

Service Manual

100 Series



AHE-125-DN1



Contents

Caution Notes.....2

Introduction3

Maintenance Schedule.....6

System Features7

Component Cut-Aways8

Operational Flowchart.....10

Operating the LCD.....11

Aqua-Hot Controller.....13

Fluid Level Sensor.....18

High-Limit Thermostats.....20

Low-Temperature Cutoff Thermostat.....22

Three-Way Valve23

Tempering Valve25

Fluid Circulation Pump.....27

AC Electric System.....29

AC Relay31

ETS Module32

High Altitude Replacement.....34

General Troubleshooting.....39

Winterization.....40

Burner Troubleshooting41

Appendix A: System Schematics43

Appendix B: Parts.....49

Appendix C: Measuring Antifreeze53

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 125DN Series is a Hydronic Heating System that can provide heat and hot water on demand using a built-in electric heating element and an external diesel burner.

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

1. Interior heating system: provides quiet, comfortable interior heat and even temperatures.
2. Tank-less hot water system: provides a flow of comfortable hot water.

The Aqua-Hot heating system heats an ethylene glycol-based antifreeze (50%) and distilled water solution (50%) that is stored in the Aqua-Hot's boiler tank. This fluid solution must be up to operating temperature before the Aqua-Hot will provide interior heat or hot water. The tank-less hot water system produces approximately 0.8 GPM of hot water. This system is also hot water priority, so it will shut off the heat any time hot water is called for.

Once the fluid is to temperature (180°F), a fluid circulation pump transports the heated glycol/water mixture through the

heating loop and to heat exchangers to evenly warm the coach. Water is heated on-demand by going into a heat exchanger located in the Aqua-Hot. The water is heated by transfer from the heated antifreeze and distilled water solution. The heated domestic water then flows through the tempering valve to be mixed with cool water from the fresh water tank to achieve an appropriate temperature before it flows to the faucet.

To get the Aqua-Hot to temperature, turn the electric heating element and/or the external diesel burner to the "ON" position on the Aqua-Hot LCD screen, or on the coach control panel. It may take up to 20 minutes to get to operating temperature before heat or hot water are available.

For continuous hot water or heat in colder conditions, it is recommended to utilize the external 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.

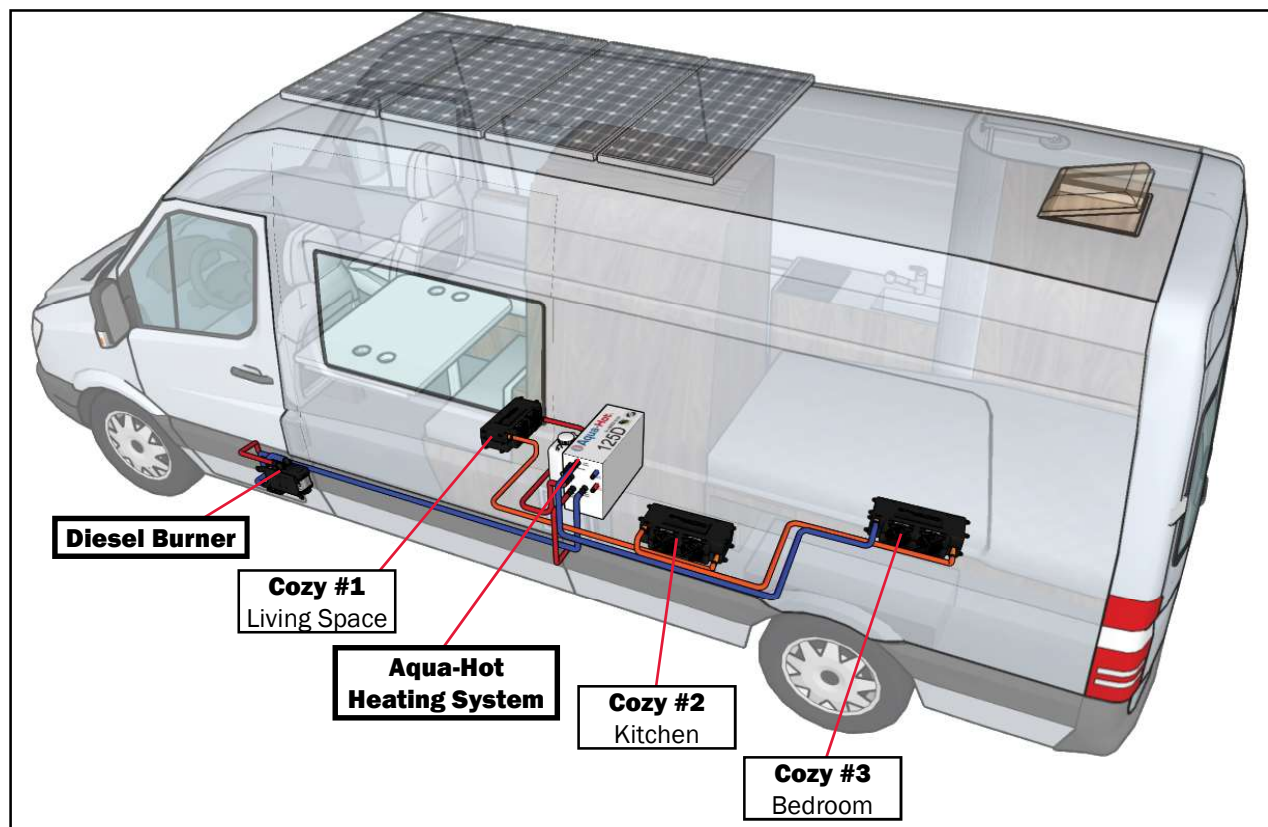


Figure 1

NOTE: This is just a sample for mounting locations of the Cozy heat exchangers. Actual placement and quantity may vary on the individual design of the RV. For questions or assistance, contact Aqua-Hot at 574-AIR-XCEL (574-247-9235).

Heat Priority Option:

The Aqua-Hot comes equipped with the three-way valve (sometimes known as the summer/winter valve). This controls the flow of the antifreeze and water heating solution within the Aqua-Hot to deliver either hot water or interior as priority. Tapping on this element will change the valve's orientation. When this element displays "INT. HEAT", this valve is oriented to provide interior heat by circulating the heating solution throughout the interior heating zone. When the element says "HOT WATER", the valve is oriented so that the heating solution is routed to prioritize hot water.

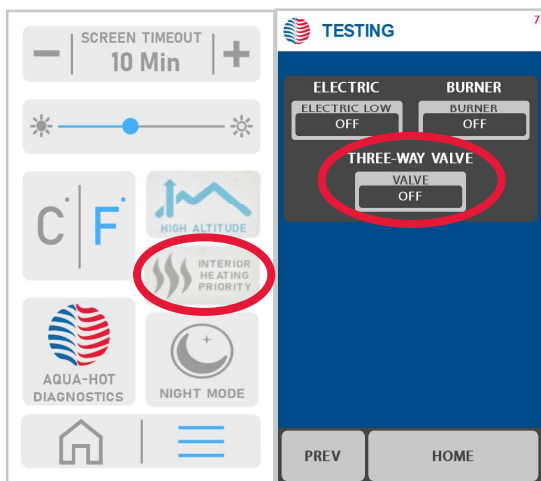


Figure 2

High Altitude Option:

The Aqua-Hot 125D comes equipped with a High Altitude mode that allows the external diesel burner to operate properly at high altitudes. It is recommended any time the coach is at an altitude higher than 5,000 feet, to activate the High Altitude button on the LCD screen. This modifies the fuel pump rate to decrease the flow of diesel fuel. This allows for less emissions, less carbon build-up, and proper diesel burner operation.

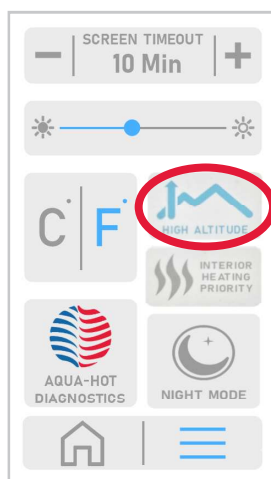


Figure 3

Important Notes:

- A qualified installer or service technician must perform equipment installation or service. Contact Aqua-Hot for Factory Authorized Service Centers or Certified Technicians located near you at www.aquahot.com/service-help, or call us at 574-AIR-XCEL (574-247-9235). Warranty work must be performed by an Aqua-Hot Authorized Service Center
- Your on-product identity label contains the specifications of your unit. Factory settings may be adjusted by the vehicle manufacturer, confirm final setting with your dealer.
- This heating system has been certified for installation in recreational vehicles only.
- Please read this manual and follow instructions to avoid injuries during service and/or operation.

The diesel burner is the Aqua-Hot's primary and most powerful heat source, and provides all of the heating and hot water needs when cold temperatures exist, and/or when there is a high demand for hot water. It can be activated by turning the burner on by tapping BURNER to ON on the LCD screen shown below. The burner has 4 modes: LOW, HIGH, AUTO, and OFF. While in LOW mode, the burner will maintain a tank temperature of 165°F and minimum temperature of 160°F. In HIGH mode, the burner will keep the tank temperature between 160°F and 180°F. In AUTO mode, the burner will toggle between HIGH and LOW as needed, using temperature readings from the coach interior thermistors. OFF mode, the burner is off and will not provide any heat to the Aqua-Hot tank. The electric element has the same functionality as the diesel burner.

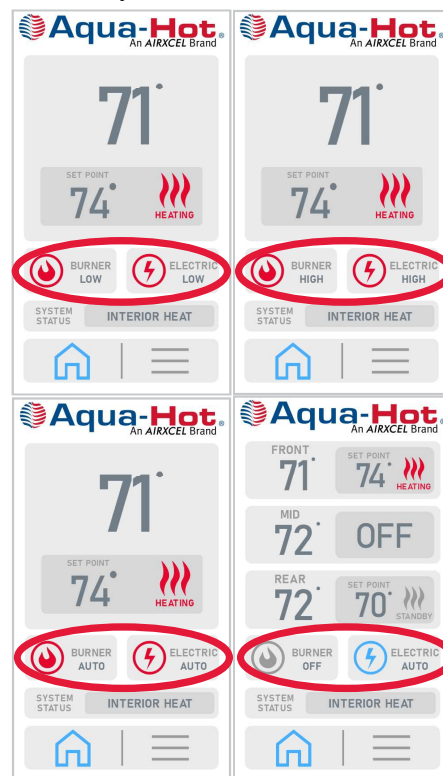


Figure 4

Introduction to this Document

Welcome to the Aqua-Hot 125DN 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 125DN.

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.

Troubleshooting and diagnosis of the Aqua-Hot is most efficiently and effectively accomplished with the Aqua-Hot LCD display, which will relay in plain-language, diagnosis of many Aqua-Hot related issues.



Figure 5

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.

CAUTION

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

WARNING

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

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 manual, and any other Aqua-Hot documentation relevant to this unit.

- Read this manual before servicing 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.
- 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 PSI (zero pressure system). Air pressure to the tank must not exceed 18 PSI. Exceeding this rating will cause internal damage to the Aqua-Hot.
- Use caution when working on or near any gas systems.
- DO NOT connect the 12-volt DC power to the Aqua-Hot if the vehicle requires welding.

CAUTION

- At maximum operating temperature, the coolant and vapor will be very hot and scalding that may result in serious burns or injury. Be aware of hot surfaces.
- Use special caution when children are present. Children must not be allowed to play with the heater or perform cleaning and/or maintenance.
- Installation and repairs may only be carried out by an authorized, factory-trained Aqua-Hot technician. The heating system must be serviced in accordance with local codes, or, in the absence of local codes, follow NFPA 1192. National safety regulations must be adhered to.

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 63 on page 34.

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 66 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.

Reference the Appendix on page 48 for the proper tool and instructions for usage in measuring the system's antifreeze mixture ratio.

The Aqua-Hot does not need regular replacement of the ethylene 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.

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 ethylene glycol antifreeze and distilled water is recommended. The Aqua-Hot 125DN boiler tank holds approximately 1.8 gallons (6.8 liters).

The mixture may be modified to provide the most adequate freezing, boiling, and rust/anti-corrosive protection. A 50/50 mixture of ethylene glycol and distilled water has a freeze point of approximately -35°F (-37°C) and a boiling point of approximately 223°F (106°C). Refer to the table below to determine the best protection mixture ratio. Reference page 48 for measuring the antifreeze mixture with a refractometer.

Ethylene Glycol												
Freeze Point (°F)	32	25	20	15	10	5	0	-10	-20	-30	-40	-50
Concentration (%)	0	10	16	21	25	29	33	39	44	48	52	56

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 (103°C).

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.

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.



An AIRXCEL Brand

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 a 20-Amps maximum for over-current protection for the 120-VAC power supply.

Mount the Heater and Unit so that the Access cover can be easily removed for service.

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

Minimum Service Clearances

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

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



Meets or Exceeds: UL 307A, UL 174
C SA/CAN B140.0-06
CAN/C SA-C22.2 No. 110-94

Listing 20L01

Max Tank Pressure	0 PSI
Watts (DC)	84W
Watts (AC)	1500W
Tank Capacity	1.8 gal. (Ethylene Glycol)
Volts/Amps	12VDC, 7A
Volts/Amps/Frequency	120VAC, 13.75A, 50/60Hz
Burner Model	Webasto TT Evo
Burner Fuel	Diesel
Burner Rating	17,060 BTU

Model Number: AHE-125-DN1
Serial Number: A125DN-XXXXXX__
Burner Serial Number: XXXXXX

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



Figure 6

System Specifications

Electric Element

Power Consumption1500 W (maximum)
Voltage120V AC

DC Power

Consumption 84W (maximum)

Zone Heat Circulation

Pumps 1
Power Consumption (max)..... 21W
Voltage 12V DC

Heating Zones

Maximum3

Domestic Water Heating

Maximum 0.8 GPM

Physical Specifications

Dimensions (US).....17.625" L x 7.625" W x 11.5" H
Dry Weight51lbs. (24kg)
Wet Weight.....70lbs. (31kg)

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.

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.

Aqua-Hot 125D

1. Tempering Valve
2. Fluid Circulation Pump
3. Aqua-Hot Controller
4. Antifreeze and Water Heating Solution Tank
5. AC Electric Element
6. AC Activation Relay
7. Plate-to-plate Heat Exchanger
8. Three-Way Valve
9. Zone Air-Blead Valve
10. Fluid Expansion Port (to overflow bottle)
11. Zone Return
12. Fluid Fill Port
13. Zone Supply
14. External Diesel Burner Return
15. External Diesel Burner Supply
16. Domestic Cold-Water Inlet
17. Domestic Hot-Water Outlet
18. Domestic Low Point Drain
19. Cabinet Drain

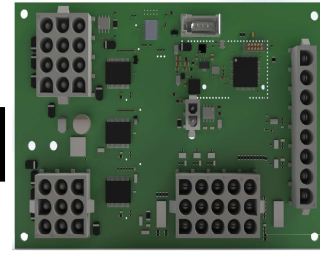


Figure 7

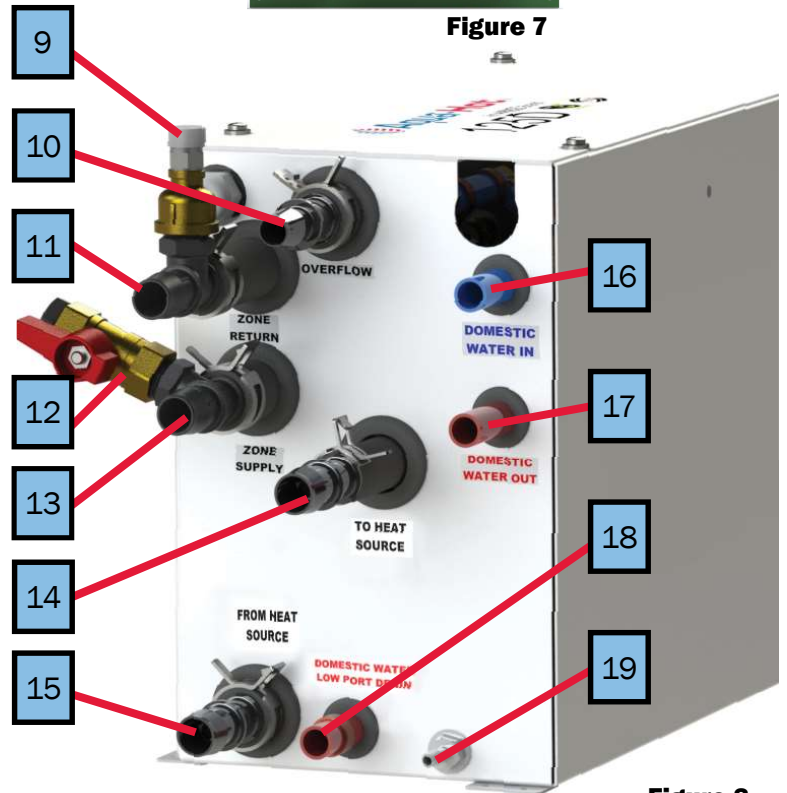


Figure 8



Figure 9

NOTE: The side panel in the view above has been made transparent to aid in the explanation of the heater. DO NOT remove the side panel. Doing so risks irreparable damage to the Aqua-Hot. Only remove the service panel for service.

