

SERVICE MANUAL

200 SERIES



250P and 250D



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About the Aqua-Hot 250D and 250P

The Aqua-Hot 250D, and 250P are hydronic (water based) heating systems that provide interior heat and tankless, continuous hot water in one small, easy to install package.

The heating system provides moist, quiet, comfortable interior heat. It is equipped with one thermostatically controlled temperature zone.

The tankless hot water system produces 90 gallons per hour (1.5gal/minute) of continuous hot water

The system uses one or a combination of heat sources to heat FDA-approved “Generally Recognized As Safe” (GRAS) propylene glycol based anti-freeze solution contained within the Aqua-Hot boiler tank.

The 250D and 250P use a 12-volt DC powered burner (Propane or Diesel respectively) as the primary heating source. The propane and diesel burners should be used as the primary heating source for hot water, and interior heating needs. The 250 also has one 120-volt AC, 1000 watt electric element for use when shore power is available as a supplemental heating source. Once the tank has been brought to operating temperature by the propane or diesel burner, the electric element can be used to maintain this temperature, as well as provide hot water and interior heat for light-duty applications. The burner, and the electric element can be used together or separately.

For continuous hot water or heat in colder conditions, the propane or diesel burner must be active.

Should additional assistance be required, please contact the product application department at +1 (800) 685-4298, Monday through Friday, between 7am and 4pm Mountain Standard Time.

Caution Notes

As you read this information, take particular note of the NOTICE, CAUTION, WARNING and DANGER symbols when they appear. This information is important for safe and efficient use of the Aqua-Hot system.

NOTICE signals a situation where potential damage to the Aqua-Hot could occur.



CAUTION signals a situation where potential harm or risk of minor or moderate injury could occur if you do not follow instructions.



WARNING signals a hazardous situation where potential harm, risk of serious injury, or death could result if instructions are not followed.



DANGER signals a situation where immediate risk of serious injury or death will result if instructions are not followed.



NOTE: This manual will also use notes sections similar to this one to draw attention to features and practices which should be observed.

Read all instructions before installing the Aqua-Hot unit. Aqua-Hot Heating Systems is not liable for damage resulting from failing to follow instructions contained in this, and any other Aqua-Hot documentation relevant to this unit.

- Read this service manual before installing or using the Aqua-Hot System to reduce the risk of injury to persons or damage to the equipment
- The product identity label contains specifications of the unit, to what standard it has been tested, and important safety notices.
- The Aqua-Hot must be installed in a compartment that is closed off from living quarters and accessible only from the outdoors.
- Propylene glycol based anti-freeze “Generally Recognized As Safe” by the FDA must be utilized for the anti-freeze and water heating solution.
- An interlock switch prevents the Aqua-Hot heater from operating when the cover is not installed, or is installed incorrectly
- Disconnect electric wiring to the Aqua-Hot System before welding or plasma cutting the coach to avoid damage to equipment



WARNING

If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury, or death.

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this, or any other appliance.

WHAT TO DO IF YOU SMELL GAS

- Evacuate all persons from the vehicle
- Shut off the gas supply at the gas container or source
- Do not touch any electrical switch or use any phone or radio in the vehicle
- Do not start the vehicle's engine or electric generator
- Contact the nearest gas supplier or qualified service technician for repairs
- If you cannot reach a gas supplier or qualified service technician, contact the nearest fire department
- Do not turn on the gas supply until the gas leak(s) have been repaired.
- Installation and service must be performed by a qualified installer, service agency, or gas supplier



CAUTION

- Air pressure to the tank must not exceed 18 PSI. Exceeding this rating will cause internal damage to the Aqua-Hot.
- The Aqua-Hot's exhaust is extremely hot, and must be kept away from heat sensitive materials
- Use caution when working on or near the propane gas system
- DO NOT connect the 12-volt DC power to the Aqua-Hot if the vehicle requires welding
- At maximum operating temperature, the coolant will be very hot and scalding hot vapor or coolant may result in serious burns or injury.
- DO NOT activate the burner until the anti-freeze and water heating solution has been added to the boiler tank to avoid serious damage to the heater

NOTICE

This appliance operates on both AC and DC power.

Use only nontoxic propylene glycol based boiler antifreeze with additives generally recognized as safe ("GRAS") by the FDA.

Failure to winterize your heater, when stored in freezing temperatures, will result in serious damage to the product's domestic hot water heating system.

Air pressure applied to the tank must not exceed 20 psi. Excess pressure will result in internal damage.

For detailed information, reference the owner's manual or contact Aqua-Hot Heating Systems, Inc. at 800-685-4298.

AVIS

Cet appareil fonctionne à la fois sur une alimentation a. c. et c. c.

Utiliser uniquement un antigel de chaudière à base de propylène glycol non toxique avec des additifs généralement jugés sans danger « GJSD » (« GRAS » /generally recognized as safe) par la FDA.

Ne pas hiverner l'appareil de chauffage lorsqu'il est entreposé à des températures inférieures à 0 ° C provoquera de graves dommages au système de chauffage d'eau chaude domestique du produit.

La pression d'air appliquée au réservoir ne doit pas dépasser 20 psi. Tout excès de pression provoquera des dommages internes.

Pour des informations détaillées, consulter le manuel d'utilisation et contacter Aqua-Hot Heating Systems, Inc. en composant le 800-685-4298.

SAFETY INSTRUCTIONS

A. This appliance does not have a pilot. It is equipped with an ignition device, which automatically lights the burner. Do not try to light the burner by hand.

B. BEFORE OPERATING, smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Forced or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

CONSIGNES DE SÉCURITÉ

A. Cet appareil ne comporte pas de veilleuse. Il est muni d'un dispositif d'allumage qui allume automatiquement le brûleur. Ne tentez pas d'allumer le brûleur manuellement.

B. AVANT DE FAIRE FONCTIONNER, reniflez tout autour de l'appareil pour déceler une odeur de gaz. Reniflez près du plancher, car certains gaz sont plus lourds que l'air et peuvent s'accumuler au niveau du sol. QUE FAIRE SI VOUS SENTEZ UNE ODEUR DE GAS :

- Ne pas tenter d'allumer d'appareil.
- Ne touchez à aucun interrupteur ; ne pas vous servir des téléphones se trouvant dans le bâtiment.
- Appelez immédiatement votre fournisseur de gaz depuis un voisin. Suivez les instructions du fournisseur.
- Si vous ne pouvez rejoindre le fournisseur, appelez le service des incendies.

C. Ne poussez ou tournez la manette d'admission du gaz qu'à la main; ne jamais utiliser d'outil. Si la manette reste coincée, ne pas tenter de la réparer, appelez un technicien qualifié. Le fait de forcer la manette ou de la réparer peut déclencher une explosion ou un incendie.

D. N'utilisez pas cet appareil s'il a été plongé dans l'eau, même partiellement. Faites inspecter l'appareil par un technicien qualifié et remplacez toute partie du système de contrôle et toute commande qui ont été plongés dans l'eau.



250P



www.aqua-hot.com

OPERATING INSTRUCTIONS

1. **STOP!** Read the safety information to the left on this label.
2. This appliance is equipped with an ignition device, which automatically lights the burner. Do not try to light the burner by hand.
3. Ensure that the gas control valve is turned on. Follow "B" in the safety information to the left on this label. If you don't smell gas, go to the next step.

4. Refer to the Owner's Manual for information regarding normal operation of this heating system.

5. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" below on this label and refer to the Owner's Manual troubleshooting section or call the technical support department at 1-800-685-4298.

TO TURN OFF GAS TO APPLIANCE

1. Turn off all electric power to the appliance if service is to be performed.
2. Set all interior thermostats to their lowest setting.
3. Turn the gas control knob located on the heater's propane inlet port clockwise to the "OFF" position.

INSTRUCTIONS DE MISE EN MARCHÉ

1. **ARRÊTEZ!** Lisez les instructions de sécurité sur la portion à gauche de cette étiquette.

2. Cet appareil est muni d'un dispositif d'allumage qui allume automatiquement le brûleur. Ne tentez pas d'allumer le brûleur manuellement.

3. Assurez-vous que la soupape de contrôle de gaz est bien ouverte. Passez à l'étape B des instructions de sécurité sur la portion à gauche de cette étiquette. S'il n'y a pas d'odeur de gaz, passez à l'étape suivante.

4. Référez au Manuel du propriétaire pour des informations au sujet du fonctionnement normal de ce système de chauffage.

5. Si l'appareil ne fonctionne pas, veuillez suivre les instructions « Pour couper le gaz vers l'appareil » ci-dessous sur cette étiquette et référez à la section Dépannage du Manuel du propriétaire ou appelez le service de soutien technique au 1.800.685.4298.

COMMENT COUPER L'ADMISSION DE GAZ DE L'APPAREIL

1. Coupez l'alimentation électrique de l'appareil s'il faut procéder à l'entretien.
2. Réglez tous les thermostats intérieurs à leur réglage le plus bas.
3. Tournez le bouton de contrôle du gaz, situé sur le port d'entrée de propane du chauffe-eau, vers la droite à la position « OFF » (Arrêt).

1. Domestic Cold Water Inlet
2. Domestic Hot Water Outlet
3. Diesel Fuel Connections
4. 12V DC Harness Junction
5. Expansion Tank Connection
6. Heating Zone Outlet Port
7. Heating Zone Return Port
8. 120V AC Connection
9. Interlock Switch
10. 3-Way Valve
11. Diesel Burner Assembly
12. Boiler Tank
13. Tempering Valve
14. Diesel Burner Controller
15. Drain Valve
16. Zone Circulation Pump
17. Access Cover Screw

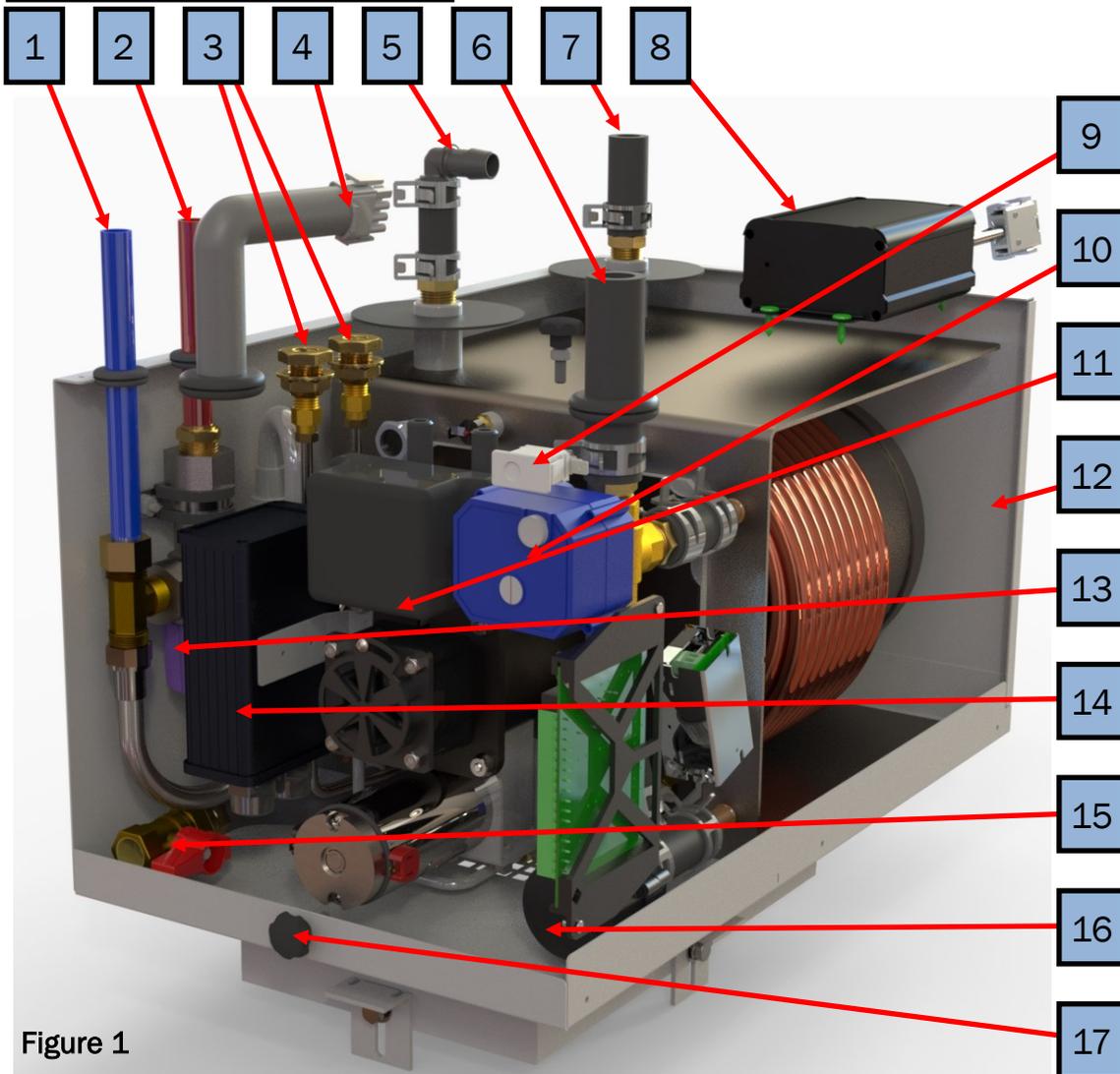


Figure 1

1. Domestic Cold Water Inlet
2. Hot Water Outlet
3. Propane Inlet Ball Valve
4. 12V DC Harness Junction
5. Expansion Tank Connection
6. Heating Zone Outlet Port
7. Heating Zone Return Port
8. 120V AC Electrical Relay Box
9. Propane Burner Assembly
10. Tempering Valve
11. Boiler Tank
12. 3-Way Valve
13. Propane Burner Controller
14. Interlock Switch
15. Drain Valve
16. Zone Circulation Pump
17. Access Cover Screw

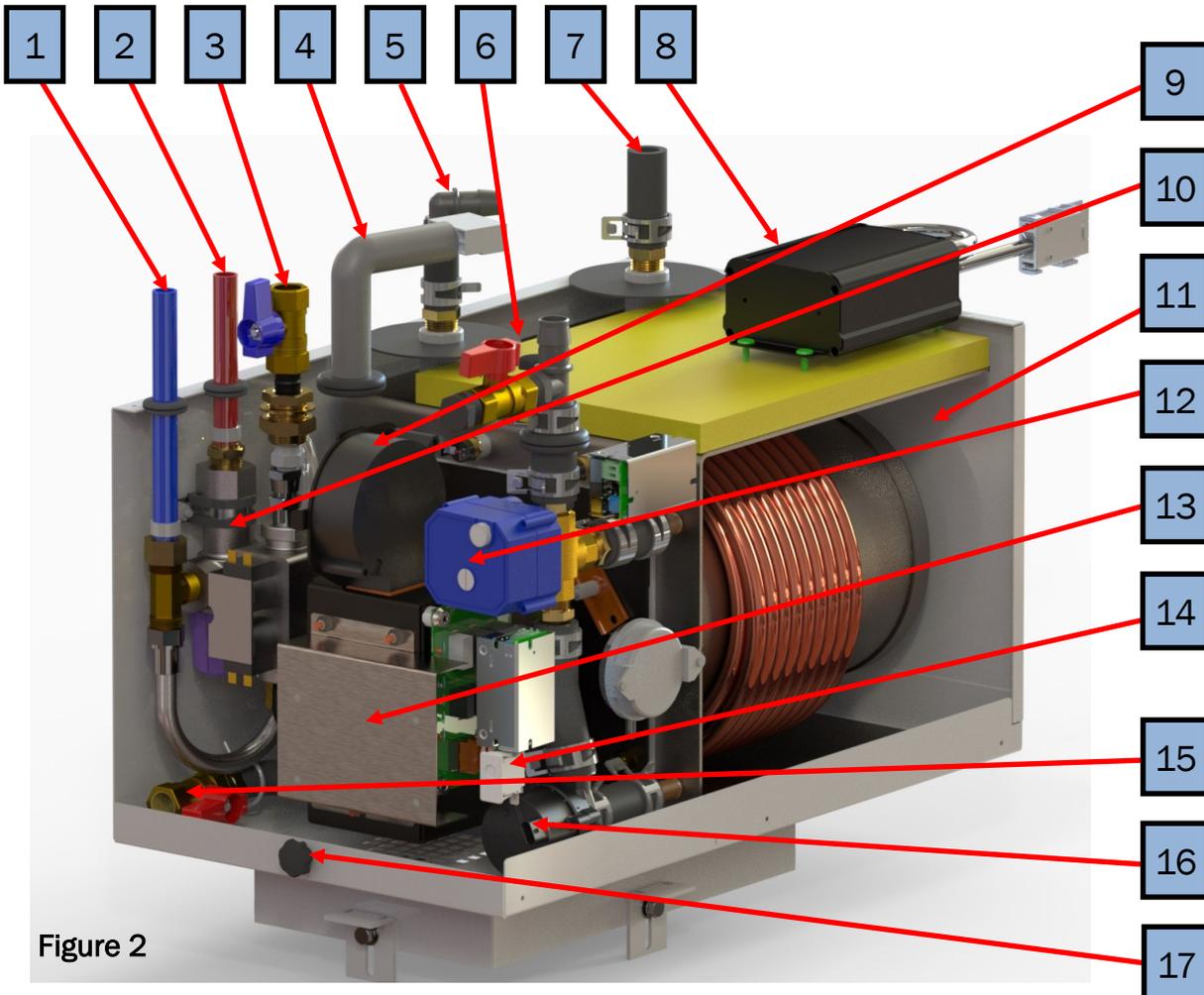
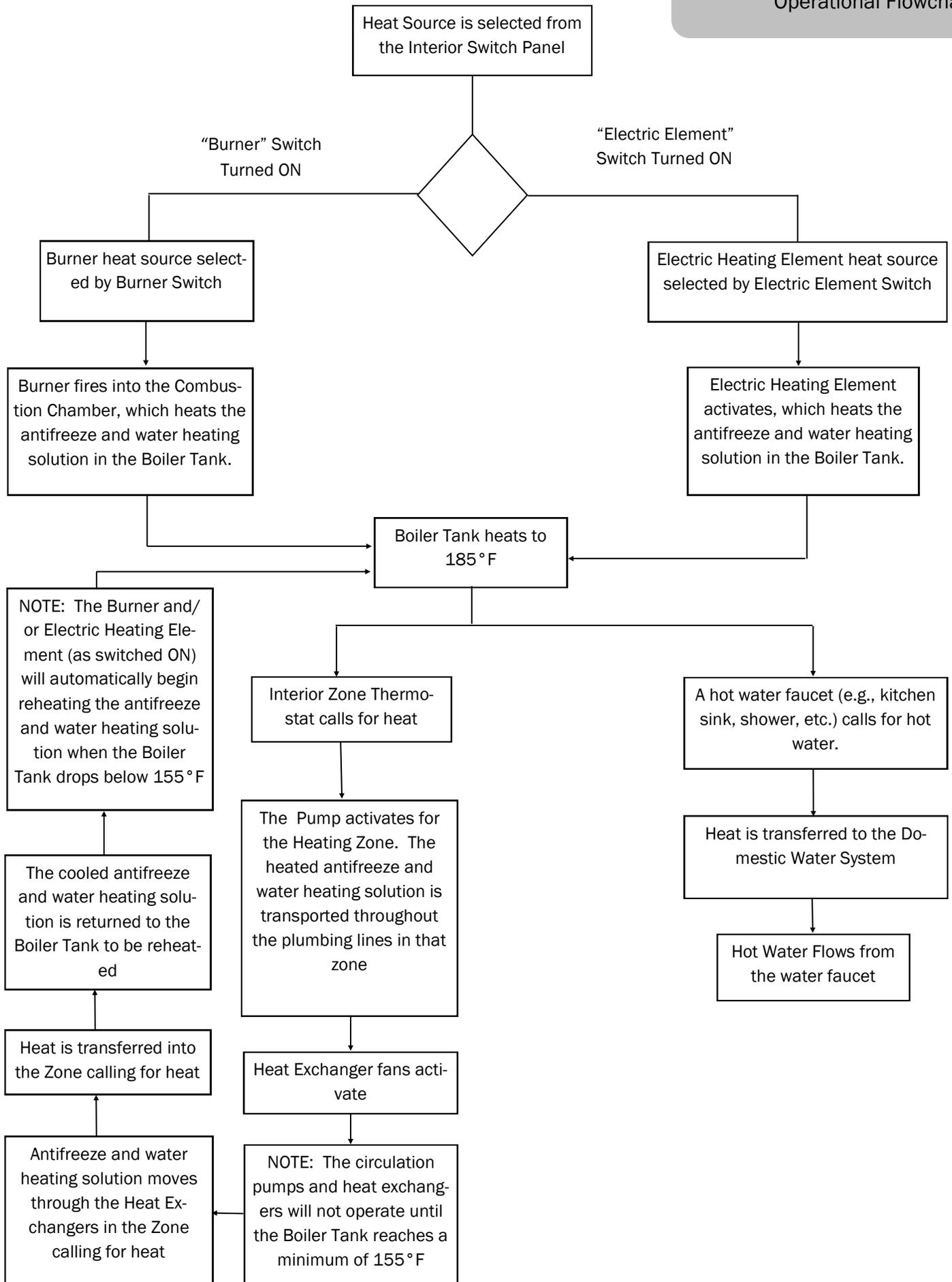


Figure 2



Relay Control Board

The relay control board at use in your Aqua-Hot 200 series unit is designed to function in conjunction with the Fenwal burner control card, or diesel burner controller to allow the heater to operate. This section will introduce you to the basic functions of the board.

Indicator lights line the bottom of the relay control board and are designated D1 through D6. Each of these lights indicates a function or event that is taking place. The detailed function of these lights will be explained on the next page.

- D1: Heating Status Light (orange)
- D2: Electric Element Power (green)
- D3: Pump Power (Blue)
- D4: Low-Temperature Cutoff Status (yellow)
- D5: Burner Status (green)
- D6: Interior Zone Heating (orange)

Fuse Functions, Locations, and Ratings

There are three fast-blow fuses included with this relay board, and may need to be replaced if they cease to function. The cradles for these fuses are labelled FH1, FH2, and FH3 and will contain either a 5A or 10A fuse. Only the 250P will utilize the 5A fuse in slot FH3, the 250D uses a 20A fuse integrated into the wiring harness to fill this need.

FH1: 10A, AC Activation Circuit and Burner

FH2: 5A, Switch Power

FH3: 5A, Burner Controller Power (250P only)

A note on diagnosing the Relay Control Board

If after diagnosing the Aqua-Hot you believe that the relay control board is at fault, it is very strongly advised that you contact Aqua-Hot Heating Systems Technical Support to ensure that the issue has been accurately diagnosed. These components have a very low rate of failure, and for that reason we recommend contacting us before replacing it in an attempt to reduce down time and unit repair costs.

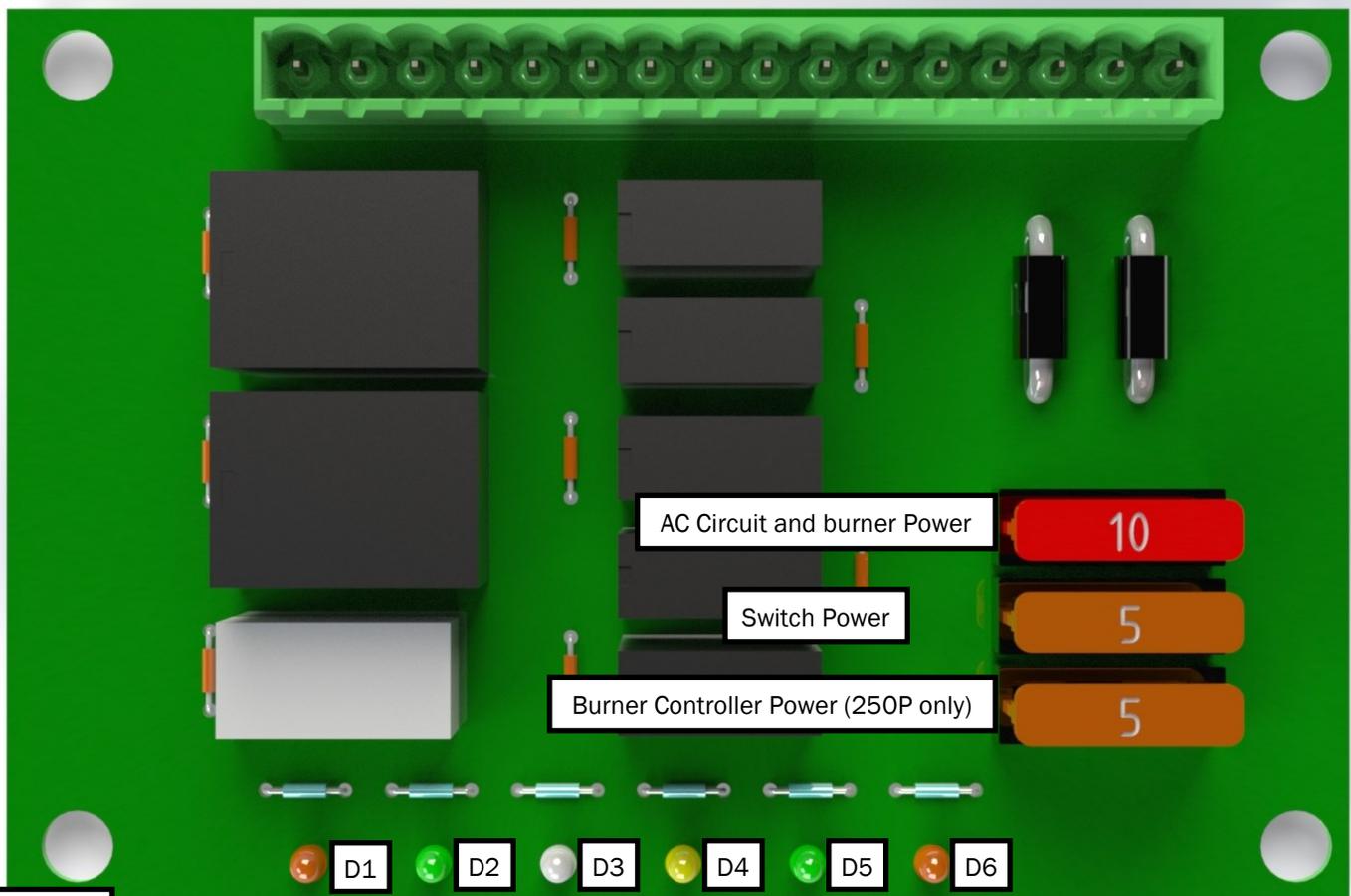


Figure 3

Heating Status (D1)

This indicator light will illuminate orange when the burner and/or electric heating element switch on the interior switch panel is on, and the control thermostat is calling for heat.

If the heater is functioning and the light is not illuminated, or the heater is not functioning and the light is illuminated, there is an issue with the wiring or one of the components.

Electric Heating Element Status (D2)

This indicator light shows the status of the electric heating element by illuminating green when the electric element switch is on. If the green LED does not illuminate, the electric element switch is off or the unit is low on fluid.

The D2 light functions with the interior electric element switch to provide functionality when requested. When the electric element switch is on, the D2 light should also be on.

If the D2 indicator light is not illuminated, but the electric switch on the interior switch panel is in the “ON” position, there is a short in the 12V DC side of the electric element circuit. This could be due to a bad connection, a bad switch, a bad fluid level sensor, or the fuse present in FH2 is not functional.

NOTE: It is possible for the Electric Heating Element and Heating Status lights to be illuminated, and the electric element not function due to an issue with the 110V AC power supply.

Pump (D3)

This indicator light shows the power status of the circulation pump within the Aqua-Hot. The circulation pump is responsible for circulating fluid through the heating zone, and stirring the fluid within the tank while it is heating.

The system functions correctly if the coach thermostat is calling for heat, the pump is operating, and the light is illuminated blue.

If the light is off while the coach thermostat is calling for heat or hot water, there may exist an issue with coach wiring, or with the relay control board.

Low-Temperature Cutoff Status (D4)

The low-temp cutoff status thermostat deactivates interior heat when domestic hot water is being used, and activates the stir pump in conjunction with the burner switch.

When this light is on, it indicates that there is either a demand for hot water, or the Aqua-Hot is not yet up to operating temperature.

Burner Status (D5)

This indicator light shows the status of the burner by illuminating green when the burner switch is on. On the 250D the indicator light on the switch panel will not illuminate if the burner is faulting.

If the burner switch is in the “ON” position, and the control thermostat is calling for heat, the D5 indicator light should illuminate in addition to the D1 heating status light.

If the indicator light remains off while the burner switch is in the “ON” position, it could indicate that there is a short present, the fuse in FH2 may be burned out, or the unit may be low on fluid.

Heating Zone Status (D6)

This light indicates the status of the coach thermostat and the heat exchanger fans. The indicator light will illuminate orange when the coach thermostat is requesting interior heat, or hot water is being requested.

If a fault condition occurs, it could be due to a wiring issue, a faulty thermostat, or issues with the heat exchanger fans.

Interior Switch Panel

Overview:

The interior switch panel is used to control the two potential heating sources for the Aqua-Hot's boiler tank. When a switch is activated, the indicator light on the switch will illuminate.

Burner Switch:

When the burner switch is in the ON position, the control thermostat will communicate with the relay control board, and burner controller that heat is needed for the tank. The burner will activate, and the unit will begin to warm up.

A cold boiler tank can be expected to reach temperature in approximately 10-20 minutes, depending on the ambient temperature. In colder temperatures, it may take longer to heat the unit to its operating temperature.

In order to reach and maintain temperature under all demands, the Burner switch must be in the "ON" position. Keep in mind that the electric element is a *supplemental* only heat source. This means that the element can provide hot water for simple tasks such as hand washing, and maintaining tank temperature at times when there is no load. The burner is intended as the primary heat source.

Additionally, the burner switch can be used to reset a low-voltage condition. This is accomplished by turning the switch "OFF" for 30 seconds, and then turning it back on. This is sometimes known as "power cycling."

Electric Element Switch

When the coach is plugged into an AC power source (e.g. shore power, or a generator) and the electric element switch is "ON," the electric heating element will be used to provide heat to the boiler tank if the need arises. A cold boiler tank can expect to be brought to operating temperature by the electric heating element in 1-2 hours depending on the ambient temperature. The electric element is intended as a *secondary, or supplementary* heating source. If used alone, the electric element will NOT be able to provide enough heat for continuous hot water, or interior heat.

 <p>LDE-200-805</p>	<div style="background-color: #f4a460; padding: 5px; text-align: center;">  WARNING </div> <p>Heater Exhaust Produces Carbon Monoxide (CO₂)</p> <p>Carbon Monoxide (CO₂) can cause headaches, brain damage or death.</p> <p>DO NOT operate heater within a closed interior area. Confirm heater switch is in OFF position when vehicle is in an enclosed space.</p>
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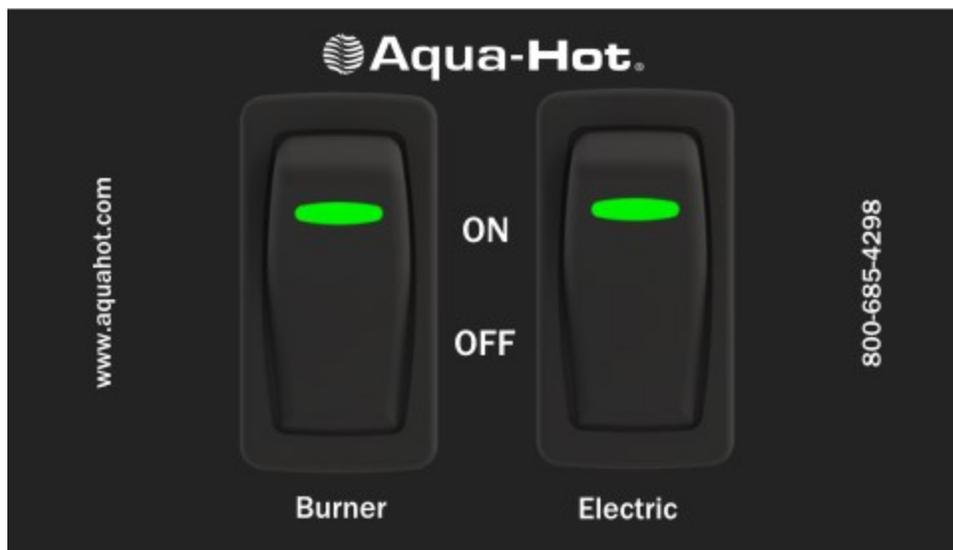
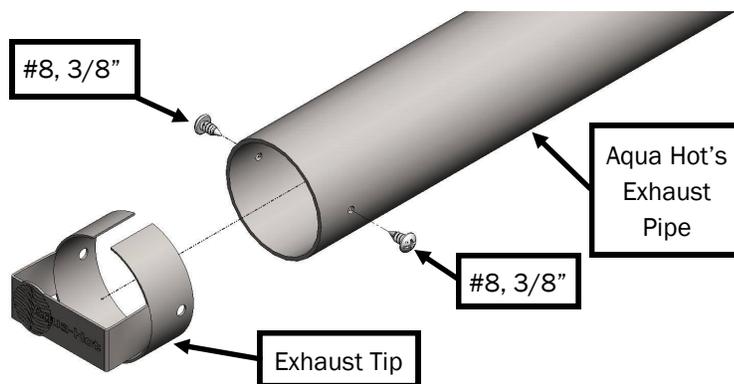
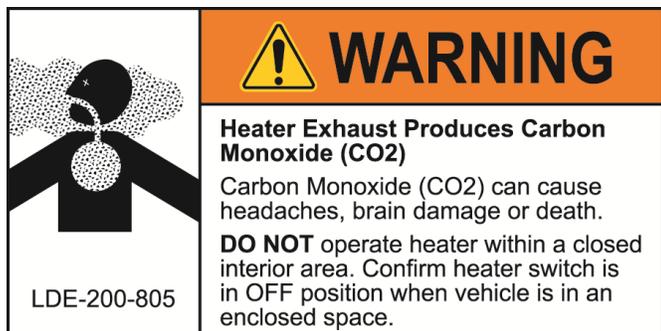
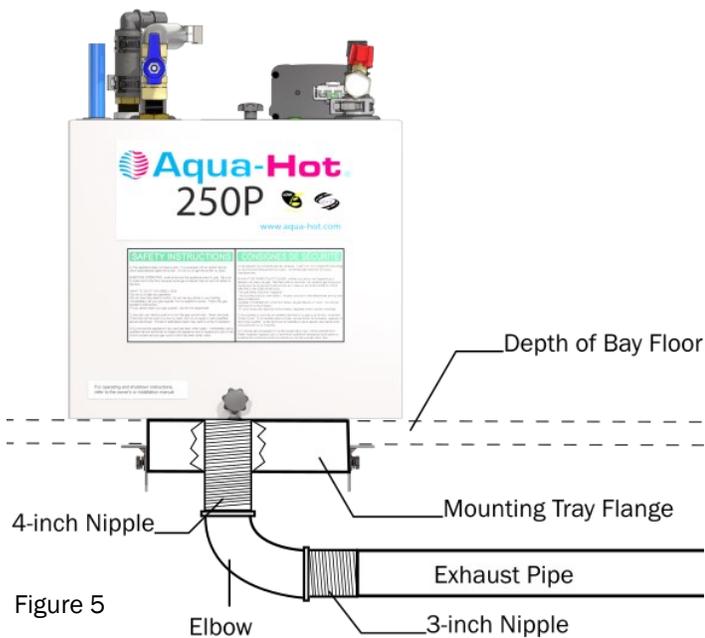


Figure 4

Exhaust Requirements

The Aqua-Hot's exhaust is hot and must be kept away from any heat-sensitive material. Therefore, the exhaust system should be checked to ensure that it continues to meet the following requirements.

