

Service Manual

200 Series



AHE-250-D01



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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 must be observed.

System Overview

The Aqua-Hot 250 Diesel Series is a Hydronic (water-based) Heating Systems that can provide heat and tank-less, continuous hot water in one small, easy to install package.

The Aqua-Hot Heating is a 2-in-1 System

1. Interior heating system: provides moist, quiet, comfortable interior heat and even temperatures. It is equipped with one thermostatically-controlled temperature zone.
2. Tank-less hot water system: provides a flow of continuous hot water. It produces 90 gallons per hour (1.5 GPM).

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

The 250D uses a 12-volt DC powered diesel burner as the primary heating source. The diesel burner 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 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, it is recommended to utilize the diesel burner. The electric heating element will provide heat only in mild conditions and provide light duty hot water needs.

Should additional assistance be needed, please contact the Technical Support at 574-AIR-XCEL (574-247-9235), Monday through Friday, between 7:00am and 4:00pm MST.



CAUTION

As with any appliance, allow the Aqua-Hot to completely shut down BEFORE disengaging the coach 12V power disconnect.

Introduction to this Document

Welcome to the Aqua-Hot 250D Service Manual. This manual will serve as a guide for diagnosing and repairing the Aqua-Hot, how to perform standard maintenance, and guide you through troubleshooting procedures to repair the Aqua-Hot. This service manual is designed to aid trained and qualified technicians to properly service and troubleshoot the Aqua-Hot.

Each section in this manual is dedicated to the diagnosis of specific components within the Aqua-Hot which may be inhibiting the operation of the heater.

If additional assistance is needed in diagnosing and repairing the Aqua-Hot, please contact our Technical Service Department at 574-AIR-XCEL (574-247-9235) from 7:00am to 4:00pm MST Monday through Friday.



WARNING

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



Figure 1

Read all instructions before servicing 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 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 standards 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 exterior of the vehicle.
- **Propylene glycol** based antifreeze “Generally Recognized As Safe” (GRAS) by the FDA must be utilized for the antifreeze and water heating solution.
- An interlock switch prevents the Aqua-Hot heater from operating when the cover is not installed in the correct position.
- Disconnect electric wiring to the Aqua-Hot System before welding or plasma cutting the coach to avoid damage to equipment.
- The Aqua-Hot tank and heating loop operate at 0.0 PSI (zero pressure system). Air pressure to the tank must not exceed 20 PSI. Exceeding this rating will cause internal damage to the Aqua-Hot.
- Use caution when working on or near any diesel fuel system.
- Do not store or use gasoline or other flammable vapors or liquids in the vicinity of this or any other appliance.
- The Aqua-Hot’s exhaust is HOT and must be kept away from heat sensitive material.
- 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 cause in serious burns or injury. Be aware of hot surfaces.
- Do NOT activate the burner until the antifreeze and water heating solution has been added to the boiler tank to avoid serious damage to the heater.
- Installation and repairs may only be carried out by an authorized, factory-trained Aqua-Hot technician. The heating system must be installed in accordance with local codes, or in accordance with the Standard for Recreational Vehicles, (RVIA) ANSI A 119.2/NFPA 501C, NFPA 1192.



WHAT TO DO IF YOU SMELL GAS

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

The Aqua-Hot’s exhaust is HOT!

- Do NOT park in areas where dry conditions exist (IE grassy, dry fields).
- Do NOT operate the burner inside an enclosed building.
- The heater must be switched OFF when refueling.

NOTE: Should any additional assistance be needed, please contact the Technical Support Department at 574-AIR-XCEL (574-247-9235).

NOTE: Service parts and accessories are available through Aqua-Hot Factory Authorized Service Centers or at www.aquahot.com.



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

Maintenance Schedule

Monthly Maintenance

Check the Aqua-Hot's antifreeze and distilled water heating solution to ensure that it is at the proper level. This can be accomplished by visually checking the coolant level in the Aqua-Hot's expansion bottle; reference Figure 10 on page 14.

Please note that the coolant level should be checked **ONLY** when the Aqua-Hot is at maximum operating temperature. This should be done immediately after the electric element disengages, or after the diesel burner has completed a cycle.

At maximum operating temperature, the antifreeze and distilled water heating solution should be at the level marked "HOT" on the expansion bottle.

It is also recommended to run the diesel burner once a month for a full cycle (at least 20 minutes) to ensure optimum heater condition.

Annual Maintenance

To maintain the Aqua-Hot at its full potential, it is highly recommended to have the diesel burner tuned up annually. This involves the fuel filter replaced, burner cleaned, inspecting the exhaust and combustion air lines for damage and ensure they are clear, checking the fuel lines for any leaks, checking the hoses and wiring to make sure there is no damage or cracks.

Replenishing the Antifreeze and Water Heating Solution

If the antifreeze and distilled water heating solution needs replenishing, remove the cap for the expansion bottle and fill it to the "HOT" mark (only when the tank is to temperature). Replace the expansion bottle cap when this is complete. **DO NOT** operate the unit without first replacing the cap of the bottle. Reference Figure 10 for additional information. Excess air will escape through this bottle as the stir pump of the unit operates. While bleeding this system of air, it will be necessary to continue to fill the bottle until this process is complete.

The Aqua-Hot does not need regular replacement of the propylene glycol antifreeze and distilled water heating solution, but in the event that more antifreeze is required, contact Aqua-Hot Heating Systems to purchase antifreeze, or for guidance in selecting an appropriate antifreeze product for use with this unit.



DANGER

When the Aqua-Hot is at maximum operating temperature, the coolant is very hot. If the Aqua-Hot heating system is accessed, scalding by hot vapor or coolant may occur. Before cleaning or servicing, disconnect all power supplies.



WARNING

DO NOT operate the diesel burner and/or electric heating element without antifreeze and distilled water heating solution present in the Aqua-Hot's boiler tank. Doing so will cause serious damage to the heater.

In order to provide the best freeze protection, boil-over protection, anti-corrosion, and rust protection, a mixture of 50/50 **propylene glycol** antifreeze and distilled water is recommended. The Aqua-Hot 250D boiler tank holds approximately 3.7 gallons.

The mixture may be modified to provide the most adequate freezing, boiling, and rust/anti-corrosive protection. A 50/50 mixture of **propylene glycol** and distilled water has a freeze point of approximately -35°F and a boiling point of approximately 223°F. Refer to the table below to determine the best protection mixture ratio. Reference page 64 for measuring the antifreeze mixture with a refractometer.

Propylene Glycol												
Freeze Point (°F)	0	-4	-7	-9	-12	-15	-18	-23	-29	-34	-40	-46
Concentration (%)	0	12	19	25	30	34	38	44	49	53	57	60

Overheat Protection

Every Aqua-Hot is equipped with at least two overheat protection devices. These are commonly known as the high-limit thermostats. These thermostats operate by maintaining a circuit while the unit is below 218°F.

In the event of an overheat condition, the high limit thermostats will cut the operating signal to the diesel burner, and/or the electric element. When this signal is interrupted, the electric element and diesel burner will immediately disengage. Contact Aqua-Hot Heating Systems LLC for assistance in locating a qualified person to service this heater after an overheat situation.



WARNING

DO NOT attempt to reset the high-limit thermostats after an overheat condition until the unit has been serviced by a qualified technician. Failure to do so could result in damage to the unit, personal injury, or death.



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 574-AIR-XCEL (574-247-9235).

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: 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 DB185555
 Number:
 Model Number: 250D
 Serial Number: A250D-XXXXXX

7501 Miller Drive • Frederick, CO 80504 • 574-AIR-XCEL • www.aquahot.com

NOTE: This product label is attached to the side of the Aqua-Hot, and provides a ready reference to specifications, test standards, and important safety notices.



Figure 2

System Specifications

Electric Element

Power Consumption1000 W (maximum)
 Voltage120V AC

DC Power

Heat Input.....66,000 BTU/hr ± 10%
 Fuel Consumption0.40 gallon/hr
 Power Consumption 108W (maximum)

Zone Heat Circulation

Pumps1
 Power Consumption (max)..... 21W
 Voltage 12V DC

Heating Zones

Maximum 1

Domestic Water Heating

Maximum 1.5 GPM

Physical Specifications

Dimensions (US).....22.44"L x 12.46"W x 17.2"H
 Dry Weight 84lbs.
 Wet Weight..... 104lbs.

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.

250 Diesel Components

- | | |
|------------------------------|-------------------------------|
| 1. Access Cover Screw | 11. 12V DC Harness Junction |
| 2. Drain Valve | 12. Expansion Tank Connection |
| 3. 3-Way Valve | 13. Heating Zone Outlet Port |
| 4. Tempering Valve | 14. Heating Zone Return Port |
| 5. Diesel Burner Controller | 15. 120V AC Connection |
| 6. Diesel Burner Assembly | 16. Boiler Tank |
| 7. Interlock Switch | 17. Domestic Hot-Water Coil |
| 8. Domestic Cold Water Inlet | 18. Zone Circulation Pump |
| 9. Domestic Hot Water Outlet | |
| 10. Diesel Fuel Connections | |

NOTE: The side and top panels in the view below have been made transparent to aid in the explanation of the heater. DO NOT remove these panels. Doing so risks irreparable damage to the Aqua-Hot. Only remove the service panel for service.

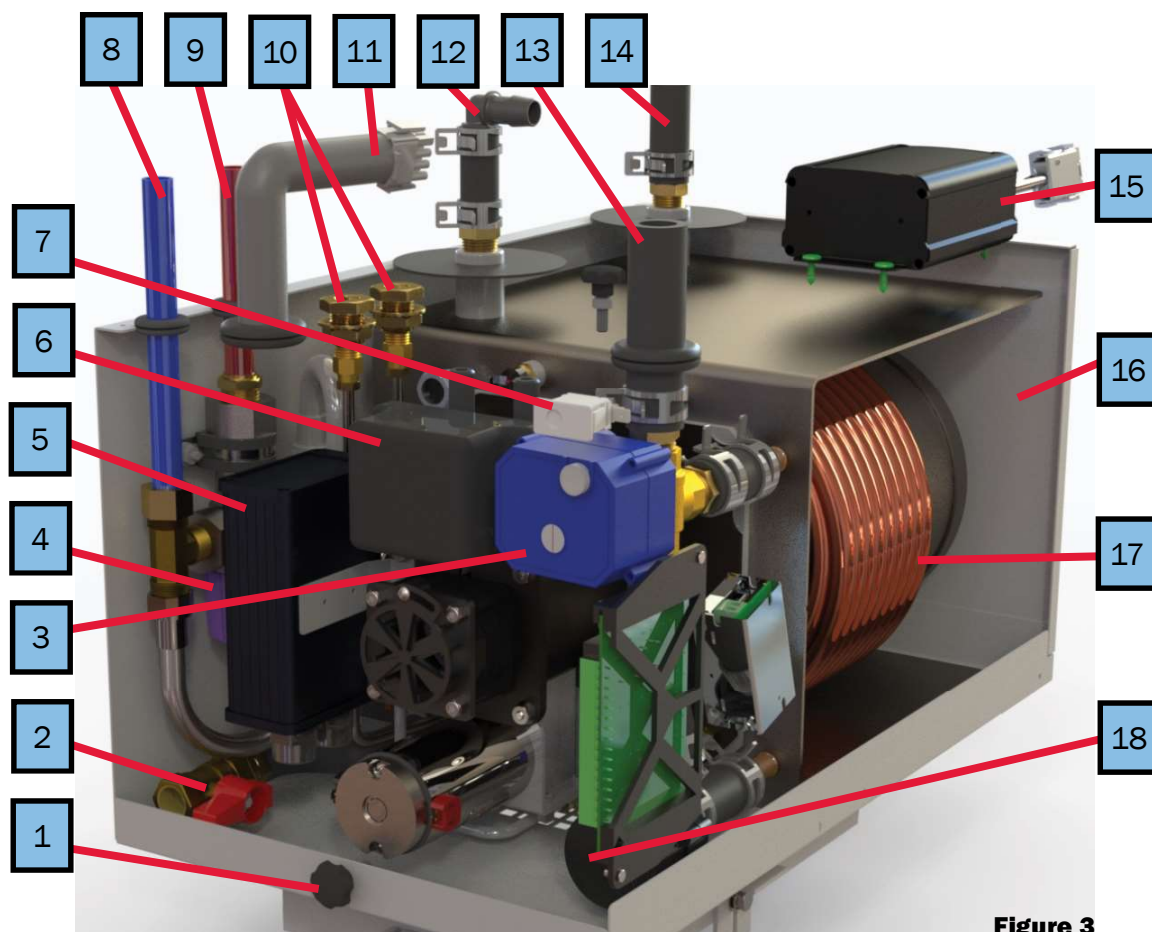
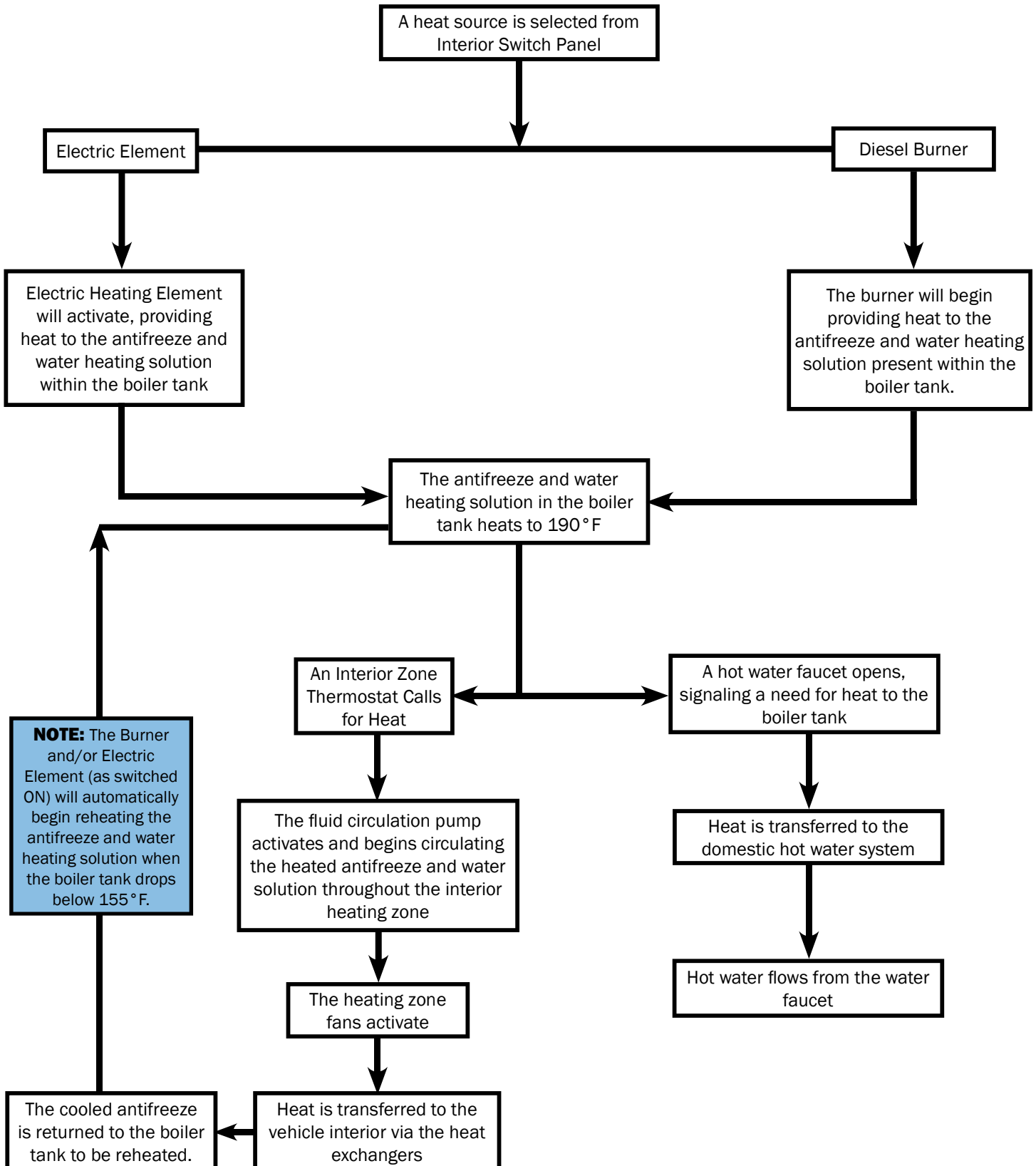


Figure 3

Operational Flow Chart



Relay Control Board

The relay control board at use in your Aqua-Hot 250 Diesel Series is designed to function in conjunction with the 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 labeled FH1, FH2, and FH3 and will contain either a 5A or 10A fuse. The 250D does not utilize the 5A fuse in slot FH3, it uses a 20A fuse integrated into the wiring harness to fill this need.

- **FH1:** 10A - AC Activation Circuit and Burner
- **FH2:** 5A - Switch Power

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.

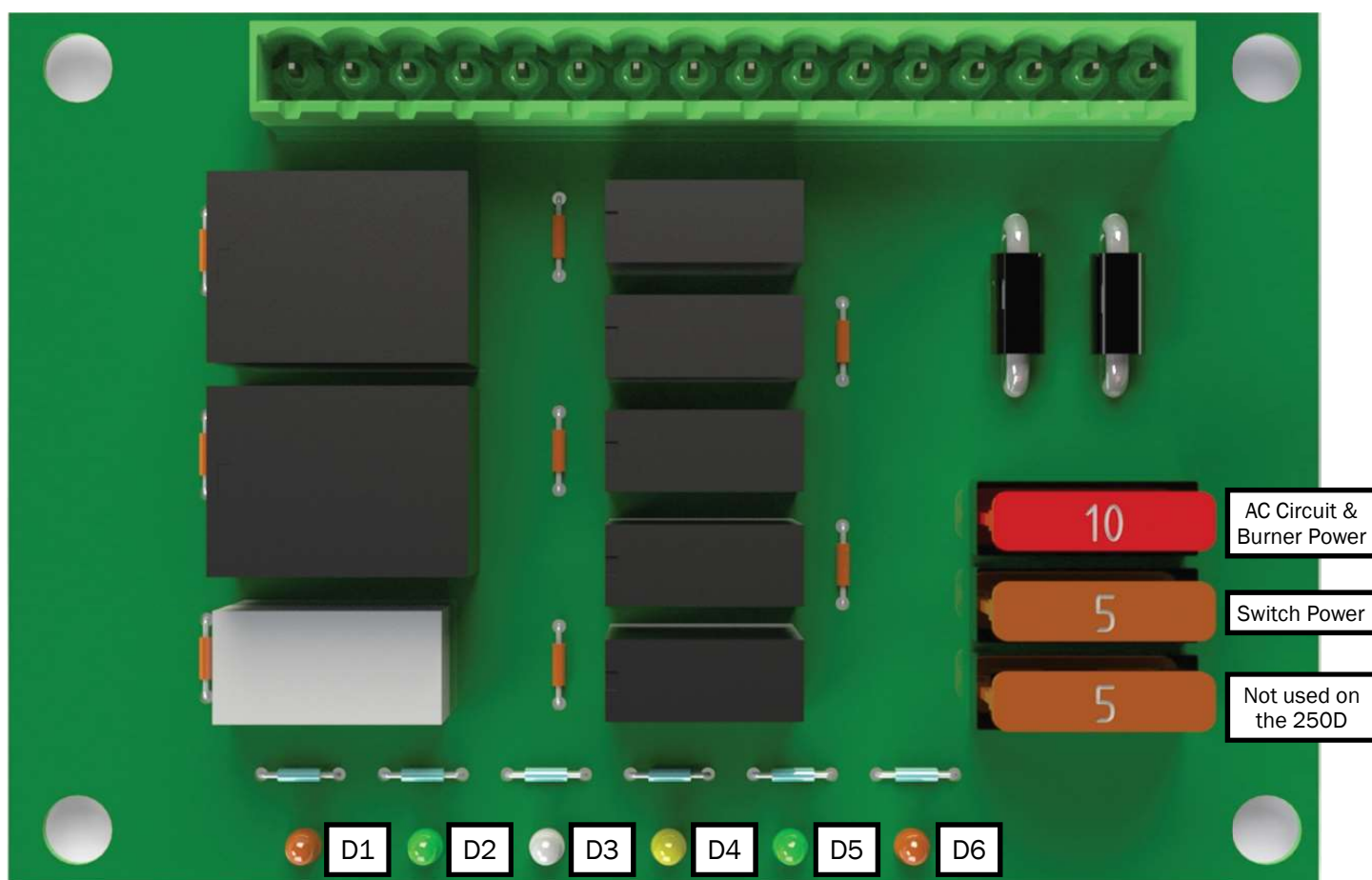


Figure 4

Heating Status (D1):

This indicator light will illuminate orange when the burner and/or electric 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.

Circulation 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 be an issue with the 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 model, 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 that 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

Introduction:

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 the 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 known as "power-cycling".

Electric Element Switch:

When the coach is plugged into an AC power source (i.e. 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, supplementary* heating source. If used alone, the electric element will NOT be able to provide enough heat for continuous hot water or interior heat.

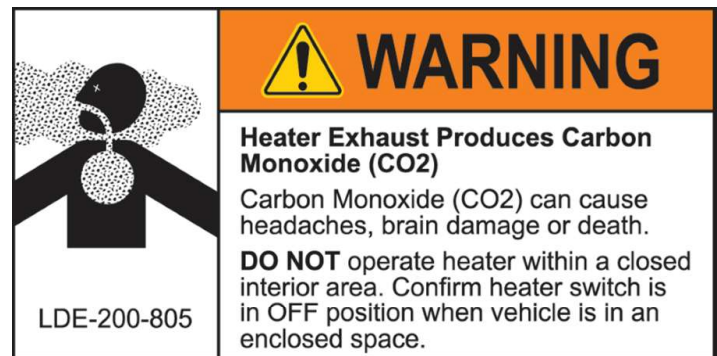


Figure 5

Exhaust System Requirements

Introduction:

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).
- 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.

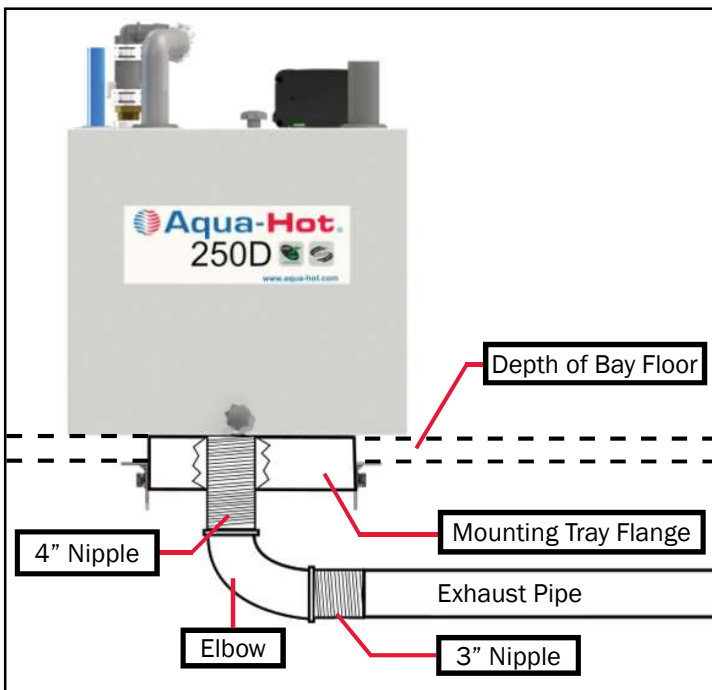


Figure 6

 LDE-200-805	 WARNING
	Heater Exhaust Produces Carbon Monoxide (CO₂) Carbon Monoxide (CO ₂) can cause headaches, brain damage or death. DO NOT operate heater within a closed interior area. Confirm heater switch is in OFF position when vehicle is in an enclosed space.

