

New Water System Brings Added Problem of Thermal Expansion for Homeowners in Small Town

I was recently called to a small city in north-central Kansas. A project that involved replacement of the city's distribution system, service lines and water meter settings had only recently been completed. The city was receiving numerous complaints that there was air in the water system and increased water pressure. The operator and city officials questioned how these problems were possible and what the cause might be.

We discussed what changes might have been made with the new system compared to the prior system. Had any components been changed? With the operator further describing the problems being experienced by some homeowners, I asked, "Did the new project include check valves on the meter settings?" The answer was that check valves were included; the old system did not have check valves on meter settings.

I then asked if homeowners had complained of issues with their hot water heaters such as with leaks. The operator replied in the affirmative. Yes, there had been numerous complaints. Waterlines in one home had burst and flooded a finished basement.

The cause of the problems being experienced by the homeowners was apparent. Excessive water pressure in some homes was not due to air in the lines; it was due to thermal expansion. The installation of a check valve on each meter setting was preventing water from backing into the city's main where the small amount of water can be easily accommodated for.

Water at 55 degrees F expands about two percent when heated to 150 degrees, and this expansion results in more than three quarts of additional volume in a typical 40-gallon water heater or piping system.

Who's at fault?

Is the city at fault with this matter? In my opinion, no, the city is not at fault. In this case the operator is relatively new. This city had to pay for professional

consultants to design and inspect the project. I'm not an engineer – but it's my opinion that the installation of check valves on short, closed plumbing systems is a matter that should have been discussed and reviewed by the engineering firm at the time the system was being designed and when specifications were being prepared for bidding. Thermal expansion is not a new problem! In this case also, the operator had also contacted the consultant several times to explain the problems that some homeowners were having with the excessive pressure.

When a dual-check or check-valve is installed with or without a water meter, the backflow preventer becomes an effective "non-return" barrier, making the homeowner's system "closed". Expanded water cannot find its way back to the city main, so in periods of water heater recovery when there is no hot water drawn, expanded water volume can create a pressure increase until the heater's safety relief valve, usually set at 150 psi, relieves pressure and hot water drains through the relief valve drain.

The first indication of a thermal expansion problem is the phone call from an angry customer because his/her water heater relief valve is continually spilling hot water. The possible liability facing the supplying water system, however, is far more serious than the customer being angry about wasted water. What the customer, the water purveyor, and even many plumbers may not realize is that long before

the 150 psi relief valve pops, dangerous pressures are continually being exerted on the water heater, fittings, fixtures, appliances, and the piping system on a regular basis several times a day.

As I mentioned, thermal expansion is not a new problem, but I believe it is an issue that needs to be revisited and discussed.

Operators, engineers and other training personnel should not assume that everybody understands the problem. Most cities in Kansas do not install check valves on services as they are not required. However, check valves on meter

Water at 55 degrees F expands about two percent when heated to 150 degrees, and this expansion results in more than three quarts of additional volume in a typical 40-gallon water heater or piping system.

