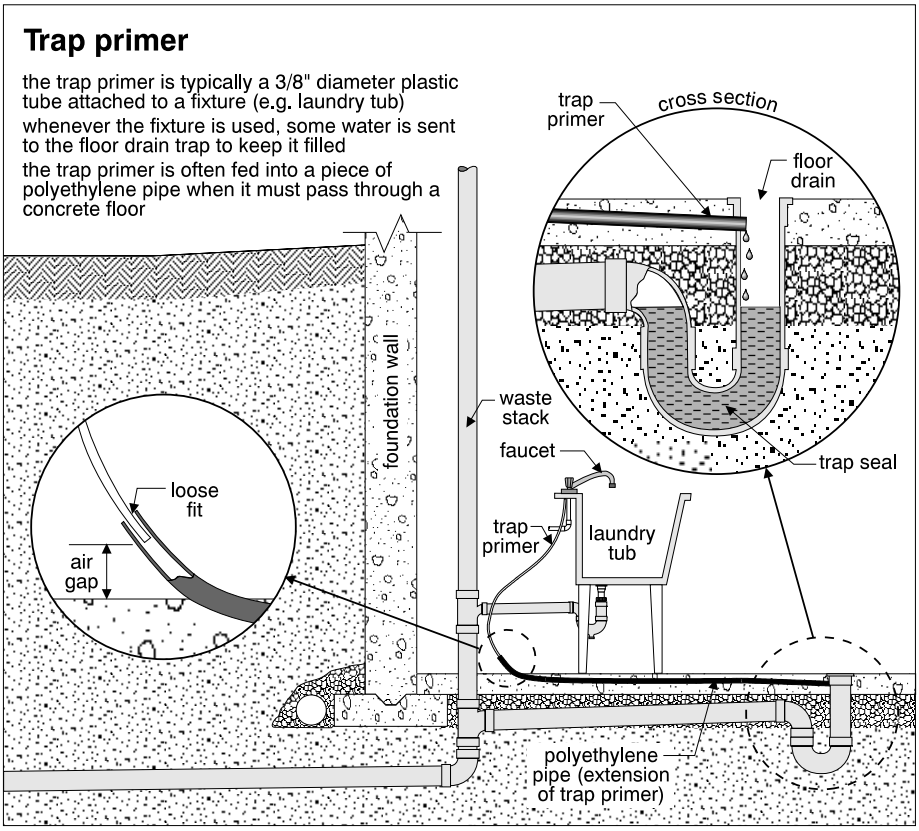


So now we have a good understanding of the function of waste piping and traps. What else is left?