Components

Introduction:

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.

Replacement parts can be ordered online through Aqua-Hot's webstore at www.aquahot.com.

If additional assistance is needed, the technical support team can be contacted at 574-AIR-XCEL (574-247-9235) Monday through Friday, 7am to 4pm Mountain Standard Time.

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.

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 does not illuminate when the switch is in the ON position

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 #12 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 labeled "NO" and #12 is connected to the terminal labeled "COM".
5. Using an ohmmeter, check the interlock switch for continuity while the switch button is manually 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

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 into 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 labeled "NO" and wire #12 connected to the terminal labeled "COM".

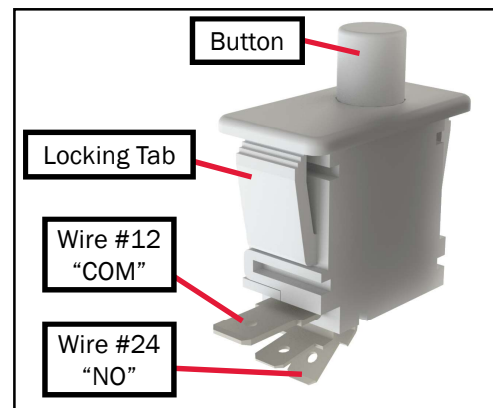


Figure 9

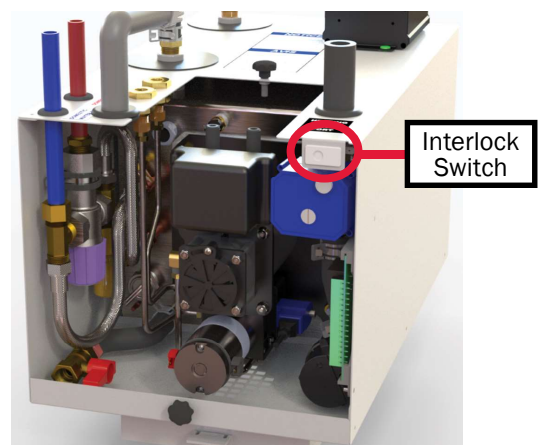


Figure 10

Fluid Level Sensor

Introduction:

The fluid level sensor monitors the current fluid level within the Aqua-Hot. This device is intended as a fail-safe measure which will disengage the Aqua-Hot if the fluid ever drops below a set threshold. The fluid level sensor is located on the expansion bottle, which is mounted to the side of the unit (see below).

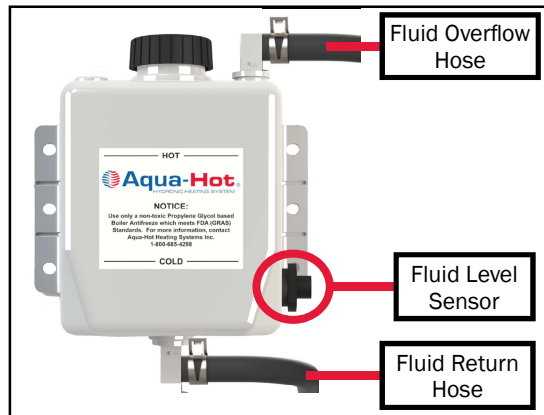


Figure 10

If the fluid level sensor is malfunctioning, the Aqua-Hot will show no signs of operation whatsoever. Troubleshoot this sensor if there is an adequate amount of fluid present within the Aqua-Hot, and the unit does not operate:

- 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 Guidelines:

Before troubleshooting the fluid level sensor, ensure that the following requirements have been met.

- The fluid expansion bottle is filled to at least the “COLD” mark.
- Verify that all coach-side in-line fuses are functional.
- Ensure that the unit is completely cool.
- Ensure that DC electrical power is supplied to the Aqua-Hot.
- Ensure that AC electrical power is supplied to the Aqua-Hot’s electric element.
- Ensure that the fluid level sensor is oriented correctly (see below).



Figure 12

If any of the requirements above are not fulfilled, correct them before continuing to diagnose the fluid level sensor. Reference the troubleshooting guide below.

Troubleshooting Procedure:

1. Verify that the Aqua-Hot’s expansion bottle is full of antifreeze 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:

In order to replace the fluid level sensor, the overflow bottle must also be replaced. Please visit www.aquahot.com or call 574-AIR-XCEL (574-247-9235) to order the expansion bottle kit. Once you have the replacement part in hand, follow the procedure below.

1. Locate the fluid expansion bottle.
2. Clamp the overflow hose as close to the bottom fitting as possible.
3. Grab a bucket or drain receptacle and place it directly under the lower fitting of the expansion bottle.
4. Remove the clamp from the lower fitting of the expansion bottle.
5. Remove the hose and allow the excess fluid to drain into the bucket.
6. Remove the overflow hose from the upper fitting of the expansion bottle.
7. Remove the old expansion bottle, disconnect the Faston connectors, and discard the old bottle.
8. Secure the new bottle in position.
9. Crimp the new faston connectors to the new fluid level sensor.
10. Connect these wires to their receptacles on the Aqua-Hot harness.
11. Reconnect the overflow hose to the upper fitting.
12. Reconnect the expansion hose to the lower fitting.
13. Fill the bottle with the previously drained fluid.
14. Remove the hose clamps.
15. Test the Aqua-Hot for normal functionality.

If additional assistance is required please contact the Aqua-Hot Heating Systems Technical support department at 574-AIR-XCEL (574-247-9235) from 7:00am to 4:00pm MST Monday through Friday.

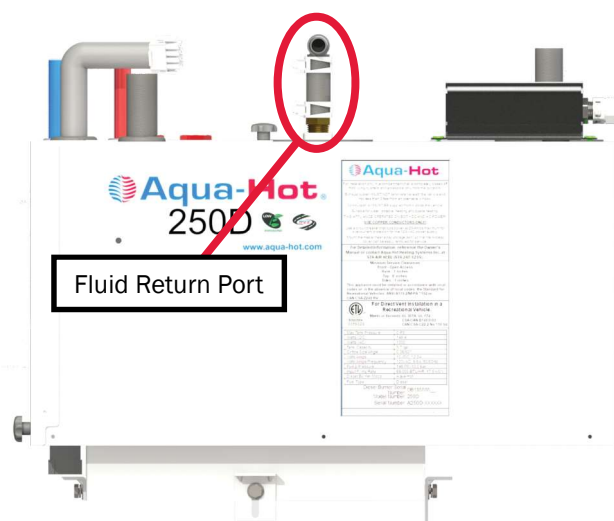


Figure 13

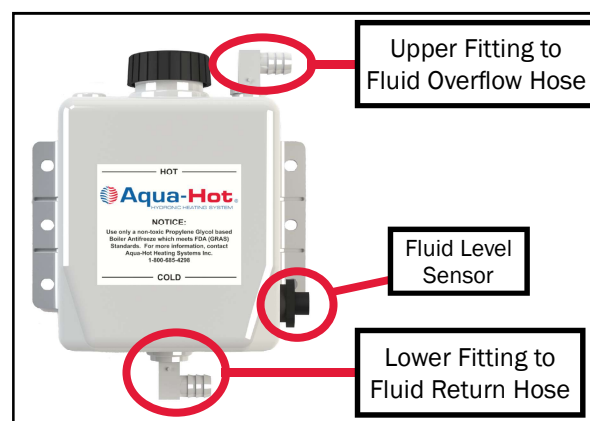


Figure 14

Control Thermostat

The control thermostat is installed into the Aqua-Hot's boiler tank and monitors the temperature of the antifreeze 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 10 for the relay control board LED indicator information.

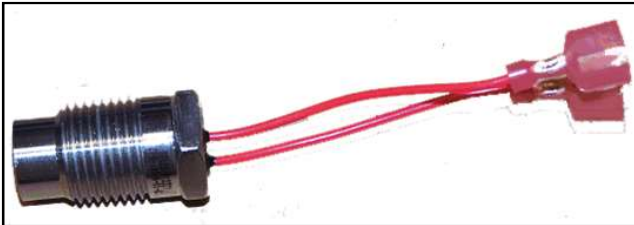


Figure 15

Troubleshooting Conditions:

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

- There is a lack of hot domestic water and/or interior heat.
- The orange heating status light (D1) does not illuminate while the unit is below 175 °F.

Troubleshooting:

1. Verify the following before troubleshooting the control thermostat:
 - The Interlock Switch is depressed (access cover is properly installed).
 - The overflow bottle is adequately filled.
 - The High-Limit Thermostats are not tripped.
 - Fuses in the relay control board are functional.
2. Turn the burner and/or electric element switch to the ON position.
3. Check the relay control board to ensure that “Electric Heating Element Status” (D2) and/or “Burner Status” (D5) indicator light is illuminated.
4. Verify that the “Heating Status” (D1) indicator light on the relay control board is illuminated as it should be whenever the Aqua-Hot is below 175 °F.

NOTE: The 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 175 °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 175 °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 control 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.

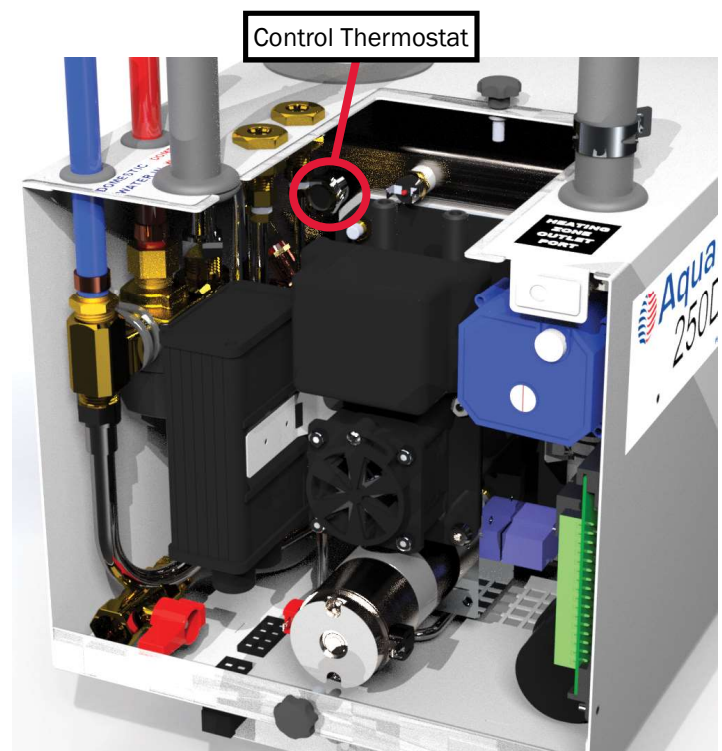


Figure 16

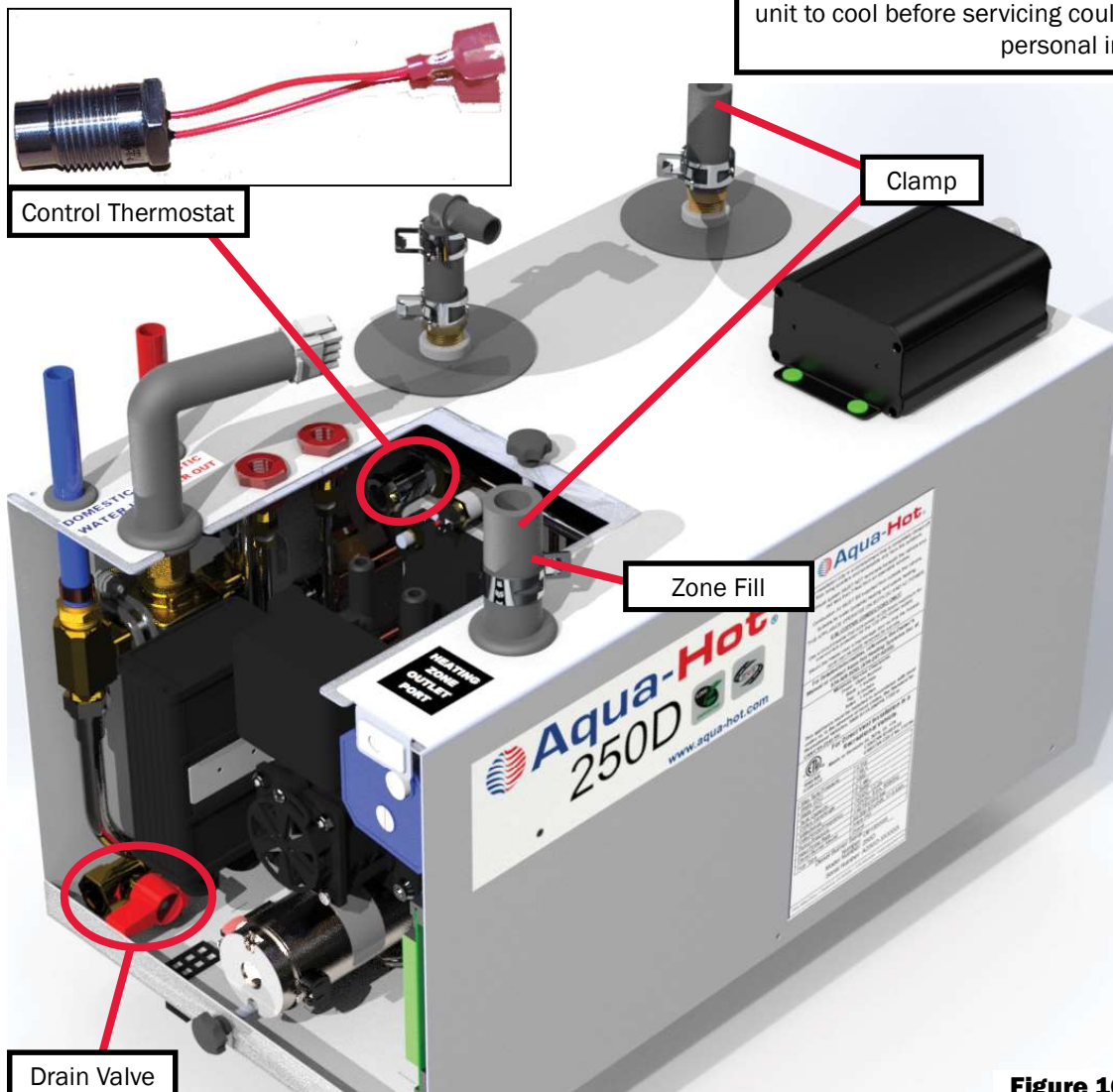
Control Thermostat Replacement Procedure

1. Ensure that the Aqua-Hot has been completely shut down, all power sources disconnected, and the unit has been allowed to cool completely.
2. Clamp the hoses indicated below with pinch off pliers to prevent drainage of the heating zone loop.
3. Drain one 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 $\frac{7}{8}$ " 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 the previously drained antifreeze and water heating solution.
9. Refill the Aqua-Hot using an external fill pump, filling through the zone fill.
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 55.



DANGER

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



Hose Pinch-Off Pliers



Figure 17

Figure 16

AC High-Limit Thermostat

Introduction:

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.

Begin troubleshooting the AC High-Limit Thermostat if the electric element fails to operate correctly.

Troubleshooting Guidelines:

The following conditions must be met before the AC High-Limit Thermostat can be diagnosed, and if necessary, repaired.

- The fluid expansion bottle is filled to at least the “COLD” mark.
- Verify that all in-line fuses are functional.
- Ensure that the unit is completely cool.
- Ensure that DC electrical power is supplied to the Aqua-Hot.
- Ensure that AC electrical power is supplied to the Aqua-Hot's electric element.

If any of the above conditions are not met, correct them before continuing with troubleshooting. Results of the troubleshooting procedure cannot be verified if the conditions listed above are not fulfilled.



DANGER

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

Troubleshooting Procedure:

1. 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 functional.
2. Ensure that the unit has been shut down and completely cooled before continuing.
 3. Shut off the coach-side power breaker to the Aqua-Hot.
 4. Disconnect the 3-pin AC Molex plug from the AC relay enclosure. Leave the DC power supply connected.
 5. Activate the “ELECTRIC” switch on the switch panel inside the coach.
 6. Using a multimeter, test for continuity across the AC high-limit thermostat by placing one lead on the unit-side Molex connection as shown below.

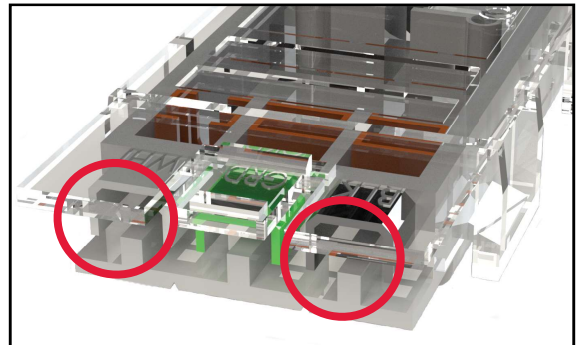


Figure 18

7. If no continuity exists, locate the AC high-limit thermostat and depress the center button to reset it. Retest for continuity.

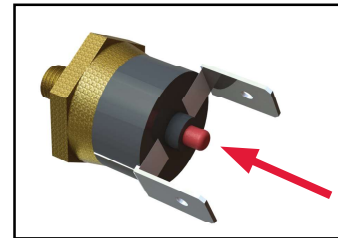


Figure 19

8. Move the electric switch to the OFF position. Reset for continuity. If continuity still exists, replace the AC relay.

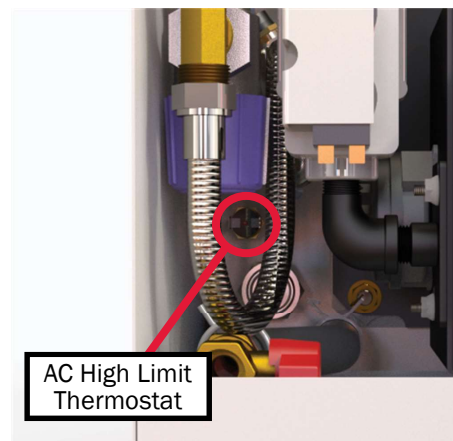


Figure 20

Replacement Procedure:

If it has been determined that the high-limit thermostat needs to be replaced, it can be easily replaced by following the directions below.

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.

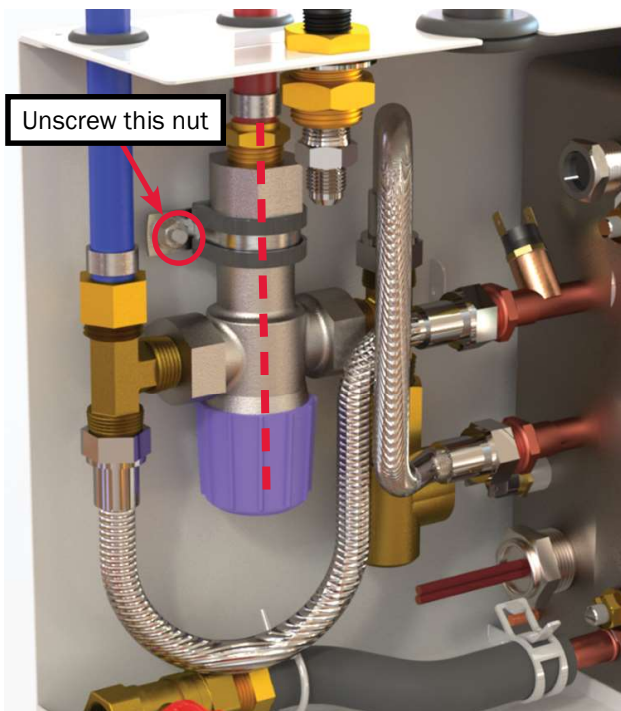


Figure 21

reinstall 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. Reconnect the domestic water connections to the PEX fittings of the tempering valve assembly.
15. Reestablish the gas, electric, and water supply to the Aqua-Hot.
16. Test for unit for normal operation.

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 $\frac{5}{8}$ " socket or crow's foot.
8. Butt-splice a new AC high-limit thermostat to the stripped wire.
9. Reinstall the AC high-limit thermostat using a $\frac{5}{8}$ " socket or crow's foot.
10. Re-secure the wires using the extra wire tie provided and

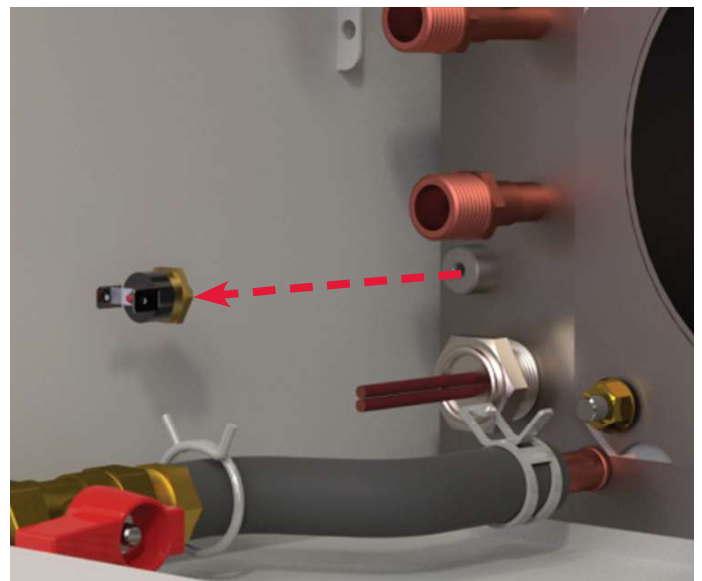


Figure 22

Burner High-Limit Thermostats

Introduction:

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) has been reached.

If the system reaches an over-temperature condition by interrupting the fuel solenoid, preventing diesel fuel from entering the combustion chamber.

Begin troubleshooting the High-Limit Thermostats if the following conditions have occurred:

- The fuel solenoid fails to operate.

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 Guidelines:

The following conditions must be met before the AC High-Limit Thermostat can be diagnosed, and if necessary, repaired.

- The fluid expansion bottle is filled to at least the “COLD” mark.
- Verify that all in-line fuses are functional.
- Ensure that the unit is completely cool.
- Ensure that DC electrical power is supplied to the Aqua-Hot.
- Ensure that AC electrical power is supplied to the Aqua-Hot’s electric element.

If any of the above conditions are not met, correct them before continuing with troubleshooting. Results of the troubleshooting procedure cannot be verified if the conditions listed above are not fulfilled.



DANGER

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

Troubleshooting Procedure:

1. Locate the high-limit thermostats (see Figure 23).
2. Disconnect the burner thermostats using the information below:
 - Wires #2 and #34 (left) or wires #34 and #8 (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. Reset 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 into 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 normal operation.

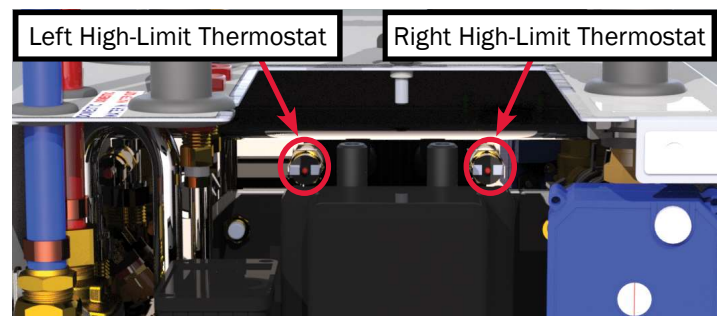


Figure 23

Low-Temperature Cutoff Thermostat

Introduction:

The Low-Temperature Cutoff Thermostat (LTCO) 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.

