

Water Heater Safety Valve

Because they are usually out of sight and out of mind, water heaters are often ignored, at least until they have problems. This appliance rarely gets any attention, even though several items of periodic maintenance are recommended.

However, there is one particular safety check that is so important, it merits its own topic. A water heater safety valve prevents catastrophic explosions such as shown in the photo at right. **It is essential that the water heater safety valve be tested at least once per year.**

You should have a safety valve in your water heating system whether it is heated by gas or electricity, whether with a tank or tankless. It is universally required by North American plumbing codes, so this topic applies to every dwelling.

Safety valves on water heater tanks will be presented here, but the principles also apply to tankless water heaters.



The Mythbusters guys on the Discovery Channel demonstrated the very real possibility of a water heater explosion when safety features are disabled and temperature control has run away. The dramatic result of the heater turning into a rocket and destroying the structure can be viewed at:

<http://www.youtube.com/watch?v=pu3FwgIHsQA>

Water Heater Safety Valve

Overview

In a closed plumbing system, the piping and water heater tank operate at the pressure of the utility water supply, which should be in the range of 50-70 pounds per square inch (~60psi) or so.

The supply pressure can spike if an upstream pressure regulator fails.

Pressure in the tank and piping will also increase as the water is heated (basic physics; pressure and temperature are proportional).

Water heater tanks and piping are designed to be safely pressurized up to a certain level. Above this, they are in danger of exploding violently, similar to a balloon when it is over-inflated.

In addition to concerns about pressure, the heater can superheat the water in the unlikely event that it fails to control temperature and the safety limit device also fails. In this case the expansive power of steam significantly increases the potential for damage.

Of course, pressure and temperature go hand in hand, so both units are of concern. For this reason the required safety valve is a dual-action device, commonly referred to as a **temperature pressure relief (TPR or T&P) valve**. It opens to discharge water when either the water pressure increases beyond a safe value (typically 150psi), or the water temperature approaches a boiling point (typically 210 F).

Water Heater Safety Valve

Overview

The safety valve can prevent big problems if the water supply pressure suddenly increases or water temperature runs away. However, the TPR valve, like most plumbing in your house, is subject to buildup of corrosion and minerals. If the safety valve gets coated or contaminated, it may not open at the desired temperature or pressure should the need arise, or it may not open at all. Without TPR valve maintenance and inspection, you have an unreliable safety valve, and this may be little better than having no valve at all.

At the top or side of your water heater there should be a brass valve with a lever on it. Identified by a metal tag and perhaps an instructional label, this TPR valve should also have a pipe connected to the outside of the house, or somewhere that hot water can safely be discharged.



**Discharge
(Drain) Line**

TPR Valve



**Read through the procedure entirely
before testing the TPR valve.**

Water Heater Safety Valve

Valve Location

Do not assume the TPR valve is properly installed. Safety valve location is important, as are features of the discharge line.

Plumbers and homeowners have been known to install the TPR valve in the *wrong location*. The safety valve temperature probe must project into the water near the top of the tank.

It can be horizontally or vertically oriented (top or side) as long as the tank fitting is within the top 6" of the tank. Follow the water heater manufacturer's instructions for proper TPR valve location; there will almost always be a dedicated $\frac{3}{4}$ " female pipe thread port for the safety valve.



TPR Valve on Top



Tankless Heater TPR Valve



TPR Valve on Side

Water Heater Safety Valve

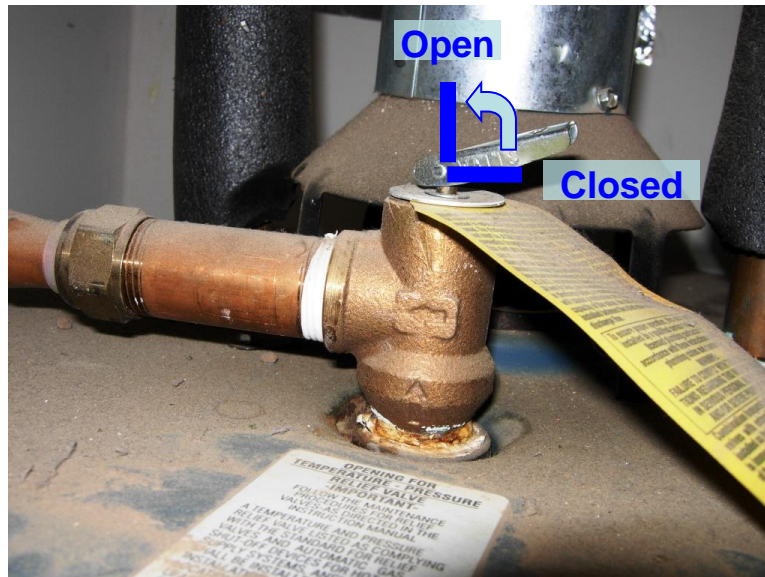
Valve Testing

You should test the TPR (T&P) valve at least once a year and observe that hot water flows out the safety drain.



