Water Heater Troubleshooting & Repair (Suburban)

This guide is intended to assist Heartland Owners in troubleshooting and repairing common failures of the Suburban Water Heater. This document doesn't specifically cover the Atwood design. But since Atwood units work in a similar way, the document may be useful to some extent with Atwood Water Heaters.

Important Notices

Who created this document?

This document has been created by Heartland Owners independently of the Heartland RV Company, and is posted to the Heartland Owners Forum as a service to the owner community.

Errors and Omissions

Because the authors are Heartland owners, not engineers or service technicians, it's possible that this document could contain errors or omissions. Readers are advised to also review the manufacturers' product documentation for more complete information and guidance.

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Contact Information

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This guide is based on the Suburban Water Heater commonly found in most Heartland RVs.

CAUTION: Electricity is dangerous. Many of us are comfortable with checking 110V AC and 12V DC circuits and are confident we can do so without damaging the circuits or causing injury to ourselves. If you are not comfortable around electrical circuits, you should consider letting a certified technician diagnose and correct the problem.

Troubleshooting Electric Mode

CAUTION: It's critically important that you check that the water heater is full of water before turning on the 110V heat. If there's no water, the heating element will burn out very quickly and will have to be replaced.

Electric Switches

Main 110V Power Switch

The main 110V switch is operated just like a light switch and most will illuminate when power flows through the switch. If the light switch normally does light up, but is not lighting up now, there may be a loose connection on the back of the switch, or the 110V circuit breaker may have tripped. Note that some newer models may use a rocker switch for electric operation.

Secondary 110V Power Switch

Again, it's critically important that you check that the water heater is full of water before turning on the 110V heat. If there's no water, the heating element will burn out very quickly and will have to be replaced. Of course, even if your trailer is in warranty, burning out the electric element is considered user error, which is not covered by the warranty against manufacturing defects.

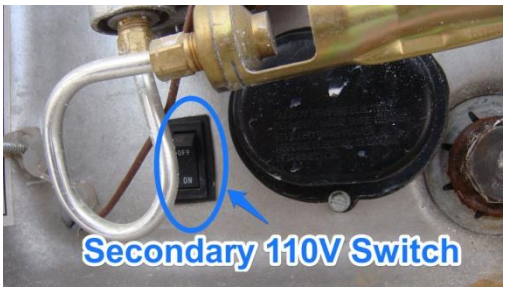
If you're not sure how to check for water in the water heater, see the section below.

The secondary 110V switch is a rocker-type that can be pinned in the OFF position with a small cotter pin. On a new trailer, to turn it on the first time, you have to remove the cotter pin and rock the switch to the ON position.

You can leave the switch ON permanently. But be aware that when you winterize, the water heater tank will be emptied, and if subsequently, a visitor turns on the inside 110V switch, the element will be ruined. **So whenever the water heater tank is emptied, it's a good idea to turn the secondary switch to the OFF position.**

The secondary switch is accessed by removing the cover from the back side of the water heater. The location on the RV will vary, but it will look something like this.

On the Suburban, with the cover off, you'll find the secondary switch in the bottom left corner.



How Can I Tell If There's Water in the Water Heater?

First, check that the Water Heater Bypass is in the normal operating position. On many trailers, there is a diagram on the basement storage door showing normal and bypass settings. If you have a Universal Docking Center (UDC) for water connections, the Water Heater Bypass is probably located in the UDC. On other trailer configurations, the bypass valve will usually be inside, near water connections to the water heater, accessible by way of a drawer or panel.

Second, open a faucet and check that water flows equally when the faucet is full to Cold and full to Hot settings.

***CAUTION**: If the water heater is in bypass mode, checking water flow will be misleading. In bypass mode, with an empty water heater, the cold water supply will flow through both the hot and cold lines.*
If not certain whether in water heater bypass mode, carefully open the temperature / pressure relief valve. With city water flowing, or the pump pumping water, when the water heater is full, water will come out of the relief valve. Exercise care. If hot water is released, you could be scalded.

While you're checking things, make sure if you have an outside shower that the faucets are turned off. If you leave them open, hot and cold water will mix and you will get lukewarm water from other faucets.

Testing the 110V Circuit to the Heating Element

First of all, make sure that both 110V switches are turned on. The primary switch, if it normally lights up, should be lit. If it's not lit, the circuit breaker may have tripped, or you may have a loose connection on the back of the light switch.