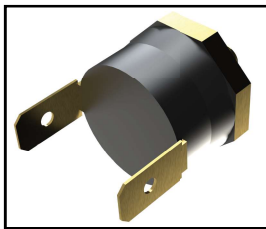


Figure 24

Troubleshooting Condition:

This thermostat should be diagnosed if there is a lack of interior heat or hot water, the D4 light is not illuminated, and the tank is up to operating temperature.

Troubleshooting Procedure:

Use the following troubleshooting tree to diagnose the Low-Temperature Cutoff Thermostat.

1. Verify the following before troubleshooting the low-temperature cutoff 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 on the relay board are functional
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.
 - Verify that the Aqua-Hot is at operating temperature between 155°F and 185°F by using a meat thermometer secured to the tank face.
 - Verify that 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:

- Disconnect wire #14B and #25 from the low-temperature cutoff thermostat.
- 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:
 - Using a temperature sensor, verify that the LTCO thermostat is below 90°F.
 - 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 and hot water has been established, the Low-Temperature Cutoff Thermostat will need to be replaced.

Replacing the Low-Temperature Cutoff Thermostat:

- 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 wrench, remove the defective LTCO thermostat from the Aqua-Hot.
- 5. Install the replacement LTCO torquing it to **15 in-lbs ONLY**. Anything more than 15 in-lbs of torque will damage the thermostat and possibly the unit.
- 6. Connect wire #14B and wire #25 to the replacement Low-Temperature Cutoff Thermostat.
- 7. Test for normal operation.

**DANGER**

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

Low-Temperature Cutoff

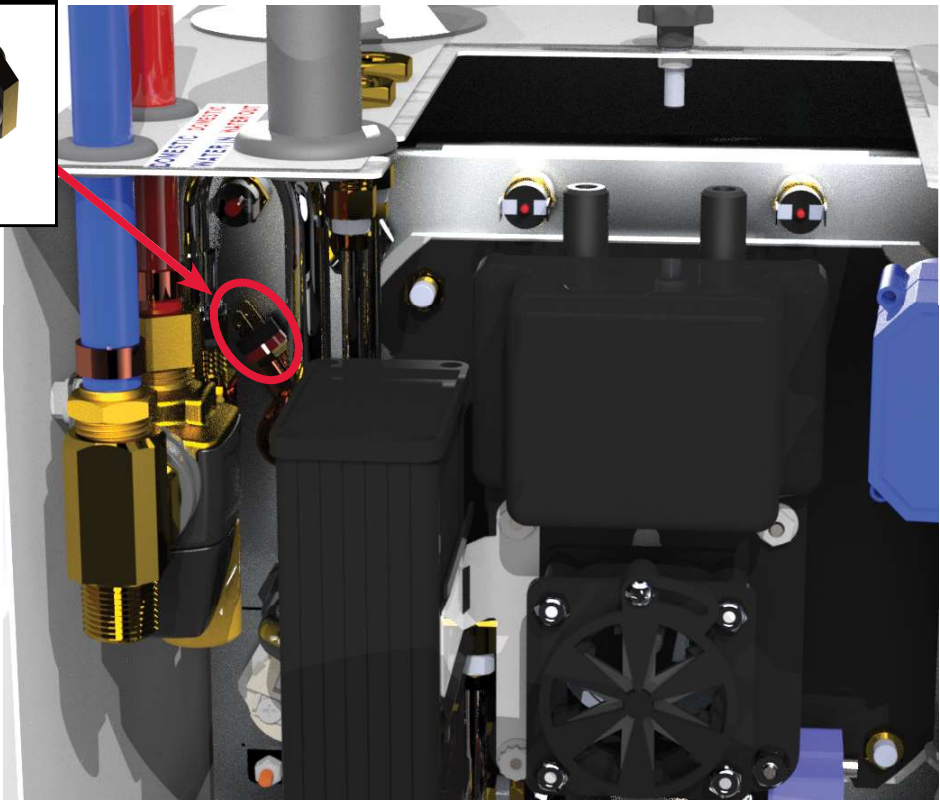
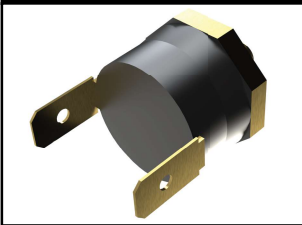


Figure 25

Three-Way Valve

Introduction:

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



Figure 26

Troubleshooting Condition:

Troubleshoot the three-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:
 - 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 on the relay board are functional
2. Verify that the heating zone is operating properly by checking the hoses to see if they are hot to the touch when a heating zone is calling for heat.
3. Locate the relay control board and ensure that both the heating zone status (D6) and the pump status (D3) indicator lights are illuminated.
 - Verify that the line on the valve display window is vertical when interior heat is being called for. If this is not occurring, check the LTCO thermostat for functionality (reference Page 21).
 - 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 hot water (horizontal), and verify that it matches the relay control board lights. D6 should illuminate while the sight glass is vertical.

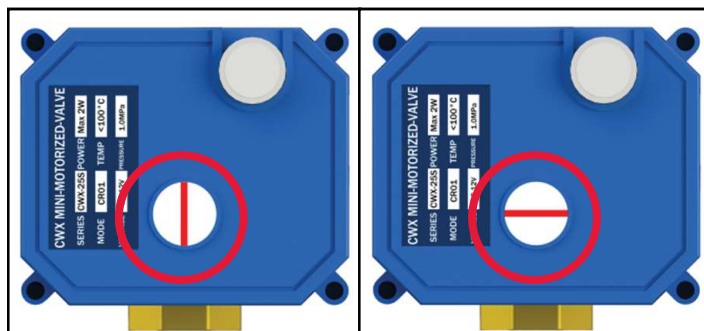


Figure 27a

Figure 27b

5. Locate the wires traveling from the three-way valve as listed below:
 - The wires of the three-way valve will terminate at the 16-pin plug of the relay control board.

NOTE: The following tests (step 6 & 7) will verify functionality of the internal workings of the three-way valve with power directly applied. The valve should actuate, and the sight glass should rotate with at least one of the following tests.

6. Apply 12V DC power to the red wire, and attach a ground wire to the green/black wire. The motor within the three-way valve should activate, rotating the red line in the sight glass vertically (Figure 27a).
7. Apply 12V DC power to the green/black wire, and attach a ground wire to the red wire. The motor within the three-way valve should activate, rotating the red line in the sight glass horizontally into "stir" mode (Figure 27b).
8. If the three-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.

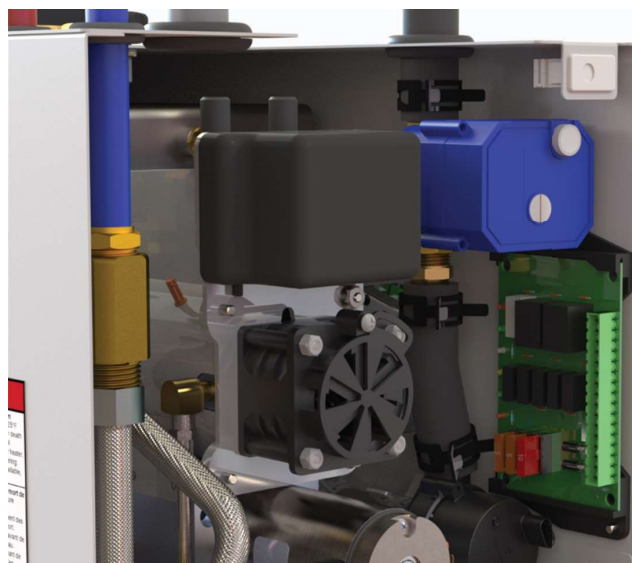


Figure 28

Replacement Procedure:

1. Ensure that the Aqua-Hot has been completely shut down, all power sources have been disconnected, and the unit has completely cooled.
2. Use clamp hose pliers to pinch tubing surrounding the three-way valve as indicated in Figure 29.
3. 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.
5. Remove the hose from the defective valve as shown in Figure 30.
6. Remove the two remaining hoses from the defective three-way valve.
7. Slide the hoses onto the valve and set the constant tension clamps back into place.
8. Install the replacement three-way valve according to the specific instructions below:
 - Reconnect the red wire to Pin #7, and the green wire to Pin #8 of the relay control board 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.

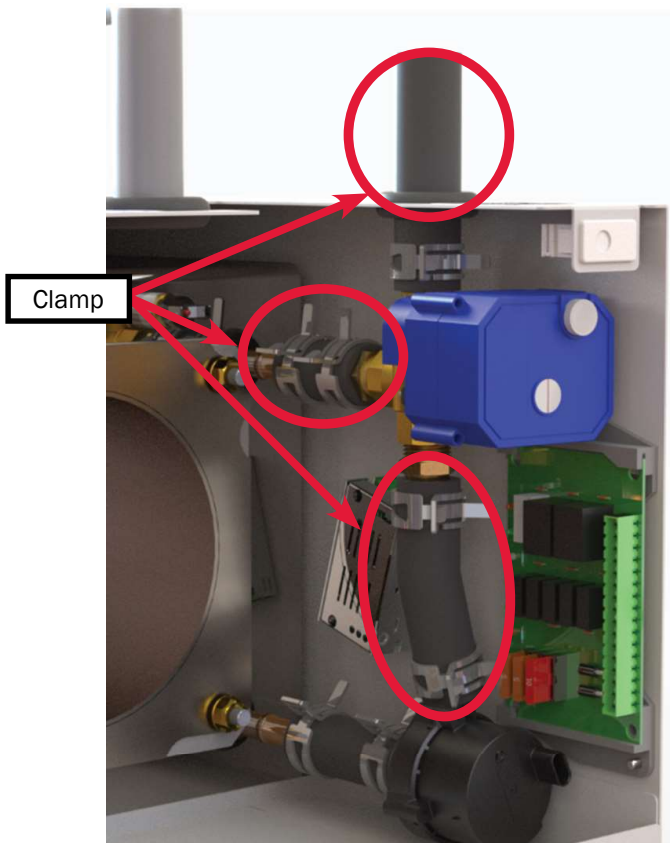


Figure 29

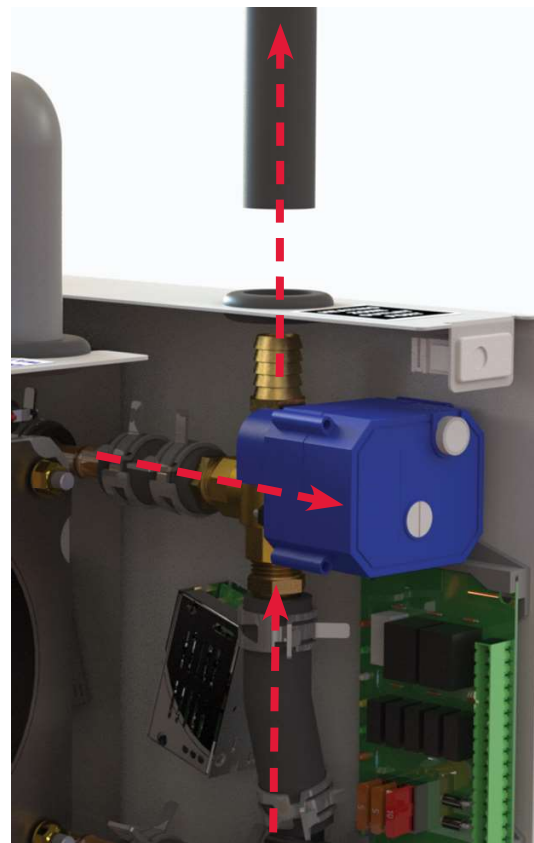


Figure 30

Tempering Valve

Introduction:

The tempering valve of the Aqua-Hot mixes the heated domestic water from the boiler tank with cold incoming 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 conditions have occurred:

- A lack of hot water.
- Hot water supply is uneven.
- Hot water is too hot.
- The D4 light is not illuminated.

Troubleshooting Condition:

1. Inspect the tempering valve to ensure that it is not leaking.
2. Activate the burner and allow the unit to heat unit the burner shuts off. This test cannot to be accomplished with the electric element.
3. Open the hot water valve on an interior faucet without a hot-stop and allow the temperature to stabilize at its hottest point.
4. Using a meat thermometer, take temperature reading of the water. It should be between 115°F and 120°F. Be aware that a water source 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 (see Figure 31). 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 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.

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 a qualified Aqua-Hot technician.



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 is necessary.
12. Reconnect the water lines to the tempering valve.

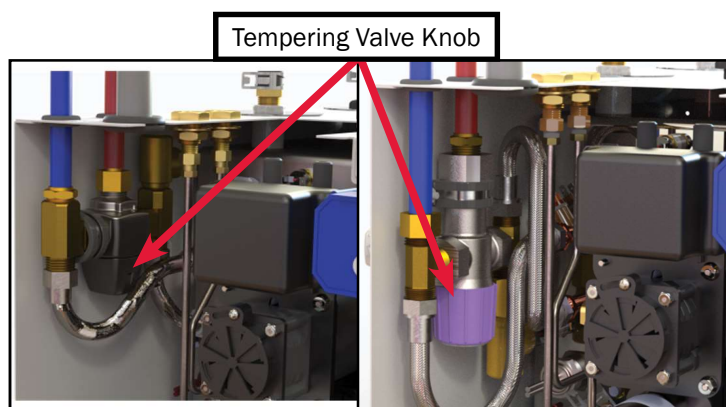


Figure 31

Circulation and Stir Pump

Introduction:

The fluid circulation pump operates to provide fluid circulation to either the interior heating zone or the antifreeze boiler tank depending on the heating and hot water needs at the time. It is used when interior heat is demanded by circulating propylene-glycol and water through the heating loop. It is used to stir the fluid mixture in the tank to ensure optimal hot water performance. The pump will also circulate the tank fluid while the burner cycles on to ensure that the tank is completely and evenly heated during a normal operating cycle.



Figure 32

Troubleshooting Condition:

Troubleshoot the circulation pump if the following conditions have occurred:

- A lack of interior heat.
- Lack of hot water or supply is uneven.

Troubleshooting Procedure:

Follow the procedure to diagnose the fluid circulation pump.

1. Verify the following before troubleshooting the circulation and stir pump:
 1. Activate an interior zone for heating and the burner switch. Locate light D6 on the relay control board.
 2. 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.

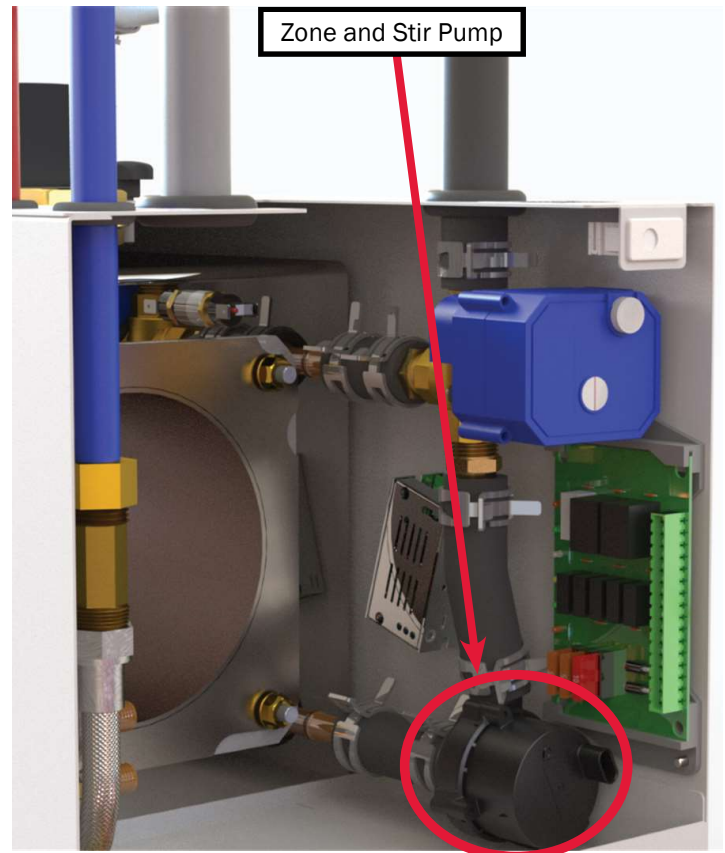


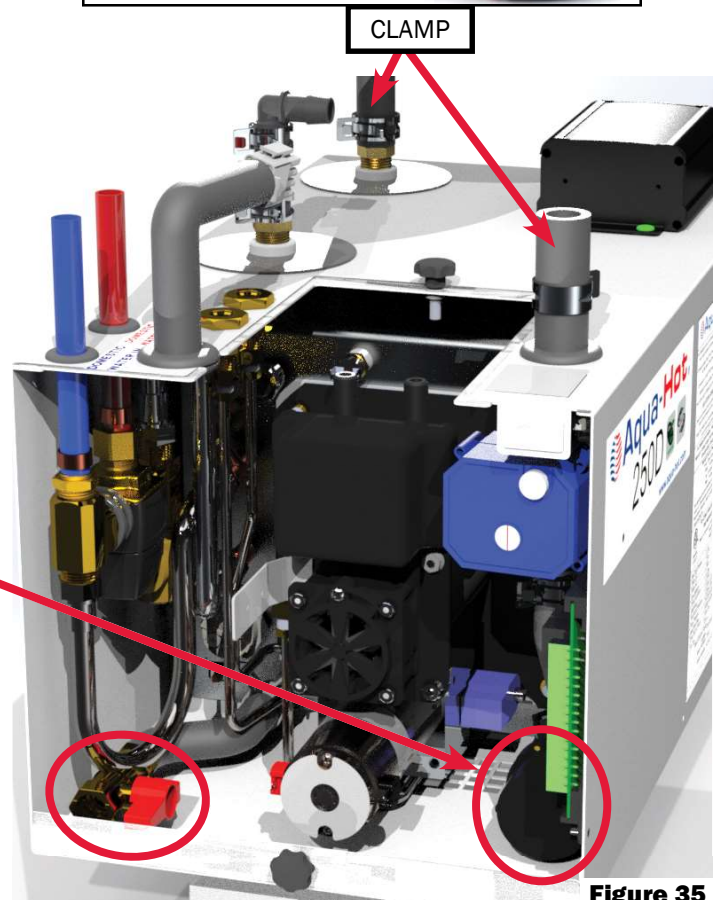
Figure 33

Replacement Procedure:

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-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.

**Figure 34**

 DANGER	
Failure to disconnect all power supplies and/or allow the unit to cool before servicing could cause serious damage and/or personal injury.	
	 WARNING
Burn Hazard Hot Coolant Circuit with Hot Surfaces can cause severe burns. DO NOT touch or service until equipment has cooled.	
LDE-200-810	

**Figure 35**

AC Electric System

Introduction:

The AC Electric system of the Aqua-Hot 200 Series unit functions to provide supplementary heat to the Aqua-Hot boiler tank. This is done with an electric element, an electric relay, and a DC “control circuit” which engages the electric element 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 diesel burner.

Troubleshooting Condition:

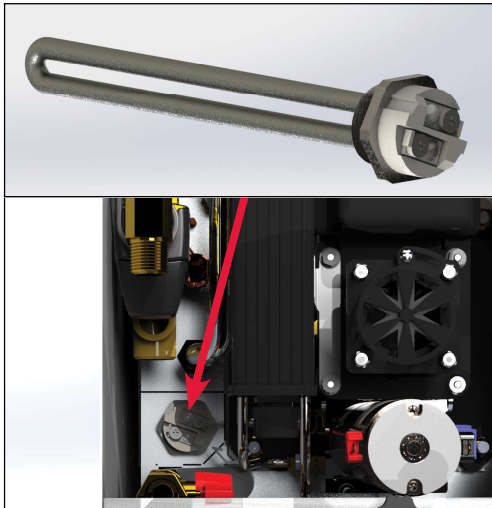


Figure 36

Troubleshoot the AC Electric system if the electric element is not functioning properly. This can be verified with a simple, but rather lengthy, test outlined below.

The following conditions must be met before the AC Electric system can be diagnosed, and if necessary, repaired.

- The fluid expansion bottle is filled to at least the “COLD” mark.
- Verify that all in-line fuses are functional.
- Ensure that the unit is completely cool.
- Ensure that DC electrical power is supplied to the Aqua-Hot.
- Ensure that AC electrical power is supplied to the element.
- Verify the thermostats are in working order.

If any of the above conditions are not met, correct them before continuing with troubleshooting. Results of the troubleshooting procedure cannot be verified if the conditions listed above are not fulfilled.

Verify Functionality:

1. Switch both the electric and the burner switches to the OFF position.
2. Allow the unit to cool completely.
3. Verify that the Aqua-Hot is connected to an AC power source such as shore power or an AC generator.
4. 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.
5. Move only the electric switch on the panel to the ON position.
6. Verify that the D2 light on the relay control board is active.
7. 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:

1. 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 on the relay board are functional
2. 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, DC 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.
3. 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 AC 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 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 11-13 ohms. If there are less than 11 ohms of resistance, the electric element can cause the coach-side breaker to trip (reference Figure 37).

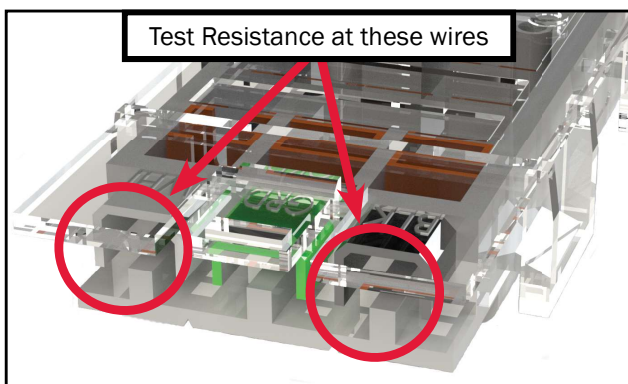


Figure 37



DANGER

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

Replacement Procedure:

1. Ensure that the Aqua-Hot has been completely shut down and all power sources have been disconnected. Be sure the boiler tank is completely cooled.
2. Using hose pinch-off pliers, clamp off the heating zone inlet and outlet ports.
3. Drain the antifreeze and water solution from the Aqua-Hot's boiler tank into an external container to be reused.
4. Remove the two wires secured to the defective electric heating element by releasing the screw terminals.
5. Using a 1-1/2" (38mm) socket, remove the defective heating element from the Aqua-Hot's boiler tank.
6. Use 6 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" (38mm) socket.
8. Reconnect the wires previously disconnected from the electric heating element and tighten the screw terminals.
9. Refill the Aqua-Hot boiler tank with the previously drained fluid, add more 50/50 mix of propylene glycol and distilled water to the tank if needed.
10. If necessary, purge the heat exchanger lines to remove any and all air from the system by running the fluid circulation pump for 20 minutes.

Diesel Burner Overview

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 antifreeze and distilled water heating solution present in the Aqua-Hot's boiler tank, which is 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 has an identifying label with information such as specifications and the serial numbers.