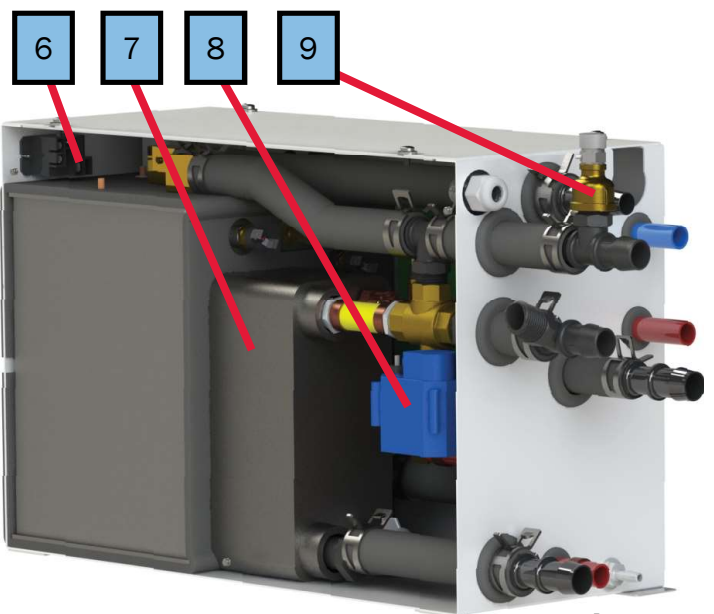


Figure 10

Aqua-Hot Diesel Burner	
1.	Combustion Air Fan
2.	Fluid Outlet
3.	Fluid Inlet
4.	Combustion Chamber
5.	Circulation Pump
6.	Exhaust Gas Temperature Sensor
7.	Exhaust Outlet
8.	Air Inlet
9.	Control Unit
10.	Burner Motor
11.	Fuel Inlet
12.	Combustion Air Inlet
13.	Fuel Pump
14.	High Altitude Bypass Assembly

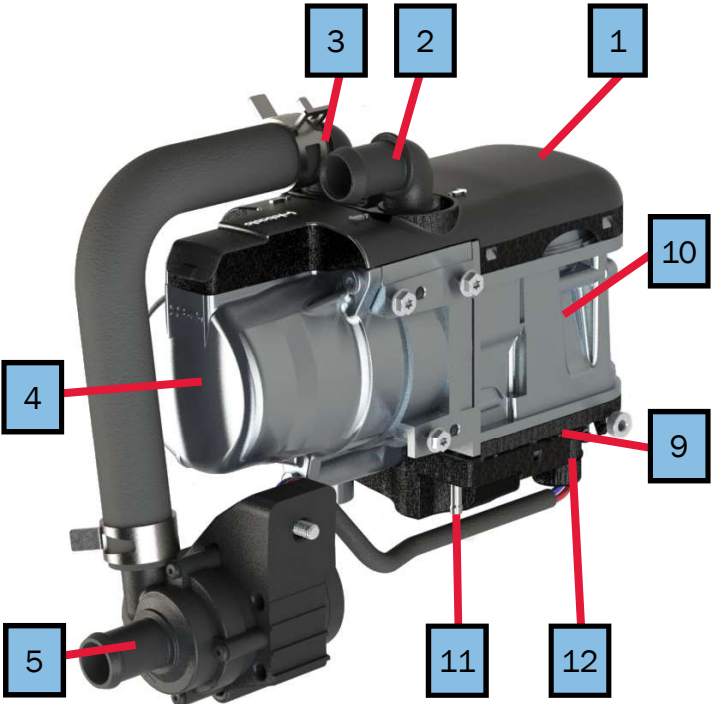


Figure 11

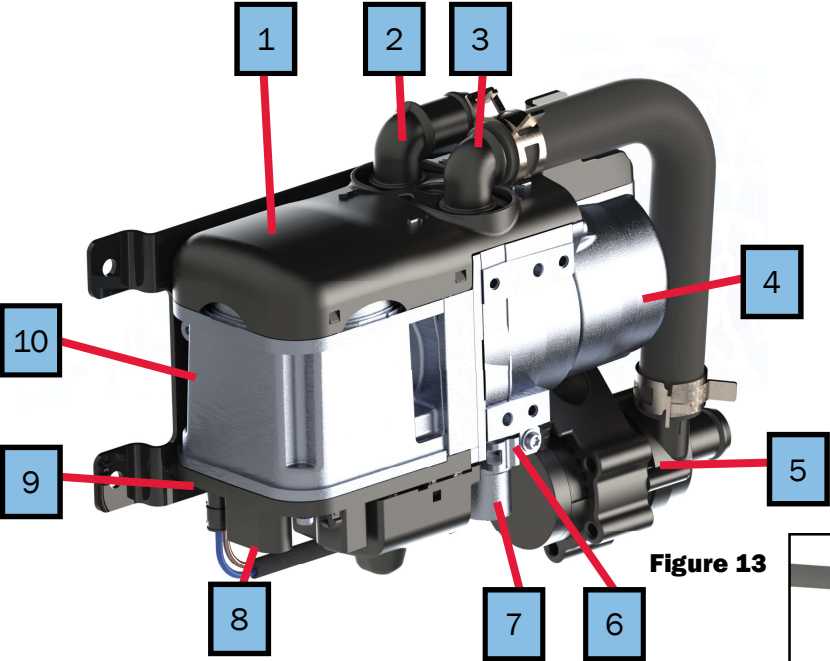


Figure 13



Figure 12

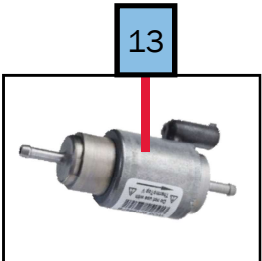


Figure 14

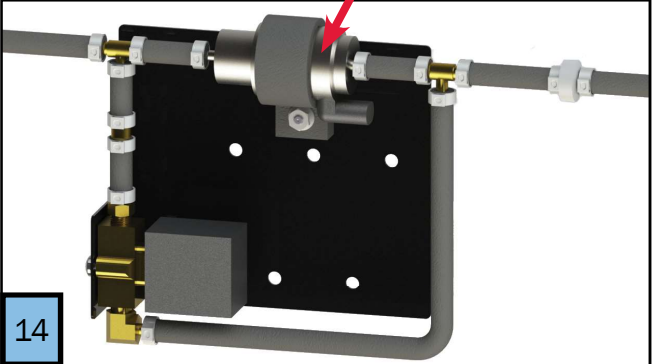
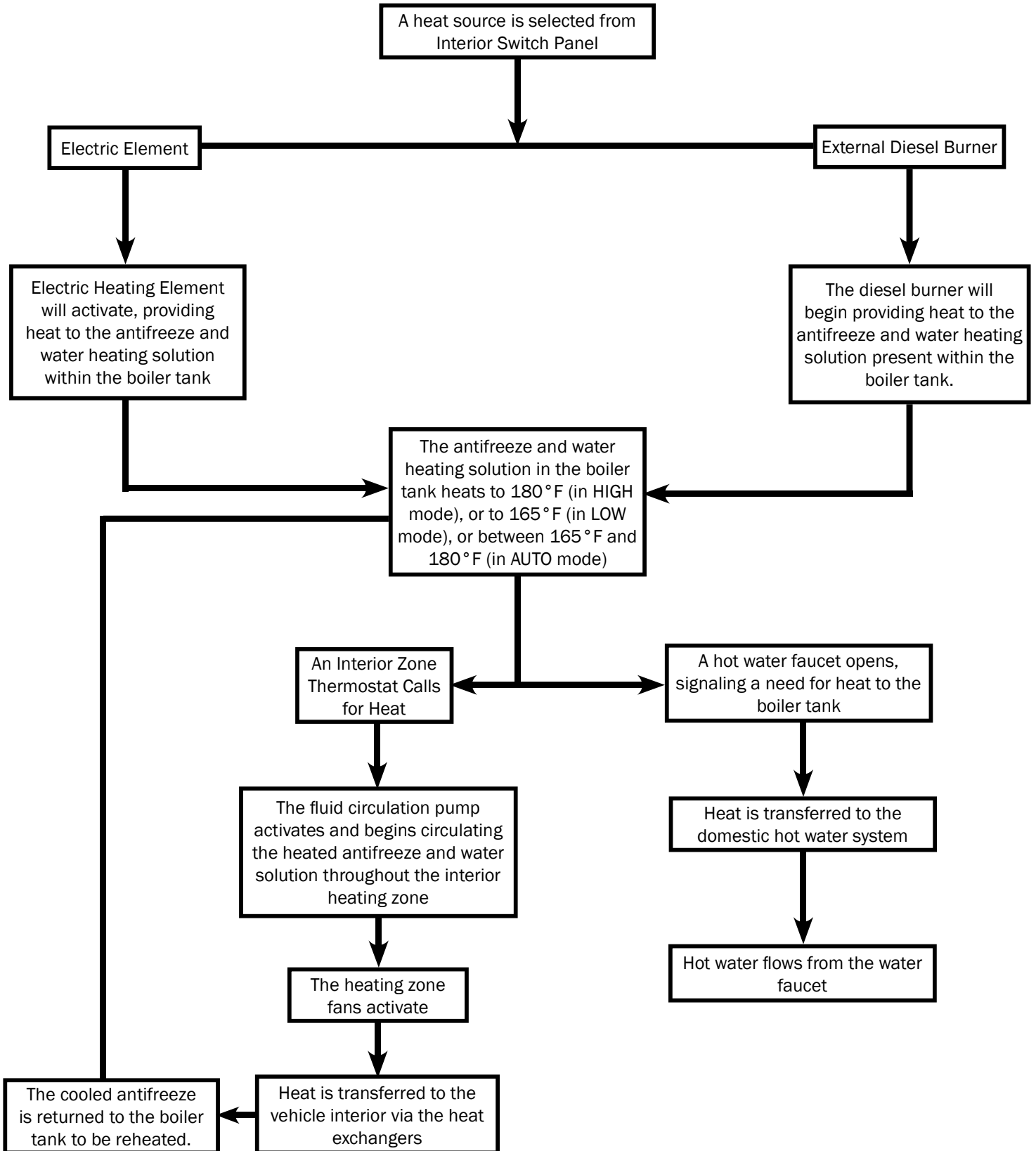


Figure 15

Operational Flow Chart



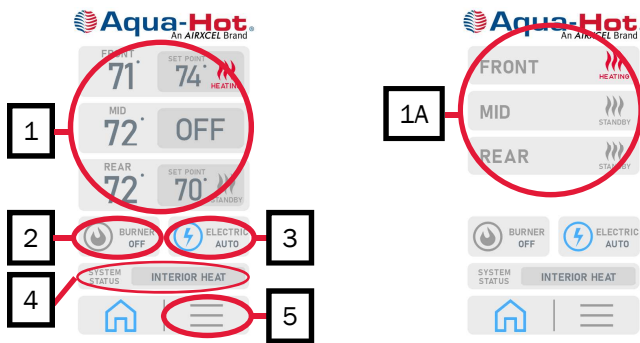
Operating the LCD

Introduction:

This document will outline the basic operating instructions for the Aqua-Hot LCD Screen.

Climate Pages:

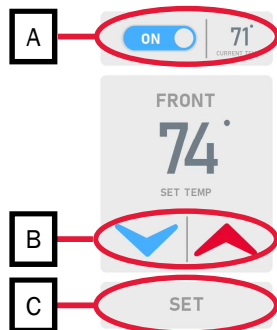
The climate pages are for most intents and purposes the “Home” of the LCD screen. From here, the end-user will select their interior temperature set-points, activate or deactivate the diesel burner, and the electric element



Zone Control (1):

Precise zone control display will differ depending on the type of zone thermostats used within the coach.

Section 1A demonstrates the appearance of the zone control section when ON/OFF thermostats are used within the coach. In this use-case, the buttons on-screen serve only as ON/OFF toggle switches.



Tapping on one of the zones shown above will display a new screen where the interior temperature can be set.

Section A:

This section shows the current zone temperature (shown as 71°F in the example

above) as well as a button to turn the zone on or off

If the zone temperature is set, but this item is not set to ON, the zone heat exchanger will not activate.

Section B:

These arrows are used to increase or decrease the desired set-point temperature of the zone thermistor.

Section C:

After the desired temperature set-point has been selected tap “SET” on the LCD to set that temperature. The Aqua-Hot will now work to maintain this interior temperature, and the screen will return home.

External Diesel Burner Activation (2):

The Diesel Burner can be activated by tapping on the burner item on-screen. The burner has three modes; LOW, HIGH, AUTO and OFF.

LOW:

While in LOW mode, the diesel burner will work to maintain a tank temperature of 165° F (74° C), with a minimum tank temperature of 160° F (71° C).

HIGH:

While set to HIGH, the diesel burner will work to maintain a tank temperature of 180° F (82° C), with a minimum tank temperature of 160° F (71° C).

AUTO:

While set to AUTO, the diesel burner will toggle between HIGH and LOW as needed using temperature readings from the coach interior thermistors.

OFF:

While off, the diesel burner will not serve to provide any heat to the boiler of the Aqua-Hot whatsoever.

Electrical Element Activation(3):

Similar to the external diesel burner, tapping this button will signal to the controller to activate the AC electric relay, energizing the 1500W electric element within the Aqua-Hot.

LOW:

While in LOW mode, the electric element will work to maintain a tank temperature of 170°F (76°C), with a minimum tank temperature of 165°F (74°C).

HIGH:

While set to HIGH, the electric element will work to maintain a tank temperature of 180°F (82°C), with a minimum tank temperature of 165°F (74°C).

AUTO:

While set to AUTO, the electric element will toggle between HIGH and LOW as needed using temperature readings from the coach interior thermistors

OFF:

While off, the element will not serve to provide any heat to the boiler of the Aqua-Hot whatsoever.

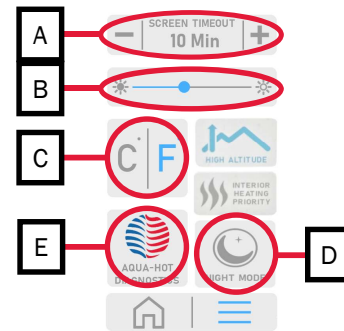
System Status(4):

This item will indicate the current operational status of the Aqua-Hot. If any faults have triggered, those will be displayed here.

During normal operation, this should display either INTERIOR HEAT or HOT WATER relating to the priority and position of the 3-way valve.

While in INTERIOR HEAT mode, the three-way valve is oriented so as to circulate heated antifreeze and water solution through the heating zones of the coach.

While in HOT WATER mode, the three-way valve is oriented so that the heated antifreeze and water solution is circulated immediately back into the boiler tank. This is known as “stirring” the tank, and it is done to provide as much heat as possible to the domestic water lines while water is flowing.



Module Options (5):

Tapping on the module options button will display the screen shown above. From here, it is possible to access unit diagnostics, activate Night Mode, change the temperature units, adjust screen brightness, and unit timeout.

Screen Timeout(A):

The screen timeout item sets the amount of time required to allow the screen to shut-off when idle.

Screen Brightness(B):

This setting changes the screen brightness.

Unit of Measurement(C):

This setting will change the display units of the Aqua-Hot. Either Fahrenheit or Celsius can be selected.

Night Mode(D):

This option toggles the Aqua-Hot’s night mode. Night mode is a setting where the speed and output of the heat exchanger fans is reduced to 80%. This is done to reduce noise of the heat exchangers.

Please note that this feature must be activated and deactivated as needed.

Aqua-Hot Diagnostics(E):

Tapping on this element will direct you to the Aqua-Hot’s built-in diagnostic, testing, and troubleshooting tools.

The Aqua-Hot Controller

Introduction:

The Aqua-Hot 125DN operates on a controller platform which has been modernized and updated from the previously used Electronic Controllers and Relay Control Boards of older Aqua-Hot units.

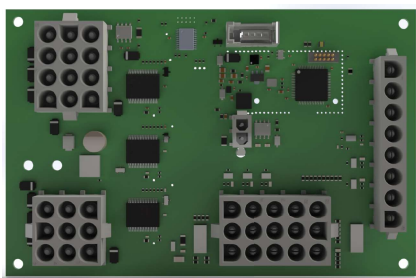


Figure 16

This controller is best utilized with the Aqua-Hot 5in display. Using the Aqua-Hot with this new display will ensure that you can take advantage of all of the tools and features of this controller.



Figure 17

Features:

This new controller brings with it new features to it which effect functionality from every stage of operation. Fail safe functionality, climate control, and troubleshooting and diagnostics have all been overhauled on this new control architecture. These features will be explained in detail below.

Troubleshooting:

The new troubleshooting functionality is perhaps the largest and most substantial change to come about from the new controller architecture. Many faults and failures within the Aqua-Hot can now be relayed in plain language to the technician servicing the Aqua-Hot. There are five system faults which will be utilized; System Voltage, Low-Level Cutoff, Over-Current, Overheat, and Burner Failed to Ignite. These will be explained below.

System Voltage:

System voltage faults indicate that there is a problem with the coach-side power supply which powers the Aqua-Hot.

The Aqua-Hot can only operate within a voltage range of 11V DC to 16V DC. If voltage drops below 11V, or exceeds 16V DC, the controller will shut down the Aqua-Hot as a safety mechanism.

Low-Level Cutoff:

The Low-Level Cutoff fault will only trigger if the minimum fluid level within the Aqua-Hot is below an acceptable operational threshold.

If the controller is showing a low-level cutoff fault, begin by diagnosing the float sensor.

Over-Current:

Over-current faults are triggered by an output channel (pump, fan, etc) that is attempting to draw too much current through the controller. This fault will be accompanied by the component which triggered the fault, for example "PUMP 2 OVER-CURRENT" will display if Pump 2 is not operating correctly.

If over-current faults are appearing on the display, troubleshoot the offending component listed as being over-current.

Overheat:

Overheat faults indicate that the unit has exceeded its overheat threshold of 210°F (99°C).

If an overheat condition has occurred, diagnose the cause of the overheat by investigating the heating sub-systems of the Aqua-Hot (electric and/or diesel burner).

Under-Current

Under-current faults indicate that the unit does not have enough voltage to properly operate. If voltage drops below 11V, the controller will shut down the Aqua-Hot as a safety mechanism.

If an under-current fault is displayed on the screen, troubleshoot the offending component listed and also check power into the Aqua-Hot.

The fault codes shown above will cover the most common Aqua-Hot related issues. For more complex issues, it may be

necessary to utilize the DIAG screens, which will be explained next.

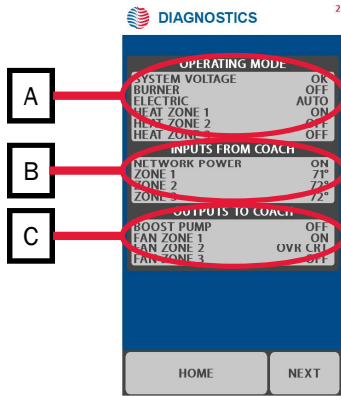


Figure 18

Diagnostic Screens (DIAG)

The diagnostic screens will show the current operational status of different elements within the Aqua-Hot. By comparing these operational statuses against the expected results it is possible to discern operational issues.

Shown below are the diagnostic screens. From these screens it is possible to see the current status of elements within both the Aqua-Hot and the status of certain elements within the coach such as zone thermostats and on/off signals. Each element on the screens listed below will be explained in detail.

Operating Mode (A):

The operating mode contains six items which relay at-a-glance information about the function of the Aqua-Hot.

System Voltage:

This section of the Operating Mode page indicates the status of the supply voltage to the Aqua-Hot. This will display “OK” if the supply voltage is between 11V DC and 16V DC.

If this element displays anything except “OK” begin troubleshooting the coach-side voltage.

Burner:

This indicates the current burner status as either ON, OFF or FAULT. ON indicates that the burner is active, and able to fire to provide heat.

OFF indicates that heat is either not required or not requested by the controller.

FAULT indicates that there is an issue with the burner.

Electric:

The Electric section indicates the controller’s current handling status of the AC electric relay.

This status indicates that the controller is attempting to activate the element relay only. This does NOT indicate whether the electric element is in working order or not.

Heat Zone #:

The next three elements indicate the current status of the heating zones (maximum 3).

This element (ON or OFF) only indicates that the zone thermostat is requesting heat, AND that the controller is providing power to the zone fans.

Inputs from Coach (B):

The Inputs from Coach section will display the signals received from within the coach as pertaining to the RVC network and the heating zone thermostats.

With respect to the zones, there will be three different items displayed next to the Zone # items depending on the type of coach-side thermostat in use.

