Intro to Electric Water Heaters Training Flyer

One type of product we sell a lot of is water heaters. Because of that it is important we all have at least a basic understanding of the how they work and the main components used. There are two main types of water heaters: Gas and Electric. This flyer is intended to serve as a brief overview of a typical electric water heater and how it works.

This week's flyer is a follow up to the Gas Water Heater Training flyer. You are encouraged to read that one in addition to this.

The Tank:

Both electric and gas water heaters have similar tanks. The inner shell of a water heater is a heavy metal tank containing a glass lining. The glass lining is to stop the metal portion of the tank from developing rust. They typically hold 40 to 60 gallons of hot water at around 50 to 100 pounds per square inch (PSI). The exterior of the tank is covered in an insulating material such as polyurethane foam and over that is a decorative outer shell and possibly an additional insulating blanket.

What is a Water Heater Element?

An element is a part used to heat water in electric style water heaters. First, a metal element (pictured below) is submerged in the water within the tank. Next an electric current is run through the metal alloy and heat is given of as a result.

In almost all residential style electrics there will be two elements; an element towards the top of the heater and one towards the bottom. These are regulated by two separate thermostats, an upper and a lower. The elements do not run simultaneously. They alternate between top and bottom. There are also smaller 'utility' style water heaters with a single element but these are sold less frequently.

Electric water heaters elements are manufactured in various wattage's (such as light bulbs.) The popular style today is a screw-in version, but a four bolt flange style is also very common. The traditional residential heating element is 4500 watts/240 volts.

Common Elements

Upper & Lower Thermostat Kit

What is the Control Circuit?

The standard control circuit consists of a high limit control switch with a reset button, upper thermostat, lower thermostat, two heating elements, and wires. The upper thermostat first sends electrical energy to the upper element until the water temperature in the upper third of the tank reaches the thermostat setting. Power is then transferred to the lower element until the remaining water reaches the lower thermostat setting.

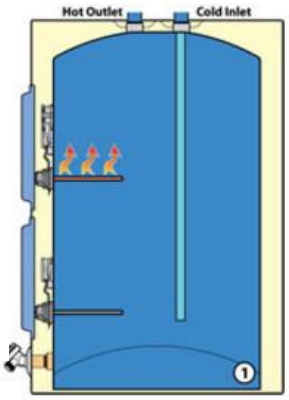
If the water temperature exceeds 170°F, the high limit control switch will trip, shutting off power to the elements.

Single element water heaters will have one element mounted at the bottom of the tank, controlled by a single thermostat and high limit switch.

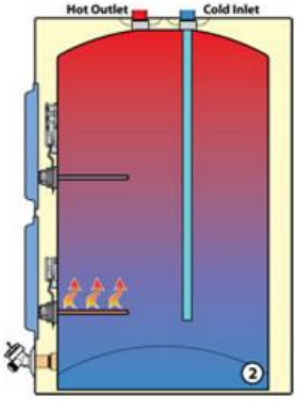
How does an Electric water heater work?

Below is a step by step walk through of how the typical electric water heater works when there is a call for hot water in a home for a typical residential heater.

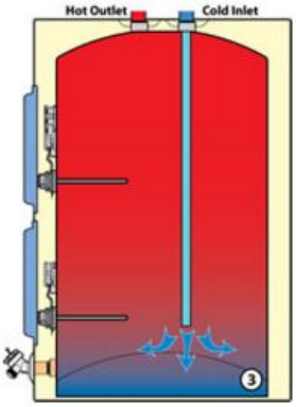
1. When power is initially turned on to the unit, the upper element is energized and heats the water in the upper third of the tank.



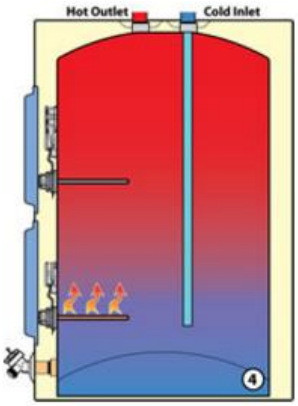
2. When the upper third of the tank is heated to the temperature set on the upper thermostat, power is switched to the lower heating element. The lower element continues to heat until the water temperature in the lower portion of the tank is heated to the lower thermostat setting.



3. As hot water is drawn from the top of the tank, the dip tube delivers cold water to the bottom of the tank.



4. Eventually the cold water mixes with the hot, lowering the temperature to below the lower thermostat setting and the bottom element is energized. If enough water is drawn to cool the upper third of the tank, the upper thermostat will send power to the upper element first. When the upper third of the tank is heated, power will again be switched to the lower element.



Thermal expansion will occur as the water rises in temperature. Please see the Expansion Tank Flyer for more information on that topic.

Anode Rods:

There is also something called an anode rod inside the tank. It is a metal rod made of magnesium or aluminum that's formed around a steel core wire. They are designed to attract corrosive elements in the water, thereby diminishing corrosion in the possible vulnerable small sections of exposed steel in the liner.

Next Steps and a Couple Questions:

This concludes the main portion of this training flyer. There is some additional information on the next page for those that would like to learn more about elements. The video below details the checking for a bad element in a Bradford White.
https://www.youtube.com/watch?v=ucGXuzJUb6k

TRUE or FALSE: The lower element is typically turned on first.
TRUE or FALSE: Bradford White has a Trouble Shooting Phone line that is open 24/7.

Supplemental Section for those who want to learn more:

Trouble Shooting:

Lee & Bradford White provide a few great options for trouble shooting and diagnosing issues with a water heater. Below are the top three:

- A customer can call one of our Branches and talk to one of our Inside Sales Team Members.
- They can also go to the Electric Water Heater Trouble Shooting Page on the Bradford White website. There are many great resources available there.
    - http://www.bradfordwhite.com/troubleshooting
- Bradford White also has a Technical Service Help Desk Phone line available 24 hours a day, 7 days a week.
    - 800-334-3393

What can go wrong with an Element?

Eventually, all heating elements (like light bulbs) will burn out. There are various things that could cause this but the main three are age, sediment build-up, and dryfire.

Older elements may burn out due to ***age*** or, more often, ***sediment build up*** from water conditions. The sediment encrusts the element blades and basically acts as insulation around the element. This prevents the heat from being transferred to the water and the element overheats and burns out. This happens to the bottom element more frequently than the top because the sediment settling to the bottom of the tank. Also, the harder the water conditions, the faster this chemical reaction usually takes place. (*You can learn more about hard water here*.)

The most common reason for element failure on new water heater installations or new element replacements is ***dryfire***. This happens because an installer fails to open a hot water faucet while the heater tank is filling with water and therefore purging or bleeding air from the system. Without opening a faucet an air pocket is left inside the tank. It can also happen if the heater is turned on while no water is in the tank. Elements are designed to burn immersed in water. When burned in an air pocket, elements generate enough heat in thirty to forty seconds to melt the copper used in their construction or cause serious internal damage which will result in complete failure in a very short period of time. Because of the rising of the air pocket this happens to the top element more often.

Another less common cause of occasional element failure can result from high voltage or a power surge generated by the electric utility company or lightning striking power lines putting a “spike” into the electrical system.

Single Loop Style

Double Loop Style