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

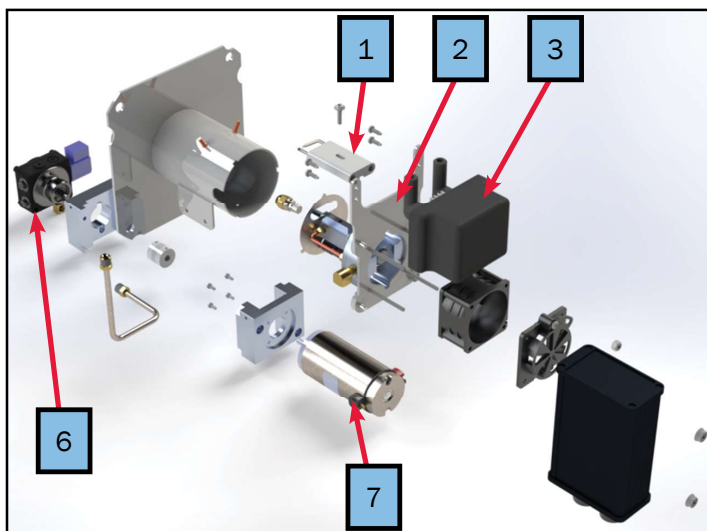


Figure 85

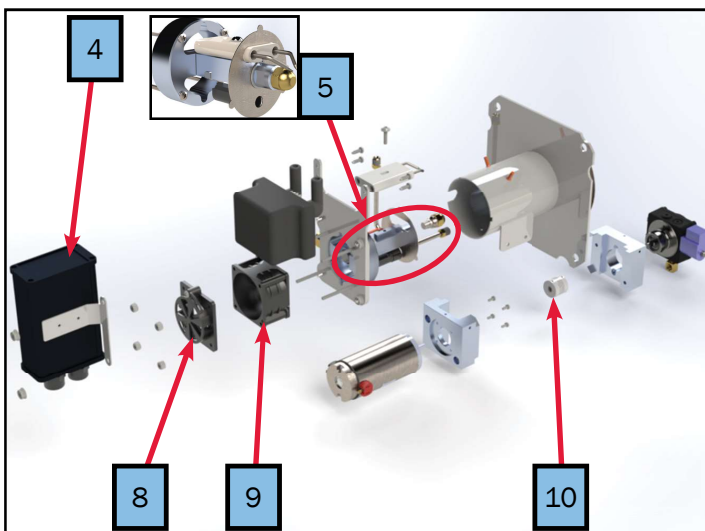


Figure 86

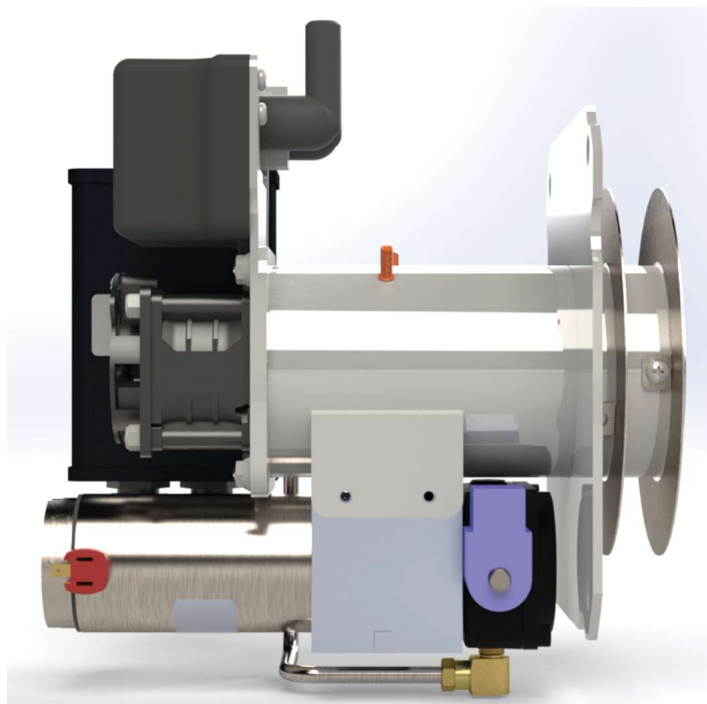


Figure 87

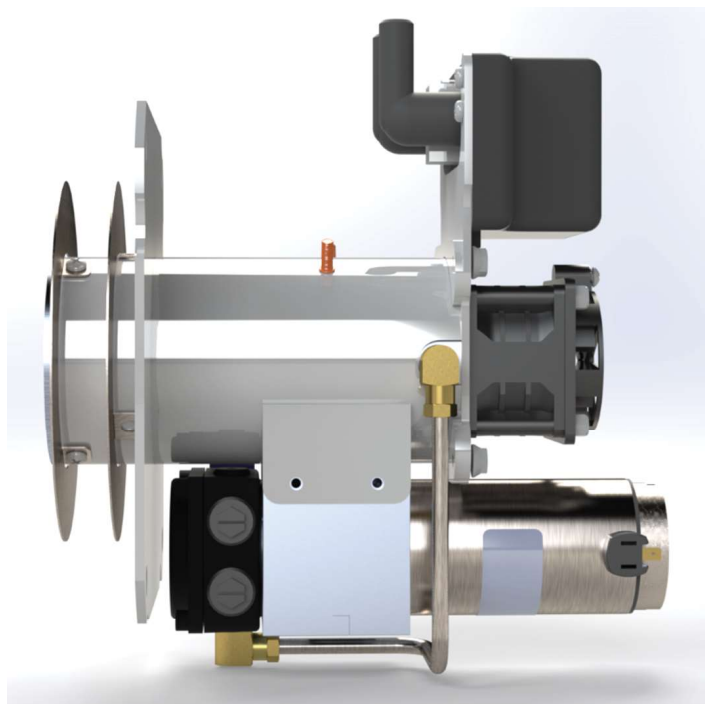
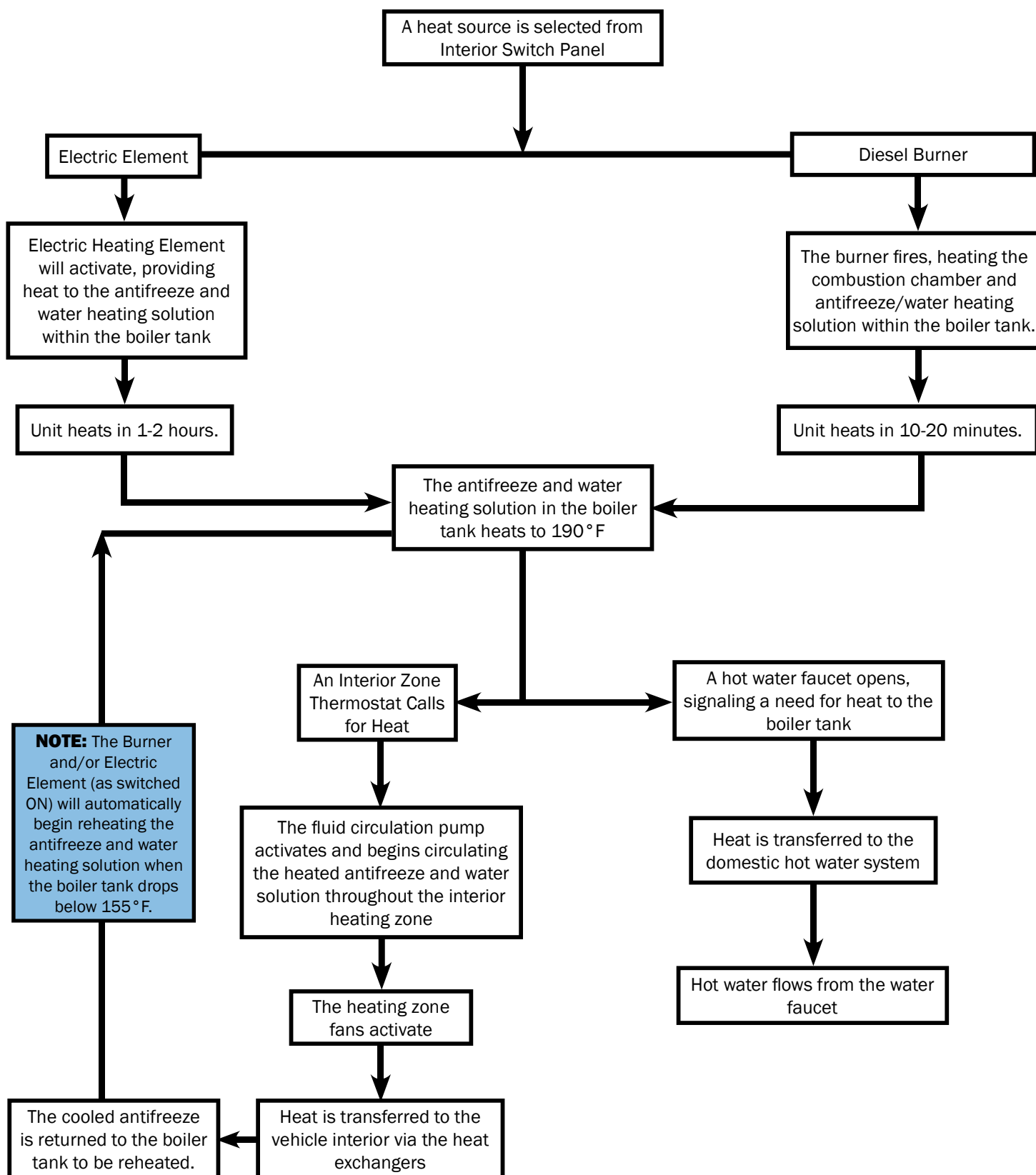
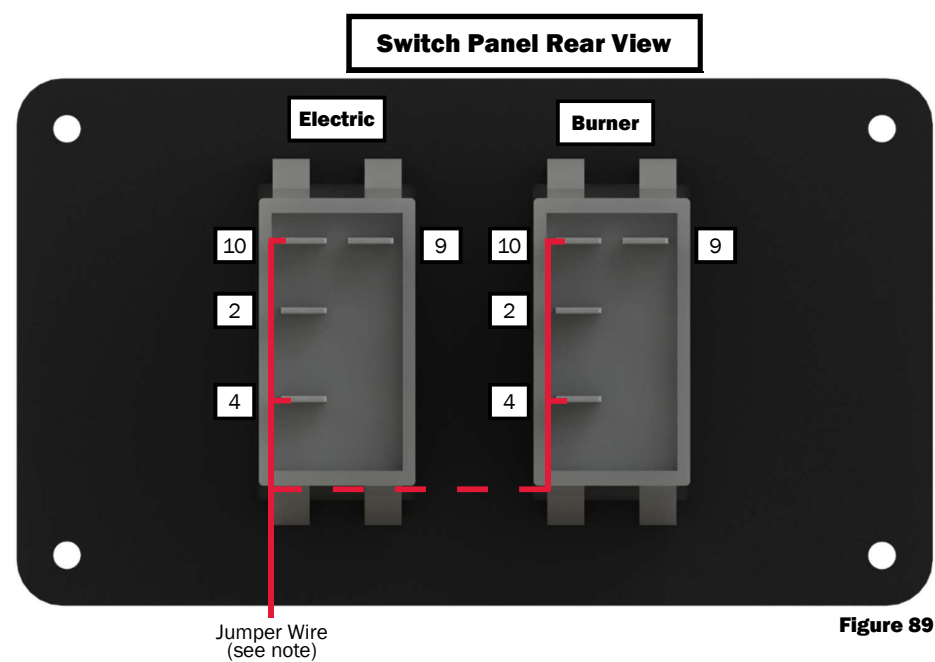


Figure 88

Operational Flow Chart





NOTE: The Burner and Electric Element switches must possess a jumper wire between Pin 4 and Pin 10 as depicted.

Figure 89

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.

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

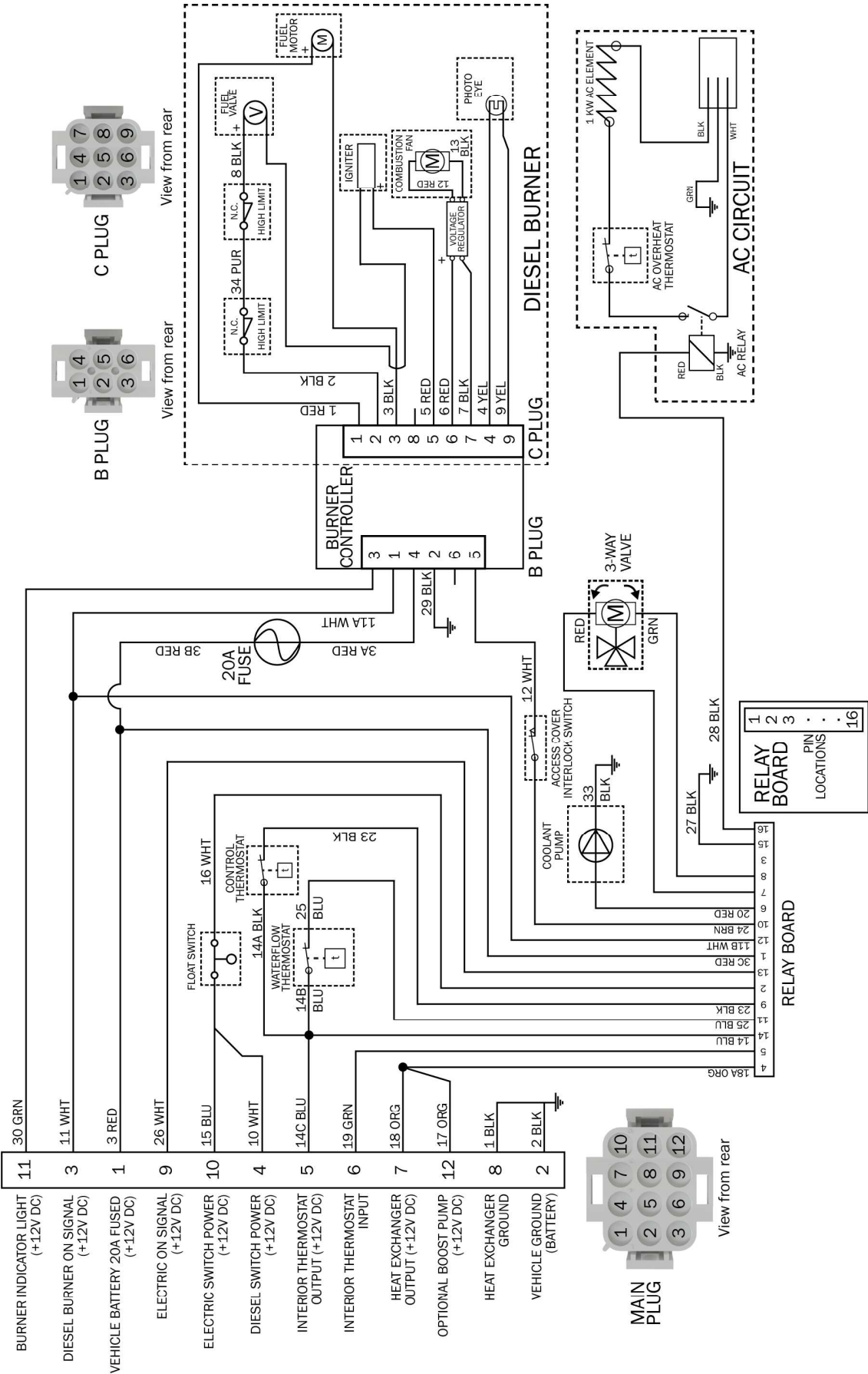


Figure 90

Switch Panel Wiring	
AC Electric Switch	AC Control Switch Plug
Pin 4	Pin 9
Pin 2	Pin 10
Pin 9	Chassis Ground
Burner Switch	8-Pin Harness Plug
Pin 4	Pin 4
Pin 2	Pin 5
Pin 9	Chassis Ground
Pin 10	Pin 11

Pin-Out Information		
Pin	Wire	8-Pin Harness Connection
Pin 1	#3	Vehicle Battery (+)
Pin 2	#2	Vehicle Battery (-)
Pin 3	#11	Burner ON signal
Pin 4	#10	Burner Switch Power
Pin 5	#14C	Thermostat Power Output
Pin 6	#19	Thermostat Power Input
Pin 7	#18	Heat Exchanger Fans (+)
Pin 8	#1	Heat Exchanger Fans (-)
Pin 9	#28	Electric ON Signal
Pin 10	#15	Electric Switch Power
Pin 11	#30	Burner Indicator Light
Pin 12	#17	Optional Boost Pump (not relevant on all coaches)

Receptacle Housing Information		
Manufacturer	Mating Part No.	Description
TE Connectivity	1-480709-0	Mate-N-Lock



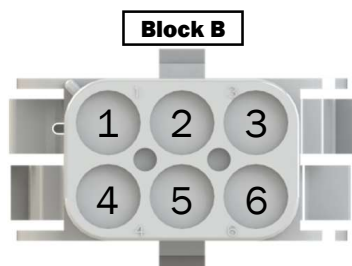
Diesel Burner Controller

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:

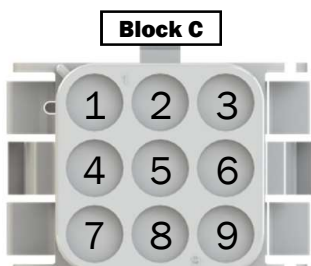
- Fan Validation
- Flame Sensing

Pin-out Information:



Wire insertion view shown

Figure 91



Wire insertion view shown

Figure 92

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 Ground (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)

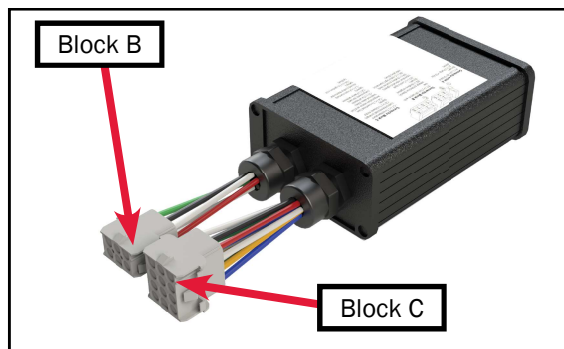


Figure 93

Replacement Indicator:

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

Troubleshooting Procedure:

1. An in-depth troubleshooting flowchart is on the next page. Before beginning this flow chart, ensure that the following conditions have been met:
 - The unit is off
 - The unit is completely cool
 - 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 functional
 - 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, resulting in mis-diagnosis of the Aqua-Hot.

Replacement Procedure:

1. Disconnect the Aqua-Hot from any and all power sources.
2. Using a $\frac{3}{8}$ " socket, remove the two bolts on the left side of the diesel burner securing the burner controller in place:

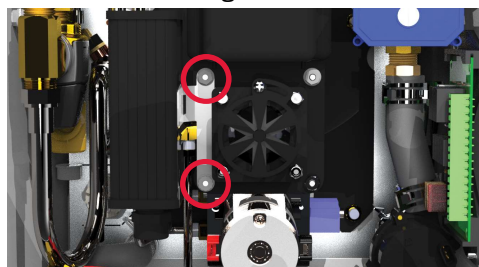
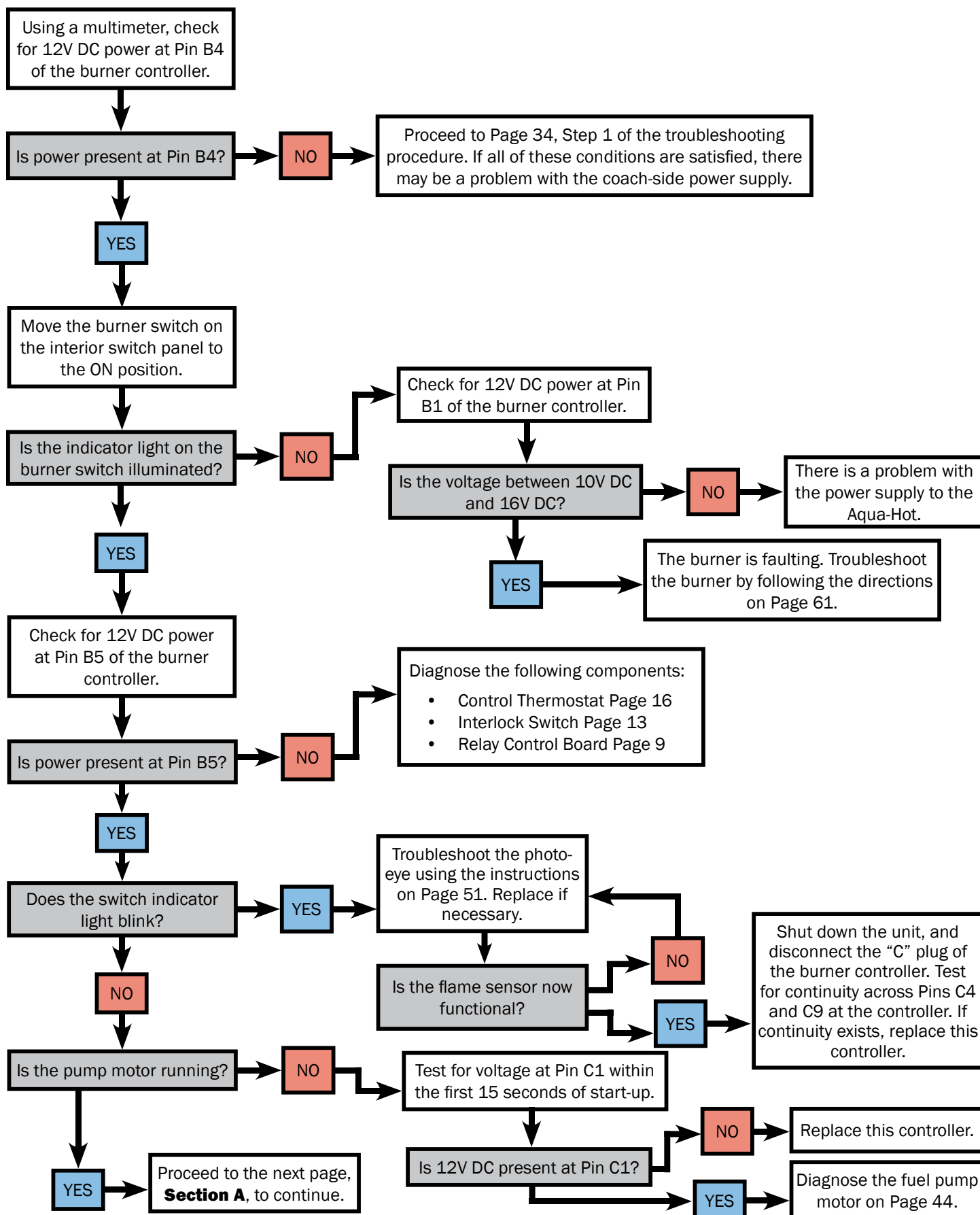
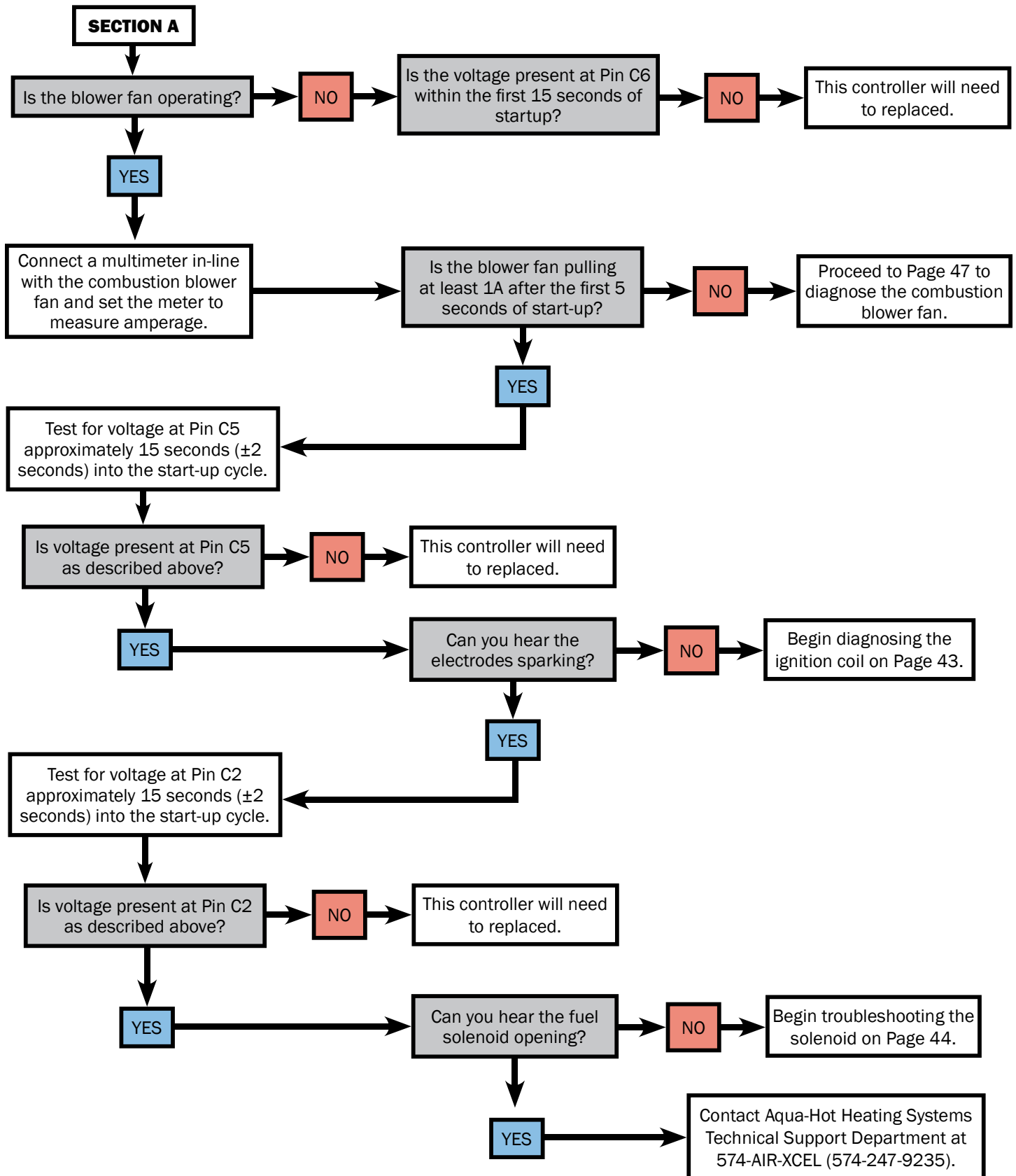


Figure 94

3. Disconnect the two plugs of the diesel burner controller.
4. Set aside the defunct component.
5. Locate the new controller and re-secure the controller with a $\frac{3}{8}$ " socket.
6. Reconnect the two plugs previously removed.
7. Test the unit for normal operation.





