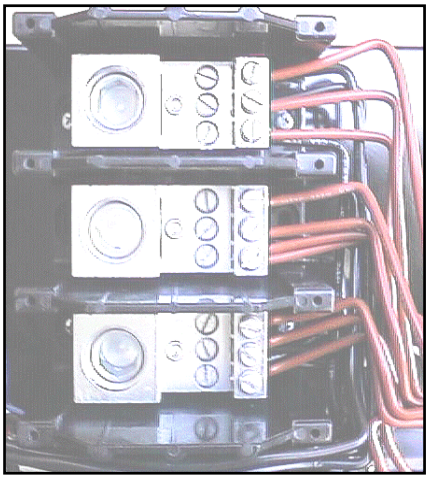
Component Diagnostic Checks - Commercial Electric

How to Check Field Wiring Block



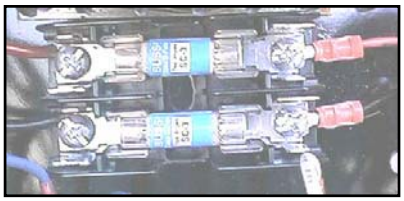
The field wiring block is the attachment point for the incoming electrical current. Line voltages may range from 208V to 480V, single phase or three phase. The figure at the left shows a three-phase configuration. You can tell it is three phase because each wire is attached at a different screw terminal on the wiring block. If all the wires were grouped together (all the red wires and all the black wires) and attached at the larger hex screw terminal, you would have a single-phase configuration.

Diagnostics for the field wiring block is limited to visual inspection and tightening all the screw terminal lugs. Look for signs of burned, charred, or broken wires on the wiring block. Compare the voltage specified on the rating plate of the heater with the terminal screw pad on the transformer and on the electric heating element head. They should all read the same voltage, for example 480 volts. The single or three phase rating does not matter when connections are made to the transformer screw terminal pad or when checking the heating elements; only voltage matters.

How to Check Transformer Fuse Panel

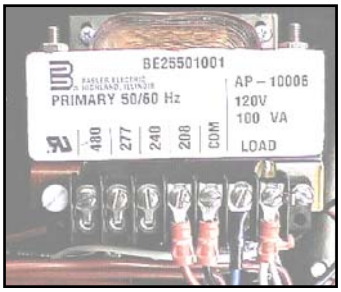
Caution: When removing fuses, ensure the power to the heater is turned off.

The transformer fuse block is the first safety on the commercial electric water heater. It contains two 3 Amp fuses and protects the rest of the electrical components from excessive amp draw. Measure line voltage along each wiring path by placing the probes of a multimeter on the two screw terminals after the fuses. Multimeter should register line voltage. You may also check each fuse by verifying continuity through the fuse. Remove the fuse from the fuse panel. Set the multimeter for continuity and check the fuse. If there is continuity, then the fuse is good. If there is no continuity, then the fuse is bad and must be replace.



When required, the fuse must be replaced with exactly the same fuse type. Look at the fuse carefully before you replace it. Also ensure the clips of the fuse holder are tight. If you can easily remove the fuse with your bare hands, without the use of tools, then the clips are not tight enough. Squeeze the clips of the fuse holder together with a pair of pliers.

How to Check Transformer

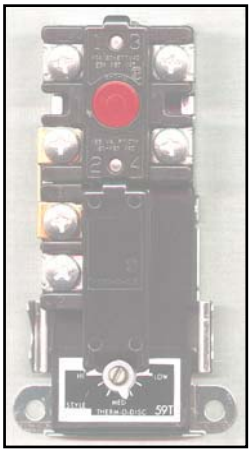


Here is the step down transformer used on all of Rheem's commercial electric water heaters from 6KW to 54KW. The transformer takes the line voltage and steps it down to 120V. The 120V is called the control voltage, and is used to operate the thermostat and the contactors. The first check for the transformer is a visual inspection of the wiring. The red wire should be attached to the terminal screw pad and match the line voltage (which should also match the rating plate and the voltage capacity of the heating elements). The black wire should be attached to the COM terminal; the blue wire to the LOAD terminal, and the white wire to the ground terminal (far right hand screw terminal).

Control voltage (120V) for the operation of the thermostat and the contactors is carried by the blue wire and returned through the white (or ground) wire. The transformer either works or it does not work. After verifying

the transformer fuses, and line voltage with the rating plate and the terminal screw pad on the transformer, measure for 120V between the blue wire (LOAD) terminal and the white (ground) terminal. If the multimeter does not register 120V, the transformer is bad and needs to be replaced.

How to Check Surface Mounted Thermostats



Rheem uses two different surface mounted thermostats in our commercial electric water heaters. Fifty-gallon capacity heaters have a thermostat temperature limit of 150° F and a safety (ECO) limit of 170° F. The 85 and 120-gallon models have a thermostat temperature limit of 170° F and a safety (ECO) limit of 190° F. To perform this test you will need a multimeter capable of reading voltage. You may also use a test lamp to verify the presence of voltage only. Ensure the test lamp has a rating equal to or greater than the line voltage of the heater.

