As Seen On Ask This Old House

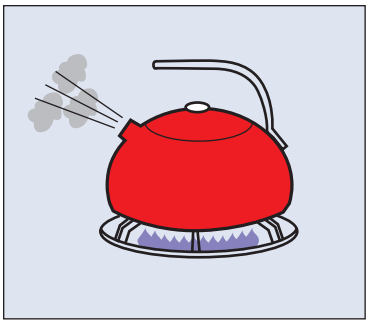
THERMAL EXPANSION AND CROSS-CONNECTION CONTROL SOLUTIONS

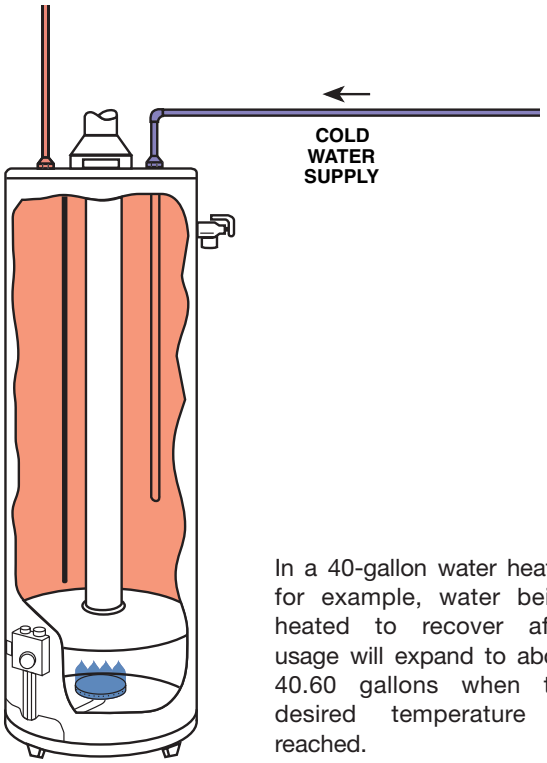
Reference Guide

AMTROL INC.

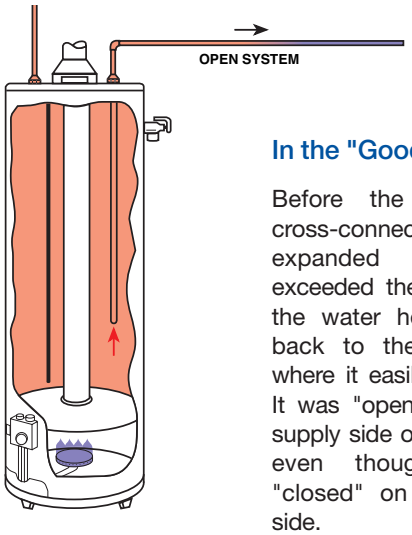
When water is heated...

It expands! Reacting to physical law, water expands in volume as its temperature rises.



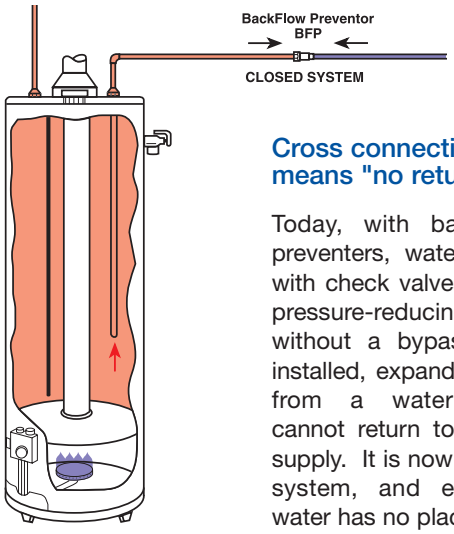


In a 40-gallon water heater, for example, water being heated to recover after usage will expand to about 40.60 gallons when the desired temperature is reached.