2.2.4 VENTS

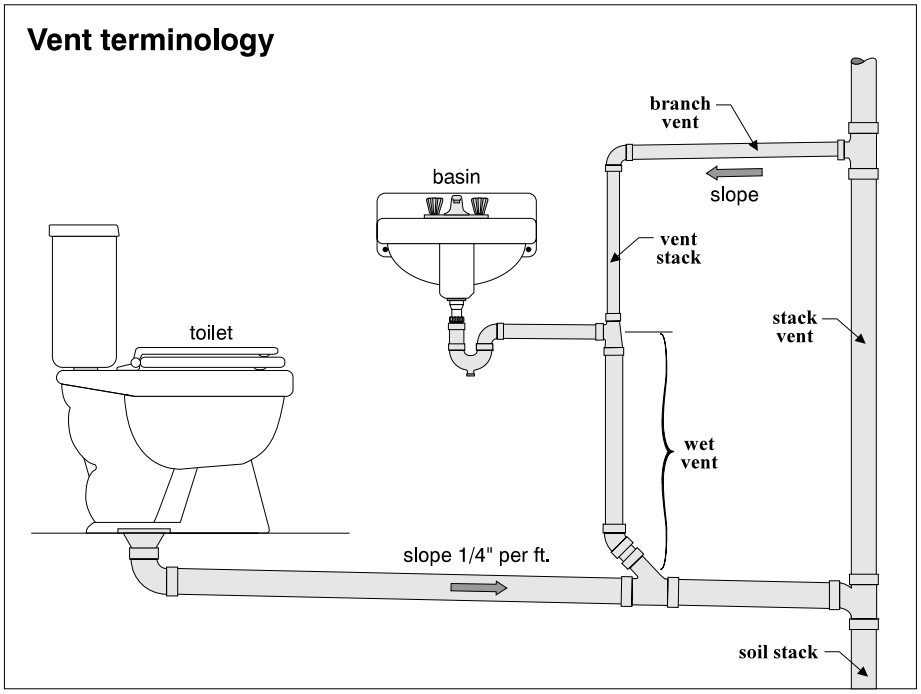
Venting System

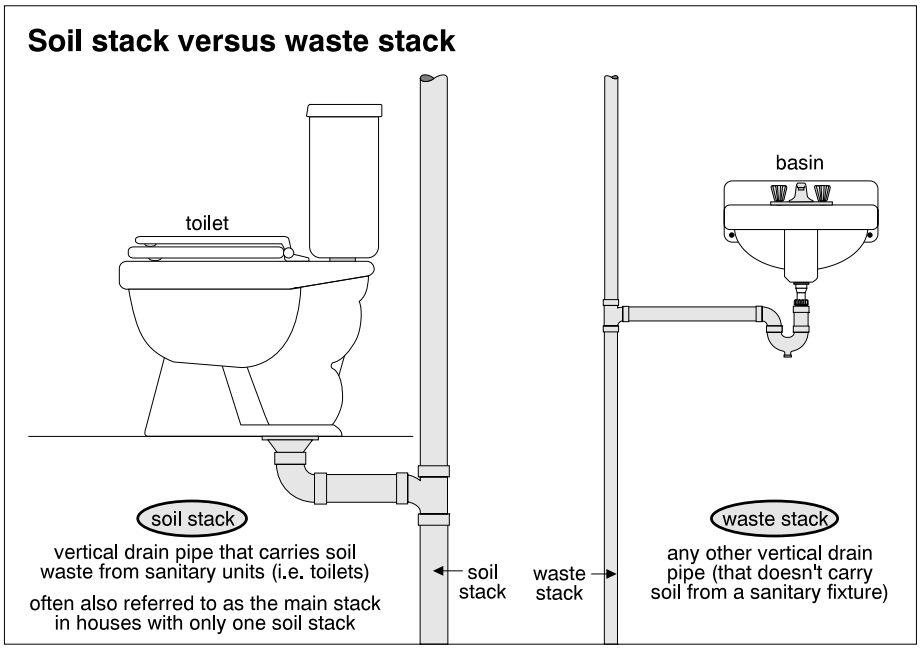
We have been talking about moving liquid and solid waste through pipes by gravity to get it out of the house. We have also been talking about using traps to keep sewer odors from coming back into the house. There is a little-seen but very important element of the waste piping that we haven't talked about. The venting system plays an important role in getting that waste out of the house.

Definitions

We are going to give you a few more simplified definitions here.

- **soil stack** — vertical pipe that carries solid, liquid or air through one story or more
- **waste stack** — vertical pipe that carries liquid or air through one story or more
- **stack vent** — extension of the soil (waste) stack above plumbing fixtures (it's a vent)
- **vent stack** — a vertical pipe used only as a vent (no part of the pipe carries solid or liquid)
- **branch vent** — joins individual vents to a stack
- **wet vent** — a vent that also acts as a drain for another fixture





Lets Waste Flow Easily

The venting system equalizes the air pressure throughout the waste piping system. Why does this matter? Let's look at the functions of vents.

The waste won't flow properly if it has trouble pushing the air in the pipe out of the way. Vents provide a path for air to get out of the waste pipes.

The waste also won't flow well if it's held back by low air pressure or a vacuum in the pipe behind it. Vents allow air to be drawn into the waste pipes.