In normal operation, there is a thermostat that determines when to turn on the heating element and closes the 110V circuit to the heating element as the water cools. When the water is hot, the thermostat opens the electrical circuit so that the water doesn't get too hot.

If the thermostat fails to open the circuit, the water temperature will continue to increase. To avoid a dangerous over-temperature condition, a second sensor, called a Hi-Limit or Electric Cut Off (ECO) opens the electrical circuit to the element. That switch then stays open, interrupting power to the heating element until you press the RESET button. The left-hand button is the electric circuit reset and the right-hand is the LP reset.

If both power switches are ON, but the electric element is not heating the water, press both reset buttons on the back of the water heater.

If pressing the reset buttons restores operation, it's an indicator that the thermostat may have failed to cut power to the heating element. This would have allowed the water temperature to reach too high a level. The Hi-Limit/ECO switch is the failsafe device that cuts power when the thermostat fails to do so.

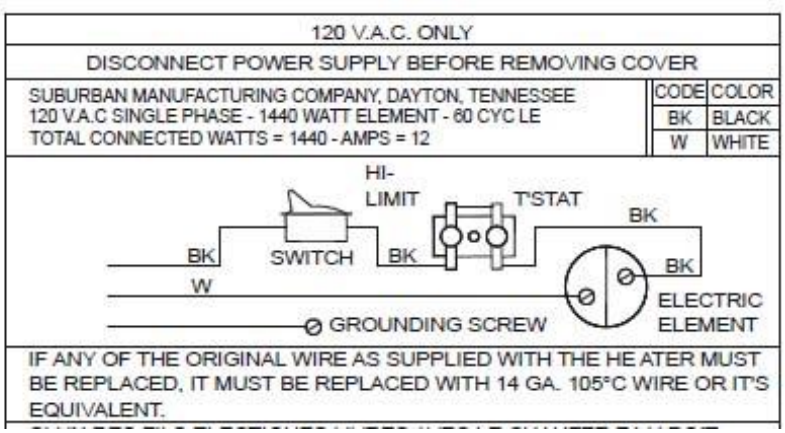
Repeated Over Temperature Shutdowns

If the heating element repeatedly shuts down and operation is restored by pressing the reset buttons, the Thermostat assembly (including the Hi-Limit/ECO switch) needs to be replaced.

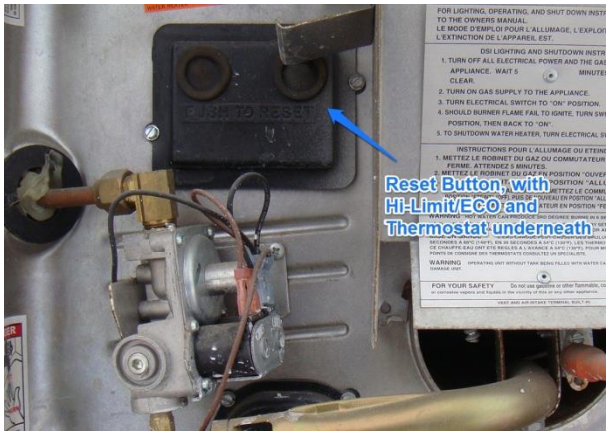
CAUTION: Never bypass the Hi-Limit/ECO or Thermostat. Doing so could result in an unsafe condition causing property damage or personal injury.

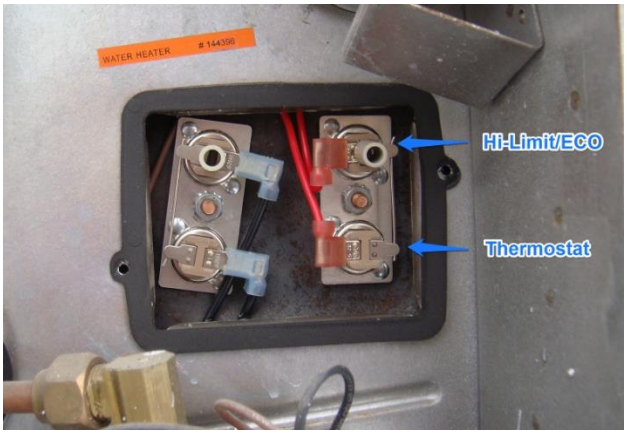
110V Wiring Diagram

This diagram shows the electric flow on the back of the water heater, through the secondary switch, to the Hi-Limit/ECO, to the Thermostat, and then to the electric element. Note that the black wire is hot, and the white wire goes to neutral.

