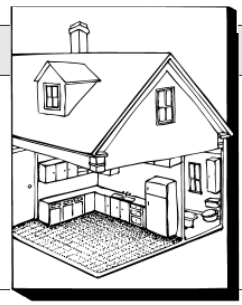
When the Pressure's Off

by Rex Cauldwell



A common complaint in today's fixture- and appliance-filled home is the lack of constant water pressure. The problem can be a simple nuisance, or result in a serious scald. If you build new homes, you can avoid pressure and volume drops by proper supply line design and installation. But if you do remodeling or renovation, you may inherit an existing water pressure problem.

Most water pressure problems can be fixed, but before I take any corrective action I always check the *volume* of water coming into the home. It's a waste of time and money to install a top-notch water supply system inside the home if the rust-clogged galvanized pipe from the street can only provide a trickle of water. Also, in many older homes, the main line from the well or meter is often undersized. In these cases, the incoming supply line has to be replaced.

Undersized Pipes

Next, I check the supply piping inside the home. Rust-filled galvanized pipes have to be replaced, of course. But by far, the biggest cause of pressure drops is undersized water lines. Even though they may meet code, in many instances 1/2-inch lines are simply too small to supply the water demands of a modern residence. When several fixtures require water at once, these lines cannot deliver.

Feeder lines. If possible, I use only 3/4-inch feeder lines to supply areas of the home that make significant water demands. For example, I try to run separate 3/4-inch lines to the kitchen, to each bathroom, to the utility room, and to any whirlpool tubs. Ideally, these should be "home runs" from where the main enters the home. Not only does this help eliminate pressure problems, but it also allows for the cutoff and isolation of each separately plumbed area of the house for repair and troubleshooting. A 3/4-inch line will supply enough water for almost any situation, assuming there's at least 40 psi water pressure entering the house.

I use 1/2-inch and smaller lines only for short taps to individual fixtures. I try never to put more than one fixture on a 1/2-inch line, but pull each fixture from the 3/4-inch main supply line.

Of course, this approach goes way beyond code, but then good design often does. Obviously you're not going to find this kind of plumbing in the average tract house — it costs more to use larger pipes, not to mention the added luxury of home runs for separate rooms. But in this case, going beyond code means you won't have to worry about pressure drops, and perhaps more important, you (or your plumber) won't have to do all the math to determine the minimum pipe size that you can get away with.

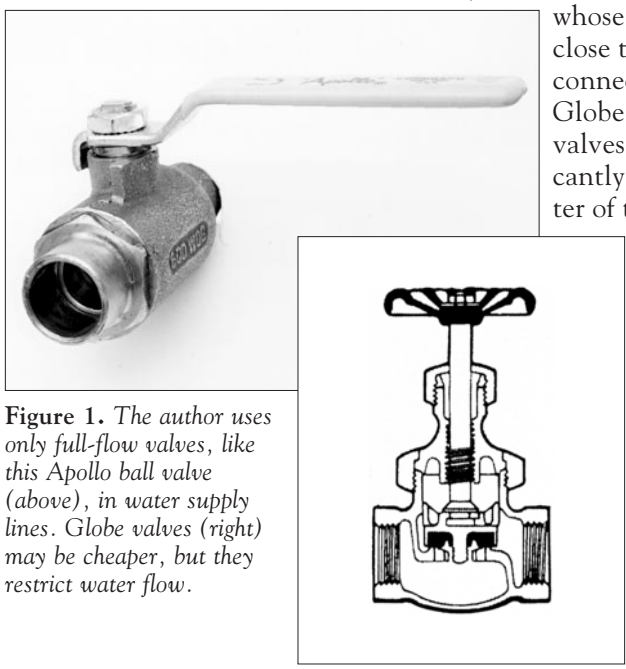


Figure 1. *The author uses only full-flow valves, like this Apollo ball valve (above), in water supply lines. Globe valves (right) may be cheaper, but they restrict water flow.*

Long pipes. Distance also affects pressure and volume, but it is not usually a problem in single-family construction. If you have a run over 100 feet long (rare in a residence) and you need full volume, you can increase the pipe diameter to 1 inch to offset the pressure loss of the longer lines. Also, for kitchens or baths more than 50 feet away from the main water heater, I run only a cold supply and install a separate water heater for the area.

