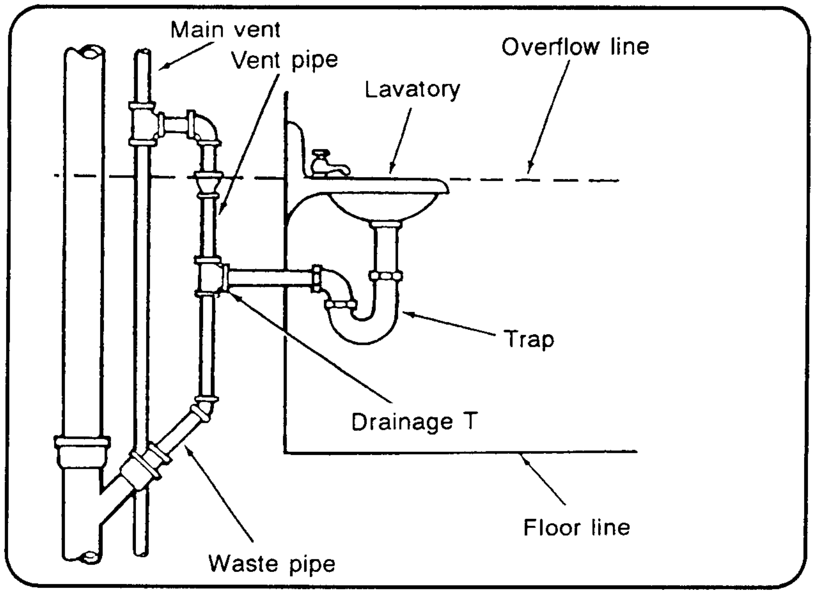

Figure 9-8. Single-fixture vent

Table 9-1. Determining pipe size from fixture to vent

Distance from Fixture Trap to Vent	Size of Fixture Drain (in inches)
2 feet 6 inches	1 ¼
3 feet 6 inches	1 ½
5 feet	2
6 feet	3
10 feet	4

b. *Battery of Fixture Vents.* Batteries of two or more fixtures can be individually vented (Figure 9-9). Each vent ties into a vent pipeline (branch) connected to the main vent.

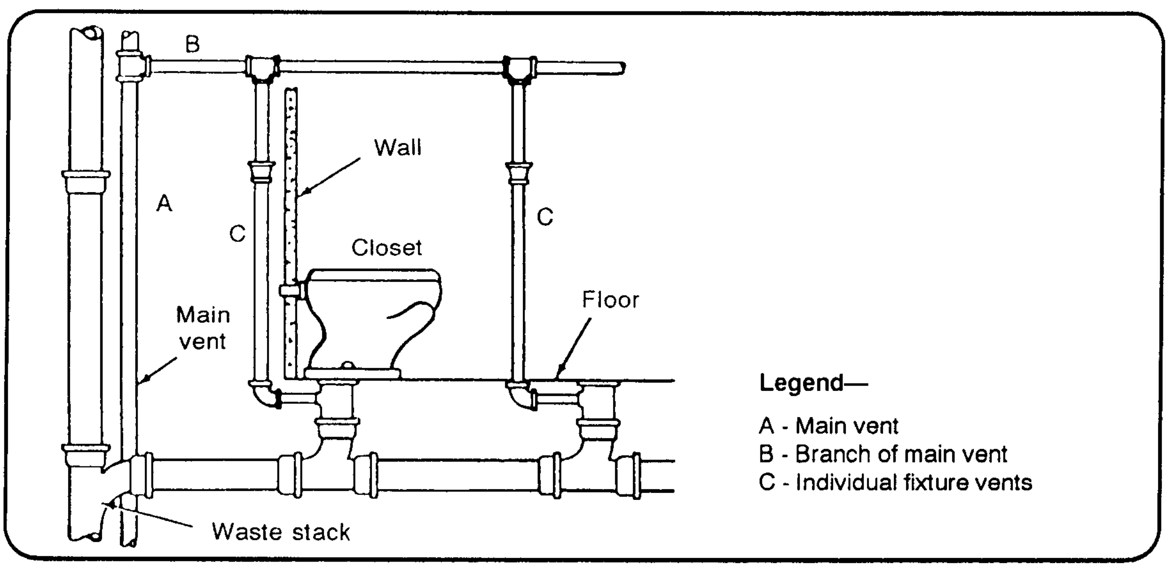

Figure 9-9. Row of fixture vents

c. *Common Vent.* Fixtures mounted side by side or back to back on a wall are common vented. In the common vent, both fixtures discharge into a double sanitary T with deflectors (Figure 9-10). This venting system usually is found in buildings where two bathrooms have a common partition.

