

Water heater 熱水器

Electric & Gas Water Heaters 電熱水器 & 瓦斯熱水器

Electric Water Heaters 電熱水器

Plastic Tank Electric Water Heaters 塑料罐電熱水器

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Servicing Electric Water Heaters 維修電熱水器

Troubleshooting the Wiring and Thermostat 排線和溫控器故障排除

Wiring 接線

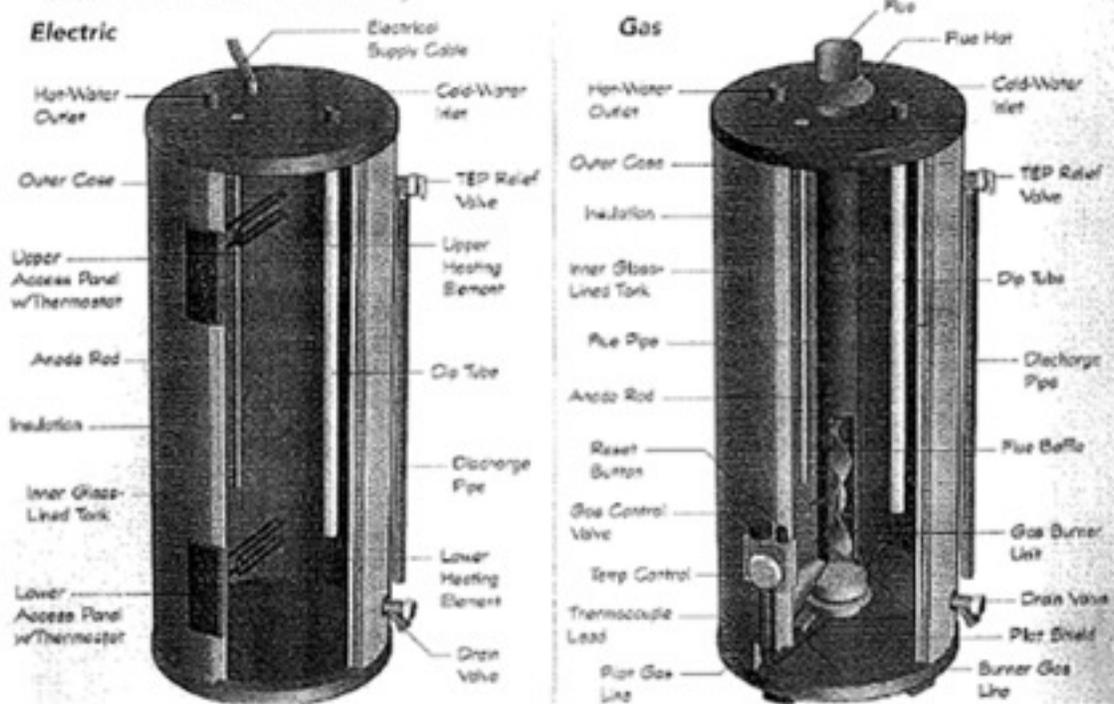
Thermostat 溫控器

Replacing a Heating Element 更換加熱元件

Replace the Thermostat 更換溫控器

While the range of water-heater options has grown in the recent years, most of the units in current use are similar to those of generation past. The reason is that conventional electric and gas-fired water heaters are affordable and fairly inexpensive to operate, and they require little maintenance. High-tech, high-efficiency models use less fuel, but they are more expensive to buy and maintain.

Water Heater Anatomy



Electric & Gas Water Heaters

Conventional tank heaters are basic-technology appliances, though these days they are more efficient than they use to be. Because of their no-frills mechanics, they are the most affordable and most popular heaters sold today.