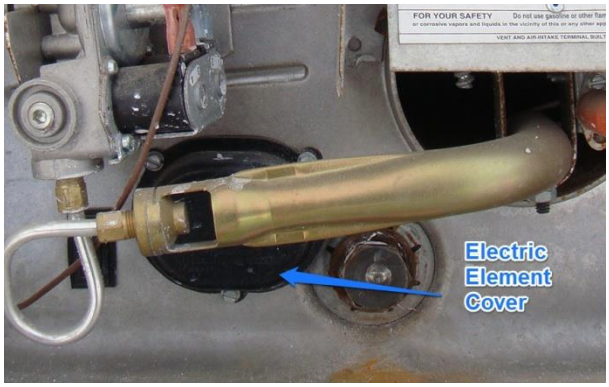


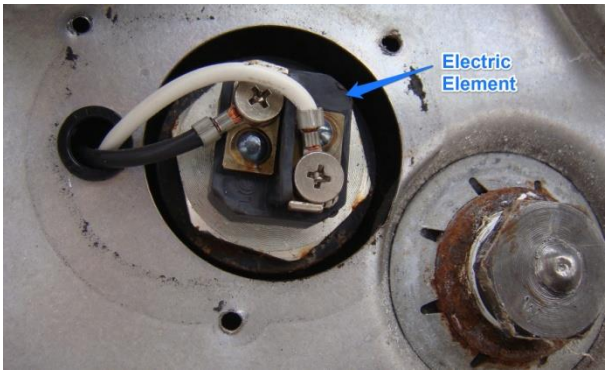
Accessing the electric components to test for power





The left picture shows the reset buttons which can be pressed with the cover in place. The right picture shows the Hi-Limit/ECO and Thermostat assemblies with cover removed. The left assembly is for the 110V circuit and the right is for the 12V circuit to the LP side of the water heater. Voltage readings may be taken on the wiring terminals for these devices. Note that the sensor on the left carries 110V AC and the sensor on the right carries 12V DC.





The left-hand picture above shows the Electric Element Cover, held in place by 2 screws. After removing the cover, use a Volt Meter set to 110V AC range to determine if 110V is reaching the electric element.

110V Not Getting to the Heating Element

If the volt meter **doesn't** show 110V at the electric element terminals, work backwards to determine where the circuit has been interrupted. Test for voltage at the thermostat, and at the Hi-Limit/ECO sensor.

If voltage is present at one side of the Hi-Limit/ECO/Thermostat device, but not at the other, and the water is cool, that device will need to be replaced. Turn off both power switches, make sure the water is cool, and drain the water heater before replacing.

CAUTION: Never bypass the Hi-Limit/ECO or Thermostat. Doing so could result in an unsafe condition causing property damage or personal injury.

If there is **NO** power on either terminal of the Hi-Limit/ECO/Thermostat, check for power on both sides of the secondary 110V switch when the switch is on. Turning the switch off should interrupt power flow.

Relay Behind the Switch Panel

Beginning in 2012 or 2013, some trailers may have an interior water heater electric switch that uses 12V DC instead of 110V AC. DC switches are typically rocker switches whereas AC switches are usually wall-type light switches. A 12V DC switch powers a relay that is probably located behind the switch panel. The relay, when energized, supplies 110V AC to the water heater.

110V is Present at the Heating Element

If voltage at the heating element is correct (measured from the black wire's terminal to frame ground) that would usually mean the electric element is defective or burned out and needs to be replaced. Before changing the element, you should do the additional tests that follow.

Checking Resistance of the Heating Element

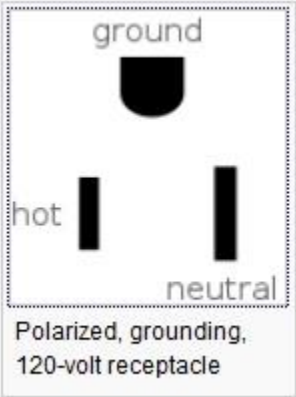
The heating element normally has a resistance of 14.5-17 Ohms. Turn both power switches off. Before proceeding, use the voltmeter to verify there is no voltage at the heating element.

CAUTION: If you touch your meter lead to a hot wire (110V) while set to read continuity, you could damage your meter and possibly injure yourself.