- The exhaust must not be directed downward as a fire could result when parked in dry, grassy areas.
- The exhaust must not terminate underneath the vehicle, underneath an openable window or vent, in the awning area of the coach (if applicable,) or near the slide-out areas
- The exhaust must be able to freely exit away from the vehicle without any obstructions
- Use standard two-inch automotive type exhaust piping and avoid bends if possible.
- The 3-inch and 4-inch black-pipe nipple and the exhaust elbow, originally supplied with the Aqua-Hot must be used (kit sold separately.)
- The exhaust tip must be used to prevent the burner from extinguishing in winds of up to 40 mph.
- Mounting must be placed every three feet to adequately support the exhaust system
- Total exhaust system length must not exceed 30ft in total length, and shall contain no more than two 90° bends.



Components

This section of the Service Manual details various components of the Aqua-Hot that may require troubleshooting and/or replacement in the event of malfunction. Components detailed here are interchangeable between the propane and diesel units. Components specific to the diesel, or propane units are detailed in their respective sections.

NOTE: Before attempting to troubleshoot any Aqua-Hot component, please check all wiring to ensure that there is no corrosion, loose and/or faulty wiring connection present which may be causing failure.

Replacement parts can be ordered online through Aqua-Hot's webstore.

If additional assistance is needed, the technical support team can be contacted at +1 (800) 685-4298, Monday through Friday, 7am to 4pm Mountain Standard Time.

Sensors and Switches

Interlock Switch

The interlock switch is a safety device designed to ensure that the Aqua-Hot's access cover is securely installed before the burner will operate.

Troubleshoot the interlock switch if the following conditions occur;

- The burner fails to operate
- The burner indicator light fails to illuminate

Troubleshooting

1. Ensure that the boiler tank has sufficiently cooled in order to require heat from the burner
2. Activate the burner switch located on the interior switch panel
3. Locate wires #37 and #24 on the wiring harness as they lead into the interlock switch
4. Disconnect the wires from the switch, noting that wire #24 is connected to the terminal labelled "NO" and #37 is connected to the terminal labelled "COM."
5. Using an ohmmeter, check the interlock switch for continuity while the switch button is depressed.
6. If continuity is not present with the button pressed in, follow the instructions in this section to replace the interlock switch.

Replacement Procedure



DANGER

Failure to disconnect all power supplies and/or allow the unit to cool before servicing could cause serious damage or personal injury.

1. Disconnect the interlock switch wires by pulling the quick connectors from the switch spade terminals
2. Release the interlock switch from the Aqua-Hot cabinet by pushing in on the locking tabs and pulling the interlock switch
3. Remove the defective interlock switch from the Aqua-Hot
4. Install the replacement interlock switch onto the Aqua-Hot ensuring that the locking tabs snap into place
5. Connect the Aqua-Hot's replacement wires to the replacement interlock switch with wire #24 connected to the terminal labelled "NO" and wire #37 connected to the terminal labelled "COM."

NOTE: If the interlock switch's wires are connected incorrectly, the interlock switch can fail to allow the Propane-burner to operate when the access cover is correctly installed.

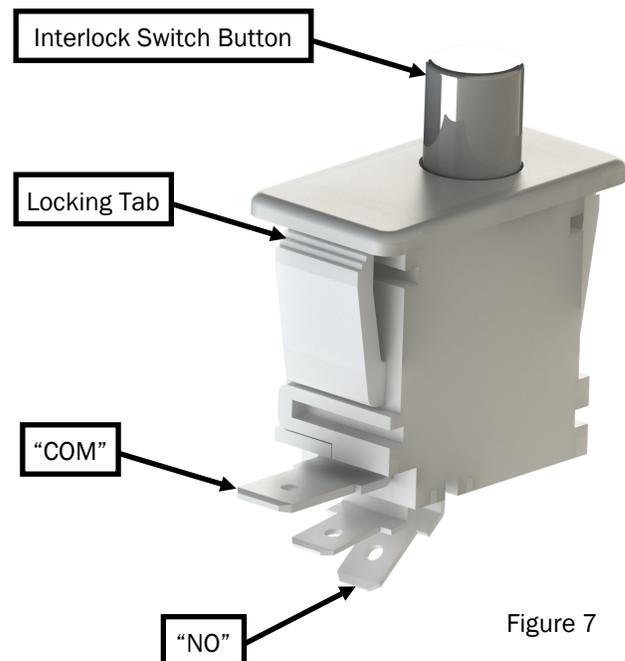


Figure 7

Expansion Bottle Fluid Sensor

Scope

The fluid sensor monitors the level of anti-freeze and water heating solution within the Aqua-Hot's expansion bottle to ensure that an adequate volume exists there, and within the boiler tank.

Troubleshoot the overflow fluid sensor if one of the following has occurred:

- The burner fails to operate
- The burner switch indicator light fails to illuminate
- The electric element fails to operate
- The indicator light on the electric switch does not illuminate

Troubleshooting

1. Verify that the Aqua-Hot's expansion bottle is full of anti-freeze and water heating solution
2. Verify that the wiring is secure, and in good working condition
3. Locate the wiring harness for the unit. Find wires #10, #15, and #16. Wires #10 and #15 will co-terminate in a yellow connector.
4. Disconnect these wires from the expansion bottle, and test for continuity across the expansion bottle sensor.

5. If the bottle contains fluid, and continuity does not exist across the fluid-level sensor, the sensor will need to be replaced.



Replacement Procedure

1. A new expansion bottle kit can be ordered online at our webstore, or by phone at +1 (800) 685-4298.
2. Using a hose clamp, clamp off the connection between the expansion bottle and the fluid return port as depicted below.
3. Disconnect the fluid expansion hose from the expansion bottle, and allow the bottle and the hose to drain into a receptacle.
4. Disconnect the wires leading from the expansion bottle to the wire harness, paying particular attention to which wires belong to each receptacle
5. Remove any and all mounting hardware used to affix the expansion bottle into place.
6. Replace the faulty expansion bottle with a replacement, using the previously removed mounting hardware to affix the new bottle in position.
7. Reconnect the expansion tubing, and fill the bottle until it reaches the cold fill line.
8. Reconnect the expansion bottle wires as they were removed. Note that connecting these wires backwards will not allow the expansion bottle sensor to function as intended.

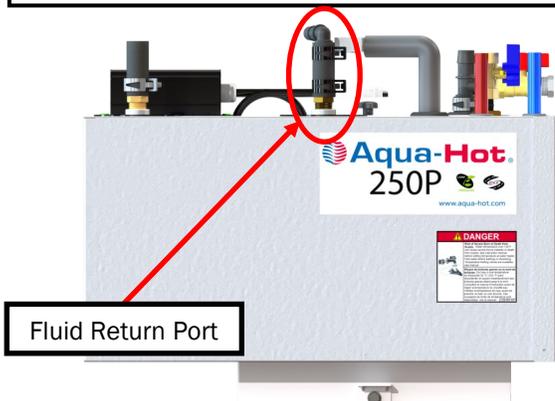


Figure 8

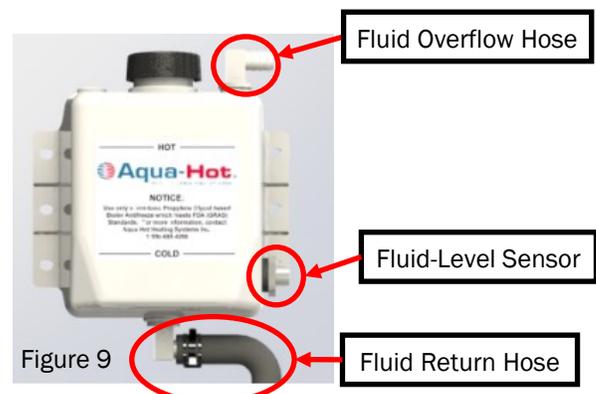


Figure 9

Thermostats

Control Thermostat

The control thermostat is installed into the Aqua-Hot's boiler tank and monitors the temperature of the anti-freeze and water heating solution to determine when it is at operating temperature and when it requires heat. The Aqua-Hot is considered to be at operating temperature between 155°F and 188°F. Please reference page 8 for relay control board LED indicator information.

Troubleshooting Condition

Troubleshoot the control thermostat if one of the following conditions has occurred:

- There is a lack of hot domestic water and interior heat
- The orange heating status light (D1) does not illuminate while the unit is below 155°F.

Troubleshooting

1. Verify the following before troubleshooting the control thermostat.
 - A. The interlock switch is depressed
 - B. The overflow bottle is adequately filled
 - C. The high-limit thermostats are not tripped
 - D. Fuses in the relay control board are functional
2. Turn the burner and/or electric element switches to the "ON" position.
3. Check the relay control board to ensure that "Electric Heating Element Status (D2)" and/or "Burner Status (D5)" indicator lights are illuminated.
4. Verify that the "Heating Status (D1)" indicator light on the electronic relay control board is illuminated as it should be whenever the Aqua-Hot is below 155°F.

NOTE: The Propane-burner and/or electric element switch must be in the ON position for the "Heating Status" indicator light on the relay control board to illuminate.

If the "Heating Status (D1)" indicator light is not illuminated, check the following;

- Verify that the temperature of the boiler tank has fallen below the 155°F minimum operating temperature by checking with an infrared thermometer. Take the reading within 12 inches from the painted tank surface with the thermometer set to "High Emissivity" or similar. Do not

attempt to take readings on a shiny surface.

- If below 155°F, disconnect the control thermostat's wires from their connection. Using an ohmmeter, check for continuity across the control thermostat.

If continuity does not exist across the thermostat under these conditions, follow the directions in this section for replacing the control thermostat.

If continuity exists across this thermostat, inspect it, and the wiring harness for any damage.



Figure 10

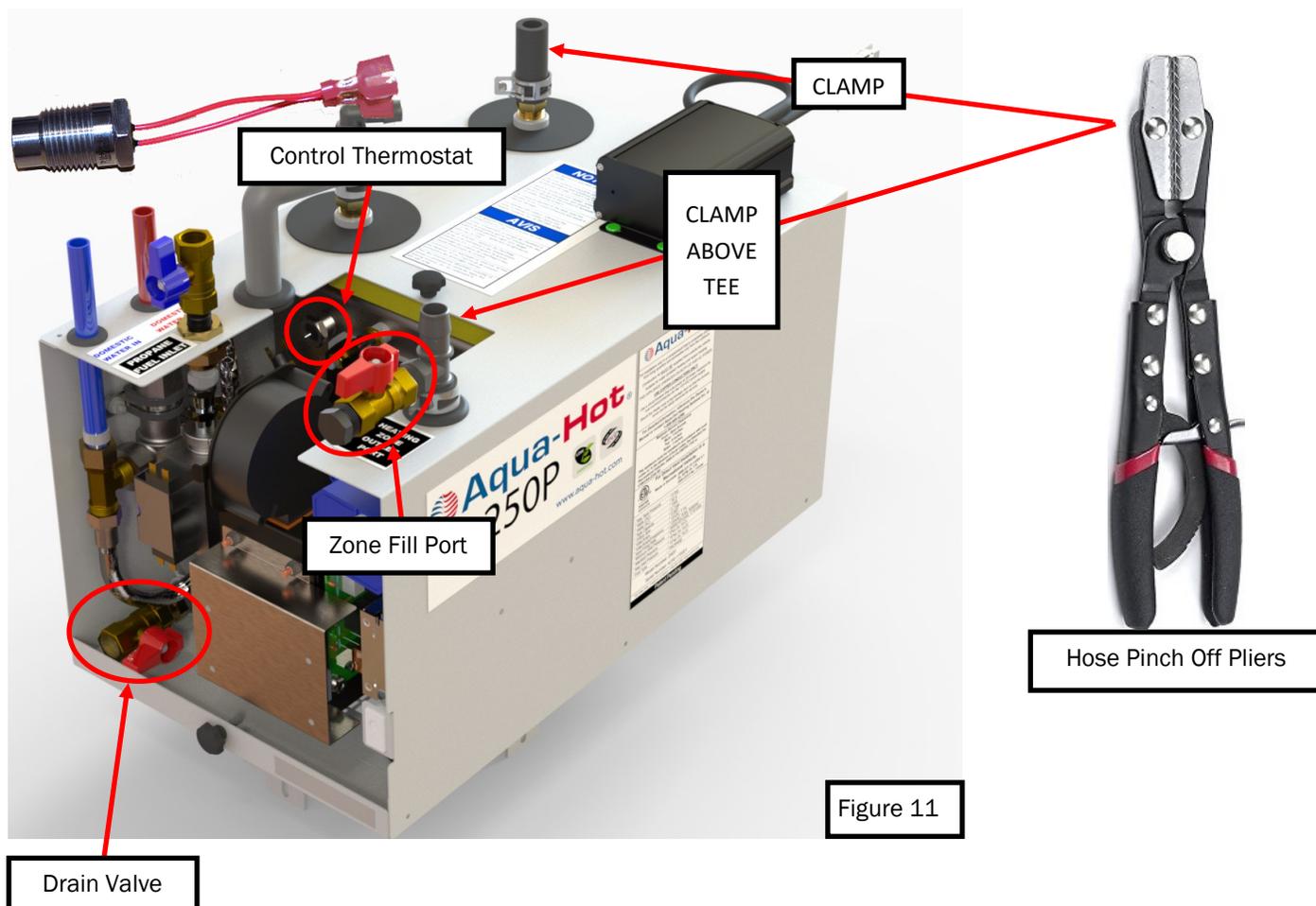
Control Thermostat Replacement Procedure



DANGER

Failure to disconnect all power supplies and/or allow the unit to cool before servicing could cause serious damage and/or personal injury.

1. Ensure that the Aqua-Hot has been completely shut down, all power sources disconnected, and the unit has been allowed to cool
2. Clamp the hoses indicated below with pinch off pliers to prevent drainage of the heating zone loop
3. Drain 1 gallon of antifreeze and water heating solution into an external container to be reused later.
4. Disconnect the defective control thermostat wires by separating the quick disconnect terminals
5. Using a 7/8" deep wall socket, unscrew the control thermostat from the Aqua-Hot's boiler tank.
6. Wrap the threads of the replacement control thermostat with 6 wraps of thread seal tape
7. Reconnect wire #14A and wire #23 to the new control thermostat
8. Refill the Aqua-Hot's boiler tank with anti-freeze and water heating solution.
9. Refill the Aqua-Hot using an external fill pump, filling through the zone fill port.
10. Test the Aqua-Hot for normal operation.
11. Test the interior heating loop to ensure that there are no air pockets trapped within the interior heating loop.
12. If necessary, purge the interior heating loop according to the guide on page 77.



AC High-Limit Thermostat

Scope:

The AC high-limit thermostat serves as a safety measure in the event that the electric heating element continues to operate after the maximum operating temperature has been reached. The high-limit thermostat allows the current for the heating element to pass through until the boiler tank reaches a temperature of 215°F. Should this temperature be reached, the high-limit thermostat blocks the current to the element, preventing the element to continue to operate.

NOTE: If the high-limit thermostat is tripped, it is recommended to test the control thermostat and AC relay for proper operation.

DANGER

Failure to disconnect all power supplies and/or allow the unit to cool before servicing could cause serious damage and/or personal injury.

Troubleshooting Condition

Troubleshoot the AC high-limit thermostat if the electric element fails to operate.

Troubleshooting

- Verify the following before troubleshooting the AC high-limit thermostat.
 - The control thermostat is calling for heat
 - The interlock switch is depressed
 - The overflow bottle is adequately filled
 - The high-limit thermostats are not tripped
 - The fuses in the relay control board are functioning
- Ensure that the unit has been shut down, and cooled completely before continuing.
- Shut off the coach-side power breaker to the Aqua-Hot
- Disconnect the 3-pin AC Molex plug from the AC relay enclosure. Leave the DC power supply connected.
- Activate the "ELECTRIC" switch on the switch panel inside the coach.
- Using a multi-meter, test for continuity across the AC high-limit thermostat by placing one lead on the unit-side Molex connection as shown in figure 12.

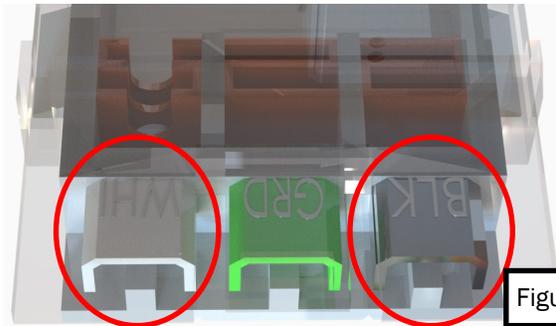


Figure 12

- If no continuity exists, locate the AC high limit thermostat and depress the center button to reset it. Retest for continuity.
 - If continuity exists continue to step 8.
 - If continuity still does not exist, follow the instructions in this section for replacing the AC high-limit thermostat.
- Move the electric switch to the "OFF" position. Retest for continuity. If continuity still exists, replace the AC relay



AC High Limit Thermostat

Figure 13

Replacement Procedure

1. Shut off gas, electric and water supply to the Aqua-Hot.
2. Disconnect the domestic water inlet and outlet line fittings from the Aqua-Hot
3. Unscrew the nut that affixes the mixing valve to the left side of the Aqua-Hot cabinet wall



Figure 14

4. Push down on the mixing valve to expose access to the AC high-limit thermostat.
5. Cut the wire tie which wraps the wires on the left side of the unit
6. Cut the black wires on the AC high-limit thermostat as close as possible to the body of the thermostat and strip the other end.
7. Remove the faulty high-limit thermostat using a 5/8" socket or crow's foot

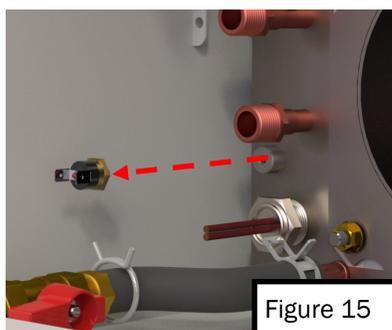


Figure 15

8. Butt-splice a new AC high-limit thermostat to the stripped wire
9. Re-install the AC high-limit thermostat using a 5/8" socket or crow's foot
10. Re-secure the wires using the extra wire tie provided and re-install the mixing valve assembly.
11. Make sure the replacement AC high-limit thermostat is functioning properly by testing for continuity across this thermostat.
12. Reposition the tempering valve assembly onto its mounting stud on the left cabinet wall.
13. Re-secure the tempering valve assembly with the previously removed nut.
14. Re-connect the domestic water connections to the Pex fittings of the tempering valve assembly.
15. Re-establish the gas, electric, and water supply to the Aqua-Hot.
16. Test the unit for normal operation.

Burner High-Limit Thermostats

Scope:

The burner high-limit thermostats serve as a safety measure in the event that the burner continues to operate after the maximum operating temperature (215 °F) is reached.

While the functional goal of the high limit thermostats remains the same between the Propane and Diesel units, the precise functionality herein differs between these units. These operational differences are outlined below.

If the system reaches an over-temperature condition, the thermostats on the 250D will both interrupt the function of the fuel solenoid, preventing diesel fuel from entering the combustion chamber.

The 250P will respond to an over-temperature condition by interrupting the power signal (left thermostat,) and the fan validation signal (right thermostat.)

NOTE: If the high-limit thermostat continues to trip, troubleshoot the control thermostat and verify that the boiler tank is full of antifreeze and water heating solution

Troubleshooting Condition

Troubleshoot the high-limit thermostats if the following conditions have occurred;

- The gas valve or fuel solenoid fails to operate
- The blower fan runs, but the burner does not ignite



DANGER

Failure to disconnect all power supplies and/or allow the unit to cool before servicing could cause serious damage and/or personal injury.

Troubleshooting

1. Locate the high-limit thermostats.
2. Disconnect the burner thermostats using the information below pertaining to the unit under service
 - 250D: Wires #2 and #34 (left) or wires #34 and #8 (right)
 - 250P: Wires #37 and #39 (left) or wires #38 and #36 (right)

3. Place a jumper wire between the two wires on the harness to bypass the high-limit thermostat. Check the Aqua-Hot for normal operation.

NOTE: Bypassing the high-limit thermostats is for testing only and must *not* be used as a substitute for normal operation.

4. Disconnect the DC high-limit thermostat wires, then, using an ohmmeter, check the thermostat for continuity
5. If continuity does not exist, depress the button in the center of the thermostat to reset it. Retest for continuity
6. If the thermostat at this point still does not have continuity, follow the instructions in this section to replace the thermostat

Replacement Procedure

1. Ensure that the Aqua-Hot has been completely shut down, all power sources disconnected, and the unit is allowed to cool completely before continuing
2. Remove the two wires from the defective high-limit thermostat
3. Using a 5/8" socket or crow's foot, remove the defective high-limit thermostat from the face of the tank
4. Install the replacement high-limit thermostat into the port on the face of the boiler tank, and finger tighten the new thermostat in place
5. Reconnect wire #2 and wire #34 (left) and/or wire #34 and wire #8 (right) to the high limit thermostat which has just been replaced
6. Test for unit operation

Left High-Limit Thermostat

Right High-Limit Thermostat

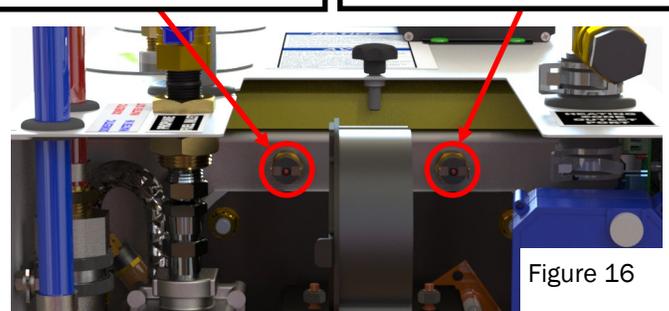


Figure 16

Low-Temperature Cutoff Thermostat

Scope

The Low-Temperature Cutoff Thermostat operates the domestic hot water priority system by blocking the interior heating feature when domestic hot water is being used. This ensures that even heat is provided for domestic hot water, which avoids the possibility of cold water pockets during showers, and other heavy-load applications. Ensure the Aqua-Hot is up to temperature before troubleshooting the Low-Temperature Cutoff Thermostat.

Troubleshooting Condition

Troubleshoot the Low-Temperature Cutoff Thermostat if any of the following conditions have occurred;

- There is a lack of interior heat
- There is a lack of hot water
- The D4 light is not illuminated

Troubleshooting:

1. Verify the following before troubleshooting the low-temperature cutoff thermostat.
 - A. The control thermostat is calling for heat
 - B. The interlock switch is depressed
 - C. The overflow bottle is adequately filled
 - D. The high-limit thermostats are not tripped
 - E. The fuses on the relay board are in working order
2. Determine if the unit is ready to provide heat by verifying that the “Low-Temperature Cutoff Status” light is NOT illuminated on the relay control board.
 - A.) Verify that the Aqua-Hot is at operating temperature between 155°F and 185°F using a meat, or candy thermometer secured to the tank face.
 - B.) Verify that the domestic hot water is not being used.
3. If the “Low Temperature Cutoff Status” light on the relay control board is illuminated after the unit has reached operating temperature, complete the following.
 - A.) Disconnect wire #14B and #25 from the low temperature cutoff thermostat. If the D4 light goes out on the relay control board, replace the LTCO.

B. If the light does not go out after disconnecting the low-temperature cutoff thermostat, contact Aqua-Hot Heating Systems for assistance in diagnosing this issue.

Lack of Hot Water

1. If the LTCO indicator light does not illuminate when domestic water is being used, or when the Aqua-Hot falls below operating temperature, complete the following;
 - A.) Using a temperature sensor, verify that the LTCO thermostat is below 90°F.
 - B.) Inspect the wiring to ensure that the Aqua-Hot is wired properly and that the LTCO thermostat has not been disconnected
2. Disconnect both wires from the Low-Temperature cutoff thermostat. Using a jumper wire, connect these two wires together.
3. With the jumper wire installed, check the coach for hot-water availability. If after jumping these wires together, hot water has been established, the low-temperature cutoff thermostat will need to be replaced.



Figure 17

Replacement Procedure



DANGER

Failure to disconnect all power supplies and/or allow the unit to cool before servicing could cause serious damage and/or personal injury.

1. Ensure that the Aqua-Hot has been completely shut down, and that all the power sources have been disconnected
2. Locate the low-temperature cutoff thermostat on the Aqua-Hot
3. Disconnect the defective LTCO thermostat by separating the quick-disconnect terminals
4. Using a 5/8" wrench or crow's foot, remove the defective LTCO thermostat from the Aqua-Hot
5. Install the replacement LTCO torquing it to 15in/lbs ONLY. Anything more than 15in/lbs of torque will damage the thermostat, and possibly the unit.
6. Connect wire #31 and wire #32 to the replacement low-temperature cutoff thermostat.

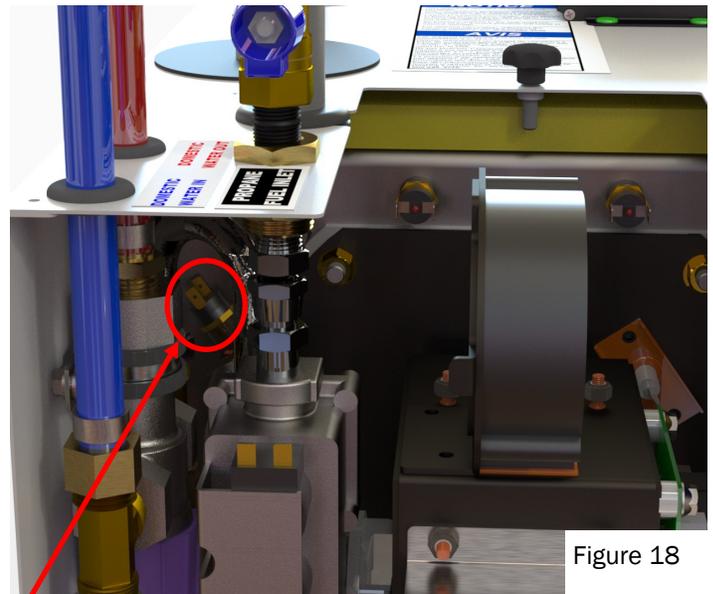


Figure 18



Low-Temperature Cutoff
Thermostat

3-Way Valve

Scope

The Aqua-Hot has a 3-way directional valve to control coolant priority within the Aqua-Hot. This ensures that there will be a supply when heated water is being called, but can provide interior heating when the need arises.

Troubleshooting Condition

Troubleshoot the 3-way valve if the following conditions have occurred;

- An absence of interior heat
- Inconsistent, or complete lack of hot water

Troubleshooting

1. Verify the following before troubleshooting the three-way valve.
 - A. The control thermostat is calling for heat
 - B. The interlock switch is depressed
 - C. The overflow bottle is adequately filled
 - D. The high-limit thermostats are not tripped
 - E. The relay control board fuses are in working order
2. Verify that the heating zone is operating properly by checking the following
3. Locate the relay control board and ensure that both the heating zone status light (D6,) and the pump status (D3) indicator lights are illuminated.

A.) Verify that the line on the valve display window is vertical when interior heat is being called. If this is not occurring, check the LTCO thermostat for functionality (reference page 19, if necessary.)

B.) Verify that the line on the valve display window is horizontal when hot water is being requested. This is known as “stir” mode.

4. Ensure that the modes change between interior heat (vertical) and how water (horizontal) and verify that it matches the electronic control board lights. D6 should illuminate while the sight glass is vertical
5. Locate the wires travelling from the 3-way valve according to your specific Aqua-Hot model listed below

250P: The wires of the three-way valve will terminate in two fast-on connectors

250D: The wires of the three-way valve will terminate at the 16-pin plug of the Relay control board

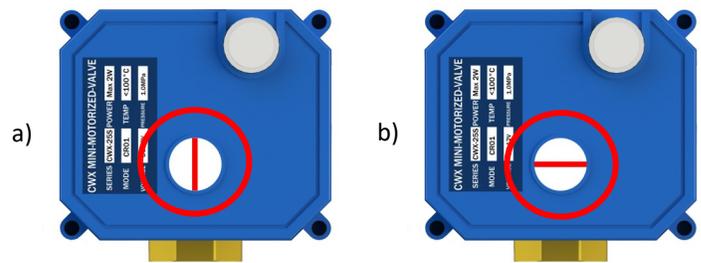


Figure 19

6. The following tests (steps #6 and #7) will verify functionality of the internal workings of the 3-way valve with power directly applied. The valve should actuate, and the sight glass should rotate with at least one of the following tests.
7. Apply 12V DC power to the red wire, and attach a ground wire to the green/black wire. The motor within the 3-way valve should activate, rotating the red line in the sight glass should rotate horizontally into “stir” mode.
8. Apply 12V DC power to the green/black wire, and attach a ground wire to the red wire. The motor within the 3-way valve should activate, rotating the red line in the sight glass.
9. If the 3-way valve does not function in either of the above tests, it will need to be replaced. Follow the instructions on the next page to replace this component if necessary.

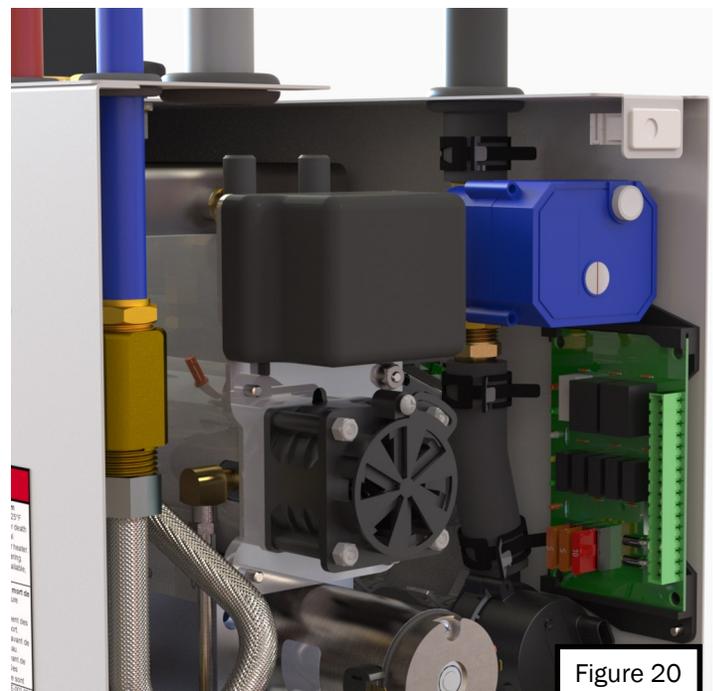


Figure 20

Replacement Procedure



DANGER

Failure to disconnect all power supplies and/or allow the unit to cool before servicing could cause serious damage and/or personal injury.

1. Ensure that the Aqua-Hot has been completely shut down, that all power sources have been disconnected, and that the unit has completely cooled.
2. Use clamp hose pliers to pinch tubing surrounding the 3-way valve as indicated below.
3. On the 250P, disconnect the valve wires from the harness. On the 250D, remove the valve wires from the green connector plugged into the relay control board.
4. Using constant tension pliers, loosen and slide back the constant tension clamps securing the hose to the defective valve

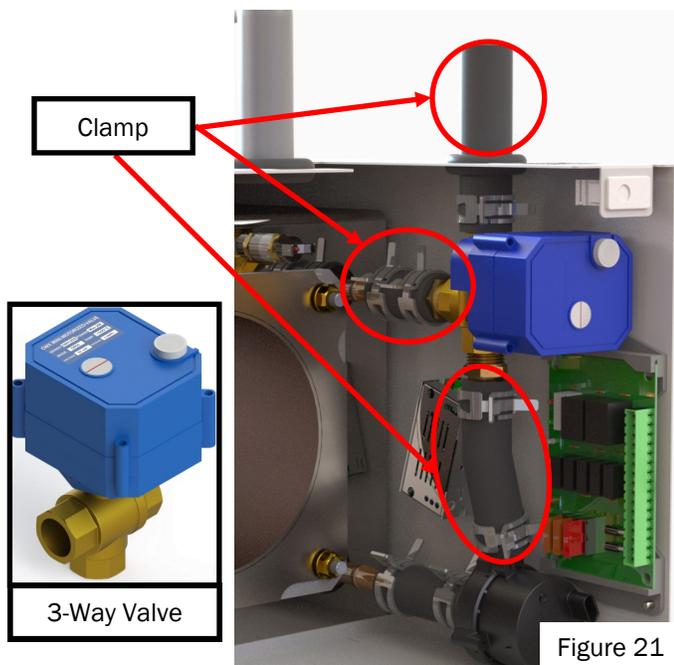


Figure 21

5. Remove the hose from the defective valve as shown to the right
6. Remove the two remaining hoses from the defective three-way valve, and remove it

7. Slide the hoses onto the valve and set the constant tension clamps back into place
8. Install the replacement 3-way valve according to the specific instructions below related to your unit
 - 250D:** Reconnect the red wire to Pin 7, and the green wire to Pin 8 of the relay control board connector.
 - 250P:** Crimp a **male** 22-18AWG “Faston” connector to the red wire of the three way valve. Connect to wire #21 “Faston” connector.

Crimp a **female** 22-18AWG “Faston” connector to the green/black wire of the three way valve. Connect to wire #22 “Faston” connector.

9. Refill the Aqua-Hot’s boiler tank, purging the heating loop if necessary

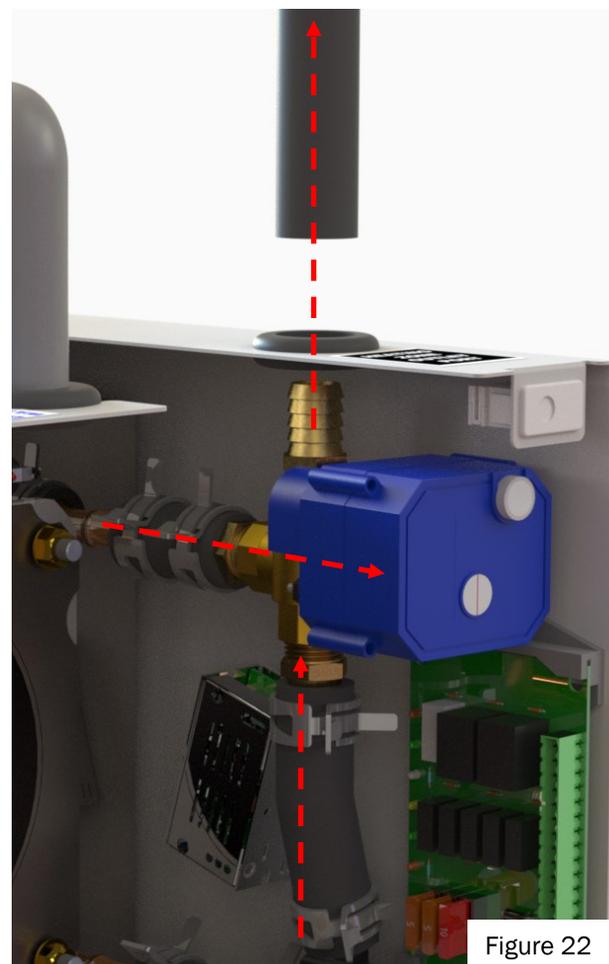


Figure 22

Tempering Valve

Introduction:

The tempering valve for the Aqua-Hot mixes the heated domestic water from the boiler tank with cold domestic water at a preset ratio to deliver steady hot water, and reduce the risk of scalding. It is recommended that you review the “Lack of Hot Water Troubleshooting Guide” prior to diagnosing the tempering valve.

