

TECHNICAL BULLETIN

BULLETIN 45

THERMAL EXPANSION

SYMPTOMS	<ul style="list-style-type: none">• Effects are only noticeable after hot water use followed by periods of no water use.• Relief valve drips during any recovery cycle when no hot or cold water is used.• Hot water pipes creak while heater is recovering and all valves are closed.• Tanks or other components of the water supply system fail prematurely.• A metallic creaking noise might actually be heard in the location of the heater as the pressure is relieved and the stretched tank returns to a natural shape.• Faucets drips during any recovery cycle when no hot or cold water is used.• Water surges when a valve is first open and then pressure drops.
CAUSE	<p>The water in a water heating system expands when it is heated and has a greater volume. Since water will not compress (like air), system designers must include provisions for thermal expansion. (Water in a closed tank at 50 psi, when heated just 10 degrees, will reach a pressure of 250 psi).</p> <p>Many water supply systems have check valves at the water meter to prevent any possible contamination of the public water supply by the accidental back-flow of contaminated water into the supply mains. These check valves are often required by code, and some cities are even installing the check valves. They serve a useful purpose. Do not remove them!</p> <p>The use of pressure reducing valves (PRV) is another cause. PRVs are designed to conserve water and prolong fixture life. Many PRVs also act as very effective check valves. Again, do not remove them!</p> <p>Water softeners in the system may also act as back-flow preventers.</p>
TEST	<p>Follow these easy steps to diagnose thermal expansion:</p> <ul style="list-style-type: none">• Turn the heater thermostat all the way down, and install a water pressure gauge with dead hand (AOS part #4798) on the drain valve. Open the drain valve, so the gauge reads system pressure.• Open a hot water tap and allow 15% to 20% of the tanks volume to run out. Shut off the drain valve and make sure that no other fixture in the system, hot or cold, is open. Make sure that outside fixtures, if they are on the same system, are turned off too. Any water leaks or use will make the test meaningless.• Check the water pressure gauge, and turn the pointer so it lines up with the pressure indicating needle. Turn the thermostat back up to its normal position, so the heater cycles on. Watch the pressure gauge.• If the system is closed, the pressure will start to climb steadily and rapidly. A small amount of thermal expansion control may be built into the system because of trapped air pockets or a water hammer arrestor. In that case the pressure will increase slightly, hold steady for a short time and then rapidly increase. The temperature and pressure relief valve (T&P) or PRV should open and release water once the pressure reaches the maximum setting on the valve. The valve will close once the pressure falls below the pressure setting of the valve.

THE FIX

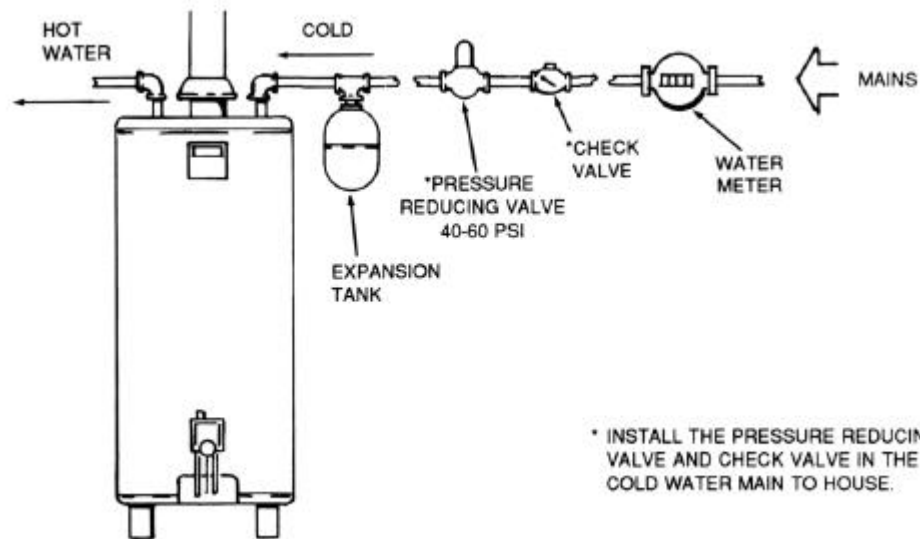
The ideal fix involves the use of a pressure reducing valve if supply pressures are above 60 to 70 psi, and a properly sized expansion tank. The PRV reduces supply pressures to 40 to 60 psi allowing an economically priced and sized expansion tank to be used. The PRV also offers the benefit of saving water and prolonging the life of water flow valves. The PRV is not required if the system already has one or if high supply pressures are desired.

The PRV is installed between the check valve and the water heating system. The expansion tank is installed between the PRV and the water heating system. Follow the manufacturers instructions for installing the expansion tank.

Run the thermal expansion check again. The pressure should increase only slightly then hold steady throughout the recovery cycle. The expanded water is flowing back from the heater and into the pressurized storage bladder of the expansion tank. Air pressure will force this water out of the expansion tank into the supply once usage resumes.

DO NOT DEPEND ON THE T&P VALVE TO HANDLE THERMAL EXPANSION! The T&P valve, according to the makers of those valves, was designed as an emergency relief device only. The T&P could be subject to reduced effectiveness or failure.

FIGURE



WARNING

Thermal expansion of water, if not compensated for in system design, will lead to the early failure of components. These failures are not covered by the manufacturer's warranty, so it is extremely important that everyone be aware of the causes, symptoms and solutions to thermal expansion in a closed water heating system.