Electric Water Heaters

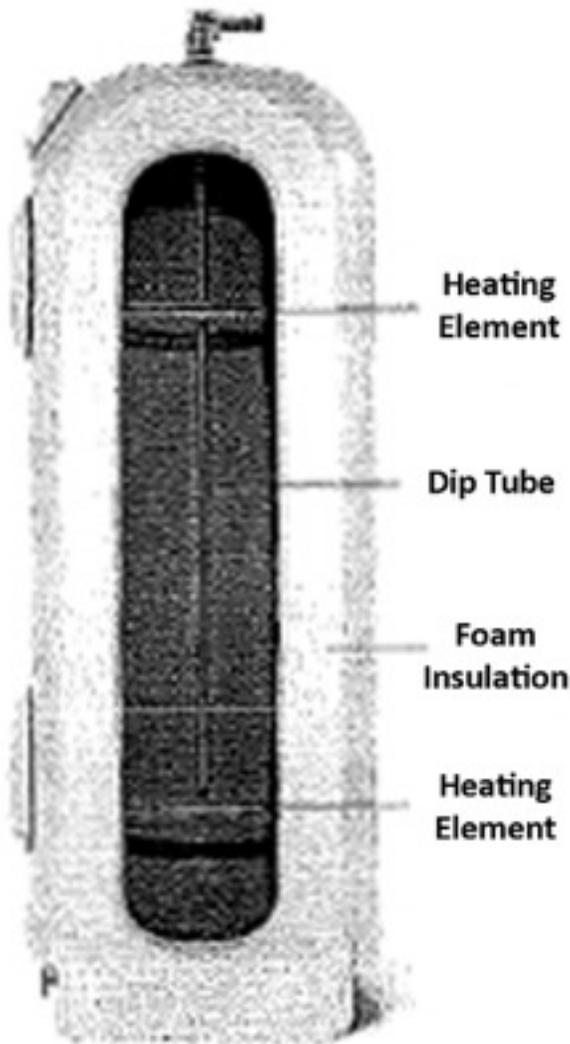
An electric water heater consists of a welded steel inner tank covered by insulation and a metal outer cabinet. The inner surface of the steel tank is coated with a furnace-fired porcelain lining, often described as a glass lining. The bottom of the tank is slightly convex, which helps to control sediment, and a drain valve sits just above the bottom of the tank. The top of the tank has two water fittings and sometimes a separate anode fitting. The top (or upper side) of the heater also contains a fitting for a temperature-and-pressure (T&P) relief valve.

Two resistance-heat electrodes, called elements, heat the water in the tank. Each element is controlled by its own thermostat. The thermostats are joined electrically so that the elements can be energized in sequence; the bottom element comes on only when the top one shuts off. The elements are threaded or bolted into the unit, and the thermostats and surface-mounted next to the elements, covered by access panels and insulation. To help keep the tank from rusting, a magnesium anode rod is installed through the top of the heater. And finally, a dip tube usually hangs from the inlet fitting and delivers incoming water to the bottom of the tank.

Plastic Tank Electric Water Heaters

Electric water heaters with plastic tanks carry a life-time warranty and cost about double the price of standard water heaters. Plastic makes an ideal tank because it can't corrode. In hard-water situations, steel tank heaters tend to accumulate precipitated minerals shorten the service life. Sediment can be a problem in plastic heaters, but it's more manageable; they have rounded bottoms with large, centered drain plugs for easy draining. Plastic tanks are also highly insulated with non-ozone-depleting foam insulation. Along with better insulation comes lower fuel costs. You can earn back the price difference of these units in five to ten years.