Troubleshooting Condition

Troubleshoot the tempering valve if the following condition has occurred:

- There is a lack of domestic hot water
- If domestic hot water is too hot
- The D4 light is not illuminated
- The hot water supply is uneven

Troubleshooting

1. Inspect the tempering valve to ensure that it is not leaking

NOTE: Adjusting the mixing valve beyond 120° F will result in a lack of hot water and may result in scalding. Do NOT attempt to adjust the tempering valve without assistance from Aqua-Hot technical support or an Aqua-Hot technician

2. Activate the burner, and allow the unit to heat until it shuts itself off. This test cannot be accomplished with the electric element.
3. Open the hot water valve on a faucet without a hot-stop, and allow the temperature to stabilize at its hottest point.
4. Using a meat thermometer, take a temperature reading of the water. It should be between 115° F and 120° F. Be aware that a source water-temperature of less than 65° F may prevent hot water from reaching this threshold.
5. Test the tempering valve’s functionality by turning the knob. If the knob does not rotate, this tempering valve will need to be replaced. On newer heaters it will be necessary to remove a black plastic cap from the body of the tempering valve.
6. While running water, if the inlet pipe is excessively hot, while the outlet is lukewarm and adjusting the mixing valve results in no change, it may be a faulty mixing valve.
7. If adjustment of the mixing valve knob is able to effect change in temperature, it must be continually adjusted until the output range of the hot water is between 115° F and 120° F.



Replacement Procedure

1. Turn off the coach water supply
2. Drain the water pressure by opening the faucets and allowing the water to drain
3. Disconnect the coach water lines from the tempering valve assembly
4. Disconnect the PEX pipe fittings from the tempering valve assembly
5. Remove the pressure relief valve assembly from the tempering valve assembly
6. Using a back-up wrench, unscrew the tempering valve from the Aqua-Hot. Failure to use a back-up wrench could result in damage to the cold water inlet pipe.
7. Remove the brass fittings from the defective tempering valve
8. Install the brass fitting onto the replacement tempering valve. Use thread seal on the fittings.
9. Install the replacement tempering valve onto the Aqua-Hot using the back-up wrench to tighten
10. Install the pressure relief valve onto the replacement tempering valve. Use thread seal tape.
11. Reconnect the PEX pipe and fittings onto the replacement tempering valve. Use thread seal tape. Be sure to inspect rubber seals and replace if necessary.
12. Reconnect the water lines to the tempering valve.

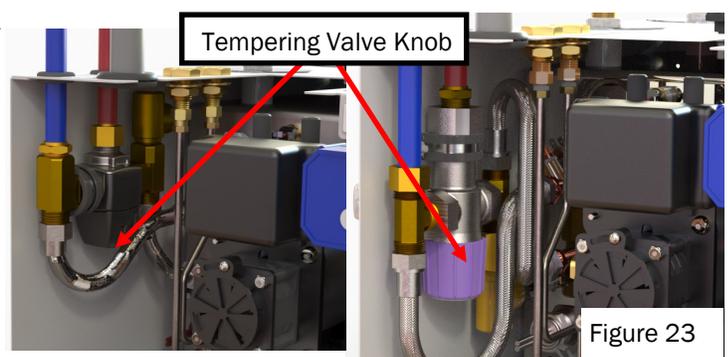


Figure 23

Circulation and Stir Pump

Scope

The circulation and stir pump is used when;

- Interior heat is demanded
 - The propylene-glycol and water mixture is heated and circulated through the heating loop to provide interior heat
- Domestic Hot Water is needed
 - The pump will operate in “Stir” mode to agitate the propylene-glycol and hot water mixture to ensure optimal hot water performance
- Burner “ON” cycles
 - The pump will circulate to stir the propylene-glycol mixture to ensure that the tank is completely, and evenly heated during its normal operating cycle

Troubleshooting Condition

Troubleshoot the circulation pump if the following conditions have occurred;

- There is a lack of interior heat
- Lack of, or uneven hot water

Troubleshooting

1. Verify the following before troubleshooting the circulation and stir pump.
 - A. The control thermostat is calling for heat
 - B. The interlock switch is depressed
 - C. The overflow bottle is adequately filled
 - D. The high-limit thermostats are not tripped
 - E. The fuses of the relay control board are functioning
2. Activate an interior zone for heating and the burner switch, and locate light D6 on the relay control board.
3. Light D6 should illuminate, and the circulation pump should begin operating.
4. If the circulation pump still does not operate, locate wire #20 on the wire harness, and apply 12V DC current directly to the pump.
 - If the pump operates with 12V DC applied, begin diagnosing the relay control board.
 - If the pump does not operate with 12V DC directly applied to it, the pump will need to be replaced.

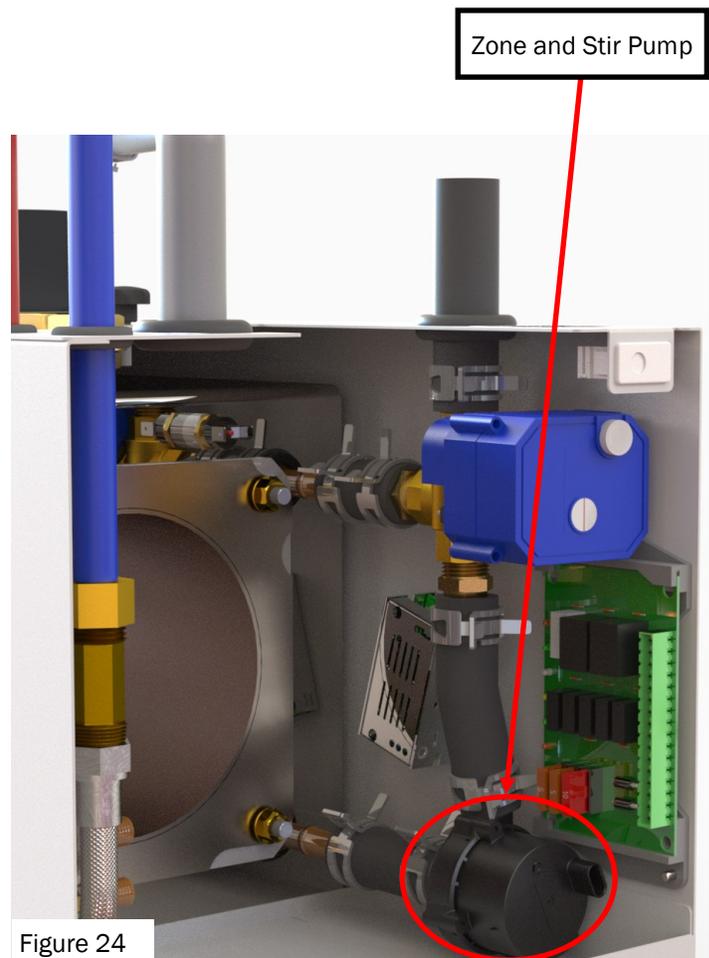


Figure 24

Replacement Procedure



DANGER

Failure to disconnect all power supplies and/or allow the unit to cool before servicing could cause serious damage and/or personal injury.

1. Ensure that the Aqua-Hot has been completely shut down, all power sources have been disconnected, and that the unit has been allowed to cool completely
2. Clamp the zone outlet, and the zone return with hose pinch-off pliers as shown below
3. Drain the antifreeze and water heating solution from the Aqua-Hot's boiler tank using the drain valve
4. Disconnect the defective pump's wires by removing the electrical plug from the pump body

5. Using constant tension pliers, loosen and slide back the constant tension clamps securing the hoses to the circulation pump
6. Remove the hoses from the defective circulation pump
7. Set the defective pump aside, and put the replacement pump in the same position
8. Slide the hoses back onto the replacement pump and set the constant tension clamps back into place
9. Connect the wires to the replacement pump
10. Refill the boiler tank with a 50/50 mixture of propylene-glycol and distilled water
11. Once the tank has been filled, purge the heating zones by directly connecting the fluid pump to 12V DC power for at least 20 minutes



WARNING



Burn Hazard

Hot Coolant Circuit with Hot Surfaces can cause sever burns.

DO NOT touch or service until equipment has cooled.

LDE-200-810

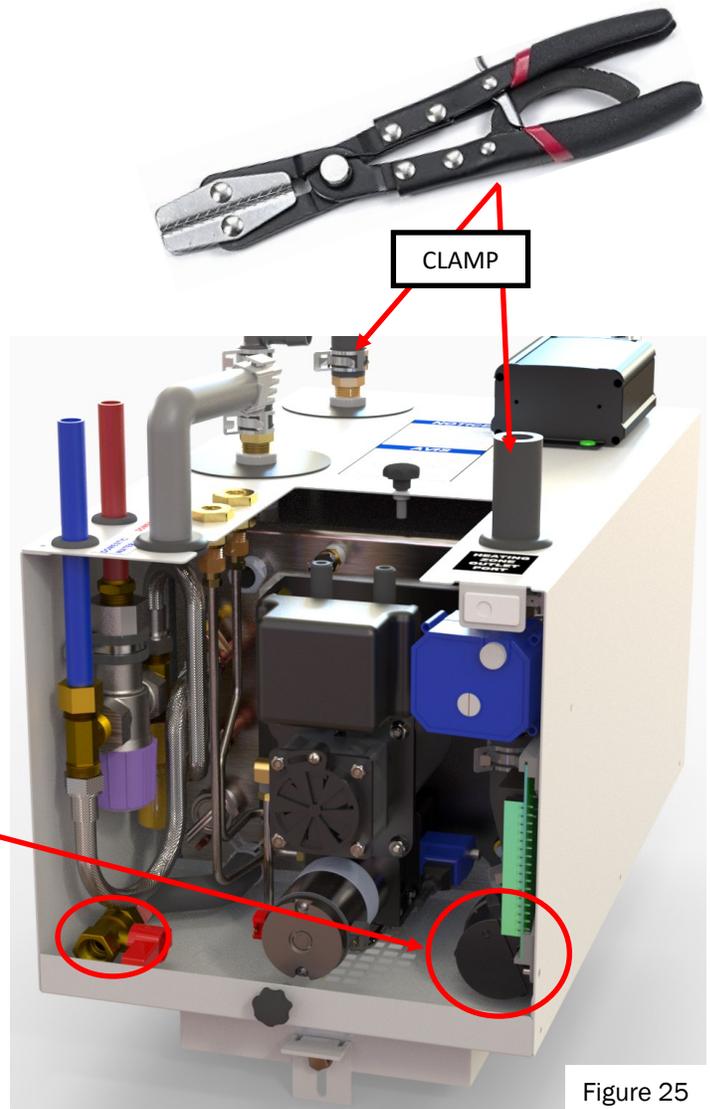


Figure 25

AC Electric System

Scope

The AC Electric System of an Aqua-Hot 200 Series unit functions to provide supplementary heat to the Aqua-Hot boiler tank. This is accomplished with an electric element, an electric relay, and a DC “control circuit” which engages the electric elements when determined necessary by the control thermostat and the relay control board.

The electric heating element is not intended to serve as the sole heating source of the Aqua-Hot. The AC electric system will provide enough heat for hand washing, and to maintain tank temperature. Any greater applications require the use of the propane or diesel burner.



Figure 26

Troubleshooting Condition

Troubleshoot the AC electric system if the electric element is non-functioning. This can be verified with a simple, but rather lengthy test, outlined below.

Verify Functionality:

- Switch both the electric, and burner switches to the “OFF” position.
- Allow the unit to cool completely.
- Verify that the Aqua-Hot is connected to an AC power source such as shore power or an AC generator.
- Using an infrared thermometer take the temperature of the tank face. The thermometer should be 12” away from the tank face, and set to “high emissivity.” Record this temperature on a notepad.
- Move only the electric switch on the panel to the “ON” position
- Verify that the D2 light on the relay control board is active.
- After an hour, take another temperature reading on the tank face. If the temperature of the tank face has risen, the electric element is correctly operating.

If, through the above procedure it’s been determined that the electric element is not functioning properly, follow the instructions below to troubleshoot.

Troubleshooting

- Verify the following before troubleshooting the AC Electric System.
 - The control thermostat is calling for heat
 - The interlock switch is depressed
 - The overflow bottle is adequately filled
 - The AC high-limit thermostat is not tripped
 - The fuses of the relay control board are functional
- Install a jumper wire on wires #26 and #15. This will circumvent the electric element switch and should cause the electric element to activate

- If the electric element status indicator light, D2 illuminates on the relay control board with the jumper wire installed, troubleshoot the electric element switch on the interior switch panel.

- If the electric element status indicator light does not illuminate when the jumper wire is installed, verify that the fluid expansion bottle is adequately filled, and that the fuse in FH2 is still functional.

- Check the Aqua-Hot’s boiler tank temperature. If the tank temperature is below 155 °F and the electric element status light D2 is not illuminated, begin troubleshooting the control thermostat.

If the boiler tank is above 155 °F, the Aqua-Hot is up at operating temperature, and will not request heat.

- Verify that the relay control board is sending 12V DC power to the AC relay. Using a voltmeter, test wire #28 for 12V DC power

- If 12V DC is not present while the electric element switch is in the “ON” position, and the D2 light is active, the relay control board will need to be replaced.

- If 12V DC power is present at wire #28, disassemble the AC relay enclosure and check for power at pin #1 of the AC relay. If power is not present at pin #1, inspect the wiring harness for damage.

4. If 12V DC is present at pin #1 (wire #28) of the relay, complete the following:
 - Turn off all coach-side breakers providing power to the Aqua-Hot, then disconnect the Molex plug AC connection
 - Using an ohmmeter, check for continuity across wires #1 and #4 of the AC relay.

If no continuity exists at this point, the relay must be replaced.

5. Verify that the electric heating element is receiving adequate AC power by completing the following:
 - Plug the coach into shore power or turn on the generator
 - Using an AC voltmeter, verify that 110V AC are present at the Molex plug connected to the Aqua-Hot. If there is not 110V at this plug, there is a problem with the coach-side power
 - Using a digital clamp-meter, verify the electric element is drawing between 8A and 8.5A

6. Verify that the electric element has the proper resistance

- Disconnect the AC molex plug from the 250 AC enclosure.

- Move the electric switch, located on the interior switch panel to the "ON" position. Using an ohmmeter, test for resistance on the white and black terminals of the Aqua-Hot molex terminal.

- Resistance should be between approximately 11

and 13 ohms. If there are less than 11 ohms of resistance, the electric element can cause the coach-side breaker to trip. Reference Figure 27.

Replacement Procedure



1. Ensure that the Aqua-Hot has been completely shut down, all power sources have been disconnected, and the unit has been completely cooled before proceeding
2. Using hose pinch-off pliers, clamp off the heating zone inlet, and outlet ports.
3. Drain the anti-freeze and water heating solution into an external container to be reused later
4. Remove the two wires secured to the defective heating element by releasing the screw terminals
5. Using a 1-1/2" socket, remove the defective electric heating element from the Aqua-Hot's boiler tank
6. Wrap six wraps of teflon tape, and pipe dope around the threads of the new electric element to ensure that it forms an adequate seal
7. Install the replacement 1kW electric element into the boiler tank and secure it with the 1-1/2" socket used previously
8. Reconnect the wires previously disconnected from the electric heating element and tighten the screw terminals
9. Refill the Aqua-Hot boiler tank with a 50/50 mix of anti-freeze and distilled water heating solution.
10. If necessary, purge the heat exchanger lines to remove all air from the system.

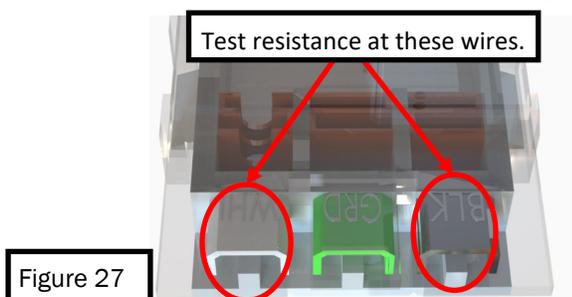
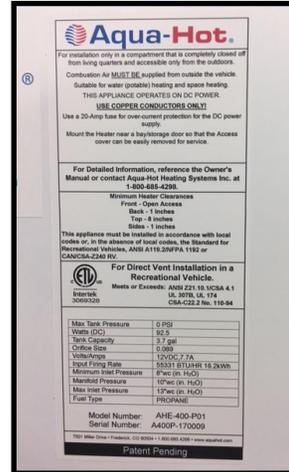
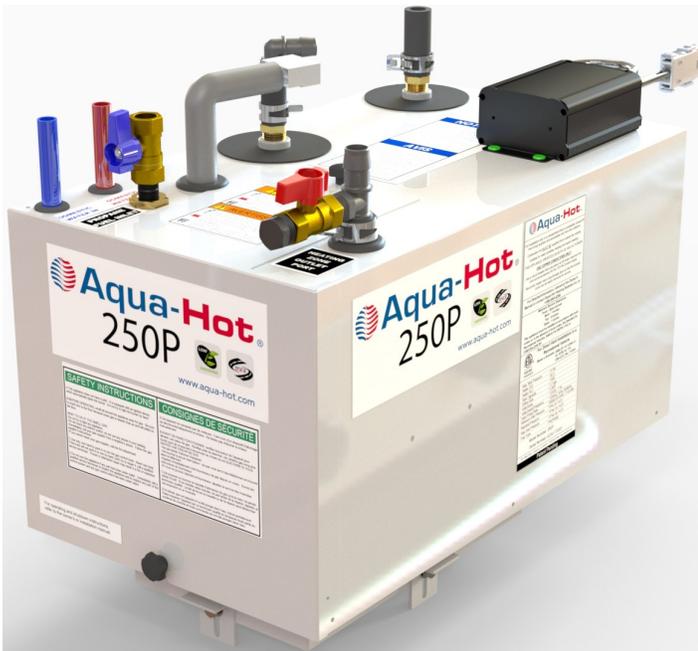


Figure 27



Propane Burner

Heat Input (Firing Rate) 60,000BTU/hr ± 10%
 Continuous Fuel Consumption 0.66g/hr
 Typical Consumption 0.33g/hr

Electric Heating Element

Specifications 120V AC, 1kW

Maximum DC System Power Consumption

Specification 12V DC, 42W

Zone Heat Circulation

Pumps 1
 Power Specification 12V DC, 21W

Heating Zones

Maximum 1

Domestic Water Heating

Continuous Supply Capacity 1.5gal/min

Specification

Dimensions: 11.69”H x 12.45”W x 21.61”L
 Dry Weight: 84 lbs
 Wet Weight: 104 lbs

Aqua-Hot®

For installation only in a compartment that is completely closed off from living quarters and accessible only from the outdoors.
 Exhaust system **MUST NOT** terminate beneath the vehicle and not less than 3 feet from an operable window.
 Combustion Air **MUST BE** supplied from outside the vehicle.
 Suitable for water (potable) heating and space heating.
THIS APPLIANCE OPERATES ON BOTH DC AND AC POWER.
USE COPPER CONDUCTORS ONLY!
 Use a circuit breaker that cuts power at 20-Amps maximum for over-current protection for the 120-VAC power supply.
 Mount the Heater near a bay/storage door so that the Access cover can be easily removed for service.

For Detailed Information, reference the Owner's Manual or contact Aqua-Hot Heating Systems Inc. at 1-800-685-4298.

Minimum Service Clearances
 Front - Open Access
 Back - 1 Inches
 Top - 8 inches
 Sides - 1 inches

This appliance must be installed in accordance with local codes or, in the absence of local codes, the Standard for Recreational Vehicles, ANSI A119.2/NFPA 1192 or CAN/CSA-Z240 RV.

For Direct Vent Installation in a Recreational Vehicle.
 Meets or Exceeds: ANSI Z21.10.1/CSA 4.1
 UL 307B, UL 174
 CSA-C22.2 No. 110-94

Max Tank Pressure	0 PSI
Watts (DC)	92.5
Tank Capacity	3.7 gal
Orifice Size	0.093"
Volts/Amps	12VDC 7.7A
Input Firing Rate	60000 BTU/HR. 17.6 kWh
Minimum Inlet Pressure	8"wc (in. H ₂ O)
Manifold Pressure	10"wc (in. H ₂ O)
Max Inlet Pressure	13"wc (in. H ₂ O)
Fuel Type	PROPANE

Model Number: 250P
 Serial Number: A250P-170009

7501 Miller Drive • Frederick, CO 80504 • 1.800.685.4298 • www.aquahot.com

Patent Pending

NOTICE

All vehicle installations must comply with the requirements listed in the Recreational Vehicle Industry Association's (RVIA) ANSI/NFPA 1192 Handbook for Recreational Vehicle Standards. To receive a copy of this handbook and other pertinent RVIA Standards, write to: Recreation Vehicle Industry Association, 1896 Preston White Drive, P.O. Box 2999, Reston, VA 22090-0999, call them at (703) 620-6003, or online at www.rvia.org, www.nfpa.org.

Note: The product label attached to each Aqua-Hot provides a ready reference to specifications, test standards, and important safety notices.

Propane Burner Overview

The Aqua-Hot's propane burner is the heart of the Aqua-Hot unit. The propane burner is the device which ignites, and sustains the combustion of a propane-air mixture. The propane burner functions as the primary source of heat in 250P units. Heat energy from the propane combustion reaction is transferred from the combustion chamber into the anti-freeze and water heating solution, where it is then used for interior heat, or hot water.

The propane burner operates on standard, readily available propane found at a local propane store.

The burner itself contains six user-serviceable components that can be repaired, or replaced as part of standard service, or in depth repair.

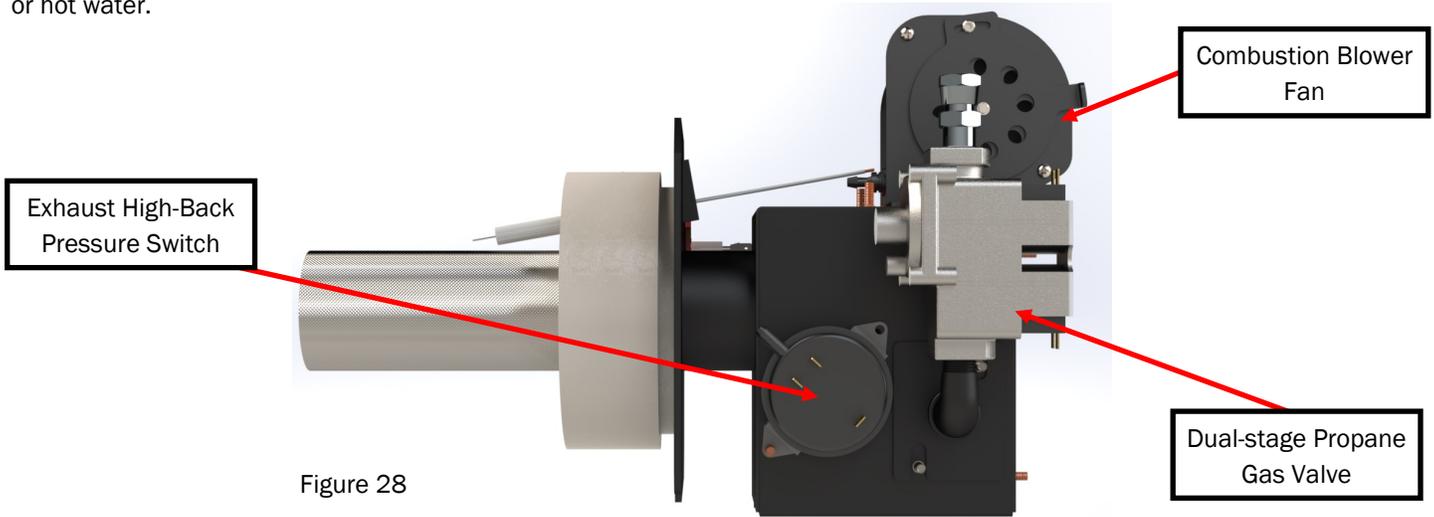


Figure 28

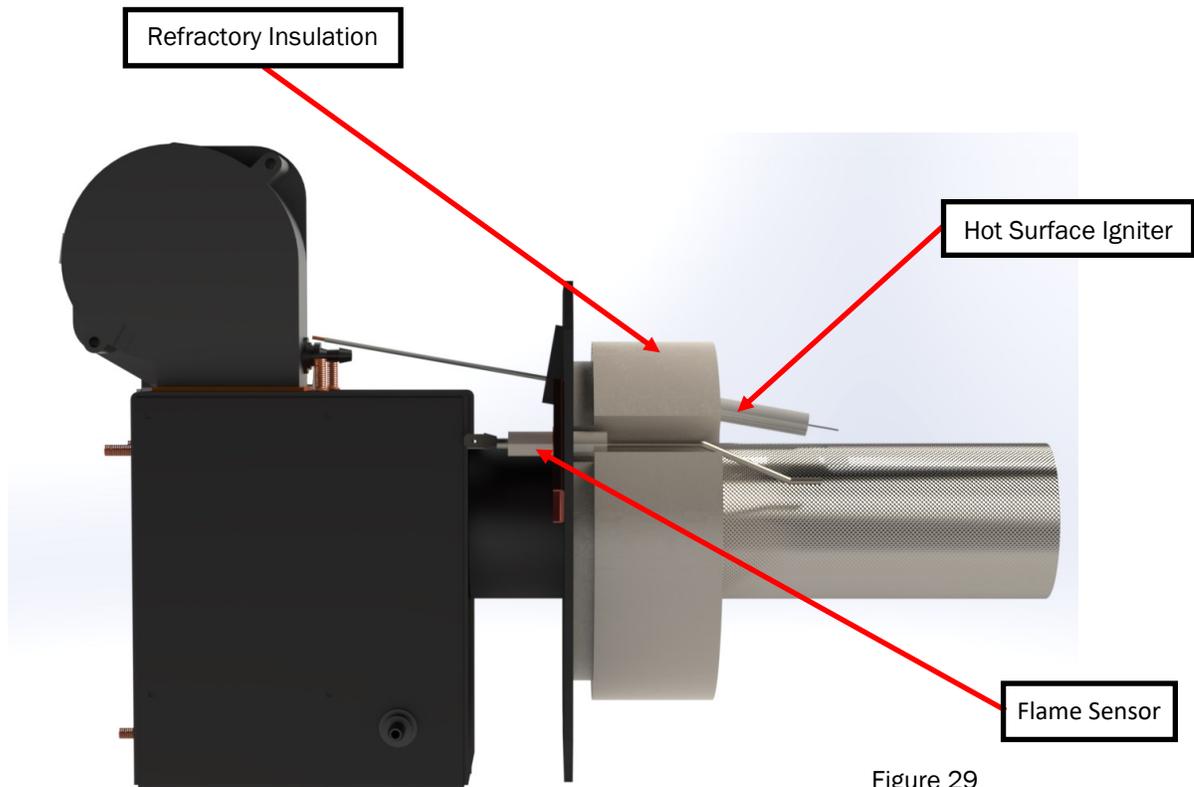
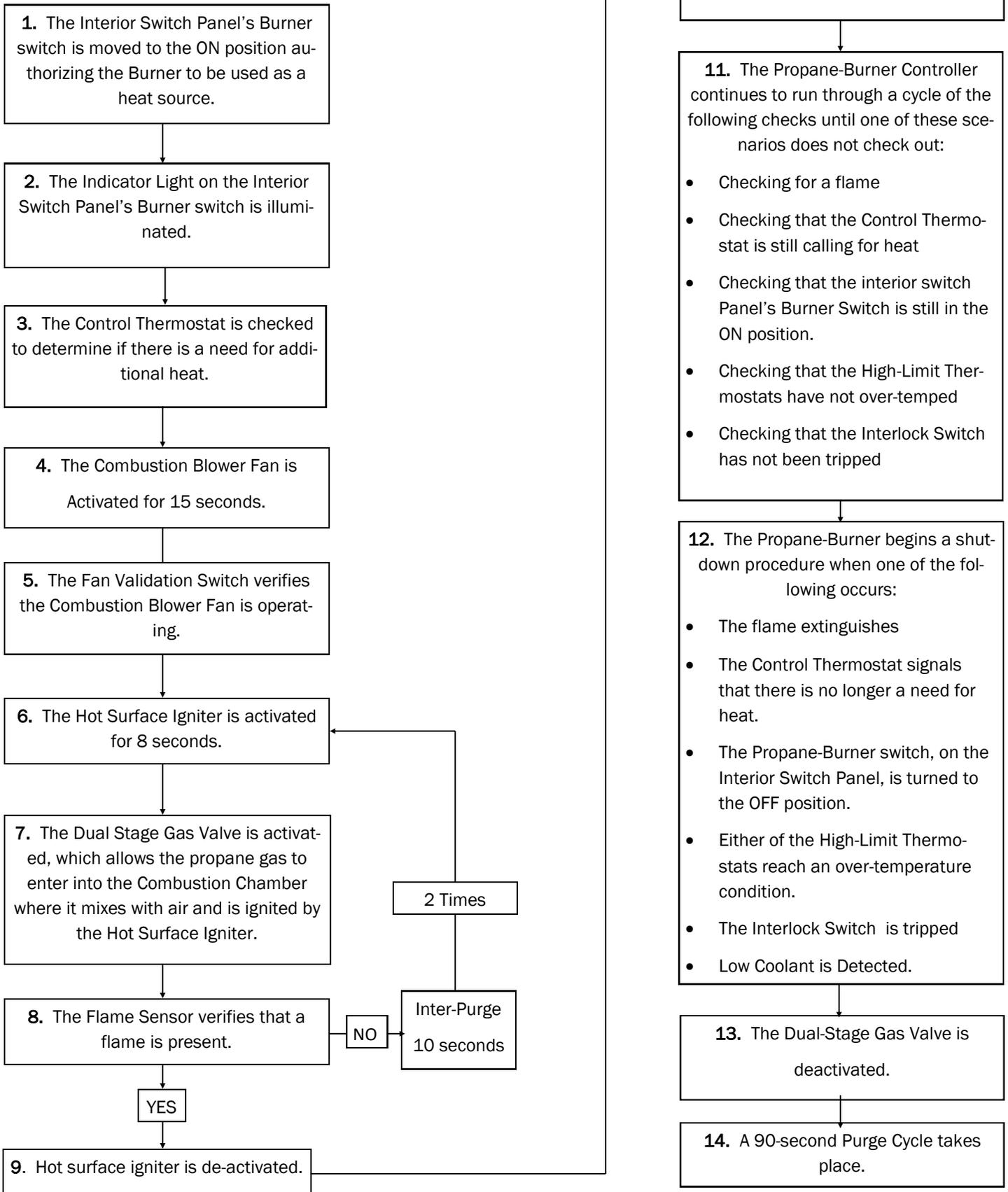
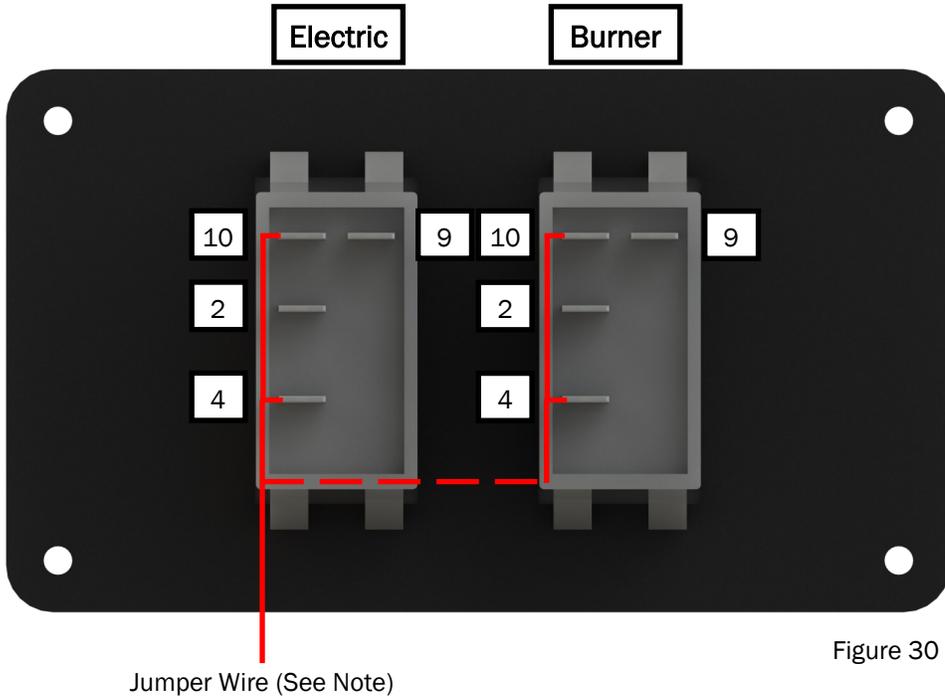


Figure 29

Operational Flow-Chart





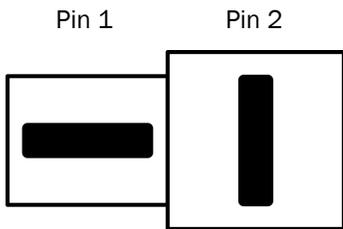
NOTE: The burner and electric element switches must possess a jumper wire between pin 4 and pin 10 as depicted on this page.

Figure 30

WARNING

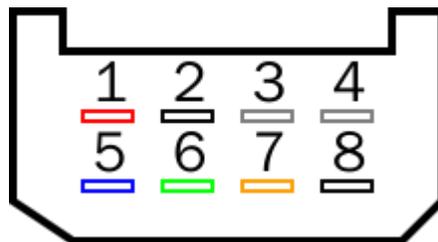
DO NOT INSTALL JUMPER WIRES ACROSS THE SWITCHES IN THE SWITCH PANEL. JUMPER WIRES ARE ONLY TO BE INSTALLED BETWEEN PIN 4 AND PIN 10 ON EACH SWITCH. FAILURE TO ADHERE TO THIS GUIDELINE MAY RESULT IN DAMAGE TO YOUR AQUA-HOT AND/OR COACH.

AC Electric Switch	AC Control Switch Plug
Pin 4	Pin 1
Pin 2	Pin 2
Pin 9	Chassis Ground
Burner Switch	8-Pin Harness Plug
Pin 4	Pin 3
Pin 2	Pin 4
Pin 9	Chassis Ground



2-pin AC Control Switch Plug

Manufacturer: TE Connectivity
 Mating Part No: 180907
 Common Name: Fastin-Faston Series



8-pin Harness Plug

Manufacturer: TE Connectivity
 Mating Part No: 163007
 Common name: 8-Way Fastin Receptacle

Fenwal Control Card

Function:

The purpose of the Fenwal card is to control the propane burner. Please note that the Aqua-Hot 250P units are absent a unified “controller” as it is traditionally known, and instead use a combination of the relay control board and Fenwal control card to accomplish these needs.

