

The Bomb in Your Home Needs Your Attention!

By Stephen Ruback, Professional Inspector [TREC license 6030]

page 1 of 2

Not the icon of doom that shows up on your computer at the worst possible time – this is the real thing. You just haven't recognized it because it's been disguised as a water heater.

Remember that cylindrical thing hidden away in some corner, closet or attic that magically converts the cool, incoming water to a nice hot bath or shower? That's it. Some folks even have two of them.

Let's think a little smaller for a moment. When you heat a few cups of water in a pot, or teakettle. Once that water is boiling, what could happen if it spilled? Could that be dangerous or harmful? Of course.

Now, enlarge the picture. Water is rather compact, weighing in at about 8.2 pounds per gallon. If you convert that measly single gallon of water to a gas [steam], it will insist on taking up more than 1250 gallons of space. Your water heater tank doesn't have anywhere near that kind of room inside, and it's already busy, holding 40 or 50 gallons of water. Turning all 40 gallons into steam would demand more than 50,000 gallons of space. This could be a problem.

What would happen if the thermostat died and the heater went into full-time on mode? A typical electric water heater would reach full boiling temperature in little more than two hours. A typical gas heater would reach boiling temperature in less than an hour.

Let's look briefly at how big a problem that might be. Just for illustration, consider one gallon of water in a two gallon super strong, sealed tank. That gives a whole gallon of air space to play with. Converting that gallon of water into steam, will raise the pressure in that tank to more than 18 thousand psi. [pounds per square inch].

Typical water heater tanks are claimed to withstand as much as 150 psi. A significant portion of that pressure allowance is taken up with normal water pressure which typically runs more than 50 psi, but it gets even more interesting.

A common water heater tank size is 50 gallons, so the pressure in that one gallon air space, at boiling, would rise to more than 900,000 psi, if the tank were strong enough. It would have to be a really super strong tank to hold that kind of pressure. Better than that – there's no air space at all in your water heater. That means the pressure potential is infinite, but lets just say that it's greater than trillions of pounds per square inch! No tank in the known universe could hold back that kind of pressure. In short, if the thermostat gets tired, falls asleep, quits or dies on the job, your water heater will keep on heating – without other intervention – quickly becoming a 300 - 400 pound bomb.

Water heaters do blow up – spectacularly! They can make like a rocket and land down the street. They can level a house. It's happened a lot. The death toll is real. It's not a pretty thought. That's why an enterprising fellow, back in the 40's invented a low cost device to prevent these catastrophes. It's called a Temperature & Pressure [or Pressure/Temperature] relief valve. That's your T&P or PT valve for short. If your thermostat fails and the PT valve doesn't do its job or is improperly installed, we are back to square one with a very real, live bomb in the house. It's because of the PT valves, and short water heater life spans, that we don't hear much in the news about water heater explosions these days.

Thermostats are sealed units with no user serviceable parts inside. We are at their mercy, but PT valves are a slightly different story. They can be checked for proper installation and routinely checked for operation

A PT valve is required for each water heater, but they are not always installed properly, and they can die too. Yours is calling to you at this very moment.

Their function is to automatically open and relieve the temperature and pressure in an overheat situation, thus avoiding an explosion.

That means, in an emergency

blow, they will be spewing boiling water full blast. As the water heater keeps heating, they will keep spewing. Wouldn't it be handy if that boiling water was directed outside to a visible location that didn't cause damage? Well, they are supposed to be, but not all are. You may wish to check yours.

The valve is sized to discharge enough hot water from the tank, to keep the tank from overheating by pulling in cool water from the supply line. If the pipe is blocked, restricted or too small, we're back to the bomb. The discharge pipe for the PT valve is not supposed to be smaller than the size of the opening on the valve [typically 3/4 copper or galvanized pipe]. If it is, your flow is restricted. Elbows restrict flow. More than four, and you and your family are definitely at risk. Uphill flow allows water to collect in the pipe. When it blows, that water can act like a plug – kaboom. Keep that drain line running down, all the way to the end.

Your PT valve should have a dedicated drain line. That is a line not connected to the drip pan or any other line, and going directly to a safe and visible location [preferably outside]. Any deviation from this can cause serious problems.

For it to work, the temperature sensor inside must extend into the tank several inches. When it is installed in a pipe outside of the tank, it won't work. Be sure yours is installed in the right place for your tank. That's directly on top, or on the side of the water tank. If your water heater is so old it doesn't have a PT valve port, replace it, real soon.