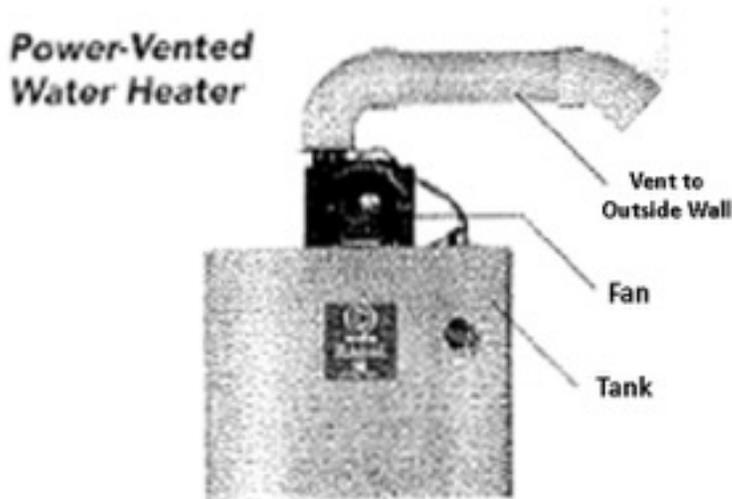
Plastic Tank



Gas-Fired Water Heaters

A gas-fired water heater is like an electric unit in many respects (glazed tank, anode rod, dip tube, relief valve), but its open-flame heating components require design differences. A flue tube runs through the center of the tank, from bottom to top. Viewed from above, the tank looks like a donut. To capture latent exhaust-gas heat, a wavy steel damper is suspended in the flue like a ribbon. The bottom of the tank is convex, which helps send sediment to the outer edges and away from the area just above the burner, and at the top, the exhaust-gas flue hat.

Gas goes to the burner through a thermostatically triggered control valve mounted on the lower front of the heater. The burner is joined to the control valve by three tubes. The largest of the tubes is the main gas feed. The mid-size tube is the pilot-gas feed, and the smallest is the thermocouple lead. A thermocouple is little more than a copper wire with an expansion plug controlling the gas valve at one end and a heat sensor at the other. The heat from the flame sends a millivolt of electricity to the expansion plug, which holds the gas control valve open.



Power-Venting

A power-vented, or direct vent, heater has a sealed burner. A fan expels its gases, so the vent pipe does not need to be vertical. You can run the vent pipe horizontally down a long joist space and have it exit at a rim joist, for example. Power-vented units have a price tag two to three times that of a conventional gas-fired water heater and higher repair costs. They are a little more efficient, but not enough to earn back the price difference over a unit's useful life.

Common Water-Heater Problems

You will generally come across just a few main problems with a water heater: a faulty T&P relief valve, accumulation of sediment in the bottom of the tank, and a corroded anode rod. You'll learn how to deal with other more-specific problems on pages 248 to 255.

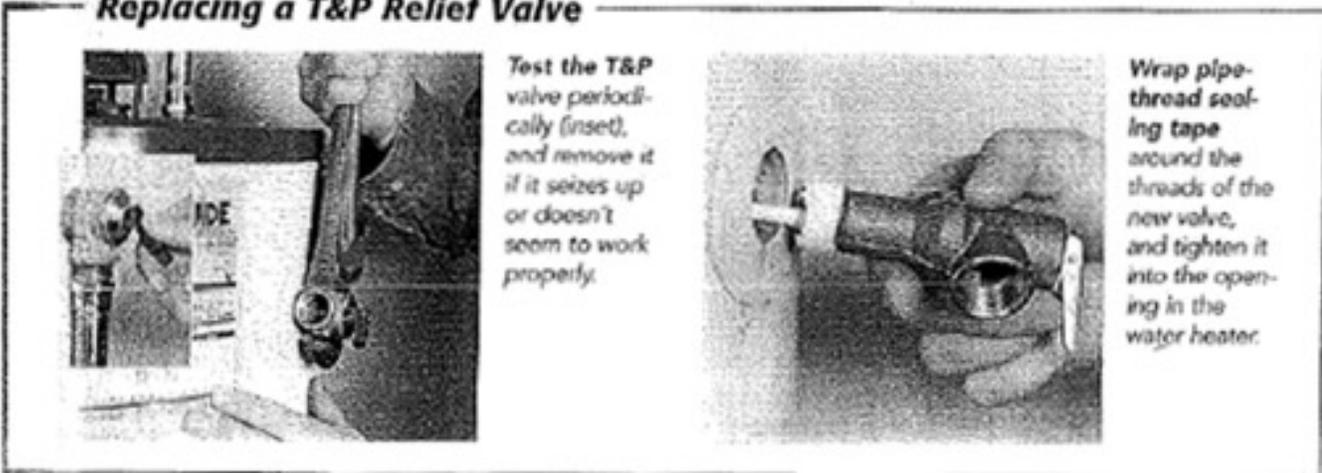
Faulty T&P Relief Valves

A temperature-and-pressure (T&P) relief valve is a water heater's primary safety device. Should a thermostat stick and the heater does not shut off, the resulting increase in heat and pressure would be relieved through the T&P valve. Otherwise, the heater could explode.