When a call for heat is received from the control thermostat, the controller will reset, perform a self-check routine, and a pre-purge delay will begin. Following this pre-purge period, the igniter and gas valve will be engaged. Once the flame detector recognizes a flame, the hot surface igniter is shut-off, and the dual-stage gas valve remains engaged.

Replacement Indicator

Replace the Fenwal control card if it fails to operate properly, or is damaged.

Troubleshooting Procedure

1. Verify that there is adequate fluid in the expansion bottle
2. Ensure that the fuses on the relay control board within the Aqua-Hot are functional.

NOTE: The interlock switch will prevent the propane burner from operating. Ensure that the interlock switch is depressed before continuing troubleshooting procedures.

3. Verify the functionality of the high-limit thermostats by following the directions on page 18.
4. Inspect the control thermostat, and verify that it is functioning properly by following the directions on page 14.
5. Follow the directions on page 47 to verify the functionality of the fan validation switch.

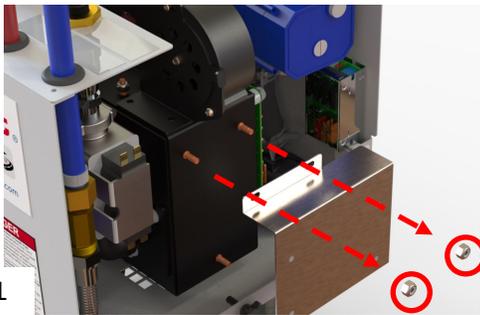


Figure 31

6. Using a 3/8” wrench, remove the two nuts affixing the Fenwal control card to the propane burner assembly. This will grant access to the Fenwal card for diagnostic. Reference figure 31.

7. Temporarily depress the interlock switch for the purpose of this test alone.
8. Locate a multi-meter, and set it to test for voltage.
9. Move the burner switch, located on the interior switch panel to the “ON” position.
 - Verify that 12V DC power is present at pin 10 of the relay control board while the D5 indicator light is illuminated. If 12V DC is not present, the relay control board will need to be replaced.
10. Test for voltage at pins “PWR,” “HSI+,” and “BLO” on the Fenwal card.
11. Power should be present on “PWR”
 - If it is not, check the wiring harness for damage
12. Pin “BLO” should have 12V DC power during start up.
 - If 12V DC are not present at this pin during attempted start-up, the card will need to be replaced.
13. Pin “HSI+” will have power late in the start-up cycle. In order to test this pin, it is necessary to test voltage throughout the start-up sequence.
 - If pin “HSI+” never receives 12V DC from start up, to automated shut down, the Fenwal card will need to be replaced.

Fenwal Control Card Specification	
Input Power	9.5-15V or 50/60hz AC
Input Current Drain	200mA @12V DC
Gas Valve Rating	1.0A @12V DC
Operating Temperature	-40°F to +167°F -40°C to +75°C
Flame Sensitivity	0.7µA minimum
Flame Failure Response Time	0.8 seconds maximum
Types of Gases	Natural, LP, or Manufactured
Spark Rate	10 sparks/second
Dimensions	4.00x2.30x1.50 inches 10.16x5.84x3.81 cm
Weight	3.0 ounces (85g)
Enclosure	Uncovered with integral stand-offs or potted module
Moisture Resistance	Conformal coated to 95% RH. Do not directly expose to water
Tries for Ignition	3 attempts
Trial for Ignition Periods	7.0 Seconds (this model)
Prepurge & Interpurge Times	15 seconds

Detaching the Propane Burner

Scope:

The instructions in this section detail how to safely remove, and re-install the propane burner found on the Aqua-Hot 250P.



WARNING

Disconnect the Aqua-Hot from any and all power sources, and shut-off the fuel supply to the unit before detaching the burner from the Aqua-Hot. Failure to do so before service may lead to unit damage and/or personal injury.

Procedure:

1. Disconnect the Aqua-Hot from all electrical sources.
2. Close the propane ball valve atop the Aqua-Hot cabinet.
3. Shut off the coach propane bottle at the source.
4. Using a 3/8" socket or nut driver, remove the two nuts from the ground studs located atop the propane burner assembly.

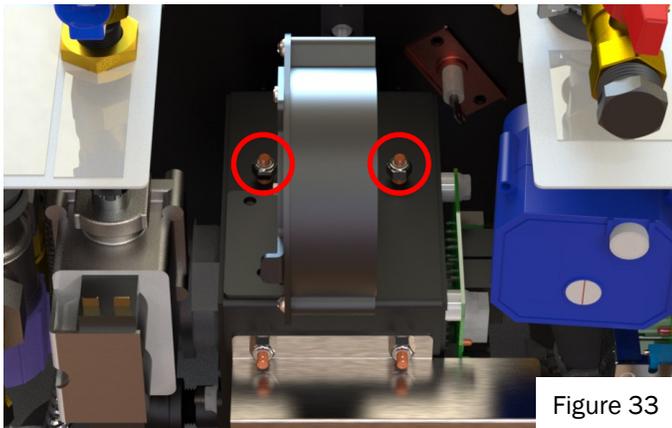


Figure 33

5. Gently remove the wires anchored to these studs.
6. Disconnect wire #39 from the left high-limit thermostat
7. Disconnect wire #38 from the right high-limit thermostat
8. Remove the Fenwal control card using a 3/8" socket or nut driver to remove the top two nuts.
9. Disconnect wire #46 from the Fenwal control card at the tab labelled "HSI+."

10. Disconnect wire #48 from the Fenwal control card at the tab labelled "BLO."



Figure 34

11. Disconnect wire #17 from the Fenwal control card at the tab labelled "PWR."
12. Set the Fenwal control card and the steel enclosure aside.
13. It will be necessary to loosen the bulkhead fitting of the propane line. Using two 3/8" wrenches loosen the bulkhead fitting so that it is possible to grant clearance between the fitting and the dual-stage propane valve.

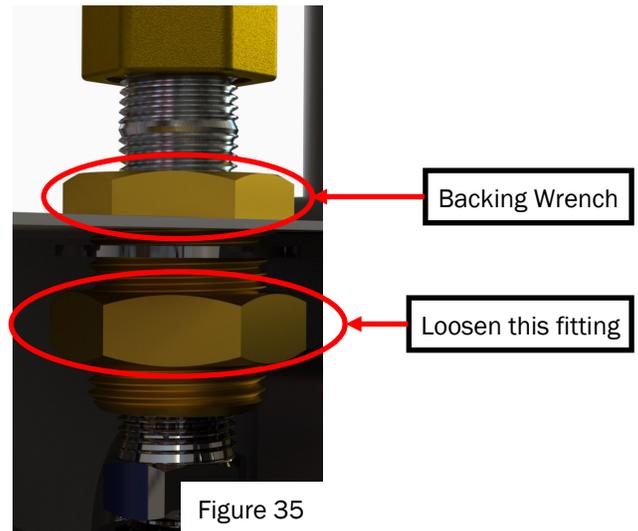


Figure 35

14. Using two 11/16" wrenches, loosen the fittings securing the propane line to the bulkhead fittings. Use one as a backing wrench, loosening only the bottom nut. Reference Figure 36.

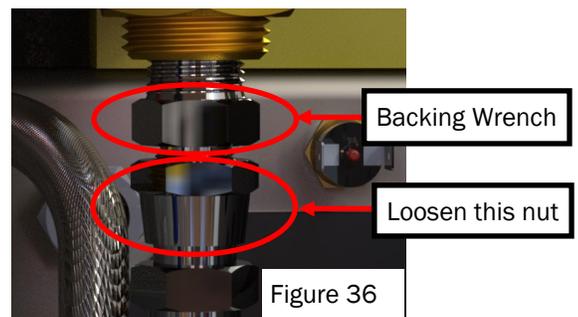
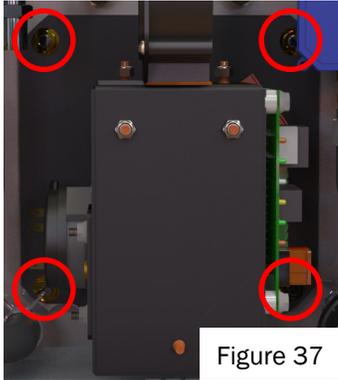
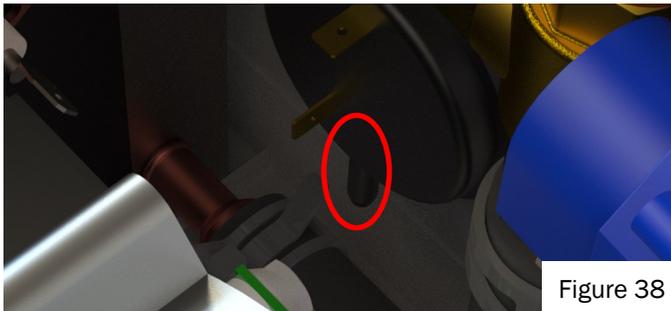


Figure 36

- Using a 1/2" socket and extension, remove the four corner bolts securing the propane burner in place. It may be necessary to use a swivel fitting in order to gain access to all four corner nuts.



- Very carefully slide the burner back from the tank face until you can gain access to the relay control board.
- Disconnect the main wire harness from the relay control board by removing the 16-pin connector from its mate on the relay control board.
- Carefully remove the clear tubing from the pressure switch located on the right side of the Aqua-Hot cabinet.



- Continue to carefully remove the diesel burner from the Aqua-Hot cabinet. Please note that wires may have become entangled in your unit complicating removal. Take care to not damage any wires or other hardware within the Aqua-Hot.

Re-install the Propane Burner

1. Before re-installing the diesel burner, the mounting gaskets must be replaced. If you have not already, locate these replacement gaskets and prep them to be installed.
2. Slide the combustion chamber, and the old gaskets forward until they are completely removed from the Aqua-Hot.

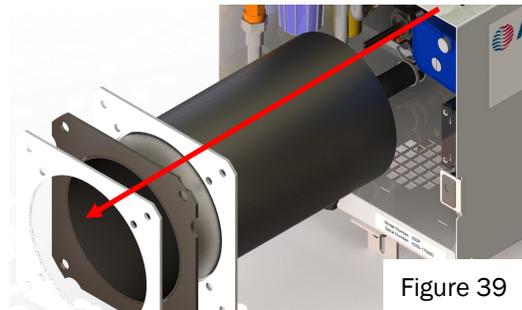


Figure 39

3. Remove and discard these old gaskets.
4. Locate the replacement gaskets. Slide one gasket into place between the combustion chamber and the tank face of the Aqua-Hot.
5. Slide the combustion chamber back into place.
6. Position the second gasket into place atop the combustion chamber flange
7. Position the propane burner so that it can be easily slid back into place, but do not slide the burner forward completely.
8. Reconnect the main wire harness to the relay control board at the 16-pin connection.
9. Re-attach the clear tubing to the pressure switch located on the right side of the Aqua-Hot cabinet.

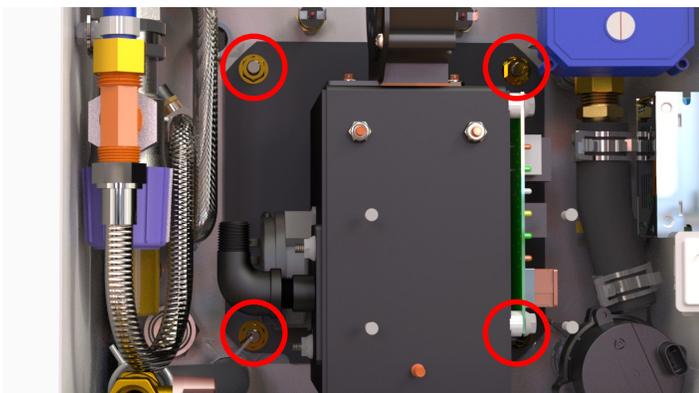


Figure 40

10. Very carefully slide the propane burner assembly back into the combustion chamber. Take great care to not damage the refractory insulation.
11. Using a 1/2" socket and extension, re-secure the propane burner to the mounting studs on the Aqua-Hot tank face. It may be necessary to use a swivel fitting to gain access to all mounting hardware.
12. Slide the bulkhead fitting back into place over the propane valve fittings.
13. Using two 3/8" wrenches, re-secure the bulkhead fittings.

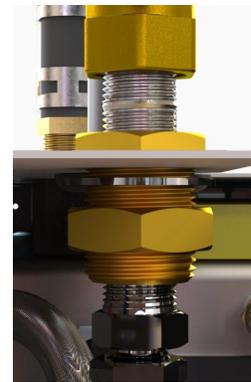


Figure 41

14. Using two 11/16" wrenches, tighten the fitting securing the propane line to the bulkhead fittings. Use one as a backing wrench, and tighten only the bottom fitting until it is secure.
15. Retrieve the Fenwal control card.
16. Reconnect wire #17 to the Fenwal control card at the pin labelled "PWR."
17. Reconnect wire #48 to the Fenwal control card at the pin labelled "BLO."
18. Reconnect wire #46 to the Fenwal control card at the pin labelled "HSI+."
19. Secure the Fenwal control card, and its housing to the side of the propane burner assembly using a 3/8" socket or nut driver to secure two nuts to the top of the enclosure.

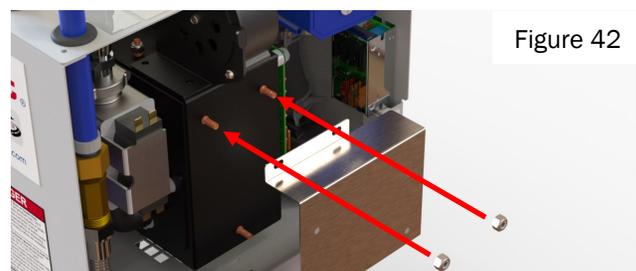


Figure 42

20. Re-connect wire #38 to the right high-limit thermostat.
21. Re-connect wire #39 to the left high-limit thermostat.
22. Re-connect wires #1, #2, and #45 to the left ground stud.
23. Reconnect wires #47, #33, and #27 to the right ground stud.
24. Secure these ground wires with the previously removed 3/16" nuts atop the propane burner sub-assembly.

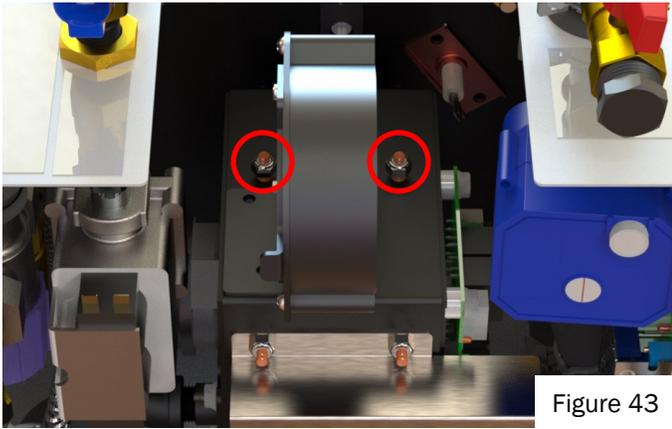


Figure 43

25. Reconnect the Aqua-Hot to a propane source to check for leaks in the propane fittings.
26. Open the propane ball valve on the Aqua-Hot, and open any propane shut-off valves present within the coach.
27. Check for propane leaks around the recently reconnected propane fittings using an approved propane leak detection method.
28. If excess propane is found anywhere around these fittings, address the leaks and repeat the above process. Repeat as necessary until no leaks remain.
29. Once complete, re-install the access cover of the Aqua-Hot.

Mounting Gasket



The Aqua-Hot operates on both AC and DC power. Be sure to disconnect the 120V AC power supply from the Aqua-Hot prior to servicing. Failure to do so could result in serious personal injury, electrical shock, or even death.

Function

The mounting gaskets create a tight seal between the boiler tank and the combustion chamber and the combustion chamber and burner mounting plate.

Replacement Indicator

The mounting gasket should be replaced each time the burner is detached from the Aqua-Hot.

Replacement Procedure



Ensure that the gas supply line has been shut off prior to the start of this replacement procedure.

1. Follow the instructions on page 34 to detach the propane burner.
2. Remove the existing gasket from the front of the combustion chamber of the Aqua-Hot.
3. Remove the second gasket from the back side of the combustion chamber.
4. Note that it may be necessary to use a scraping tool such as a putty knife to completely remove the old gasket from the combustion chamber.
5. Set the replacement mounting gasket into place on the boiler tank's front plate.
6. Follow the procedure on page 36 to reattach the propane burner to the Aqua-Hot.

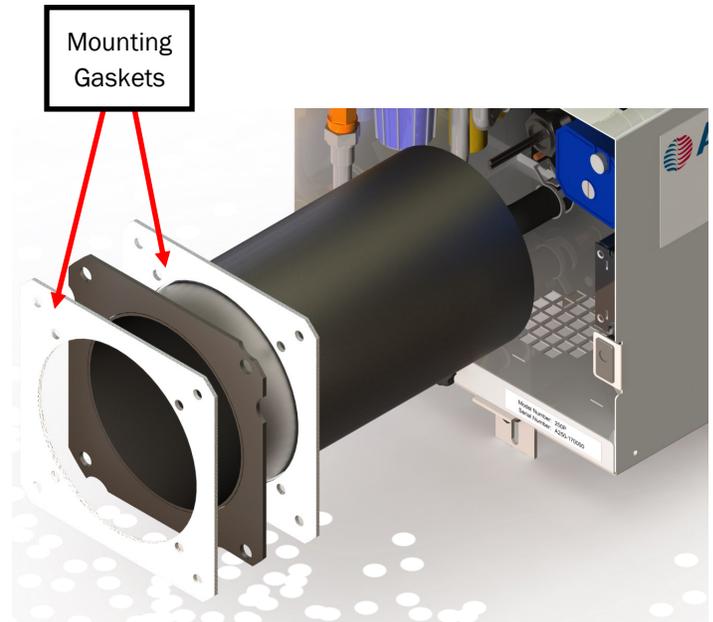


Figure 44

NOTE: The interlock switch will prevent the propane-burner from operating without the access cover intact; therefore, the switch will need to be manually depressed during this troubleshooting procedure.

Hot Surface Igniter

Function

The hot surface igniter ignites the propane gas and air mixture inside of the combustion chamber. It will activate approximately 10 seconds after the initial start-up sequence begins, and approximately five seconds before the dual-stage propane gas valve opens to ensure that it is up to proper ignition temperature of 1300°F before propane enters the combustion chamber.



DANGER

The Aqua-Hot operates on both AC and DC power. Be sure to disconnect the 120V AC power supply from the Aqua-Hot prior to servicing. Failure to do so could result in serious personal injury, electrical shock, or even death.

Replacement Indicator

Replace the hot surface igniter if:

- The unit fails to ignite the propane gas
- If the igniter is cracked, or otherwise damaged
- If there is a “popping” sound during start up

Troubleshooting

1. Verify the following before troubleshooting the hot surface igniter.
 - A. The control thermostat is calling for heat
 - B. The interlock switch is depressed
 - C. The overflow bottle is adequately filled
 - D. The high-limit thermostats are not tripped
 - E. All fuses in the relay control board are in working order

NOTE: The interlock switch will prevent the propane-burner from operating without the access cover intact; therefore, the switch will need to be manually depressed during this troubleshooting procedure.

2. Turn the propane burner switch to the “ON” position on the interior switch panel.
3. Approximately 10 seconds after the blower fan begins operating, the propane burner controller will activate the

hot surface igniter

4. Check the burner controller for 12V DC at the hot surface igniter wire (#46 Red.)
 - If no voltage is present, proceed to page 32 to diagnose the fenwal control card
5. Check the hot surface igniter buck-boost for 12V DC at wires #48 red, and #49 black.
 - If less than 12V DC are present, replace the buck-boost module
6. If voltage exists on step 4, locate a DC clamp-on type meter, and test the hot surface igniter wires, #46 red, or #47 black for amp draw.
 - If the amp-draw is less than 1.5A, replace the hot surface igniter.



CAUTION

The Hot Surface Igniter is extremely HOT, use caution when handling or serious burns may occur.

Visual Inspection Procedure

It is possible to view the hot surface igniter as a means to verify functionality.

1. Turn the Propane-Burner switch, located on the interior switch panel to the “OFF” position.
2. Close the propane gas ball valve located atop the heater where the coach-side propane line connects to the heater.
3. Using a Phillips screwdriver, loosen the hot surface igniter and carefully remove it from its mounting position.
4. With the hot surface igniter removed, and the propane shut-off valve in the closed position, move the propane burner switch to the “ON” position.
5. Approximately 10 seconds after the blower fan starts, the



Hot Surface Igniter

Figure 45

hot surface igniter should start warming. The tip should glow red for approximately 10 seconds.

- If the tip does not glow, the hot surface igniter will need to be replaced

6. If the hot surface igniter is in working condition, very carefully re-install it. If the ceramic casing or tip of the hot surface igniter is damaged, it will cease to function.

Replacement Procedure:

1. If not done so already, shut off all power sources to the Aqua-Hot
2. Turn off the propane at the ball valve atop the Aqua-Hot.
3. Remove the access cover of the Aqua-Hot to gain access to internal components.
4. Disconnect the hot surface igniter from the buck-boost module.
5. Using a Phillips screwdriver, remove the screw on the burner which is securing the hot surface igniter.

9. Reconnect the hot surface igniter to the igniter buck-boost. Red wire to "OUT +," and the black wire to "OUT -."

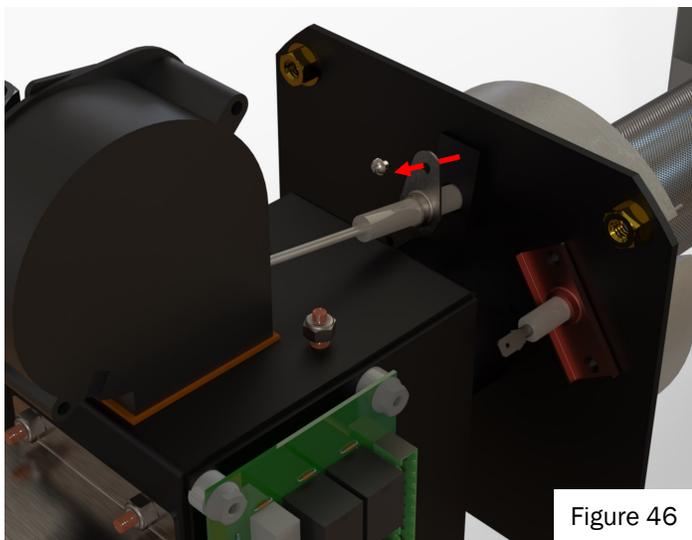


Figure 46

NOTE: The propane burner is shown as removed in the above graphic to aid in location and demonstration purposes. It is not necessary to remove the propane burner to replace this component.

6. Discard the defunct igniter.
7. Position the replacement igniter on the face of the burner.
8. Secure the igniter in place with the previously removed Phillips screw.

Refractory Insulation

Function:

The refractory acts as an insulator to protect the hot surface igniter from being overheated by the flame. Troubleshoot the refractory if the propane burner “pops” on ignition, or if the propane burner fails to ignite. The refractory should be replaced if it is ever damaged.



DANGER

The Aqua-Hot operates on both AC and DC power. Be sure to disconnect the 120V AC power supply from the Aqua-Hot prior to servicing. Failure to do so could result in serious personal injury, electrical shock, or even death.

Troubleshooting:

1. Follow the instructions starting on page 34 to remove the propane burner.
2. Once the propane burner has been removed, carefully inspect the refractory for any damage.
 - If the refractory has been damaged, it needs to be replaced.
3. With the burner removed, ensure that the refractory is secured in place on the propane burner, seated against the mounting plate.

NOTE: Improper handling of the burner may cause the refractory to shift its position on the propane burner, causing it to cover the hot surface igniter. This can inhibit the function of the propane burner.

Replacement Procedure

1. Turn the propane-burner switch located on the interior switch panel to the “OFF” position.
2. Turn the propane gas-supply valve, located atop the Aqua-Hot to the “OFF” position.
3. Turn off the coach propane supply valve.
4. If you have not already done so, follow the instructions on page 34 to remove the propane burner.
5. Locate and remove both the hot surface igniter and the flame sensor
6. Remove the defective refractory
7. Install the replacement refractory onto the propane burner, ensuring that both the flame sensor, and hot surface igniter holes are aligned
8. Re-install the flame sensor and hot-surface igniter onto the propane burner
9. Re-install the propane burner onto the heater, and tighten the nuts securing the burner in place.
10. Connect the propane gas line to the dual stage gas valve, and securely tighten the fittings to 30 ft/lbs.
11. Test the Aqua-Hot for proper operation

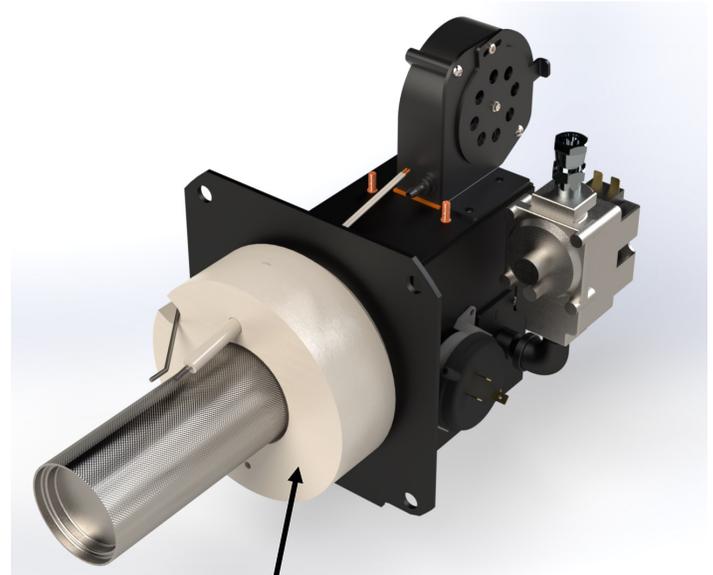


Figure 47

Refractory Insulation

Dual-Stage Propane Gas Valve

Function:

The dual-stage propane gas valve will activate approximately 6 seconds after the hot surface igniter has been activated, allowing propane gas to enter the combustion chamber and achieve combustion. Given that the propane gas valve is dual-stage, both stages must be activated for propane fuel to flow into the combustion chamber.

Replacement Indicator:

Replace the dual-stage propane gas valve if either stage fails to open, failing to allow propane gas to enter the combustion chamber.

Before troubleshooting the dual-stage propane gas valve, ensure that the coach has an adequate supply of propane gas, and that all valves and shutoffs are open, allowing propane flow to the Aqua-Hot.

Troubleshooting

- Verify the following before troubleshooting the dual stage gas valve.
 - The control thermostat is calling for heat
 - The interlock switch is depressed
 - The overflow bottle is adequately filled
 - The high-limit thermostats are not tripped
 - The fuses in the relay control card are functioning
- Turn the propane-burner switch, located on the interior switch panel to the "ON" position.
- Verify that the tank face is less than 155° F. If it is not, allow the unit time to cool before continuing. These tests will not work with a hot unit.
- Verify that the dual stage gas valve is receiving voltage during the first fifteen seconds of the start-up cycle when the unit is activated from a cold state.
 - Test for voltage at wire #41 (ORANGE) at the Fenwal control card. If there is no voltage here, begin troubleshooting the Fenwal card on page 32
- If the Fenwal card is sending voltage to the dual-stage gas valve, check for voltage at the dual-stage propane valve as denoted by Figure 54 on the next page.
 - If voltage is not present at the gas valve, inspect the wiring harness for damage.
- If voltage is present, but the gas valve is non-functioning replace the dual-stage gas valve.

Replacement Procedure

- Shut off the propane gas supply by turning the propane inlet port ball valve to the "OFF" position
- Shut off coach-side propane supply valve
- Using an 11/16 wrench, remove the propane supply line from the dual-stage gas valve

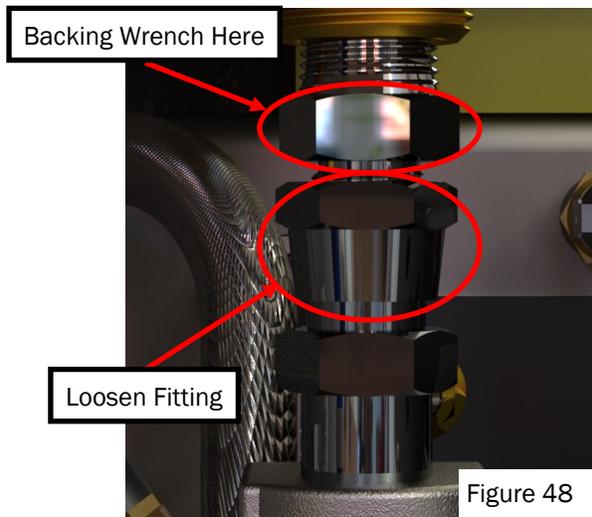


Figure 48

- Using two 3/4" wrenches, loosen, but do not completely remove the bulkhead fitting

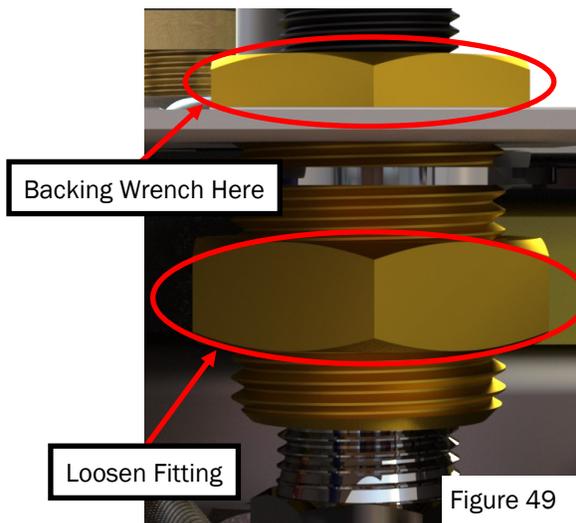


Figure 49

- Disconnect wires #40, #41 and the ground wires from the gas valve.

- Remove the two nuts securing the dual stage gas valve to the burner plenum.

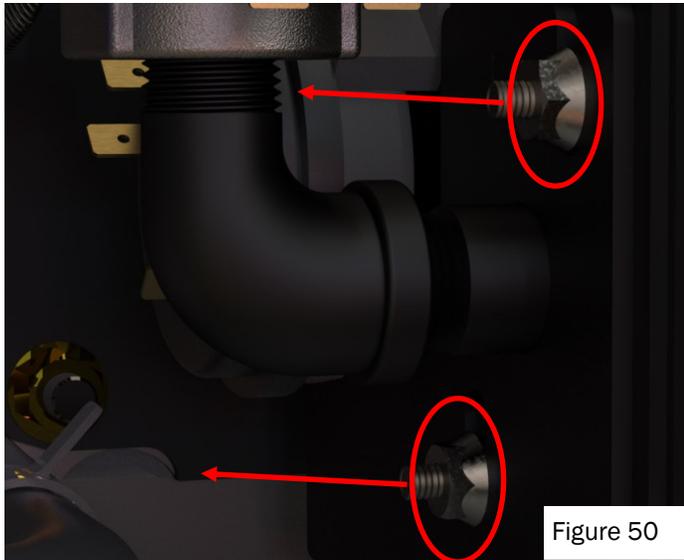


Figure 50

- Remove the fittings present at the top and bottom of the dual-stage propane gas valve as shown below.



Figure 51

- Clean these now-removed fittings, then apply new thread seal tape.
- Re-install these fittings onto the new dual-stage propane gas valve.
- Re-secure the nozzle into place on the side of the burner plenum assembly as previously removed in step 6. Take great care to ensure that grease does not cover the fuel nozzle.

- Re-attach the propane supply valve to the bulkhead fitting

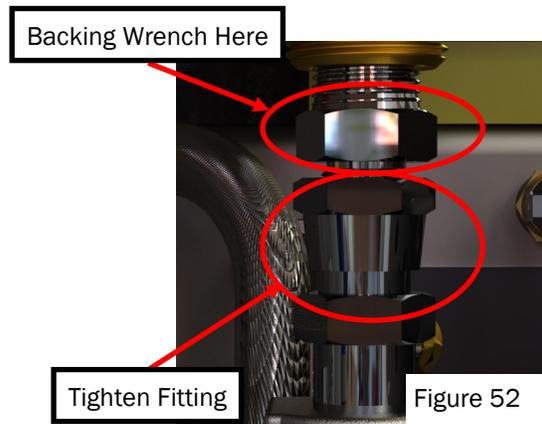


Figure 52

- Tighten the bulkhead fitting to the Aqua-Hot cabinet.

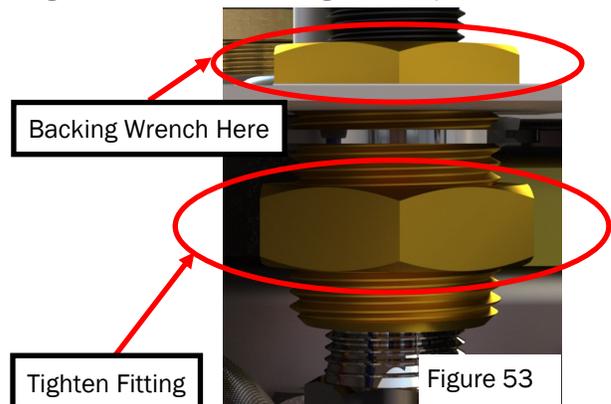


Figure 53

- Reconnect wires #40 and #41 to the dual stage gas valve. Wire #41 will terminate at the top positive connection, and wire #40 will terminate at the bottom positive connection. Connect the ground wires in a similar fashion.

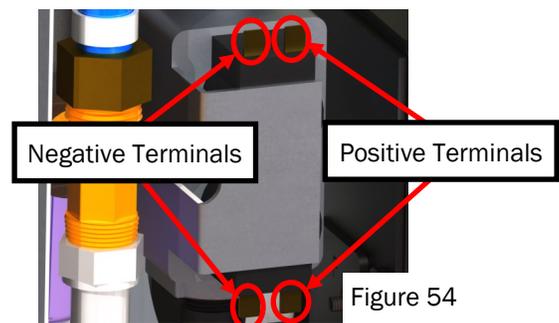


Figure 54

- Turn the propane ball valve back to the "ON" position, and inspect the propane fittings for any propane leaks using an approved propane detection method.
- If propane leaks are found, shut off the propane valve, and address the leak. Repeat this process until no leaks remain.
- Test the unit for normal operation.

Propane Combustion Blower Fan

Function

The combustion blower fan creates combustion air, which is blown into the combustion chamber to mix with the propane gas before it is ignited. Reference page 45 for the adjustment procedure.

The interlock switch will prevent the burner from operating without the access cover installed. Therefore, for troubleshooting and diagnostic procedures only, the interlock switch will need to be depressed.

Replacement Indicator

Replace the combustion blower fan if, after troubleshooting the unit fails to operate.