After verifying no voltage at the element, remove one of the heating element wires to check the resistance. If resistance is infinite (open) replace the element.

Check Neutral before Replacing the Element

Before replacing the element based on finding voltage at the element, you should **turn off power to the water heater (both switches)**, and check continuity of the white wire terminal (neutral), to the neutral pin of the closest RV outlet (the larger pin in the outlet).



CAUTION: If you touch your meter lead to a hot wire (110V) while set to read continuity, you could damage your meter and possibly injure yourself. Before checking continuity, you should set the meter to 110V and verify which pin is hot and which pin is neutral. Then switch to Ohms mode to check continuity.

Replacing the Heating Element and Gasket

Replacement Suburban heating elements may be purchased from most RV dealers, or online. Compatible heating elements are also available at many big-box hardware stores. The standard element is 1440 watts. As of 2013, Suburban offers an element with a different composition that won't be damaged if turned on with no water in the water heater. When replacing the element on 2013 or later water heaters, look for the newer type element.

1. Turn off both 110V power switches and the LP switch and make sure the water has cooled.
2. Follow the procedure later in this document to drain the water heater.
3. Remove the cover from the heating element.
4. Remove the wires from the heating element and gently bend them back away from the opening.
5. The gas burner assembly barrel blocks access to the heating element. Before removing the burner assembly light a stove burner then shut off the LP supply at the tanks. The burner will go out when the residual pressure is gone. That step reduces gas pressure in the lines during disassembly of the burner assembly.

6. The burner assembly (the barrel part) is likely the only thing needed to be removed and you may not have to loosen any gas fittings. The gas tube & orifice should be resting in a hole in the end of the burner.
7. Using a 7/16" wrench, remove the burner assembly barrel.
8. Using a 1-1/2" socket or wrench, or a specialized tool such as the Camco 9883 Element Wrench, rotate the heating element counter-clockwise to loosen and remove it. If stuck, use penetrating oil to loosen it.
9. Clean the mounting surface where the new gasket will be applied so that it makes good contact.
10. Install the new gasket and new heating element. Applying a coating of plumber's grease to the new gasket will help prevent leaks (use a product safe for rubber gaskets). Using anti-seize on the element threads will make it easier to remove the element in the future.
11. Tighten to compress the gasket, but do not over tighten.
12. Reattach wires and replace the cover.
13. Reconnect the burner assembly and be sure the gas fittings are tight. Turn on the gas supply, test the joints with a soapy water spray before & during first lighting of the burner.
14. Install the anode rod and fill the water heater.
15. Test for correct operation.

CAUTION: Propane is extremely dangerous. Any time that gas fittings are loosened or removed, after reinstalling/tightening, it's critically important that you ensure there are no gas leaks.

Troubleshooting LP Mode

To operate in LP mode, turn on the LP rocker switch in your control panel. A small indicator light will illuminate for about 15 seconds to let you know that the ignition sequence is underway. During the 15 seconds, the control board will attempt to purge air from the propane feed line and then will attempt to light the propane 3 times over the next 6 seconds. If it fails, the water heater will lock the LP operation for safety reasons and the light will stay on. To clear the lockout, turn the switch off for 10 seconds and then turn on again to retry. Note that if the water in the tank is already heated, the ignition sequence may not occur until the water cools to less than 100 degrees.

Note: If the DC voltage falls below 12V, the water heater control board may not operate correctly, causing a failure. This could easily happen while boon docking, but could also happen for other reasons.

CAUTION: Propane is extremely dangerous. Because of the explosive dangers involved with propane, the advice presented here cannot go beyond simple checks of the propane operation. If the control board, ignition components, gas valve, burner operation, or flame sensing devices are suspected of failure, you should find a certified technician to correct the problem.

If you smell propane while trying to diagnose a water heater problem, STOP and wait for the propane to dissipate. If the smell continues, close both LP tank valves and get help.

Propane Supply

In order for the LP side of the Water Heater to function correctly, it needs 11 Water Column Inches of propane pressure. Since this is checked with specialized equipment, we can't check it directly without calling in a certified technician who has the appropriate tools.

One proxy for the specialized equipment is the RV Furnace. The furnace relies on good propane flow in order to operate correctly. If the furnace is operating correctly, propane flow is probably ok. If it's not practical to run the furnace, another proxy would be an LP generator, if you have one. It's also very demanding on propane flow. The next choice would be to check at the range top in the kitchen. If all burners operate with normal flame, that's a good indicator, but unfortunately, it may not be definitive.