The problem with T&P valves is that you can't always tell when they are no longer working. A leaky valve may signal a defect, but just as often, it indicates that the valve is working just as it should. A temporary pressure surge elsewhere in the system may have been relieved through the T&P valve.

The best way to know for sure is to keep track of when the water appears. If it only happens when you do laundry, for example, your washer solenoid, which can produce substantial back-shock in the water system when it abruptly shuts off the water flow to the machine is the likely culprit. (See "Water-Hammer arrestors", on page 248)

Replacing a T&P Relief Valve



Test the T&P valve periodically (inset), and remove it if it seizes up or doesn't seem to work properly.

Wrap pipe-thread sealing tape around the threads of the new valve, and tighten it into the opening in the water heater.

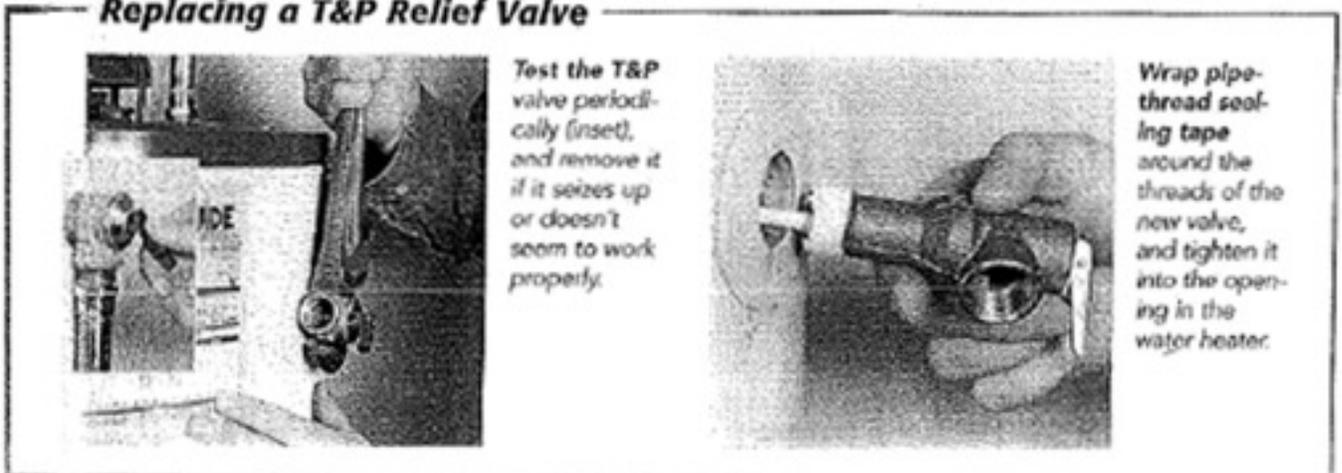
Testing & Replacing a T&P Relief Valve

It's good practice to test your water heater's T&P valve every six months or so. Just lift the test lever and let it snap back (insert photo below). This should produce a momentary blast of hot water through the valve's over flow tube. If no water appears or if the lever won't budge, replace the valve immediately.

If water does appear but you notice that the valve now drips steadily, your test probably deposited flakes of scale in the valve seat. This scale will often clear itself if you open the close the valve several times. If it doesn't, tap lightly on the lever pin with a hammer and then retest. If it still leaks, replace the valve.

To replace a T&P relief valve, shut off the water and power (gas or electricity) and let the water cool for at least a few hours. Open an upstairs faucet and the tank's drain valve. You won't need to empty the entire tank, just drain it to a point below the valve fitting. The T&P valve may be mounted on the top or in the side of heater. In either case, remove the over flow pipe from its outlet. Then use a pipe wrench to unscrew the old valve from the tank. Coat the new valve's threads with pipe-thread sealing tape or pipe joint compound, and tighten it into the heater. Stop when the valve feels snug. Then reinstall the overflow pipe.

