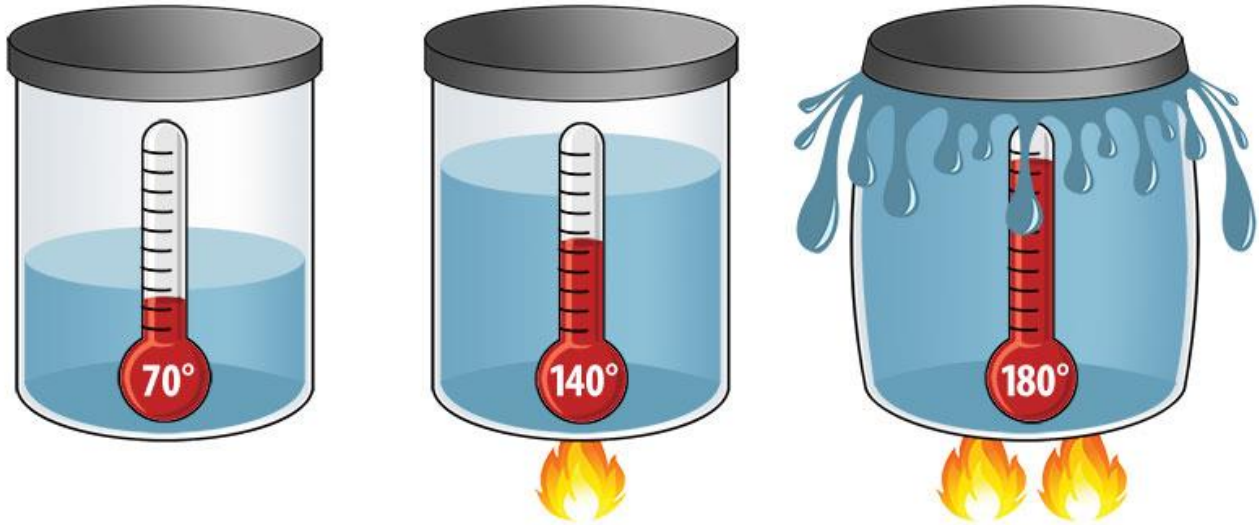


# What Is Thermal Expansion in a Closed Loop System?

*...and what can I do about it?*



## What is Thermal Expansion?

Thermal expansion is among the more serious of plumbing concerns, but one that many homeowners know little about. Because many homes aren't at risk, it rarely seems to enter the typical plumbing discussion. Of the homes that are, many lack adequate protection, since code requirements are often only enforced on new installations.

Water doesn't compress very much at all when subjected to pressure. And when heated, it expands in volume: the contents of a 40 gallon water tank can expand by half a gallon or more when heated! Neither of these properties bode well for closed looped plumbing systems.

If your home has a Backflow Prevention Device, Pressure Reducing Valve (PRV), recirculating pump with check valve, or anything else that prevents backflow of water installed, its plumbing system is considered "closed". A closed system is one in which potable water has no way to exit a home's plumbing (in an open system, water inside plumbing can be forced back into the city water main through the supply line).

When heated water expands in a closed system, that additional volume has nowhere to go if fixtures aren't being used: the backflow preventer, PRV or check valve blocks the only other path of exit. This is a very good thing should backflow from your home threaten to contaminate the water supply, but a very bad thing for fixtures, pipes and water heater if precautions aren't taken.

The pressure added to a closed system by thermal expansion can wear out seals, damage solenoid valves (like those found on washing machines, dishwashers) and even rupture pipe. Water heaters can find their lives severely shortened thanks to the added stress. In extreme cases, increased pressure in a Oil, gas or propane powered water heater can cause the flue inside to collapse, creating a carbon monoxide leak.

## Ways to Deal with Thermal Expansion

International Code Council (ICC) requires that a thermal expansion device be installed whenever PRV or backflow prevention is present. This usually comes in the form of an expansion tank that connects to the water heater or service line, accommodating volume increases. Other options include valves with discharge outlets that simply drain whatever the system can't hold, and special toilet fill valves that drain excess volume into the toilet tank.