If You Suspect a Problem with Propane Flow

Besides an empty tank, the most common causes of poor propane flow are:

- Tank valve opened too quickly, deploying the overflow protection device inside the tank.
- Failing high-pressure pigtail between tank and regulator.
- Failing high-pressure regulator (Between the tank and the auto-changeover regulator. On 5th wheels, usually by the door side tank.)
- Failing auto-changeover regulator.

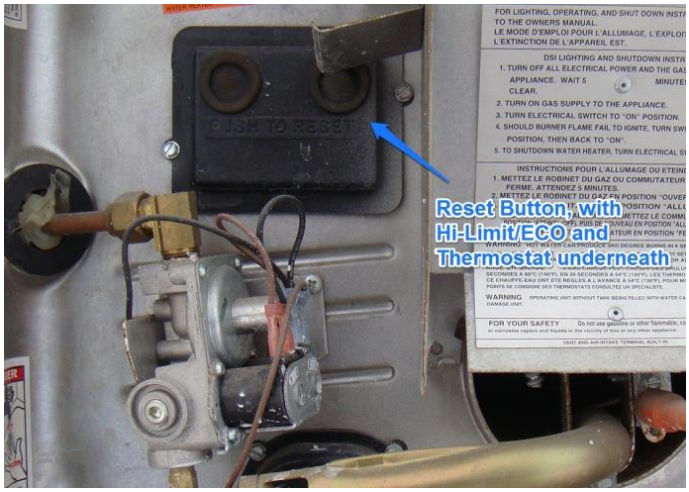
Close the valve on the tank being used, wait a few seconds, and re-open it very slowly to reset the overflow protection device. If that doesn't resolve the problem, try switching the auto-changeover regulator to the other LP tank and slowly open that tank valve. If that doesn't resolve the problem,

swap the position of the LP tanks to bypass a possible failing high-pressure pigtail, or failing high-pressure regulator.

If none of those actions resolve the problem, and you still suspect a problem with poor propane flow, you may have to replace the auto-changeover regulator.

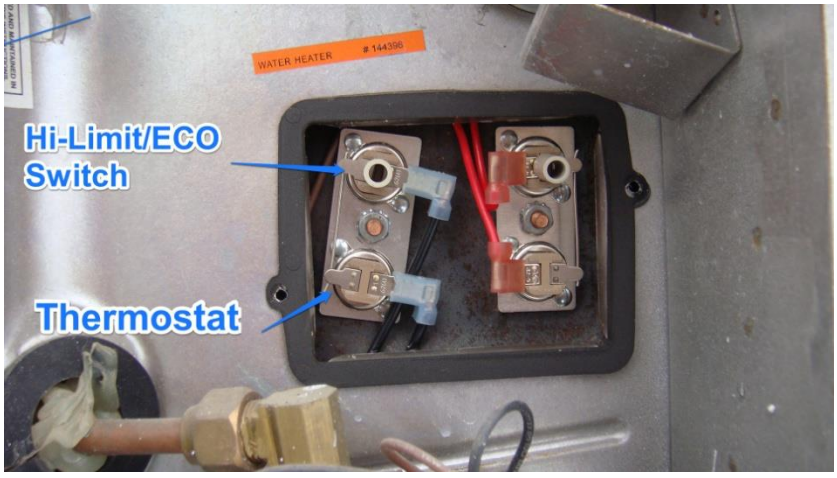
Hi-Limit/ECO Switch and Thermostat Assembly

If the direct spark ignition is not operating, and there is therefore no attempt to ignite the propane when the LP switch is turned on, an over temperature condition may have occurred. press both reset buttons. Try operating the LP switch again.