Replacing a T&P Relief Valve



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SMART TIP

Top-Mounted and Replacement T&P Valves

If your water heater's T&P relief valve is threaded into the top of the unit, you may need to cut the overflow pipe to remove it. After you've installed the new valve, reconnect the old overflow pipe, using a soldered coupling or compression coupling to repair the cut. If your old valve was without an overflow pipe, install one. Run it to within 6 inches of the floor.

When buying a replacement T&P valve, be sure that it has a pressure rating lower than that of the water heater rating. If your heater is rated at 175 psi, as noted on its service tag, buy a valve that is rated at 150 psi. Local codes may specify a pressure rating.

Cleaning the burner

As combustion gases degrade the inner surface of the water heater, flakes of rusty metal may fall onto the burner. The rust can cover gas jets around the burner's perimeter. With some jets blocked, the rust will flame orange and high, signaling a loss in efficiency.

Check the burner for rust as part of your routine maintenance. With the heater turned to pilot, remove the outer and inner access panels at the base of the heater. Shine a flashlight onto the burner. Then turn on the water heater. If some of the gas openings still appear clogged, you'll have to remove the burner to clear them out. To do so, turn off the gas and loosen the nuts securing the three burner tubes to the gas control valve. Slide out the burner and poke through the openings with a piece of wire.

Troubleshooting the Wiring and Thermostat

Tools and Materials

- Insulated screwdriver *TIME NEEDED: 30 MIN.*
- Electrician's pliers

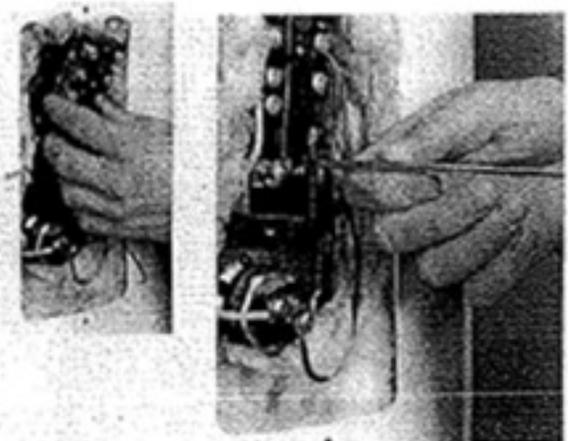
PLUMBING TIP: Don't assume that you need a new thermostat if the water heater stops working. The problem may be as simple as a loose wire. Turn off the power at the main service panel before checking, though.



1 With the power shut off at the electrical service panel, remove the water-heater access panel and insulation. Check for charred wires (inset).



2 Trim any charred wires, and strip the insulation back 1/2 in. Insert the wire back into its slot, and tighten the terminal screw.



3 With the power still turned off, loosen the wiring connections and replace the thermostat. Snap it into its clip (inset), and tighten the screws.

Replace the Thermocouple

If you need to replace the thermocouple, pull the sensor from its clip. (Some are held in place by a screw.) Take the old thermocouple to a hardware store, and buy a matching one. Connect the new thermocouple, making sure the sensor will catch the pilot flame. Reinstall the burner and reconnect the burner tubes to the control valve.