Disassembly of the Burner Head Sub-Assembly

Introduction:

The Aqua-Hot diesel burner has been designed to aid in service maintenance by allowing the burner components to be disassembled without the need to completely remove the diesel burner assembly. This will shorten the required time to perform maintenance items or 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 side of the burner.
4. Remove the two nuts securing the burner controller to the side of the burner assembly as shown below with a $\frac{3}{8}$ " socket.

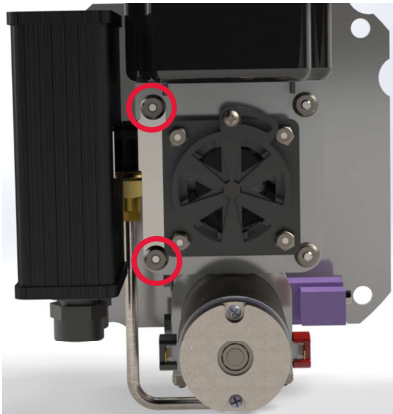


Figure 94

5. Disconnect and set the burner controller aside.
6. Locate the steel fuel line running from the bottom of the burner to the left side.
7. Using a $\frac{7}{16}$ " wrench, loosen and remove the **lower** fuel fitting from the side of the burner:

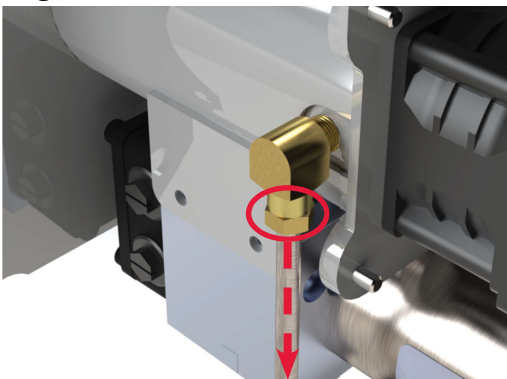


Figure 95

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.

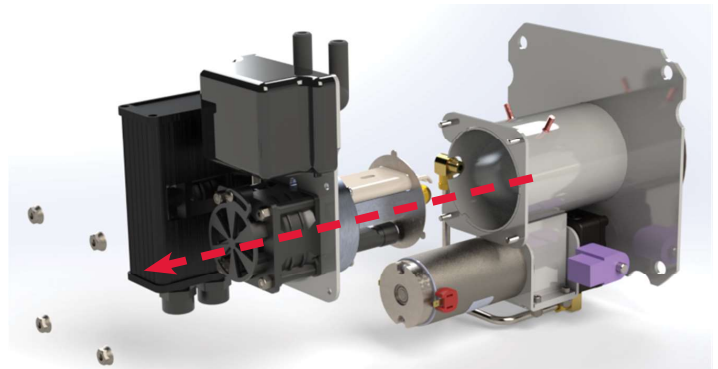


Figure 96

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

Reassembly of the Burner Head Sub-Assembly

Introduction:

The following instructions will aid in reassembling the previously removed diesel burner sub-assembly.

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 $\frac{3}{8}$ " socket.
5. Using a $\frac{7}{16}$ " 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 of the diesel burner controller to the wiring harness present within the Aqua-Hot.

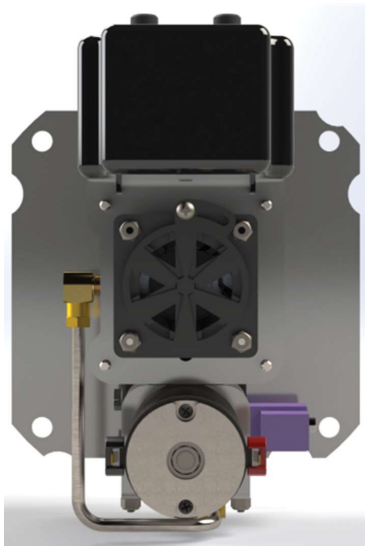


Figure 97

7. Slide the diesel burner controller back into its position on the left side of the igniter coil flange.
8. Using a $\frac{3}{8}$ " 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.

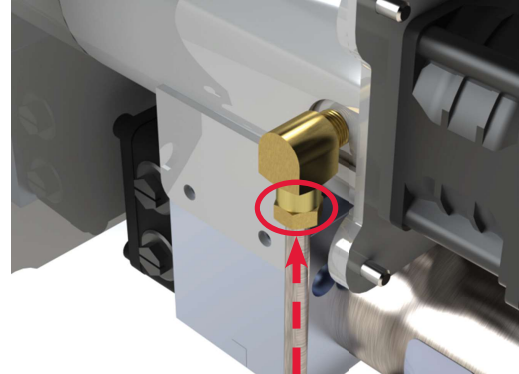


Figure 98

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

Detaching the Diesel Burner

Introduction:

This section details how to safely remove and reinstall 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 of 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 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 $\frac{3}{8}$ " socket, remove the two nuts securing the diesel burner controller to the burner assembly as shown below:

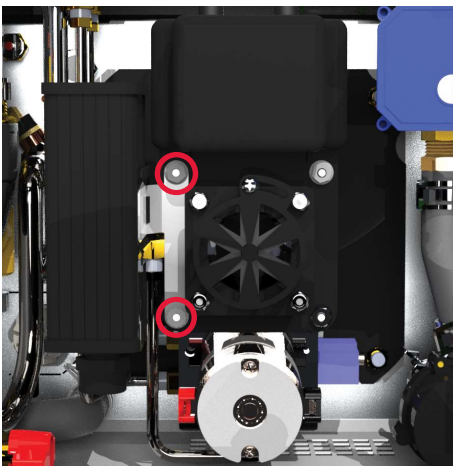


Figure 99

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.
7. Disconnect the diesel fuel line fittings using a $\frac{7}{16}$ " wrench.

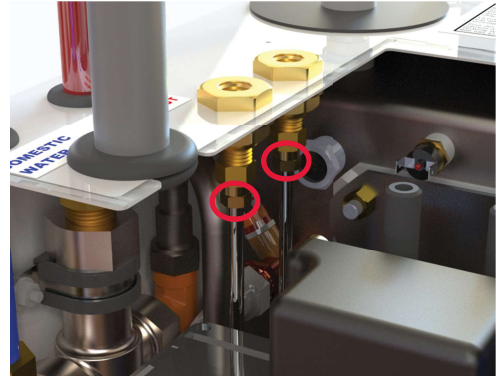


Figure 100

8. Locate the blower fan buck boost module and remove it from the hook and loop tape on the cabinet wall.

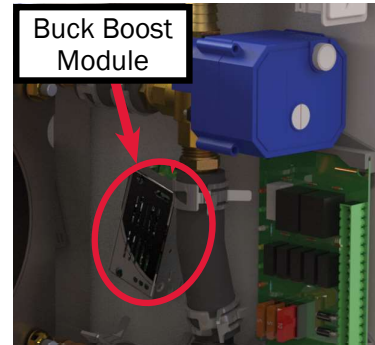


Figure 101

9. Using a $\frac{1}{2}$ " 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.

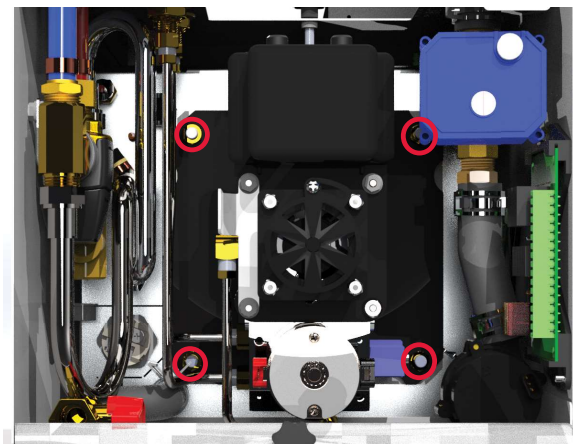


Figure 102

10. 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.
11. There are two studs located on top of 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. See below.

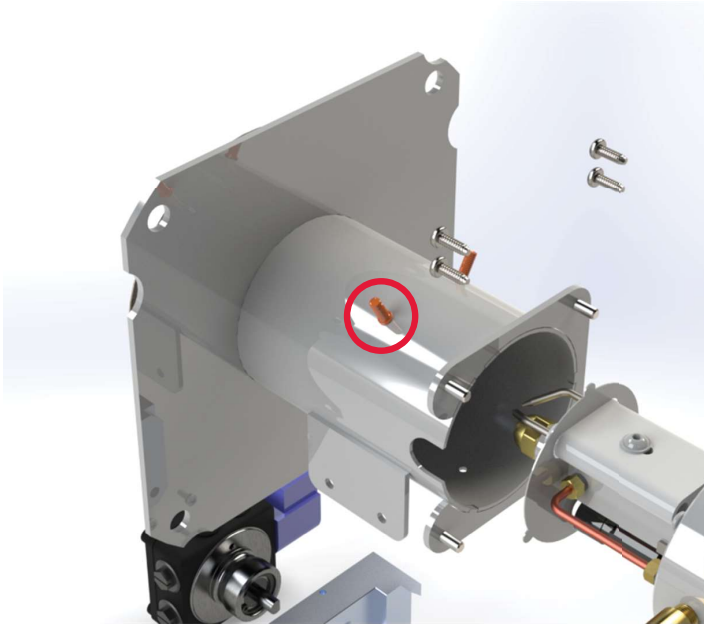


Figure 103

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

Reattaching the Diesel Burner

Procedure:

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 $\frac{1}{2}$ " 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. See below.

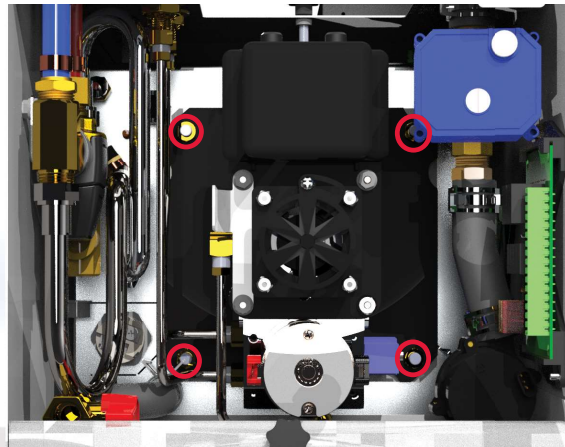


Figure 104

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

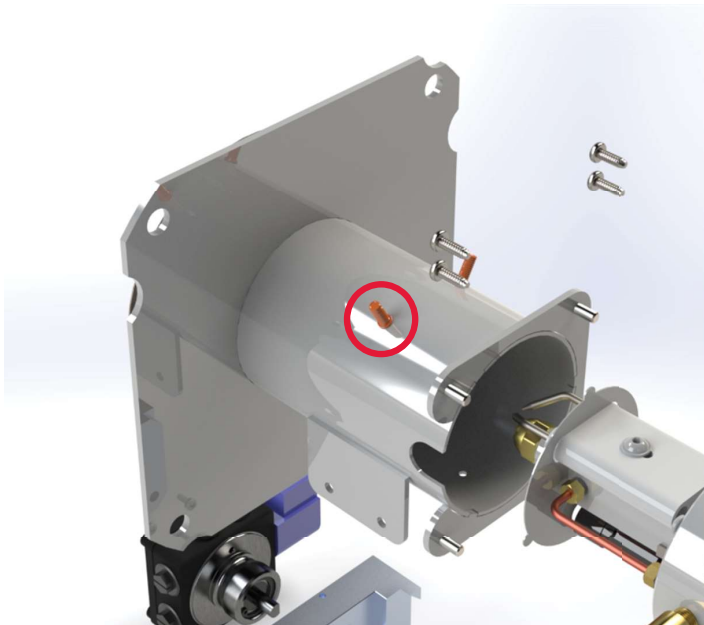


Figure 105

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 $\frac{7}{16}$ " wrench. See the image below. It may be necessary to use two wrenches to avoid damage to the rest of the fitting assembly.

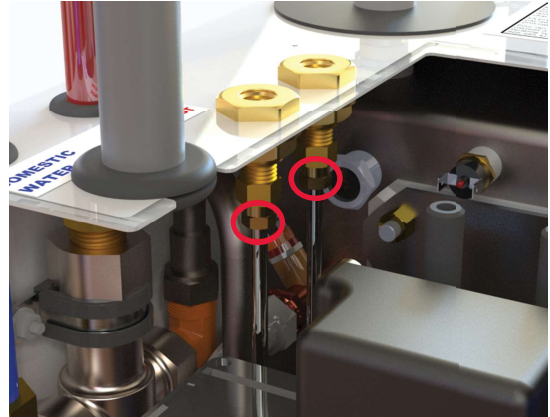


Figure 106

7. Reconnect the diesel burner controller plugs.
8. Using a $\frac{3}{8}$ " socket, reinstall the diesel burner controller onto its mounting studs indicated below.

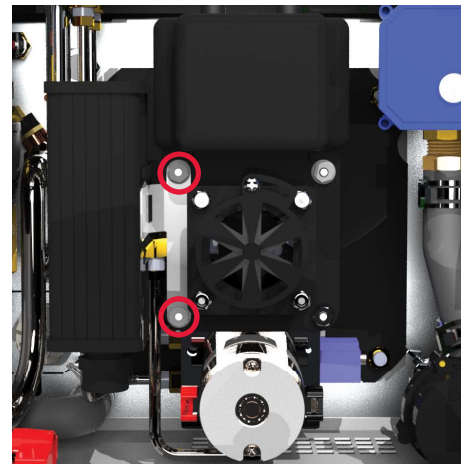


Figure 107

9. Reinstall 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.

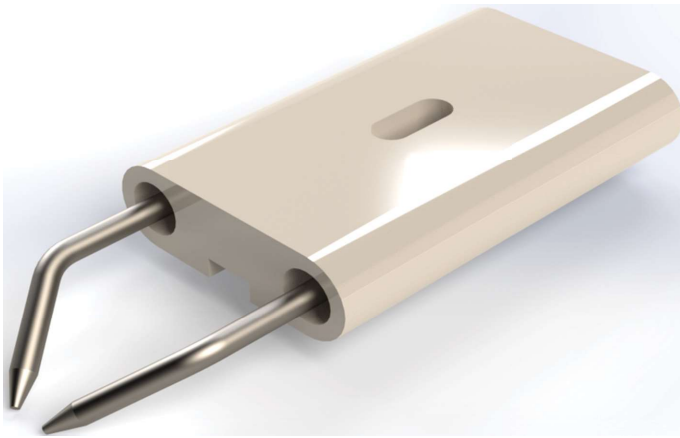


Figure 108

Replacement Procedure:

1. Follow the directions on Page 39 to remove the diesel burner head from the Aqua-Hot.
2. Using a $\frac{1}{8}$ " Hex or Allen wrench, remove the bolt securing the igniter assembly to the top of the fuel tower as shown below.

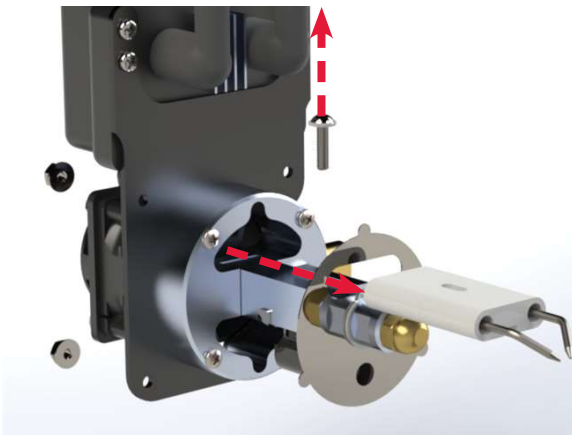


Figure 109

3. Once the bolt has been removed, disconnect the wires from the back of the igniter.

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 on top of the fuel tower.
7. Reconnect the wires to the back of the igniter.
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. See below.

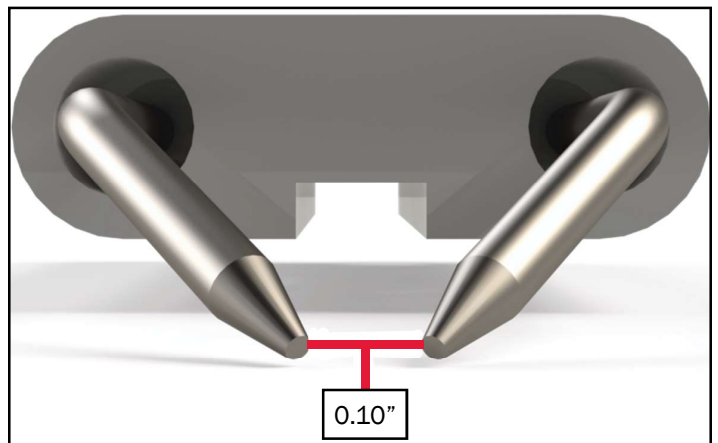


Figure 110

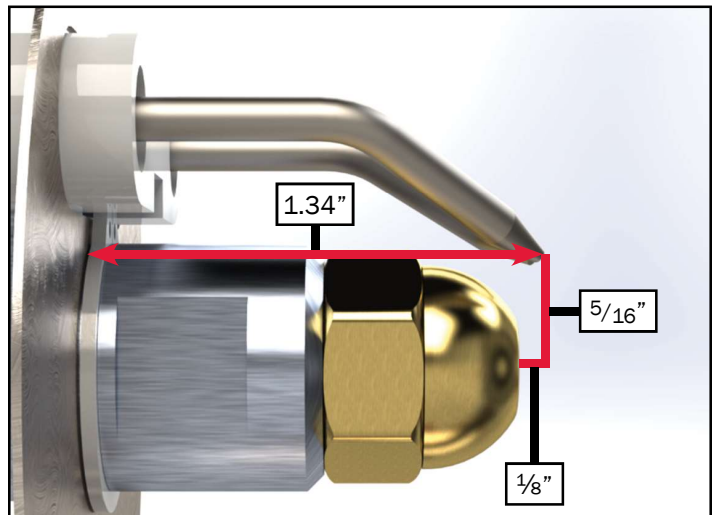


Figure 111

9. Using a $\frac{1}{8}$ " Allen wrench, reattach the previously removed bolt and washer which secures the igniter module.
10. Follow the instructions on Page 38 to reinsert 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 to ignite the diesel fuel cone within the Aqua-Hot's combustion chamber.



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.

Troubleshooting Procedure:

1. Move the burner switch on the interior switch panel to the OFF position.
2. Remove the access cover of the Aqua-Hot.
3. Follow the directions on Page 39 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.
6. Remove and reapply 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 Phillips screwdriver, remove the four screws securing the igniter coil to the igniter coil flange.

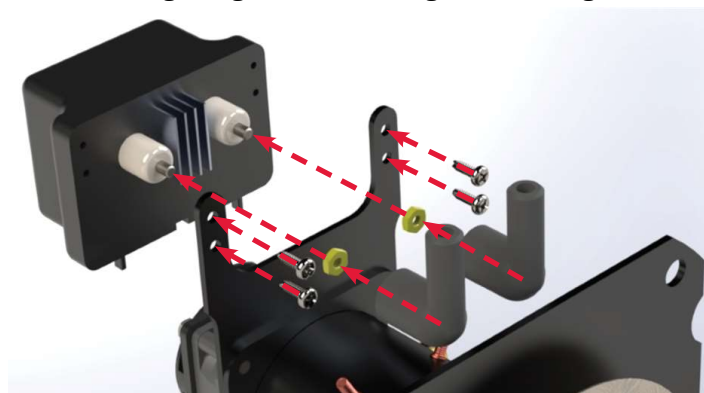


Figure 112

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 Phillips 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 to ensure a controlled burn. This is done 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 Indicator:

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 and/or 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

Fuel Motor Troubleshooting Procedure:

1. Move the diesel burner switch on the interior panel to the OFF position.
2. Locate the 20A in-line fuse, and if necessary, replace it.
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 as shown below.

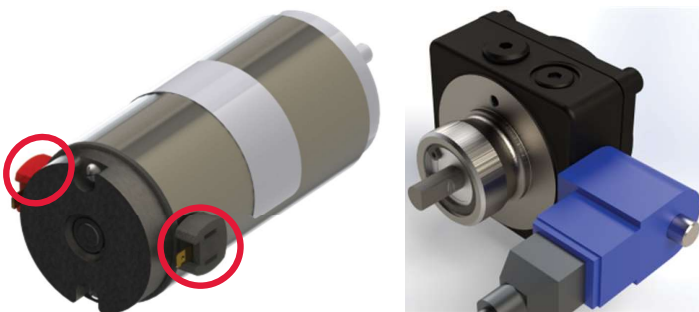


Figure 113

5. If the motor meets any of the above replacement indicators, it will need to be replaced.

Fuel Pump Troubleshooting Procedure:

1. Follow the instructions on Page 39 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 that are loosened by this action.