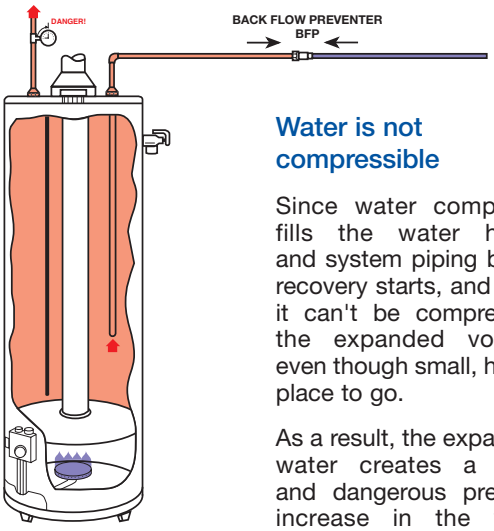
In the "Good Old" days

Before the advent of cross-connection control, expanded water that exceeded the capacity of the water heater flowed back to the city main, where it easily dissipated. It was "open" at the city supply side of the system, even though it was "closed" on the system side.



Cross connection means "no return"

Today, with back flow preventers, water meters with check valves, and/or pressure-reducing valves without a bypass being installed, expanded water from a water heater cannot return to the city supply. It is now a closed system, and expanded water has no place to go.



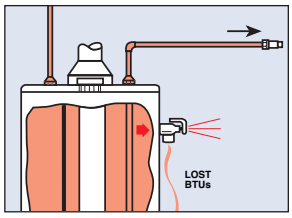
Water is not compressible

Since water completely fills the water heater and system piping before recovery starts, and since it can't be compressed, the expanded volume, even though small, has no place to go.

As a result, the expanding water creates a rapid and dangerous pressure increase in the water heater and system piping, much like the action of a hydraulic ram.

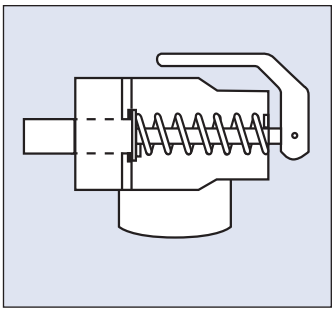
So "pop" goes the relief valve

The setting on a temperature & pressure safety relief is quickly reached, and the relief valve opens, losing heater water down the drain or, more often than not, all over the floor.

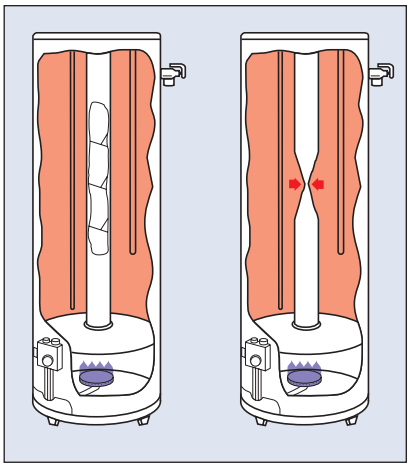


The illogical practice of operating your safety valve once or twice a day is not only wasteful (you paid to heat the water that went down the drain), it's also dangerous.

First of all, the T & P relief valve you installed serves as an emergency control only. It was never designed as an operating control. Once a safety valve is used on a daily basis, it isn't that safe.



Deposits on the seat... deteriorating springs... wear-and-tear erosion can wear out a relief valve in no time at all.

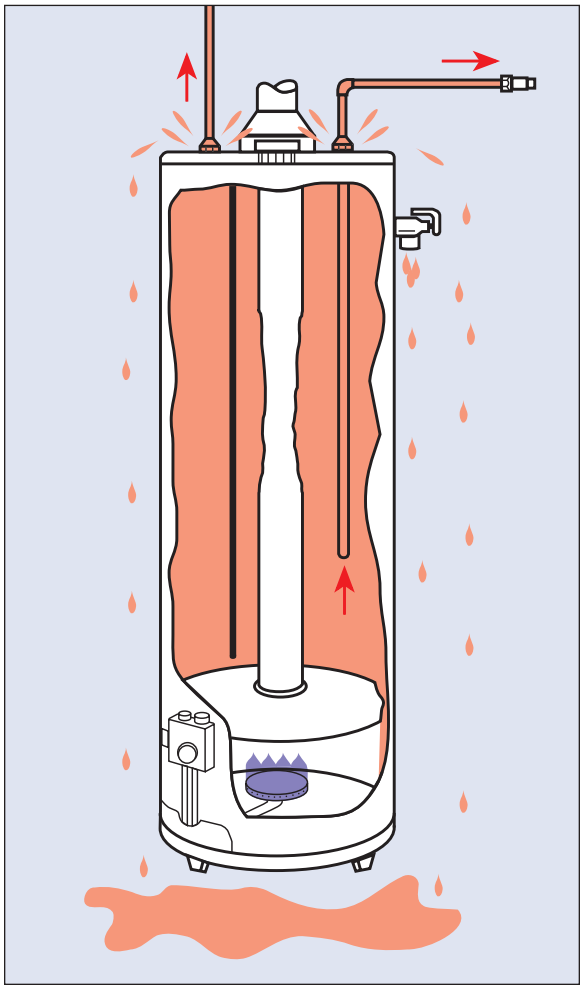


Dangerous pressures before relief

What most people don't realize is that dangerous conditions can exist during thermal expansion long before the relief valve operates.