Elevation has more of an effect than distance, but since most single-family homes are three stories or less this isn't usually a problem. To figure pressure loss from elevation, subtract 1/2 psi for each foot. A standard two-story house with the main coming into the basement will lose around 10 psi on the second floor. I normally set these houses around 60 psi to compensate.

Valves and Fittings

Cheap valves can also kill water pressure. I have been on calls where water pressure was practically nonexistent at the far reaches of the home only because too many low-quality pressure-eating valves had been used.

All in-line valves should be *full-flow*, or *full-port*, valves — valves whose inside diameter is very close to the pipe diameter size it connects to (see Figure 1). Globe, stop, and stop-and-waste valves restrict water flow significantly because the inside diameter of the open valve is smaller than the pipe's inside diameter. The only valves that don't have to be full flow are the "stops" immediately under fixtures.

Fittings, especially 90-degree ones, also reduce water pressure. With 3/4-inch pipe this should not be a problem as long as you keep turns to a minimum. The friction loss of a 3/4-inch copper 90-degree elbow only adds the equivalent of 2.5 feet of pipe to a run.

Adding water conditioning equipment can lower your house pressure by at least 10 psi. If this is a problem, a good installer will take measures to boost the pressure as necessary.

Pressure-balancing valves in baths and showers can help lessen pressure problems, as well as prevent scalding. The building codes usually require these in new construction. In older homes where it isn't practical to replace all the controls with anti-scald units, a temperature control valve

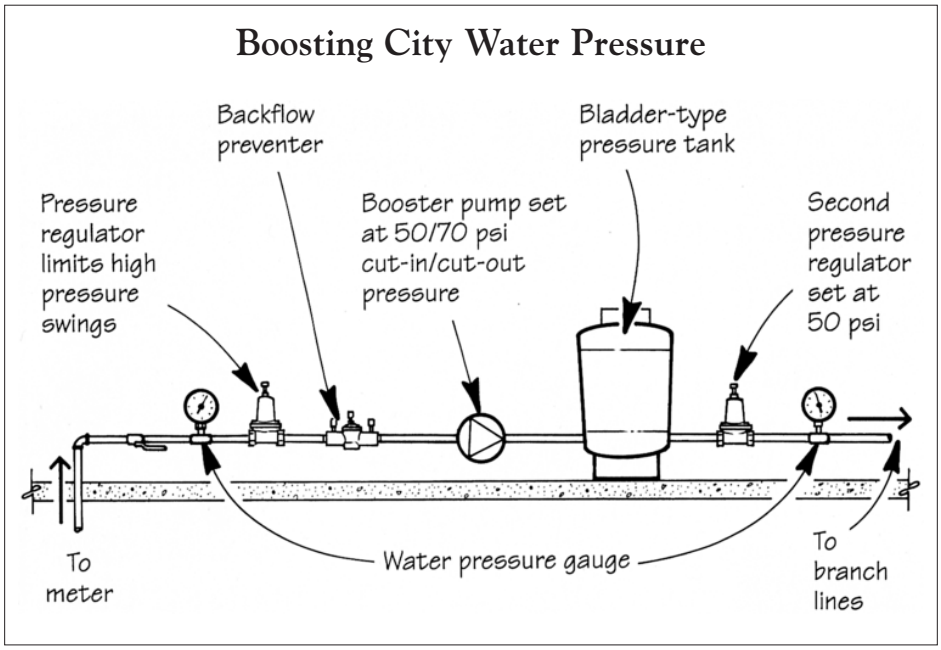


Figure 2. *Where city water pressure fluctuates, the author sometimes installs a small booster pump and pressure tank to regulate the pressure of incoming municipal water.*

(mixer valve) can be installed immediately adjacent to the water heater as a backup measure. If the water heater malfunctions and produces scalding water, the mixer valve automatically mixes cold water with the hot output to lower the temperature.

