

# PART 1 HOW YOUR HOUSE WORKS PLUMBING

The fixtures and appliances in your plumbing system get a lot of attention because they're the parts you use every day. The real stars, though, are the pipes that connect them. The illustration shows typical components and how they're configured to form the three basic plumbing systems: water supply, waste removal and venting. Also included are simple repairs, maintenance tips, and a look at the gear you'll need to keep the water flowing in your home.

## SUPPLY SYSTEMS

Early plumbers picked up their title from the name of the material they worked with most: *plumbum*—Latin for lead. Unfortunately, they didn't know it was toxic. These days, supply piping comes in several flavors—all more agreeable to healthy living. While installations before about 1950 typically had 1/2- and 3/4-in. supply lines of galvanized iron, now they're rigid copper, plastic, or a combination of copper and plastic. DIY'ers prefer CPVC plastic, fitted with solvent-weld joints, while pros use PEX plastic. PEX comes in memory-free coils and is easy to install, but requires about \$400 in special tools.

Water enters from a public water main or private well at pressures between 40 and 80 psi. Once inside the house, the service line branches to the water heater. Beyond the heater, hot- and cold-water trunk lines run side by side, branching to serve fixtures along the way. Where water softeners are used, dedicated hard-water lines provide drinking water and serve outdoor faucets.

## WASTE PIPES

While supply systems bring water under pressure, waste removal usually relies on gravity. This gives waste lines a distinctive look. They're typically larger and their fittings are shaped to encourage the best possible flow. Pipes are generally sized to match the fixtures they serve. Sinks and tubs need 1 1/2-in. lines, showers and laundry stands need 2-in. lines, and toilets need 3-in. lines. Typically, the waste lines all converge in a central vertical drain called the stack. Older drain lines are made of cast iron, galvanized steel or copper, while modern installations are made with PVC plastic and solvent-weld fittings.

## VENTING SYSTEMS

Sewer gas is composed of up to 90 percent methane and can cause headaches and respiratory illness, so it's important to make sure it doesn't migrate back through fixture drains and into the house. To achieve this, each fixture has a water dam held in a U-shaped pipe called a trap. Toilets have a built-in trap that serves the same purpose.

But traps alone aren't enough. Flowing water pulls air behind it, and high-volume flows can create enough suction to pull water from nearby traps, breaking the seals. This is what a vent system is designed to prevent. There are two vent types: stack vents and revents. Fixtures near a larger vertical stack can draw air from it, but if a fixture is too far away, or the piping steps up, revents are needed. Revents typically join the stack above the highest fixture.

## KITCHEN SINK

Sinks come in stainless steel, solid-surface resins, enamel on cast iron and porcelain on steel. Today, the emphasis is on complementing the countertop. With polished granite and other natural-stone counters in vogue, speckled solid-surface resins are the most popular. These undermount sinks are epoxied in place.

## FAUCET

Homeowners 20 years ago let the plumber pick the faucets and he almost always picked chrome. Nickel-chromium was a dozen times tougher than polished brass.

Then came physical vapor deposition (PVD), a vacuum-chamber technology that sputters subatomic metal particles onto charged faucet parts. Add argon gas and you get a ceramic coating tougher than chrome that can look like any finish you can imagine. And with today's lifetime-warranted modern ceramic cartridges, there's no going back.

## DISHWASHER

If you're washing your dishes after they come out of the dishwasher, it might be time to upgrade. Look for a steel cabinet, a good sound-deadening package, built-in water heater, food grinder and, if possible, a sensor that reads the amount of soil in the discharge.

**MAINTENANCE:** Seals and O-rings at the bottom of your dishwasher must stay wet to work. If you'll be away for a few weeks, pour a small amount of mineral oil in the bottom of the machine. The oil will float on the water, preventing evaporation, and the water will keep the seals from drying out.