- ON: This indicates that the zone is active, and the zone thermostat is calling for heat
- OFF: This indicates that heat is either not needed, or not requested by the zone thermostat
- 71°: This indicates the set-point of the coach thermostats. The example in Figure 10 is showing the coach thermostat is requesting it be 71°F in Zone 1. This is only available with certain coach thermostats.

Outputs to Coach (C):

The Outputs to Coach indicates that the controller is sending power to components within the coach. This section may also show faults with components in each zone.

In the example in Figure 18, the controller is not sending power to the boost pump, so the boost pump is shown as OFF.

Fan Zone 1 is ON, meaning that the controller is sending power to the Zone 1 fans.

Fan Zone 2 is Over Current, indicating that there may be a problem with the fans in this zone.

Fan Zone 3 is not active. The controller is not receiving a request for heat from the coach, and it is not powering the zone fans.

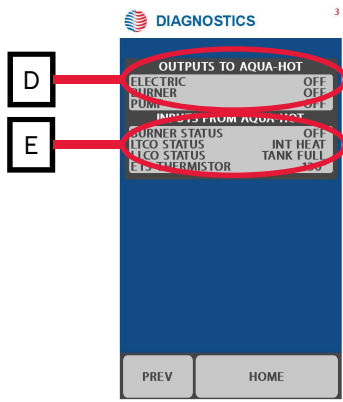


Figure 19

Outputs to Aqua-Hot (D):

The Outputs to Aqua-Hot section describes the current status of the controllable elements within the Aqua-Hot which are the Burner Status, Fluid Circulation Pump, and the Electric Element.

This indicates only that the controller is attempting to operate these elements, not their current functional status.

Inputs from Aqua-Hot (E):

The Inputs to Aqua-Hot will contain the current readings from sensors within the Aqua-Hot. Four elements will be shown on this page; Burner Status, LTCO Status, LLCO Status, and ETS Thermistor.

Burner Status:

The Burner Status element on this page indicates the status of the external diesel burner.

LTCO Status:

The LTCO status indicates the sensor reading from the Low-Temperature Cutoff Thermostat, which is the device that governs whether to provide heat or hot water.

LLCO Status:

LLCO status relays the current sensor reading of the Low-Level Cutoff sensor within the overflow bottle.

The LLCO is implemented to measure the fluid level within the overflow bottle to ensure that it does not drop below a safe threshold.

ETS Thermistor:

The ETS Thermistor (short for engine temperature sensor) will display the current temperature of the antifreeze and water heating solution within the Aqua-Hot.

The ETS provides this temperature information to the controller, which then governs when the external diesel burner and/or electric element shut off.

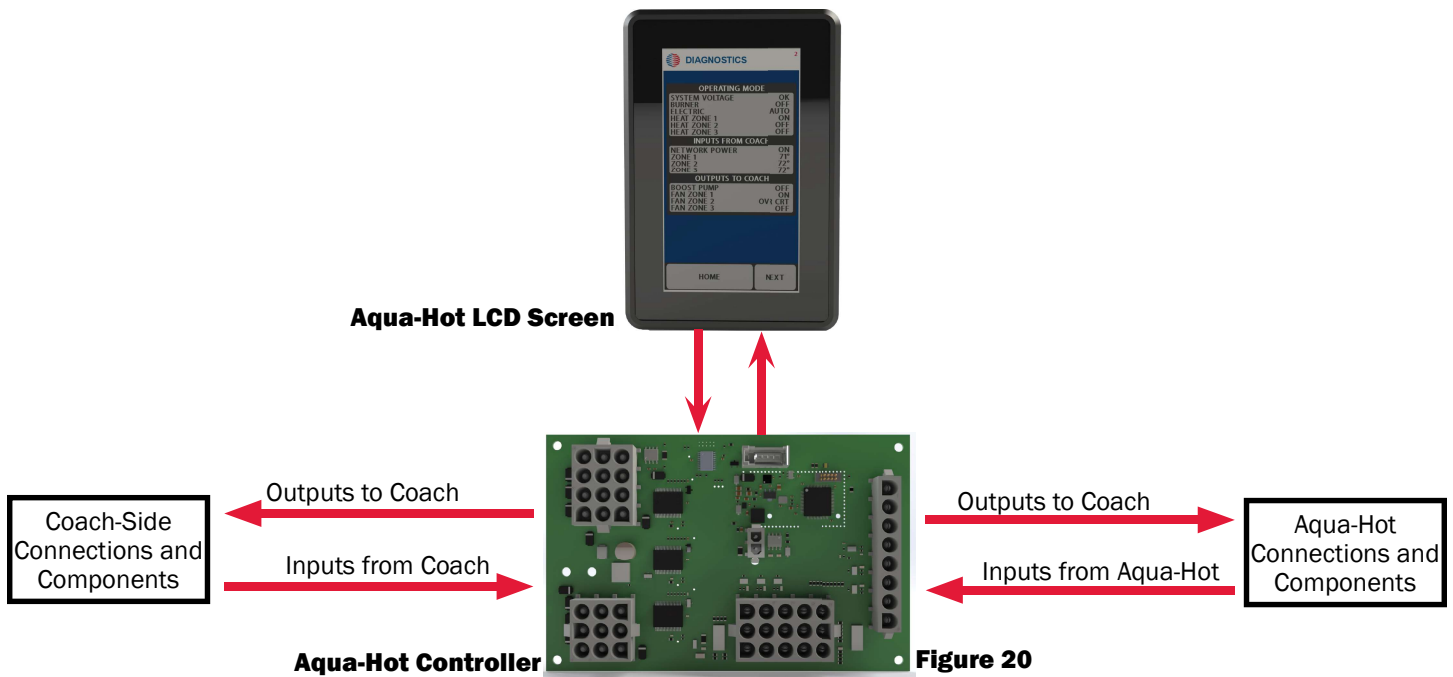


Figure 20

Testing Functionality:

One of the new features of this control system is the ability to independently activate specific elements within the Aqua-Hot for testing purposes.

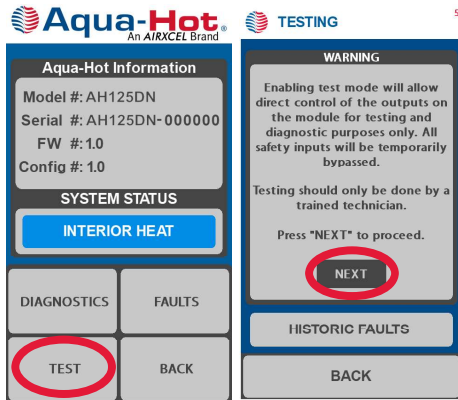


Figure 21

This will allow a technician to activate specific elements within the Aqua-Hot as needed without jumping wires or utilizing external power supplies in most troubleshooting cases. Any elements activated via the testing screen will remain active for a maximum of five minutes.

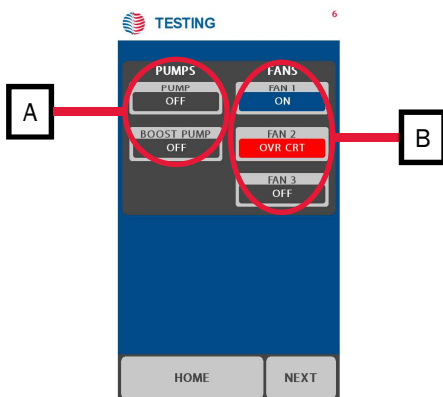


Figure 22

Pumps (A):

Both the zone circulation pump and the boost pump (if applicable) can be activated by tapping the corresponding pump on the test screen.

Fans (B):

All three zone fans can be activated as needed to test communication between the zone fans and the controller. Please note that this will only work if the zones have been directly wired to the Aqua-Hot as described in the installation manual.

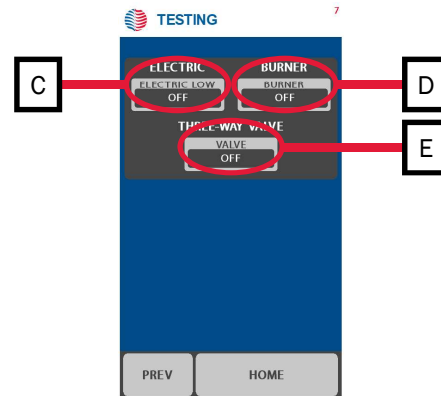


Figure 23

Heating sub-systems can be activated independent of their control circuits and other control sensors as a means of testing functionality. These systems will activate for a maximum of five minutes before shutting down.

Activating heating sub-systems in this manner will disregard all sensor inputs while attempting to activate these heating systems. As such, if the unit is near operating temperature, activating these systems may trigger an overheat condition.

DO NOT attempt to activate these sub-systems while the unit is near operating temperature



Electric (C):

Activating the Electric heating sub-system will energize the relay which controls the AC electric element.

After tapping this button on the screen, there should be an audible click from within the Aqua-Hot cabinet. If there is no such click, verify the functionality of the AC electric relay.

This test CANNOT directly energize the AC electric element. It is used only to verify the functionality of the command and control system.

Burner (D):

This element will energize the Diesel Burner signal wire, which will then trigger the heat source to activate.

Three-Way Valve (E):

The final element on this screen is not directly related to the heating subsystems of the Aqua-Hot.

The three-way valve (sometimes known as the summer/winter valve) controls the flow of the antifreeze and water heating solution within the Aqua-Hot to deliver either hot water, or interior heat as requested.

Tapping on this element will change the valve's orientation. When this element displays "INT. HEAT" this valve is oriented to provide interior heat by circulating heating solution throughout the interior heating zone. When this element displays "HOT WATER" the valve is oriented such that heating solution is routed so that hot water can be provided.

Controller Replacement Procedure:

1. Disconnect all power to the Aqua-Hot.
2. Remove top cover of the Aqua-Hot to gain access to the interior components.
3. Disconnect the DC harness from the controller.
 - Suggested disconnect order (see Figure 24):
 - 3-Pin Molex power connector
 - 12-Pin Molex (top right of the controller)
 - 9-Pin Molex (top left of the controller)
 - RVC (middle right of the controller)
 - 15-Pin Molex (middle left of the controller)
 - 8-Pin Molex (bottom of the controller)
 - DO NOT DISCONNECT THE DC HARNESS FROM ANY OTHER ELECTRICAL CONNECTION IN THE UNIT.
4. Using a $\frac{3}{8}$ " (10mm) socket, remove the nut from the top of the mounting plate.
 - SAVE THE NUT TO USE AGAIN
5. Lean the top of the mounting out from the unit wall, and then slide the controller and mounting plate upwards and out of the unit.
 - The bottom of the mounting plate has key-ways holding it in place (no nuts or other fasteners)
6. With the controller and mounting plate out of the unit, use a $\frac{1}{4}$ " socket or nut driver to remove the nuts from all four corners.
 - SAVE THESE FOR LATER USE
7. Remove the controller from the mounting plate.
 - Ensure that all 4 spacers remain on the mounting plate screws
8. Discard defective controller.
9. Plate new controller onto the mounting plate.
 - Ensure the controller is properly oriented - reference Figure 24.
10. Using the 4 nuts previously removed, fasten the controller to the mounting plate.
11. Insert the controller and mounting plate into the Aqua-Hot. As you insert the controller and mounting plate into the Aqua-Hot, the bottom of the mounting plate should slide along the wall with the top of the mounting plate leaned away from the wall to ensure the bottom catches the key-ways while the top clears the mounting stud.
12. Lean the top of the controller and mounting plate back against the wall and ensure that the bottom of the mounting plate is seated on the key-ways.
13. Using the previously removed nut, fasten the mounting plate to the wall of the Aqua-Hot.
14. Carefully reinstall all of the plugs from the DC harness.

NOTE: All plugs have only ONE correct orientation. Do **NOT** force the plug into place.

- Ensure that both tabs for all Molex connectors click into place indicating a properly seated connection.
- Ensure that the single tab for the RVC cable clicks into place indicating a properly seated connection.
- Suggested order:
 - 8-Pin Molex (bottom of the controller)
 - 15-Pin Molex (middle left of the controller)
 - RVC (middle right of the controller)
 - 9-Pin Molex (top left of the controller)
 - 12-Pin Molex (top right of the controller)
 - 3-Pin Molex power connector

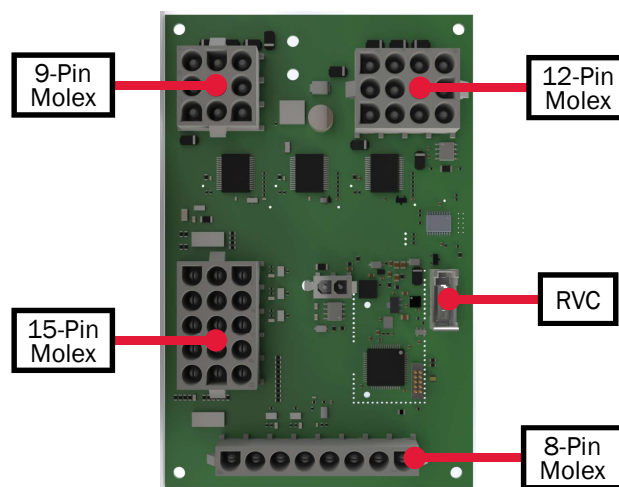


Figure 24

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 Figure 27).

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.

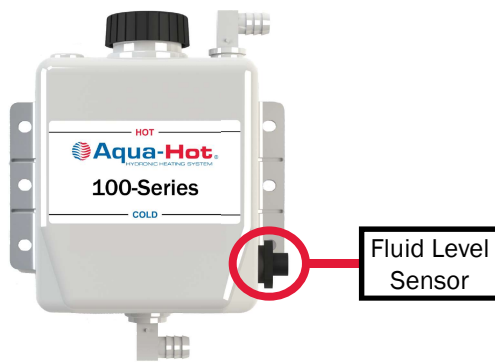


Figure 25

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).

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

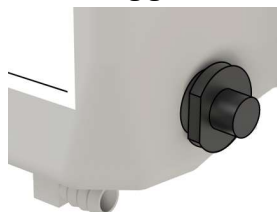
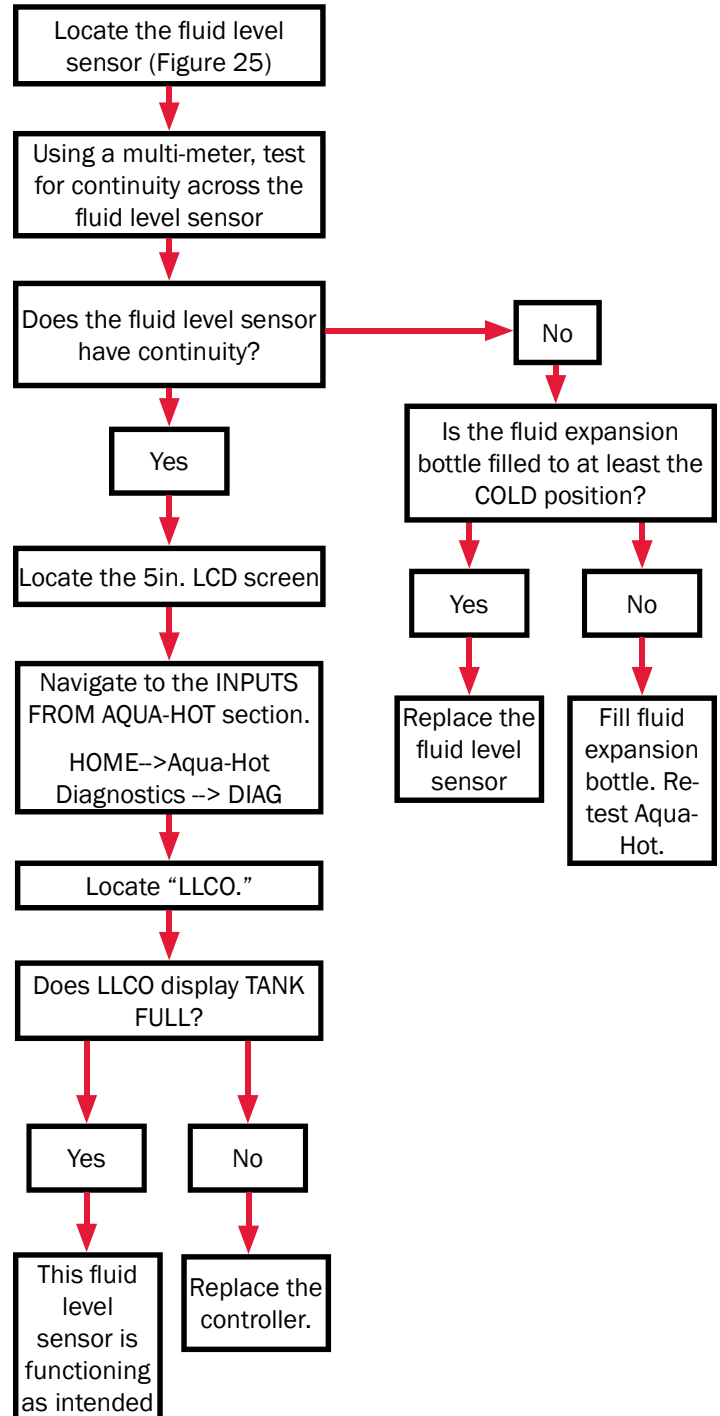


Figure 26

Troubleshooting Procedure:





WARNING

Before continuing to the replacement procedure, ensure that the unit has cooled to ambient temperature, all power sources have been disconnected, and the unit is completely shut off.

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 +1 (800) 685-4298 from 7:00am to 4:00pm MST Monday through Friday.

Expansion Bottle can be found mounted to the side of the Aqua-Hot unit

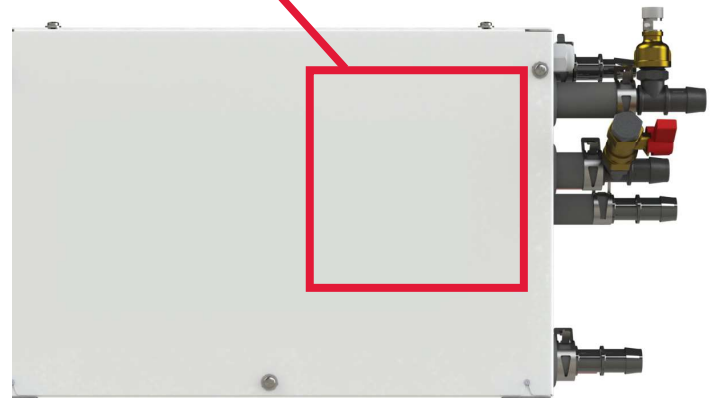


Figure 27

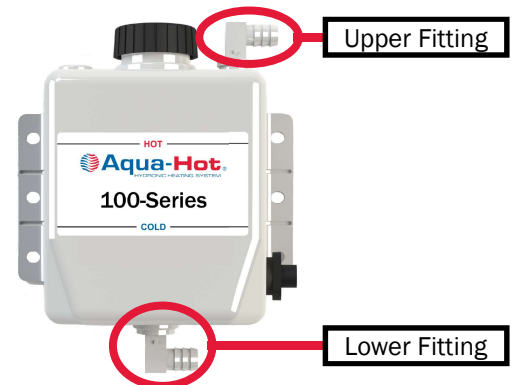


Figure 28

High-Limit Thermostats

Introduction:

The Aqua-Hot is equipped with three resettable High-Limit Thermostats. These thermostats are in place to prevent the heater from operating beyond its safe operational threshold. These thermostats are resettable and easily replaceable.