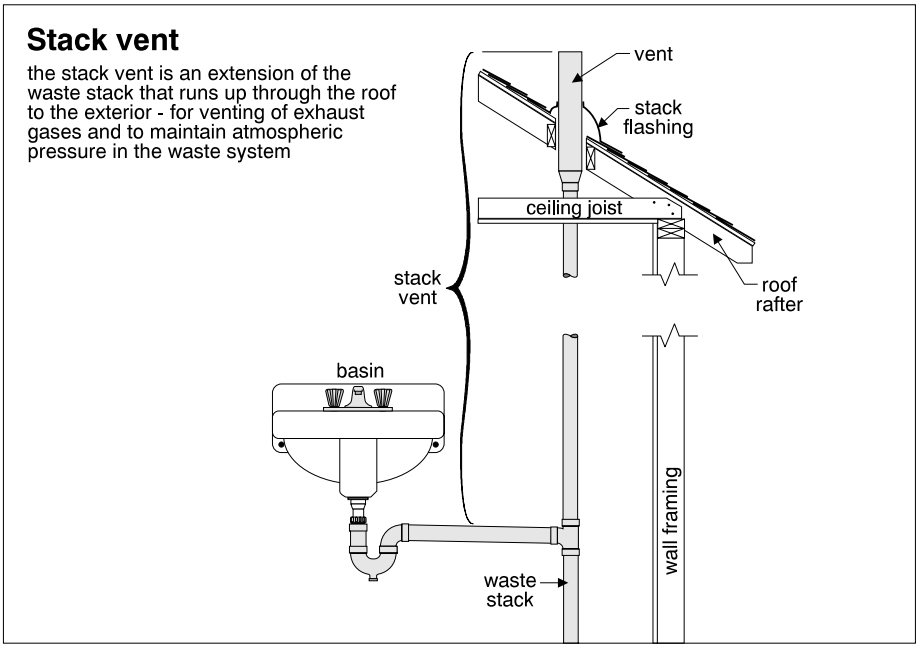
We don't want the water to be siphoned out of the trap every time a fixture is used. Vents allow air to be drawn in to break a siphon.

We want to provide a path for the sewer odors to escape from the house. Without venting, the sewer gases will eventually work their way through the water in the trap, and the odors will enter the house. Vents provide a path for sewer gases to escape outdoors.

To summarize, the venting system allows air in front of the waste to get out of the way, prevents vacuums forming behind the waste, prevents siphoning of traps and allows sewer odors out of the house before they leak through the trap water.

Vents Connect Waste Piping To Outdoor Air

To allow equalization of air pressure throughout the waste plumbing system, we attach vent pipes to the tops of all the waste and drain lines and run them up through the roof. This allows air to escape up the vent pipes and through the roof. It also allows air to be drawn down the vent pipes from outside. Sewer gases can also escape up through the vent pipes. The venting system connects the waste piping system to the outdoor air, and lets air move into and out of the waste piping system as needed.



Why do vents extend through the roof to get rid of the sewer gases? Vents would work if they went out through a wall of the house. There are two problems with this:

1. The vent pipes have to be above the fixtures so the vent pipes won't fill with water.
2. The sewer gases escaping from the vents smell. We don't want to draw them in through windows or other openings.

Minimize Number Of Vents

As a general rule, every fixture needs a vent. Because we are lazy and cheap, we try to minimize the number of vent pipes. We manifold vents wherever we can just as we did on the drain piping system. There are many rules in plumbing codes for when, where, how many, how long, and how big vent pipes should be. Let's try to simplify things and then we will talk about what home inspectors can look at, which is not much.