Troubleshooting

- Verify the following before troubleshooting the propane combustion blower fan.
 - The control thermostat is calling for heat
 - The interlock switch is depressed
 - The overflow bottle is adequately filled
 - The left high-limit thermostats are not tripped
 - The fuses in the relay control board are functional
- Turn the burner switch, located on the interior switch panel to the "ON" position.
- Verify that the burner controller is sending power to the combustion blower motor
 - Using a digital voltmeter, check wire #48 (RED) for 12V DC. If no voltage is present, begin diagnosing the Fenwal control card using the instructions on page 32
- Verify that the buck-boost module is functioning properly by using a digital voltmeter to test for voltage at the buck-boost. It should read 12.5V DC. If there is no voltage exiting the buck-boost module, it will need to be replaced.
- If at this point, all tests of the combustion blower fan are successful, but the blower still fails to operate, the blower fan itself will need to be replaced.

Replacement Procedure

- Turn the propane burner switch, located on the interior switch panel to the "OFF" position.
- Disconnect the wires connecting the blower fan to the buck-boost module. Using a 3/8" socket, loosen the nuts securing the combustion blower fan to the top of the burner assembly.
- Discard the orange gasket which seals the blower fan to the propane burner assembly.

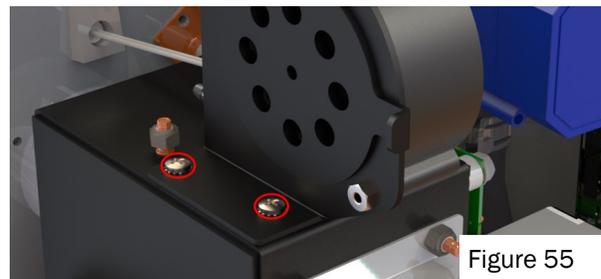


Figure 55

- Using a phillips screwdriver, and a 9mm socket, separate the defective blower fan from the air-shutter assembly by loosening the nuts shown in figure 56.

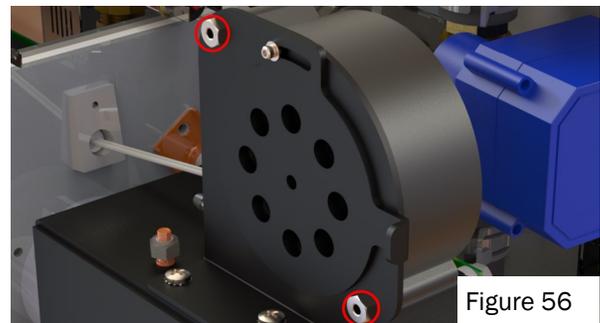


Figure 56

- Remove the hose from the barb on the blower fan.
- Discard the defective blower fan, and secure the new blower fan to the air shutter assembly using the previously mentioned phillips screwdriver, and 9mm socket. Tighten this hardware to 12in/lbs.
- Re-attach the hose to the barb of the blower fan.
- Reposition the air shutter assembly and new blower fan to the propane burner assembly. Take care to ensure that the orange sealing gasket is properly aligned.
- Using a 3/8" socket, secure the now repaired assembly to the top of the propane burner.
- Reconnect the wires of the blower fan to the buck-boost module.

Adjustment of the Propane Air Shutter

Should the propane air shutter come out of adjustment, follow the instructions below.

1. Loosen, but do not remove the set screw on the air shutter assembly.
2. Place a 9/32" drill bit, or a 0.275" pin gauge in the center of the top hole of the air shutter. Keeping the bit in the center of the hole, close the air shutter until it stops. This will set the gap at approximately 0.275".
3. While holding the bit in place, tighten the set screw.
4. Remove the drill bit and ensure that the air shutter is secure.

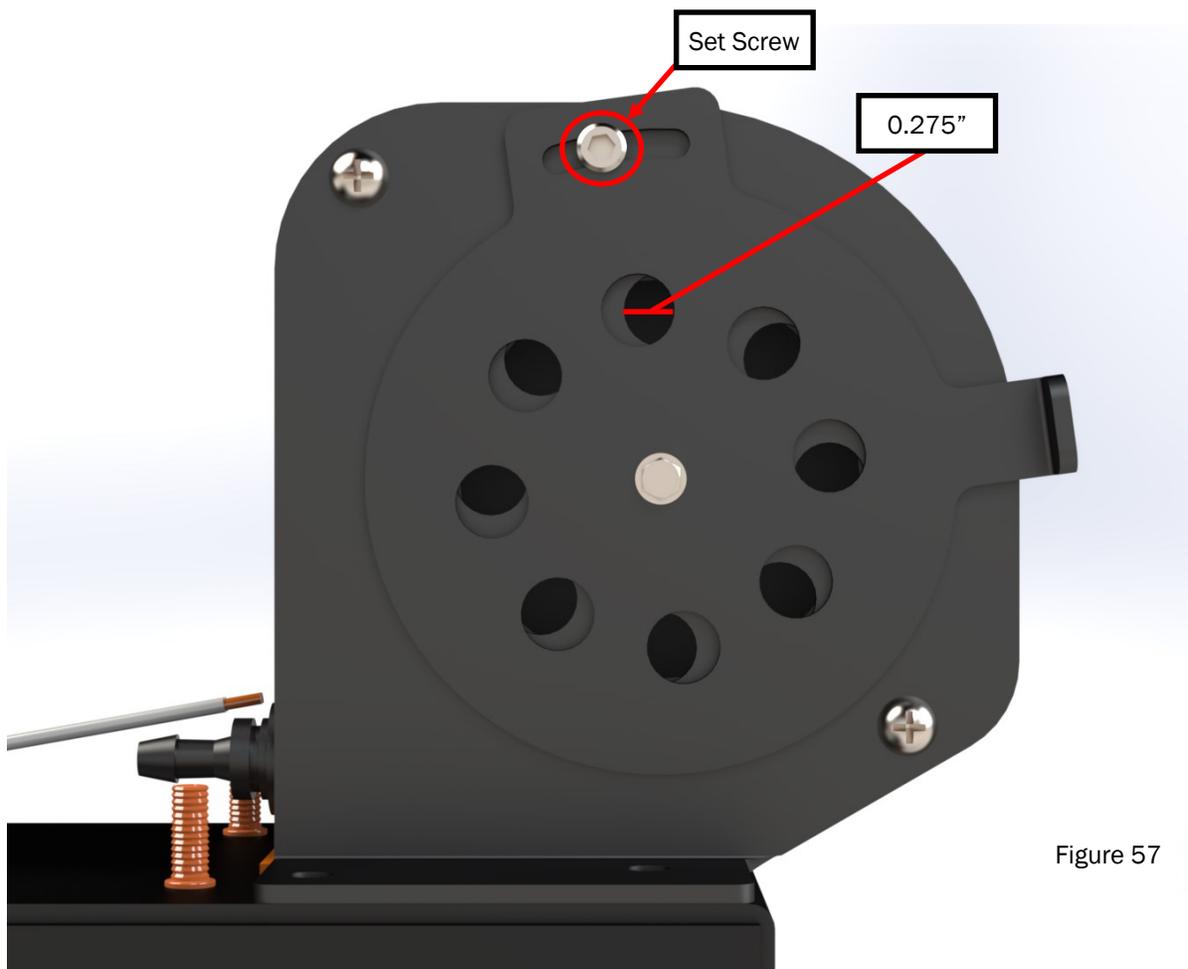


Figure 57

Exhaust “High Back Pressure” Switch

The purpose of the high back pressure switch is to monitor back pressure inside the combustion chamber, and shut the burner down if it senses high back pressure. This switch is normally closed, moving to the open position if excessive back pressure is detected inside the combustion chamber.

This function serves as a safety mechanism, deactivating the burner if exhaust and gaseous fuel “back-flows” into the cabinet of the Aqua-Hot, or if there is an obstruction or damage to the exhaust system.

Replacement Indicator

The high back pressure switch will need to be replaced if it ceases to function correctly, or if the switch is physically damaged.

NOTE: The interlock switch will inhibit the operation of the Aqua-Hot if it is damaged, or not depressed. Ensure that the interlock switch is depressed before troubleshooting this switch.

Troubleshooting Procedure

1. Verify the following before troubleshooting the back pressure switch
 - A. The control thermostat is calling for heat
 - B. The interlock switch is depressed
 - C. The overflow bottle is adequately filled
 - D. The high-limit thermostats are not tripped
 - E. The fuses on the relay control board are functional
2. Turn the propane burner switch, located on the interior switch panel to the “OFF” position, and if necessary, allow the Aqua-Hot to completely shut down.
3. Locate the exhaust “high back pressure” switch, located on the left side of the propane burner assembly.
4. Disconnect the two wires connected to the switch by firmly pulling on the quick disconnect terminals. Be careful not to damage these terminals.
5. Using a digital voltmeter, check the switch for continuity as described below. Reference figure 59 for the exact pin location.
 - A. Check for continuity between the pins labelled “C” and “NO”. There should be NO continuity between these pins. If continuity exists, replace this switch.

- B. Check for continuity between the pins labelled “C” and “NC”. If continuity does NOT exist between these pins, this switch will need to be replaced.

Replacement Procedure

1. Disconnect the two wires connected to the switch by firmly pulling on the quick disconnect terminals.
2. Using a #2 Philips screwdriver, loosen the two screws securing the switch to the left side of the propane burner.
3. Remove the defective switch
4. Secure the replacement switch to the side of the propane burner.
5. Reconnect the previously removed wires to the high back pressure switch.
6. Test for proper operation.

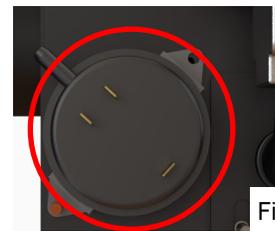


Figure 58

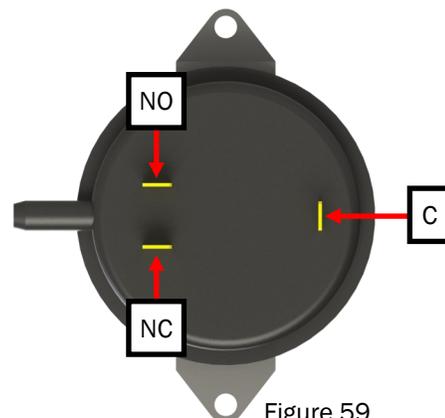


Figure 59

Fan Validation Switch

Function

The purpose of the fan validation switch is to monitor the combustion blower fan and verify that it is operating correctly. This switch is normally open. If the fan validation switch fails to operate, the fuel valve solenoid will not open, and the combustion chamber will not be supplied with combustible fuel.

Replacement Indicator

Replace the fan validation switch if the switch fails to operate or if it is physically damaged.

NOTE: The interlock switch will inhibit the operation of the Aqua-Hot if it is damaged, or not depressed. Ensure that the interlock switch is depressed before troubleshooting this switch.

Troubleshooting Procedure

1. Verify the following before troubleshooting the fan validation switch.
 - A. The control thermostat is calling for heat
 - B. The interlock switch is depressed
 - C. The overflow bottle is adequately filled
 - D. The high-limit thermostats are not tripped
 - E. The fuses on the relay control board are functional
2. Move the propane burner switch, located on the interior switch panel to the "OFF" position, and if necessary, allow the propane burner to completely shut down.
3. Locate the fan validation switch. It is attached to the cabinet wall on the right of the propane burner assembly. Reference Figure 60.
4. Disconnect the two wires connected to the switch by firmly pulling on the quick disconnect terminals. Take care to ensure that the terminals are not damaged during this process.
5. Using a digital voltmeter, check the fan validation switch for continuity.
 - A. If continuity exists across the two terminals on the fan validation switch, it will need to be replaced.
6. Move the burner switch, located on the interior switch panel to the "ON" position. Test for continuity across this switch while the combustion blower fan is on. If continuity does not exist, replace the fan validation switch.

Replacement Procedure

1. Move the propane burner switch, located on the interior switch panel to the "OFF" position, and if necessary, allow the propane burner to completely shut down.
2. Locate the fan validation switch. It is attached to the cabinet wall on the right of the propane burner assembly. Reference Figure 60.
3. Disconnect the two wires connected to the switch by firmly pulling on the quick disconnect terminals.
4. Using a 3/16" Allen wrench, remove the nuts securing the fan validation switch to the cabinet wall of the Aqua-Hot.
5. Remove the defective switch.
6. Secure the replacement switch to the side of the Aqua-Hot cabinet in place of the defunct component.
7. Secure the previously removed nuts to the cabinet wall with a 3/16" allen wrench
8. Reconnect the previously disconnected wires to the switch.
9. Test unit for proper operation.

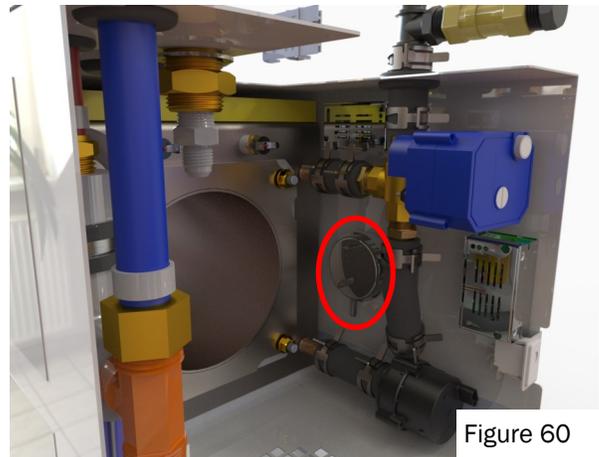


Figure 60



Figure 61

Buck-Boost Converter — Combustion Blower Fan

Function

The purpose of the buck-boost converter is to maintain a preset output voltage supplied to the combustion blower fan. This provides predictable and controllable operation of the blower fan to ensure the most ideal conditions for sustaining burner operation.

NOTE: There are two buck-boost converters at use within the propane units of the 200 series. Reference figures 62 and 64 to ensure that you are troubleshooting the correct module.

Replacement Indicator

Replace the buck-boost converter if it fails to provide 12V DC power, or if it is physically damaged.

Troubleshooting

1. Move the propane-burner switch, located on the interior switch panel to the “ON” position.
2. Verify the following before troubleshooting the buck-boost module.
 - A. The control thermostat is calling for heat
 - B. The interlock switch is depressed
 - C. The overflow bottle is adequately filled
 - D. The high-limit thermostats are not tripped
 - E. The relay board fuses are in working order
 - F. The fan validation switch is functioning properly. Reference page 47.
 - G. The D5 indicator light is illuminated
3. Verify that the propane burner controller is sending 12V DC power to the buck-boost module 15 seconds from initial start-up. Check voltage at the pin labelled “BLO”
 - If the propane burner controller is not supplying power while all of the above criteria are met, the Fenwal control card needs to be replaced.
4. If the propane burner controller is sending power on the “BLO” pin, check the wiring harness for damage. Repair or replace the wiring harness if necessary.
5. Verify that the buck-boost converter is sending power to the combustion blower motor. This voltage should be approximately 12.5V DC when the supply voltage is between

11V DC and 15V DC.

- If the buck-boost converter does not output approximately 12.5V DC. If the supply voltage is between 11V DC and 15V DC, the buck-boost will need to be replaced.

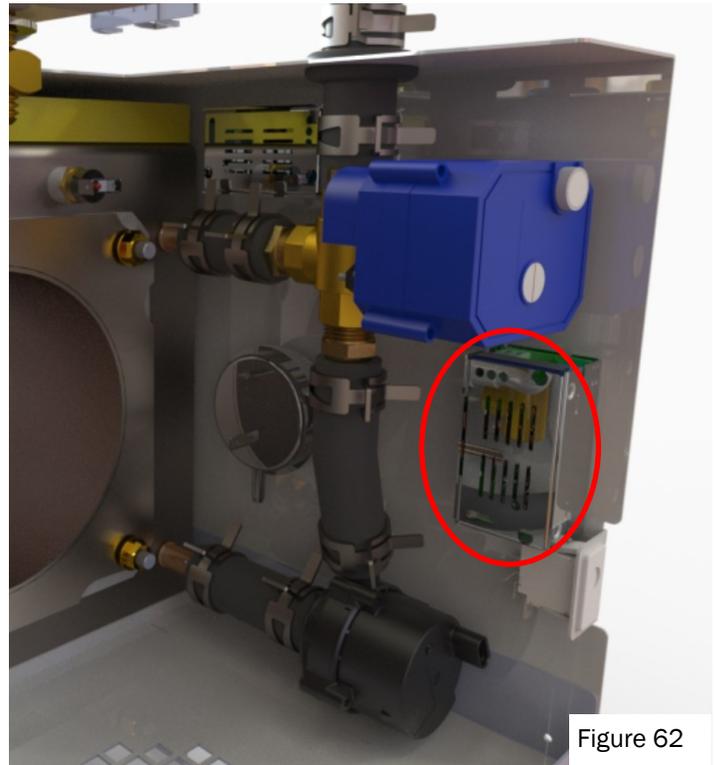


Figure 62



Figure 63

Buck-Boost Converter— Hot Surface Igniter (Propane Series Only)

Function

The purpose of the buck-boost converter is to maintain a preset output voltage, allowing the hot surface igniter to function optimally under normal conditions.

Replacement Indicator

Replace the buck-boost converter module if it fails to provide steady 12V DC power, or is physically damaged.

Troubleshooting Procedure

1. Move the propane-burner switch, located on the interior switch panel to the “ON” position.
2. Verify the following before troubleshooting the buck-boost module.
 - A. The control thermostat is calling for heat
 - B. The interlock switch is depressed
 - C. The overflow bottle is adequately filled
 - D. The high-limit thermostats are not tripped
 - E. The fuses in the relay control board are functional
 - F. The fan validation switch is functioning correctly. Reference page 47
 - G. The D5 indicator light is illuminated
3. Verify that the Fenwal burner controller is sending 12V DC power to the buck-boost module at pin labelled “HSI+”
 - If the propane burner controller is not supplying power while all of the above criteria are met, the Fenwal control card must be replaced.
4. If the propane burner controller is sending power on the “HSI+” pin, check the wiring harness for damage. Repair or replace the wiring harness if necessary.
5. Verify that the buck-boost converter is sending power to the hot surface igniter. This voltage should be approximately 12.5V DC when the supply voltage is between 11V DC and 15V DC.
 - If the buck-boost converter does not output approximately 12.5V DC if the supply voltage is between 11V DC and 15V DC, the buck-boost will need to be replaced.



Figure 64



Figure 65

Replacing the Buck-Boost Modules

Scope:

If it has been determined that the buck-boost modules must be replaced, follow the instructions hereinafter to correctly remove and replace a buck-boost module.

Procedure:

1. Move all switches on the interior switch panel to the "OFF" position.
2. Disconnect the Aqua-Hot from any power source.
3. Locate the buck-boost module which is to be replaced.
4. Carefully remove the buck-boost module from its position on the side of the Aqua-Hot cabinet.
5. Using a flat head screw driver, loosen the four terminal screws found at both ends of the buck-boost module. These screws are shown below.
6. Discard the non-functional buck-boost module.

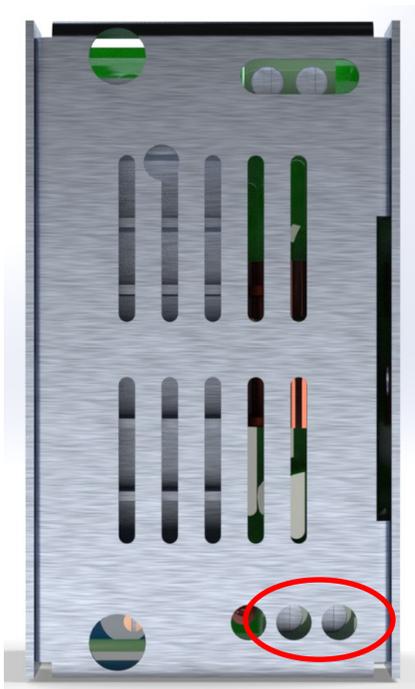


Figure 66

7. Insert the previously removed leads into their respective positions on the buck-boost module. Each end of the buck-boost is labelled "IN" and "OUT." Read below for specific pin-out information.

Hot Surface Igniter

- Connect wires #46 to the pin labelled "IN(+)" and #47 to "IN(-)" on the buck-boost module.
- Connect the Hot Surface Igniter wires to the side labelled "OUT."

Blower Fan

- Connect wires #48 to the pin labelled "IN(+)" and #49 to "IN(-)" on the buck-boost module.
- Connect the wires of the replacement blower fan to the buck-boost module pins labelled "OUT," red to positive, black to negative.

8. Affix a mating piece of hook and loop tape to the back of the buck-boost module, and attach it to the inside of the Aqua-Hot cabinet.
9. Test the unit for normal operation.

Propane Flame Sensor

Function

The purpose of the flame sensor is to monitor the flame of the propane burner, and verify that a flame is present within the combustion chamber. The flame sensor itself completes a path to ground.

Service information

The flame sensor should be cleaned using a heavy duty scouring pad (such as a Scotch-Brite pad) if functionality seems to be impacted. **DO NOT** use sand paper on the flame sensor.

Replacement Indicator

Replace the flame sensor if it fails to operate or is physically damaged.

Troubleshooting Procedure

Before continuing, there are considerations which need to be taken into account. The flame sensor itself produces a very small current, measured in micro-amperes (μA .) This current is too small to be detected by most retail multi-meters. This functionality is necessary to complete this troubleshooting procedure. If you do not have, or are unable to obtain a multi-meter capable of measuring μA , please contact the Aqua-Hot Heating Systems technical support department at +1 (800) 685-4298 to assist in diagnosing this flame sensor.

If you have a multimeter capable of measuring μA , please continue below.

1. Disconnect wire #35 from the flame sensor
2. Connect the multi-meter in-line between the disconnected wire, and the flame sensor
3. Set the multimeter to measure μA
4. Move the propane burner switch, located on the interior switch panel to the "ON" position
5. Check the amp draw on the multi-meter. It should be $0.7\mu\text{A}$ or higher while a flame is established.

NOTE: If the multi-meter reads below "0" on scale, the meter leads have been reversed. Disconnect power, and reconnect the meter leads to record the proper polarity.

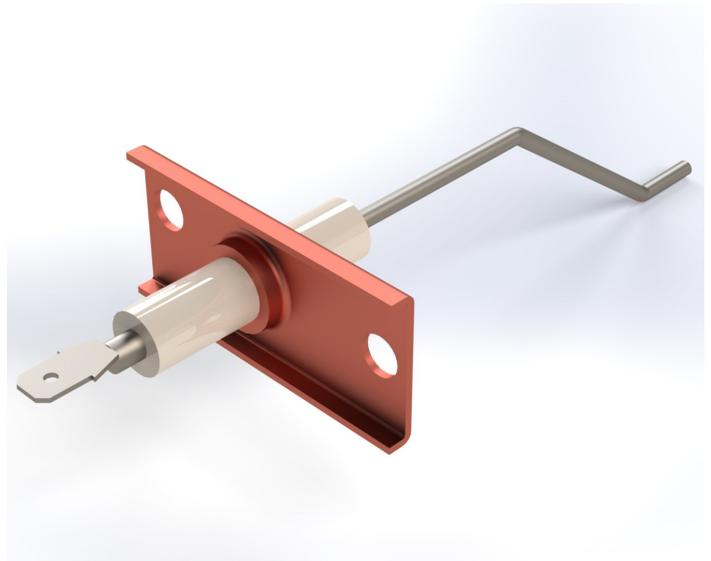


Figure 67



Figure 68

Flame Sensor Replacement Procedure

Scope:

The following instructions will assist in replacing the propane flame sensor once it has been deemed to be non-functional.

Procedure:

1. Disconnect the Aqua-Hot from any and all electric sources.
2. Ensure that the Aqua-Hot has had adequate cool-down time if the unit has been recently run.
3. Disconnect wire #35 from the flame sensor.
4. Using a 5/32" hex head Allen wrench or driver, remove the two bolts securing the flame sensor in place as shown below.

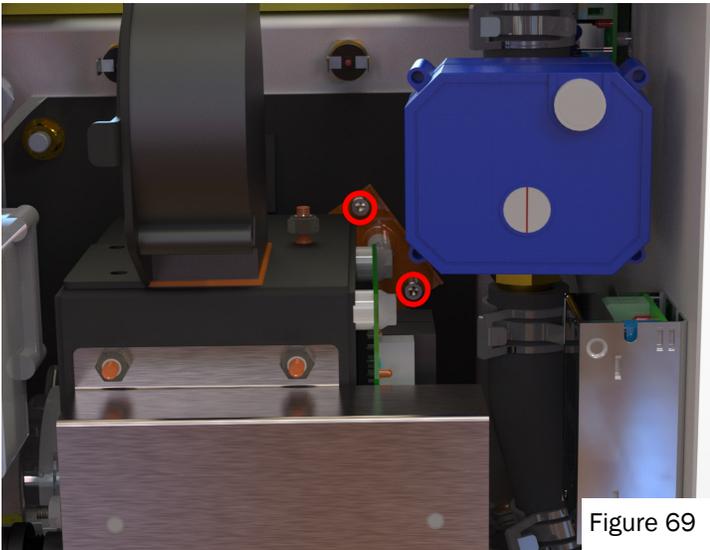


Figure 69

5. Very carefully remove the flame sensor once these bolts have been removed by gently twisting while pulling it out of the burner assembly.
6. Discard the defunct flame sensor.
7. Locate the replacement flame sensor, and twist it back into place.
8. Using the 5/32" Allen wrench, re-secure the flame sensor in place with the previously used screws.
9. Reconnect wire #35 to the flame sensor.
10. Test the unit for normal operation.



Diesel Burner

Heat Input (Firing Rate).....55,000 BTU/hr ± 10%
 Continuous Fuel Consumption..... 0.40gal/hr

Electric Heating Element

Specifications.....120V AC, 1kW

Maximum DC System Power Consumption

Specification.....12V DC, 108W

Zone Heat Circulation

Pumps.....1
 Power Specification 12V DC, 21W

Heating Zones

Maximum.....1

Domestic Water Heating

Continuous Supply Capacity1.5gal/min

Specification

Dimensions:11.69”H x 12.45”W x 21.61”L
 Dry Weight:84 lbs
 Wet Weight: 104 lbs

NOTICE

All vehicle installations must comply with the requirements listed in the Recreational Vehicle Industry Association’s (RVIA) ANSI/NFPA 1192 Handbook for Recreational Vehicle Standards. To receive a copy of this handbook and other pertinent RVIA Standards, write to: Recreation Vehicle Industry Association, 1896 Preston White Drive, P.O. Box 2999, Reston, VA 22090-0999, call them at (703) 620-6003, or online at www.rvia.org, www.nfpa.org.



Voltage / Power	12V / 72W
Pump Pressure	145 PSI/10.0 bar
Input Firing Rate	55,000 BTU/HR, 17.6 kWh
Fuel Type	Diesel
Part Number	DBE-000-000

Diesel Burner Serial Number: DB185555

For Detailed Information, reference the Owner’s Manual or contact Aqua-Hot Heating Systems Inc. at 1-800-685-4298.

7501 Miller Drive • Frederick, CO 80504 • 1.800.685.4298 • www.aquahot.com

Note: The product label attached to each Aqua-Hot provides a ready reference to specifications, test standards, and important safety notices.



For installation only in a compartment that is completely closed off from living quarters and accessible only from the outdoors.

Exhaust system MUST NOT terminate beneath the vehicle and not less than 3 feet from an openable window.

Combustion Air MUST BE supplied from outside the vehicle.

Suitable for water (potable) heating and space heating.

THIS APPLIANCE OPERATES ON BOTH DC AND AC POWER.

USE COPPER CONDUCTORS ONLY!

Use a circuit breaker that cuts power at 20-Amps maximum for over-current protection for the 120-VAC power supply.

Mount the Heater near a bay/storage door so that the Access cover can be easily removed for service.

For Detailed Information, reference the Owner’s Manual or contact Aqua-Hot Heating Systems Inc. at 1-800-685-4298.

Minimum Service Clearances

Front - Open Access
 Back - 1 Inches
 Top - 8 inches
 Sides - 1 inches

This appliance must be installed in accordance with local codes or, in the absence of local codes, the Standard for Recreational Vehicles, ANSI A119.2/NFPA 1192 or CAN/CSA-Z240 RV.



Intertek
 3069328

For Direct Vent Installation in a Recreational Vehicle.

Meets or Exceeds: UL 307A, UL 174
 CSA/CAN B140.0-03
 CAN/CSA-C22.2 No.110-94

Max Tank Pressure	0 PSI
Watts (DC)	146.4
Watts (AC)	1000
Tank Capacity	3.7 gal
Orifice Size/Angle	0.35/60°
Volts/Amps	12VDC, 12.2A
Volts/Amps/Frequency	120VAC, 9.6A, 50/60Hz
Pump Pressure	145 PSI/10.0 bar
Input Firing Rate	55,000 BTU/HR, 17.6 kWh
Diesel Burner Model	Aqua-Hot
Fuel Type	Diesel

Diesel Burner Serial Number: DB185555__
 Model Number: 250D
 Serial Number: A250D-XXXXXX__

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Diesel Burner (250D only)

The diesel burner serves as the primary heating source for the Aqua-Hot 250D. The diesel burner is responsible for mixing and igniting diesel fuel within the combustion chamber. Heat energy is then transferred from this combustion reaction into the anti-freeze and distilled water heating solution present in the Aqua-Hot's boiler tank, which is subsequently distributed to heat exchangers, or to the domestic hot water coil to provide hot water.

Standard automotive diesel fuel is to be used as the fuel source. Key components are called out below. The diesel burner will also possess a unique identifying label with information such as specifications, and a serial number.

- | | |
|-----------------------------|--------------------------|
| 1. Igniter | 8. Diesel Air Shutter |
| 2. Igniter Coil Flange | 9. Combustion Blower Fan |
| 3. Igniter Coil | 10. Fuel Pump Coupler |
| 4. Diesel Burner Controller | |
| 5. Burner Head Sub-Assembly | |
| 6. Fuel Pump | |
| 7. Fuel Pump Motor | |