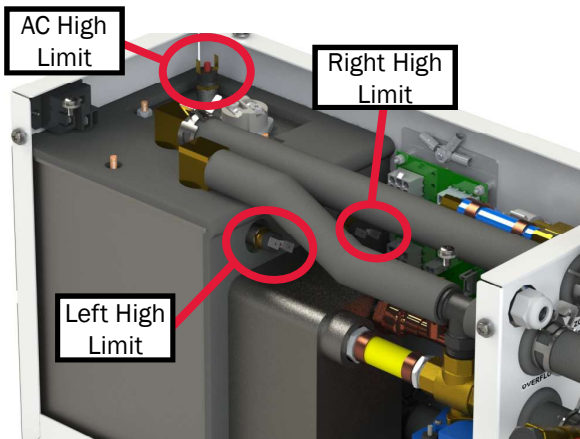


Figure 29

Begin troubleshooting the High-Limit Thermostats if the controller issues an overheat fault, or the electric and/or diesel burner fail to operate correctly.

Troubleshooting Guidelines:

The following conditions must be met before the High-Limit Thermostats 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.

Troubleshooting Procedure:

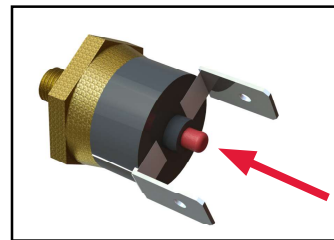
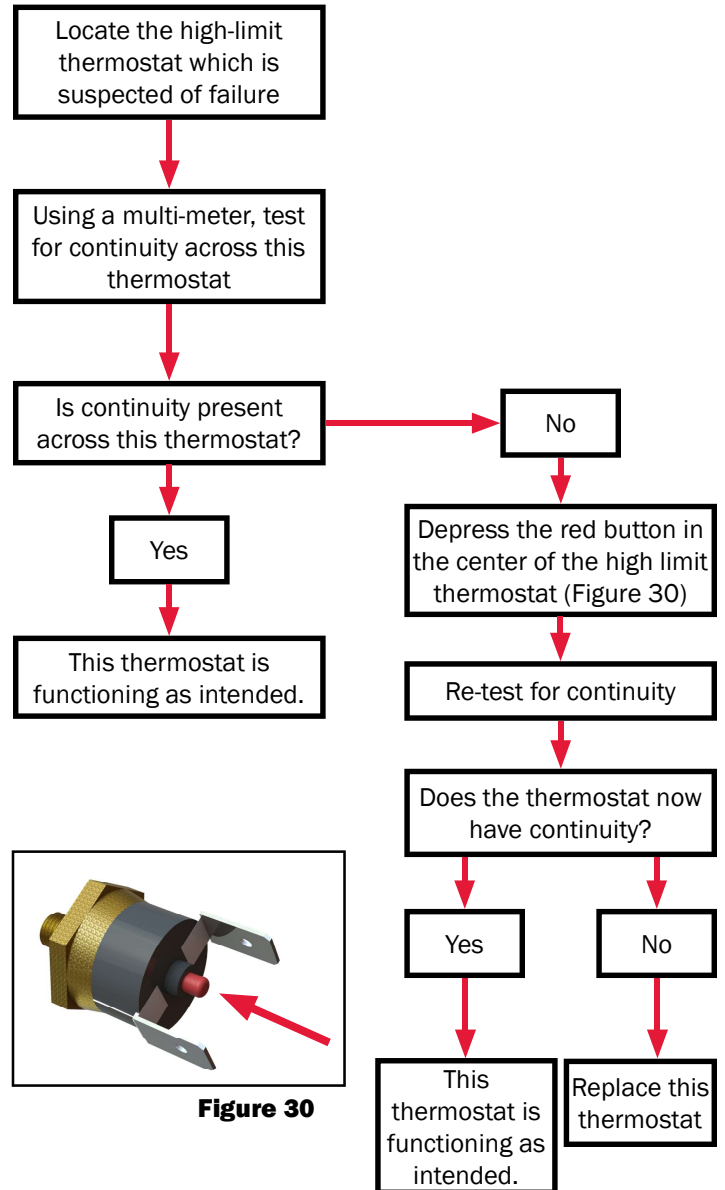


Figure 30

Replacement Procedure:

If it has been determined that one, or multiple high-limit thermostats need to be replaced, they can be easily replaced by following the directions below.

1. Disconnect all sources of AC and DC power from the Aqua-Hot (if the AC high-limit thermostat is the issue, the AC access cover will need to be removed - see Figure 32).
2. Disconnect the wires which connect to the non-functional high-limit thermostat.
3. Using a $\frac{5}{8}$ " (16mm) wrench, remove the thermostat from its location on the fluid tank.

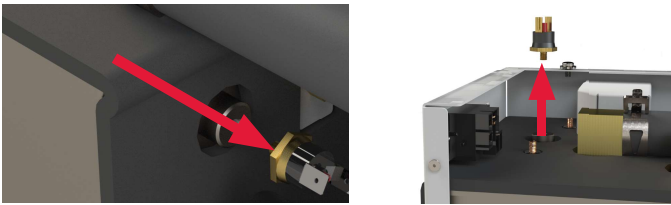


Figure 31

4. Locate the new thermostat and secure it in place of the old thermostat
5. Reconnect the disconnected wires as described by the table below.

High Limit Thermostat	Wires
Left	J6-3 and BOT1
Right	BOT1 and J6-3-HL
AC	AOT1 and AOT2

6. Test the Aqua-Hot for normal operation.

If issues persist, please contact Aqua-Hot Heating Systems for additional assistance.

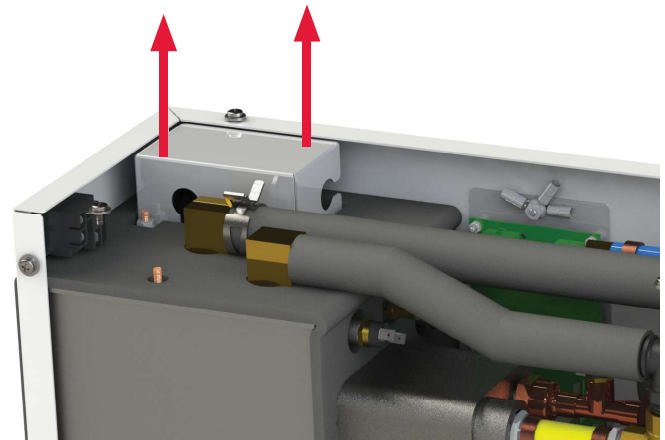


Figure 32

Low-Temperature Cutoff Thermostat

Introduction:

The Low-Temperature Cutoff Thermostat (LTCO) is installed to measure the incoming domestic water temperature. Using that reading, the Aqua-Hot controller is able to determine whether a demand for hot water exists or not.

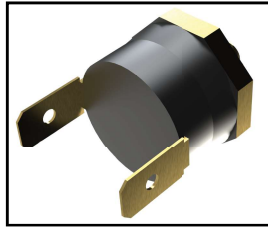


Figure 33

This thermostat should be diagnosed if there is a lack of interior heat or hot water and the tank is up to operating temperature. Follow the directions below to diagnose, and if necessary, replace the Low-Temperature Cutoff Thermostat.

Troubleshooting Procedure:

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

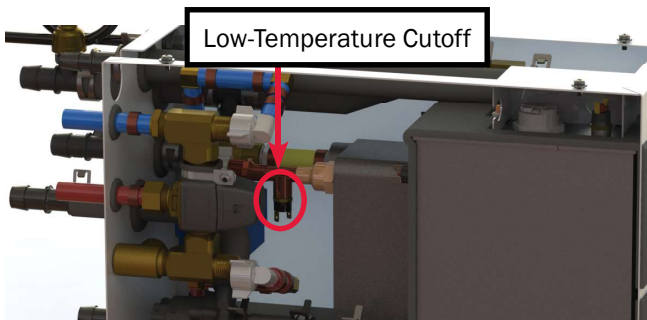
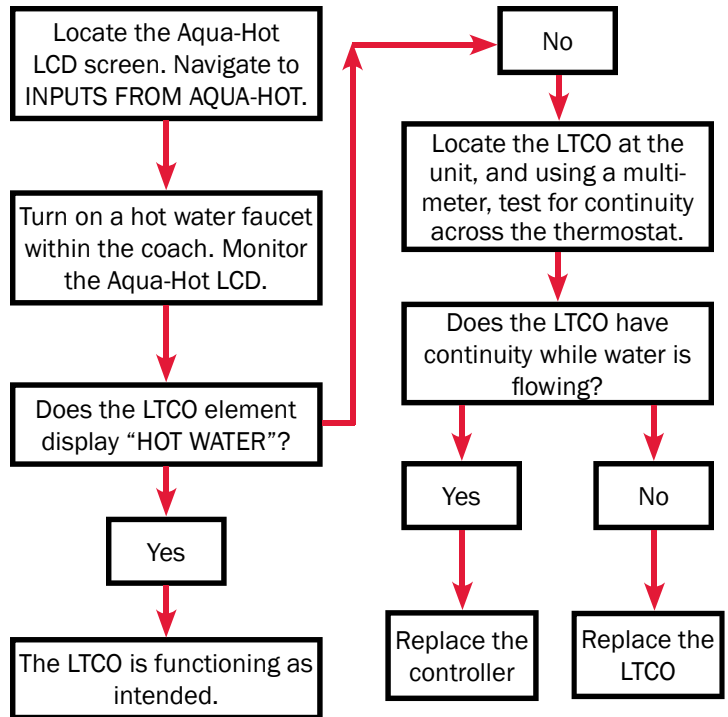


Figure 34

NOTE: The side panel has been made transparent in the view above to aid in the explanation of the repair. DO NOT remove the side panel. Doing so risks irreparable damage to the Aqua-Hot.

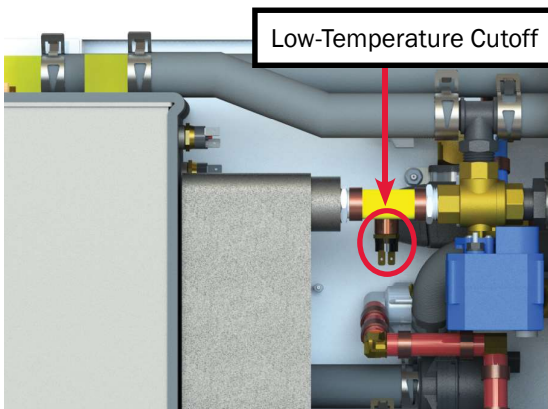


Figure 35

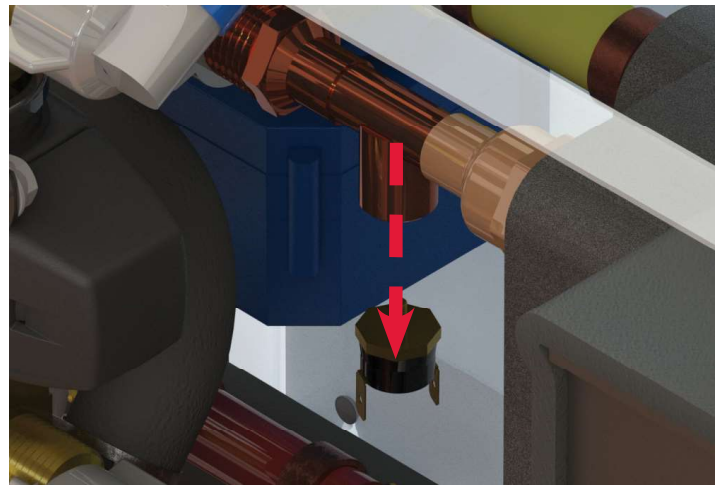


Figure 36

Replacing the Low-Temperature Cutoff Thermostat:

1. Disconnect all sources of AC and DC power from the Aqua-Hot
2. Disconnect the wires from the LTCO.
3. Remove and discard the defunct LTCO thermostat using a 5/8" wrench.
4. Position and secure the new LTCO thermostat into place.
5. Connect wires J4-1 and J4-2 to the new LTCO thermostat.

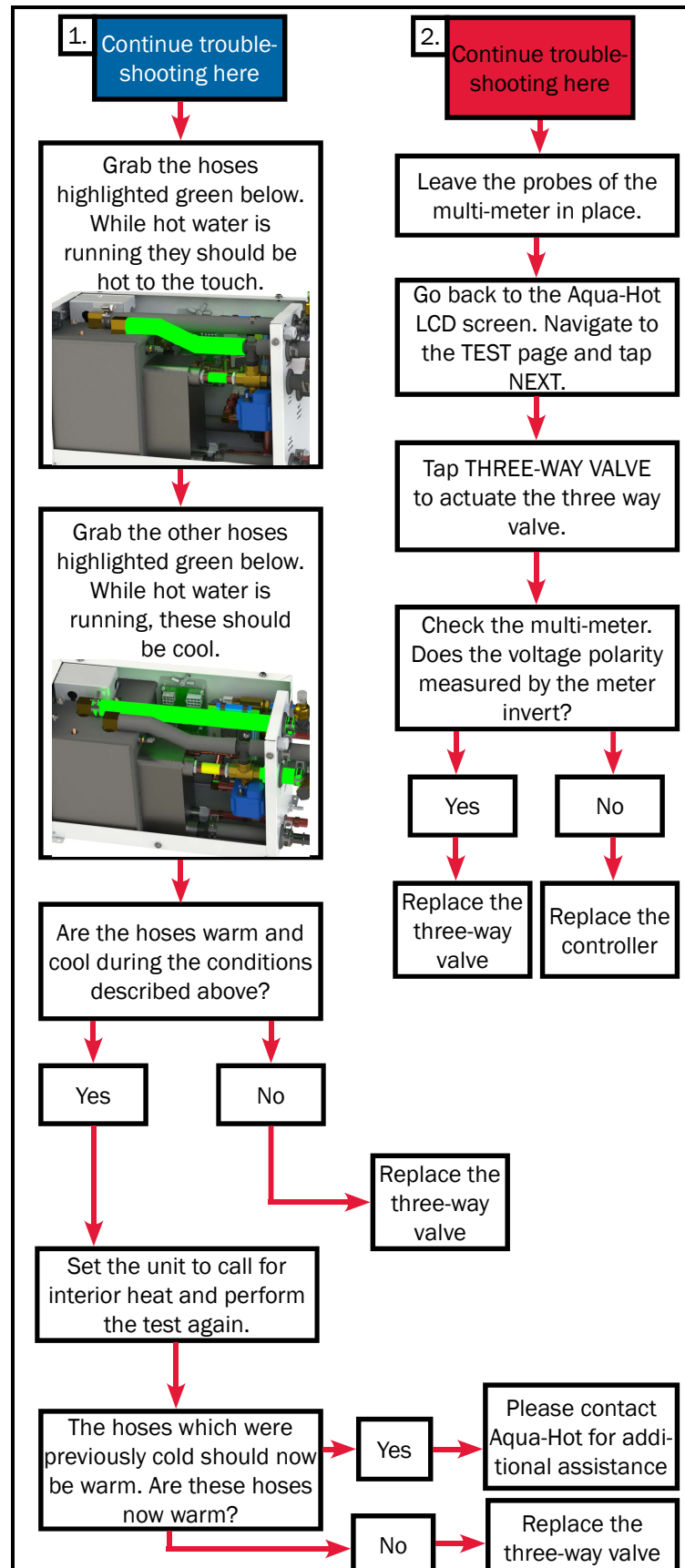
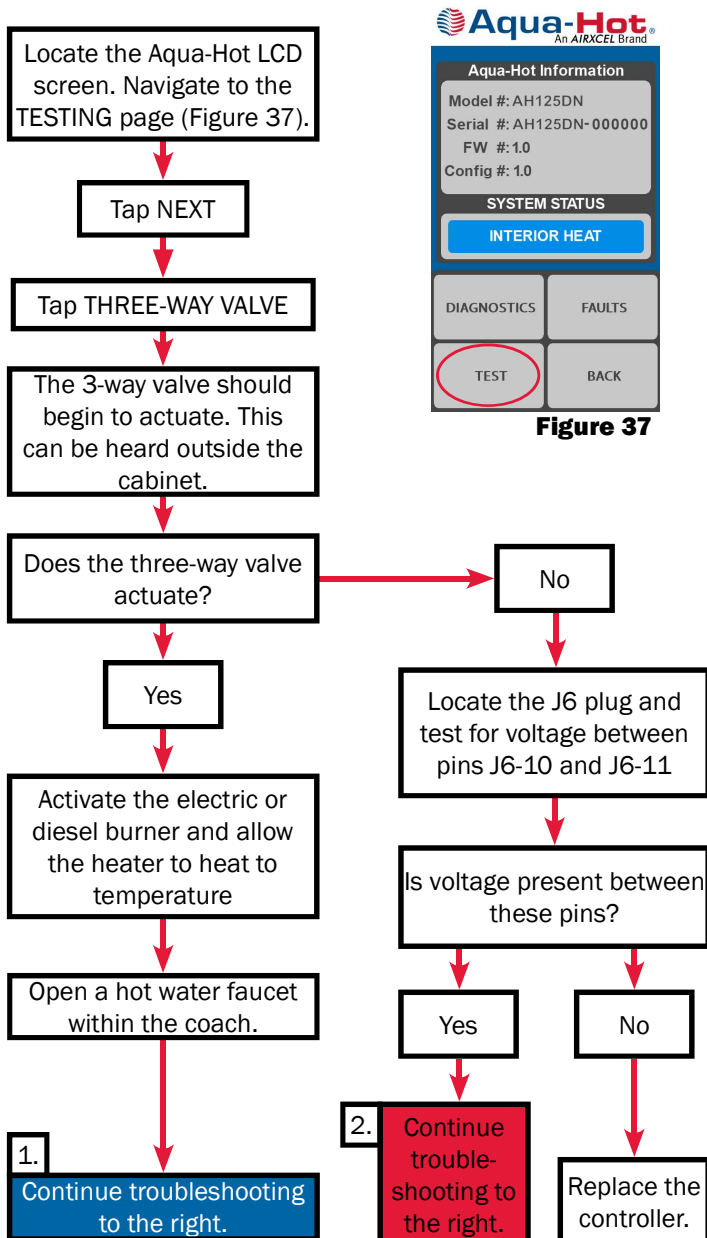
Three-Way Valve

Introduction:

The three-way valve (aka the summer/winter valve) is responsible for changing the flow of coolant either through the interior heating zone (int heat) or circulating coolant within the boiler tank (stir mode) to produce hot water.

If the three-way valve has failed, it can lead to a loss of interior heat and/or hot water. Follow the steps below to troubleshoot the three-way valve.