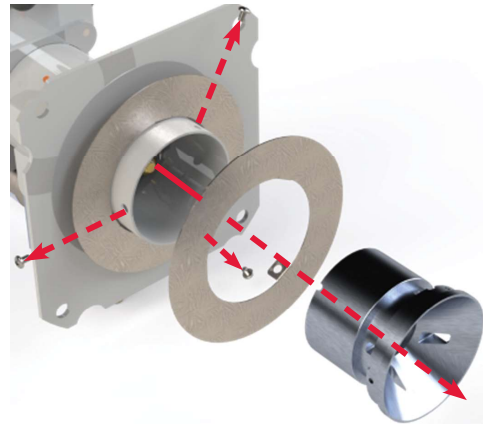


Figure 114

3. Follow the directions on Page 37 to remove the diesel burner head.
4. Using a $\frac{7}{16}$ " 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. Reinstall the diesel burner head into the main diesel burner assembly using the instructions on Page 38.
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 the technical support at +1 (800) 685-4298.
10. Remove the 12V DC power from the fuel pump motor.
11. Disconnect the burner from its independent fuel source.
12. Using two $\frac{7}{16}$ " wrenches, remove the fuel pressure gauge while using the second wrench as a backing wrench.
13. Reinstall the fuel nozzle of the Aqua-Hot.
14. Follow the directions on Page 41 to reattach the diesel burner to the Aqua-Hot.
15. Follow the directions on Page 38 to reinstall the diesel burner head.
16. Test the unit for normal operation.

Diesel Fuel Motor Replacement

Replacement Procedure:

1. Move the diesel burner switch on the interior panel to the OFF position. Shut off or disconnect any fuel and electric sources connected to the Aqua-Hot.
2. Remove the access cover of the Aqua-Hot.
3. Follow the directions on Page 39 to remove the diesel burner head.
4. Locate the steel fuel line running from the bottom of the burner to the left side. Loosen the nut on the fitting on the left by using a $\frac{7}{16}$ " wrench, loosen and remove the nut:

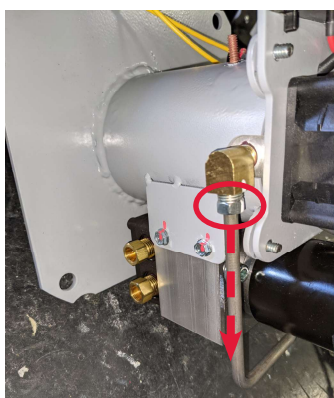
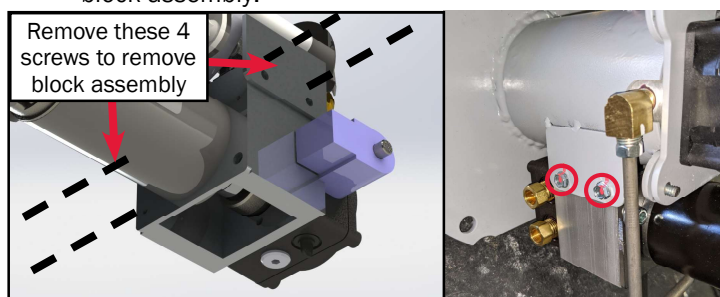


Figure 115

5. Remove the four screws as shown below to remove the block assembly:



Remove block assembly

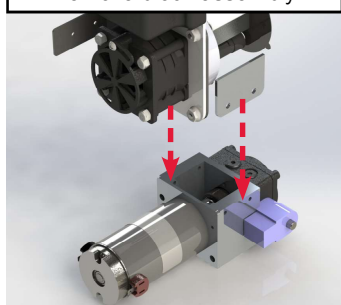


Figure 116

6. Loosen coupler set screw close to the motor as shown in Figure 117. Then rotate 45° to loosen the set screw on the bottom of the coupler.

Loosen the coupler set screw (circled below), then rotate 45° to loosen set screw below coupler.

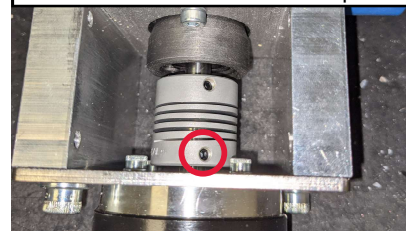
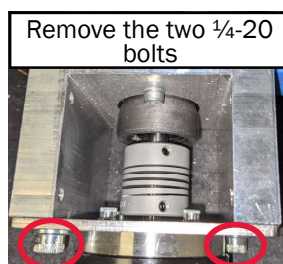


Figure 117

7. Remove the two $\frac{1}{4}$ -20 bolts and separate the flange from the block.



Remove the two $\frac{1}{4}$ -20 bolts

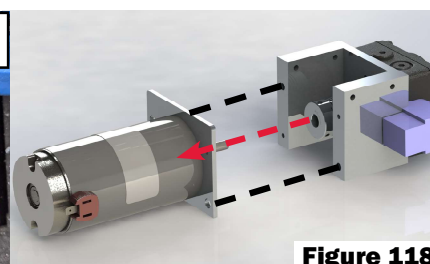


Figure 118

- Remove the motor from the flange by removing the four #6 screws.

Remove the four #6 screws to remove motor from flange

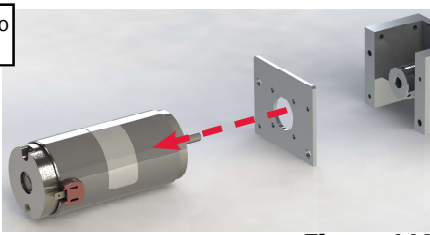


Figure 119

8. Replace the non-functional motor.
 - Center the motor on the flange and tighten the #6 screws to 9in-lbs.
9. Place the flange to the block with the two $\frac{1}{4}$ -20 bolts.
10. Tighten the set screws on the coupler at **6in-lbs**. Ensure 1 set screw is positioned over the flat on the motor shaft. DO NOT OVER-TIGHTEN.
11. Tighten the four screws for the block assembly to the bottom of the burner.
12. Using a $\frac{7}{16}$ " wrench, place and tighten the nut on the fuel fitting to reinstall the fuel line as shown in Figure 115.
13. Follow the directions on Page 41 to reattach the diesel burner head.
14. Reinstall the access cover and test for normal operation.

Diesel Fuel Pump Replacement

Replacement Procedure:

1. Move the diesel burner switch on the interior panel to the OFF position. Shut off or disconnect any fuel and electric sources connected to the Aqua-Hot.
2. Remove the access cover of the Aqua-Hot.
3. Follow the directions on Page 39 to remove the diesel burner head.
4. Locate the steel fuel line running from the bottom of the burner to the left side. Loosen the nut on the fitting on the left by using a $\frac{7}{16}$ " wrench, loosen and remove the nut. Remove the lower fuel fitting from the pump as well.

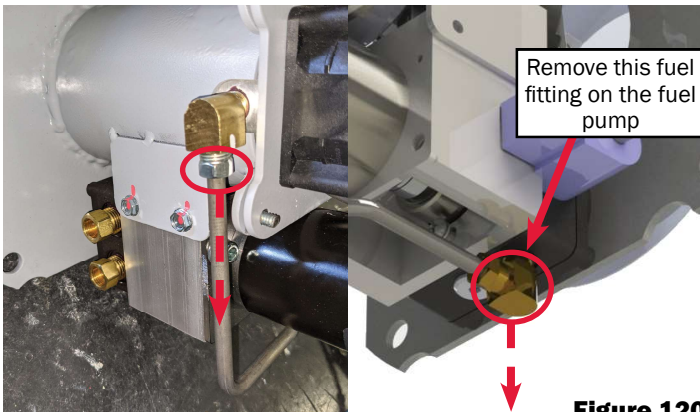


Figure 120

5. Remove the entire fuel motor and pump assembly from the bottom of the burner.
 - Remove the four screws as shown below to remove the block assembly:

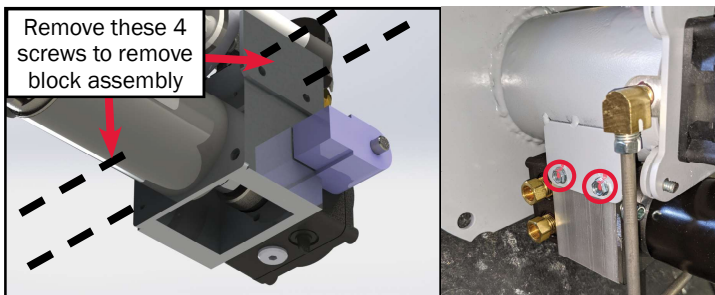


Figure 121

6. Loosen set screws close to the pump as shown below and rotate the coupler 45° to loosen the set screw below the coupler:



Figure 122

7. Remove the two $\frac{1}{4}$ -20 bolts and separate the flange from the block as shown below:

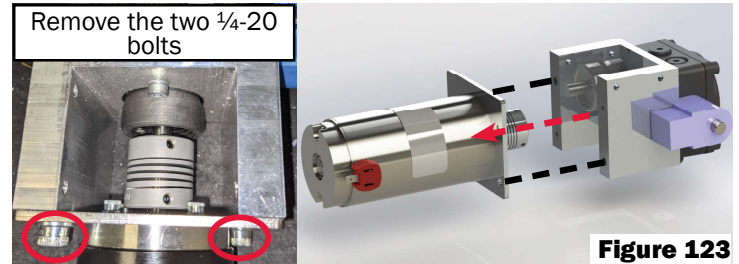


Figure 123

8. Remove the two M4 screws:

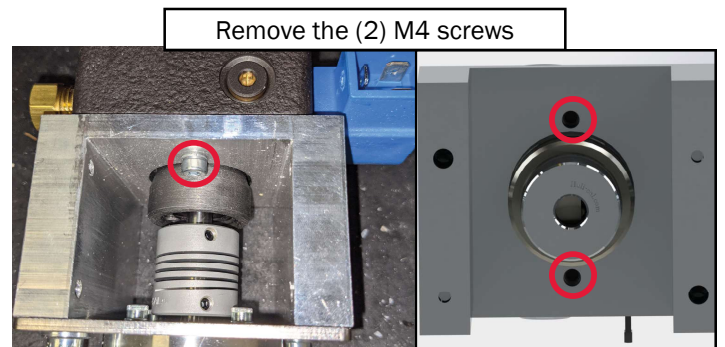


Figure 124

9. Remove the pump from the block and replace.

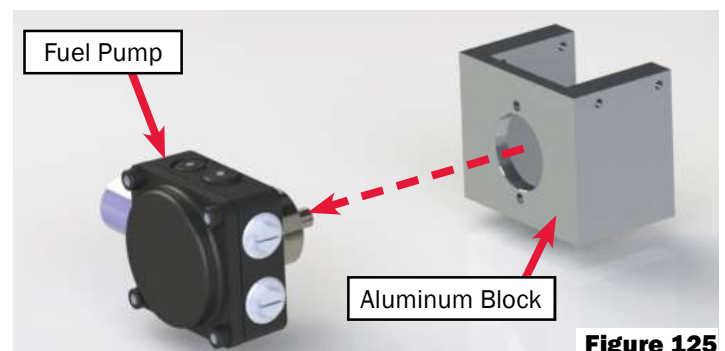


Figure 125

10. Secure the replacement pump in place with the two M4 screws.
11. Place the motor and flange to the block with the two $\frac{1}{4}$ -20 bolts.
12. Tighten the set screws on the coupler at **6in-lbs**. Ensure 1 set screw is positioned over the flat on the pump. **DO NOT OVER-TIGHTEN**.
13. Tighten the four screws for the block assembly to the bottom of the burner.
14. Using a $\frac{7}{16}$ " wrench, place and tighten the nut on the fuel fitting to reinstall the fuel line as shown in Figure 120.
15. Follow the directions on Page 41 to reattach the diesel burner head.
16. Reinstall the access cover and test 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 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 procedure listed below.

Troubleshooting Procedure:

1. Verify the following before troubleshooting the blower fan:
 - 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 on the relay board are functional
 - The in-line 20A fuse has not been burned out
2. Turn the burner switch 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 Step 4.
 - 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 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 on the interior panel to the OFF position.
2. Disconnect the blower fan and the diesel air shutter from the diesel burner assembly using an $\frac{11}{32}$ " wrench or socket to remove the four corner nuts as shown below:

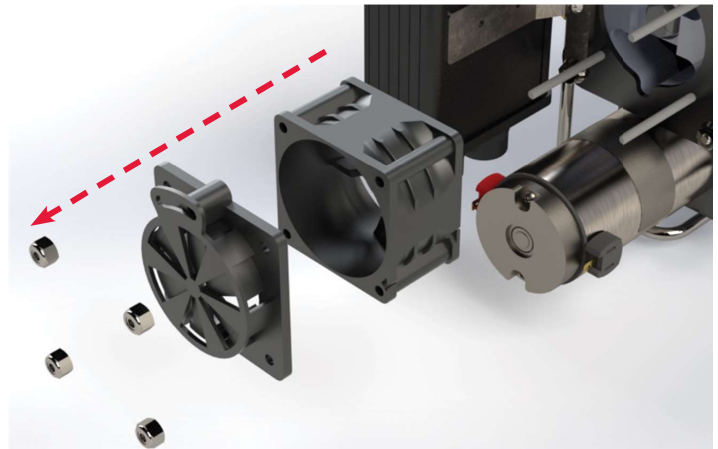


Figure 126

3. Set aside the air shutter to be reattached later.
4. Replace the non-functional fan by sliding the fan and air shutter over the mounting studs of the diesel burner assembly with arrows oriented correctly as shown below.

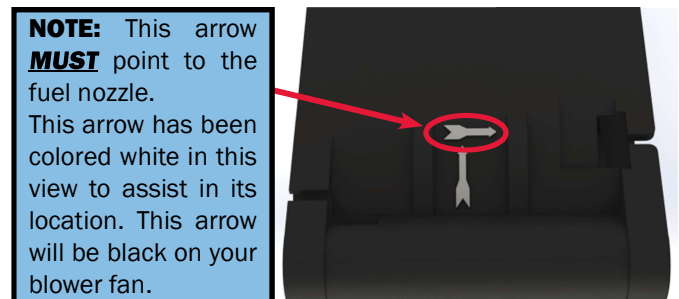


Figure 127

5. Re-secure the shutter and blower fan with the previously removed $\frac{11}{32}$ " nuts to a torque spec of 6in-lbs.
6. Reconnect the combustion blower fan to the buck boost module.
7. Test the unit for normal operation.

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.

Diesel Air Shutter Adjustment

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 Phillips screwdriver, loosen, but do not remove the adjustment screw located at the top of the air shutter.

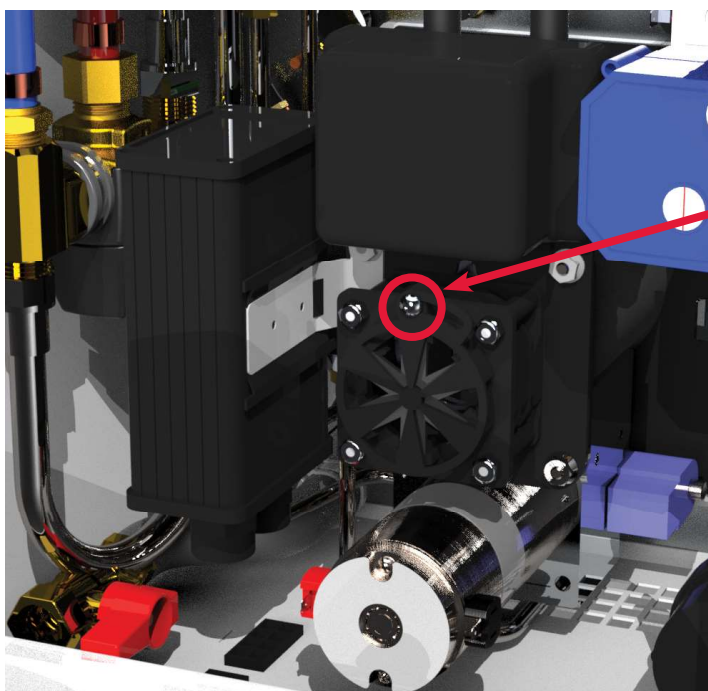


Figure 128

3. The diesel air shutter will now rotate from left to right. See Figure 129.
4. The diesel air shutter should be completely open as shown in Figure 129.
5. Once the air shutter has been correctly set, tighten the Phillips screw until the shutter no longer rotates.

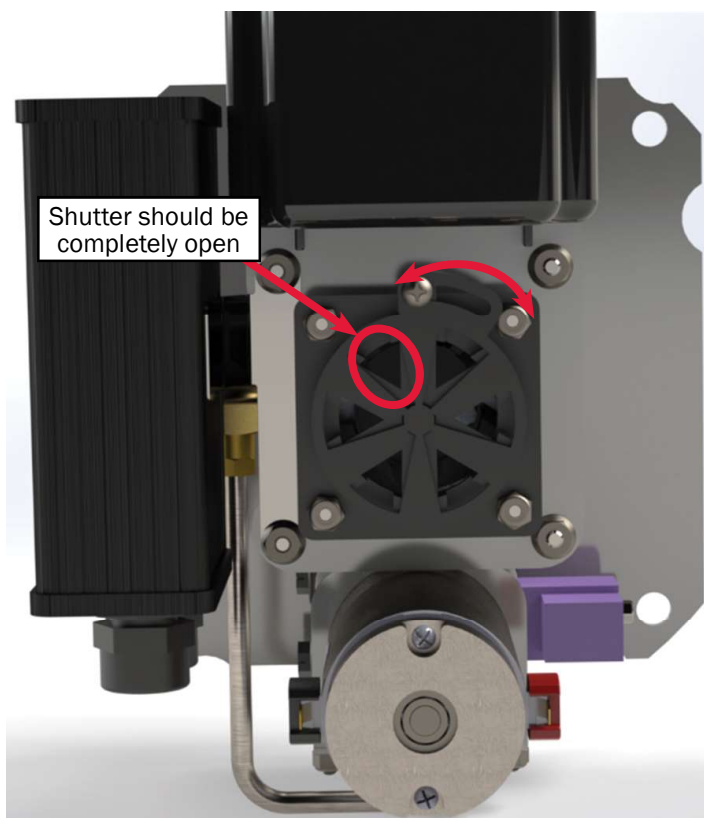


Figure 129

Buck Boost Converter - Combustion Blower Fan

Function:

The purpose of the buck boost converter is to maintain a present 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: 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 Procedure:

1. Turn the burner switch on the interior switch panel to the ON position.
2. Verify the following before troubleshooting the blower fan:
 - The control thermostat is calling for heat
 - The interlock switch is depressed
 - The overflow bottle is adequately filled
 - There is 12V DC supplied to the burner controller on Pin B4
 - 12V DC power is present at the B1 and B5 Pins of the burner controller
 - The fuses on the relay board are functional
 - The in-line 20A fuse has not been burned out
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 when the supply voltage is between 11V DC and 15V DC, the buck boost will need to be replaced.



Figure 130

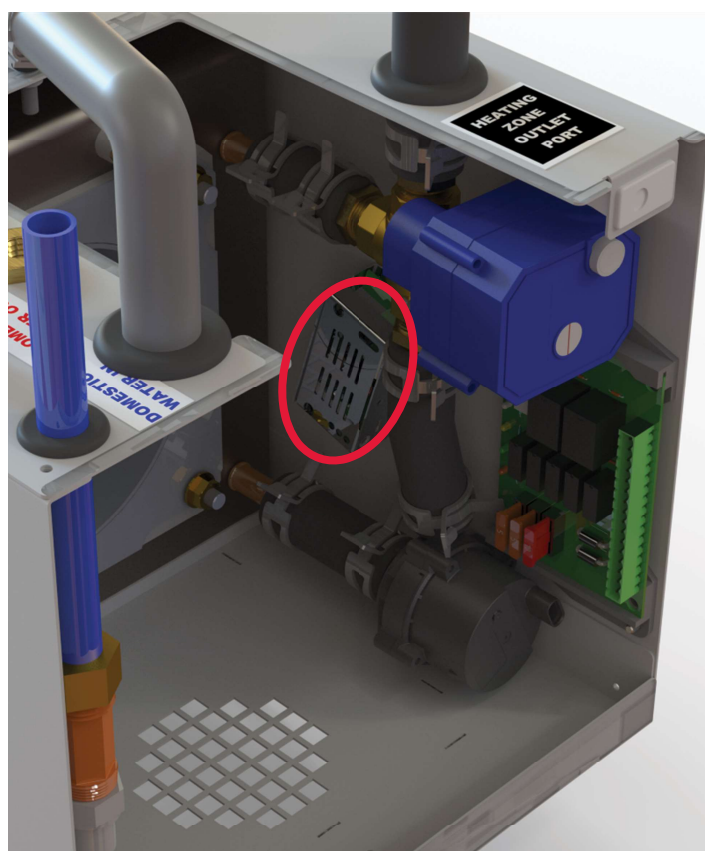


Figure 131

Replacing the Buck Boost Module

If it has been determined that the buck boost module must be replaced, follow the instructions below 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 be first set to the correct output voltage.
2. Locate the new buck boost and a multimeter. Set the meter to measure for voltage.
3. Connect the meter to the buck boost output pins labeled "OUT" on the module.
4. Connect the input pins of the buck boost to a 12V DC power source at the pins labeled "IN". Activate the power source.
5. Locate the calibration dial of the module and adjust it to the right until the voltage on the meter reads 13.5V 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 and all power sources.
9. Locate the buck boost module 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 screwdriver, loosen the four terminal screws found at both ends of the buck boost module as shown in Figure 133.
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 labeled "IN" and "OUT".
 - Connect the Aqua-Hot wiring harness wire #6 to "IN (+)" and wire #7 to "IN (-)" on 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.

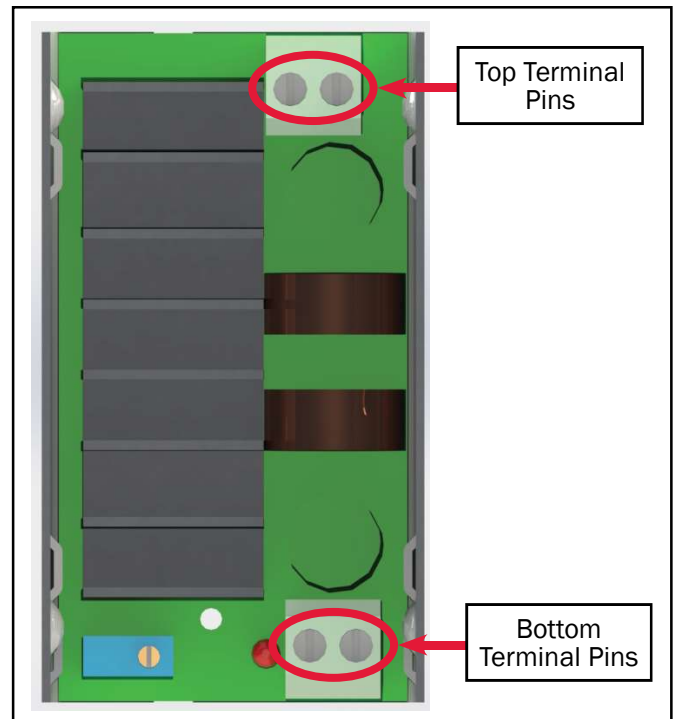


Figure 132

NOTE: The buck boost module above is shown without the front enclosure to better explain the terminal pin locations.