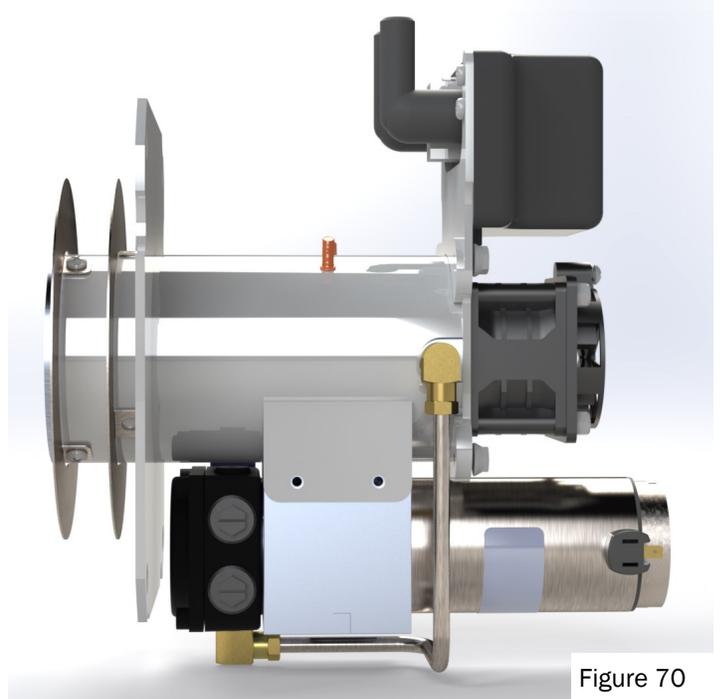
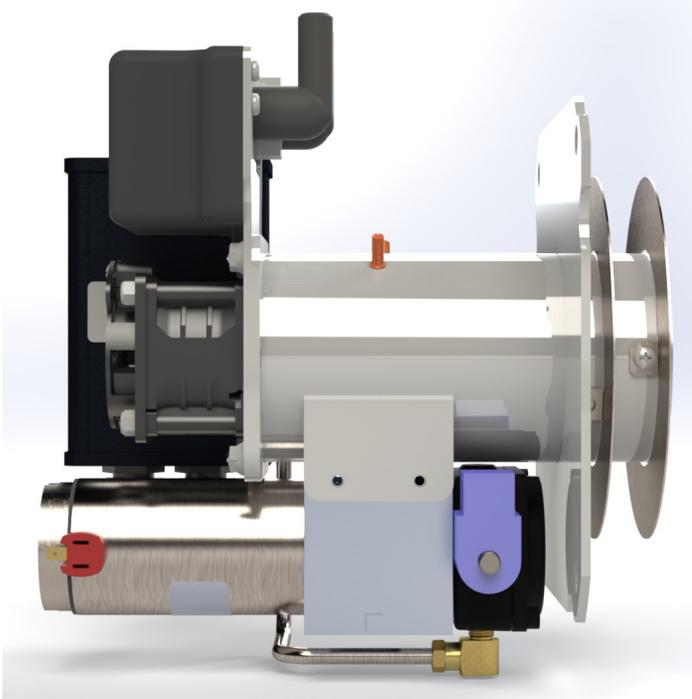
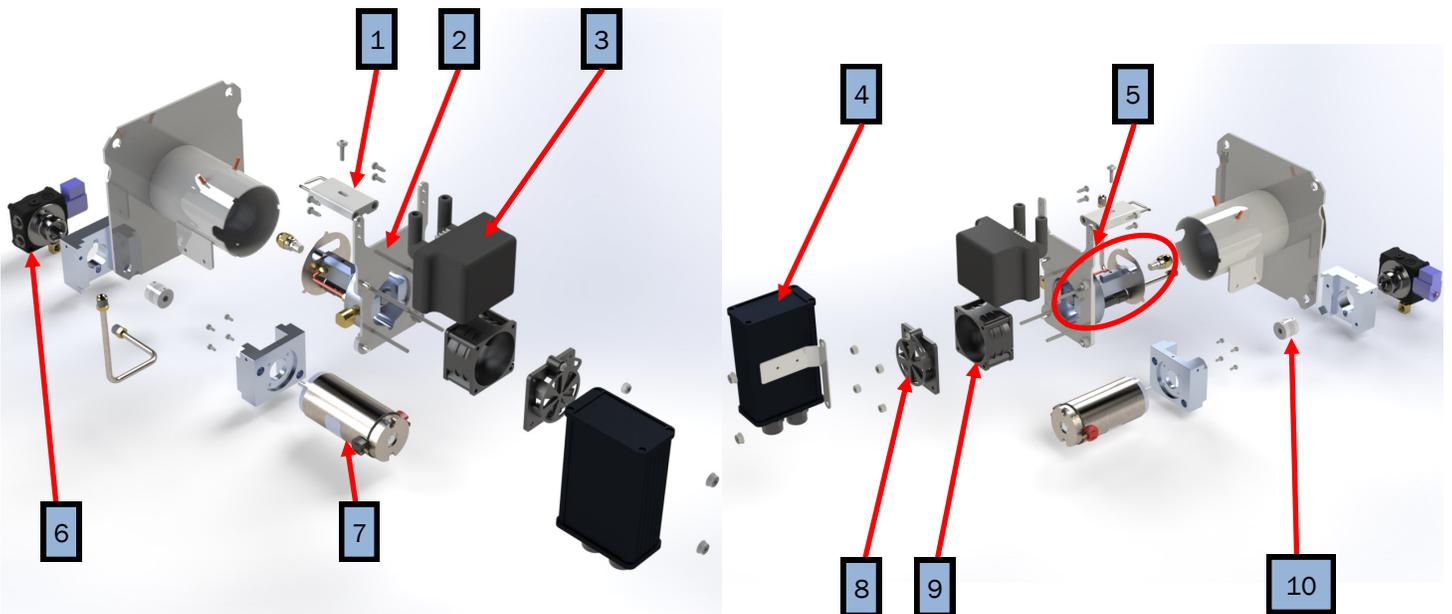
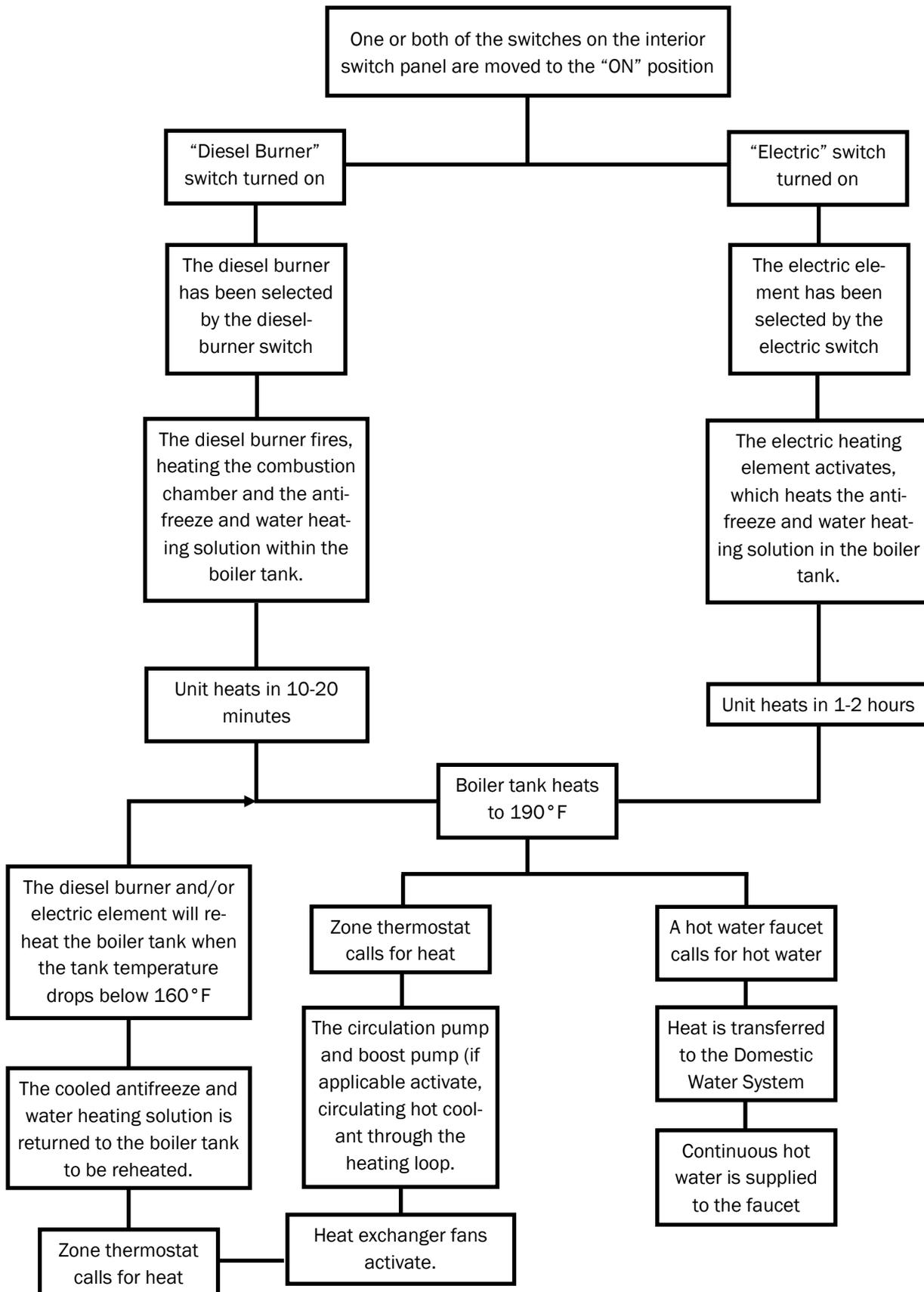
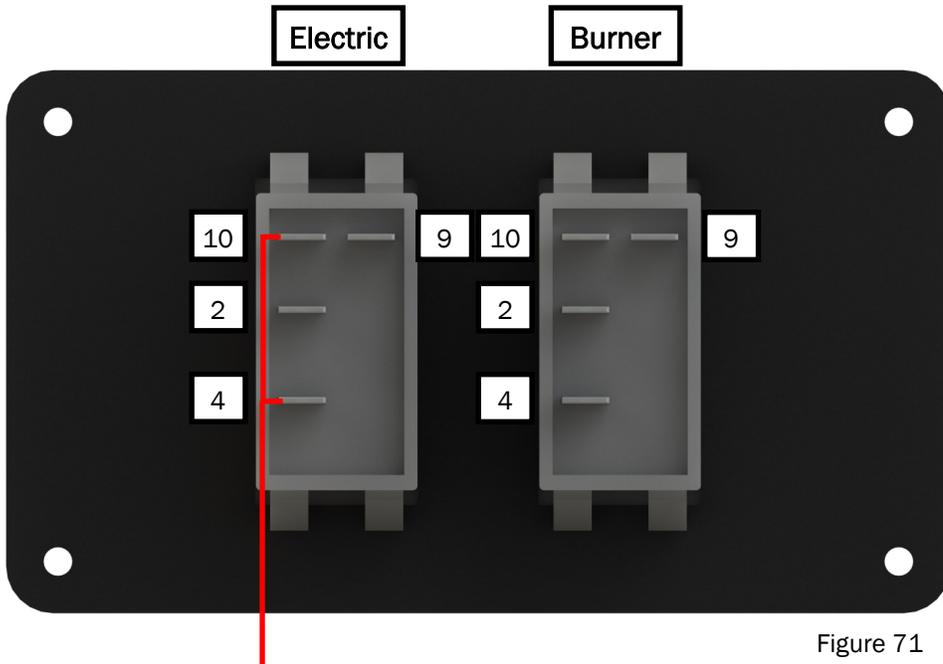


Figure 70

Operational Flow-Chart





NOTE: The electric element switch must possess a jumper wire between pin 4 and pin 10 as depicted on this page.

Figure 71

Jumper Wire (See Note)

AC Electric Switch	12-Pin MATE-N-LOCK	Burner Switch	12-Pin MATE-N-LOCK
Pin 4	Pin 9	Pin 4	Pin 4
Pin 2	Pin 10	Pin 2	Pin 5
Pin 9	Chassis Ground	Pin 9	Chassis Ground
		Pin 10	Pin 11

NOTE: The AC control circuit connections have been integrated into the 12-Pin Mate-N-Lock receptacle, differing from the 250P.

Receptacle Housing Information

Mfg: TE Connectivity
 Mating Part No: 1-480709-0
 Common Name: Mate-N-Lock



Wire Insertion View Shown

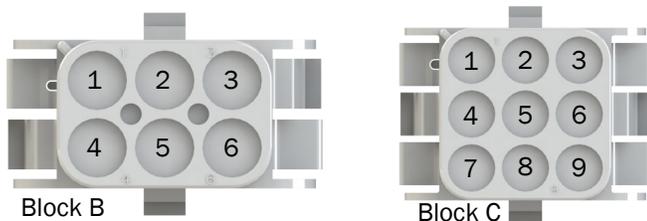
Diesel Burner Controller

Purpose:

The intent of the diesel burner controller is to manage all aspects of diesel burner operation. Please note that this information is only applicable to the diesel burner, and controls no systems or components outside of this scope. The diesel burner ensures that sustainable combustion is achieved quickly, reliably, and with a low rate of failure. The diesel burner controller also maintains the following specific functions.

- Fan Validation
- Flame Sensing

Pin-out Information



Block B	
PIN	Function
B1	On/Off Switch (White)
B2	Battery Negative (Black)
B3	Control Light/Operation Indicator (Green)
B4	Battery Positive (Red)
B5	Thermostat Input (White)
B6	Thermostat Output (Orange)
Block C	
PIN	Function
C1	To fuel motor (Red)
C2	To overheat fuse, temperature limiter, fuel solenoid valve (Black)
C3	Component Grounds (Black)
C4	To photo-eye (Yellow)
C5	To igniter coil (Red)
C6	To combustion fan (Red)
C7	Combustion fan ground (Black)
C8	EMPTY
C9	To photo-eye (Yellow)

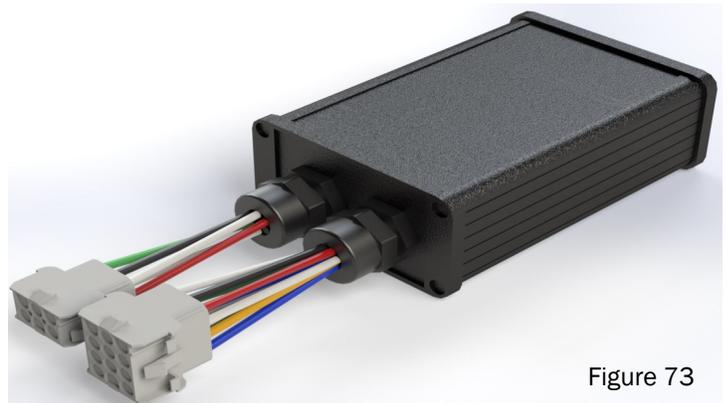


Figure 73

Replacement Indicator:

The diesel burner controller should be replaced if it fails to operate after adequate troubleshooting procedures have been observed.

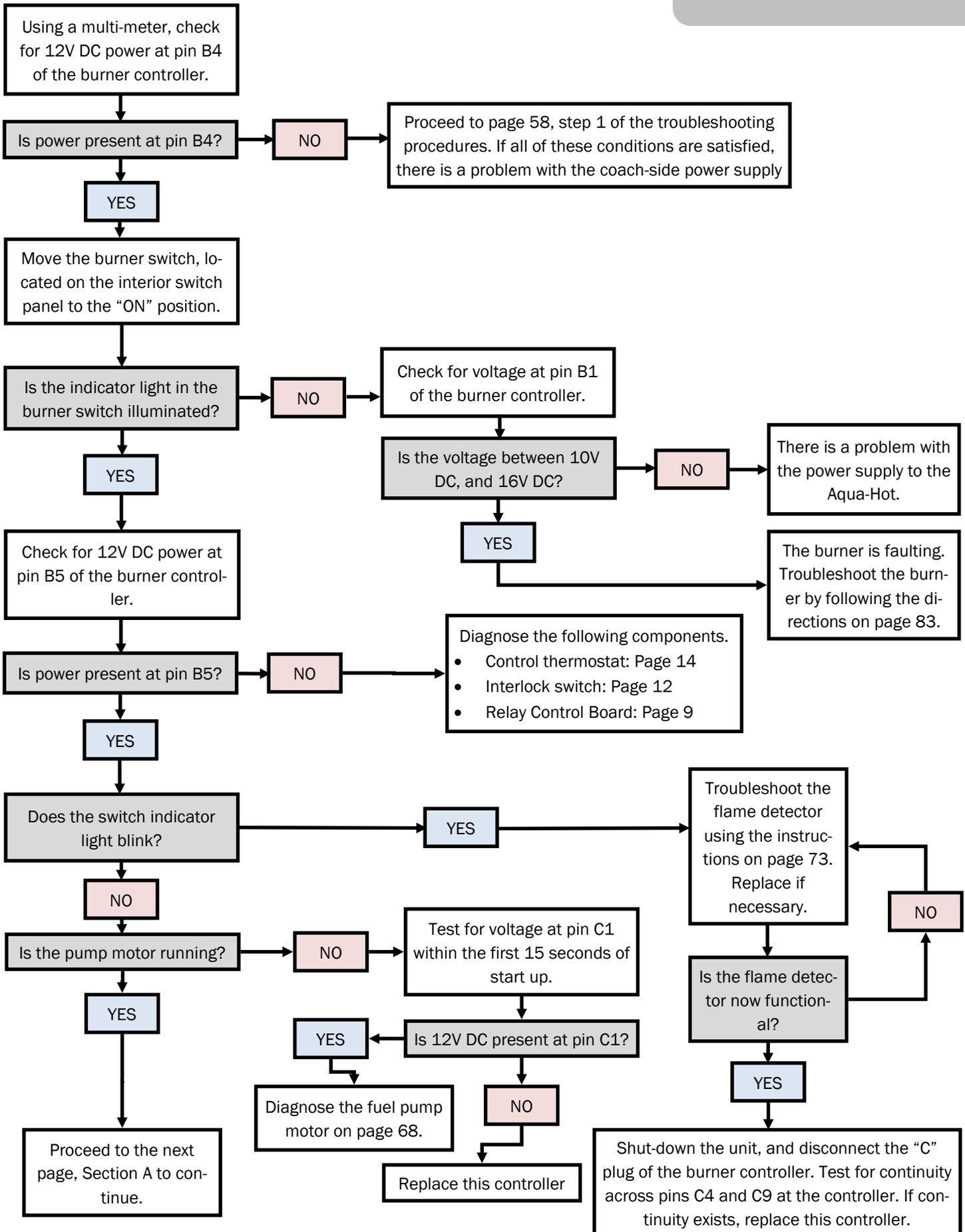
Troubleshooting Procedure:

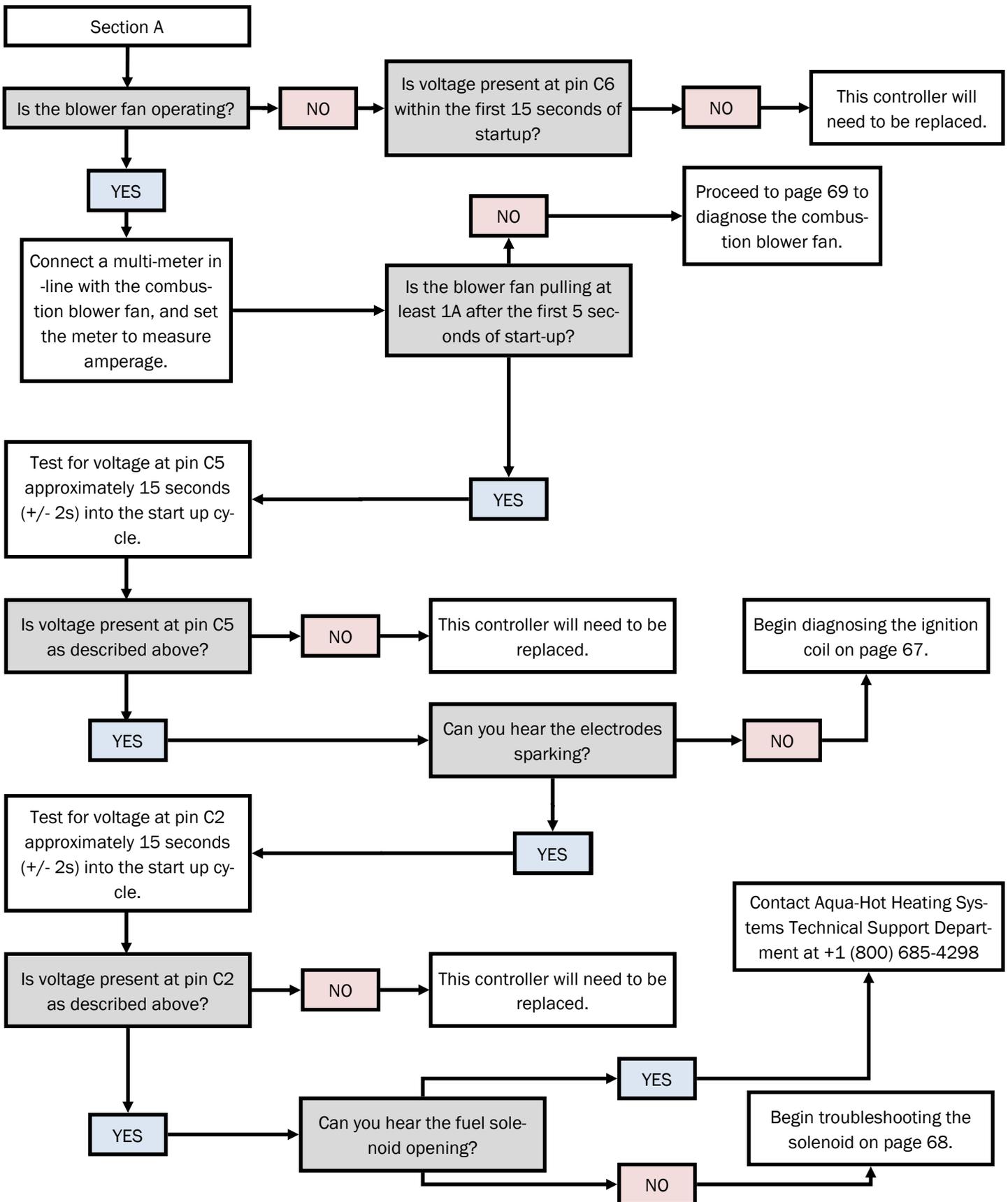
1. An in-depth troubleshooting flow-chart is provided on the next page. Before beginning this flow chart, ensure that the following conditions are met.
 - A. The unit is off
 - B. The unit is completely cool
 - C. The interlock switch is depressed
 - D. The overflow bottle is adequately filled
 - E. The high-limit thermostats are not tripped
 - F. The fuses in the relay control board are functional
 - G. The 20A in-line fuse is in good working condition

If these conditions are not met the following troubleshooting procedures will not return accurate diagnostic results, possibly resulting in mis-diagnosis of the Aqua-Hot.

Replacement Procedure

1. Disconnect the Aqua-Hot from any and all power sources.
2. Using a 3/8" socket, remove the two bolts on the left side of the diesel burner securing the burner controller in place.
3. Disconnect the two plugs of the diesel burner controller.
4. Set aside the defunct component.
5. Locate the new diesel burner controller.
6. Slide the new controller into place on the studs.
7. Re-secure the controller with a 3/8" socket.
8. Reconnect the two plugs previously removed.
9. Test the unit for operation.





Disassembly of the Burner Head Sub-Assembly

Scope:

The Aqua-Hot diesel burner has been designed to aid in service and maintenance by allowing the burner components to be disassembled without the need to completely remove the diesel burner assembly. This should shorten the required time to perform many maintenance items, such as the annual service.

Procedure:

1. Disconnect the Aqua-Hot from any and all electrical sources.
2. Remove the access cover from the front of the Aqua-Hot.
3. Locate the diesel burner controller on the left hand side of the burner.
4. Remove the two nuts securing the burner controller to the side of the burner assembly as shown below. A 3/8" socket will be needed.

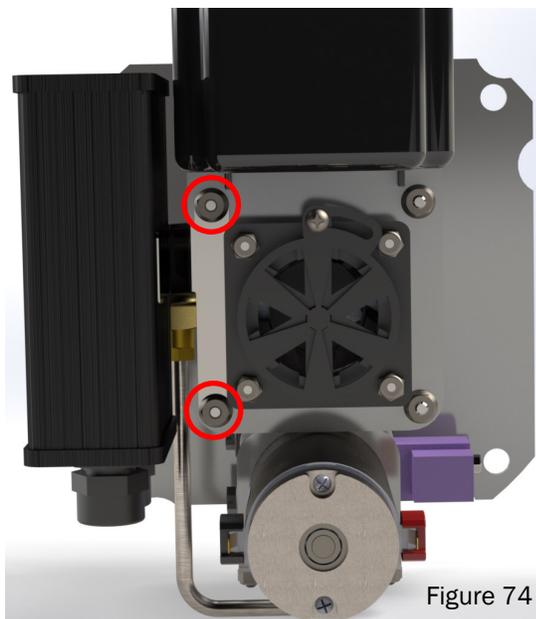


Figure 74

5. Disconnect, and set aside the diesel burner controller.
6. Locate the steel fuel line running from the bottom of the burner to the left side.
7. Using a 7/16" wrench, loosen and remove the **lower** fuel fitting from the side of the burner. Reference figure 75 to the right.

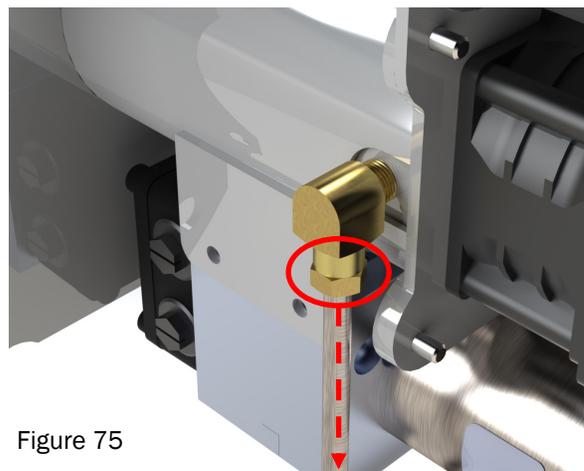


Figure 75

8. Remove the remaining two nuts from the right side of the diesel burner assembly.
9. Disconnect the blower fan by separating the wires at the white two-pin connector.
10. Disconnect the photo-eye by separating the wires at the white two-pin connector.
11. Disconnect the igniter coil by separating the wires at the white two-pin connector.
12. Very carefully remove the burner head sub-assembly from the blower tube by gripping both sides of the igniter coil flange. Do **NOT** pull on the air shutter or the blower fan.

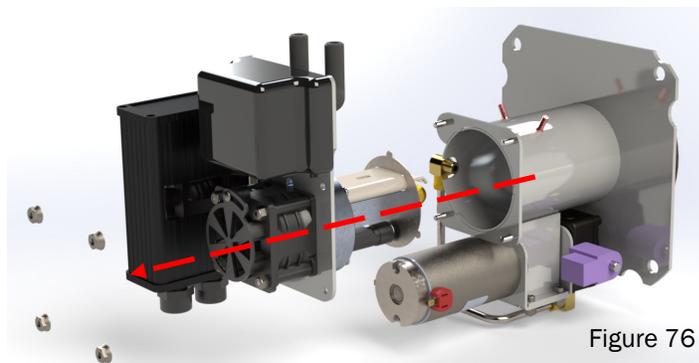


Figure 76

13. Having performed this procedure it is possible to access most internal workings of the diesel burner for maintenance, and if necessary, repair.

Re-Assembly of Diesel Burner Head Sub-Assembly

Scope:

The following instructions will aid in re-assembling previously removed diesel componentry.

Procedure:

1. Locate the burner head sub-assembly.
2. Very carefully slide this sub-assembly back into position on the main body of the diesel burner. Do not slide the sub-assembly in completely.
3. Slide this sub-assembly completely into the burner body until it seats completely on the four corner studs.
4. Secure the fuel tower assembly in place with the right two nuts and a 3/8" socket.
5. Using a 7/16" wrench, reattach the lower fuel line fitting to its position on the fuel tower assembly.

NOTICE

Take care to ensure that wires are correctly reconnected to the Aqua-Hot harness. Failure to correctly reconnect these wires may result in damage to the Aqua-Hot and/or the enclosed components.

6. Reconnect the plugs to of the diesel burner controller to the wiring harness present within the Aqua-Hot.

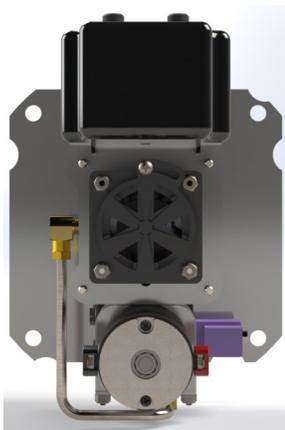


Figure 77

7. Slide the diesel burner controller back into its position on the left side of the igniter coil flange.
8. Using a 3/8" socket, reattach the left two securement nuts to the diesel burner. This will secure the diesel burner controller and the fuel tower sub-assembly into place.

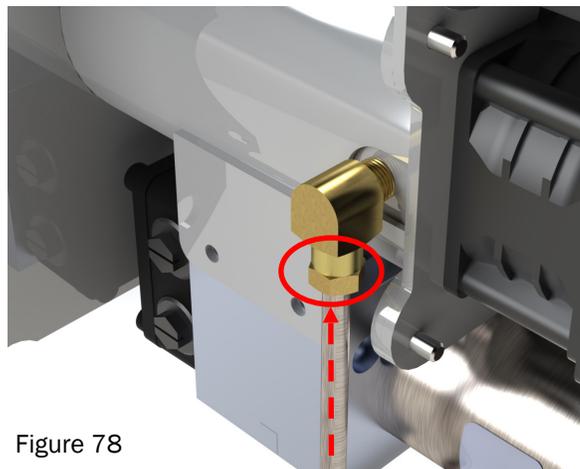


Figure 78

9. Reconnect the blower fan (black and red), photo-eye (yellow,) and igniter coil (black and red) to the Aqua-Hot main harness.
10. Test the unit for normal operation.

Detaching the Diesel Burner

Scope:

This section details how to safely remove, and re-install the diesel burner found on the Aqua-Hot 250D. It may be necessary to perform this procedure for repair and maintenance.



WARNING

Be sure to move the Burner switch on the interior switch panel to the "OFF" position and disconnect the burner power supply before detaching the burner from the Aqua-Hot. Failure to turn off the burner and disconnect power could result in serious bodily injury.

Procedure:

1. Move the burner switch, located on the interior switch panel to the "OFF" position. Ensure that the heater is off, and has cooled completely before continuing.
2. Shut off or disconnect any fuel and electric sources connected to the Aqua-Hot
3. Remove the access cover by removing the thumb screws located at the top and bottom of the cabinet exterior.
4. Using a 3/8" socket, remove the two nuts securing the diesel burner controller to the burner assembly. Reference figure 79 below.

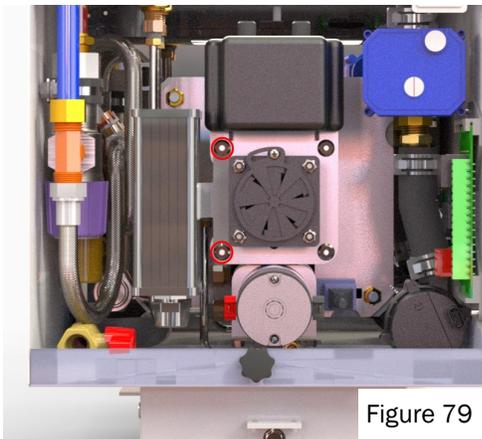


Figure 79

5. Once these nuts have been removed, physically remove the burner controller from the cabinet assembly.

6. Disconnect the burner controller harness plugs and set the diesel burner controller aside.

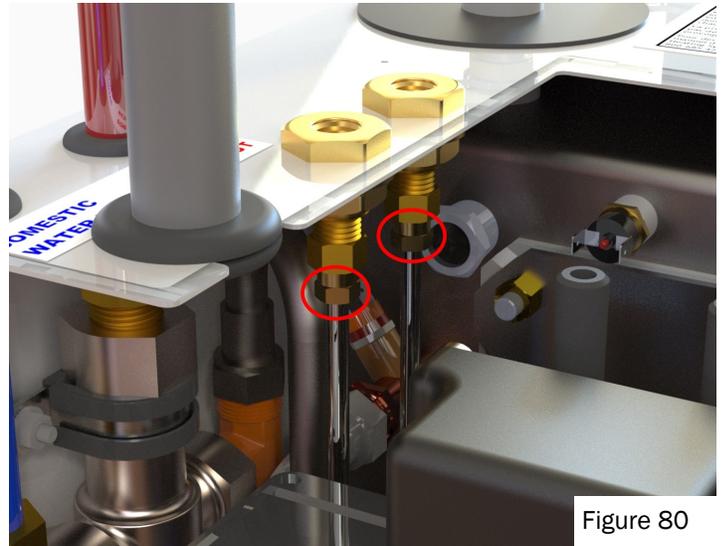


Figure 80

7. Disconnect the diesel fuel line fittings using a 7/16" wrench. (Fig. 65.)
8. Locate the blower fan buck-boost module, and remove it from the hook and loop tape on the cabinet wall.
9. Using a 1/2" socket, remove the four nuts from the four corners of the flange as shown below. A swivel socket adapter may be required to access all hardware.

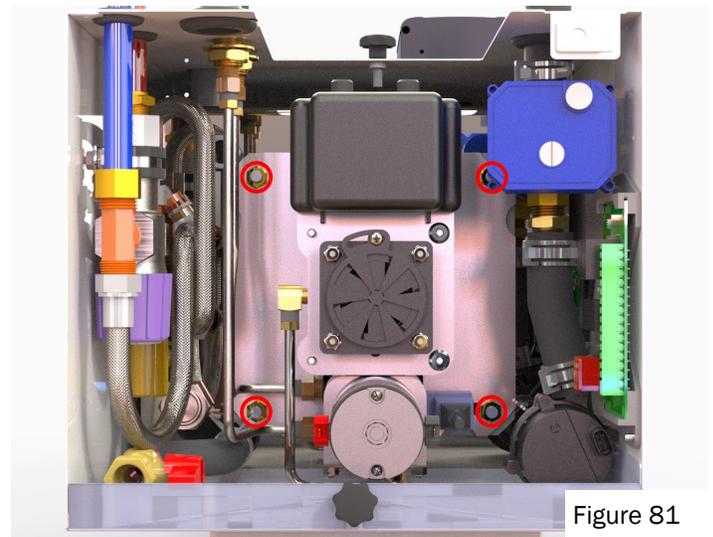
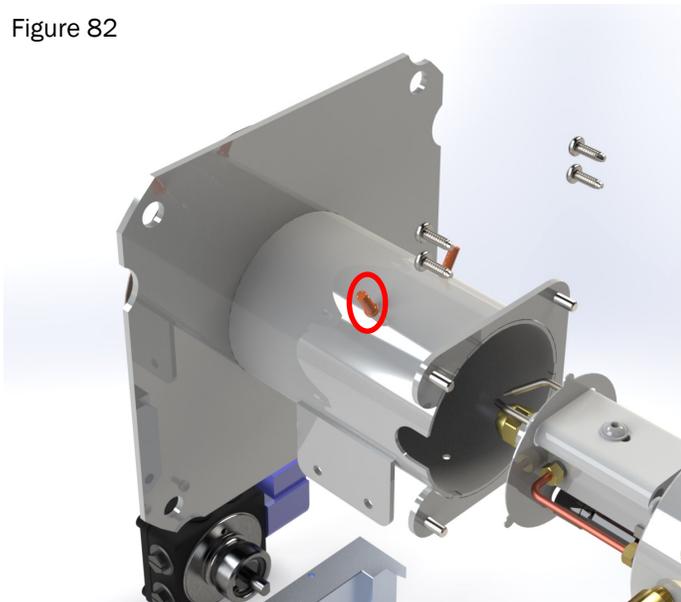


Figure 81

11. Slide the burner out slightly, but do NOT attempt to remove it completely. This will create better access to the ground studs for their removal.
12. There are two studs located atop the air-flow tube of the diesel burner which serves as ground for the unit's DC electrical system. Remove the wires affixed to the left ground stud. Reference figure 82 below.

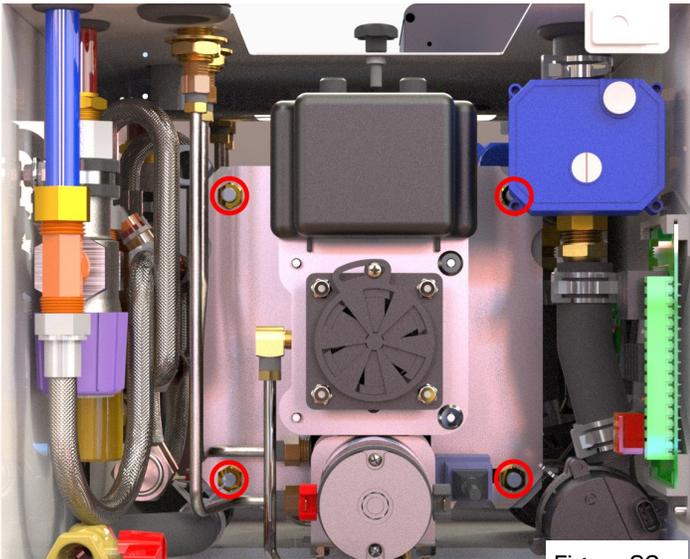
Figure 82



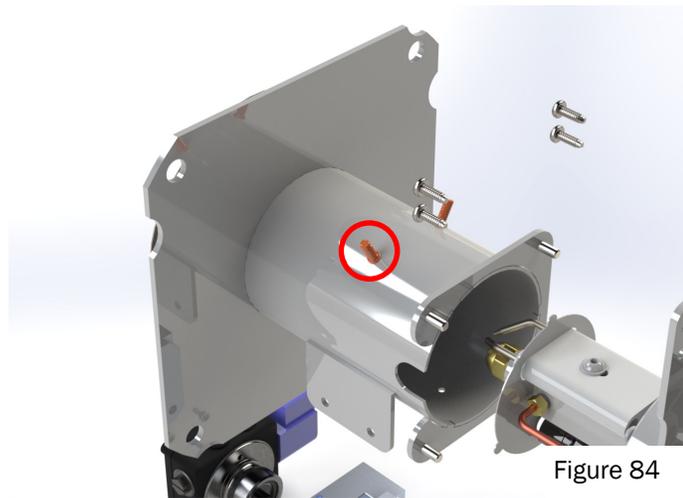
13. Disconnect wires #2 and #8 from the high-limit thermostats
14. Carefully remove the diesel burner assembly from the Aqua-Hot cabinet.

Re-Attaching the Diesel Burner

1. Align the four corners of the diesel burner with the mounting bolts located on the tank face, and slide the burner into place.
2. Using a 1/2" socket, tighten all four corner nuts until the burner is securely affixed to the front of the tank face. A swivel socket adapter may be required to access all securement studs. Reference figure 83 below.

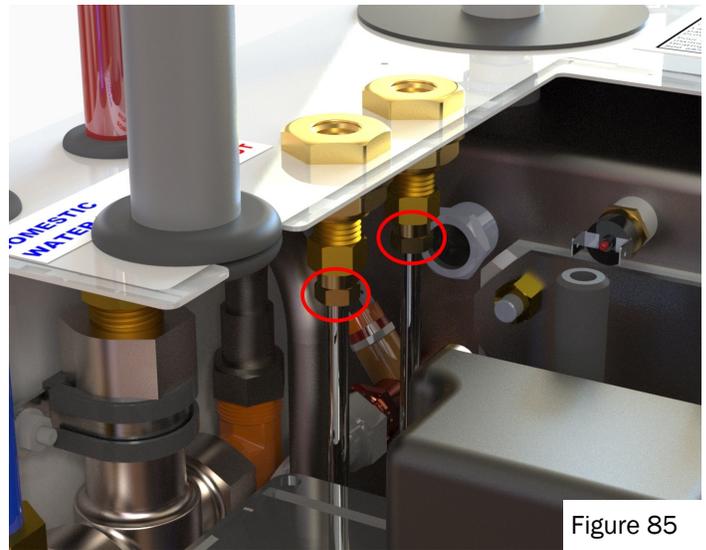


3. Re-affix wires 33, 1A, 27, and 29 to the left ground stud located atop the air-flow tube of the diesel burner. Reference figure 84 below.