Troubleshooting Procedure:



NOTICE

DO NOT remove the rivets securing the side panel into place. Attempting to do so risks irreparable damage to the boiler tank of the Aqua-Hot

Before replacing the 3-way valve, you must purchase the repair kit. The Repair Kit should include:

- Three-Way Valve
- Black Nylon tee adapter
- Black Nylon barb adapter
- 2-Pin electrical connector

Replacement Procedure:

1. Drain coolant from system.
 - Pour into a bucket to be reused later.
2. Remove top and side panels from the Aqua-Hot.
 - Save screws and washers to reuse later
3. Locate the Three-Way Valve in the Aqua-Hot.

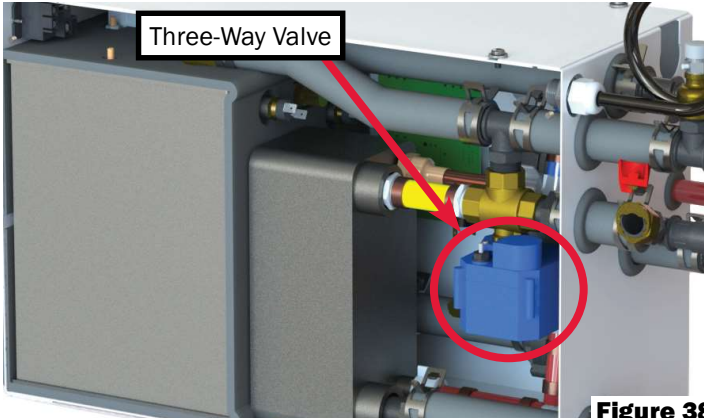


Figure 38

4. Disconnect the electrical connection from the Three-Way Valve to the DC harness.
5. On the right side of the Three-Way Valve, move the constant tension clamp onto the brass of the Three-Way Valve to ensure it is out of the way.
6. On the top of the Three-Way Valve, move the two (2) constant tension clamps AWAY from the tee fitting so that they are as far from the barb as possible.
7. On the left of the Three-Way Valve, unscrew the brass PEX fitting from the Three-Way Valve using a wrench.
 - There may be residual fluid that exits the fittings - use towels or other clean up items as necessary.
8. Remove 3/4" heater hose from the tee on the top of the Three-Way Valve.

- There may be residual fluid that exits the fittings - use towels or other clean up items as necessary.
9. Carefully remove the Three-Way Valve from the last 3/4" heater hose on the right of the valve.
 - There may be residual fluid that exits the fittings - use towels or other clean up items as necessary.
 10. Remove constant tension clamp from the brass of the Three-Way Valve on the right, and place it on the new Three-Way Valve in the same position on the brass.
 11. Discard the old valve and fittings.
 12. Using a nylon wire brush, clean the threads of the PEX fitting so that it is free of leftover thread sealant.
 13. Carefully insert the single barb back into the heater hose that the old valve was attached to.
 14. Add thread sealant (454 Loctite or better) to the threads of the PEX fitting.
 15. Using a wrench, thread the PEX fitting into the three-way valve.
 - 3-6 rotations
 - DO NOT BRACE ON THE BLUE PLASTIC WHEN TIGHTENING. This may damage the mechanism or electrical components.
 16. Install the hoses on the tee on the top of the valve.
 17. Move the constant tension hose clamps to just behind the barb of each fitting.
 - Left side of the tee on the top of the 3-way valve.
 - Right side of the tee on the top of the 3-way valve.
 - Right side of the 3-way valve, off the brass onto the hose.
 18. Connect the electrical wire from the valve to the DC harness.
 19. Reinstall the side panel and lid using the saved screws and washers from Step 2.
 20. Refill the unit with the coolant saved from Step 1.
 - Add more coolant is needed.
 - Monitor the newly installed parts and fittings for leaks.



Figure 39

Tempering Valve

Introduction:

The tempering valve of the Aqua-Hot mixes the hot domestic water from the interior of the Aqua-Hot with cold incoming domestic water to temper it to a threshold where scalding will not occur.

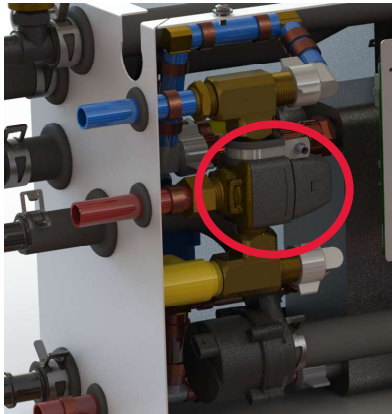


Figure 40

NOTE: The side panels have been made transparent in the view above to aid in the explanation of the repair. DO NOT remove the side panels. Doing so risks irreparable damage to the Aqua-Hot.

! DANGER

Risk of Severe Burn or Death from Scalds. Water temperature over 51°C (123.8°F) can cause severe burns instantly or death from scalds. See instruction manual before setting temperature at water heater. Feel water before bathing or showering. Temperature limiting valves are available, see manual.

WARNING:
 HOT WATER CAN PRODUCE 3RD DEGREE BURNS
 - IN 6s AT 60°C (140°F)
 - IN 30s AT 54°C (129.2°F)
 WATER DELIVERY TEMPERATURE MIXING VALVE WAS FACTORY SET AT 49°C (120.2°F).
 CONTACT QUALIFIED SERVICE PERSONNEL FOR ADJUSTMENTS.

Risque de brûlures graves ou la mort de brûlures. De l'eau à une température au-dessus de 51 °C (125 °F) peut ébouillanter et causer instantanément des brûlures graves allant jusqu'à la mort. Consultez le manuel d'instruction avant de régler la température du chauffe-eau. Vérifiez la température de l'eau avant de prendre un bain ou une douche. Des soupapes de limite de température sont disponibles. Voir le manuel.

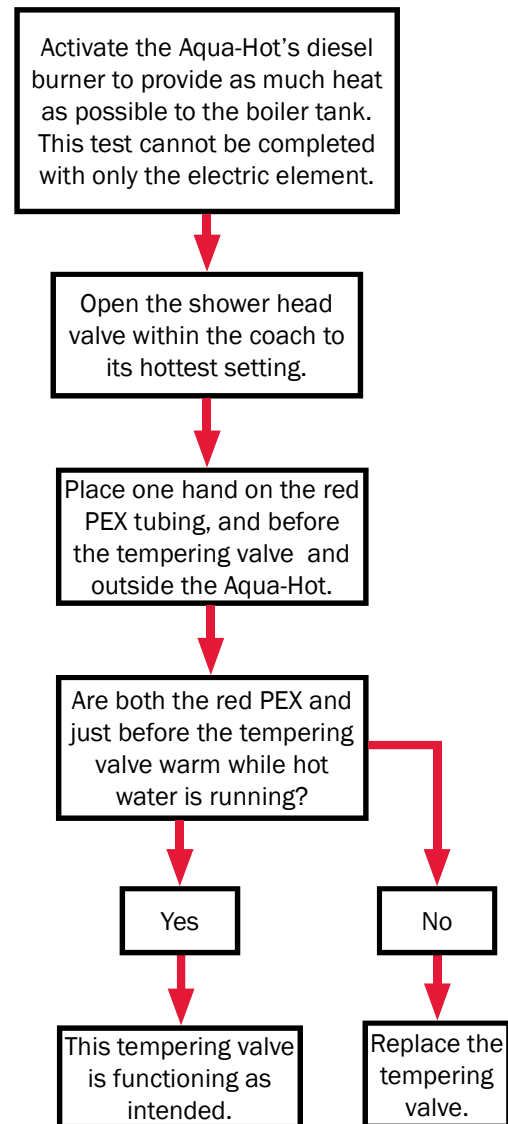
AVERTISSEMENT:
 L'EAU CHAUDE PEUT PRODUIRE DES BRÛLURES DE TROISIÈME DEGRÉ
 - EN 6s À 60 °C (140 °F)
 - EN 30s À 54 °C (129,2 °F)
 LA VANNE DE MÉLANGE DE TEMPÉRATURE D'ALIMENTATION EN EAU A ÉTÉ RÉGLÉE EN USINE À 49 °C (120,2 °F). CONTACTER DU PERSONNEL DE SERVICE QUALIFIÉ POUR LES AJUSTEMENTS.

LDE-003-260

Testing Procedure:

Follow the testing procedure to the right in order to diagnose the tempering valve. 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.



NOTE: Adjusting the mixing valve beyond 120 °F (49 °C) 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. Shut off the external domestic water connection, and open a hot water faucet valve within the coach to relieve the water pressure.
2. Open the domestic water drain valve on the Aqua-Hot and release water in the system.
 - Attach hose to the 1/2" PEX barb to release fluid without spilling throughout the coach
 - Ensure that the hose does not rise from the drain valve otherwise proper drainage will not happen.
3. Disconnect the coach side domestic water connections
4. Remove the top cover and side covers of the Aqua-Hot to gain access to the interior components.
 - Save the screws and washers to be reused later.
5. Using a 3/8" (10mm) socket, remove the nut which secures the domestic water valve assembly to the side of the Aqua-Hot cabinet (shown below).

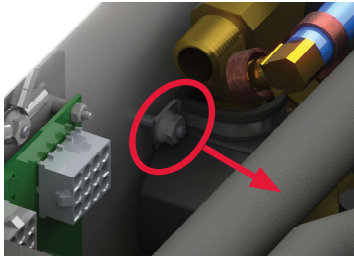


Figure 41

6. Disconnect the swivel fittings attached to the brass tees on the tempering valve.
 - One swivel fitting is attached to the red PEX and the other is attached to the blue PEX.
 - There may be residual fluid in the lines. Use clean-up items and tools as needed.

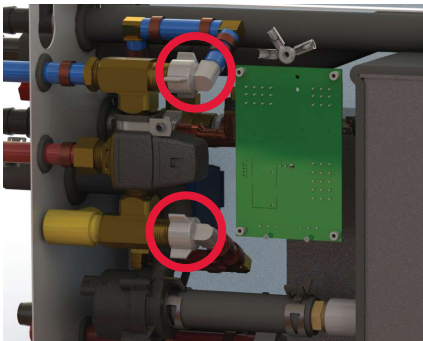


Figure 42

7. Remove the P-clamp from the stud on the wall of the Aqua-Hot. Save the P-clamp for reuse later.
8. Slide the tempering valve assembly gently backwards towards the coolant tank until the PEX tubes of the assembly are no longer protruding from the Aqua-Hot.
 - Ensure you do not collide with the controller or damage

any other components in the Aqua-Hot.

9. Remove the assembly from the Aqua-Hot.
10. Remove all three fittings from the tempering valve as shown below.

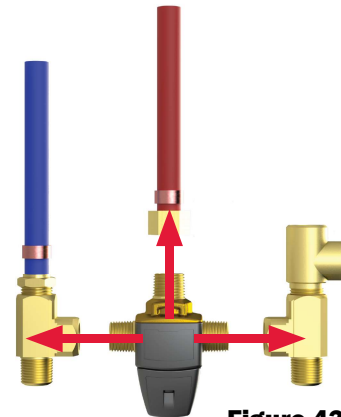


Figure 43

11. Discard the defunct mixing valve.
12. Using Teflon tape and domestic water safe thread sealant, reinstall all fittings to previous orientations.
13. Place previous P-clamp onto the assembly before inserting into the Aqua-Hot.
14. Insert repaired assembly into the Aqua-Hot and slide the red and blue PEX through their ports in the front face of the Aqua-Hot.
 - Use soapy water as necessary to lubricate the PEX going through the rubber grommets in the ports.
 - DO NOT SPRAY ELECTRICAL COMPONENTS AND WIRES WITH SOAPY WATER.
15. Connect the swivel fittings back to their respective places on the assembly.
 - Do NOT over-tighten the swivel fittings.
16. Using the nut from Step 5, tighten down the P-clamp on the assembly.
17. Reattach the domestic water lines and check for leaks before replacing the side and top panels of the Aqua-Hot.
18. After checking for leaks, replace the side and top panels of the Aqua-Hot using the screws from Step 4.

Fluid Circulation 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.



Figure 44

Troubleshooting Procedure:

If the fluid circulation pump has failed, it will typically indicate an over-current fault on the controller fault log. If this is the case, the fault must be verified before replacing the circulation pump. Follow the procedure to diagnose the fluid circulation pump.

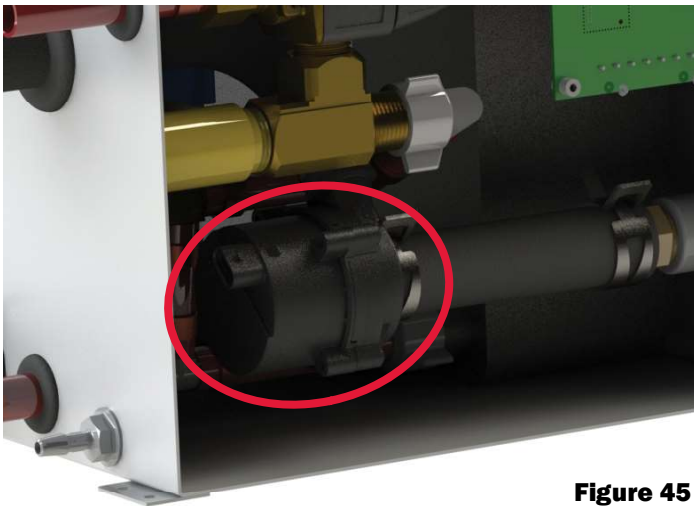


Figure 45

NOTE: The side panel has been made transparent in the view above to aid in the explanation of the repair. DO NOT remove the side panels. Doing so risks irreparable damage to the Aqua-Hot.

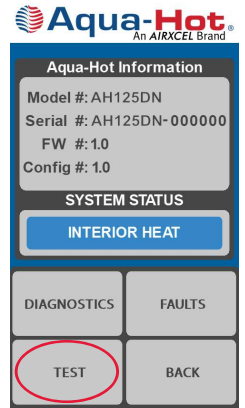
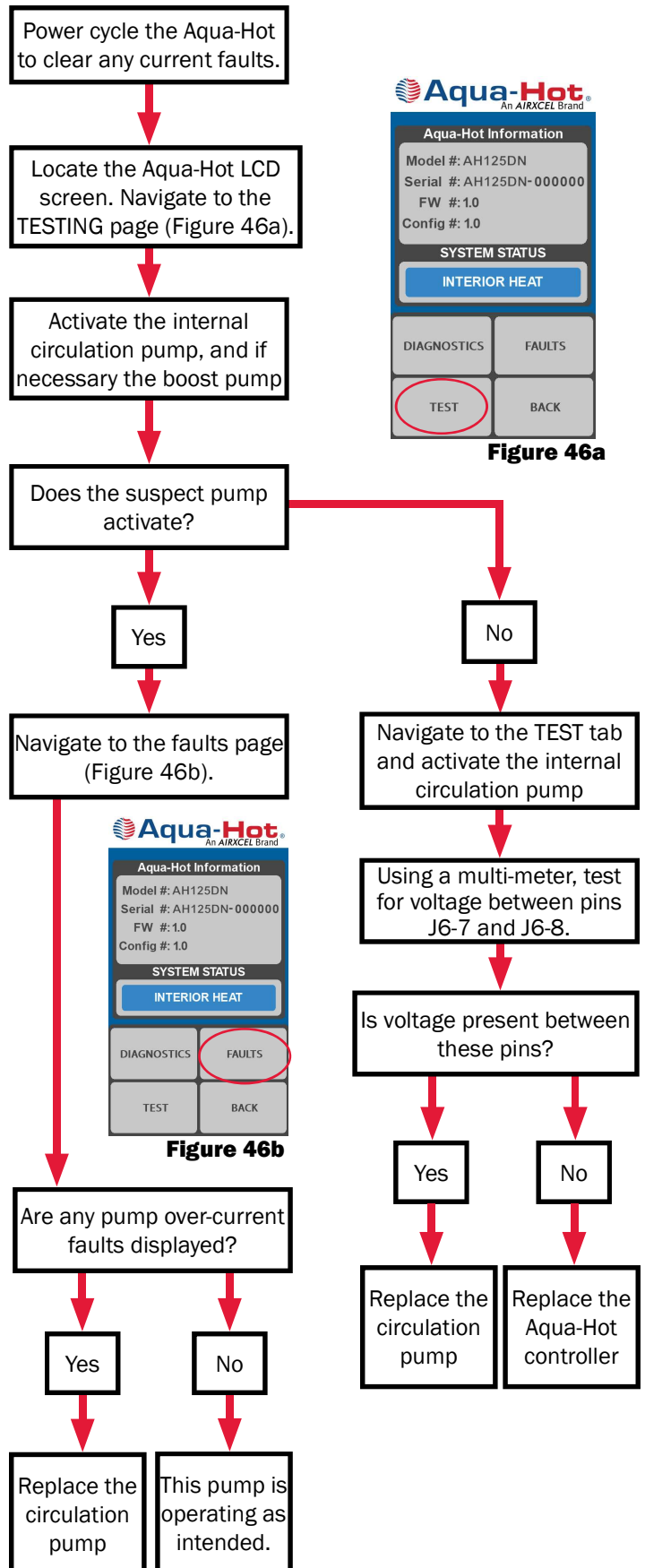


Figure 46a

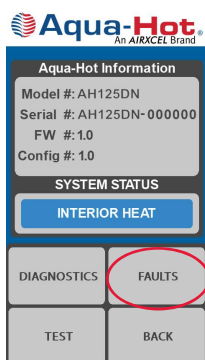


Figure 46b

Replacement Procedure:

1. Drain coolant from system. Pour into a bucket to be reused later.
2. Remove the top and side panels from the Aqua-Hot. Save the screws and washers to be reused later.
3. Place a paper towel into the Aqua-Hot unit on the bottom of the cabinet. (This is to help absorb any residual coolant left in the lines upon pump removal.)
4. Remove electrical plug to the circulation pump and move up and out of the way.
5. Remove both hose clamps from the barbs of the pump.
 - Leave the clamps on the 90° hose and hose from the tank - to be reused later.

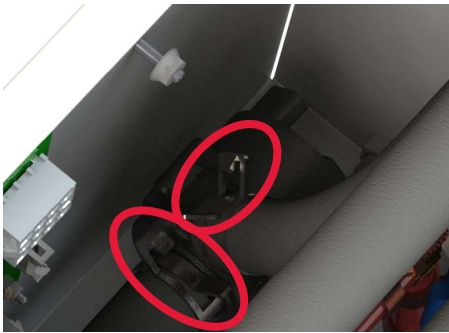


Figure 47

6. Carefully remove the 90° hose from the pump.
7. Carefully remove the pump from the hose attached to the tank.
8. Remove the pump from the Aqua-Hot and discard it.
9. Insert the new circulation pump into the Aqua-Hot and attach it to the hose coming from the tank.
10. Attach the 90° hose to the circulation pump barb.
11. Move both hose clamps onto the barbs of the new circulation pump.
12. Plug the connection from Step 4 into the circulation pump.
13. Reinstall the side and top panels using the saved screws and washers from Step 2.
14. Refill the unit with the coolant saved in Step 1.
 - Add more coolant if needed.
 - Monitor the newly installed parts and fittings for leaks.