## BATH BASIN

Traditional basins are available in acrylic, enamel on cast iron, porcelain on vitreous china and porcelain on steel. Countertops with integral basins come in solid-surface resins, cultured marble and cultured onyx. Pedestal lavs are typically made of vitreous china. As for faucets, most are deck mounted, but wall mounts have come back into vogue. Reliable, easy-to-replace nylon cartridge mechanisms are typical.

## TOILET

Toilets are made almost exclusively of vitreous china. There are two types: gravity flow and pressure assist, which uses a burst of air to help clear the bowl.

**MAINTENANCE:** When the holes under the bowl rim clog with mineral deposits, flushing is affected. To fix, pour vinegar in the overflow tube in the center of the tank and let it stand for a half-hour. Then use 12-ga. electrical wire to ream out the holes.

## BATH/SHOWER

Plastic-coated porcelain on steel, with its low cost and improved durability, has largely supplanted cast iron and steel for tubs. Acrylic, on the other hand, offers the most colors. Stand-alone showers are often custom-built around a drain pan. Full showers come as one-piece units or in pieces for retrofitting.

**MAINTENANCE:** Clean out loose caulk and replace it with new caulk that's made for tub and tile use. These contain a fungicide that helps prevent mildew.

## WASHING MACHINE

Washing machines are connected with rubber hoses—the best are steel reinforced. The drain hose loops above the drum to prevent the fill cycle from pumping water down the drain. Water-hammer arresters at the supply lines help reduce the shock of rapidly shutting automatic valves.

**MAINTENANCE:** Few things make a bigger mess than a ruptured washer water-supply hose. Inspect the hoses for deterioration, and replace them every five years if they're not steel reinforced.

## WATER HEATER

The typical water heater has an insulated tank that stores hot water so it's ready for use. Tankless water heaters don't store water, but heat it as it's drawn. They're more efficient, but may not keep up with heavy demand.

**MAINTENANCE:** Temperature-and-pressure relief valves keep your water heater from exploding if the thermostat malfunctions. Test the T&P valve once a year by operating its lever. If water doesn't come out of the valve pipe, the valve must be replaced immediately.

Every six months, drain a few buckets from the tap at the bottom of the water heater to remove sediment. This improves heater efficiency and helps reduce corrosion.

## ESSENTIAL TOOLS

A pro carries a truck-load of tools to get him through the day, but homeowners need just a few. Some plumbing tools are specialized, but others can be used on all kinds of projects.

### 1. Allen Wrench Set

You'll need these for faucet handles.