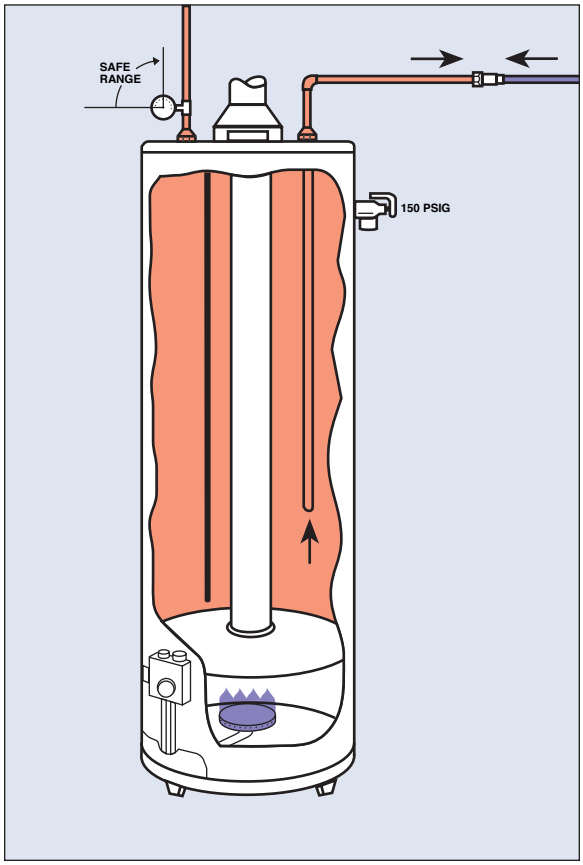
Internal pressures repeatedly occurring during recovery periods can collapse the center flue of a gas-fired water heater, creating a hazardous presence of deadly carbon monoxide gas, or even a water-heater explosion.

Solution



Even though the relief valve operates during each recovery period, high internal pressures occurring over and over again can accelerate tank leakage and shorten water-heater life, no matter how it is fired.

Controlled Pressure Rise During Thermal Expansion

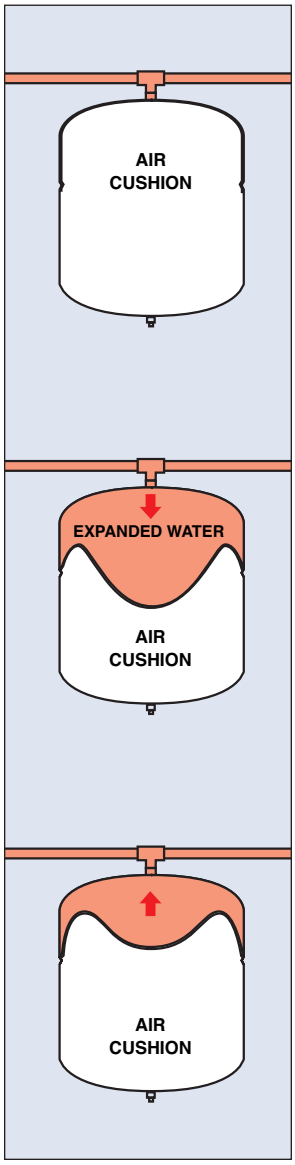


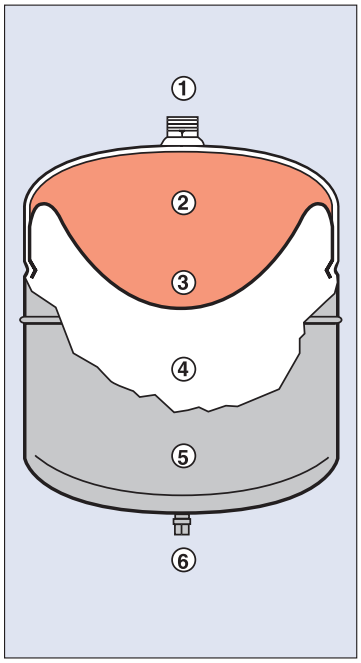
The best solution to thermal expansion is to control the pressure it generates within a safe operating range, well below the emergency setting of a relief valve. This allows thermal expansion to occur without causing a dangerous increase in pressure.