Vent location

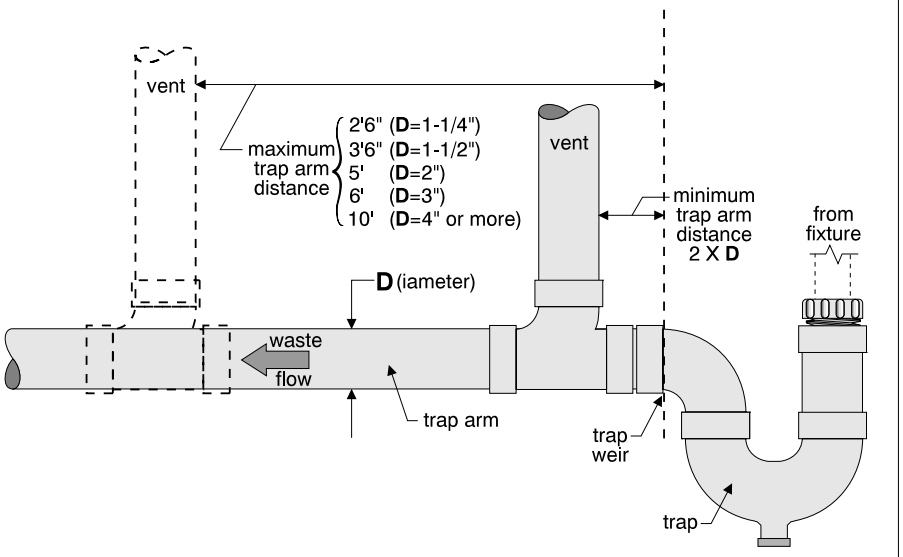
Minimum Distance From Trap To Vent

Every fixture needs to be vented, as a general rule. The ideal spot for a vent is just downstream of (after) the trap. The vent should be past the trap by at least twice the pipe diameter. If it's a 2-inch drain pipe, the vent should be at least 4 inches beyond the trap. If the vent is too close, waste leaving the trap may splash up into the vent, eventually clogging the vent. This is called a **crown-vented trap**, and most authorities do not permit these.

Maximum Distance From Trap To Vent

The maximum distance from the trap to the vent is usually about 5 feet, although the rules vary. (We'll talk about this more a little later.) Let's look at what's magic about 5 feet. Water flowing out of the fixture pushes the air in front of it up the vent pipe and out of the way. As the water flows through the trap and down the drain, the pipe may be filled with water. Remember that this is a nearly horizontal pipe running from the trap over to a vertical stack. Its slope is usually ¼-inch per foot. When the water flows, all the air has been pushed out of the pipe and the pipe may be completely filled with water. When the fixture empties, we want most of the water to flow down the drain, but the last bit of water should stay in the trap.

Proper vent location relative to trap



Solid Slug Of Water Siphons Trap

Gravity wants to pull most of the water down the drain pipe. Gravity also wants to leave the water in the trap because it's a low spot. But how do we split that solid slug of water flowing through the pipe so that some stays in the trap, and the rest flows down the drain? If there is no vent on the top of the pipe, there is no way for air to be introduced between the water flowing down the drain and the water we want to stay in the trap. A vacuum forms in the pipe between the water going down the drain and the water that wants to stay in the trap. A siphon is created and the atmospheric air pressure pushing down on the fixture drain pushes the water out of the trap to satisfy the vacuum. This breaks the seal that the trap is supposed to form and allows odors into the house through the fixture.

Vents Break The Vacuum

A vent on the top of the pipe downstream from the trap allows air into the drain pipe. This allows some water to stay in the trap and the rest to flow down the drain.