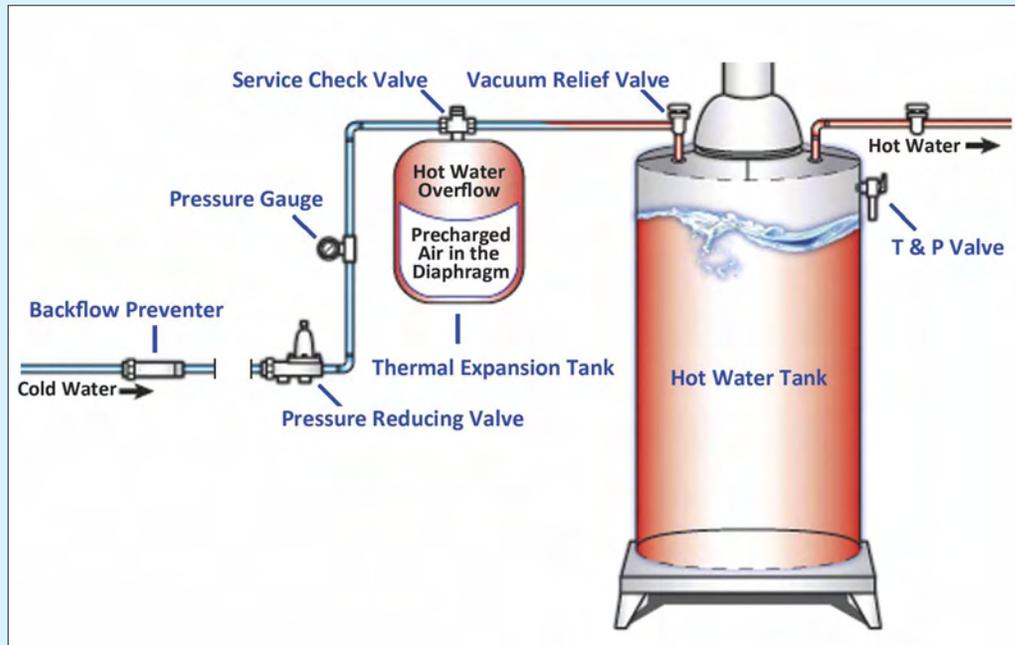
Potential Problems Due to Thermal Expansion

Thermal expansion of water in a closed plumbing system can create a number of annoying and potentially dangerous problems. These include: the build up of unusually high pressure in a system (even when a pressure reducing valve is installed); pressure surges; and the chronic or continuous dripping of a temperature and pressure (T&P) relief valve. In addition, dripping faucets and leaking toilet tank ball cock fill valves are also problematic with thermal expansion.

More serious problems can also occur due to thermal expansion. When dangerous pressures are created in a water heater, internal parts such as the internal flues, fittings or water connections may fail. If a flue collapses it can lead to the potential release of toxic gases, such as carbon monoxide into living areas. Thermal expansion can also lead to a ruptured or distorted hot water heater tank and may void the manufacturer's warranty.

This graphic shows a basic installation where the backflow preventer is

shown close to the water heater. The installation may or may not have a pressure reducing valve. The installation of a pressure reducing valve will not prevent thermal expansion.



settings are very common on rural water systems. The plumbing systems on farmsteads typically have adequate capacity to accommodate for the expanded water. Regardless, if a system decides to install single or dual check valves, then that city or rural water district should notify all customers of the possibility of thermal expansion and they need to make provisions of having expansion tanks installed.

Not all homes will experience problems due to thermal expansion. It depends on the size and length of piping and how "tight" the homeowner's plumbing system is. Homes with copper or steel lines versus PVC or poly lines will be more susceptible to thermal expansion as copper and steel lines will not flex like the newer poly and pex lines will. Some building codes for new homes may require the installation of pressure surge tanks to accommodate the expanded water.

Check valves or dual checks and backflow preventers are not required by the Kansas Department of Health and Environment on residential homes for backflow prevention. Each water system is to have an approved cross connection control program and implement it. However, more and more cities are installing check valves to protect the municipal water supply from backflow contamination.

The water purveyor is not responsible for installing pressure relief tanks in homes. Customers are responsible for the installation of a pressure relief tank. But the water purveyor needs to do its part – which is to help educate homeowners about the devices and the potential for thermal expansion. It would also seem to be some responsibility for the design engineer to discuss potential concerns with the city council or RWD board before finalizing the design of the system.

Water system operators or board/council members who want to learn about thermal expansion are invited to attend a training session on cross connection control. KRWA sponsors numerous such classes across Kansas annually. Check out KRWA's training calendar at www.krwa.net. There is no charge to attend the first day or two for information on the subject.

Greg Metz joined KRWA as a Technical Assistant in July 2009. He previously worked at the city of Washington for 13 years where he was involved in city utilities including the power plant, streets, water and wastewater. He also served as purchasing agent for those utilities.