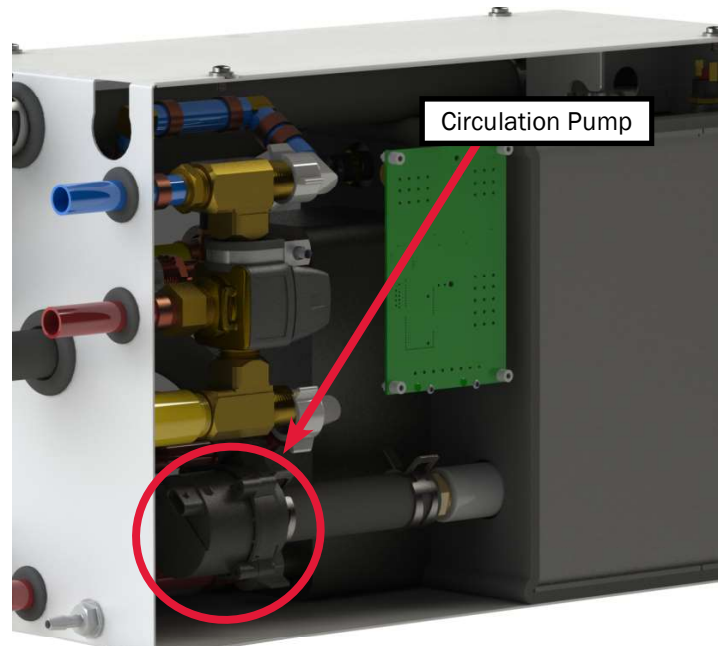


Figure 48

NOTE: The side panel has been made transparent in the view above to aid in the explanation of the repair. DO NOT remove the side panels. Doing so risks irreparable damage to the Aqua-Hot.

AC Electric System

Introduction:

The AC Electric system of the Aqua-Hot 125DN unit functions to provide heat to the Aqua-Hot boiler tank. This is done with an electric element and an electric relay.

Troubleshooting Procedure:

Troubleshoot the AC Electric system if the electric element is not functioning properly.

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.
- Verify there are no faults on the Aqua-Hot LCD.

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.

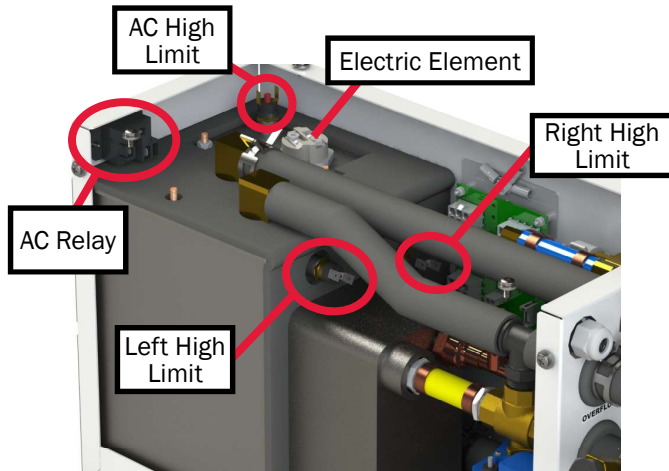


Figure 49

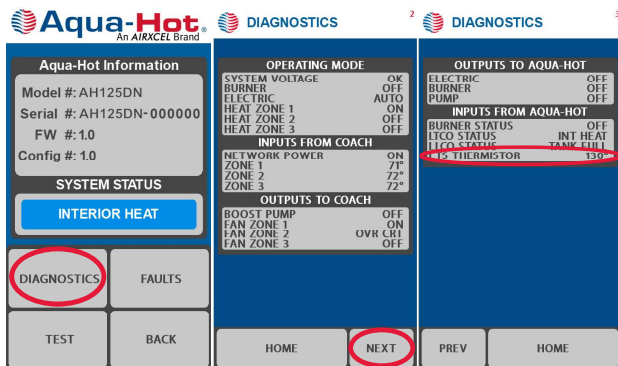
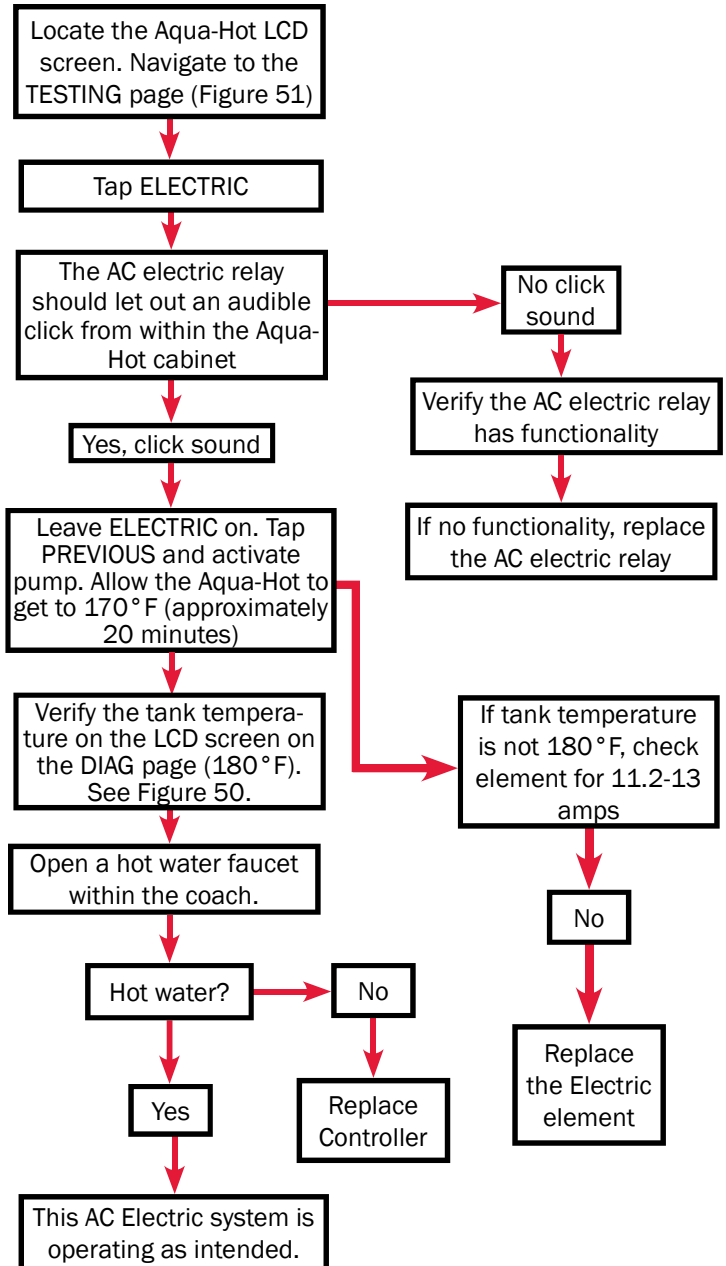


Figure 50

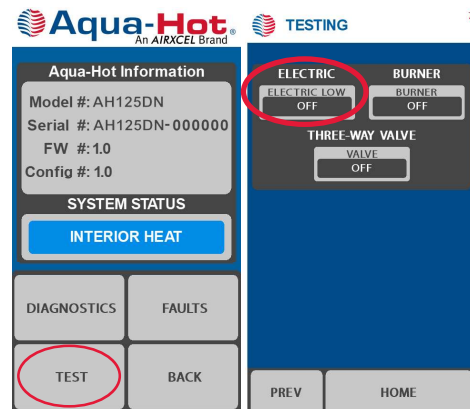


Figure 51

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 from the TO HEAT SOURCE and FROM HEAT SOURCE hoses, turning the unit so that the front is down. Drain the coolant into an external container to be reused.
4. Remove the AC access panel on the Aqua-Hot (Figure 52).
5. Remove the two wires secured to the defective electric heating element by releasing the screw terminals (Figure 56).
6. Using a 1-1/2" (38mm) socket, remove the defective heating element from the Aqua-Hot's boiler tank.
7. Use a healthy amount of Loctite 454 on the threads of the new electric element to ensure that it forms an adequate seal.
8. Install the replacement 1500W electric element into the boiler tank and secure it with the 1-1/2" (38mm) socket.
9. Reconnect the wires previously disconnected from the electric heating element and tighten the screw terminals, then put the AC cover back on.
10. Refill the Aqua-Hot boiler tank with the previously drained fluid, add more 50/50 mix of ethylene glycol and distilled water to the tank if needed.
11. 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.

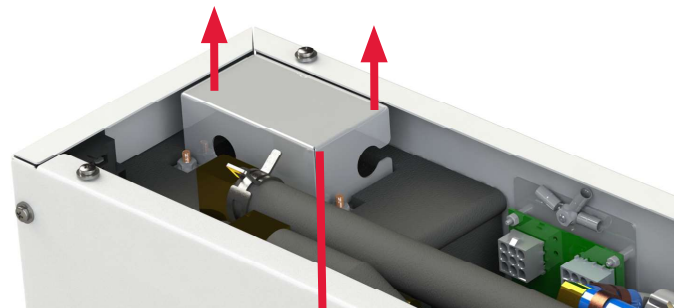


Figure 52

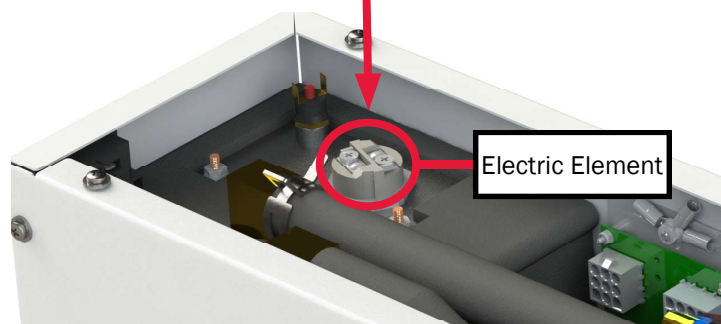


Figure 53

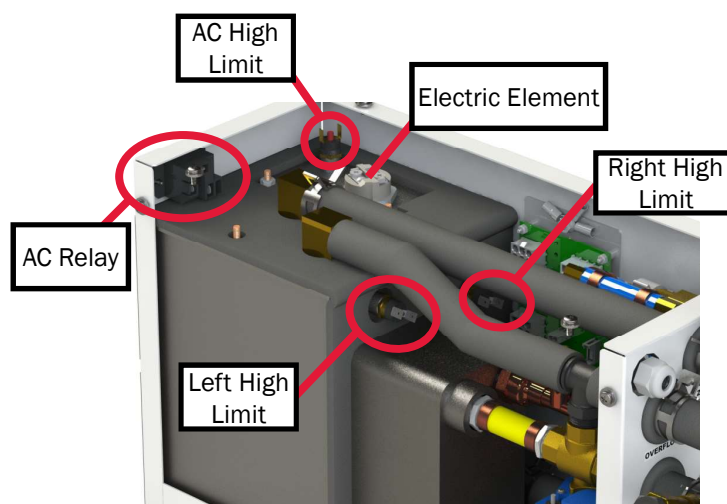


Figure 54

AC Relay

Introduction:

The AC Relay is an electrical device where the DC circuit from the controller determines whether the AC power is permitted to flow to the electric heating element. This allows the controller to switch the electric heating element on and off in conjunction with the interior switch panel and ETS module even though the electric element is on a separate circuit.

Troubleshooting Procedure:

Troubleshoot the AC Relay if the electric element fails to operate. This can be verified with a simple test outlined below.

The following conditions must be met before the AC Relay 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.
- 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.

1. Locate the AC wires connected to the AC Relay and remove the wires from the relay.
2. Using an ohmmeter, check the AC relay pins for continuity.
3. If no continuity exists, follow the procedure to replace the AC Relay.

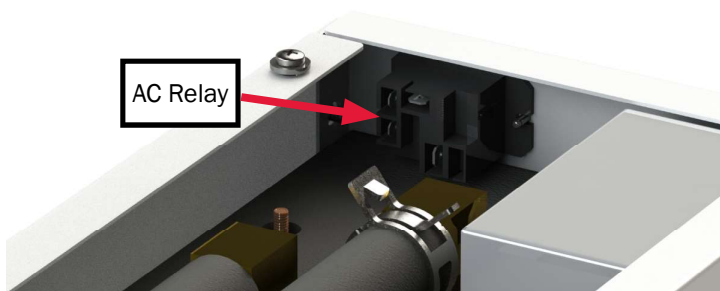


Figure 55

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. Ensure that the coach is not connected to shore power and that a generator is not connected during this procedure.
3. Remove all wires from the relay.
4. Remove the defective relay by drilling the rivets that hold the relay in place (reference Figure 56) and discard the defective relay.
5. Rivet the replacement AC relay to the previous position.
6. Using the wiring diagram on page 42, connect the wires previously removed to the replacement AC relay.

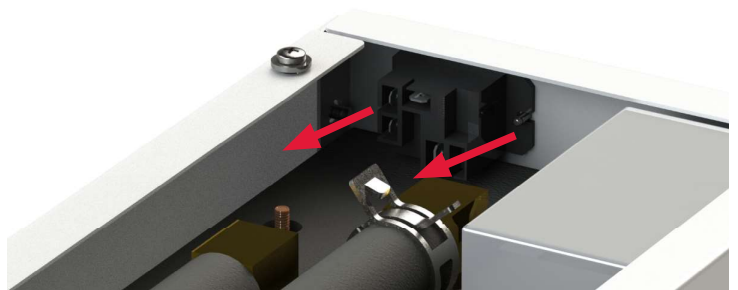


Figure 56

ETS Module

Introduction:

The ETS (Engine Temperature Sensor) Module is a brass thermistor that continually measures the temperature of the fluid within the Aqua-Hot boiler tank. This module then relays the information to the Aqua-Hot controller, thereby allowing the controller to activate and deactivate the unit as heating and hot water needs change.

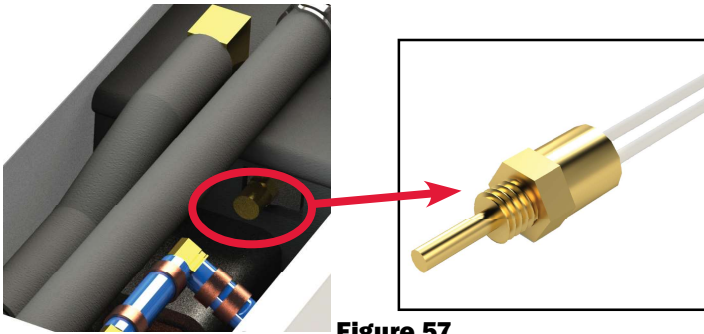


Figure 57

Troubleshooting Procedure:

Troubleshooting the ETS module is a relatively straight forward process. Follow the instructions below to diagnose the ETS module. Troubleshoot the ETS module if the following conditions have occurred:

- A lack of hot water.
- A lack of interior heat.
- The Aqua-Hot is not operating.

Verify the following before proceeding with the troubleshooting:

- The overflow bottle is adequately filled.
- 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.
- The high-limit thermostats are not tripped.
- All fuses 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.

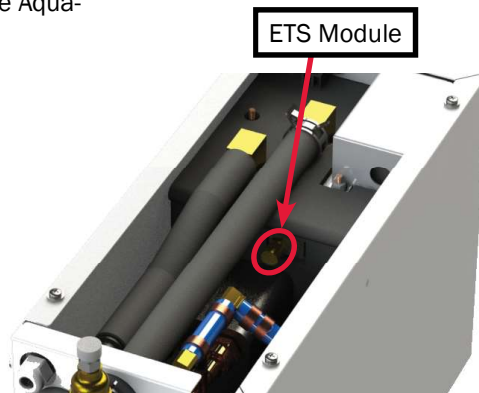


Figure 58

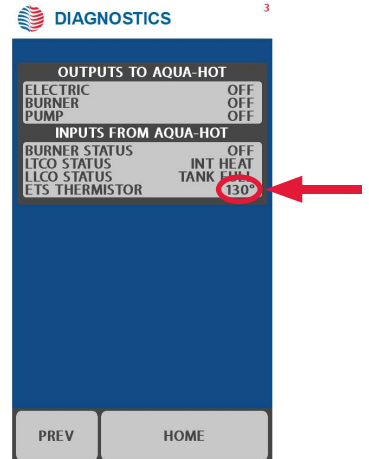
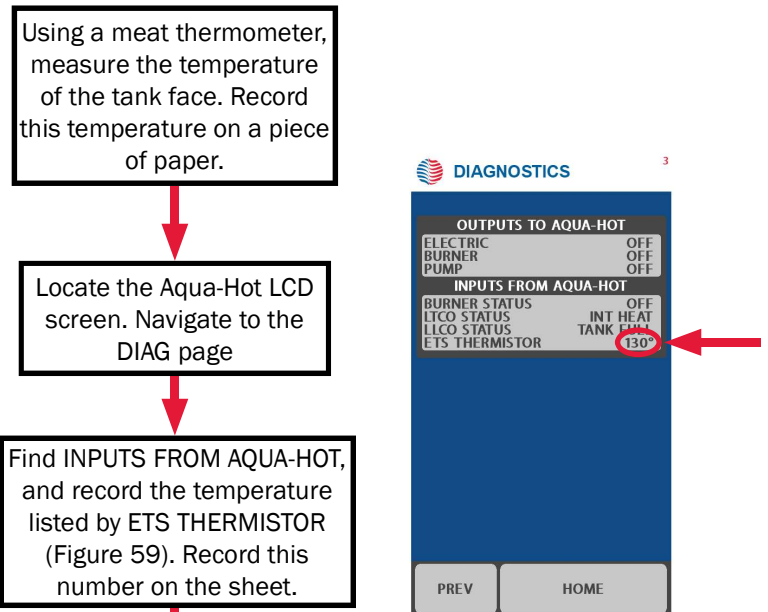
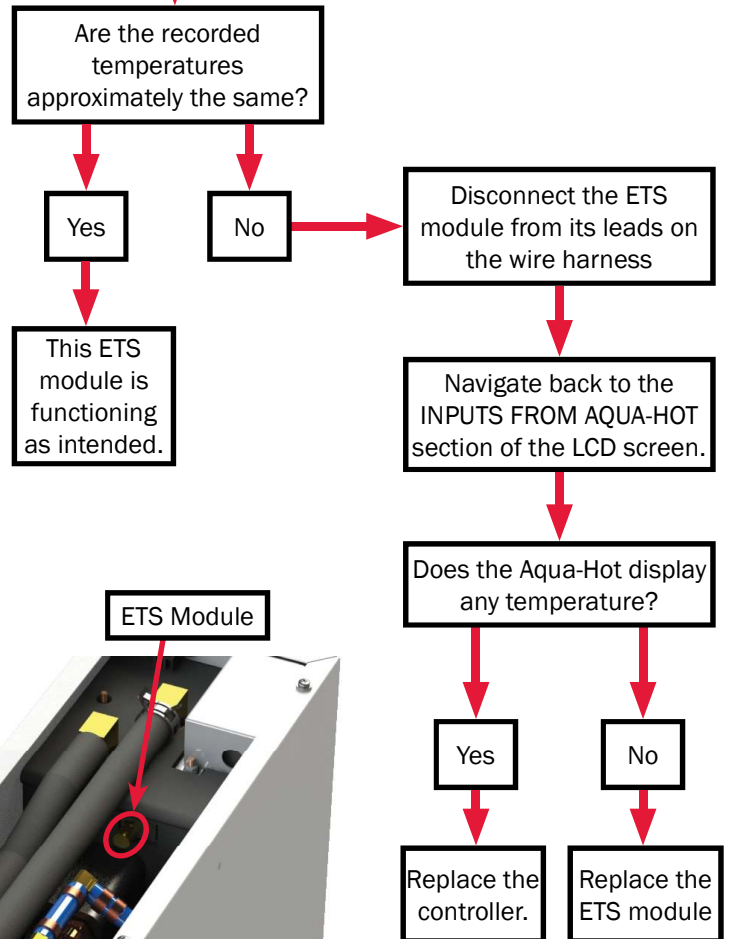


Figure 59



Replacement Procedure:

If the ETS Module has been diagnosed and a replacement must be made, follow the instructions below.