Vents Are Within 5 Feet Of Traps

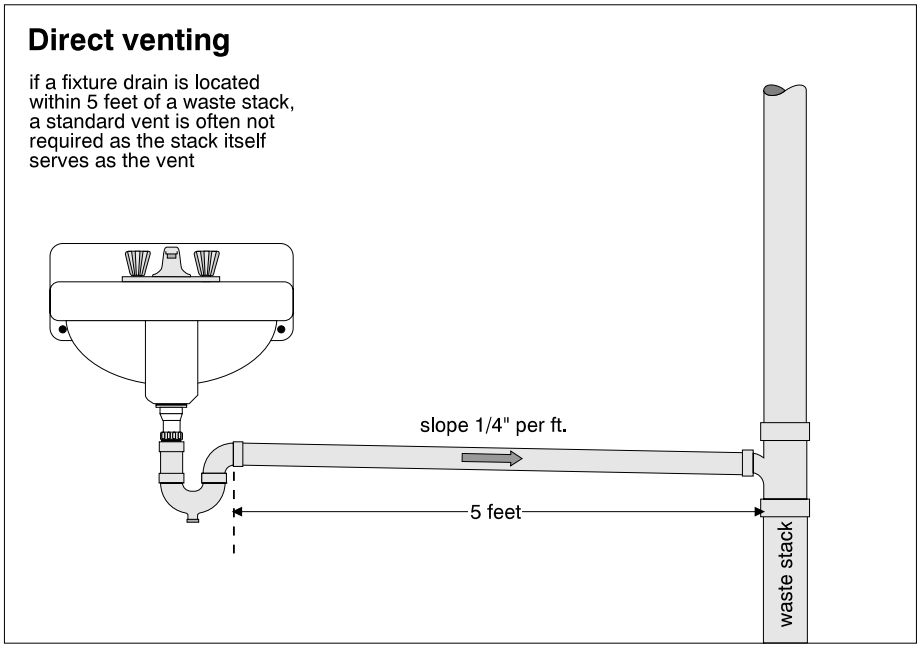
How far from the trap can the vent be? Remember we said that the slope of this drain is about ¼-inch per foot. The smallest common drain line is 1¼-inch diameter. As the last bit of water flows out of the trap over the **crown weir** (the bottom of the trap outlet), the drain pipe will no longer be filled with water, at the weir. The drain further downstream will still be completely flooded, because the pipe slopes down away from the trap. Air can't get into the drain pipe past the trap, and it can't get in from the drain pipe downstream, because both of these are flooded.

Put The Vent At The Vacuum

We need to put the vent where the vacuum wants to form. This is the part of the drain pipe past the trap, but before the part of the pipe that is still flooded. If the vent is downstream of the point where this flooding occurs, the vent will not be effective. With a 1¼-inch diameter pipe, sloping at ¼-inch per foot, the pipe 5 feet away or more from the trap will be flooded by water just coming over the crown weir of the trap. This is why vents must be within 5 feet of a trap to be effective.

Bending The 5-Foot Rule

Any fixture within 5 feet of the stack should not need a separate vent. Since many drain and waste pipes are larger than 1¼-inch diameter, there is a safety factor built into this. As a matter of fact, some plumbing authorities allow you to go further in some cases without having a vent. For example, toilets require a 3-inch waste line. Some jurisdictions allow up to a 12-foot run from the toilet to the vent. This is because we have the same ¼-inch per foot slope and the 12-foot run will not allow the waste to fill the 3 inch pipe and flood the vent. This rule varies, and you should learn your local rules.



Here's a chart of the rules that apply in various parts of North America.

VENT LOCATIONS			
Trap Arm Diameter in Inches	**Jurisdiction A: Maximum Distance to Vent in Feet**	**Jurisdiction B: Maximum Distance to Vent in Feet**	**Jurisdiction C: Maximum Distance to Vent in Feet**
1¼	2½	5	5
1½	3½	6	5
2	5	8	5
3	6	12	10 (for a toilet)

In Other Words…

We can say the whole thing another way. The fall of the trap arm should be less than one diameter over the distance between the trap and the vent. Remember, you'll rarely see this in the field so don't memorize all these numbers. We just want you to understand the principle.

Several Fixtures Can Use One Vent

If we have a single large stack vent for a toilet, for example, some areas allow any fixtures within 5 feet of the stack to use the stack for venting. Basins and bathtubs may not need separate vents. A second toilet that backs onto the wall with the stack vent for the first toilet can use the same stack vent. This is why bathrooms are sometimes back to back. However, we usually aren't allowed to share vents if the fixtures are on different floor levels in the house.