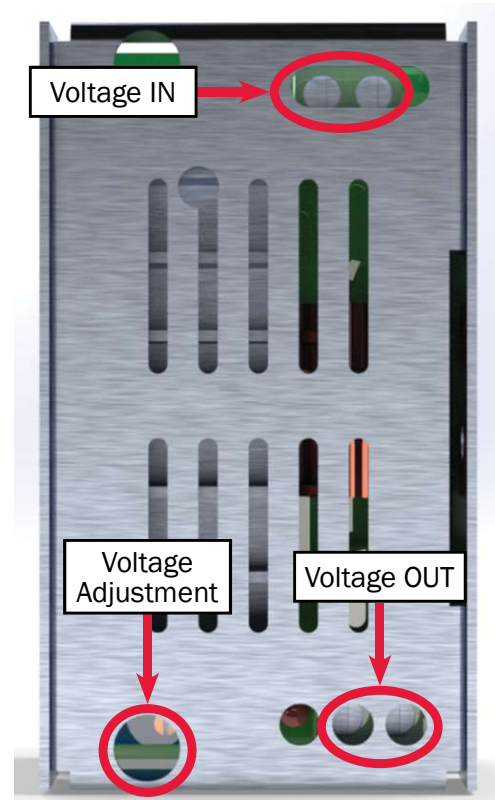


Figure 133

Photo-Eye

Function:

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

Replacement Indicator:

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



Figure 134

NOTE: The Photo-disc has been removed in the view above to aid in the location of the photo-eye.

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 39 to remove the diesel burner head sub-assembly. 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 37.
3. Using a multimeter, 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.

Troubleshooting Procedure:

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 37 to remove the burner head sub-assembly.
2. Using a ¼" wrench or socket, remove the four corner bolts securing the blower fan to the igniter flange. It may be necessary to use a Phillips screwdriver to back the bolt.
3. Using a 5/32" Allen wrench, remove the bolt that secures the photo-eye in place as shown below.

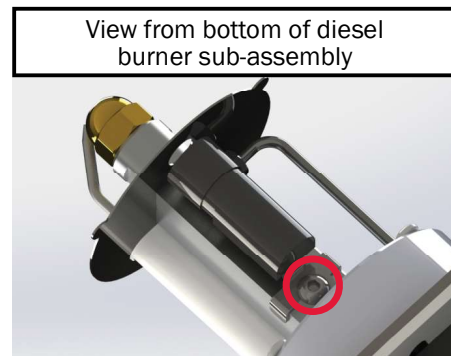


Figure 135

4. Remove the defective photo-cell from the rest of the photo-eye assembly as shown below.

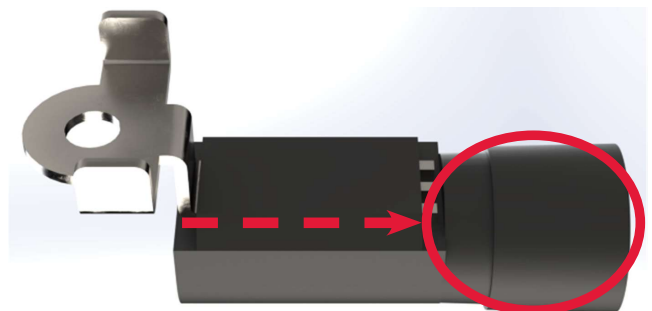


Figure 136

5. Remove the mounting flange from the defective photo-eye by using a small screwdriver to depress the middle tab:



Figure 137

6. Slide the defective photo-eye off of the mounting bracket.
7. Discard the defunct photo-eye.
8. Position and secure the new photo-eye on the mounting bracket.
9. Using a small screwdriver, 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 $\frac{5}{32}$ " Allen wrench, secure the photo-eye to the fuel tower on the burner head sub-assembly as shown below:

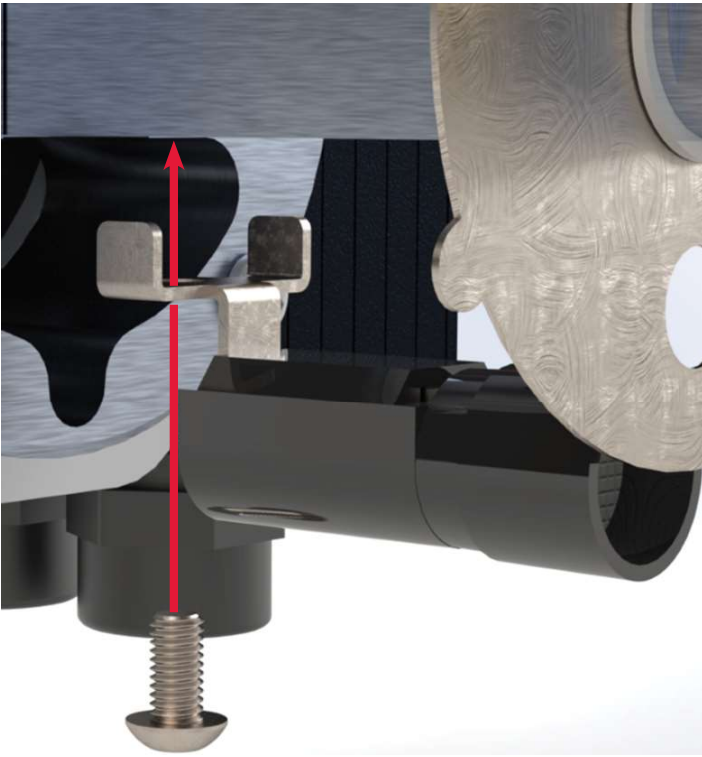


Figure 138

12. Feed the wires of the new photo-eye through the fuel tower base as they were initially removed.
13. Using a $\frac{1}{4}$ " wrench or socket, re-secure the blower fan and the air shutter in place.
14. Follow the instructions on Page 38 to reinstall 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 that services 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 below.

Procedure:

1. Follow the directions on Page 39 to remove the diesel burner head from the Aqua-Hot.
2. Using a $\frac{1}{8}$ " Hex or Allen wrench, remove the bolt securing the igniter assembly to the top of the fuel tower - see Figure 139.
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 in Figure 139.
4. Using a $\frac{5}{8}$ " socket and a $\frac{5}{8}$ " backing wrench, carefully remove the old diesel fuel nozzle from the fuel tower.
5. Replace the old diesel fuel nozzle and tighten to 130 in/lbs of torque. Make sure to use the backing wrench and take care to not exceed this rating, as doing so may damage the fuel nozzle.
6. 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 build-up from the air swirler and/or the combustion chamber.

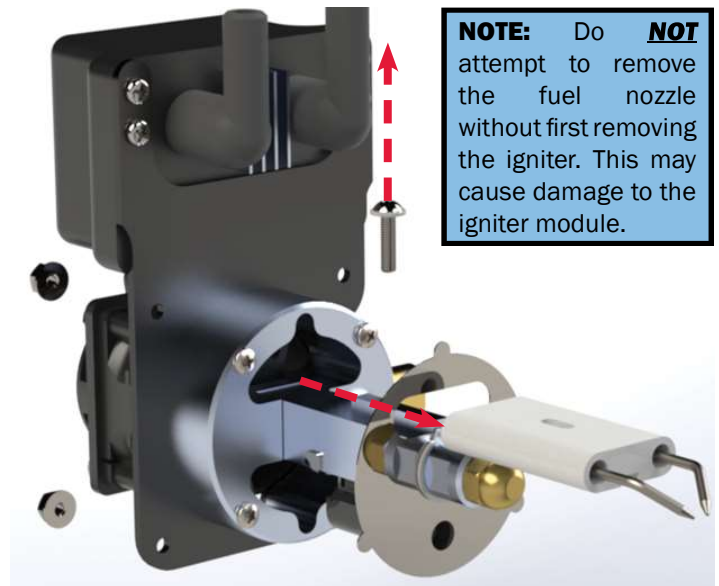


Figure 139

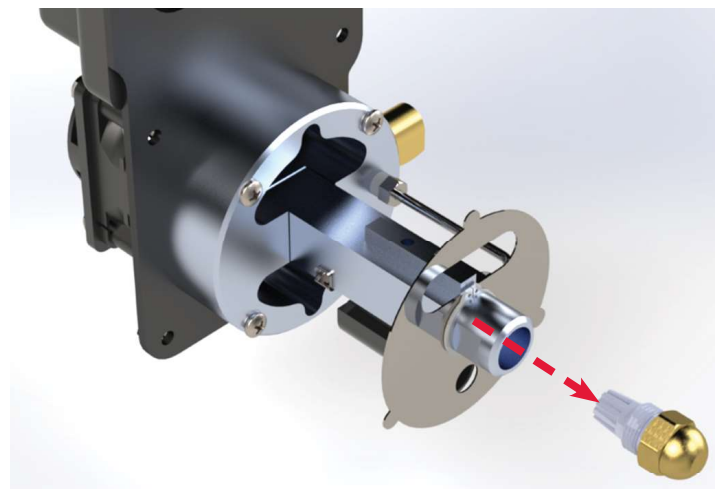


Figure 140

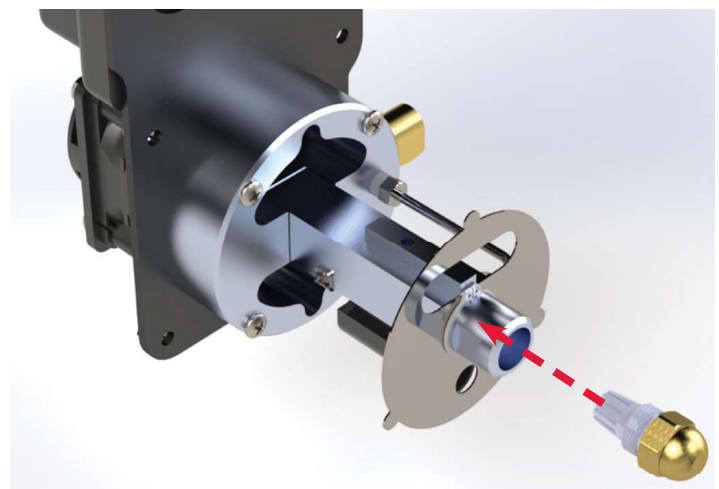


Figure 141

Re-Assembly After Completing the Diesel Annual Service

Procedure:

1. Slide the igniter back into its slot located on top the diesel fuel tower until the distance between the face of the fuel nozzle is $\frac{1}{8}$ " and the igniter tips are $\frac{5}{16}$ " from the center of the fuel nozzle. Reference Figure 142.
2. Using a $\frac{1}{8}$ " Hex or Allen wrench, secure the previously removed bolt in place without damaging the ceramic casing of the igniter. Reference Figure 143 to properly position the igniter in place.
3. Follow the directions on Page 41 to reinstall the diesel burner head.
4. Test the unit for normal operation.

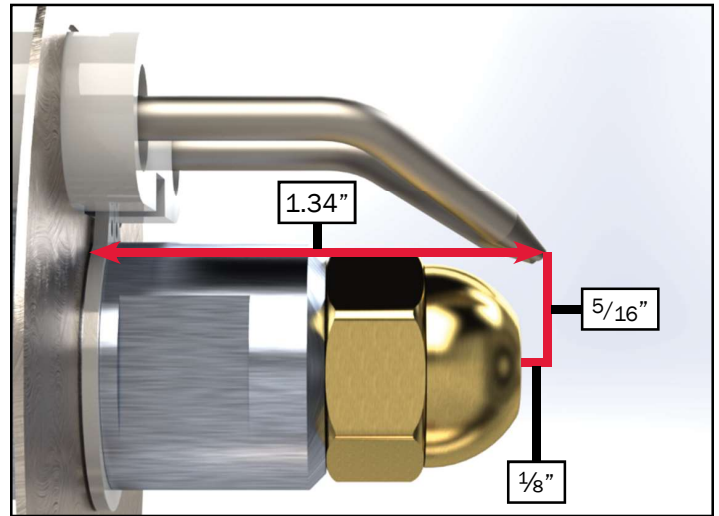


Figure 142

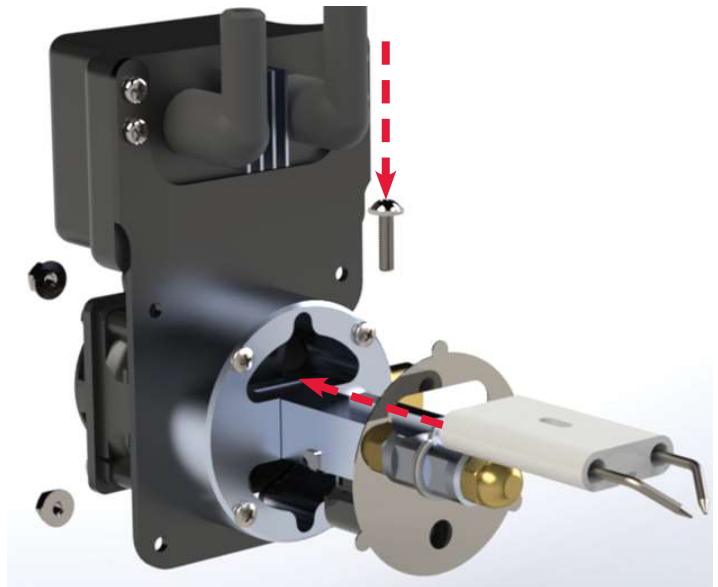


Figure 143

Filling and Purging the Aqua-Hot 250D

Outlined below is the procedure for filling the Aqua-Hot with a 50/50 solution of propylene glycol and distilled water. Follow the directions below to fill and purge the Aqua-Hot.

A 50/50 mixture of “GRAS” (Generally Recognized as Safe) approved **propylene glycol** antifreeze and distilled or de-ionized water is recommended. The mixture may be modified to provide the most adequate freezing, boiling, and rust/anti-corrosive protection. Reference pages 62-63 for more information about antifreeze.

Procedure:

1. Locate the fill valve at the zone port outlet (Figure 145).
2. Make a ½” NPT connection from the propylene glycol source to the fill valve.
3. Remove the access cover and locate the 3-way valve in the Aqua-Hot. Ensure that the sight glass is oriented as shown below. Reference Page 5, Figure 3 (Item #3) for the 3-Way Valve location.

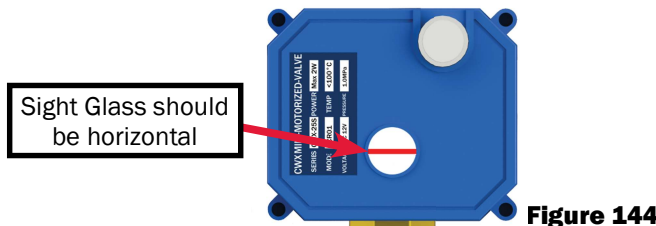


Figure 144

NOTE: If the sight glass is not oriented in this way while the unit is cold, apply power to the main harness connection and the valve will return to horizontal.

4. Activate the fluid transfer pump and begin filling the Aqua-Hot through the fill valve.
5. When the fluid level reaches the cold mark on the expansion bottle, deactivate the fluid pump.
6. Close the fill valve and disconnect the pump.
7. Reattach the access cover.
8. Turn on the burner at the interior control panel and set the thermostat to its maximum temperature to allow for interior heating. Let the Aqua-Hot run for at least 20 minutes to ensure that any air in the heating loop has been purged. If necessary, top off the propylene glycol solution at the fluid expansion bottle.

WARNING

Only Propylene Glycol based “boiler” antifreeze deemed “GRAS” by the FDA shall be used in the Aqua-Hot’s hydronic heating system, Failure to use approved antifreeze could cause serious injury or death.

CAUTION

Ensure that the expansion tube is connected to both the expansion bottle and to the Aqua-Hot. Also ensure that the overflow hose is connected to the top port on the expansion bottle and is allowed to flow out of the coach through the floor of the bay as shown below.

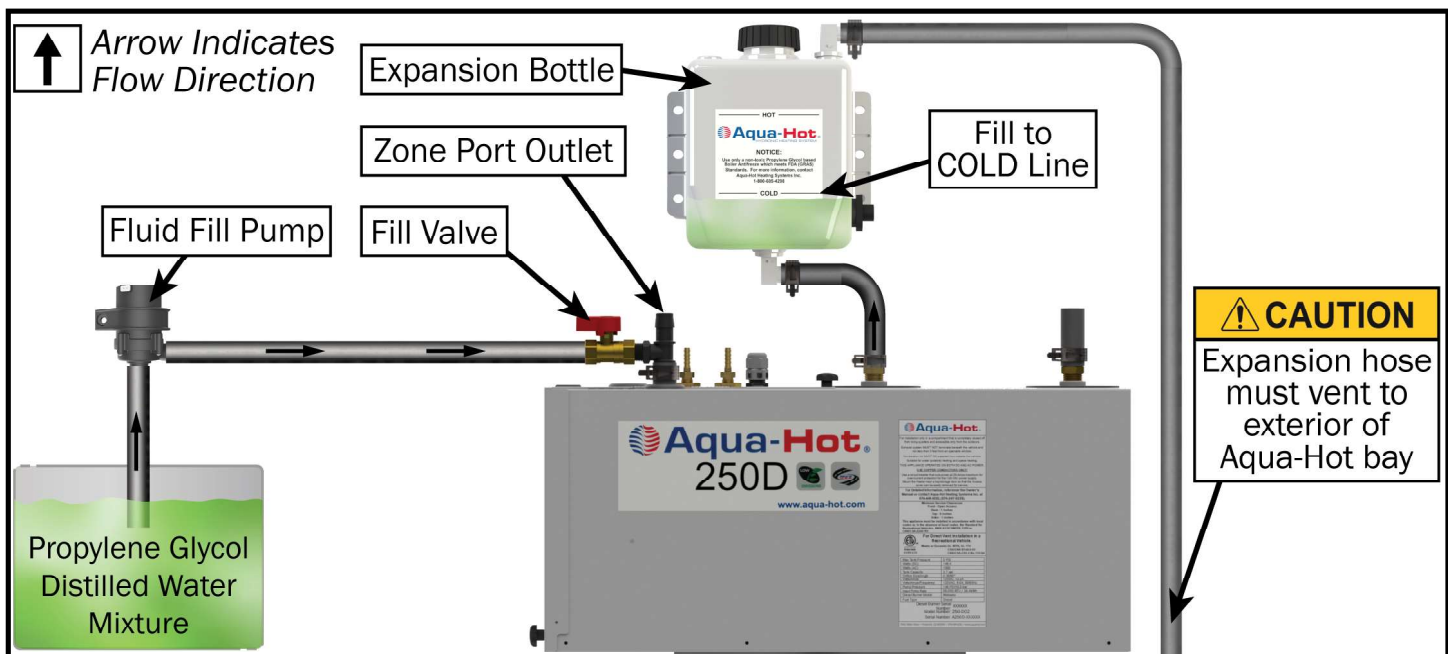


Figure 145

Winterizing the Aqua-Hot

The Aqua-Hot's domestic water heating system must be completely drained of domestic water at any time the heater is stored where freezing temperatures may be experienced.

Please follow these instructions when winterizing the Aqua-Hot domestic water heating system. Reference Figure 146 for a system overview and pages 62 and 63 for selecting the appropriate winterization antifreeze.

NOTE: The Aqua-Hot can continue to be used for interior heat once the domestic hot water system has been winterized.

1. Disconnect or shut off any external sources of freshwater.
2. Open all faucets, shower heads, and similar. Open both the "HOT" and "COLD" valves on the faucet, if applicable.
 - If only one valve, open it to the "halfway point".
3. Ensure that the coach is connected to a waste collection point, such as a grey water tank.
4. Attach an external fluid pump to your fresh water connection.
5. Ensure that the fill pump intake hose is situated in a large enough supply of "GRAS" winterization antifreeze so 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 in 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.

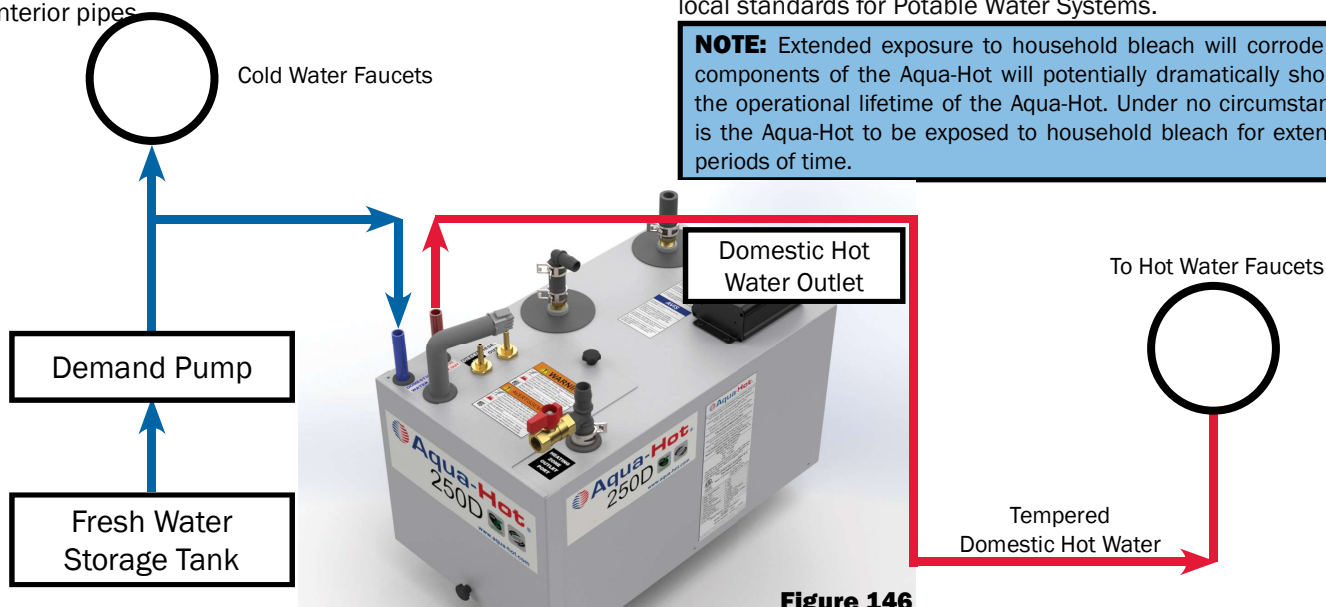


Figure 146



WARNING

Not winterizing the Aqua-Hot when freezing temperatures are present will result in serious damage to the Aqua-Hot domestic water heating system. Ensure that only non-toxic RV antifreeze (FDA approved "GRAS" antifreeze) rated for winterization is used when winterizing this unit. The warranty does not cover freeze damage.

De-Winterization:

1. To de-winterize the unit, connect a freshwater source to the coach.
2. Ensure that all the interior faucets have been re-opened. This includes both 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.

NOTICE

Disinfecting the Domestic Water System

The Aqua-Hot Heating components are not compatible to prolonged exposure to sodium hypochlorite (bleach or liquid bleach). Using products containing bleach, including water refreshers, may cause corrosion of the domestic water lines, resulting in a catastrophic failure of the Aqua-Hot system by creating leaks that cannot be repaired. This damage is not covered by the Aqua-Hot warranty.

If disinfecting the hot water system, be sure to follow NFPA 1192 Standard of Recreational Vehicles "Instructions for Disinfection of Potable Water Systems" or any other applicable local standards for Potable Water Systems.

NOTE: Extended exposure to household bleach will corrode the components of the Aqua-Hot will potentially dramatically shorten the operational lifetime of the Aqua-Hot. Under no circumstances is the Aqua-Hot to be exposed to household bleach for extended periods of time.

General Troubleshooting

Purpose:

This section serves to solve common operational problems, to reduce down-town and unit repair costs, by fixing the simplest problems first.

Troubleshooting Procedure:

If your 250D has been unused for an extended period of time, performing the annual service may resolve many problems. Instructions for the annual service are on Page 53 or may be performed by an Aqua-Hot Factory Certified Service Center. They can be found on the website at www.aquahot.com.