This is easily accomplished by adding an expansion tank with a sealed-in, compressible air cushion, which will compress as thermal expansion occurs, providing the place for the expanded volume of water to go during recovery.

By sizing the air cushion according to Boyle's Law, we can select the maximum pressure on the system when the total amount of expanded water has been generated.

When hot water is used in the system, the pressurized air cushion forces hot water back into the system for use, not waste.



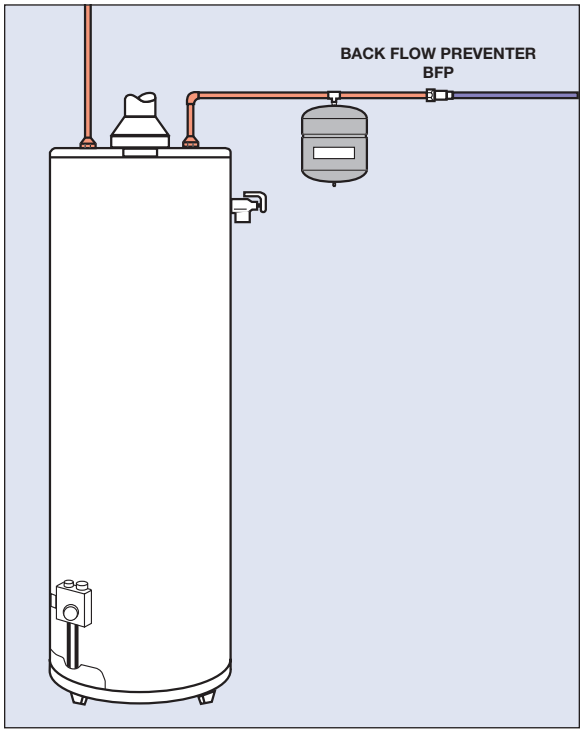


1. System Connection
2. Separate, rigid polypropylene-lined water reservoir (NSF listed)
3. Heavy-duty butyl diaphragm
4. Sealed-in, permanent air charge
5. Welded steel pressure support domes
6. Air charging valve

The thermal expansion tank features the sealed-in air cushion, pre-charged to the minimum system pressure before recovery is started. A rugged butyl diaphragm seals in the air cushion and also separates air from hot domestic water to prevent air from being dissolved by hot system water.

Finally, on the water side of the expansion tank is a separate, rigid polypropylene liner so fresh, corrosive, domestic hot water can be handled without fear of corrosion and leaks.

The thermal-expansion tank for domestic water heaters, sized right, is the only logical answer to the growing problem of thermal expansion in water heaters protected by BFP, check valves or pressure-reducing valves. A simple installation to the supply side on the water heater, this small tank will eliminate the dangerous condition so that the relief valve will not open during normal heating cycles.



ANSI/NSF 61

Water Heater* Size (gals.)	Static Supply Pressure (psi)**		
	40	60	80
40	ST-5	ST-5	ST-5
50	ST-5	ST-5	ST-5
60	ST-5	ST-5	ST-8
80	ST-8	ST-8	ST-12
120	ST-12	ST-12	ST-25V

Max. Temp. Setting 140°F

Water Heater* Size (gals.)	Static Supply Pressure (psi)**		
	40	60	80
40	ST-5	ST-5	ST-5
50	ST-5	ST-5	ST-8
60	ST-8	ST-8	ST-8
80	ST-8	ST-8	ST-12
120	ST-12	ST-12	ST-25V

Max. Temp. Setting 150°F

Water Heater* Size (gals.)	Static Supply Pressure (psi)**		
	40	60	80
40	ST-8	ST-8	ST-8
50	ST-8	ST-8	ST-12
60	ST-8	ST-12	ST-25V
80	ST-12	ST-25V	ST-25V
120	ST-25V	ST-25V	ST-25V

Max. Temp. Setting 180°F

Sizing charts based on:

- Precharge matched to incoming supply pressure prior to installation
- Incoming water temperature 40°F
- 150psi T & P safety relief valve

AMTROL's Therm-X-Trol® brochure MC#4090 contains precise sizing guidelines for sytems not covered in the above charts.

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