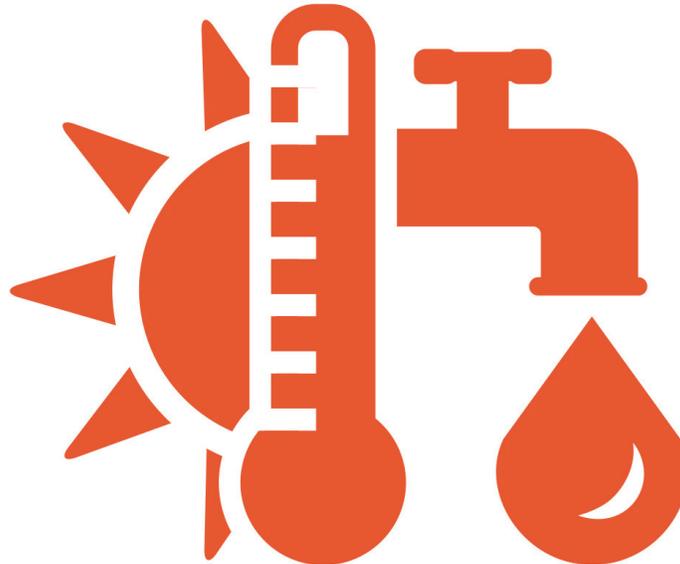


Facilities Fundamentals: **DIY Plumbing Essentials**



**Presented by the Facilities Services
Plumbing & Heating Subunit**

Hosted By:



THE UNIVERSITY OF
TENNESSEE
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FACILITIES SERVICES

Electric Water Heater Repair – Presented by Jeff Miller

What's Inside a Water Heater?

Most residential electric water heaters have two heating elements: one near the top of the tank and one near the bottom. Power enters the top and runs to the high-temperature cutoff switch, and then to the thermostats and elements. The top and bottom elements are controlled by separate thermostats. When the water on the top of the tank is hot, the top element turns off and the lower one heats.

The upper and lower heating elements never come on at the same time. The water inlet to the heater is at the top and runs through a pipe (dip tube) to an area in the lower part of the water heater. This is so you won't have cold water entering where hot water is leaving the heater.

- If your electric hot water heater is slow to heat, runs out of hot water faster than it used to, or doesn't deliver any hot water at all, there's a high chance that simply replacing one or both of the heating elements will solve the problem.
- Before you test the elements, check to make sure the circuit breaker is on and not tripped. Also press the reset button on the high-temperature cutoff located just above the upper thermostat. Resetting either the circuit breaker or the high-temperature cutoff may resolve the problem, but the fact that they were tripped in the first place may indicate an electrical problem. If they trip again, test the heating elements.
- First, find the circuit breaker in the main electrical panel that's labeled for the water heater and switch it off. Then go back to the water heater and test for power with the non-contact voltage detector. Make sure the tester is working by putting the tip into an outlet you know has power. The tester should indicate power by lighting up.
- Now test the wires leading into the water heater. If they're covered by metal conduit, the tester won't read voltage. Instead you'll have to remove the metal thermostat cover on the side of the water heater, pull out the insulation and hold the tester near the wires leading into the top of the high-temperature cutoff switch
- Test both hot wires. Then hold the tester against the metal water heater shell. If the tester doesn't light up, it's safe to test the elements.

Test for a burned-out element:

- Test continuity for a burned-out element: Clip the alligator clamp onto one of the element screws and touch the other screw with the tester probe. If the tester doesn't light, replace the element.
- For this you'll need a continuity tester (\$5 to \$10). It's basically a light bulb and battery with two wires attached. Touching the end of each wire to a continuous circuit will cause the bulb to light. You'll find both of these tools near the electrical testers in any hardware store or home center. You may also find a continuity tester called a "water heater tester" near the replacement elements.
- First perform a continuity test to see if an element is burned out. Electricity won't flow through a burned-out element. Disconnect the wires from the terminal screws. Then connect the alligator clip to one terminal and touch the probe to the other one. The tester should light up, indicating a complete circuit. If there's no light, the element is bad.

Test for a shorted element:

- Test for a Short Circuit: Clip the alligator clip to one of the element screws and touch the tester probe to the element mounting bracket. Repeat on the other screw. If the tester light comes on either time, there's a short. Replace the element.

- Next, test to see if the element is shorted out. If the element has a short, power will flow through the metal tank of the water heater.
- With the wires still disconnected, touch one probe (or connect the alligator clip) to one screw terminal and touch the other tester probe to the element mounting bracket (Photo 3). Repeat the test on the second terminal. If the tester lights on either test, the element has a short; replace it. Test both terminals on both elements.
- Rarely, both elements will test OK, but you're still not getting hot water. Try pushing the button on the "high-temperature cutoff," located just above the upper thermostat. It may solve the problem, but if the problem recurs, check your heating elements.