PT valves get old and die, sometimes before the water heater dies. The only way to know if one works is to test it. That's why there's a little lever on top, so you can open it briefly to verify it is not stuck.

The valve manufacturer suggests, in rather large print, the valve should be tested at least once a year. It's a simple thing to do. Be sure the drain line for your PT valve is directed to a safe place, and lift the lever for a few seconds.

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page 2 of 2

Observe the water flow and return the lever to its original position. If it works, you're OK. If it won't open, or won't close fully, you have a bomb waiting to happen. Any malfunction calls for replacement of the valve.

When you do your weekly or monthly home maintenance survey – you do that, right? Every time you walk by the PT valve outlet, notice whether it is dribbling water. If it does, it's time for replacement, as your bomb is almost ready.

Other Common Concerns

Water heaters in garages should be installed with their ignition sources at least 18 inches above the floor. That's because cars get parked in garages. Cars carry gasoline, which is very flammable. Cars can leak gasoline. Gasoline vapors are heavier than air, so they would gather at floor level. Most garages are open enough to allow some of the vapor to escape [from a small leak], hence the 18 inch height. Does this apply to electric heaters too? You bet. Switches generate sparks, and the electric thermostat operates a switch.

Gas water heaters offer additional dangers. The hot combustion gasses are supposed to be directed outside by the flue pipe. Right on the side of each section of the pipe it says keep at least one inch space from flammable materials. Does wood burn? Does plastic burn? Of course, so make sure nothing is too close to your flue pipe – like rafters, roofing materials, foam insulated pipes or plastic ducts.

If your flue pipe doesn't specify a clearance distance, it is probably single wall type that gets even hotter and requires even more space. Such flue pipes are outmoded and considered unsafe. Schedule replacement as soon as possible.

Gas water heaters actually have a fire in the bottom to heat the water. This fire requires lots of air to support the combustion. Inadequate combustion air causes generation of carbon monoxide.

While any exhaust fumes are not

good to breathe, carbon monoxide kills, quietly and without smell. Early trouble signs are nausea and headaches. Be sure your water heater has a generous supply of outside air for combustion, and that the flue is fully vented to the outside. Those water heaters tucked into a closet or back room suck large amounts of air from your living space and depend on poorly sealed house construction for that air. In newer, tighter, energy efficient construction, inside gas water heaters must have a dependable source of combustion air from the outside.

Typical life expectancy for gas water heaters is about ten years, a little more for electric. The most common failure mode is a leak. When was the last time you even looked at your water heater? Unless it's in the garage, it is supposed to have a drip pan under it, with at least a 1 inch diameter drain line, directed to a visible location [preferably outside]. That way, when [not if] it leaks, you may have a visible warning before the flood. Is your drip pan bigger than the diameter of the heater to catch all probable leaks? It is clear of insulation and other debris that could plug the drain? Most are not. If your water heater is in your garage and you have a bunch of stuff stored in your garage, you might appreciate having a drip pan under that water heater too.

Where is your shut off valve? When the water heater leaks, it would be handy to be able to shut off the hot water line and still be able to use the cold facilities. Be sure you can get to that valve. Not all are accessible. Even worse, some have been installed on the output side which turns off the hot water flow to the house, but does not stop the water coming into the water heater – oops.

Corroded fittings, valves and joints indicate a problem waiting to happen. It's usually more convenient to have these taken care of before they spring into emergency mode. Most plumbing

adventures can be avoided with proper preparation, vigilance and timely maintenance. Leaks never really fix themselves in the long run.

That brings up a related question. Where is your main water shut off valve? Can you quickly and easily turn off your water supply before your house is flooded, when you have an emergency leak? There is supposed to be a service supply valve for every house, but a surprisingly large number do not have one. Just because you have one doesn't mean it works. It's simple to test. Close the main service valve, then open one faucet and see if the water stops flowing. If it doesn't, you have a problem.

If your only shutoff valve is at the meter in one of those cute plastic boxes near the curb, think about how much damage could be caused by a runaway leak when it takes hours for the water department to respond to your call.

In the case of water heaters, and plumbing in general, "out of sight is out of mind" may not be in your best interest.

By the way, new homes always need an inspection too. Be sure of what you are buying, and avoid ugly surprises with a thorough home inspection, *before* you close the deal. You will save money and trouble in the long run.

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