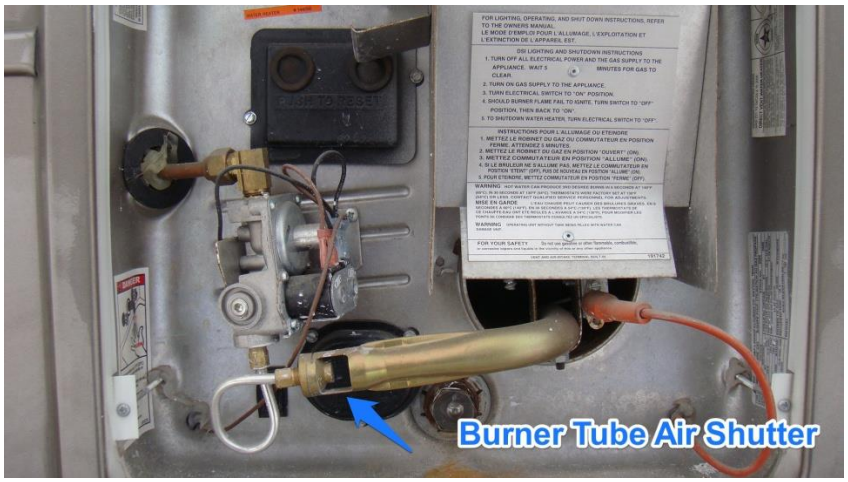
Checking the Hi-Limit/ECO Switch and Thermostat Assembly

If pressing the reset buttons doesn't resolve the problem, remove the cover from the reset buttons and check for 12V DC at the Hi-Limit/ECO Switch and at the Thermostat. If 12V DC is present on the top connector, but not on the bottom connector, and water is cool, the Hi-Limit/ECO Switch / Thermostat assembly needs to be replaced. Turn off all power switches, close the LP tank valves, drain the tank, and replace the assembly. Then refill the tank and retry LP operation.



Obstruction of the Air Intake

Check for evidence of insects or other foreign material blocking the air intake or burner tube Air Shutter. Clean as necessary.



Other Problems with the LP Side of the Water Heater

Going further with LP diagnostics requires more specialized training than can safely be provided in a guide such as this. At this point, you'll have to find a certified technician to fix the water heater.

Warranty

The water heater is warranted by Suburban. Check the documentation that came with your trailer to determine the length of warranty on the water heater and whether repairs will be covered by the warranty.

Changing the Check Valve

Some owners have experienced failed or broken check valves with the plastic units used on some models. If the check valve cracks or breaks, water will leak into the basement and underbelly. In addition, a failed check valve may allow cold water or antifreeze (when winterizing) to enter the water heater through the hot water outlet. Aside from the expense of filling the water heater tank with antifreeze, antifreeze can damage the water heater.

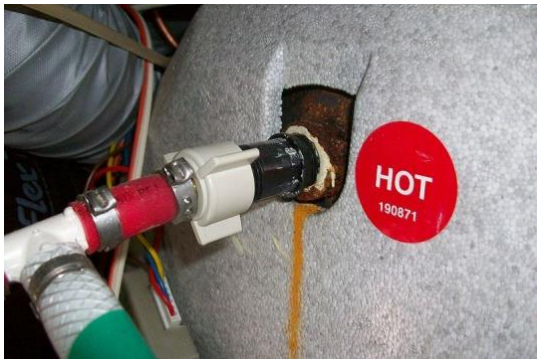
To fix this issue many owner have replaced the plastic check valve with a brass check valve ("like this one from Camco"). You may want to consider replacing the plastic valve early in the life of your trailer, to prevent problems.

Note that some brass plumbing fixtures contain a minute amount of lead left over from the manufacturing process. While most authorities believe this level of lead content is not a problem, stricter environmental authorities believe that even minute amounts of lead should be avoided in water supply equipment. If this is a concern to you, you may want to skip this modification.

In early 2013, Heartland began using brass check valves across the product line. Also note that models that have 3 independent valves for the water heater bypass probably do not use a check valve on the water heater hot water out connection.

Installing the new check valve is fairly simple.

1. Turn off both the electric and LP gas sources to the water heater.
2. Relieve pressure, remove the anode rod and drain the water heater.
3. Remove the basement wall to gain access to the back side of the water heater.
4. Locate the Hot Water Outlet Port near the top of the water heater.



5. Remove the water line from the check valve. This can be done by hand.

6. Use a wrench to remove the check valve from the water heater. Apply force gradually to avoid possibly cracking the plastic check valve. The check valve may be brittle and could break easily leaving difficult to remove broken pieces.

7. If the old check valve has already broken, a nipple removal tool may help. Nipple removal tools can be found in the sprinkler section of most Home Depot stores. If the plastic is not coming out of the threads, a hacksaw blade may help clean the threads.
8. Make sure the threads of the water heater are clean and that nothing is clogging the outlet.

9. Install the new check valve into the water heater. Use pipe dope or Teflon tape on all joints. A male to male adapter (close nipple) will be needed if using the Camco check valve, but these are easily found and any plumbing or hardware store.