Separate Vents For Each Floor Level

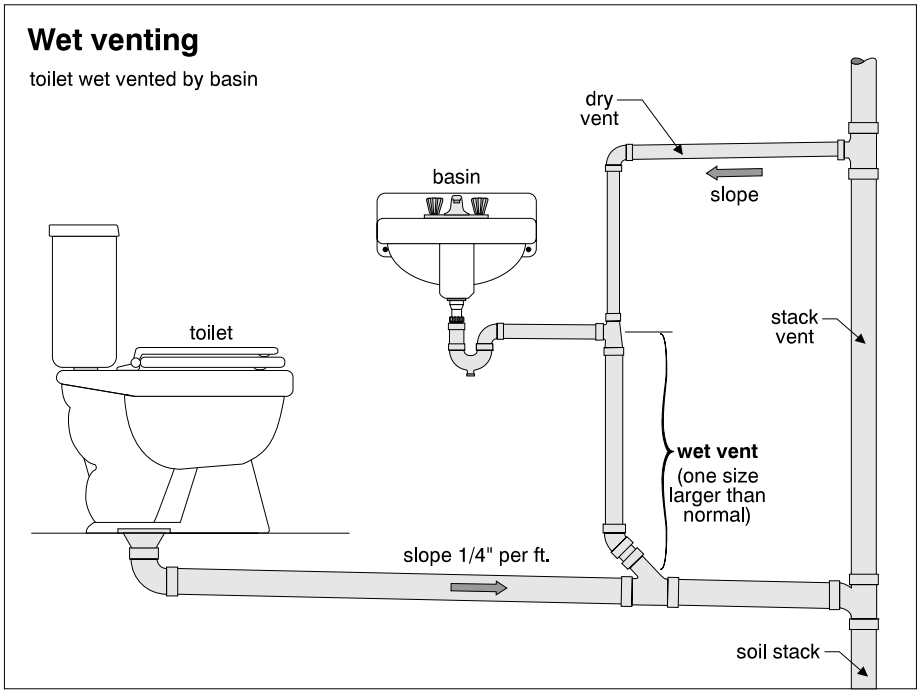
Let's start by thinking that every vertical drain pipe needs a vent at the top of it. If we dump waste into a vertical waste pipe (soil stack) at the second-floor level from a bathroom, for example, we can also dump waste into the same pipe at the first floor from a powder room and/or kitchen sink. Since the vertical pipe is a soil stack for the bathroom above, we can't use it as a vent for the first-floor fixtures. These fixtures need one or more separate vents. They are usually manifolded to save money. The separate vent has to run up through the house, and once it gets above the fixtures on the top floor, the vent from the first floor can join the main pipe (stack vent) going through the roof. Most vent pipes are manifolded before they go through the roof, because —

- we can save pipe
- every time we cut a hole in the roof, we need a flashing and we have a potential leakage spot

Wet vents

What Is Wet Venting?

Sometimes the drain from one fixture can act as the vent for another. When this is done, the downstream fixture is **wet vented**. This often happens with a bathtub and a basin in a bathroom. The trap and drain below the bathtub are below the floor. The vent from the bathtub drain runs up through the wall. If the sink is nearby, the temptation to connect the drain from the sink into the tub vent pipe is almost irresistible. The authorities allow this, which makes the bathtub wet vented. You generally have to increase the sink drain size, and the sink and bathtub must be at the same floor level. The thinking here is that the sink will not often be draining when the bathtub is draining, and if so, it will only be briefly. The bathtub is adequately vented.



Venting Summary

To summarize, the venting system neutralizes the air pressure in the waste plumbing system. Sometimes air is pushed out through the vents and sometimes air is drawn in. All vents must terminate above the roof so we don't get odors back into the house.

Inspection Strategies

There is not much you can see of the venting system in a typical home. You should make sure there is at least one vent pipe that comes through the roof, and as you test all of your plumbing fixtures, you will want to be checking for sewer odors and listening for a gurgling, siphoning sound at traps as fixtures are drained. Toilets, incidentally, are allowed to gurgle.