**2. Basin Wrench**  
This tool reaches up under and behind a sink to grip faucet nuts.

**3. Closet Auger**  
The best tool for stubborn toilet clogs.

**4. Drain Auger**  
A small auger that works well on drains.

**5. Combination Screwdriver**  
One driver that handles all screws.

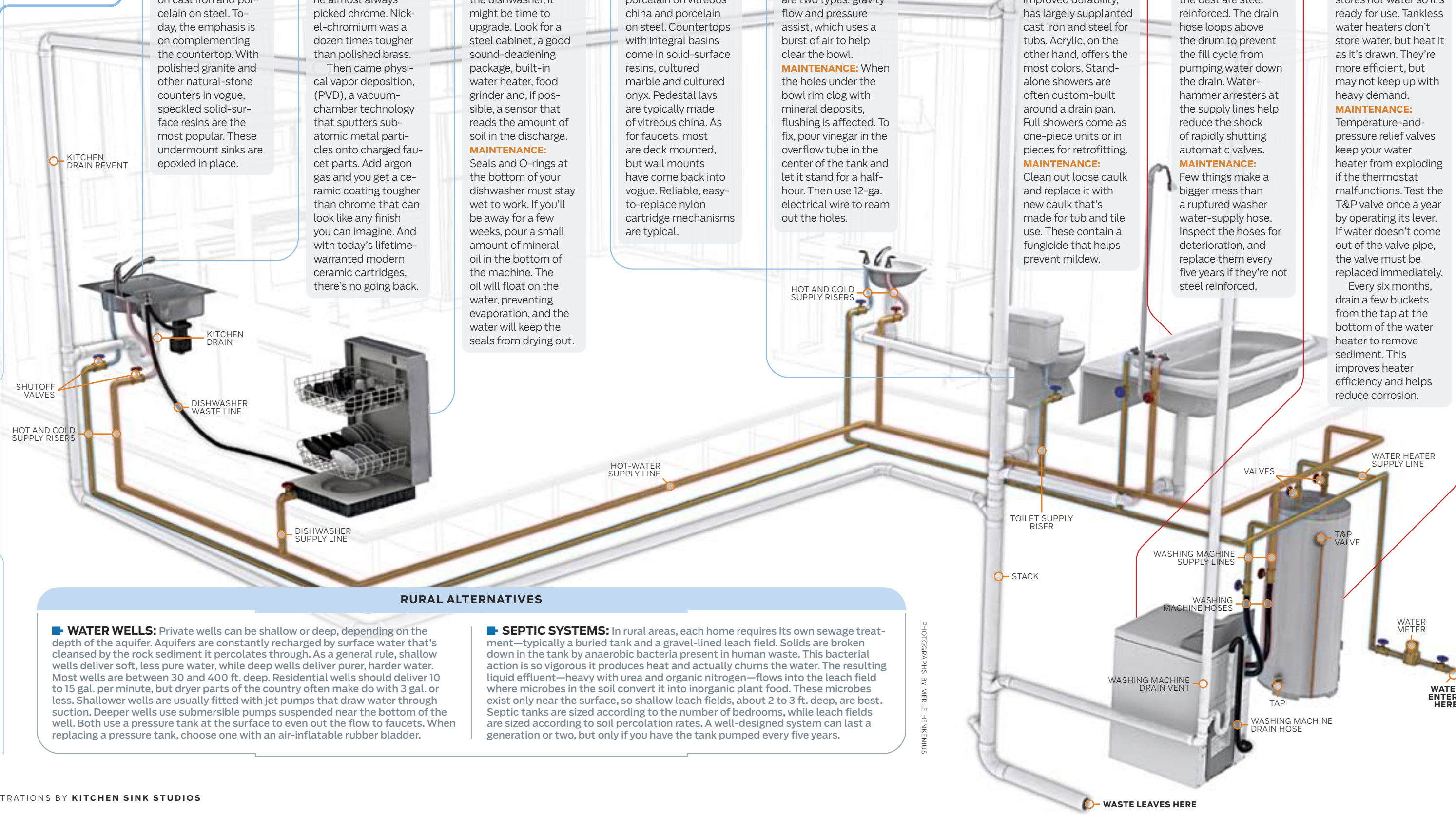
**6. Deep-Cup Plunger**  
Required since most drains clog eventually.

This kind works on toilets, too.

**7. Hacksaw**  
Miniature hacksaws reach into tight places to cut pipes and bolts.

**8. Handle Puller**  
For removing faucet handles.

**9. Water Pump Pliers**  
Slip-joint pliers that work on everything from faucets to P traps.



## RURAL ALTERNATIVES

**WATER WELLS:** Private wells can be shallow or deep, depending on the depth of the aquifer. Aquifers are constantly recharged by surface water that's cleaned by the rock sediment it percolates through. As a general rule, shallow wells deliver soft, less pure water, while deep wells deliver purer, harder water. Most wells are between 30 and 400 ft. deep. Residential wells should deliver 10 to 15 gal. per minute, but dryer parts of the country often make do with 3 gal. or less. Shallower wells are usually fitted with jet pumps that draw water through suction. Deeper wells use submersible pumps suspended near the bottom of the well. Both use a pressure tank at the surface to even out the flow to faucets. When replacing a pressure tank, choose one with an air-inflatable rubber bladder.