Replacing an element:

- Drain the water from the tank and unscrew the old element using a heating element wrench. You'll need a long, sturdy Phillips screwdriver to turn the socket. If it won't unscrew, use a cold chisel and hammer to loosen the threads.
- To replace an element, start by draining the tank. With the power still turned off, close the cold-water inlet valve.
- Open the hot water faucet in the kitchen. Then connect a garden hose to the drain valve and open it to drain the tank. For thread-in-type elements like we show here, you'll need a water heater element wrench.
- Then install the new element, using the wrench to tighten it, and reconnect the wires. Close the drain valve and fill the tank before switching on the circuit breaker.
- If testing reveals the elements are good, the thermostat may be faulty. The thermostat testing procedure is complex, so it is recommended simply replacing the thermostat(s). You don't have to drain the tank to replace a thermostat. Simply remove the old thermostat—they're usually held by a metal clip—transfer the wires to the corresponding terminals of the new thermostat, and attach the new thermostat.
- Replace the access cover panel.
- Completely fill the water heater tank with water. This is critical because running electricity to heater elements that are not immersed in water will destroy the heating element.
- Turn power to the water heater back on at the main power panel. Do this by turning on the circuit breaker or fuse powering the heater.

Pressure Relief Valve/Pop off Valve:

- Water heater pressure relief valves are safety devices designed to relieve pressure from a water heater in case of extreme temperature/pressure rise.
- Water expands as it is heated. If a water heater thermostat malfunctions and continues to heat water nonstop the tank would eventually explode if it didn't have a relief valve to relieve the pressure.
- If the primary regulating device fails to by-pass at a set system pressure, the relief valve will open and allow liquid to flow freely.

Annual Maintenance:

- Drain about a quarter of the tank a few times a year to remove sediment and debris. Turn off the cold water supply, hook up a garden hose to the drain valve, and then run into a bucket until the water is clear.

Toilet Repair – Presented by Blaine Fortes

If the toilet isn't filling properly, is overflowing or is running all the time:

Replacing Fill Valve:

- Turn off the water at the shutoff valve and drain the tank by flushing the toilet.
- Place a small container under the supply line before you disconnect it to drain the water. You can also use a rag to get most of the water out of the tank.
- Disconnect the supply line and fill valve nut then remove the fill valve.
- The new fill valve will go on similar to how the old one came off. Adjust the height of the valve so the marking on top of the valve is at least one inch above the overflow tube.
- Place the valve shank onto the fill valve, then insert the fill valve into the tank opening, push down on the valve shank, and tighten the locknut one-half turn beyond hand tight.
- Connect the supply line.
- Inside the tank attach the refill tube (trim if necessary to avoid any kinks) and angle adaptor to the overflow.
- Turn the water back on and allow the tank to fill.
- Adjust the water level by squeezing the adjustment clip and moving the float up or down.

Replacing a Flapper Valve:

- An old toilet flapper can be the cause for a running toilet. Since this part is made of rubber it can get hard and break down over time. Once the plastic is worn out it will not form a tight enough seal to stop the flow of water as it should, from the toilet to the drain.
- The first thing to do is to turn the water to the toilet off. To drain the toilet tank simply flush the toilet after the water is turned off.
- To remove the old toilet flapper, first unhook the chain from the toilet handle rod. Next pull each side, or ear, of the flapper out to unhook it from the flush valve.
- The most common toilet configuration has the flapper attached by the ears on the sides of the flush valve. If this is how your toilet is built you will need to cut off the ring on the back of the flapper.
- If your fill valve doesn't have the side hooks for the flapper you will need to use the ring to slide the flapper into place.
- Put the new flapper into place and hook each ear onto the flush valve.
- Connect the flapper chain onto the toilet handle rod. Make any necessary adjustments to the chain. It needs to be long enough to allow the flapper to sit firmly in place but not so long that it gets caught under the flapper as the water rushes out.
- Turn the water back on and test by flushing a couple of times.

Installing New Handle:

- Toilet handles install similarly to the way the old ones are removed.
- Push the new handle's stem through the hole on the side of the toilet tank.
- Slide the washer over the handle's stem and screw the nut back into place. Remember that it threads in reverse; screw it on counterclockwise to tighten it.
- Lift up the toilet lever and push its end down through the hole at the end of the handle's stem.

Unclogging a Toilet – Presented by Robby Huggins

Using a Plunger:

- Turn off the water at the valve, usually under the toilet tank. Before using the plunger, turn off the water to stop the toilet from overflowing.
- Cover the drain hole with the plunger, making sure there's water coming up at least halfway up the rubber cup on the plunger.
- Push the plunger up and down without breaking the seal. Push the plunger down until it touches the drain and then pull up sharply, but not enough to break the suction. Repeat this a couple of times.
- Warning: If you used bleach or other chemical on the clog first, don't plunge the drain without wearing safety glasses. Hot water is sometimes more effective.
- If there's not enough water in the bowl, pour some in. Be sure to stand the plunger upright over the drain. Following both of these tips ensures a tight seal.
- Hopefully, when you release the suction on the drain the clog should be dislodged releasing the water.