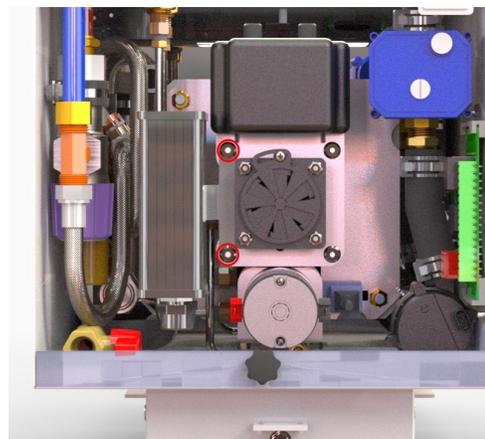


4. Reconnect wires #6 and #8 to the left and right high-limit thermostats.

5. Locate the blower fan buck-boost module and reattach the buck-boost to the hook and loop on the inside of the cabinet.
6. Reconnect the diesel fuel line fittings to the external fuel connection using a 7/16" wrench. Reference figure 85 below. It may be necessary to use two wrenches to avoid damage to the rest of the fitting assembly.



7. Reconnect the diesel burner controller plugs



8. Using a 3/8" socket, re-install the diesel burner controller onto its mounting studs indicated below.
9. Re-install the heater cover and test for normal operation.

Diesel Igniter Module

Purpose:

The diesel igniter module functions to ignite the diesel fuel cone pattern inside the combustion chamber whenever is necessary in order to ensure continuous heat or hot water is always available to the coach.

Replacement Indicator:

The diesel igniter module must be replaced if the module fails to operate, has been physically damaged, or if the igniter electrodes are not 0.10" apart.

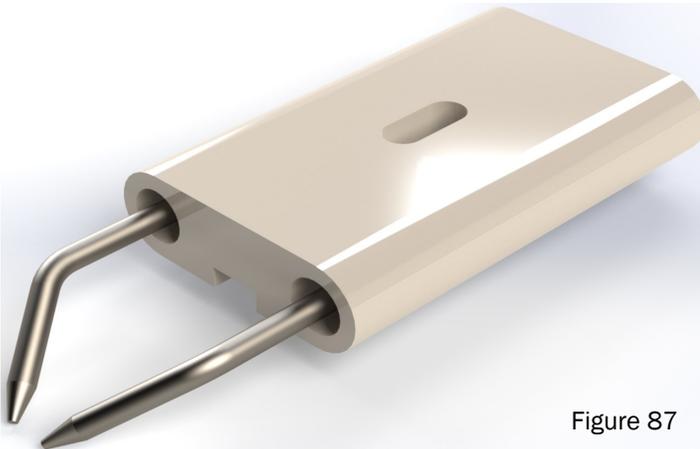


Figure 87

Replacement Procedure:

1. Follow the directions on page 61 to remove the diesel burner head from the Aqua-Hot.
2. Using a 1/8" hex or Allen wrench, remove the bolt securing the igniter assembly to the top of the fuel tower as shown below.

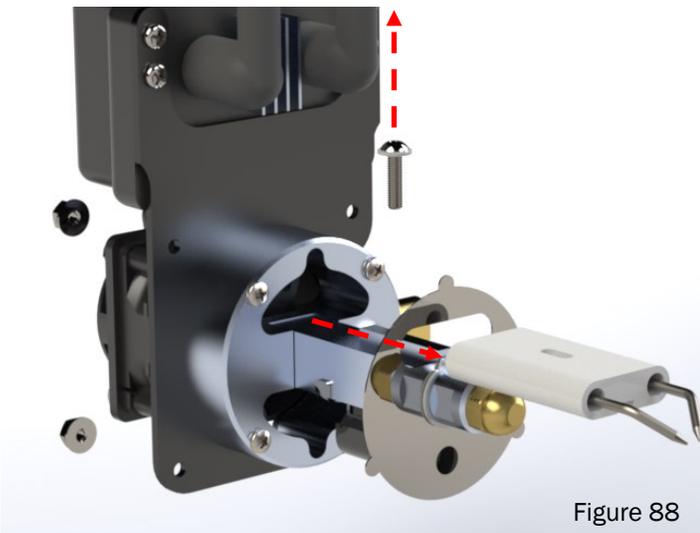


Figure 88

3. Once the bolt has been removed, disconnect the wires from the back of the ignitor.
4. Slide the igniter forward until it can be completely removed from the diesel fuel delivery assembly.
5. Discard the defunct igniter.
6. Locate the replacement igniter module. Carefully slide it into place atop the fuel tower.
7. Reconnect the wires to the back of the ignitor
8. Carefully measure the distance from the front of the igniter module to the static plate as shown below. It should measure 1.34" from the static plate. A caliper may be necessary. Reference figure 89 below.
9. Using a 1/8" Allen wrench, re-attach the previously removed bolt and washer which secures the igniter module.

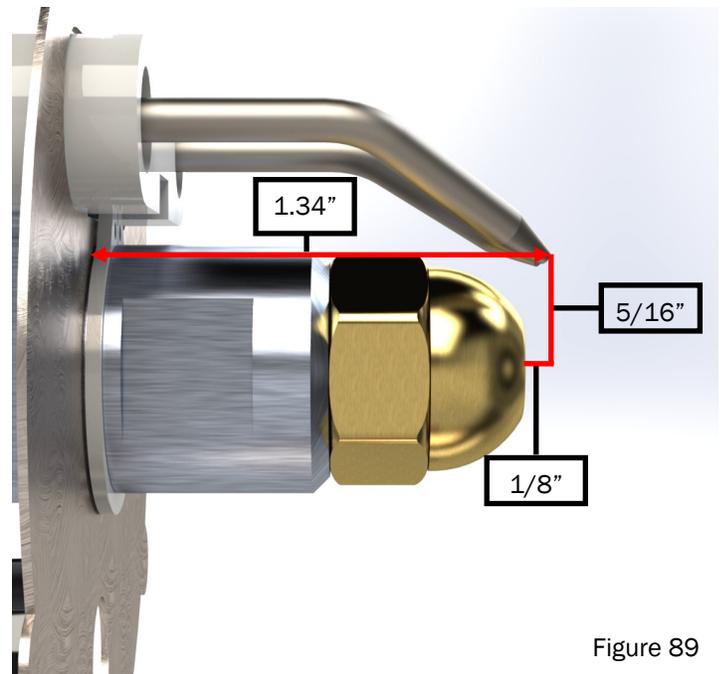


Figure 89

10. Follow the instructions on page 62 to re-insert and re-secure the diesel burner head.

Ignition Coil

Purpose:

The ignition coil functions as a voltage transformer to provide adequate voltage to the igniter electrodes thereby igniting the diesel fuel cone within the Aqua-Hot's combustion chamber.

Troubleshooting Procedure:

1. Move the burner switch, located on the interior switch panel to the "OFF" position
2. Remove the access cover of the Aqua-Hot
3. Follow the directions on page 61 to remove the diesel burner head
4. Secure the fuel tower assembly so that it can stand freely, and the igniter module is clearly visible
5. Apply 12V DC power and ground directly to the igniter coil at the two-pin connector.

DANGER

ELECTRIC HAZARD EXISTS WHEN PERFORMING THIS TROUBLESHOOTING PROCEDURE

TAKE EXTREME CAUTION WHEN PERFORMING THIS TEST

DO NOT TOUCH THE IGNITER MODULE UNDER ANY CIRCUMSTANCES WHILE IT IS CONNECTED TO AN ELECTRICAL SOURCE

6. Remove, and re-apply 12V DC power to the igniter coil 200 times. If the coil fails once during this time, the coil will need to be replaced.

Replacement Procedure:

1. Remove the two rubber-jackets from the studs of the igniter coil
2. Remove the two nuts securing the cable leads to the igniter coil
3. Disconnect the two-pin connector from the front of the igniter (wires #3 and #5.)
4. Using a Philips screwdriver, remove the four screws securing the igniter coil to the igniter coil flange.

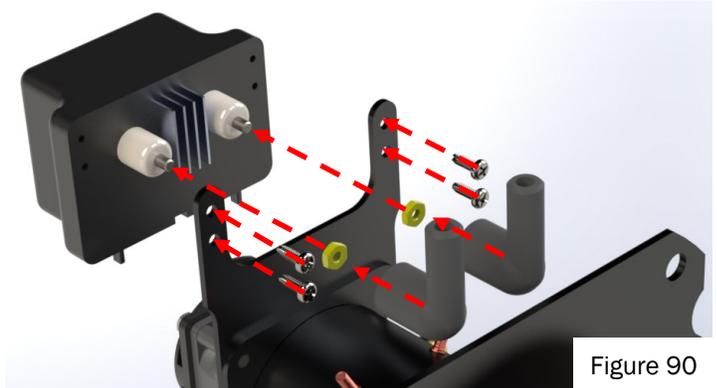


Figure 90

5. Discard the defunct igniter coil
6. Position the new igniter coil on the flange, aligning the four holes on either side of the igniter coil with their matching holes on the flange.
7. Secure the new igniter coil to the flange with the Philips head screws.
8. Reconnect the two-pin connector to the wire harness
9. Re-secure the disconnected nuts, and leads to the igniter coil studs.
10. Test the unit for operation.

Diesel Fuel Delivery System

Function:

The diesel fuel supply system is designed to provide the diesel burner with steady, continuous fuel thereby ensuring a controlled burn. This is accomplished by two main components; the diesel fuel pump, and the diesel fuel motor. The fuel pump is powered by a 12V DC motor. The following tests will determine the functionality of the diesel pump.

Replacement Indicators:

The motor must be replaced if it meets any of the following conditions:

- The motor operates at a low speed
- The motor fails to operate at all
- The motor operates with excessive noise
- The motor operates with excessive heat
- The in-line fuse of the Aqua-Hot continually burns out

The fuel pump must be replaced if it meets any of the following conditions:

- The pump fails to provide adequate fuel pressure
- The fuel pump is seized
- The fuel pump solenoid fails to open

Motor Troubleshooting Procedure:

1. Move the diesel-burner switch, located on the interior switch panel to the "OFF" position.
2. Locate the 20A in-line fuse on the main harness of the 250D.
3. Verify the functionality of this fuse, and if necessary, replace it.
4. Using an external power supply, apply 12V DC power to the fuel pump motor at the positive and negative terminals shown below.
5. If the motor meets any of the above replacement indicators, it will need to be replaced.

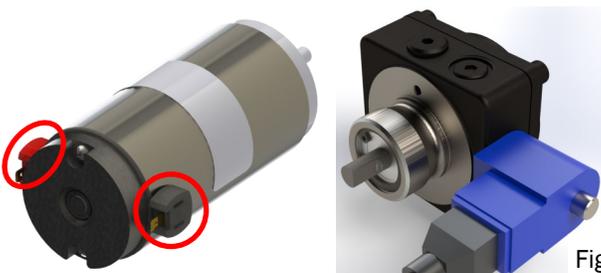


Figure 91

Fuel Pump Troubleshooting Procedure:

1. Follow the instructions on page 63 to detach the diesel burner from the Aqua-Hot 250D
2. Remove the three screws from the burner tube. Set aside the air swirler, and the flange which are loosened by this action.

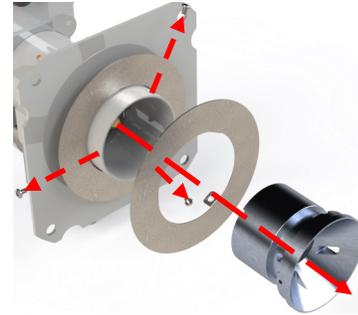


Figure 92

3. Follow the directions on page 61 to remove the diesel-burner head
4. Using a 7/16" wrench, and an additional backing wrench of the same size, remove the fuel nozzle.
5. Secure the fuel pressure gauge in place of the now-removed fuel nozzle.
6. The directions on page 62 to re-install this burner head with the fuel pressure gauge installed.
7. Ensure that the diesel burner is connected to an independent fuel source
8. Apply 12V DC directly to the fuel pump motor.
9. The fuel pressure should be between 140PSI and 150PSI. If it is not, please contact technical support at +1 (800) 685-4298.
10. Follow the instructions on page 61 to remove the diesel burner head
11. Using two 7/16" wrenches, remove the fuel pressure gauge while using the second wrench as a backing wrench.
12. Re-install the fuel nozzle of the Aqua-Hot.
13. Follow the directions on page 65 to re-attach the diesel burner to the Aqua-Hot.
14. Follow the directions on page 62 to re-install the diesel burner head.
15. Test the unit for normal operation.

Diesel Combustion Blower fan

Function:

The purpose of the diesel burner combustion blower fan is to supply the combustion chamber with adequate air, so as to facilitate the safe, reliable, and controlled combustion of diesel fuel within the Aqua-Hot

Replacement Indicator:

The combustion blower fan should be replaced if it fails to operate under normal circumstances as determined by the troubleshooting procedures listed below.

Troubleshooting Procedures:

1. Verify the following before troubleshooting the igniter blower fan:
 - A. The control thermostat is calling for heat
 - B. The interlock switch is depressed
 - C. The overflow bottle is adequately filled
 - D. The high-limit thermostats are not tripped
 - E. The fuses in the relay control board are functional
 - F. The in-line 20A fuse has not been burned out
2. Turn the burner switch, located on the interior switch panel to the "ON" position.
3. Verify that the burner controller is sending power to the combustion blower motor by testing for voltage on the incoming pins of the buck-boost module. If voltage is present at this stage, continue to the next step.
 - If voltage is not present during this time, it may point to a bad burner controller. Please contact the Aqua-Hot technical support department to verify this diagnosis.
4. Verify the functionality of the buck-boost module by checking that the outgoing voltage is between 13.4V and 13.5V. If the voltage is between 13.4V and 13.5V, continue to step 5.
 - If the outgoing voltage of the buck-boost module is not within this range, the buck-boost module will need to be replaced.
5. Move the burner switch, located on the interior switch panel to the "OFF" position, and allow the unit to shut down completely.
6. Disconnect the blower fan from the buck-boost module, and apply 12V DC directly to the fan. It should reach full speed very quickly. If the fan fails to function as expected, it will need to be replaced.

Replacement Procedure

1. Move the diesel burner switch, located on the interior switch panel to the "OFF" position.
2. Disconnect the blower fan, and diesel air shutter from the diesel burner assembly using an 11/32" wrench or socket to remove the four corner nuts as shown below.
3. Set aside the air shutter to be re-attached later.

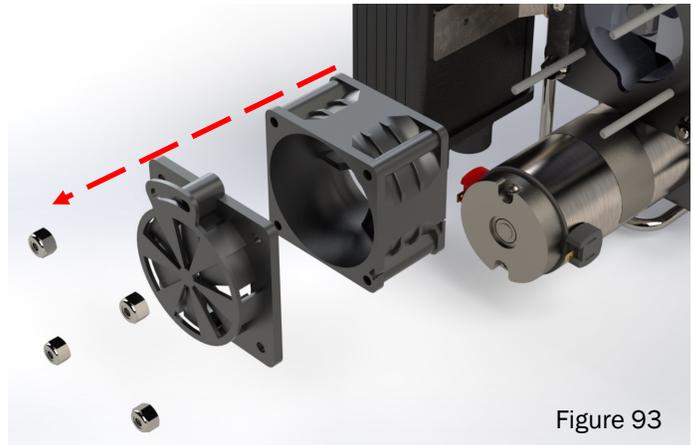


Figure 93

4. Replace the non-functional fan
5. Slide the replacement fan, and air shutter over the mounting studs of the diesel burner assembly with arrows oriented correctly. See below.
6. Re-secure the shutter and blower fan with the previously

NOTE: This arrow ***MUST*** point to the fuel nozzle.
This arrow has been colored white in this view to assist in its location. This arrow will be black on your blower fan.

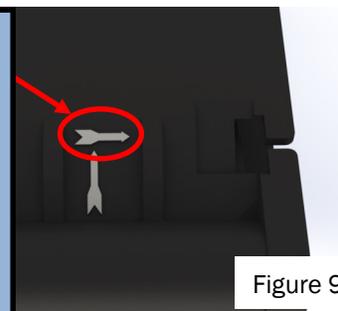


Figure 94



WARNING

Failure to correctly orient the blower fan will result in combustion exhaust venting into the Aqua-Hot cabinet, and could result in serious personal injury. Take extreme care to ensure that the fan is oriented correctly prior to starting the unit.

removed 11-32" nuts to a torque spec of 6in-lbs.

7. Re-connect the combustion blower fan to the buck-boost module.
8. Test the unit for operation.

Adjustment of the Diesel Air Shutter

If the diesel air shutter is knocked out of adjustment, or a replacement air shutter is required, it must first be adjusted before the unit's first startup after maintenance. Follow the steps below in order to correctly set the diesel air shutter.

1. Remove the access cover from the Aqua-Hot to gain access to the air shutter.
2. Using a Philips head screwdriver, loosen, but do not remove the adjustment screw located at the top of the air shutter.

NOTICE

Do NOT overtighten this screw. Overtightening this screw may cause damage to the air shutter which may necessitate its replacement.

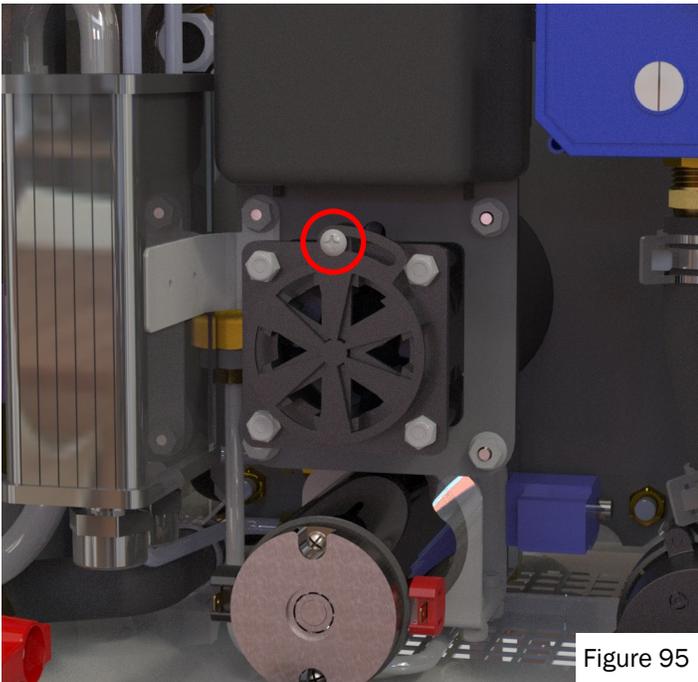


Figure 95

3. The diesel air shutter will now rotate from left to right.
4. The diesel air shutter should be completely open.
5. Once the air shutter has been correctly set, tighten the Philips screw until the shutter no longer rotates.

Buck-Boost Converter — Combustion Blower Fan

Function

The purpose of the buck-boost converter is to maintain a preset output voltage supplied to the combustion blower fan. This provides predictable and controllable operation of the blower fan to ensure the most ideal conditions for sustaining burner operation.

The 250D units contain only one buck-boost module, and it is relevant only to the combustion blower fan.

Replacement Indicator

Replace the buck-boost converter if it fails to provide 13.5V DC power, or if it is physically damaged.

Troubleshooting

1. Move the burner switch, located on the interior switch panel to the “ON” position.
2. Verify the following before troubleshooting the buck-boost module.
 - A. The control thermostat is calling for heat
 - B. The interlock switch is depressed
 - C. The overflow bottle is adequately filled
 - D. There is 12V DC supplied to the burner controller on pin B4
 - E. The fuses on the relay control board are functional
 - F. 12V DC power is present at the B1 and B5 pins of the burner controller
3. Verify that the burner controller is sending 12V DC power to the buck-boost module at pins #6 and #7 of the burner controller “C” plug.
 - If the burner controller is not supplying power while all of the above criteria are met, the burner controller needs to be replaced.
4. If the burner controller is sending power on the pins #6 and #7 of the burner controller “C” plug. Repair or replace the wiring harness if necessary.
5. Verify that the buck-boost converter is sending power to the combustion blower motor. This voltage should be approximately 13.5V DC when the supply voltage is between 11V DC and 15V DC.
 - If the buck-boost converter does not output approximately 13.5V DC if the supply voltage is between 11V DC and 15V DC, the buck-boost will

need to be replaced.

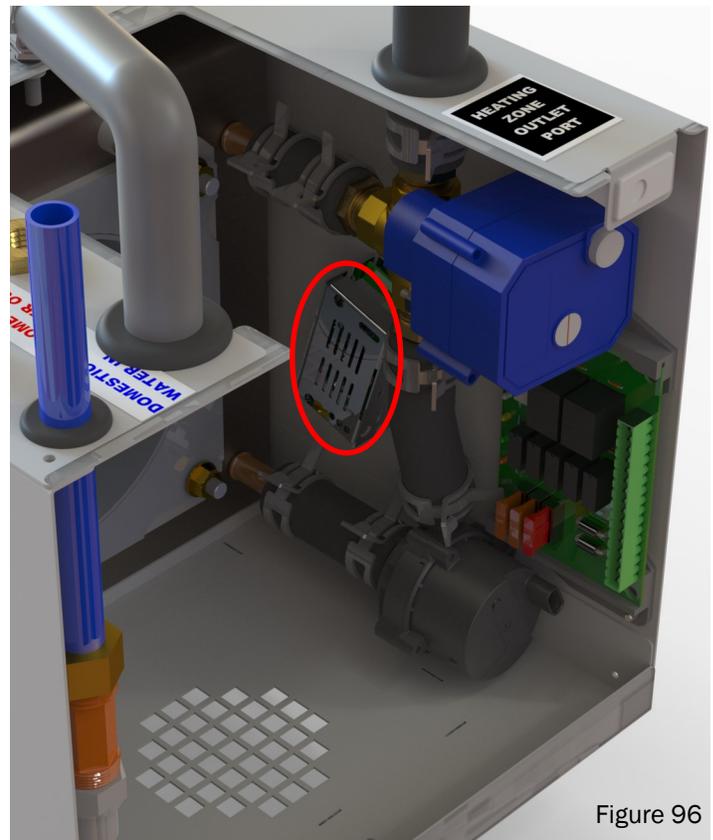


Figure 96

Diesel Combustion Fan Buck-boost



Figure 97

Replacing the Buck-Boost Modules

Scope:

If it has been determined that the buck-boost modules must be replaced, follow the instructions hereinafter to correctly remove and replace a buck-boost module.

Procedure:

1. Before removing the defunct buck-boost module from the Aqua-Hot, the replacement buck-boost must first be set to the correct output voltage.
2. Locate the new buck-boost, and a multi-meter. Set the meter to measure for voltage.
3. Connect the meter to the buck-boost output pins labelled "OUT" on the module.
4. Connect the input pins of the buck-boost to a 12V DC power source at the pins labelled "IN." Activate this power source.
5. Locate the calibration dial of the module, and adjust it to the right until the voltage on the meter reads 12.5V DC.
6. Once the replacement buck-boost has been set, deactivate the power source and disconnect the meter and the power source from the buck-boost.
7. Move all switches on the interior switch panel to the "OFF" position.
8. Disconnect the Aqua-Hot from any power sources.
9. Locate the buck-boost module which is to be replaced.
10. Carefully remove the buck-boost module from its position on the side of the Aqua-Hot cabinet.
11. Using a flat head screw driver, loosen the four terminal screws found at both ends of the buck-boost module. These screws are shown below.
12. Discard the non-functional buck-boost module.
13. Insert the previously removed leads into their respective positions on the buck-boost module. Each end of the buck-boost is labelled "IN" and "OUT."

- Connect the Aqua-Hot wiring harness wire #6 to "IN (+)" and wire #7 to "IN (-)" on the new buck-boost module.

- Connect the blower fan wire #12 to "OUT (+)" and wire #13 to "OUT (-)" of the new buck-boost module.

14. Affix the replacement buck-boost module to the inside of the Aqua-Hot cabinet using the pre-attached hook and loop tape.
15. Test the unit for normal operation.

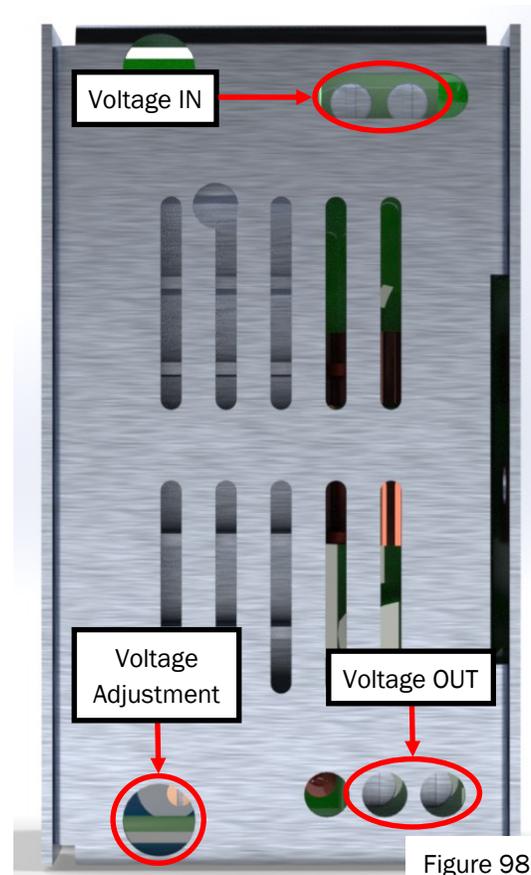


Figure 98

Photo Eye

Purpose:

The diesel photo eye is designed to detect flame within the combustion chamber. Whenever flame is detected, the igniter module is disengaged.



Figure 99

Replacement Indicator:

The photo eye should be replaced if it is physically damaged, or fails to function properly after troubleshooting procedures have been completed.

Troubleshooting Procedure:

In order to determine that the photo-eye is functioning correctly or otherwise, it is necessary to remove the photo-eye from the main diesel assembly, and test for resistance of the photo-eye at various exposure levels.

1. Follow the instructions on page 61 to remove the diesel burner head subassembly. This will grant access to the photo-eye.
2. Locate wires #4 and #9 to test for resistance. These will have been disconnected during the disassembly of the diesel burner on page 61.
3. Using a multi-meter, test for resistance across the photo-eye with the photo-eye uncovered. Cover the diesel photo-eye with something to simulate a complete darkness condition. Photo-eye resistance specifications are listed below
 - Greater than 1,000Ω in darkness
 - Less than 900Ω in light
4. If the photo-eye is not meeting the above listed specifications under the correct conditions, it will need to be replaced.

Replacing the Diesel Photo-Eye

If after performing troubleshooting or consulting with technical support, it is determined that the photo-eye is not functional, follow the instructions below to replace the photo-eye.

1. If not done so already, follow the instructions on page 61 to remove the burner head sub-assembly.
2. Using a 1/4" wrench or socket, remove the four corner bolts securing the blower fan to the igniter flange. It may be necessary to use a Philips screwdriver to back the bolt.
3. Using a 5/32" Allen wrench, remove the bolt which secures the photo-eye in place as shown below.

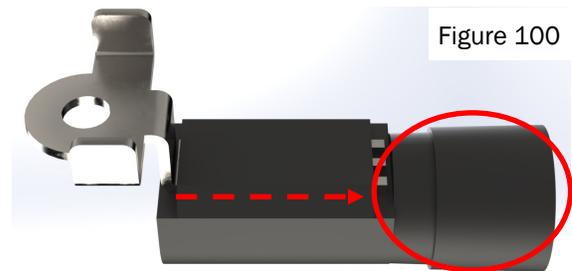


Figure 100

4. Remove the defective photo-cell from the rest of the photo-eye assembly as shown below.
5. Remove the mounting flange from the defective photo-eye by using a small screw driver to depress the middle tab.
6. Slide the defective photo-eye off of the mounting bracket.
7. Discard the defunct photo-eye.

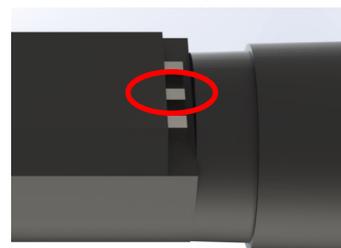


Figure 101

8. Position and secure the new photo-eye on the mounting bracket.
9. Using a small screw driver, raise the center tab of the mounting bracket as it was before the defective module was removed.
10. Thread the new wires of the photo-eye back through its position near the blower fan.
11. Using a 5/32" Allen wrench, secure the photo-eye to the fuel tower on the burner head sub-assembly as shown on the next page

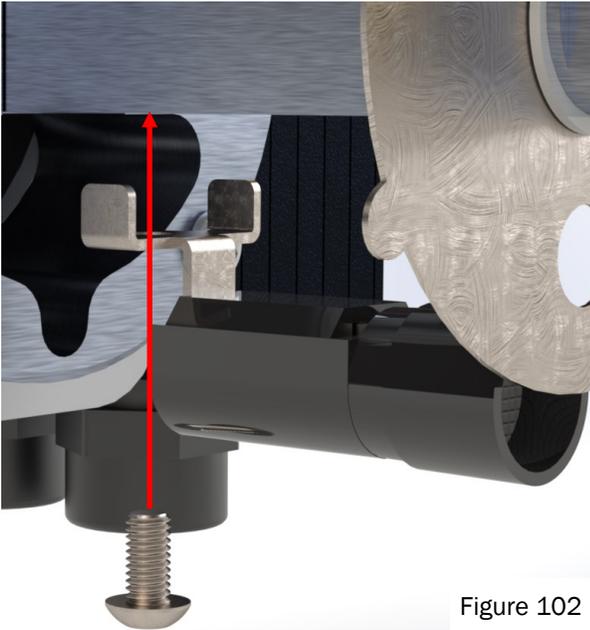


Figure 102

12. Feed the wires of the new photo eye through the fuel tower base as they were initially removed.
13. Using a 1/4" wrench or socket, re-secure the blower fan and the air shutter in place.
14. Follow the instructions on page 62 to re-install the diesel burner head into the Aqua-Hot.
15. Test the unit for normal operation.

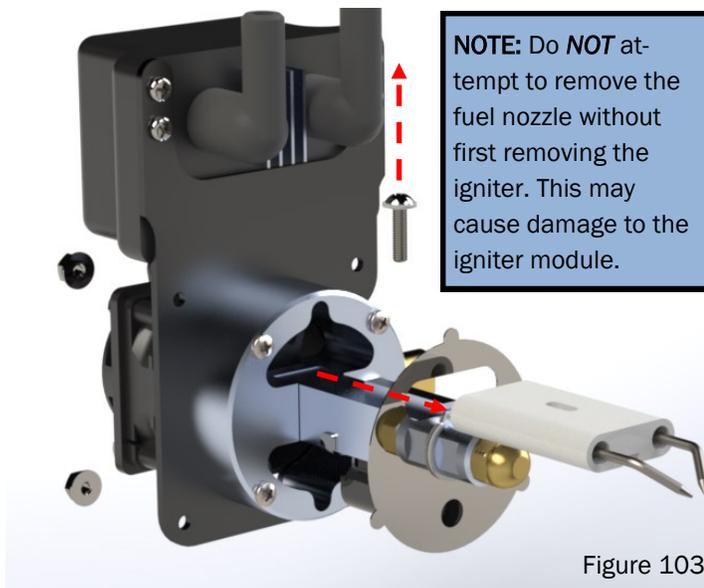
Performing the Diesel Annual Service

Purpose:

Every Aqua-Hot 250D is equipped with a diesel burner which serves as the primary heat source. This burner will need to be serviced annually in order to ensure optimal performance. Detailed instructions for this annual service are included below.

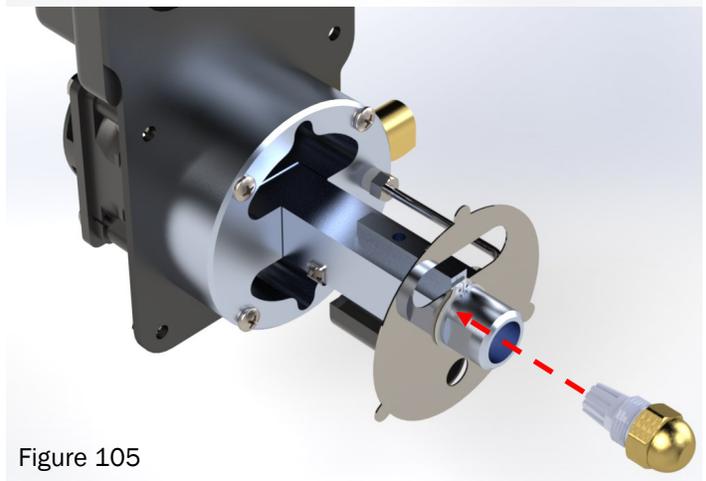
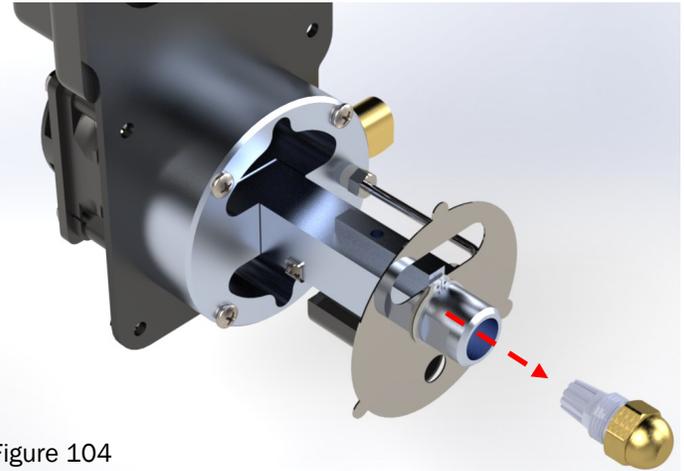
Procedure:

1. Follow the directions on page 61 to remove the diesel burner head from the Aqua-Hot.
2. Using a 1/8" hex or Allen wrench, remove the bolt securing the igniter assembly to the top of the fuel tower as shown below.
3. Once the bolt has been removed, carefully slide the igniter forward until it can be completely removed from the diesel fuel delivery assembly as shown below.
4. Using a 5/8" socket, and a 5/8" backing wrench, carefully remove the old diesel fuel nozzle from the fuel tower.



7. Replace the diesel fuel nozzle, and tighten to 130 in/lbs of torque. Do not forget the backing wrench, and take care not to exceed this rating, as doing so may damage the fuel nozzle.

8. If there is excessive carbon build up, or the unit was needlessly smoking on start-up before the annual maintenance, it may be necessary to scrub excess carbon buildup from the air swirler and/or the combustion chamber.



Re-Assembly After Completing the Annual Service

1. Slide the igniter back into its slot located atop the diesel fuel tower until the distance between the face of the fuel nozzle is $1/8$ " , and the igniter tips are $5/16$ " from the center of the fuel nozzle.