Check for voltage to the water heater:

1. Check manual disconnect switch, fuses and service panel breakers.

2. Determine voltage to heater. Check with a multimeter or test lamp across terminal 1 of the ECO and the white (ground) wire terminal of the transformer. If voltage is being supplied, meter will register 120V or lamp will light. NOTE: If you are using a wide spectrum test lamp (50-400V) you may receive a false voltage reading. If there is no voltage supply to the thermostat, the problem may be the transformer fuses, the transformer, the location of the red wire on the terminal screw pad or the line voltage to the heater.

3. Determine voltage through the high limit switch. Place test prongs on terminal 2 of the ECO and the white (ground) wire terminal of the transformer. If voltage is being supplied, meter will register 120V or lamp will light. This means the ECO is not tripped. If the meter does not register 120V, press the red RESET button on the thermostat and retest. Replace the thermostat is the meter does not register 120V.

Check operation of the surface mounted thermostat

1. Turn the temperature dial on the thermostat to its highest setting. This forces the thermostat to call for heat. Place the test prongs on terminal 1 (bottom of the bus bar) and the white (ground) wire terminal of the transformer. This test checks for the presence of power between the thermostat and the ECO. If voltage is being supplied, the meter will register 120V or lamp will light.

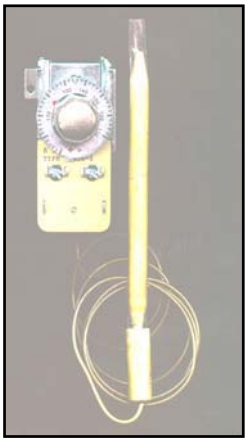
2. Move the test prong from terminal 1 to terminal 2 of the thermostat; the other test prong remains on the white (ground) wire terminal of the transformer. This test checks the operation of the switch pole inside the thermostat. If voltage is being supplied, the meter will register 120V or the lamp will light. You may also hear the contactors 'snap' closed. If meter fails to register, make sure the water inside the tank is cooler than the thermostat setting. Recheck the thermostat. If the meter fails to register a second time, the thermostat is defective and should be replaced.

3. Turn the temperature dial on the thermostat to its lowest setting. This forces the thermostat to satisfy. All voltage to the contactors should be suspended. You may hear the contactors snap open. Repeat step 2 and check for voltage on terminal 2 of the thermostat. You should not read 120V. If the multimeter registers 120V, the thermostat is stuck closed and should be replaced.

Check for calibration of the surface mounted thermostat

Turn the temperature dial on the thermostat to its highest setting. Wait for the heater to fully recover. Draw a small quantity of hot water from the T&P valve and measure the temperature of the water. For 50 gallon models, the water temperature should be 150° F (+/- 5 degrees); for 85 and 120 gallon models, the water temperature should be 170° F (+/- 5 degrees).

How to Check Immersion Mounted Thermostats



This section focuses on the 50, 85, 120 gallon immersion thermostats. The 10 gallon booster heater thermostats are a different part number, but are checked using the same sequence.

Check for voltage to the water heater:

1. Check manual disconnect switch, fuses and service panel breakers.

2. Determine voltage to heater. Check with a multimeter or test lamp the top blue wire of the immersion ECO and the white (ground) wire terminal of the transformer. If voltage is being supplied, meter will register 120V or lamp will light. NOTE: If you are using a wide spectrum test lamp (50-400V) you may receive a false voltage reading. If there is no voltage supply to the ECO, the problem may be the transformer fuses, the transformer, the location of the red wire on the terminal screw pad or the line voltage to the heater.

3. Determine voltage through the ECO. Place test prongs on the bottom blue wire of the ECO and the white (ground) wire terminal of the transformer. If voltage is being supplied, meter will register 120V or lamp will light. This means the ECO is not tripped. If the meter does not register 120V, press the black/red RESET button on the ECO and retest. Replace the ECO is the meter does not register 120V.

Check operation of the immersion mounted thermostat:

1. Turn the temperature dial (see Figure 12) on the immersion thermostat to its highest setting. This forces the thermostat to call for heat. Place the test prongs on top blue wire and the white (ground) wire terminal of the transformer. This test checks for the presence of voltage between the thermostat and the ECO. If voltage is being supplied, the meter will register 120V or lamp will light.

2. Move the test prong to the bottom blue wire; the other test prong remains on the white (ground) wire terminal of the transformer. This test checks the operation of the switch pole inside the immersion thermostat. If voltage is being supplied, the meter will register 120V or the lamp will light. If meter fails to register, cool the water inside the tank and recheck. If the meter fails to register a second time, the thermostat is defective and should be replaced. If the heater is multi-staged, continue this process on the remaining thermostats.

3. Turn the temperature dial on the immersion thermostat to its lowest setting. This forces the thermostat to satisfy. All voltage to the contactors should be suspended. Repeat step 2 and check for voltage on the bottom blue wire. You should not read 120V. If the multimeter registers 120V, the thermostat is stuck closed and should be replaced. If the heater is multi-staged, continue this process on the remaining thermostats.