10. Reconnect the water line to the new check valve.

11. Replace the anode rod, refill the freshwater system, and check for leaks.

Routine Maintenance on the Water Heater

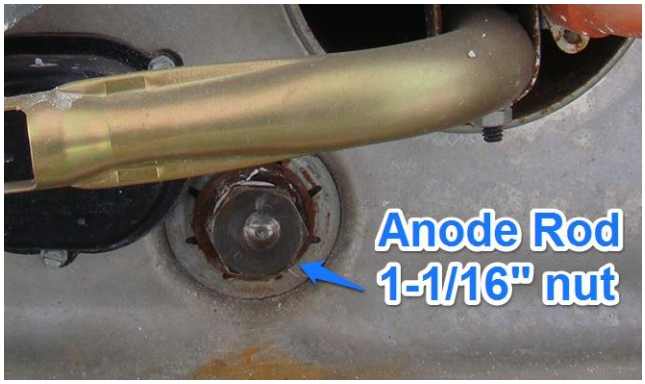
Draining the Water Heater / Winterizing

***CAUTION**: Before draining the tank or changing the anode rod, turn the water heater off and allow the water to cool. Then lift the pressure relief valve on the back of the heater before loosening the rod. If you skip these steps, you could be scalded by hot water, or the water pressure could cause the anode rod to be propelled away from the RV at high speed causing injury or property damage.*

1. Turn off the water heater (110V and LP) and allow it to cool completely.
2. Turn off the secondary 110V switch on the back of the water heater
3. Turn off the city water and the water pump.
4. Open hot and cold water faucets
5. Open the pressure relief valve
6. After pressure is relieved, use an anode rod removal wrench, or standard 1-1/16" socket wrench to rotate the nut counter-clockwise and unscrew the anode rod. Note that Atwood water heaters will have a drain plug, but no anode rod.
7. Allow the water to drain completely. You may want to take this opportunity to clean the residue at the bottom of the water heater tank using a wand attached to your water hose.
8. If winterizing, turn the Water Heater Bypass control to the BYPASS position to prevent water or RV antifreeze from entering the water heater tank.
9. You may want to reinstall the anode rod/drain plug at this time, using Teflon tape or equivalent to prevent water leaks. Teflon tape will also make future removal easier. **Do not over tighten.**
10. Atwood only: The following is a quote from the Atwood Manual.

    "After draining the tank, because of the placement of the Drain Plug, approximately two quarts of water will remain in the tank. This water contains most of the harmful corrosive particles. To remove these harmful corrosive particles flush the tank with either air or water. Whether using air or water pressure, it may be applied through the inlet or outlet on the rear of the tank or the Pressure Temperature Relief Valve. (If using the Pressure Temperature Relief Valve the Support Flange must be removed). The pressure will force out the remaining water and the corrosive particles. If you use water pressure, pump fresh water into the tank with the assistance of the on-board pump or use external water for 90 seconds to allow the fresh water to agitate the stagnant water on the bottom of the tank and force deposits through the drain opening. Continue repeating adding water and draining until the particles have been cleared from the water remaining in the tank."

Anode Rod



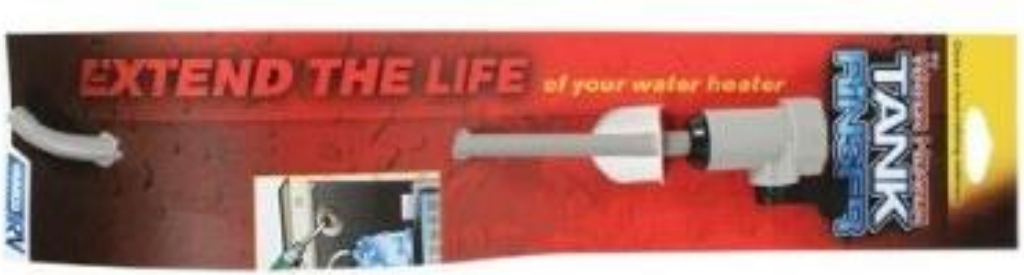
The water in the tank creates a chemical reaction that can attack and destroy the lining of the water heater. In order to protect the lining, a sacrificial anode rod is used. As the rod is worn away, it will eventually need to be replaced. A new anode rod costs about $15, is available at most RV dealers, and from numerous online sellers, and can be installed without any special training. You will need a 1-1/16" socket to remove the old rod.