- Ensure that the Aqua-Hot is supplied with electrical power.
- Ensure there is an adequate supply of fuel (at least ¼ tank).
- Ensure that the Aqua-Hot boiler tank has an adequate supply of antifreeze and water heating solution by checking the level at the expansion bottle. If the level is low, reference the maintenance section of this guide for refilling instructions.
- Verify the functionality of any in-line fuses connected to the Aqua-Hot. Replace these fuses if necessary.
- Ensure that all coach-side hot water faucets are closed.
- Locate the relay control board within the Aqua-Hot unit. See Page 9 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.
- Visually inspect the interior cabinet of the Aqua-Hot unit, searching for any damaged or disconnected wires. Reconnect or repair any damaged wires.
- 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 and follow the procedure on Page 20 to troubleshoot this component.
- Locate the right high-limit thermostat and follow the procedure on Page 20 to troubleshoot this component.
- Visually inspect the exhaust system of the Aqua-Hot to ensure that it has not been damaged or removed.

- Test for unit operation:
 - If the burner fails to operate, proceed to Page 61 to begin the diesel burner troubleshooting.
 - If the burner begins to operate at this stage, choose a troubleshooting guide below based on the issue.

Lack of, or Uneven, Hot Water

A lack of hot water, or uneven delivery of hot water (hot water that contains cold spots), is typically due to a failure of one more of five components: the shower head, the stir pump, the three-way valve, the low-temperature cutoff thermostat, or the tempering valve.

- Shower Head
 - It is possible that the shower head in the coach is drawing hot water too quickly from the Aqua-Hot, overtaxing the unit resulting in hot water delivery problems. The shower head should be limited at 1.5GPM max.
- Stir Pump
 - Reference Page 26 to troubleshoot the stir pump.
- Three-Way Valve
 - Reference Page 23 to troubleshoot the three-way valve.
- Low-Temperature Cutoff Thermostat
 - Reference Page 21 to troubleshoot this component.
- Tempering Valve
 - Reference Page 25 to troubleshoot the tempering valve.

Once these components have been diagnosed, restart the Aqua-Hot and allow it to heat to operating temperature. Draw hot water to determine if the problem has been addressed.

If after troubleshooting and these components are found to be in good working condition, contact the Technical Support Department at 574-AIR-XCEL (574-247-9235) for assistance. You can also find a Factory Authorized Service Center for diagnostic and repair. Find your local service center online at www.aquahot.com.

Lack of Interior Heat

A lack of interior heat with a functioning burner can be attributed to many potential issues in the Aqua-Hot. Diagnosis will involve three stages. Stage 1 will outline common reasons for overall unit non-function that exists outside of the unit. Stage 2 will diagnose common issues inside the unit, including lack of burner operation. Stage 3 will address specific reasons for a lack of interior heat.

It is very important that troubleshooting proceed in the order outlined below. The issues most common with a lack of heat are:

- A non-functional three-way valve
- A seized circulation pump
- Air trapped in the coach heating loop
- A malfunctioning low-temperature cutoff thermostat

Stage 1:

- The coach is supplied with power
- The Aqua-Hot has an adequate supply of fuel
- All coach-side fuses are functional and able to supply power
- All water sources connected to the coach are shut off
- All fuses on the relay control board are functional
- The overflow bottle is filled to at least the COLD mark

Stage 2:

- Visually inspect the interior cabinet of the Aqua-Hot unit, searching for any damaged or disconnected wires. Reconnect or repair if necessary.
- The 250D contains a 20A fuse in the wiring harness. Make sure this fuse has not burned out.
- Make sure the high-limit thermostats are not tripped or defective. Replace if necessary.
- Test for unit operation.
 - If the burner fails to operate, follow the procedure on Page 61 to begin diesel burner troubleshooting.

Stage 3:

1. Begin troubleshooting the three-way valve. See Page 23.
2. Reference Page 21 to diagnose the Low-Temperature Cutoff Thermostat.
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, see the procedure on Page 26 for troubleshooting.
4. Locate all of the heat exchangers within the 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 antifreeze and water heating solution.
 - It may be 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 55 for the heating loop purge procedure.

At this point, if steady interior heat cannot be achieved, contact Technical Support at 574-AIR-XCEL (574-247-9235), or take the coach to an Aqua-Hot Factory Authorized Service Center. One can be found at www.aquahot.com.

250D Unit Smoke

Purpose:

It is possible that the Aqua-Hot 250D may smoke upon first start-up. There are many possible causes for smoke as listed below.

If the unit has sat for an extended period of time unused, please perform the annual service.

- Clear exhaust or no smoke
 - The unit is operating correctly
- Blue/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 the issue quickly.

Blue/White Smoke

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 16 for the procedure. Test the unit after this is complete.
3. Detach the diesel burner from the Aqua-Hot (see Page 39) to 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 sub-assembly, looking for any damage or leak locations.

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 39 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.
 - If the igniter electrodes are out of adjustment, adjust them inward or outward until the distance measured is 0.10". Take care to not damage the igniter during this process.

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.

4. The igniter module may be incorrectly positioned on the diesel burner head assembly. Reference Page 42 for precise positioning information.
5. Air may be present in the fuel system, resulting in the uneven delivery of fuel to the nozzle and causing excessive smoke. Check the fuel delivery system for any damage or loose clamps which may introduce air into the fuel line.
6. Ensure that fuel delivery sub-assembly is functioning properly. Reference Page 44 for the procedure.
7. Check the ignition coil for proper operation.

Black Smoke:

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.
3. Remove the access cover of the unit.
4. Ensure that the air shutter is completely open.
5. Attempt to shake the burner sub-assembly. If the burner moves, it has been improperly seated. Follow the directions on Page 39 to remove and reinstall the diesel burner.
6. If at this stage the burner is still producing black smoke, it is recommended that the annual service be performed. See Page 53 for the procedure.
7. Diagnose the fuel delivery system. See Page 44.
8. Visually inspect the inside of the combustion chamber for any warping or apparent heat damage.
9. Remove the diesel burner from the Aqua-Hot - see Page 39.
10. Remove the combustion chamber to gain access to the heat exchanger as shown in Figure 147.
11. Using a wire brush, scrub the heat exchanger inside the Aqua-Hot as shown in Figure 147.
12. If at this stage, black exhaust smoke is not remedied, contact the Aqua-Hot Technical Support at 574-AIR-XCEL (574-247-9235) or locate your nearest authorized service center.



Figure 147

Diesel Burner Troubleshooting

This section will assist in troubleshooting the Aqua-Hot diesel burner.

If additional assistance is needed, please contact the technical support department at 574-AIR-XCEL (574-247-9235).

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.
3. Remove the cabinet access panel from the front of the Aqua-Hot.

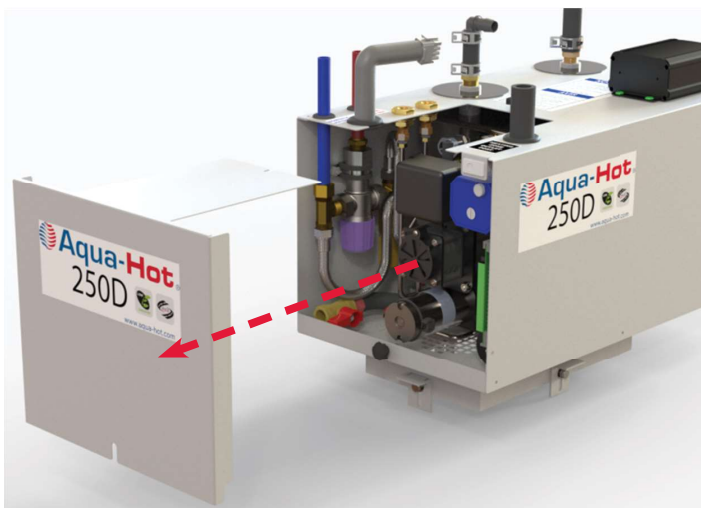


Figure 148

4. Verify that the 20A fuse included as part of the diesel harness is functional. Replace if necessary.
5. Move the burner switch on the interior switch panel to the ON position.
6. Make sure the interlock switch is depressed.
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 16.

8. Locate the left and right high-limit thermostats and press the red center button on both thermostats to reset.
 - Test for continuity on both thermostats. Both should have continuity after reset. If one does not have continuity, follow the instructions on Page 20 to replace one or both.

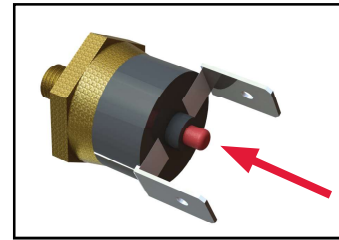


Figure 149

9. Verify the functionality of the diesel fuel delivery system by following the procedure on Page 44.
10. Check the igniter module for functionality by following the directions on Page 42.
11. Troubleshoot the igniter coil referencing the procedure on Page 43.
12. Ensure that the photo-eye is functioning properly by completing the procedure on Page 51.
13. Ensure that the air shutter is set to the factory mark.

If at this stage the diesel burner is still not operational, contact technical support at 574-AIR-XCEL (574-247-9235) for assistance to diagnose and repair the diesel burner.

Antifreeze Types

The following information addresses the necessary usage of a propylene glycol based “boiler” type antifreeze in the Aqua-Hot. Propylene glycol is a safer alternative to the more toxic ethylene glycol antifreeze; however, as mandated by IAPMO (International Association of Plumbing and Mechanical Officials), only propylene glycol based “boiler” type antifreezes deemed “Generally Recognized As Safe” (GRAS) by the FDA should be utilized.

Due to the significant impact various types of antifreeze can have on a hydronic heating system, including 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 based antifreeze is selected.

RV & Marine Antifreeze

These types of propylene glycol based antifreeze products are formulated specifically for “winterizing” applications only. Although RV & Marine antifreeze is often “Generally Recognized As Safe” by the FDA, **it should never be used in the Aqua-Hot’s Hydronic Heating System**. This type of antifreeze is not formulated to transfer heat, which is essential to the heating system’s functionality and does not contain rust inhibitors. Please note, however, that RV & Marine antifreeze can be utilized to winterize the Aqua-Hot’s Domestic Hot Water Heating Systems.

Automotive Antifreeze/Coolant

These 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 “Generally Recognized As Safe” (GRAS) rated 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 rust inhibitors. Due to their potentially hazardous properties, they should never be used in the Aqua-Hot’s Hydronic Heating System.

Antifreeze Mixture Quality Recommendations

In order to ensure maximum performance and longevity of an Aqua-Hot heating system’s boiler tank and associated components, it has been determined that there is a need to use distilled, deionized, 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 premixed antifreeze are responsible for the use of high-quality (distilled, deionized, or soft) water when preparing their antifreeze for sale.

Hard water possesses a high-level of calcium and magnesium ions, which deplete the propylene glycol antifreeze’s corrosion inhibitors. This, in turn, causes the antifreeze and water heating solution to begin turning acidic, which can corrode the Aqua-Hot’s boiler tank and associated components prematurely. Therefore, concentrated propylene glycol should be diluted with distilled, deionized, or soft water which is 80ppm or less in total hardness. The local water agency should have up-to-date water quality reports, which should indicate if the local tap water is within this guideline.

Antifreeze Terms & Mixture Ratio

Propylene Glycol Based Antifreeze Solution

The following information addresses the process of selecting a propylene glycol based antifreeze solution that provides adequate freeze, boiling, and rust/anti-corrosive protection.

A propylene glycol antifreeze solution that is 35% to 50% propylene glycol to distilled water is recommended. Antifreeze solution with 50% propylene glycol will result in a freeze point of approximately -28°F and a boil point of approximately 222°F.

Freeze Point and Burst Point

NOTE: The installer of the Aqua-Hot system must refer to the information and chart to determine the percentage of propylene glycol the antifreeze solution should contain for the level of protection needed.

Antifreeze solution lowers the freezing point of any liquid, to which it has 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 and starts producing a “slushy” consistency, the antifreeze in the solution will continue to combat the normal expansion of the solution as it freezes. 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 antifreeze employed.

Rust and Anti-Corrosive Inhibitors

Another major function of antifreeze solution is to provide

protection to the internal metal components of the Aqua-Hot Hydronic Heating System from corrosion and rust. Antifreeze is able to perform this function by the addition of rust and anti-corrosive inhibitors, which are designed specifically to activate in a water solution.

Summary

Antifreeze solution has three basic functions: freeze protection, boil-over protection, and rust/anti-corrosion protection.

Propylene glycol antifreeze solution is also primarily responsible for heat transfer; however, propylene glycol itself does not possess acceptable heat transfer characteristics. Therefore, as water is an excellent heat conductor, it is added to the mixture. Propylene glycol antifreeze solution, mixed with distilled water, at a ratio of 35% to 50% is recommended to provide the best performance combination of the aforementioned functions. If excess propylene glycol exists within the heating solution, the water's heat absorption properties are compromised. Ultimately, this could inhibit the Aqua-Hot from providing adequate domestic hot water and interior heating.

Additionally, if the antifreeze and water heating solution contains over 70% propylene glycol, the freezing point is actually

raised, resulting in less freeze protection. Please reference the attached graphical representation regarding the percentage of antifreeze to water and how it directly affects the solution's freezing point.

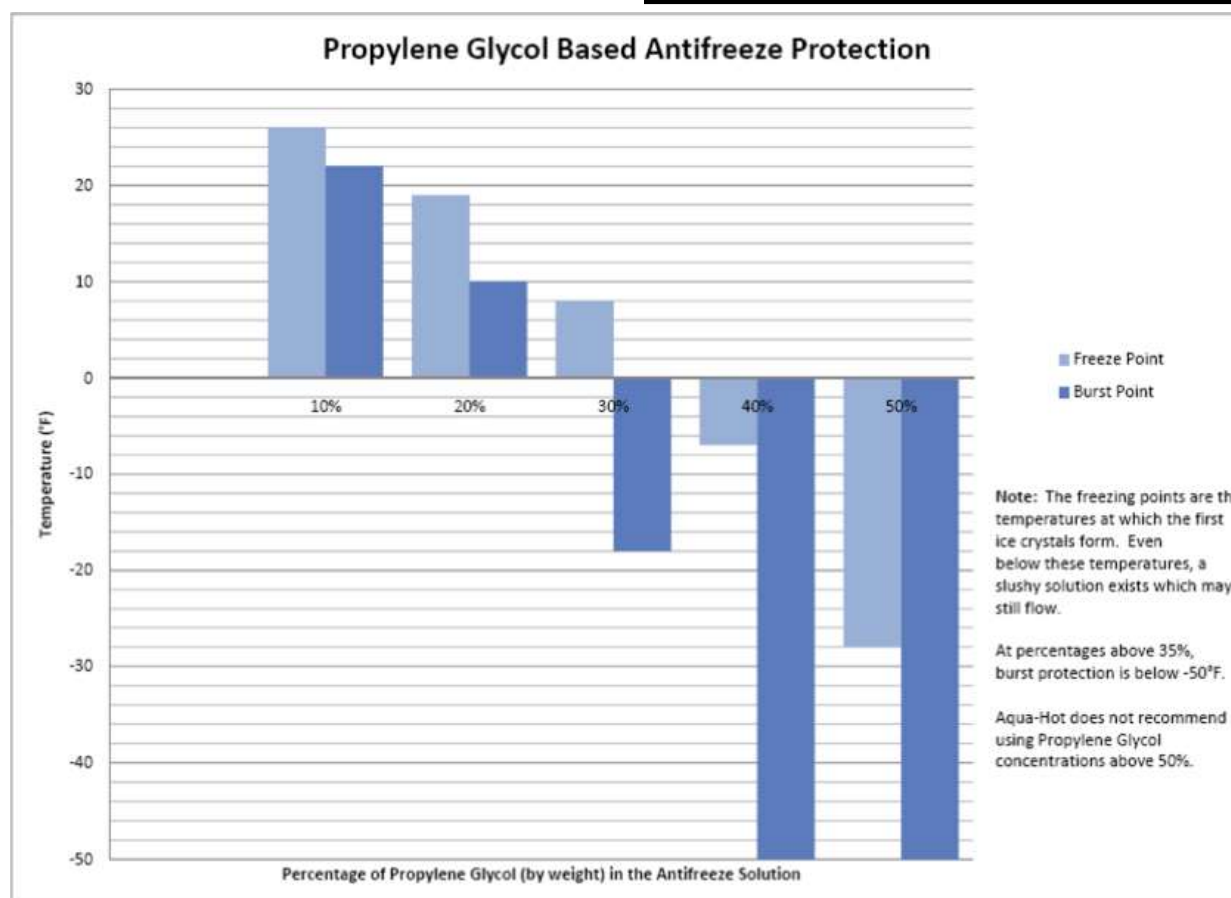
In order to provide the best freeze protection, boil-over protection, anti-corrosion, and rust protection, a mixture of 50/50 "GRAS" approved **Propylene Glycol** antifreeze and distilled or de-ionized water is recommended. Reference Page 64 for measuring the antifreeze mixture with a refractometer and also the table below for the mixture ratios.

Propylene Glycol											
Freeze Point (°F)	0	-4	-7	-9	-12	-15	-18	-23	-29	-34	-40
Concentration (%)	0	12	19	25	30	34	38	44	49	53	60

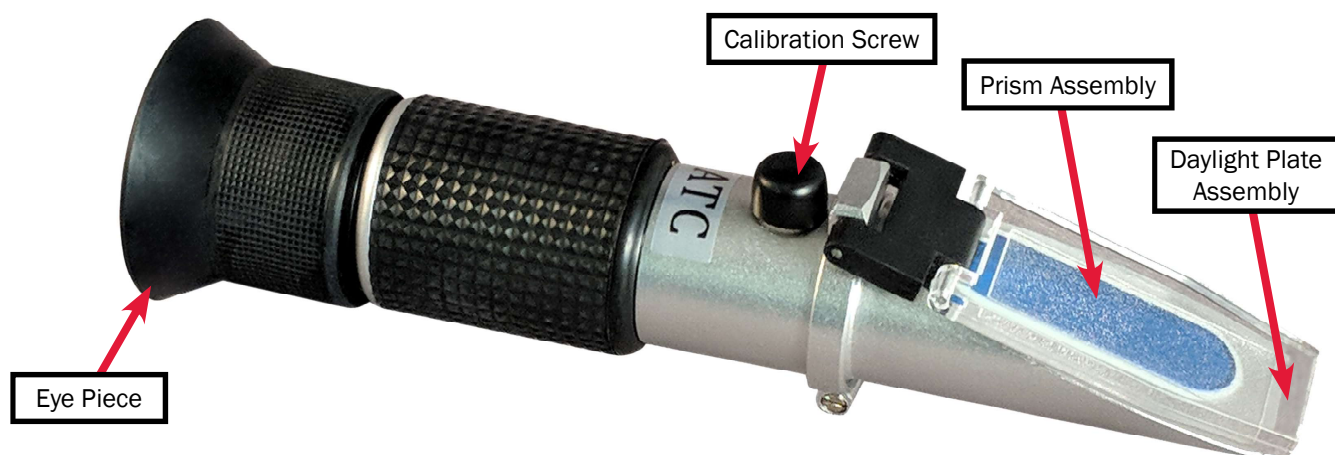


DANGER

Failure to utilize a propylene glycol which has been deemed Generally Recognized As Safe ("GRAS") by the FDA could result in serious bodily harm to the Aqua-Hot system.



Measuring Antifreeze Using a Refractometer

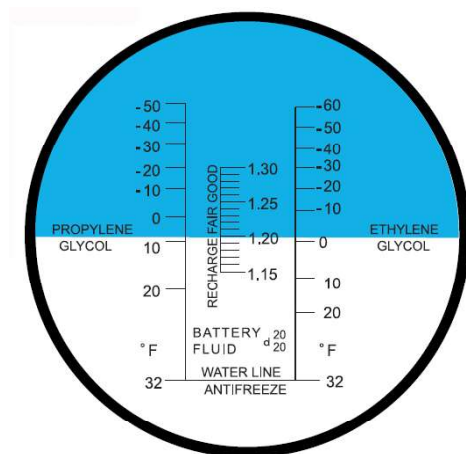


Properly Apply Antifreeze to the Prism Assembly

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.

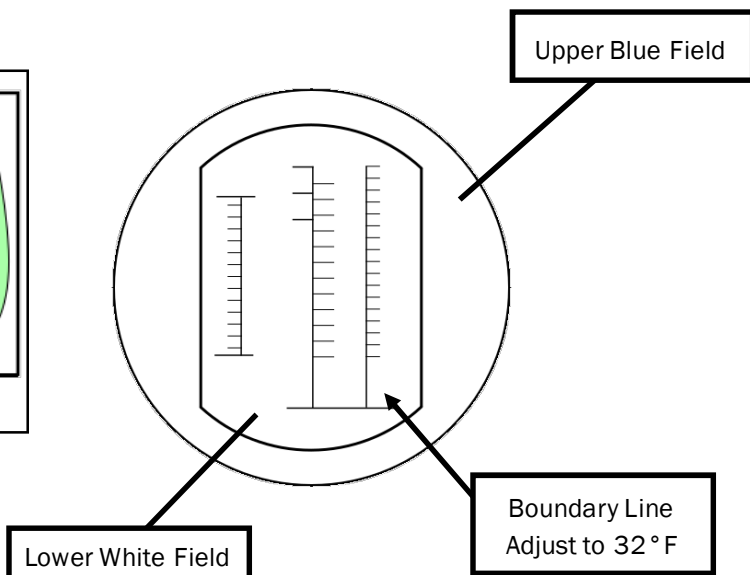
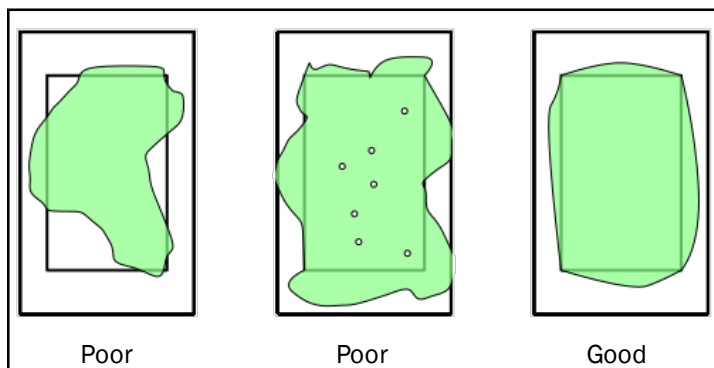
Adjust the Boundary Line

Once the glycol solution has been properly applied, adjust the calibration screw until the boundary line labeled “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.



Refractometer Sight Glass

Application of Propylene Glycol





2-YEAR LIMITED WARRANTY AQUA-HOT® HYDRONIC HEATING SYSTEM

Aqua-Hot Heating Systems Inc. warrants the Aqua-Hot Heater to be free from defects in material and workmanship under normal use and service for a period of two years on both parts and labor commencing upon the original date of registration of the vehicle. Replacement parts are warranted for the remainder of the Heater's standard warranty coverage or for six months, whichever is greater. The intent of this warranty is to protect the heater's end-user from such defects, which would occur in the manufacturing of the product. Thus, problems due to improper specifications, improper installations, improper use, the use of accessory parts or parts not authorized by Aqua-Hot Heating Systems Inc., repair by unauthorized persons, and damage or abuse of the heater are specially excluded from warranty coverage.

For additional information, or to obtain a warranty repair authorization, please contact the Aqua-Hot Heating Systems Warranty Administrator at 1-800-685-4298 (7:00 AM to 4:00 PM Mountain Standard Time) or visit www.aquahot.com.

My Comfort Zones are On-Board

Vehicle:

Purchased From:

Dealer Information:

Name:

Location:

Phone Number:

Heating System:

Serial Number:

Service Manual

200_{SERIES}

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