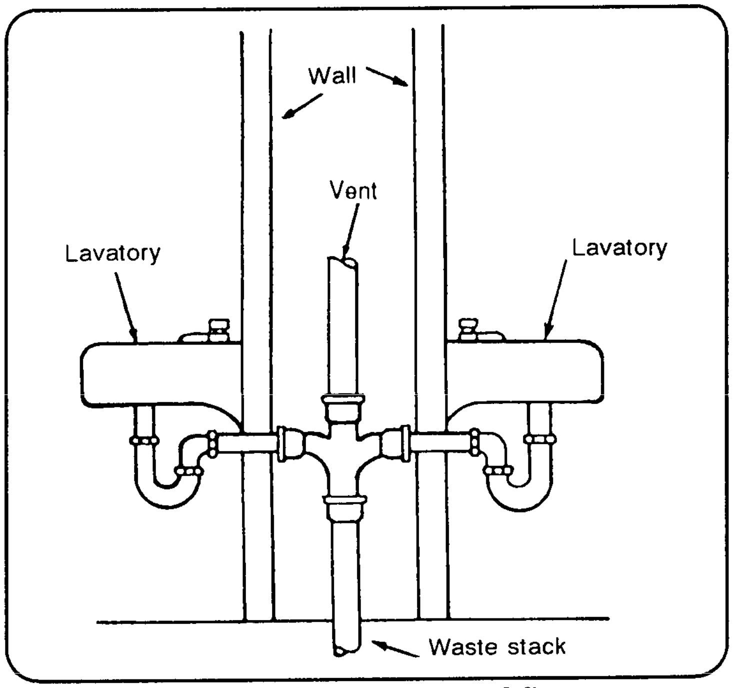

Figure 9-10. Common-vented fixtures

d. *Circuit Vent.* The circuit vent (Figure 9-11) extends from the main vent to connections on the horizontal soil or waste branch pipe between the fixture connections. This vent is used in buildings having a battery of two or more fixtures, such as lavatories. A maximum of eight fixtures are permitted on any one circuit vent. The circuit vent is usually installed between the next to the last and the last fixture on the line. Since some fixtures discharge their waste through a part of the pipe that acts as a vent for other fixtures, the vent may become clogged. Reduce clogging by connecting the vent into the top of the branch rather than its side. Water and waste from the last fixture scours the vents of the other fixtures.

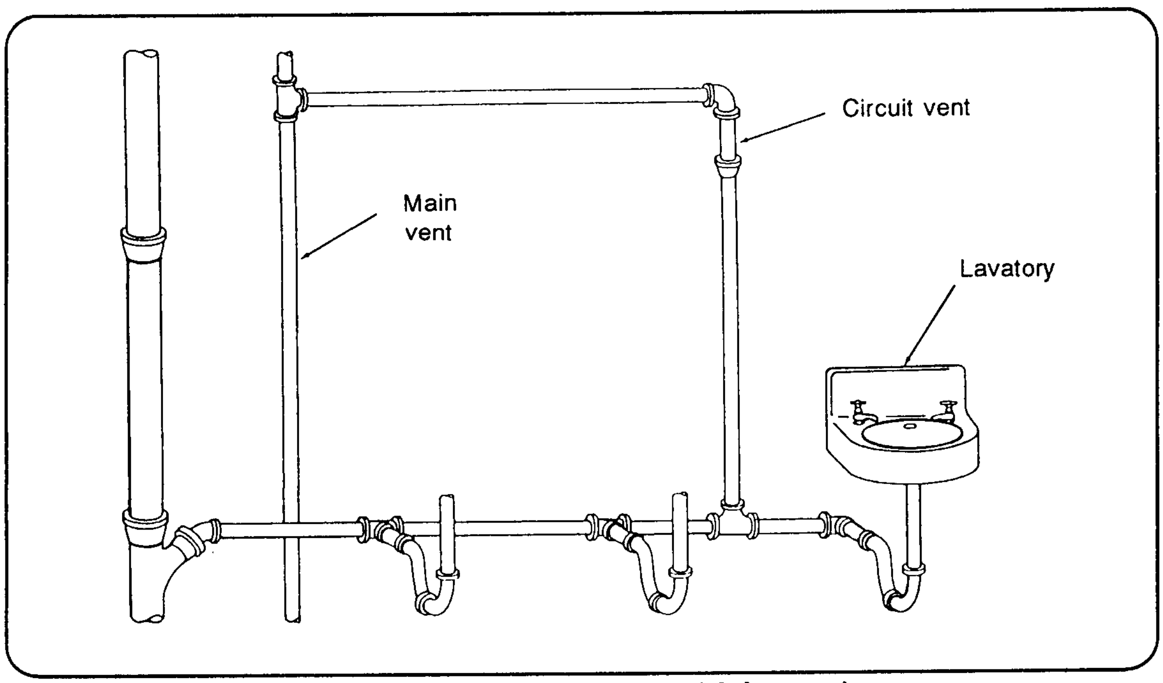

Figure 9-11. Circuit venting with lavatories

c. *Wet Vent.* The wet vent (Figure 9-12) is part of the vent line through which liquid wastes flow from another fixture that has an individual vent. It is used most commonly on a small group of bathroom fixtures. A disadvantage is that the vent tends to become fouled with waste material, which reduces its diameter or causes a stoppage. The size of the pipe for a wet vent must be large enough to take care of the fixtures based on the total DFUs.