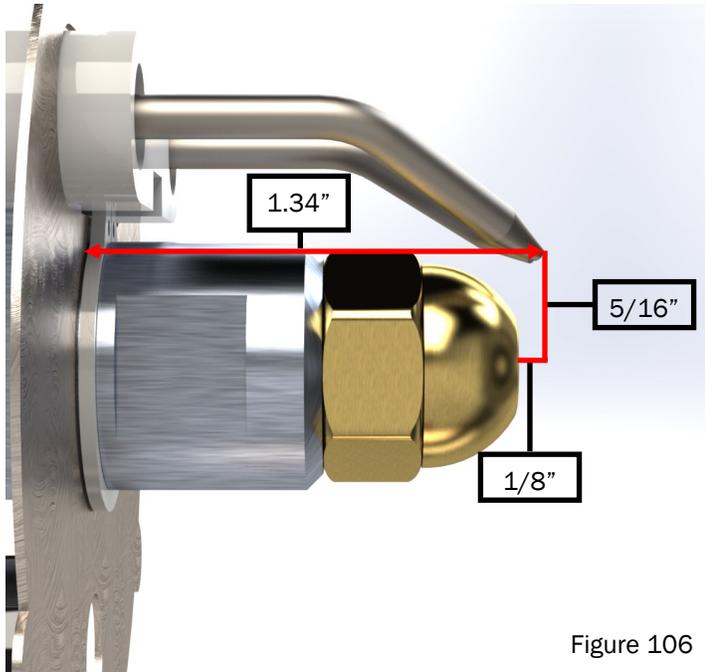


Figure 106

2. Using a $1/8$ " hex wrench, or Allen wrench, secure the previously removed bolt in place without damaging the ceramic casing of the igniter. Reference the figure below to properly position the igniter in place.

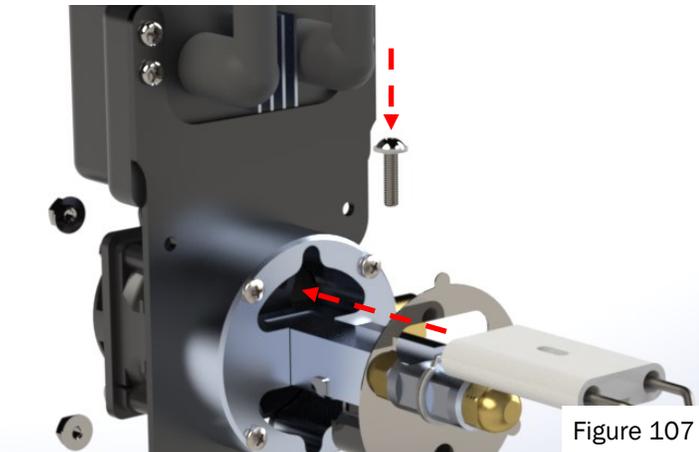


Figure 107

3. Follow the directions on page 62 to reinstall the diesel burner head.
4. Test for unit operation.

Filling the Aqua-Hot

Purpose:

Outlined below is the procedure for filling the Aqua-Hot with a 50/50 solution of propylene glycol antifreeze and distilled water. This procedure is written in such a way that purging the heating loop after filling should not be necessary. If air bubbles happen to enter the heating loop, the purge procedure can be found immediately after this filling guide.

Procedure:

1. Attach an external fill pump and hose to the Aqua-Hot at the ball valve located just above the 3-way valve. Ensure that the hose is of adequate length to allow the easy movement of the external fill pump.
 - The threads of the ball valve are 1/2" (F) NPT
2. Place the other end of the hose in a receptacle containing the anti-freeze and water solution
3. Locate the 3-way valve in the Aqua-Hot cabinet. Ensure that the red line in the sight glass is oriented horizontally as shown below.



Figure 108

4. Activate the external fill pump, and allow the pump to run until the fluid overflow bottle is filled to the "HOT" mark.
5. Once this has been achieved, de-activate the external fill pump, and move the ball valve to the closed position.
6. Ensure that the interior heating loop functions correctly by activating the Aqua-Hot, and setting the internal thermostat high enough to call for heat.
7. Repeat the fill process as necessary until no air bubbles exit at the expansion bottle.
8. Disconnect the external fill pump when this process is complete.

NOTE: Ensure that the external fill pump does not run "dry." If the pump is allowed to run dry it may fill the heating loop with air, and the interior heating loop will need to be purged.

Purging the Interior Heating Loop

Purpose:

This guide is intended to provide detailed instructions for purging the interior heating loop. It is recommended that the interior heating loop be purged after any of the following components have been replaced,

- Circulation pump
- 3-way valve
- Fluid expansion bottle
- Control thermostat
- Electric element

If the interior heating loop is not purged, it may contain trapped air, preventing the circulation of antifreeze and water heating solution through the interior heating loop. This then prevents the heat exchangers from operating correctly.



Figure 109

Procedure:

1. Remove the access cover of the Aqua-Hot
2. Locate the 3-way valve of the Aqua-Hot, and disconnect its wires from their Faston connectors (propane) or from the relay control board connection (diesel.)
3. Apply 12V DC power to the ground wire (green or black) of the valve until the line in the sight glass is oriented vertically as shown above.
4. Locate the stir pump on the bottom right of the cabinet
5. Disconnect the wire harness from the stir pump
6. Apply 12V DC directly to the pump
7. Allow this pump to run for a minimum of 20 minutes. Air bubbles should bubble through the unit to the fluid expansion bottle.
8. Reconnect the pump harness to the stir pump
9. Test the interior heating loop, ensuring that each heat exchanger is providing heat
10. Repeat steps 5-7 as many times as necessary until the interior heating loop has been purged of all air. Reconnect the 3-way valve wires when this has been completed.

Winterizing the Aqua-Hot

Purpose:

During winter months it is highly recommended that the Aqua-Hot be winterized due to the possibility of freezing temperatures causing damage to the Aqua-Hot. Damage resulting from failure to winterize the Aqua-Hot is not covered under warranty.

Additionally, allowing water to stand for extended periods of time within the Aqua-Hot's domestic water coil can prematurely corrode the domestic water coil, potentially shortening the operational lifetime of the unit.

Winterizing the Aqua-Hot will provide freeze and anti-corrosion protection while it is not in use, providing piece of mind that the Aqua-Hot will not be damaged by temperatures as low as -22°F .

Reference pages 85 and 86 for assistance in selecting an appropriate winterization antifreeze.

Winterization Procedure:

1. Disconnect, or shut off any external sources of fresh water.
2. Open all faucets, shower heads and similar. Open both the "HOT" and "COLD" valves on the faucet, if applicable.
 - If there is only one valve, open it to the "halfway" point between hot and cold.
3. Ensure that the coach is connected to a waste collection point, such as a grey water tank.
4. Attach an external fluid fill pump to your fresh water connection.
5. Ensure that the fill pump intake hose is situated in a large enough supply of winterization antifreeze that the pump does not run dry if left unattended.
6. Activate the external fill pump. Allow the pump to run until ONLY antifreeze is exiting the faucets within the coach.
7. Once this has been completed, deactivate and disconnect the external fluid pump.
8. Close all but one faucet in the coach. This will allow the winterization antifreeze to expand and contract as necessary with temperature changes, thereby greatly reducing the likelihood of pressure related damage to interior pipes.

De-Winterization Procedure:

1. To de-winterize the unit, connect a fresh water source to the coach.
2. Ensure that all of the interior faucets have been re-opened. Again, take care to ensure that both the "HOT" and "COLD" valves have been opened.
3. Turn on the external water source, and allow it to run until winterization antifreeze no longer flows from any faucets within the coach.
4. Once antifreeze no longer flows from the faucet, the unit and coach have been de-winterized.

General Troubleshooting

Purpose:

This general troubleshooting section serves to solve common operational problems, organized by increasing complexity in an effort to reduce down-time and unit repair costs by fixing the simplest problems first. These tests are interchangeable between 250P and 250D units unless explicitly stated otherwise.

Troubleshooting Procedure:

If your 250D has been unused for an extended period of time, performing the annual service may resolve many problems typically experienced by the end user. Instructions for this service can be found on page 75, or may be performed by an Aqua-Hot Factory Certified Service Center. Your local service center may be found online at www.aquahot.com.

The Aqua-Hot 250P, in comparison, has an extremely simple annual service procedure. Simply remove the flame sensor, and clean it with a light abrasive such as a Scotch-Brite pad.

- Ensure that the coach is supplied with power
- Ensure that the Aqua-Hot has access to a sufficient amount of fuel to start and sustain combustion of the burner, at least 1/4 tank.
- Check all coach-side fuses to ensure that they are functioning, and able to supply power
- Ensure that all water sources connected to the coach are shut off
- Ensure that all interior water sources are shut off.
- Locate the relay control board within the Aqua-Hot unit. Reference page 8 to identify this component.
- Verify that all of the fuses in the relay control board are in good working condition. Replace any non-functional fuses if necessary.
- Ensure that the fluid expansion bottle is filled to at least the "COLD" mark.
- Visually inspect the interior cabinet of the Aqua-Hot unit, searching for any damaged, or disconnected wires. Reconnect, or repair any damaged wires found.
- **250D ONLY:** The 250D contains a 20A fuse as part of the wiring harness. Check that this fuse has not been burned out.
- Locate the left high limit thermostat. Follow the troubleshooting steps on page 18 to troubleshoot this component, and if necessary, repair it.
- Locate the right high limit thermostat, and follow the in-

structions on page 18 to troubleshoot, and if necessary, repair it

- Visually inspect the exhaust system of the Aqua-Hot to ensure that it has not been damaged or removed in any way.
- Test for unit operation.
 - If the burner fails to operate, proceed to page 83 to begin diesel burner troubleshooting, and page 84 for the propane burner troubleshooting. Take care to select the correct troubleshooting procedure based on the burner in your unit (propane or diesel.)
 - If the burner begins to operate at this stage, choose a troubleshooting guide based upon your chief complaint from below.

Lack of, or Uneven Delivery of Hot Water

A lack of hot water, or uneven delivery of hot water (hot water that contains cold spots,) is typically attributable to a failure of one or more of five components; the shower head, the stir pump, 3-way valve, low-temperature cutoff thermostat, the tempering valve. Relevant troubleshooting procedures and information is listed below.

- Shower Head
 - It is possible that the shower head in the coach is drawing hot water too quickly from the Aqua-Hot, thereby overtaxing the unit resulting in hot water delivery problems. The shower head should be limited at 1.5gpm max.
- Stir pump
 - Reference page 24 to troubleshoot the stir pump
- 3-way valve
 - Reference page 21 to troubleshoot the 3-way valve
- Low-temperature cutoff thermostat
 - Reference page 19 to troubleshoot this component
- Tempering Valve
 - Reference page 23 to troubleshoot this component

Once these components have been diagnosed, restart the Aqua-Hot and allow it to heat itself to operating temperature. Once that's been done, draw hot water to determine if the problem has been addressed.

If after troubleshooting, these components are found to be in good working order, contact our technical support department at +1 (800) 685-4298 for assistance with troubleshooting. Alternatively, you can always take the coach to one of our Factory Authorized Service Centers for diagnostic and repair. You can find your local service center online at www.aquahot.com.

250D Unit Smoke

Purpose:

Under certain circumstances, it is possible that the Aqua-Hot 250D may smoke upon first start up. There exist many possible causes for smoke, and as such many possible issues associated therein. This guide serves to navigate those potential issues in order to repair the unit.

There are three different types of smoke that this unit could potentially emit, each indicating a different set of potential problems. If the unit has sat for an extended period of time without having run, please perform the annual service. This may resolve smoking issues with the Aqua-Hot.

- Clear exhaust or no smoke
 - This unit is operating correctly, and no troubleshooting is necessary
- Blue or White smoke
 - Fuel solenoid
 - Nozzle tower
 - Control thermostat
 - Short cycling
- Black Smoke
 - Low voltage
 - Exhaust system damage
 - Air intake
 - Burner is improperly seated
 - Combustion chamber damage
 - Fuel delivery system

As such, it is necessary to select the correct troubleshooting procedure to solve this issue as quickly as possible.

Blue/White Smoke Troubleshooting Procedures:

Smoke During Start up or Shut down:

1. Ensure that the unit is not short cycling (rapid power-up and shut-down) during its start up procedure. This can be caused by
 - A faulty switch
 - Damaged wiring
 - A malfunctioning control thermostat
2. Diagnose the control thermostat by testing for continuity. Reference page 13 for detailed instructions. Test the unit after this is complete.
3. Detach the diesel burner from the rest of the Aqua-Hot.

Follow the directions on page 60 to detach the diesel burner, and gain access to components for testing.

4. Remove the igniter coil flange to gain access to the fuel tower, nozzle, igniter module and photo-eye.
5. Visually inspect this subassembly, looking for any damage or leak locations.
 - If it is possible to determine a leak location from this step, contact customer service at +1 (800) 685-4298 for assistance in addressing the leak.

Smoke During the Burn Cycle

1. It is possible that the electrodes of the igniter module have been knocked out of adjustment.
2. Follow the directions on page 58 to gain access to the igniter module.
3. Using a caliper, measure the distance between the electrodes of the igniter module. This distance should be 0.10" at the closest point.

NOTE: Do not attempt to use a Webasto electrode adjustment tool. This tool is set for a distance of 0.20", and will not correctly adjust the Aqua-Hot 250D.

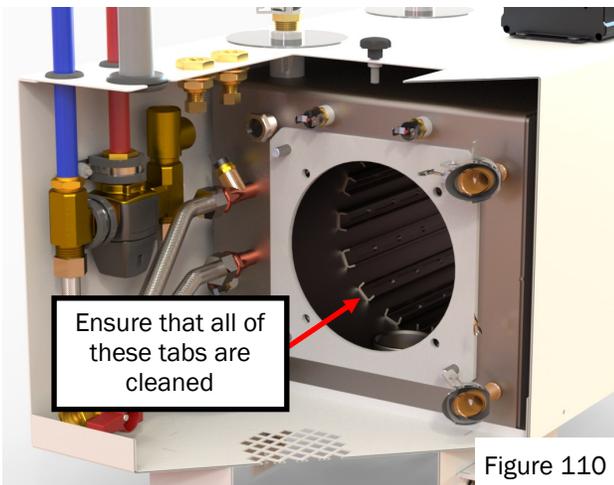
-If the igniter electrodes are out of adjustment, adjust them inward or outward until the distance measured is 0.10". Take great care to not damage the igniter during this process.

4. The igniter module may be incorrectly positioned on the diesel burner head assembly. Reference figure 89 on page 66 for precise positioning information.
5. Air may be present in the fuel system, resulting in the uneven delivery of fuel to the nozzle, and therefore excessive smoke. Check the fuel delivery system for any damage or loose clamps which may introduce air into the fuel line.
6. Ensure that the fuel delivery sub-assembly is functioning properly. Reference page 66 for detailed troubleshooting instructions.
7. Check the ignition coil for proper operation

Black Smoke Troubleshooting Procedure:

1. Ensure that the Aqua-Hot is receiving 12V DC power from the coach.
2. Inspect the exhaust system for any damage or restrictions. Remedy these issues if any are found.

3. Remove the access cover of the unit.
4. Ensure that the air shutter is completely opened.
6. Attempt to shake the burner sub-assembly. If the burner shakes, it has been improperly seated. Follow the directions starting on page 60 to remove and re-install the diesel burner.
7. If at this stage the burner is still exhausting black smoke, it is recommended that the annual service be performed on this unit. Follow the directions starting on page 74 to perform this service.
8. Diagnose the fuel delivery system. Reference page 66.
9. Visually inspect the inside of the combustion chamber for any warping or apparent heat damage.
10. Remove the diesel burner from the Aqua-Hot with the directions found on page 61.



11. Remove the combustion chamber to gain access to the heat exchanger as shown above.
12. Using a wire brush, scrub the heat exchanger inside the Aqua-Hot as indicated below.
13. If at this stage, black exhaust smoke cannot be remedied, contact Aqua-Hot technical support at +1 (800) 685-4298, or locate your nearest authorized service center.

Lack of Interior Heat

A lack of interior heat with a functioning burner is attributable to potentially many issues within the Aqua-Hot. Diagnosis of this issue will proceed in three stages. Stage 1 will outline common reasons for overall unit non-function which exist outside of the Aqua-Hot. Stage 2 will diagnose common issues within the Aqua-Hot, including lack of burner operation. Stage 3 will address specific reasons for lack of interior heat. It is very important that troubleshooting proceed in the manner outlined below in order to The issues most commonly associated with a lack of interior heat are:

- A non-functional 3-way valve
- Seized circulation pump
- Air is trapped within the coach heating loop
- A malfunctioning low-temperature cutoff thermostat

The diagnosis of this issue will occur in stages, beginning with the simplest repairs, and gradually increasing complexity. It is imperative that all of these steps be performed in order. Failure to follow these directions as outlined below may needlessly increase repair cost, and unit down time.

Stage 1 Troubleshooting:

- The coach is supplied with power
- The Aqua-Hot has access to a sufficient amount of fuel
- Check all coach-side fuses and ensure that they are all able to supply power
- Ensure that all water sources connected to the coach are shut off
- Ensure that all interior water sources are shut off.
- Locate the relay control board within the Aqua-Hot unit. Reference page 30 to identify this component.
- Verify that all of the fuses in the relay control board are in good working condition
- Ensure that the overflow bottle is filled to at least the "COLD" mark.

Stage 2 Troubleshooting:

- Visually inspect the interior cabinet of the Aqua-Hot unit, searching for any damaged, or disconnected wires. Reconnect, or repair any damaged wires found.
- The 250D contains a 20A fuse as part of the wiring harness. Check that this fuse has not been burned out.

- Locate the left high limit thermostat. Follow the troubleshooting steps on page 17 to diagnose this component, and if necessary, repair it.
- Locate the right high limit thermostat, and follow the instructions on page 17 to diagnose, and if necessary, repair it
- Test for unit operation.
 - If the burner fails to operate, proceed to page 81 to begin diesel burner troubleshooting
 - Proceed to page 82 to diagnose the propane burner

Stage 3 Troubleshooting:

1. Begin troubleshooting the 3-way valve. Turn to page 20 for detailed instructions.
2. Reference page 18 to diagnose the low-temperature cut-off thermostat (LTCO.)
3. Locate the circulation pump within the Aqua-Hot cabinet. It should begin operating immediately when the heater starts up. If the pump does not begin to operate, turn to page 23 for troubleshooting.
4. Locate all of the heat exchangers within your coach, and determine if any of them are outputting heat.
 - If at least one heat exchanger is outputting heat, an air bubble may be preventing the flow of the anti-freeze and water heating solution.
 - It may possible to resolve this issue by allowing the circulation pump to run continuously, checking the heat exchangers periodically to determine if they have begun to function. See page 75 for in-depth heating loop purge procedures.

At this point, if steady interior heat cannot be achieved, you may contact technical support at +1 (800) 685-4298, or take the coach to an Aqua-Hot Factory Authorized Service Center. Your nearest service center can be found online at www.aquahot.com.

Diesel Burner Troubleshooting

This section will assist in troubleshooting the Aqua-Hot burner, whether it be a diesel burner or propane burner. It is organized in checklist form organized in ascending complexity, with page numbers included to point to troubleshooting procedures for individual components.

The diesel burner and propane burner are very different assemblies. Attempting to apply propane burner diagnostics to a diesel burner may result in erroneous diagnosis of burner problems, and may complicate further repairs.

As always, if you require additional assistance in diagnosing problems with your Aqua-Hot, please contact our technical support department at +1 (800) 685-4298.

Troubleshooting Procedure

1. If this unit has been inactive for an extended period of time, perform the diesel service prior to beginning these troubleshooting steps. The annual service will typically resolve many common issues which may impede unit operation.
2. Locate the fluid overflow bottle, and ensure that it is filled to at least the "COLD" mark.

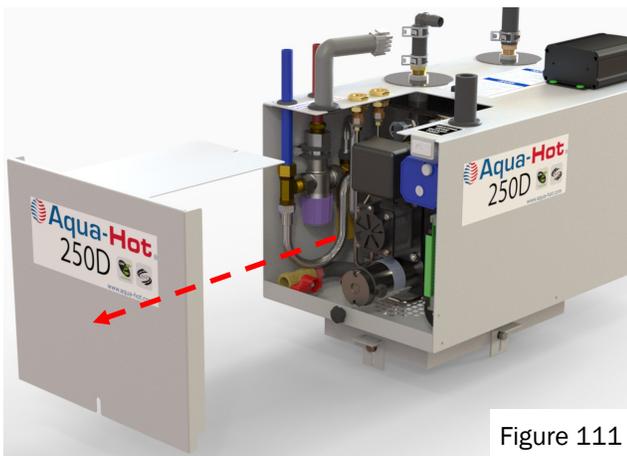


Figure 111

3. Remove the cabinet access panel from the front of the Aqua-Hot
4. Verify that the 20A fuse included as part of the diesel harness is functional. Replace if necessary.
5. Move the burner switch, located on the internal switch panel to the "ON" position.
6. Depress the interlock switch.
7. Verify that 12V DC power is present at pin B5 of the diesel burner controller.
 - If 12V DC is not present, check the control thermostat for functionality by following the directions on page 14.
8. Locate the left and right high limit thermostats.
9. Depress the red, center button of both of these thermostats to reset them.
10. Test both thermostats for continuity.
 - Both of these thermostats should have continuity after they have been reset. If one does not have continuity, follow the instructions on page 17 to replace one or both of them.
11. Verify the functionality of the diesel fuel delivery system by following the instructions on page 66.
12. Check the igniter module for functionality by following the directions on page 64.
13. Troubleshoot the igniter coil referencing the instructions on page 65.
14. Ensure that the photo-eye is functioning as intended by completing the troubleshooting steps on page 71.
15. Ensure that the air shutter is set to the factory mark.
16. If, at this stage the diesel burner is not-operational, it is recommended that you contact technical support at +1 (800) 685-4298 to diagnose and repair this burner.

Propane Burner Troubleshooting

1. Locate the fluid overflow bottle, and ensure that it is filled to at least the “COLD” mark
2. Remove the cabinet access panel from the front of the Aqua-Hot.
3. Move the burner switch, located on the interior switch panel to the “ON” position.
4. Depress the interlock switch.
5. If the blower fan begins to operate, continue to step 7.
6. If the blower fan does NOT operate, turn to page 42 to troubleshoot, and if necessary, repair the blower fan. Return to this step when the blower fan troubleshooting has been completed.
7. Troubleshoot the exhaust back pressure switch by following the direction on page 44.
8. Troubleshoot the fan validation switch on page 45.
9. Troubleshoot the dual-stage gas valve, following instructions on page 41.
10. Check that the air shutter is properly adjusted by utilizing the information on page 43.
11. Troubleshoot the hot surface igniter, referencing page 38 for detailed instructions.
12. Troubleshoot the hot surface igniter buck-boost with the instructions found on page 47.
13. Troubleshoot the Fenwal Control Card referencing page 31.
14. Follow the instructions on page 33 to remove the propane burner from the Aqua-Hot. This will grant access to components for troubleshooting.
15. Check that the refractory insulation is not damaged by following the instructions on page 40.
16. Check the mounting gaskets to ensure that they are not damaged or missing. Reference page 37 for detailed instructions herein.

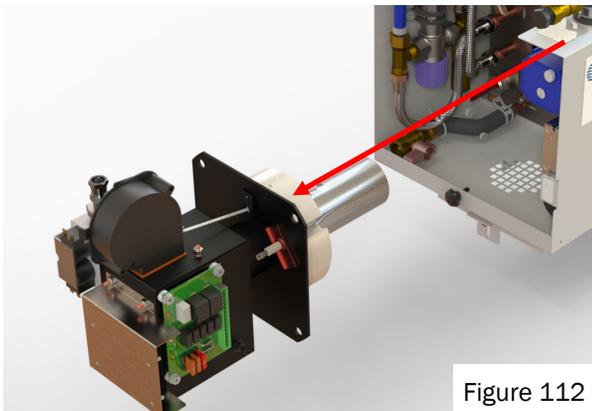


Figure 112

Antifreeze and Water Heating Solution

Purpose:

The anti-freeze and water heating solution serves as a transport medium for the Aqua-Hot, transferring heat from the internal heating sources to the heat exchangers at use within the coach. In conjunction with the 3-way valve, and the circulation pump, this solution ensures that your Aqua-Hot is able to provide continuous heat or hot water when demanded by the coach. This solution should be a 50/50 mixture of concentrated propylene glycol antifreeze and distilled water.

This mixture is not subject to the adage that more is better. Adding more than 50% antifreeze, or more than 50% distilled water will **NEGATIVELY** impact the heat transfer capabilities of the solution, and will also negatively impact the freeze protection afforded by this solution. There will be more about freeze and burst protection later in this section.

Antifreeze Types:

The following information will address the necessary usage of a propylene glycol based “boiler” type antifreeze in the Aqua-Hot. Propylene glycol is a safer alternative to the more common ethylene glycol antifreeze. Propylene glycol differs from ethylene glycol in that it has a greatly reduced toxicity when compared to ethylene glycol, and is considered “Generally Recognized As Safe” (GRAS) by the United States Food and Drug Administration (FDA.) As mandated by the International Association of Plumbing and Mechanical Officials (IAPMO,) only propylene glycol based boiler type antifreezes deemed “GRAS” by the FDA should be utilized.

Because of the significant impact that various types of antifreeze can have on a hydronic heating system, including, but not limited to the level of safety provided, it has been recognized that there is a need to provide an explanation regarding two additional prominent types of antifreeze/coolant available. The following information should be utilized as an educational means of ensuring that the proper type of propylene glycol antifreeze is selected.



DANGER

Failure to utilize a propylene glycol which has been deemed Generally Recognized As Safe (GRAS) by the US Food and Drug Administration (FDA) could result in serious bodily harm.

RV & Marine Antifreeze:

These types of propylene glycol based antifreeze products are formulated specifically for “winterizing” applications only. Although RV and Marine antifreeze is often “GRAS” approved by the FDA, ***it should never be used in the Aqua-Hot hydronic heating system.*** This type of antifreeze is not formulated to transfer heat, which is essential to the heating system’s functionality. Additionally, this type of antifreeze solution does not contain rust or corrosion inhibitors. Please note, however, that RV & Marine antifreeze may be utilized to winterize the Aqua-Hot’s domestic water heating system.

Automotive Antifreeze/Coolant:

Automotive types of propylene glycol based antifreeze products are formulated specifically to protect automotive engines against corrosion, freezing temperatures, and overheating. They also have excellent heat transfer and thermal conductivity characteristics. Although these types of antifreeze products are considered less toxic, and safer than ethylene glycol for people, pets, and the environment, they are not “GRAS” by the FDA. Therefore, they must be marked with a “harmful if swallowed” warning. This additional warning is required because these types of antifreeze products contain high levels of chemical inhibitors. Due to their potentially hazardous properties, ***they should never be used in the Aqua-Hot hydronic heating system.***

Antifreeze Mixture Water Quality:

In order to ensure the maximum performance and longevity of an Aqua-Hot boiler tank and associated components, it has been determined that there is a need to use distilled, de-ionized, or soft water in combination with concentrated propylene glycol for the Aqua-Hot’s antifreeze and water heating solution. Please note that this is only necessary when mixing concentrated propylene glycol antifreeze with water; suppliers of pre-mixed antifreeze are responsible for the use of high-quality distilled, de-ionized, or soft water when preparing their antifreeze for sale.

Hard water possesses a high-level of calcium and magnesium ions, which deplete the corrosion inhibitors present within the propylene glycol solution. This in turn causes the antifreeze and water heating solution to become acidic, which will prematurely corrode the Aqua-Hot’s boiler tank and associated components leading to a shortened operational life. Therefore, concentrated propylene glycol should be diluted with distilled, de-ionized, or soft water that is 80PPM or

less in total hardness. Local water agencies should have up-to-date water reports that will indicate if the local tap water is within this guideline.

Antifreeze Terms and Mixture Ratio:

The following information addresses the process of selecting an antifreeze and water mixture ration that provides adequate freezing, boiling, and ruse/anticorrosive protection. A 50/50 mixture of propylene glycol and distilled water ratio is recommended, which will result in a freeze point of approximately -28°F and a boiling point of approximately 222°F .

The following information should be utilized for the purpose of clarifying some terms commonly associated with antifreeze.

Freeze Point and Burst Point:

Antifreeze lowers the freezing point of any liquid to which it has been added by preventing the formation of ice crystals. However, as the ambient temperature continues to decline, the water in the solution will attempt to attain a solid state. The point in which the water begins to solidify is termed the “freeze point.” Although the water in the solution has begun to freeze, producing a “slushy” consistency, the antifreeze in the solution will continue to combat the normal expansion of the solution as it freezes.

Burst Point:

The point in which the solution can begin to expand due to colder temperatures is called the “burst point.” Once the solution reaches the burst point, the potential is present for ruptured pipes to exist. The burst point of the antifreeze and water heating solution is dependent upon the brand of propylene glycol employed.

Boiling Point:

The Aqua-Hot utilizes the antifreeze and water heating solution as a transportation means for heat produced from the internal processes. The antifreeze absorbs the heat created until its boiling point is reached. It is at this point that the liquid turns to a gas and is expelled to prevent the heating system from overheating. Each time the boiling point is reached, a loss of efficiency occurs because the heat produced is expelled rather than used for the function of the heating system. Therefore, a higher boiling point is desired as a means to combat the loss of efficiency, which allows the antifreeze to transport the heat created from the internal process throughout the coach where it can be used productively

rather than dissipating due to its change from a liquid to a gas.

Rust and Anti-Corrosion Inhibitors:

Another major function of antifreeze is to provide protection to the internal metal components of the Aqua-Hot hydronic heating system from corrosion and rust. Antifreeze is able to fill this need by the addition of rust and corrosion inhibitors that are specifically designed to activate in a water solution.

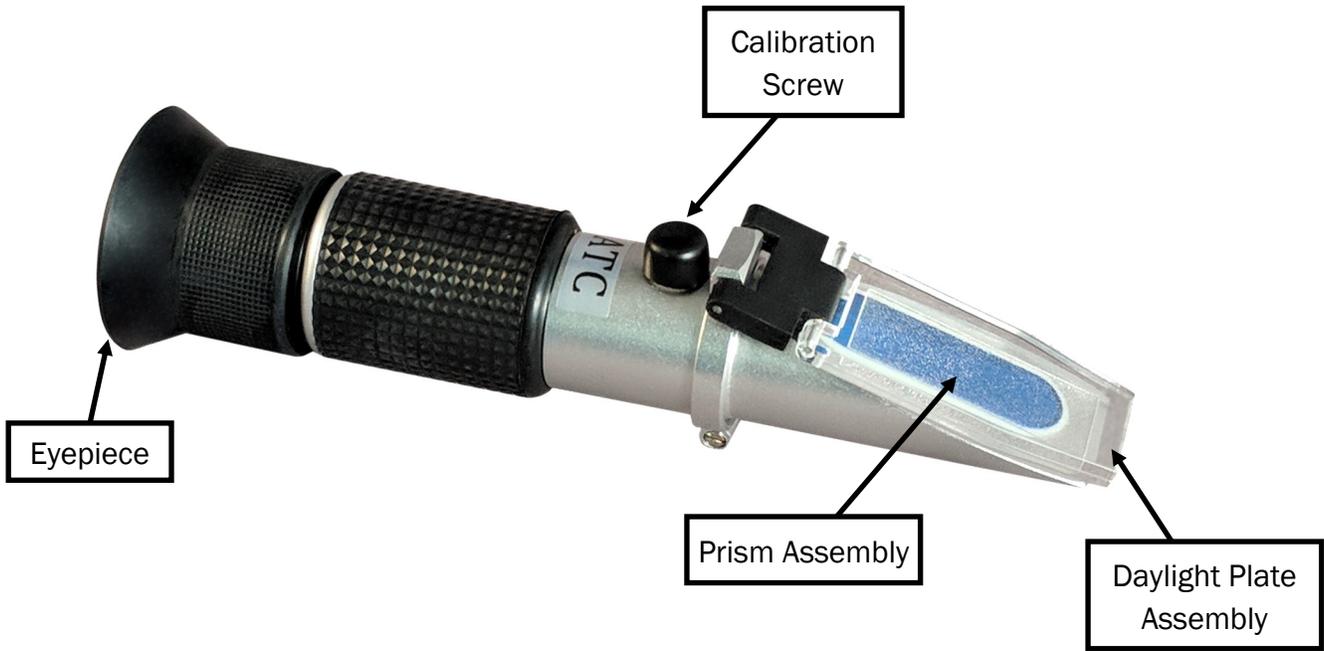
Summary:

Antifreeze has three basic functions; freeze protection, boil-over protection, corrosion, and rust protection.

Antifreeze is also primarily responsible for heat transfer characteristics which are further enhanced by the addition of distilled water.

A 50/50 solution of propylene glycol antifreeze and water is recommended to provide the best performance combination of the aforementioned functions. If excess propylene glycol exists within an antifreeze and water heating solution, the water’s heat absorption properties are compromised, which could ultimately inhibit the Aqua-Hot from providing hot water and interior heating.

Measuring Propylene Glycol Using a Refractometer

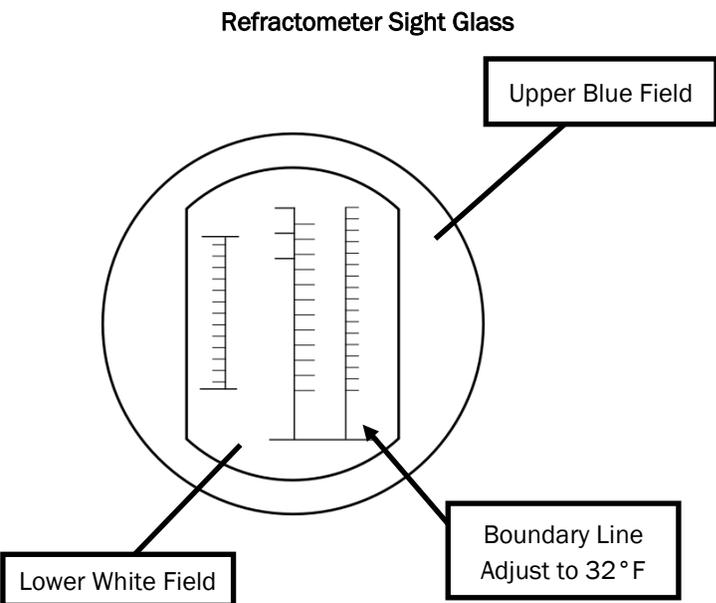
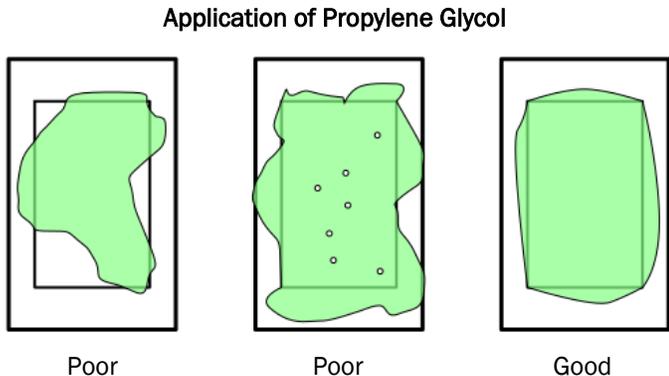


Properly Apply Antifreeze to the Prism Assembly

Use the guide below to properly apply the propylene glycol mixture to the prism assembly of the refractometer. Once that is complete, peer through the eyeglass of the refractometer to continue to the next step.

Adjust the Boundary Line

Once the glycol solution has been properly applied, adjust the calibration screw until the boundary line labelled "Propylene Glycol" is set to 32 °F. The graphic to the right has been designed as an aid, but note that it may differ from what is shown in the refractometer sight glass.



SERVICE MANUAL

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SERIES



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