Note: Atwood Water Heaters have a different tank lining that doesn't require an anode rod. There will be a drain plug only.

***CAUTION**: Before draining the tank or changing the anode rod, turn the water heater off and allow the water to cool. Then lift the pressure relief valve on the back of the heater before loosening the rod. If you skip these steps, you could be scalded by hot water, or the water pressure could cause the anode rod to be propelled away from the RV at high speed causing injury or property damage.*

See the procedure above for draining the water heater tank.
Using an anode rod removal wrench, or standard 1-1/16" socket wrench, rotate the nut counter-clockwise and unscrew the anode rod. Before inserting the new anode rod, wrap the threads of the rod with Teflon tape or equivalent to prevent water leaks. This will also allow easier future removal. **Do not over tighten.**

Before you replace the anode rod, it's a good idea to flush out the residue that's at the bottom of the tank. You'll need a water hose with a narrow extension that will fit into the opening for the rod. Most RV dealer parts shops will carry an inexpensive tool made for this purpose.



Anode Rod Life

You should inspect the anode rod annually. If there's substantial (75% eroded) erosion, or if you can see the interior metal support, you should replace the element. If you empty the water heater when the RV is not in use, you may prolong the life of the anode rod.

Keep in mind that a new anode rod is very inexpensive compared to the cost of a new water heater if the inside lining is damaged because you let the anode rod wear out. For $15, you might just replace the anode rod every year.

Seeping/Dripping

If the pressure relief valve on the back of the water heater seeps or drips water, you may have lost the air pocket that is normally present at the top of the water heater. This can occur over time.

To re-establish the air pocket, follow these steps.

1. Shut off the water heater (LP and electric)
2. If using city water, turn off the faucet. If on internal water, turn off the pump.
3. Open a hot water faucet in the RV.

CAUTION: If the water is still hot, you could get scalded in the next step)

4. Carefully open the pressure relief valve and allow water to flow out until it stops flowing.
5. Let the pressure relieve valve snap back to the closed position.
6. Close the hot water faucet and turn on the water supply.
7. Turn the water heater on and check for normal operation.

If the seeping/dripping continues, the pressure relieve valve is probably defective.

Unpleasant sulphur or rotten-egg odor

For Suburban Water Heaters, the following is a quote from the Suburban Manual.

> "Sulphur water can be caused by a chemical action or by bacteria. The solution to eliminate is chlorination of the water system. Add about six (6) ounces of chlorinated common household liquid bleach to each 10 gallons in the water tank. Then run the chlorinated water throughout the system, opening each faucet one at a time until you smell the chlorine. Let the RV sit for a few days and the chlorine should take care of the problem. Then you will need to take care of the chlorine. Remove the chlorine by flushing the system with fresh water. This may take several attempts. You may consider adding a filtering system that removes chlorine and prevents sulphur water. If the sulphur or rotten egg smell continues, flush the system once again as described above and replace anode rod as necessary."

For Atwood Water Heaters, the following is a quote from the Atwood Manual.

1. "Turn off main water supply. Drain the water heater tank and reinstall drain plug. Remove the pressure-temperature relief valve. Mix solution of 4 parts white vinegar to two parts water. With a funnel, carefully pour solution into tank.
2. Cycle water heater with the above solution, letting it run under normal operation 4-5 times.
3. Remove the drain plug and thoroughly drain all water from the tank.
4. Flush the water heater to remove any sediment. You may flush the tank with air pressure or fresh water. Pressure may be applied through either the inlet or outlet valves on the rear of the tank or through the pressure temperature relief valve coupling located on the front of the unit."

Document Change History

Version 1.1 – March 8, 2013

Version 1.2 – June 24, 2013

- Page 7: corrected left/right references for 110V and 12V circuits on Thermostat/ECO assembly.
- Page 8: added note about possible use of 12V relay to energize 110V electricity to water heater.
- Page 9: added note about new electric heating element that isn't damaged if run with no water.
- Page 14: added notes about Heartland use of brass fittings beginning early 2013 and likelihood that units with 3 separate valves for the hot water bypass probably don't have a check valve.

Version 1.3 – June 13, 2015

- Page 5: added note about checking for water in water heater by operating temp/pressure relief valve.
- Page 6: corrected left/right references for 110V and 12V circuits on Thermostat/ECO assembly.