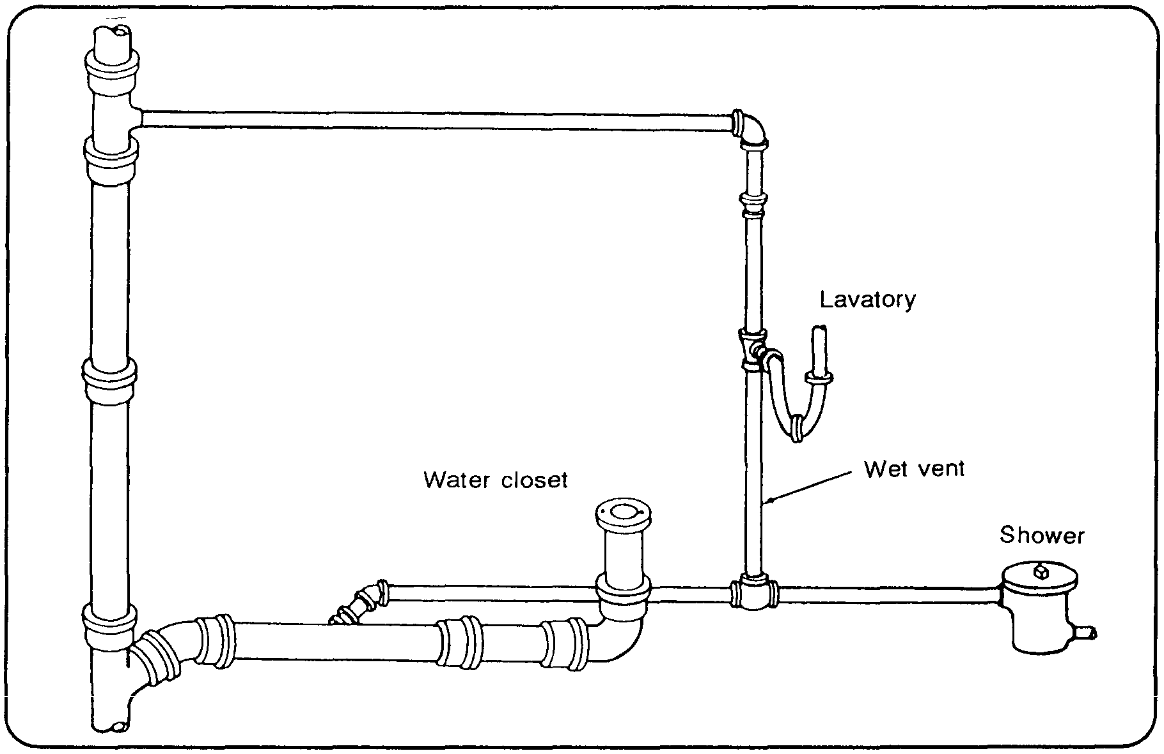

Figure 9-12. Group of wet-vent fixtures

9-5. Sizes. Never use a pipe smaller than 2 inches in diameter.

a. *Main Vent.* To determine the correct pipe size for the main vent, use Table 9-2 along with the number of DFUs, the length of the vent, and the diameter of the soil-and-waste stack. The main vent must be at least one-hall the size of the stack, and the main soil-and-waste vent must be at least as large as the stack.

b. *Individual Fixture Vent.* A pipe less than 1 1/4 inches in diameter should not be used for ventilation because waste materials may cause stoppages. Table 9-3 lists the recommended sizes (in diameter) for individual, branch, circuit, and stack vents.

Table 9-2. Size and length of main vents

Diameter of Soil-and-Waste Stack (in inches)	Number of DFUs to be Connected	Maximum Permissible Developed Length of Vent (in feet) — Diameter of Vent (in inches)							
		1 1/2	2	2 1/2	3	4	5	6	8
1 1/2	8	150							
2	12	75	310						
2	24	70	300						
2 1/2	42	35	140	450					
3	30	20	80	260	650				
3	60	18	75	240	600				
4	100		35	100	260	1,100			
4	250		30	95	240	1,000			
4	500		22	70	180	750			
5	550			28	70	320	1,000		
5	1,100			20	50	240	750		
6	950				20	95	240	1,000	
6	1,900				18	70	180	750	
8	1,800					30	80	350	1,100
8	3,600					25	60	250	800
10	2,800						30	80	350
10	5,600						25	60	250

EXAMPLE

What size main vent (diameter) would you need for the following: soil-and-waste stack diameter of 3 inches, DFUs of 59, and a 2OO-foot vent length? Use the following steps with Table 9-2:

Step 1. Read down the first column to **3.**

Step 2. Find 30 in the second column.

Step 3. **Go** to the next higher number, 60 (since there are 59 DFUs).

Step 4. Read across to the figure that is closest to 200, and select 240.

Step 5. Read up from 240.

Result: The main vent would be 2 1/2 inches in diameter.

Table 9-3. Size of individual, branch, circuit, and stack vents

Fixture	Minimum Size of Vent (in inches)
Lavatory	1 1/4
Drinking fountain	1 1/4
Sink	1 1/2
Shower	1 1/2
Bathtub	1 1/2
Laundry tub	1 1/2
Slop sink	1 1/2
Water closet	2