The tried and true way to deal with thermal expansion is with expansion tanks. Installed on the supply line, these tanks feature a rubber bladder or diaphragm that separates an air chamber from the rest of the tank. Air is pumped in to match the pressure of the water supply. When water expands, instead of building pressure in the confines of the water heater or plumbing, it enters the expansion tank, compressing the air. Once expansion has stopped and there's room, the compressed air pushes the water back into the supply.

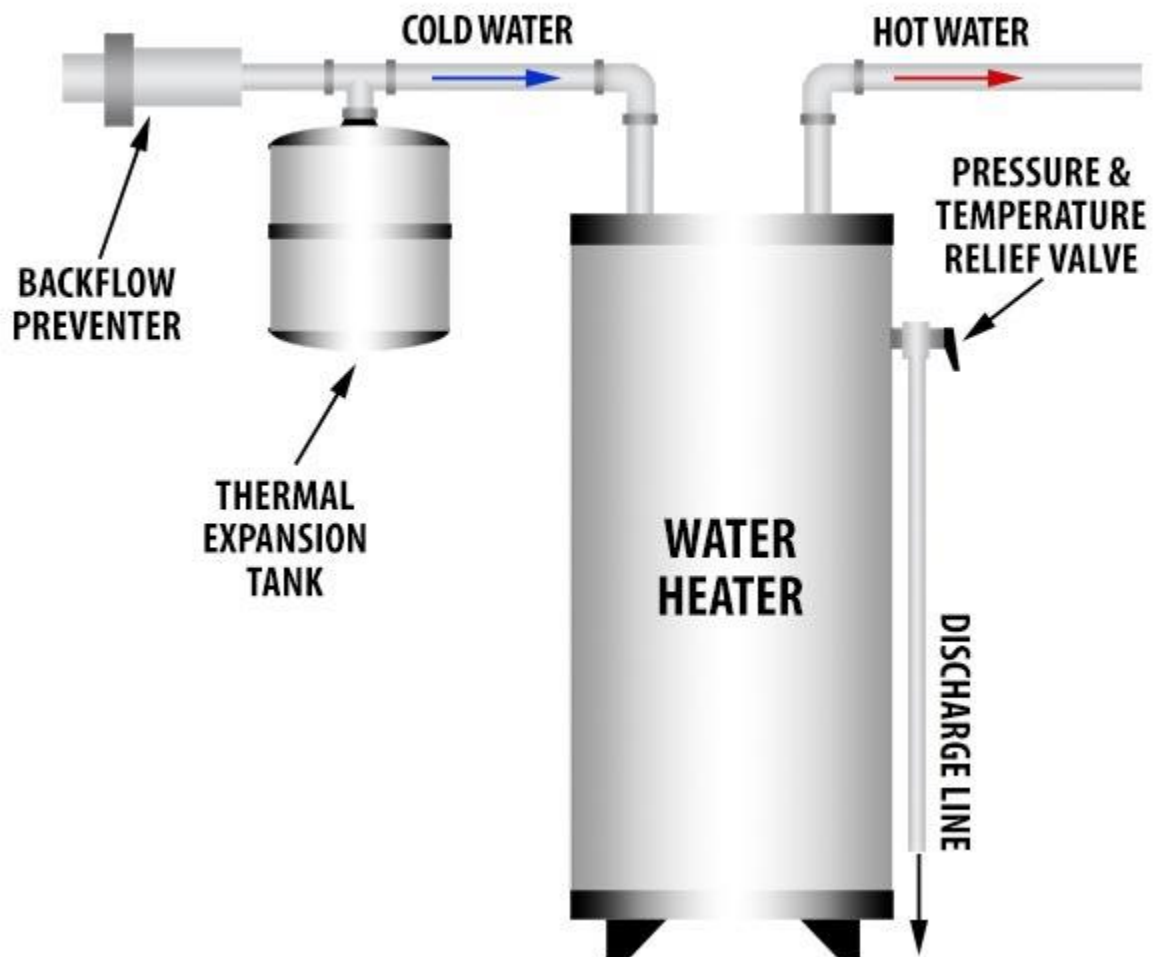
Expansion tanks must be pressurized correctly in order to function properly. It's always best to follow the manufacturer's instructions, which usually call for the air pressure to match the supply pressure (you can measure this on a spigot using a water pressure gauge. If the pressure is set too low, water will too easily enter the tank, which is not designed for such regular usage. Set too high, and water has a more difficult time getting in, defeating the tank's purpose. You can verify the tank's pressure using a standard tire air gauge.