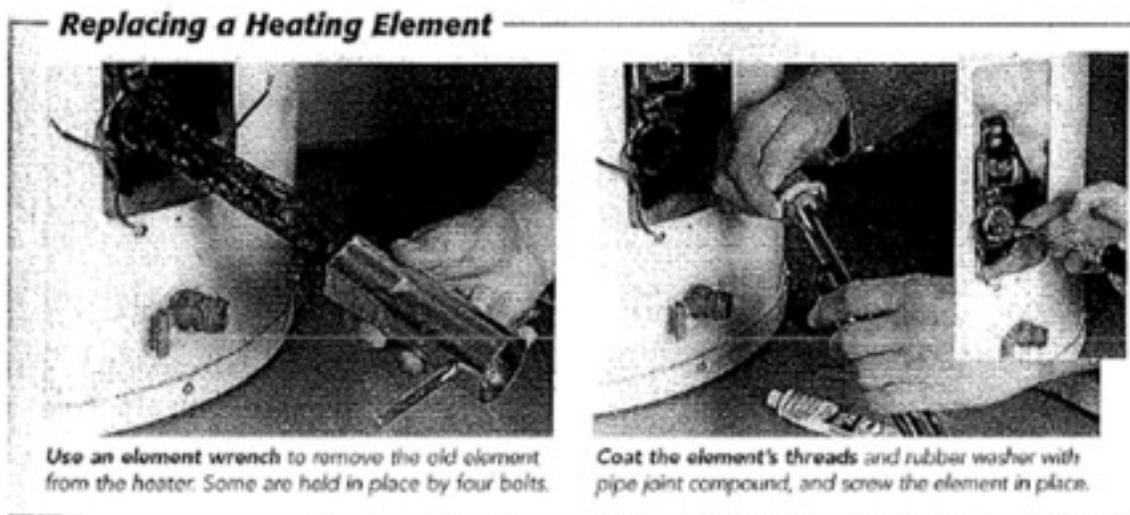
To re-light the water heater, press down on the pilot button and hold it down for 30 seconds before lighting a match held with needle nose pliers. Feed the flame into the heater. If the pilot goes out when you let up on the button, repeat the procedure. You may need to do this several times for the gas to push all the air from the pilot feed line. When the pilot stays on, replace the access panels and turn the control knob to "ON".

Servicing Electric Water Heaters

Electric water heaters are simple appliances. Diagnosis is easy using a volt-ohmmeter, which most plumbers carry. However, few homeowners own testing equipment, so a symptomatic approach (without test equipment) is best.

Troubleshooting the Wiring and Thermostat

If the water heater stops working, the trouble may be as simple as a tripped circuit breaker, blown fuse, or loose wire. Or it could be the thermostat. Do the easy things first. Check the electrical service panel and the thermostat reset button.



Wiring

While tripped breakers often signal a defective heater component or a loose wire, the problem may be as simple as a momentary voltage spike (power grid). Reset the breaker or install a new fuse. If the breaker trips immediately or in a day or two, look for a loose wire.

Turn off the power, and remove the upper and lower access panels. Peel the insulation back, and look closely at all wire connections. If you see a wire that looks charred, loosen the binding screw holding it in place and trim the wire beyond the char mark.

Strip about $\frac{1}{2}$ inch of insulation from the end of the wire. Slide the wire under the terminal, and tighten the binding screw. Follow by tightening all other binding screws you can see. Expansion and contraction from heating and cooling loosens terminal screws.

Troubleshooting the Wiring and Thermostat

Tools and Materials

- Insulated screwdriver. *TIME NEEDED: 30 MIN.*
- Electrician's pliers

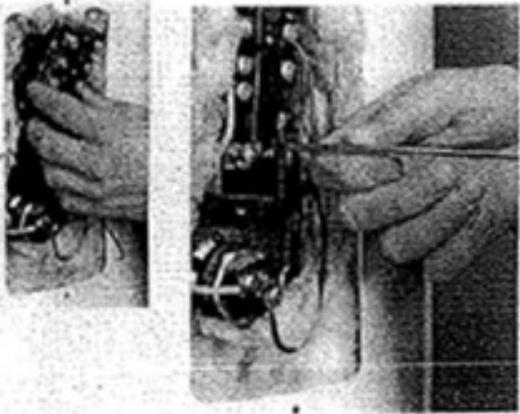
PLUMBING TIP: Don't assume that you need a new thermostat if the water heater stops working. The problem may be as simple as a loose wire. Turn off the power at the main service panel before checking, though.



1 With the power shut off at the electrical service panel, remove the water-heater access panel and insulation. Check for charred wires (inset).