Check calibration of the immersion mounted thermostat:

Component Diagnostic Checks - Commercial Electric

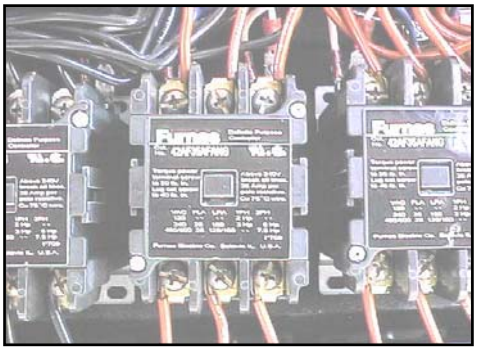
Turn the temperature dial on the thermostat(s) to its highest setting. This forces the thermostat to call for heat. Wait for the heater to fully recover. Draw a small quantity of hot water from the T&P valve and measure the temperature of the water. The water temperature should be 190° F (+/- 5 degrees).

Quick Check: Turn thermostat to demand heat. Listen for the contactors to snap closed or check for 120V at the first contactor. If 120V, then the immersion ECO and immersion thermostat are working.

How to Check an Open or Grounded Heating Element

Order FaxBack document # 1314.

How to Check the Contactors



The purpose of the contactors is to relay line voltage. Remember, you can find the line voltage rating on the heaters rating plate. Each contactor controls three legs of line voltage; and controls both the black wire legs or red wire legs. Contactors contain an electro-magnet that is energized by 120 volts. The contactors are spring loaded to keep the contact points open (not allowing current to pass) until the coil is energized. When the thermostat demands heat, 120 volts is relayed through the thermostat to the contactors. The electromagnetic coil is energized, the spring tension is defeated and the contact points close. Once the contact points close, line voltage is relayed through the contactor to the fuse blocks.

Due to the wiring configuration, there will always be line voltage at the top of the contactors.

Each leg of the contactor needs to be checked for line voltage. If a contact point fuses closed (due to high heat) then one leg of the line voltage will always be 'hot'. Although not difficult to do, this process is very repetitive. The smallest 3 element, 6 KW water heater will have six legs to check; the largest 9 element heater will have 18 legs.

Assuming the line voltage is correct, the transformer is working and the thermostat is demanding heat -

The electromagnetic coil inside the contactors should now be energized and the contact point closed. Using a multimeter, measure for line voltage at the bottom (lower) screw terminal of each leg of the contactor. Do not forget both the red legs and the black legs. If any one leg does not register line voltage, the entire contactor needs to be replace. If the heater is three phase, see the section entitled How to Check Line Voltage.

There is a small black spring loaded button in the center of the contactor. This button will allow manual closing of the contactors. To verify the contactor is not working, perform the multimeter check in the previous paragraph. If the multimeter does not register line voltage at the bottom of the contactor, press and hold the black button. This will manually close the contactors and the multimeter should read line voltage.
Turn the thermostat to the lowest setting so the contactors are
not energized and closed -

With the thermostat satisfied, 120V power is suspended to the contactors. The electromagnetic coil is not energized and the contact points are 'open', preventing line voltage from passing to the fuse blocks. Using a multimeter, check for line voltage at the bottom of the contactor. The multimeter should not read any voltage at all.

If line voltage is present the contactors have fused closed and are allowing one leg of the line voltage to pass to the fuse blocks and heating elements.

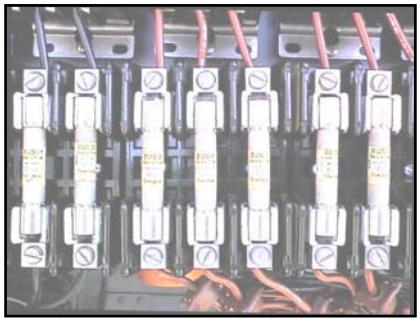
NOTE: On newer production model heaters, the contactor does not have a button in the center.

How to Check the Fuse Blocks

Caution: When removing fuses, ensure the power to the heater is turned off.

The fuse blocks are another safety feature of Rheem's commercial electric water heaters. Their purpose is to protect the heating elements from excessive current draw. Checking this fuse block is similar to checking the transformer fuse panel.

Verify line voltage along each wiring path by measuring line voltage at the bottom (lower) screw terminal of each leg of the fuse block. Multimeter should register line voltage. If the heater is three phase, see the section entitled How to Check Line Voltage. You may also check each fuse by verifying continuity through the fuse.



Remove the fuse from the fuse block. Set the multimeter for continuity and check the fuse. If there is continuity, then the fuse is good. If there is no continuity, then the fuse is blown and must be replaced.

When required, the fuse must be replaced with exactly the same fuse type. Fuses may be "T" series or "G" series. Look at the fuse carefully before you replace it. Also ensure the clips of the fuse holder are tight.If you can easily remove the fuse with your bare hands, without the use of tools, then the clips are not tight enough. Squeeze the clips of the fuse holder together with a pair of pliers.