What is Thermal Expansion and why is it dangerous?

Most homes are supplied with hot water from an electric or gas heated tank. Until the heating element stops working, and one is faced with a cold shower, the water heater is usually taken for granted.

However, if not properly maintained, a water heater may become a safety hazard.

Water expands in volume as its temperature rises. The extra volume caused by thermal expansion must go somewhere. If not, the heated water creates an increase in pressure. This is the principle of a steam engine.

The temperature and pressure in the water heater is reduced when hot water is withdrawn from a faucet and cold water enters the tank. The increase in pressure from thermal expansion can also be reduced by water flowing back into the public water system. However, when a check valve, pressure-reducing valve or backflow preventer is installed in the service pipe a “closed system” is created. Provisions must be made for thermal expansion in these cases. Residents that have backflow prevention devices attached to their water line are at an increased risk to thermal expansion.

The thermostat of the water heater normally maintains the water temperature at about 130º F (54º C). However, if the thermostat fails to shut off the heater, the temperature of the water will continue to increase.

If the water temperature increases to more than 212º F (100º C), the water within the tank becomes “super heated”. When this super heated water is suddenly exposed to the atmosphere when a faucet is opened, it instantly flashes into steam and a violent reaction may result. As the pressure within the tank continues to build up under super heated conditions, the tank may explode.

How backflow affects Thermal Expansion.

It is important for residents to understand that with the addition of a backflow prevention assembly connected to their water line that the chances of thermal expansion occurring increase.

Water normally flows in one direction, from the public water system through the water meter and finally to the customer’s tap. This is the only direction that any water distribution system is setup for, however under certain conditions water can flow in the reverse direction.

Water flowing in the reverse direction is known as **backflow**. Backflow occurs when *backsiphonage* or *backpressure* conditions are created within a water line.

Backsiphonage is water movement in the unintended direction through the force of suction created by a vacuum. A vacuum may occur due to a loss of pressure in the water distribution system during a high withdrawal of water or when a plumbing system break occurs, and also during the shutdown of the main distribution line in some plumbing systems. A reduction of pressure below atmospheric pressure results in a vacuum within the piping that could create backsiphonage (suction) within the water line.

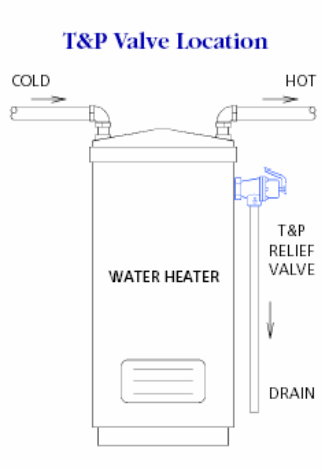
Backpressure may be created when a source of pressure, such as from thermal expansion, creates a pressure greater than the supplied pressure from the distribution system and pushes the water backwards in the opposite direction.

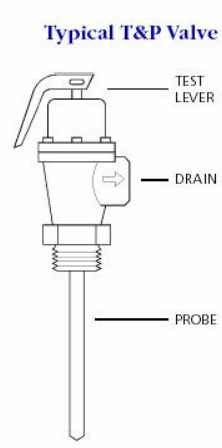
Backflow: An added ingredient to the danger

A backflow assembly/device connected to the residents' water line will *usually** stop the water moving in the reverse direction and prevent backflow and a possible cross-connection (contact between potable and non-potable water). This is how the closed loop system is created. When pressure buildup in the water heater exceeds the tanks' capacity, the pressure as a last resort, will travel back up the incoming water line until it reaches the backflow assembly/device, which blocks and stops the movement. Once the pressure expansion is blocked a very dangerous situation develops as the pressure continues to build within the system which could ultimately lead to a violent rupture within the water tank or water line.

** Denotes that only a backflow assembly that is properly installed, used, maintained and tested annually will prevent backflow*

Protection from Thermal Expansion





Protection from thermal expansion is provided in a plumbing system by the installation of a ***thermal expansion tank*** in the hot water system piping downstream of the hot water tank and a ***temperature and pressure relief valve*** (T & P Valve) at the top of the tank. (Per Oregon State Plumbing Code).

The thermal expansion tank controls the increased pressure generated within the normal operating temperature range of the water heater. The small tank with a sealed compressible air cushion provides a space to store and hold the additional expanded water volume.

The T & P Valve is the primary safety feature for the water heater. The ***temperature*** portion of the T & P Valve is designed to open and vent water to the atmosphere whenever the water temperature within the tank reaches approximately 210º F (99º C). Venting allows cold water to enter the tank.

The ***pressure*** portion of a T & P Valve is designed to open and vent to the atmosphere whenever water pressure within the tank exceeds the pressure setting on the valve. The T & P Valve is normally pre-set at 125 psi or 150 psi.

Water heaters installed in compliance with the current plumbing code will have the required T & P Valve and thermal expansion tank. For public health protection, the water purveyor may require the installation of a check valve or backflow preventer downstream of the water meter. In these situations, it is essential that a T & P Valve and thermal expansion tank be properly installed and maintained in the plumbing system due to the reasons listed above.

What should I do to protect myself from Thermal Expansion?

- The homeowner should check to see that an expansion tank and T & P Valve are in place.
- ***If there is any doubt, the homeowner should contact a licensed plumber***.
- The T & P Valve should be periodically inspected to ensure that it is properly operating.
- Some T & P Valves are equipped with a test lever. Manually lifting the lever unseats the valve, allowing water to discharge. If water continues to leak from the T & P Valve after closing, the valve may need to be replaced. A drain line must be installed to avoid water damage and scalding injury when the valve operates.
- The T & P Valve should be periodically removed and visually inspected for corrosion deposits and to insure it has not been improperly altered or repaired.
- The above work can best be done by a **licensed plumber**.