Using an Auger:

- Place the auger into the drain and feed it through the pipe until it reaches the clog. Rotate the handle to break up the clog.
- One end of the auger is curved and has a plastic or vinyl coating to keep from scratching the finish on the bowl. This will be the end you put directly into the toilet. The other end has a crank. This allows you to rotate the spiral auger head to break up or pull out the object clogging the toilet.
- To use the auger, retract the auger into its housing as far as it will go. Then place the curved end of the housing into the toilet bowl, inserting it into the opening as far as it will go. As you're using it, be careful not to force it. You don't want to break the porcelain.
- By being able to hook an object with the spiral end and then retract the auger back through its housing, you can pull an object out of the toilet bowl, such as a child's toy, that you don't want entering your home's drain system.

Removing the Toilet:

- Turn off the water to the toilet.
- Remove the tank lid.
- Use a rag to pick up any remaining water.
- Remove the caps sitting on the bolts.
- Unscrew nuts with an adjustable wrench.
- Rock the bowl a bit to loosen the grip on the floor, pick up the toilet making sure it is level and carefully move out of the way.
- Remove the wax ring from the toilet and the floor. Clean the floor around the drain hole.
- Once the clog is removed from the toilet, place a new wax ring on the toilet flange and carefully position on top of the drain hole. You only get one shot to place it. Replace the wax ring if you miss.
- Gently rock the bowl until it sits level on the floor. Care must be taken when bolting down as to not break the toilet.
- Turn the water back on, let it fill up and hopefully it flushes.

Faucets & Drains – Presented by Jonathan Parigin

Replacing Cartridges and Seals in Faucets:

Leaking, dripping, water coming out of the handle – the cartridge or seal is worn out inside the faucet.

- Turn off the water at the shut off valves under the sink or at the main water supply. Fully open the faucet to both the hot and cold positions to allow any residual water to escape.
- Removing the faucet handle: Turn the handle on to make sure the water is off. Pry off the handle cap using a small flat screwdriver. Unscrew the screw within the handle using a screwdriver or Allen wrench. Lift the handle up to remove it from assembly.
- Remove the Retaining Clip: Use slip joint pliers to remove the retaining nut. Lift the faucet spout straight up to remove it.
- Remove O-ring: remove the O-ring from the housing. If you can't slip the O-ring from its groove, cut it with a utility knife. Clean any debris from the faucet housing with a soft cloth.
- Replacing the Cartridge: Grip the top of the cartridge with pliers and pull straight up to remove it. With the cartridge out inspect O-rings for any damage. Replace all rings with matching size. If the cartridge has any damage install a new cartridge making sure it is aligned correctly.
- Install the O-ring: Coat the O-ring with silicone grease or Vaseline and install on the faucet cylinder. Re-attach the spout. Insert the retaining clip and/or screw on the plastic retaining nut. Place the handle on the assembly, secure with the screw you removed earlier and replace the handle cap. Place the handle in the on position and slowly turn the water back on at the valve.

Annual Maintenance:

- Stops: Once a year you want to exercise the valves so they don't stick. Turn them on and off a few times. When I turn them all the way on I back it up just a little bit to keep it from seizing up inside. Exercise these once a year and that will keep debris from collecting.

Shower Valves:

- Replacing shower valves is almost the same as a faucet. You want to turn your main water supply off.
- When you replace the cartridge, O-rings and seals, it is very similar to faucets.

Shower Heads:

- Wrap the jaws of slip joint pliers with electrical tape or place a towel around the shower arm to protect the finish, then grip the shower arm with the slip-joint pliers for backup.
- Use an adjustable wrench to loosen and unscrew the old shower head by turning it counterclockwise.
- Remove the old showerhead. Turn the showerhead by hand counterclockwise to remove it.
- Clean off any rust or mineral deposits and old tape or sealant on the shower arm threads.
- Wrap the threads: Wrap Teflon tape in a clockwise direction 2-3 times around the threads of the shower arm. Press the tape into the threads.
- Screw the new showerhead onto the shower arm in a clockwise direction and hand-tighten.
- Turn on the water and check for leaks.
- If leaks occur, carefully tighten the showerhead until there are no leaks or remove the head and apply additional Teflon tape.

Winterizing Exterior Faucets:

Outdoor spigots, also known as hose bibbs, can be damaged by freezing temperatures. A hose bibb that freezes and breaks can be expensive to replace, especially if the exterior of the house is brick.

To protect hose bibbs from freezing, either:

- Cut the off water to the spigots and drain the pipes.
- Install freeze resistant or frost proof hose bibb spigots.
- Install insulated foam faucet covers over the spigots.

Unstopping Drains:

- Place a bucket underneath the pipes to catch any water that may drain out.
- Detach the trap – it is the curbed pipe that dips below the horizontal and vertical pipes. Unscrew the PVC pipes by hand, if you can't then use slipjoint pliers to loosen the connections.
- Empty water from the trap into the bucket. Clean the trap of debris. Replace the washers and hand tighten the nuts and maybe snug them up with a pair of pliers, you don't want to over tighten them.
- Pop-ups: Make sure that the pop-ups are open, and hold it open by the rod while you are using a small sink plunger or Zip-It to unclog the drain. If this doesn't work, then take your trap off and dump everything out in your bucket. Pull it apart, clean it of debris.
- Sink Auger: run it down your drain and use the hand crank on the back to clear the blockage. Reassemble everything, hand tighten it and turn the water back on.



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