Pressure Boosting Strategies

Some pressure problems are caused right at the source and require a different fix.

Municipal water. City residents may get pressure fluctuations directly from the street mains. Homes on municipal water supplies should have both a back-flow preventer and a water-pressure regulator. The back-flow preventer (this is not a simple check valve) keeps all the water that enters the home from being drawn back out by a pressure drop in the street main. Although a regulator isn't required unless the incoming water pressure exceeds 80 psi, I usually install one anyway where fluctuations are a problem. By setting the regulator to an acceptable maximum pressure — say 40 or 50 psi — I can eliminate the upper pressure swings.

However, the regulator won't help for pressure drops below its setting. If the homeowner wants a steady maximum pressure at all times, I install a bladder-type water-storage tank, usually in the 20- to 60-gallon range ($150 to $400), and a pressure boosting pump (typically a Jacuzzi 4RP2) immediately after the backflow preventer and pressure regulator (Figure 2). This corrects low flow and pressure problems. However, there will still be a slight pressure swing between the booster pump's 30 psi cut-in setting and its 50 psi cut-out. If this small fluctuation annoys the homeowner, I raise the pump's setting to 40/60 or 50/70 cut-in/cut-out pressure. I then install another water pressure regulator on the output of the pump and set this to the lower end of the pressure setting. If the pump is running at 50/70 psi, the house will always get a constant 50 psi.

Checking water pressure. How can you know what the water pressure is in a building? City systems normally have no gauges, so I always add two: one right where the pipe enters the building, and the other after all the newly installed equipment so I can observe any pressure difference. For a quick check, a simple water pressure gauge can be connected to any faucet or hose bib.

Well Water

For country folk, pumping the water in from the well or spring often results in fluctuating pressure, but it need not be so. You can usually boost the pressure switch to 40/60 or 50/70 psi. Be aware however, that older pumps may not have the reserves to allow you to do this. Also, if the pressure tank is an old galvanized type, I usually replace it with a bladder-type tank. Otherwise, increasing the pressure will water-log the older tank.

Tank size. Often the pressure tank is too small. There's a complicated formula for figuring the right size tank, but nobody uses it. Here's a simple way: Time the cut-in to cut-out cycle of the pressure switch — the actual running time of the pump. It should be one minute or more for 1/2- to 3/4-hp pumps, and two minutes or more for 1 hp and above (this does not apply to old jet pumps and old low-yield wells). Any shorter cycle will prematurely wear out the pump, and will also affect the performance of the entire water supply in the house. For example, if someone is showering, the pressure in an undersized tank can quickly fall from 50 to 30 psi. Then the pump will kick on and fill the tank for several seconds. Meanwhile, the shower pressure keeps changing — which also affects the water temperature.

The solution is to replace the small tank with a large one — as large as the customer's budget will allow, within reason. Typically, a 40- to 60-gallon tank is adequate, assuming the well or spring has enough reserve. The larger the tank, the less noticeable pressure changes will be. The larger tank also lengthens the life of the pump and allows more water to be held in reserve in case of a power failure. If the pump is working properly and the tank is large enough, adding a pressure regulator after the tank's output will almost guarantee constant pressure.

Low-yield wells. It's not unusual for a well to have a recharge of 3 to 6 gallons per minute. But the actual volume of water within the well and well casing might be 20 to 100 gallons or more — giving a backup reserve in addition to what's in the pressure tank. With wells or springs that can't meet the demand, I install a 1,000-gallon storage tank in the basement that can slowly fill during the night. ■

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