Keep people away from outlet pipe as splashing hot water may scald !

Testing the safety valve is quite simple. Lift the lever to open the valve and lower the lever to close. Exercise the test lever a few times to flush out junk that might be built up around the valve seat.



Safety valve discharge pipe (drain)

One typical safety drain shown. Many variations possible.

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Valve Testing

Because of debris, the safety valve may not close again. In this case, try tapping on the stem with a wrench and cycling the test lever a few times to dislodge any debris that prevent the valve from seating closed. If this does not work, the safety valve must be replaced.

Be prepared to replace the TPR valve whenever it is tested.

Because of this risk, test the valve at a sensible time. **Do not test the TPR valve on a Saturday night** when the stores are closed and plumbers are extra expensive. If you plan to replace a defective safety valve yourself, it is a good idea to have a replacement on hand before you test it. They are not expensive (typically less than \$15) and fairly easy to replace.

If it has been a few years since the TPR valve was tested, consider replacing it. Without periodic exercise, the valve is questionably reliable.

If the safety valve does not open when you lift the lever, or you can't easily move the lever, it should definitely be replaced.

Get a feel for lever resistance by exercising a brand new TPR valve in a home improvement or hardware store.

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Valve Testing

Note that when you move the test lever on a TPR valve, you are only cycling the discharge mechanism of the safety valve. Without removing the safety valve and putting it in a special test fixture, there is no way to verify actual pressure and temperature relief operation. Doing so is impractical, and the trigger mechanisms are highly reliable. Therefore it is deemed sufficient by safety testing agencies to simply toggle the discharge mechanism.

In addition to cycling the safety valve lever at least once a year, TPR valve manufacturers also recommend removal and inspection of the valve every three years. Inspection of the TPR valve is somewhat subjective, so you may want to hire a professional to do this.

Basically, it involves removing the valve and visually examining the discharge mechanism and temperature probe for unusual wear or buildup. It also involves the free movement of the discharge valve with the test lever.

Examples of potential defects are shown on the next page, along with photos showing how new valves appear.

If you are handy, save the trouble of inspecting the TPR valve and just install a new one. It's much cheaper than hiring a plumber to inspect the safety valve.

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Valve Testing



Old TPR valve has significant mineralization and corrosion around valve seat. It does not open properly; neither does it re-seal well.



New TPR valve has solid metal and no buildup or corrosion



Old TPR valve has significant mineralization over temperature probe. It may open at a higher temperature.



New TPR valve has fresh, clean temperature probe which will operate valve at desired setpoint.

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Discharge Pipe

The TPR valve is the most critical item in a water heater safety system, but the discharge pipe is also important.

The primary concern about the discharge pipe is that it is unobstructed.



Never plug, cap or otherwise block the safety valve discharge pipe !

Some homeowners “fix” dripping water from their safety valve discharge pipe by blocking the drain line. They don’t realize that *this defeats a very important safety mechanism*. A dripping discharge pipe means the TPR valve is opening and needs attention. If temperature and pressure are normal, this means the valve is defective and must be replaced.

Other requirements for the discharge pipe:

- Routed to slope down only (never up) to prevent discharged water from remaining at valve outlet
- Must not be too small; should correspond to valve outlet size (typically 3/4”)
- Material approved for hot water (not normal PVC or soft plastic); copper or steel preferred
- Must not tie into any other drain pipes
- Short as practical with minimal bends
- Avoid threaded fittings which can easily be plugged or capped (especially at outlet)
- Must not have any valves or other devices in line which can block flow
- End pointed toward floor drain or ground outdoors at approximately 6-12” above grade

Water Heater Safety Valve

TPR Valve Replacement

There are a number of reasons to replace the safety valve, as discussed on page 6. Occasionally, the TPR (T&P) valve simply opens for no apparent reason and will not close again. Once you have determined that there is no real problem (water is not too hot and pressure is not too high), replacement is in order.