1. Drain the unit by clamping the TO HEAT SOURCE hose (Figure 60) located outside the Aqua-Hot, and removing it.



Figure 60

2. Allow the fluid to drain into an external bucket or container to be reused later. If necessary, activate the pump to aid in draining the Aqua-Hot.
3. After approximately half a gallon has been drained from the unit, clamp the hose to stop the flow of coolant.

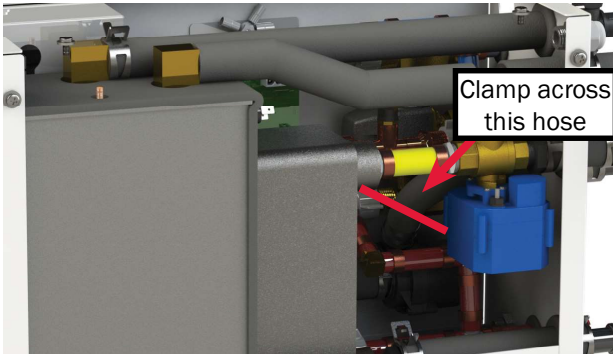


Figure 61

4. Disconnect wires from the ETS Module.
5. Using a 14mm wrench or deep socket, remove the defunct ETS module from the tank face and discard it.

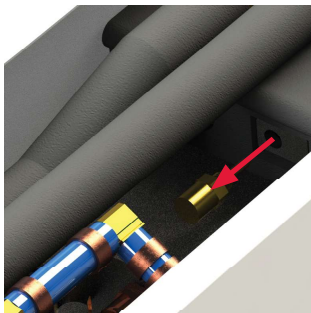


Figure 62

6. Place the replacement ETS module in its position on the tank face, and finger tighten it into place.
7. Using the 14mm wrench, tighten the module until it is snug in place.

8. Reconnect the disconnected wires from the harness.
9. Reconnect the TO HEAT SOURCE hose to the Aqua-Hot and remove the hose clamp.
10. Pour the previously removed fluid back into the fluid expansion bottle and allow it to fill the Aqua-Hot tank.
11. Once this has been completed, locate the Aqua-Hot LCD screen, navigate to the test section, and run the fluid circulation pump (and if applicable the boost pump) for at least twenty minutes to purge the heating loop of air.
12. Continually fill the fluid expansion bottle as the fluid level drops.
13. Test the Aqua-Hot for normal operation.

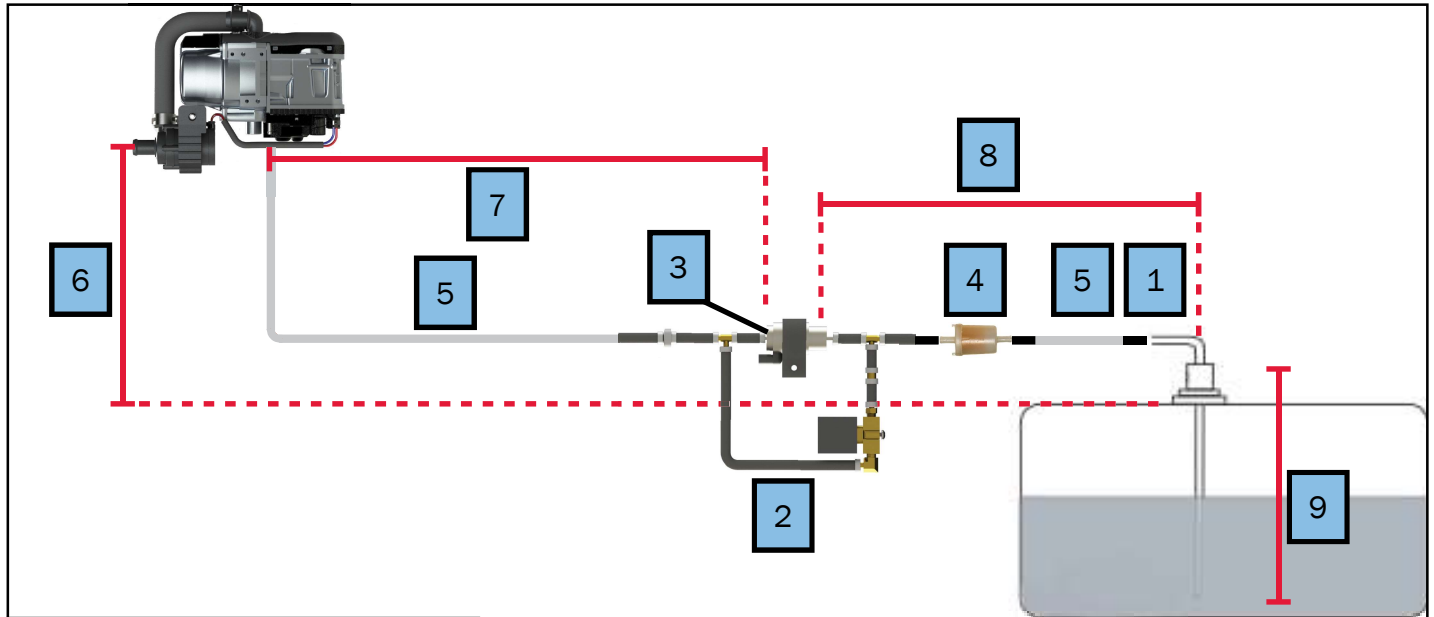


Figure 63

1. Fuel Line Coupler
2. High Altitude Bypass
3. Fuel Pump
4. Fuel Filter
5. Fuel Line
6. Max Delivery Height (6) = 9'9" (3m)
7. Max Delivery Length (6 + 7) = 28' 3" (9m)
8. Max Suction Length (8 + 9) = 9'9" (3m)
9. Max Suction Height (9) = 3' 3" (1m)

Fuel Lines Requirements

- Parts needed:
 - PLX-125-HA1, High Altitude Kit
- Potential other parts needed:
 - PLE-125-FL1, Kit, 100 Series Fuel Line (only if fuel lines are damaged)
 - PLX-125-003, Fuel Filter, 100 Series (only if fuel filter is damaged)
- Please refer to the example diagram shown above.
- The fuel line should not be descending from the fuel pump to the burner - see Figure 65.
- The fuel line should be properly secured to avoid sagging.
- The fuel line must be installed in a manner that won't cause damage to the fuel line (i.e. close to exhaust).
- The fuel line must be secured to the connections by hose clamps.
- The fuel line should be mounted and secured with hose clamps. The hose clamp must be tightened so that the two tabs on the clamp touch each other.
- The fuel line must be only steel, copper, rubber, or plastic lines made of plasticized, light, and temperature-stabilized PA 11 or PA 12.

Fuel Filter

- A fuel filter should be installed to ensure that clean fuel is delivered to the burner at all times. The fuel filter type should be 25-30 microns.
- Make sure the fuel filter is installed in an accessible area, so it can be replaced during service.
- The filter can be mounted vertically or horizontally; note the installation position and direction of flow (see Figure 68).

Fuel Pump

- The fuel pump is a combined pumping, metering, and shut-off system. It pumps fuel from the vehicle supply to the fuel connection piece to the burner via the fuel lines.
- The High Altitude Bypass is installed with the fuel pump for use in altitudes over 5,000 ft.
- Fuel Pump is required to be installed horizontally. It is not recommended to mount the assembly rotated 180° (see Figure 69).

WARNING

Do NOT use bio-diesel with the copper fuel lines. Doing so will result in damage to the burner and fuel system. Please follow instructions to ensure safe operation. Always check for any fuel leaks before operating the burner.

High Altitude Bypass Replacement:

1. Remove fuel line from the burner before performing the Fuel Purge Procedure (Page 37).
2. Remove old high altitude assembly.
3. Check fuel lines and fuel filter for damage.
4. Replace as necessary. See the diagram above and Pages 37-40 for further instructions.

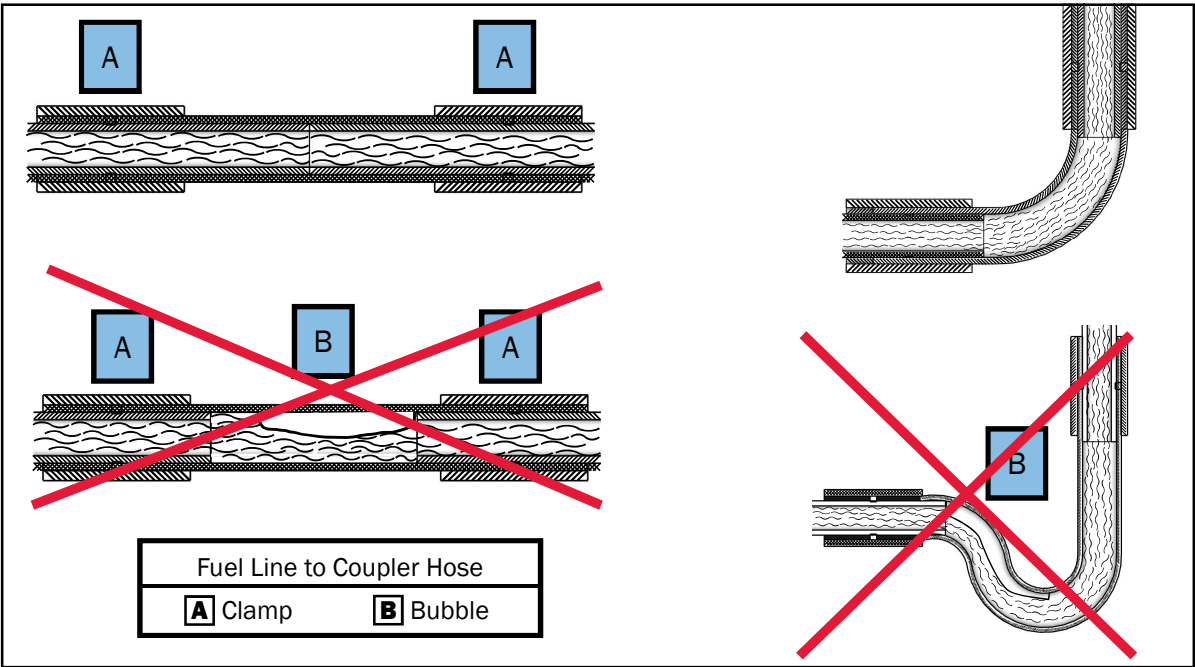


Figure 64

NOTE: The fuel lines must be secured and supported properly to avoid air traps or bubbles. Avoid unnecessary dips or bends, the line should not run downward from the fuel pump.

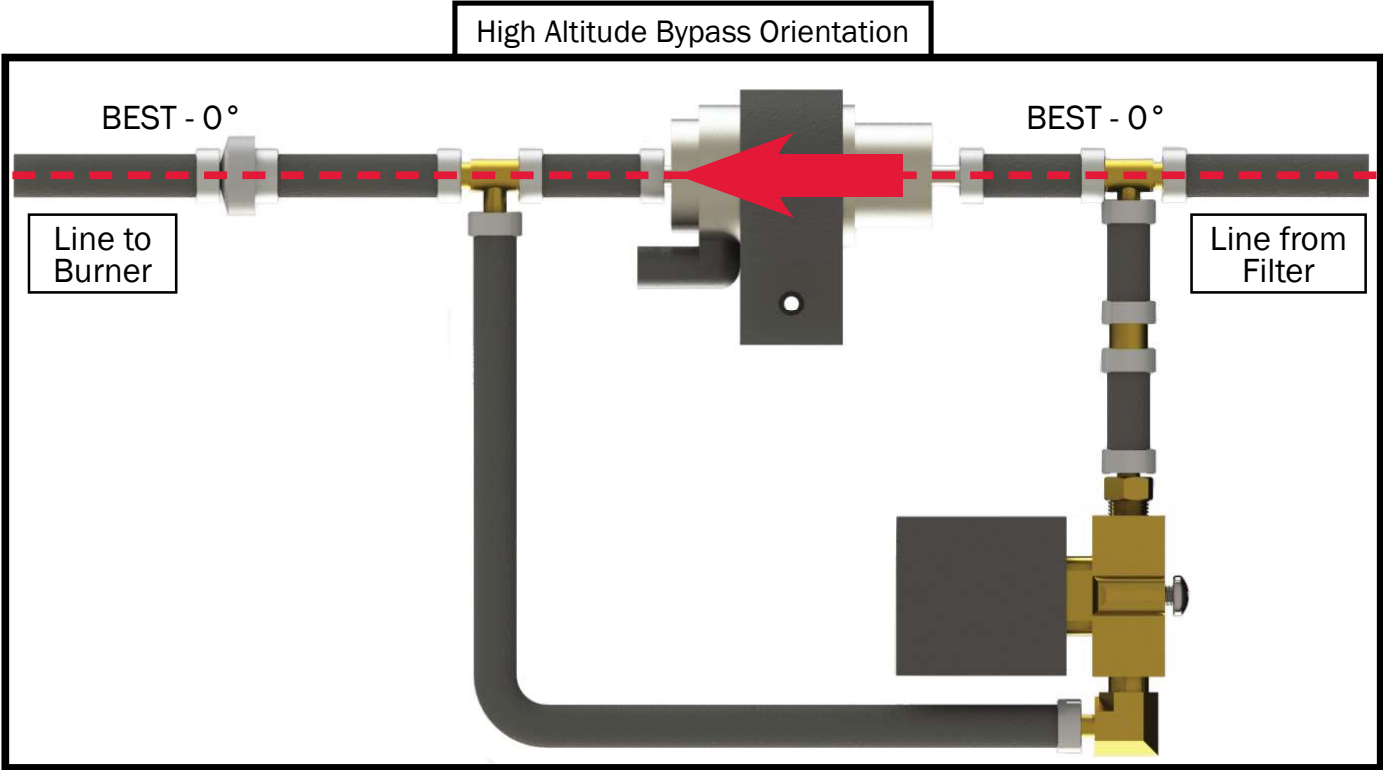


Figure 65

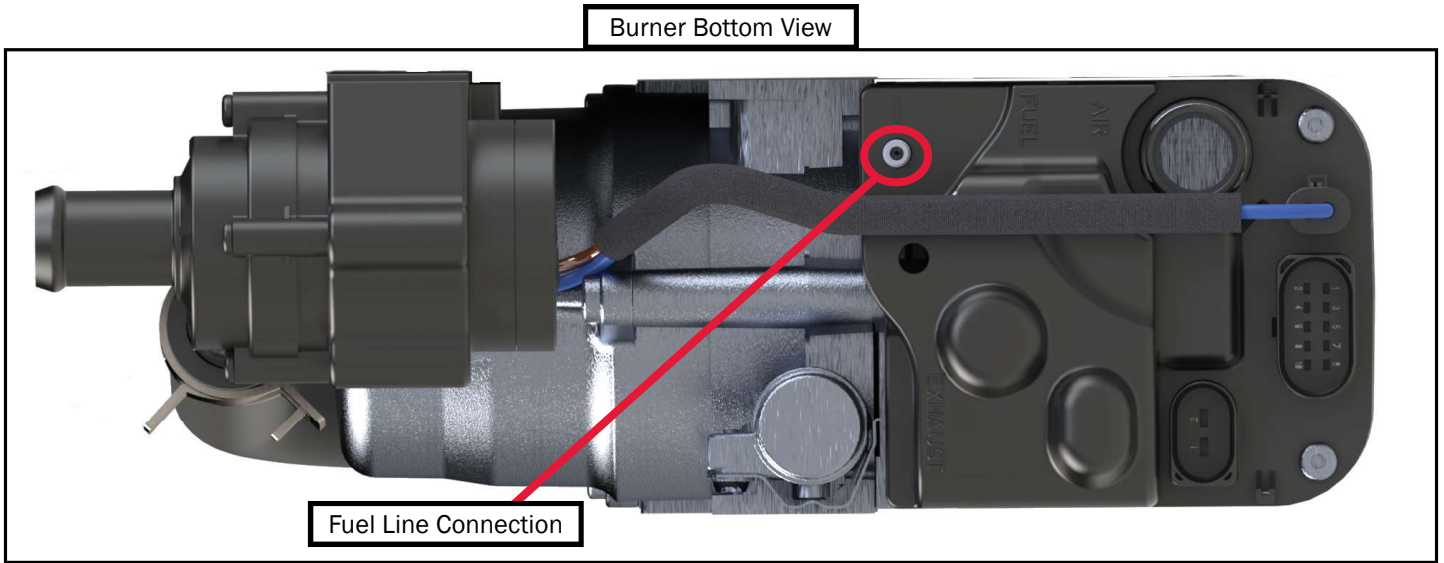


Figure 66

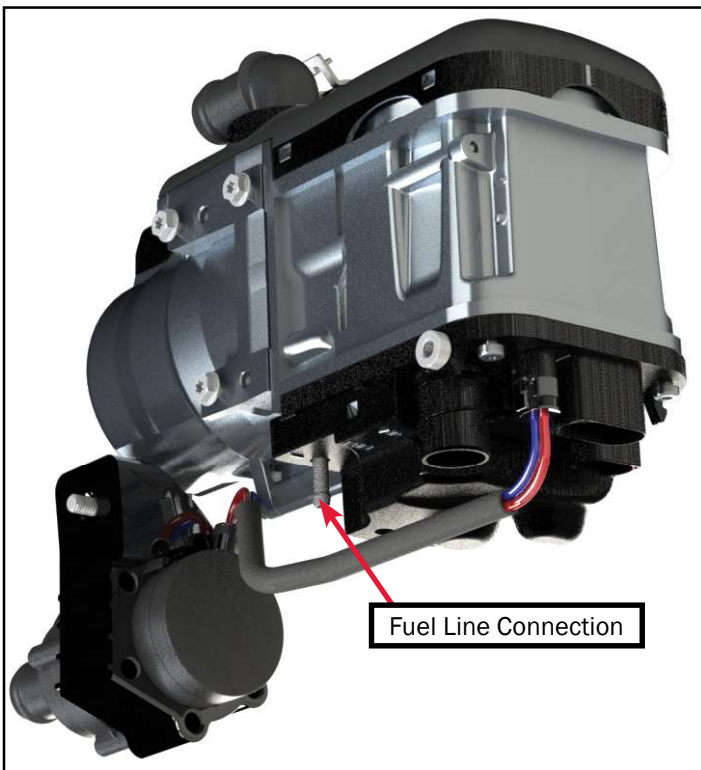


Figure 67

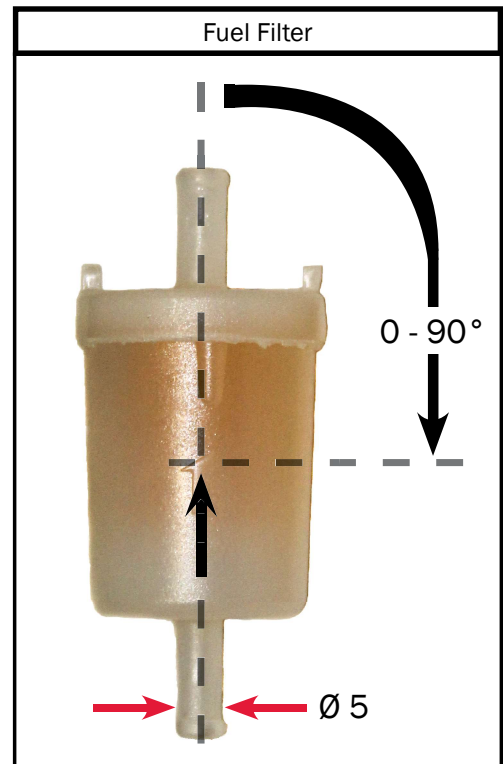


Figure 68

Fuel Purge Procedure:

The fuel lines should be automatically primed with the first operation of the burner. It may need to be power cycled a few times (3-4 times) to purge any air. Perform this procedure once the burner and Aqua-Hot are completely installed and the Aqua-Hot is adequately filled and purged.

