

Water Heater Relief Valves

By BRUCE BARKER, ACI

ONCE AGAIN, The Word invites you to travel into the dark realm of subjects that sometimes are misunderstood by home inspectors. The Word hopes you will find this trip informative and maybe a little entertaining.

The Word's subject this month is **water heater relief valves**. The Word finds this subject interesting because best practices for inspecting these important safety devices are not widely agreed upon. Note that the subject is water heater relief valves. Relief valves for boilers are similar, but are not included in this discussion.

Remember when reading all The Word columns that we're discussing general principles. Something you see in the field isn't always wrong just because it doesn't comply with a general principle. Local building codes and their interpretations, manufacturer's instructions and engineered designs trump general principles.

Why relief valves?

Many of us have seen videos where an exploding water heater becomes a rocket and shoots through the roof. If you've been on a remote island and haven't seen one, just look on the Internet. They are easy to find and quite spectacular. The water heater's thermostat should prevent this disastrous experiment in rocket science, but if it doesn't, the relief valve is the safety device that prevents an unintended launch.

The fuel for this rocketry begins with water's tendency to expand when heated, and accelerates when the tank bursts and superheated water

changes into steam, expanding in volume up to 1,600 times. Forty gallons of tap-temperature water heated to around 120° F will expand by around ½ gallon and will expand more as the temperature increases. This thermal expansion places a tremendous amount of stress on a confined vessel such as a water heater tank. The stress will be released with explosive force unless another means is available to release that stress. Safely releasing that stress is the job of a relief valve.

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Thermal expansion devices

Before we leave the subject of water's thermal expansion characteristics, let's briefly detour into thermal expansion devices, a cousin of relief valves. When water in the water heater tank is heated to normal operating temperature, that expanded water has to go somewhere; so, where does it go?

One place the expanded water can go is through the relief valve. So, when you see water at the relief valve discharge pipe, it may not indicate a defective relief valve. The relief valve may be doing exactly what it should be doing, releasing stress in the water heater tank. Further evaluation is necessary to determine if the problem really is a defective relief valve or if some problem with the water heater is causing excessive pressure or temperature in the tank.

Most of the time, the expanded water goes back into the cold-water supply pipes because the cold water supply usually is an open system that can accommodate the ebb and flow of expanding and contracting water volume in water heater tanks. But devices such as check-valves, backflow preventers, some pressure reducers, and some water meters may "close" the water supply system and prevent this ebb and flow. This leaves the expanded water with no place to go. As the water in the water heater is heated and expands, the increased pressure in the system may exceed the pressure capacity at the weakest point in the system; if so, a water leak might occur.

Murphy's Law states that this leak may occur at the washing machine supply hoses (a common weak spot) and it may occur when the occupants are on vacation. The resulting flood won't be pretty. Another common weak spot is a toilet fill valve; so, thermal expansion can be the cause of premature fill-valve failure.

A thermal expansion device is required when the cold-water supply system is closed. Sometimes, the device is located on the cold-

water supply pipe near the water heater. These devices include a tank that allows water to enter and leave the tank as required (see *Photo 1*) and a pressure relief valve that opens when thermal expansion causes excess backpressure (see *Photo 2*). Sometimes, the device is part of the fill valve in the toilet closest to the water heater. These devices usually are set to open at a lower pressure than the water heater relief valve.

When a relief valve is required

The International Residential Code (IRC) requires all appliances that heat water or store hot water be protected by both a temperature and a pressure relief valve (or a combination TPR valve). This obviously applies to storage tank water heaters, but these are not the only appliances that heat water. The requirements for some of these other water-heating appliances can be a bit confusing.

The manufacturer's installation instructions for widely used gas-fired demand (tankless) water heaters call for only a pressure relief valve (although a TPR valve sometimes is installed). The manufacturer's installation instructions for widely used electric-demand water heaters do not call for installation of any relief valve and do not even provide a place to install a relief valve.

Swimming pool water heaters are required (by the IRC) to be protected by a temperature relief valve and gas-fired pool heaters should have one (although a TPR valve usually is installed). But *The Word* has seen several models of heat pump pool heaters that do not have a place to install a relief valve and the installation instructions for a widely used manufacturer of pool heat pumps do not call for a relief valve.