**SEPTIC SYSTEMS:** In rural areas, each home requires its own sewage treatment—typically a buried tank and a gravel-lined leach field. Solids are broken down in the tank by anaerobic bacteria present in human waste. This bacterial action is so vigorous it produces heat and actually churns the water. The resulting liquid effluent—heavy with urea and organic nitrogen—flows into the leach field where microbes in the soil convert it into inorganic plant food. These microbes exist only near the surface, so shallow leach fields, about 2 to 3 ft. deep, are best. Septic tanks are sized according to the number of bedrooms, while leach fields are sized according to soil percolation rates. A well-designed system can last a generation or two, but only if you have the tank pumped every five years.

PHOTOGRAPHS BY MERLE HENKENS

## COMMON REPAIRS

- PROBLEM:** Dripping Faucet
- SOLUTION:** Replace the Seals

Repair kits are available for most modern faucets. The unit shown has a rotating ball and renewable spring-loaded seals. To replace the seals, shut the water supply and remove the handle with the wrench that came with the kit. Rotate the cap to free the ball (far left), and remove the old seals and springs. Slide the new parts on an Allen wrench and ease them into place (left). Then reassemble the faucet.

- PROBLEM:** Gurgling Sink
- SOLUTION:** Install a New Trap

The cause is usually an S trap because this design can't be properly vented. You can convert it to a P trap with an automatic vent device. Check your local codes first. Disassemble the old trap down to the floor. Use two 45-degree fittings to extend a new drain line to the back of the cabinet and install a tee about 18 in. off the floor. Connect the sink to the branch of the tee with a P trap, and add an 8-in. pipe stub to the top of the tee. Glue a female threaded adapter to the top of this pipe and thread the automatic vent into it.

- PROBLEM:** Running Toilet
- SOLUTION:** Replace the Flapper Valve

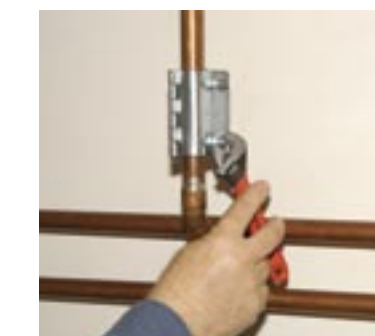
If your toilet comes on by itself, runs for a bit, then shuts off, the problem is the flapper. To fix it, first shut off the water to the toilet and flush. Lift the old flapper from its hooks. Check the valve rim for deposits and smooth it with a scouring pad (far left). If the rim feels slimy, clean it with alcohol. Slip a new flapper in place (left) and connect the chain to the flush lever so it's slightly loose.

- PROBLEM:** Basement Odor
- SOLUTION:** Seal the Floor Drain Trap

Floor drains are installed for emergencies, but when the trap dries out, gas can escape. The best fix is to add a quart of water once a week. Otherwise, a tennis ball over the hole will seal the trap, yet float if water collects. Commercial versions are available.

## EMERGENCIES

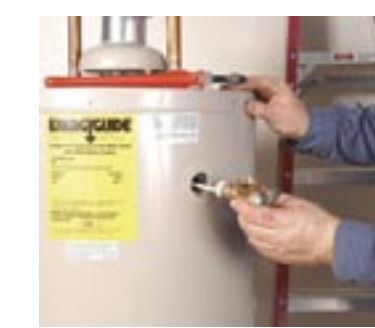
- WATER PIPE LEAK:** A pipe leak that doesn't involve a fitting is usually an easy fix with a pipe repair clamp. The clamp shown has a rubber sleeve and a two-piece clamp. Just wrap the pipe and bolt the halves together.



- CLOGGED TOILET:** When a toilet clogs, quickly remove the tank lid and press the flapper valve onto its seat. Most clogs can be cleared with a plunger, but make it one with a deep cup. If that fails, use a closet auger. Cable through the trap three times, aiming left, right and center.



- T&P VALVE LEAK:** A temperature-and-pressure relief valve is a water heater's only safety valve. If you see it leaking, shut off the water and drain a little out of the tank. Install a new valve, coating the threads lightly with pipe dope. If the new valve leaks, replace the water heater immediately.



Look for **PART 2** of HOW YOUR HOUSE WORKS, The Electrical System, in December.