

## Electric Water Heater (Thermostat) Repair



Photo #1 Wiring

### **Circuit Description**

The circuit consists of only 4 components. 1-On/Off Switch, 1-Thermostat, 1-Emergency Cutout (ECO), and 1-Water heating Element. Note: Some models do not have the On/Off switch at this location. If so, the Black (HOT) wire may go directly to the Thermostat.

All 4 components are connected in series with the power wire (Black) coming from the supply to the On/Off switch. A second (Black) wire carries the current from the On/Off switch to the Thermostat switch. A jumper connects the Thermostat to the Emergency Cutout Switch. The White wire connects directly to the other terminal on the heating element.

Note: The Thermostat and Emergency Cut Out switches are captured against the tank by a metal plate and held in place by two studs with nuts. They do not penetrate the tank, but are held snugly against the tank for thermal conductivity.

## **Operation**

When working properly, current is conducted through the two thermal switches (Thermostat and ECO) to the heating element when the On/Off switch is actuated.

## **Common Failures**

1. Failed heating element
2. Failed thermostat or ECO

## **Continuity Checks**

1. With no voltage supplied, measure resistance or Continuity of the main components. The On/Off switch should measure low resistance when on and no continuity when off.
2. The two thermal switches (Thermostat and ECO) should measure continuity or low resistance. Make measurements with one wire removed. Note: The water temperature has to be low enough for the Thermostat to call for heat.
3. The heating element should also measure continuity (Low resistance)

## **Voltage Checks**

1. Ensure adequate supply of 120vac power to unit.
2. With On/Off switch in the “On” position, Measure voltage across the element.  
Note: The water temperature has to be low enough for the Thermostat to call for heat.
3. Voltage should be 120vac across the element.



Photo #2 – Thermostat and ECO captured under the metal plate. Note: Since they are in series, it does not matter which is which.

## **Failure Mechanisms**

1. The most common failure is the Thermostat and ECO switches. They are relatively inexpensive and easy to replace without breaching the water boundary.
2. The heating element can also fail; usually caused by contaminants in the tank preventing adequate cooling. Failure of the element could also damage the Thermostat and ECO due to excessive current and therefore they should be replaced if the element is replaced.

## **Component Replacement**

Since replacement of the heating element involves breaching the tank, changing the Thermostat and ECO is usually the first and best option. The following procedure is recommended.

1. Ensure the water heater 120v Breaker is OFF
2. Take picture of the wiring for comparison when putting things back together.
3. Remove the wiring connectors from the two thermal switches.
4. Remove the two nuts which hold the capture plate and remove the Thermostat and ECO. Note: You will not be able to tell which is which and it does not matter.
5. Install the new Thermostat and ECO behind the capture plate and ensure they have adequate contact with the end of the tank. Be sure to re-attach the ground (Green) wire.
6. Re-install the wires and verify against the picture taken in step #2.
7. Test by one of the two following methods. Apply power and wait to see if the water heats or check the current draw at the power panel while turning the water heater on. If current increases by approximately 10 amps, the heater is working.

Heating Element replacement is not as simple.

1. Ensure the water heater 120v Breaker is OFF
2. Ensure the water heater is off for Gas too.
3. Drain water from the tank.
4. Remove wires from the element and remove the element from the tank.
5. Install the new element using Teflon tape to seal the threads.
6. Re-install the wires and test as in step #7 above.

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