The bottom line on whether water heater relief valves are required is this: always for storage tank water heaters (fuel-fired and electric), usually for fuel-fired demand water heaters; consult manufacturer's instructions for electric-demand water heaters.

Inspection standard

The ASHI Standards of Practice (SoP) specifically exclude testing water heater relief valves (see clause 6.2.C). Other standards might have other provisions, so be sure to comply with any standard that applies to you.



Photo 1: A thermal expansion tank
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Photo 2: A thermal expansion valve
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A reason for this exclusion is the fear that the valve may leak if tested and that we might be blamed for any damage that occurs. Well, if the valve leaks or otherwise malfunctions when tested, then there's a reportable deficiency and further evaluation is required. Water heater relief valve discharge pipes should terminate in a location where damage or injury will not occur if the valve opens. Such locations include a pan under the water heater, a floor drain or (in warm climates) to the outdoors. If the relief valve terminates in a location where damage or injury could occur, that's another reportable deficiency.

The *Word* believes that the SoP definitions of inspect and normal operating controls would impose on us a duty to operate water heater relief test valves. The clause 6.2.C exclusion gives us a choice about whether to operate water heater relief test valves based on conditions in the field. The *Word* believes that we should exceed current standards and operate these important safety devices when practical, but for those who disagree, see the disclaimer at the end of every *The Word*.

That (usually) yellow tag

Have you ever read the (usually) yellow tag that should be attached to the water heater relief valve? It contains some interesting informa-



Photo 3

This sensor separated when it was removed for the recommended periodic inspection by a licensed plumber. It was installed in August of 2008 and replaced in January of 2012.

tion about which you and your client should be aware.

The water heater relief valve test lever is intended for homeowner use and the homeowner should operate it at least annually. Minerals in the water can clog the valve and can adhere to the sensor, both of which can render the relief valve inoperative.

Now, here's a manufacturer's recommendation that *The Word* didn't know until Ned Towle brought it to *The Word's* attention (thanks, Ned). A licensed plumber should remove and inspect the valve at least every three years. Aggressive or mineral-laden water can damage the valve, rendering it inoperative in a way that simply operating the test lever may not reveal. See *Photo 3*. The *Word* recommends including these testing and inspection recommendations as information in your reports. ▶▶

Installation requirements

Here are answers to some common areas of confusion about relief valve installation requirements.

• **Is PVC OK as the discharge pipe?**

Yes, in manufactured homes. Usually no in site-built homes unless the PVC is labeled for use as a TPR discharge pipe.

• **May more than one appliance be connected to the discharge pipe?**

No.

• **May the discharge pipe be connected directly to the drainage system?**

No, it must have an air gap (usually at least 1½ inches) at the termination point, regardless of how the discharge pipe is terminated.

• **Are flexible connectors allowed as discharge pipes?**

No. Flexible connectors are not one of the water distribution pipes listed in the IRC and their diameter is less than the ¾-inch opening of most relief valves.

Remember that local interpretation can alter these general guidelines.

The relief valve sensor should extend into the top six inches of the tank. This usually isn't a problem unless the valve is installed through a fitting or other configuration between the valve and the tank that increases the distance between the relief valve and the tank. The valve's label should state the sensor's length. A small fitting, an inch or so, may be OK. You may want to call for evaluation if the label is absent or if you aren't sure the sensor extends far enough into the tank.

The Bottom Line

Water heater rocketry is a very rare occurrence, but that's to a large extent because of relief valves. Perhaps now you have a little more

respect for these important safety devices.

Memo to Poseidon: The Word does not reside on Mt. Olympus (just at its base) and welcomes other viewpoints. Send your lightning bolts or emails to Bruce@DreamHomeConsultants.com. The thoughts contained herein are those of The Word. They are not ASHI standards or policies. ■



Bruce Barker operates Dream Home Consultants. He has been building and inspecting homes since 1987. He is the author of "Everybody's Building Code" and currently serves as chair of the ASHI Standards Committee. Bruce will be presenting a session called "Code Quiz" at InspectionWorld Las Vegas, during which the audience will be encouraged to actively participate and have some fun. To read more of Barker's articles, go to www.dreamhomeconsultants.com.



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