2 Trim any charred wires, and strip the insulation back ½ in. Insert the wire back into its slot, and tighten the terminal screw.



3 With the power still turned off, loosen the wiring connections and replace the thermostat. Snap it into its clip (inset), and tighten the screws.

Thermostat

If a thermostat should stick in the “On” position, the high-limit switch (usually with the upper thermostat) will sense the added heat and open the circuit, putting the heater out of commission instantly. Press the reset button, and let the heater cycle. If it trips again, investigate the cause.

High-limit switches don't often fail, so suspect a faulty thermostat. But is it the upper or lower thermostat? Because the lower element won't come on until the upper element kicks off, this sequence offers a clue as to which thermostat has failed.

With the power on, start by pressing all the reset buttons. Cover both thermostats with insulation. Then listen for the expansion noises in the tank that signal a heat cycle. When the high-limit switch snaps off, you should be able to hear it. If it trips early in the 40 minute heating cycle, expect a faulty upper thermostat. If it trips much later, expect a defective lower thermostat.

Replace the Thermostat

If you find a defective thermostat, you can buy an inexpensive, universal replacement at most hardware stores. Just make sure that it has the same voltage and wattage rating as the old one. With the power off, undo the wiring connections and push the wires aside. Note which wire goes to each terminal, however.

Snap the thermostat into the clip on the face of the heater, and reconnect the wires. Press the reset button. Then, using a screw driver, adjust the temperature setting to 130 degrees F.

The thermostat doesn't have an in-tank sensing probe and instead senses the heat of the tank. Therefore, it's critically important that you replace the insulation and cover the thermostat completely.

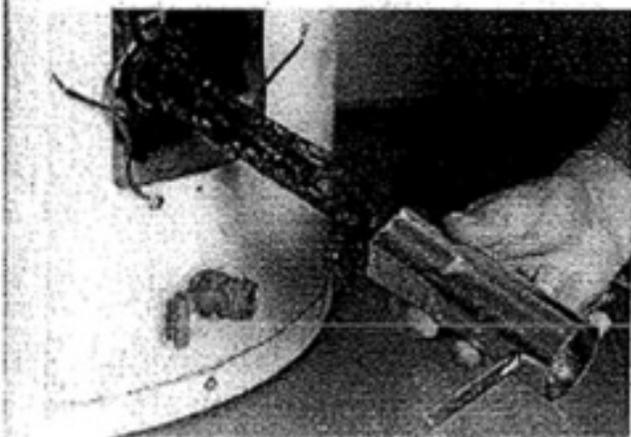
Replacing a Heating Element

Faulty thermostats and heating elements can display some of the same symptoms (only testing will tell for sure), but elements are subject to more stress and generally fail more often than do thermostats. But short of testing, how will you know which element has failed? If you get a few gallons of hot water, followed almost immediately by cold water, it's likely the lower element. Most residential heaters use 4,500-watt elements. Check the old one to make sure.

To remove a defective element, shut off the power and drain the tank. If you need to replace an upper element, just drain the tank to that level. Remove the access panel, and loosen the two terminal screws securing the wires to the element. If your heater has a bolted flange, remove all four bolts and pull the element out. If it's threaded-in, grip the wrenching surface with a pipe wrench and back it out. If the sheet-metal cabinet keeps a pipe wrench from reaching the element, as it often does, use an element wrench. They're not expensive.

To install the new element, slide the rubber gasket in place and coat both sides with pipe joint compound. Then thread or bolt the element into the tank. Trim the stressed ends of the each wire, and strip the insulation back about $\frac{3}{4}$ inch. Insert the wires under the binding clips or around the screws. Tighten both screws, making sure the wires don't drift outward. Press the reset buttons, and replace the insulation and access panel. Before turning the power back on, fill the tank and bleed all the air through an upstairs faucet. Expect the heater to take 45 minutes to recover.

Replacing a Heating Element



Use an element wrench to remove the old element from the heater. Some are held in place by four bolts.



Coat the element's threads and rubber washer with pipe joint compound, and screw the element in place.