First identify the valve appropriate to your water heater. There are two commonly available; one with a short $\frac{3}{4}$ " pipe stub and one with a longer one, depending on tank body well depth. Obtain a replacement at a plumbing supply shop, home improvement center or hardware store.

Replacement is fairly straightforward but there are some basic rules to follow to prevent injury or damage.

A general procedure to replace a water heater TPR valve follows.

A typical gas tank water heater safety valve is presented. Variations in heater, TPR valve and discharge pipe are expected.

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TPR Valve Replacement

1. Shut off power to water heater (electric) or move control to PILOT position (gas).



2. Run hot water from nearby faucet until it becomes comfortably cool. This may take several minutes.



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TPR Valve Replacement

3. Close water supply valve to water heater. Valve location and style will vary, but there should be some sort of valve near the water heater inlet.



4. Disconnect discharge pipe from the TPR valve at the top of water heater. **Use caution as hot water may still be in the line.** Also remove any additional piping from valve.

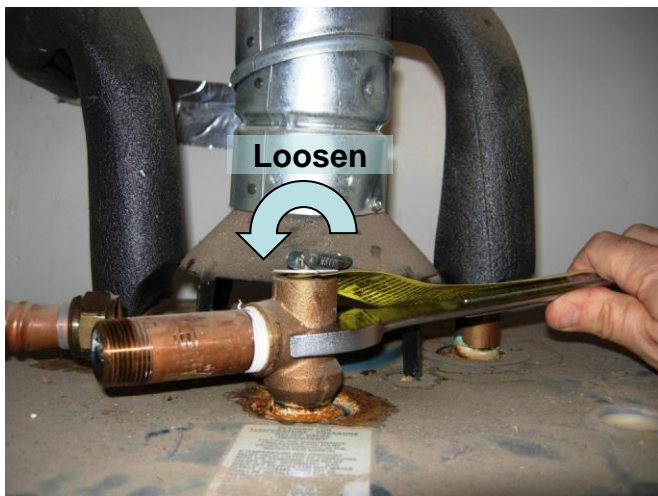


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TPR Valve Replacement

5. Using large wrench, loosen TPR valve from water heater. Valve may be stuck hard, so a large wrench and perhaps a cheater lever will be needed to break it free. Hammering on the wrench end also helps to get it started.

Do not unscrew valve yet, just get it loose. As with all pipe threads, twist counter-clockwise to loosen.



6. Attach garden hose to water heater drain valve and route to floor drain or outdoors. Hose must be below water heater drain valve. Open drain valve and release enough water to get level in tank below safety valve port. Open TPR valve or hot water faucet if needed to drain water. Water may leak from the drain valve stem.

Close drain valve when done and remove hose.



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TPR Valve Replacement

7. Unscrew old or defective TPR valve from water heater and remove. Compare it with new replacement valve to ensure that they have same dimensions and features.



Comparison
Note: Longer replacement
OK per instructions as long as probe tip is within 6" of the top of the tank.

8. Apply Teflon tape to threads of new TPR valve, if not done already. Install replacement valve in same location as old valve. Tighten by hand, then as securely as possible with large wrench. Make sure valve outlet is pointed towards discharge pipe as before.



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TPR Valve Replacement

9. Open water supply valve to heater. Wait 5-10 minutes and check for leaks around the safety valve threads. If there are leaks, try to tighten TPR valve one full turn or remove and repair damaged threads.



10. Attach any needed piping to valve, then reconnect discharge (drain) line.



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TPR Valve Replacement

11. Toggle new safety valve test lever and verify that water discharges out drain pipe. It must also close properly (no seeping out drain). Also check for leaks at the discharge outlet to drain pipe.



12. Restore power to electric heater or return gas heater control to ON position. You are finished and everything is back to normal. Just wait for the water to heat up and verify that the TPR valve does not discharge hot water.



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Water Heater Maintenance

Water heater manufacturers recommend several other maintenance items to ensure safety, reliability and longevity of the appliance. Refer to the HandyHomeowner topic index for a [Water Heater Maintenance](#) presentation.

Web links to water heater safety valves and related issues

<http://www.fsboadvertisingservice.com/home-inspector-5.htm>

Professional Engineer's article

<http://www.checkthishouse.com/water-heater-tpr-safety-valve.html>

Covers aspects of TPR valve

<http://www.factsfacts.com/MyHomeRepair/PressureRelief.htm>

TPR valves and water pressure

<http://www.nachi.org/blog/2009/07/tpr-valve-importance>

Importance of TPR valve