- If your supply pressure is above 80 psi, most manufacturers require that a PRV be installed before the expansion tank. This is also a good idea to save your plumbing from unnecessary stress.
- Expansion tanks usually have a 150 psi maximum pressure.
- Expansion tanks are sized based on the water heater's capacity and the incoming supply pressure. Be sure that you have accurate numbers for both before purchasing.

**Did You Know?** A dripping Temperature and Pressure Relief (T&P) Valve on the water heater is an indicator of a potential thermal expansion problem. This is the valve with the small handle or lever that automatically opens when either the temperature or pressure inside the heater tank exceeds a set limit (usually 150psi/210°F). These are emergency valves, and are not meant to operate regularly. When one of them leaks, the first

step is usually to replace the valve. If the leaking continues, there's a problem. **Never plug, cap or tamper with a T&P valve for risk of death, personal injury and property damage.**

## TYPICAL RESIDENTIAL INSTALLATION



Expansion tanks should be installed on the incoming cold water supply line, before the water heater. Although many tanks can be installed in any orientation, they will perform best and last longer when installed on a horizontal run, with the tank inlet pointing down (ensuring that water makes its way in only when necessary, and drains from the tank easily).

A cursory check of the tank's condition can be done anytime the water heater isn't heating by tapping its exterior with knuckles or a coin: it should sound like a (mostly)

hollow metal tank. If you hear more of a thud, the tank may be full of water. You can confirm a waterlogged tank by removing the cap protecting the Schrader air valve (the same kind found on car and bike tires) and pressing down on the pin. As with your tires, air should come out. If water comes out, the rubber has deteriorated and a new tank is needed. If nothing happens, the tank may not have enough air in it: use a bike pump or air compressor to re-pressurize the chamber, following manufacturer instructions.

**If you already have an expansion tank installed, great!** If you don't know whether your plumbing system is open or closed, find out! While your home may have a device regulating water pressure, or safeguards against contaminating the water supply, it still may be vulnerable to the damaging pressure of thermally-expanded water.

### **Quick Safety Check list:**

- ✓ Expansion tanks should be inspected annually. Once installed, the only way to get an accurate reading on the expansion tank's air pressure is to shut off the water supply and relieve system pressure by opening a faucet before measuring. Since your water heater should also be on an annual maintenance routine, it makes sense to deal with both at the same time.
- ✓ Do not remove the yellow manufactures instructions from the T&P valve.
- ✓ A service man with special training should flip the lever annually on the T & P Valve in accordance with the manufactures instructions. (not advised for homeowners because the test spews hot water which is dangerous)
- ✓ Remove the T&P valve with a wrench and insect the critical “thermal sensing element” after 3 years (T&P valves are relatively inexpensive and can be simply replaced).
- ✓ Never plug or cap the drain line from a T&P safety valve. Altering the drain line is illegal and dangerous. Utilize an anti- tamper drain line connection device.
- ✓ Place a report card on the tank signed by the service person to memorialize the maintenance and service performed.

Now you can operate your water heater in a closed loop system with reduced risk of water damage or water heater explosion.