NOTE: DO NOT run the diesel burner without the coolant filled and purged as it will cause serious damage to the burner.

1. Remove fuel line from burner before performing the fuel purge procedure.
2. Connect a 6V power source to the fuel pump to pulse the pump. The power source must be able to be pulsed (turned on and off) rapidly, for this process.



WARNING

Do NOT exceed 6V when powering the fuel pump. This can cause irreparable damage to the fuel pump.

- The pump can be powered with wire and gator clips.
- The pump pin numbers can be found on the inside of the housing where the pins are found.

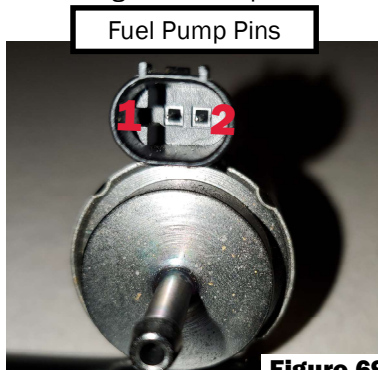


Figure 69

- Ground goes to Pin #1
- Power goes to Pin #2
- If you would rather use a plug instead of the wire and gator clips, the mating part numbers needed for the connector are:
 - Housing: 1-967644-1
 - Terminal; 0965906-1
 - Seal: 0-967067-1

3. Pulse the fuel pump at a steady 1-2 pulses per second until fuel begins to come out of the fuel line where it will connect to the burner.
4. Connect the fuel line to the burner.
5. Ensure all hose clamps and fuel fittings are tight and properly secured.
6. Ensure that the exhaust is well ventilated.
7. Turn the burner on HIGH at the screen (see Figure 70). The burner should cycle on because of the primed fuel lines.
 - There may be smoke from the exhaust on initial start-up, this is normal.
8. If the burner does not cycle on with the first start up, it will try a second time.
 - If the second start-up fails, there will be a fault message on the LCD screen (Figure 71). Tap the burner OFF at the screen.
 - Repeat Step 8.
 - If fault occurs again, repeat Steps 6-8.
9. After a successful start up, run the burner for 5 minutes.
10. After running the burner for 5 minutes, tap the HIGH ALTITUDE option on the LCD screen (see Figure 72) and run for additional 2 minutes.

After a complete, successful first operation, the fuel lines should be purged of any air and ready for normal operation and use.

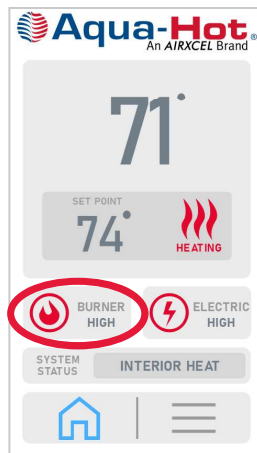


Figure 70

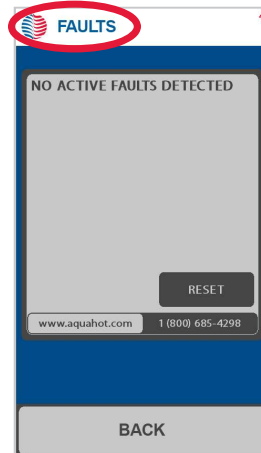


Figure 71



Figure 72

The first operation of the burner with the Aqua-Hot may not light up perfectly. This is normal and may take a couple tries to get the fuel lines purged of air before a successful start-up.

NOTE: Make sure to perform the fuel line purge procedure on Page 37 prior to starting this start up of the burner.

Activation Instructions (Diesel Burner)

1. Make sure there are no blockages or debris to the exhaust outlet or combustion air inlet.
2. Make sure the plumbing lines and fuel lines are properly purged and free of air.
3. Make sure there is adequate fuel in the vehicle fuel tank (at the least ¼ tank).
4. Turn on the burner on the heater control switch.

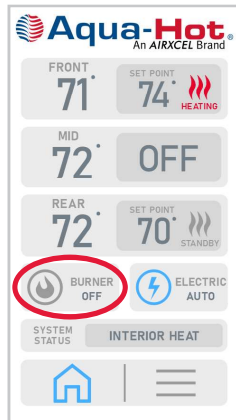


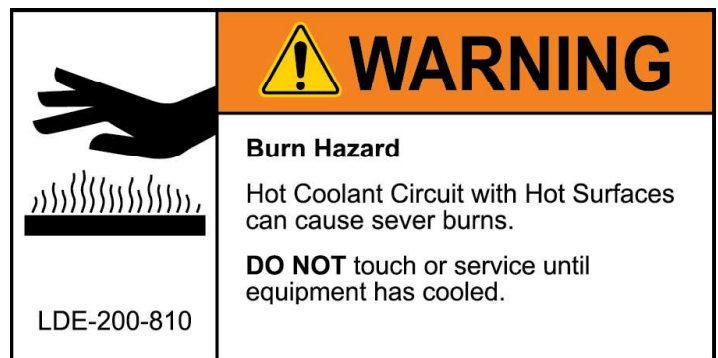
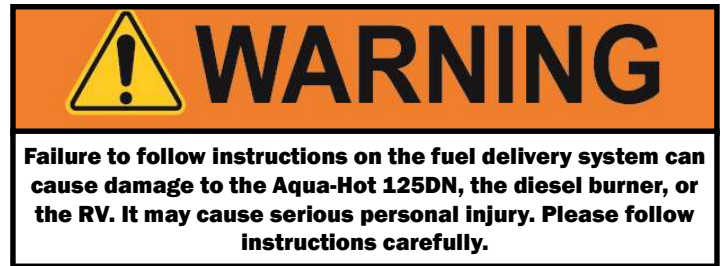
Figure 73

5. Once the burner turns on, the circulation pump and combustion air fan should run (can be determined by listening).
6. The burner should start up after approximately 120 seconds. This can be determined by the hot exhaust exiting from the exhaust tube.
7. Allow the burner to run a full cycle. Turn on the heat or hot water inside the RV to confirm the burner is properly operating.

NOTE: It is recommended to run the burner for at least 20 minutes every month to ensure optimum heater condition.

Once these checks have been confirmed, the diesel burner is now ready for normal operation and use.

NOTE: Both the electric heating element and the external diesel burner are thermostatically controlled. The element and/or burner will automatically maintain the temperature of the boiler tank's antifreeze and water heating solution.



Lack of Interior Heat or Hot Water

Introduction:

A lack of interior heat or hot water when provided with adequate heat from either the electric element and/or the diesel burner can be attributed to an overheat thermostat, the Aqua-Hot controller, the three-way valve, or the fluid circulation pump.

The troubleshooting procedures listed below are arranged in order of repair complexity. Do not replace parts without correctly determining the failure.

Follow the directions below in order to troubleshoot the Aqua-Hot. Do not skip through the troubleshooting steps, as this may needlessly complicate unit diagnosis and repair.

Troubleshooting Procedure:

- Ensure that the Aqua-Hot is supplied with electrical power.
- Ensure there is an adequate supply of diesel 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.
- Visually inspect the interior of the Aqua-Hot to ensure that there are not pinched or damaged wires.
- Locate the high-limit thermostats (3) within the Aqua-Hot. Test these thermostats for functionality, and replace them if necessary. Reference page 20.
- Locate and test the ETS module for functionality. Replace if necessary. Reference page 32.
- Locate and test the fluid circulation pump. If necessary replace it. Reference page 27.
- Locate the three-way valve and test it for functionality. Replace if necessary. Reference page 23.
- Make sure there are no faults displayed on the LCD screen. Reference Figure 65.

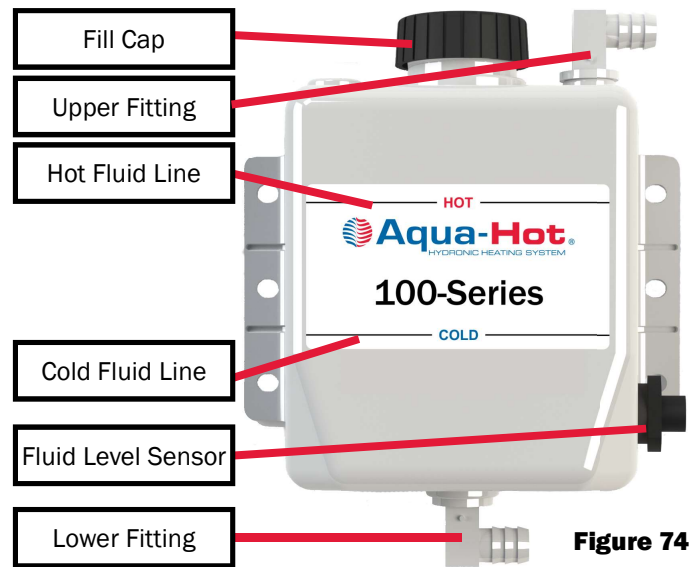


Figure 74

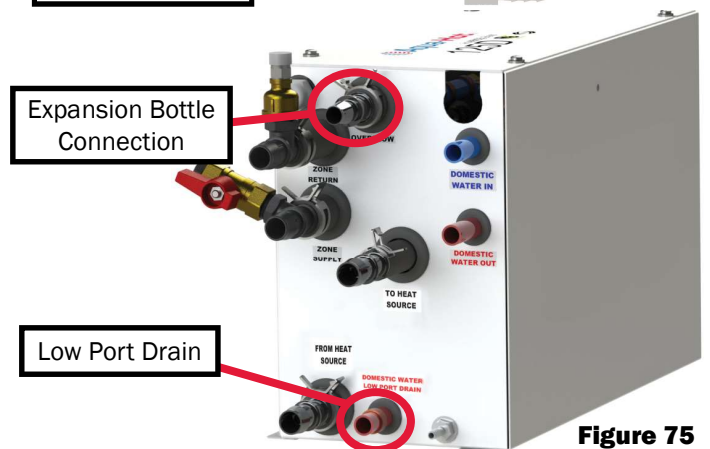


Figure 75

NOTE: The fluid level sensor is located in the Aqua-Hot's expansion tank. If the antifreeze solution in the expansion tank drops below the level of the fluid sensor, the Aqua-Hot will not operate.

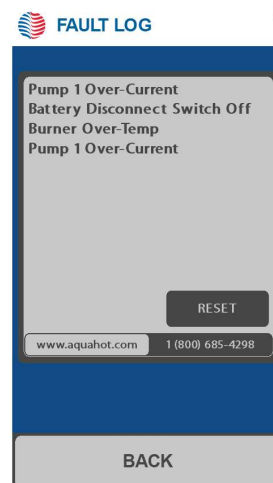


Figure 76

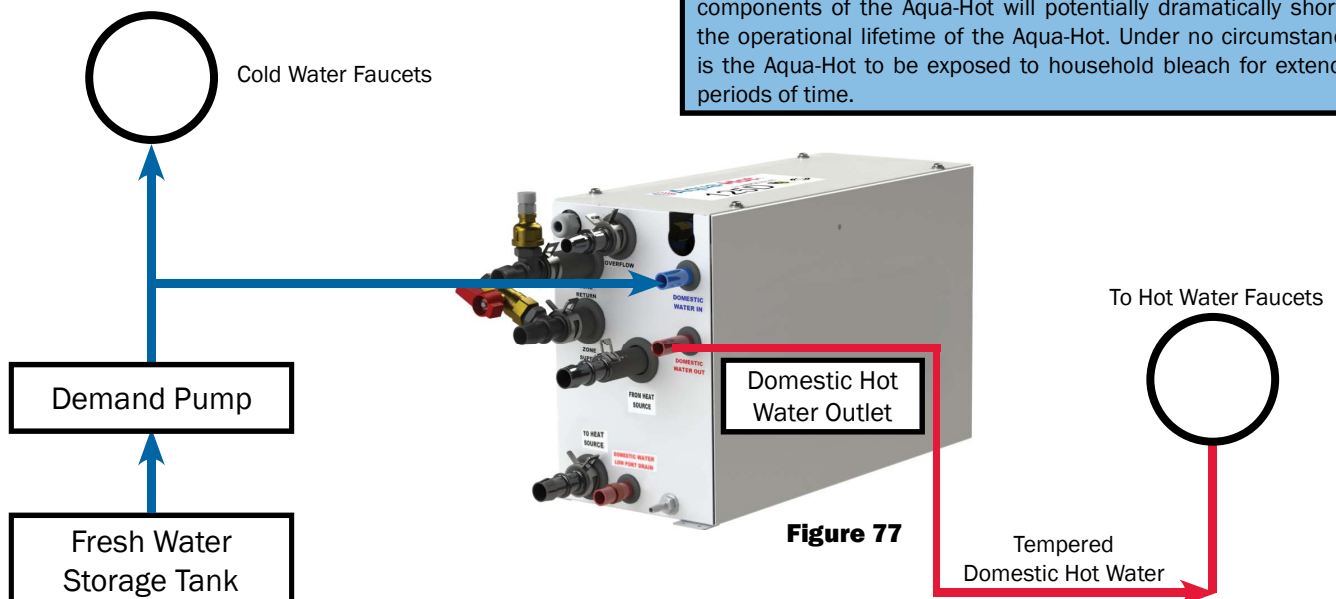
Winterizing the Aqua-Hot

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 77 below for a system overview.

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

1. Completely drain the fresh water storage tank using the Low Port drain (Figure 75).
2. Disconnect the domestic water demand pump suction line from the fresh water storage tank.
3. Attach an adequate piece of hose onto the suction side of the domestic water demand pump.
4. Place the opposite end of the hose into an adequate supply of non-toxic RV winterization antifreeze (FDA certified as "GRAS" Generally Recognized As Safe must be used) and allow the fluid to pump through.
5. Open and close all interior and exterior water faucets one at a time, until ONLY pure RV antifreeze is present. Perform this procedure for both cold and hot water faucets.
6. Remove the hose and reconnect the domestic water demand pump's suction line to the fresh water storage tank.



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 for North America) rated for winterization is used when winterizing this unit. The warranty does not cover freeze damage.

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.

External Diesel Burner Troubleshooting

This section will cover any issues with the external diesel burner. The diesel burner is the primary heat source to the 125DN.

The troubleshooting procedures listed below are arranged in order of repair complexity. Do not replace parts without correctly determining the failure.

Follow the directions below in order to troubleshoot the diesel burner. Do not skip through the troubleshooting steps, as this may needlessly complicate unit diagnosis and repair.

Troubleshooting Procedure:

- Ensure that the system is supplied with electrical power and there are no blown fuses.
- Ensure that there is at least ¼ tank of fuel in the vehicle fuel supply and the fuel filter is not clogged.
- Make sure all the electrical and plumbing connections are connected and secure.
- Ensure there are no faults for the burner. If there are, determine the fault and remedy.

The fault is indicated by a flashing “fault” light on the LCD screen during heater operation. It is indicated on the diagnostic screen by the Burner Status ON/OFF indicator. There will be a series of rapid flashes, followed by 1 or more slow flashes. The rapid flashes are an alert indicator; the slow flashes should be counted, as that is the fault code. Refer to the table below for the fault code.

F00 (continuous flashing)	Burner interlock (lock-out)
---------------------------	-----------------------------

After 5 short signals, count the long flashes:

F01 (1 flash)	No start (after 2 attempts to start)
F02 (2 flashes)	Flame failure
F03 (3 flashes)	Under-voltage or over-voltage
F04 (4 flashes)	Premature flame recognition
F05 (5 flashes)	Not used
F06 (6 flashes)	Coolant temperature sensor interrupt or temperature sensor short-circuit
F07 (7 flashes)	Fuel pump interrupt or short-circuited
F08 (8 flashes)	Combustion air fan motor interrupt or blower motor short-circuit or incorrect speed
F09 (9 flashes)	Flame sensor interrupt or short-circuit
F10 (10 flashes)	Overheating
F11 (11 flashes)	Circulating pump interrupt or short-circuit
F12 (12 flashes)	Battery main switch short-circuit
F13 (13 flashes)	Output vehicle fan short-circuit
F14 (14 flashes)	Overheating sensor defective
F15 (15 flashes)	Pre-heating/ignition circuit defective
F16 (16 flashes)	Exhaust gas temperature too high
F17 (17 flashes)	Exhaust gas temperature sensor defective

After the fault cause has been eliminated, the burner must be switched on again.

Heater Lock-out Reset Procedure

The control unit continuously monitors the heater operation. The control unit identifies errors on individual burner components and faults during operation. Should the control unit experience component errors and operational faults, the burner may be shut down and not restart.

The burner lockout reset must be done manually as shown below.

Troubleshooting Procedure:

- Turn on the burner on the interior switch.
- Remove the main power connection to the burner or pull the fuse for a minimum of 20 seconds.
- Turn the burner off on the switch.
- Reconnect the main power connection that was previously disconnected.

External Diesel Burner

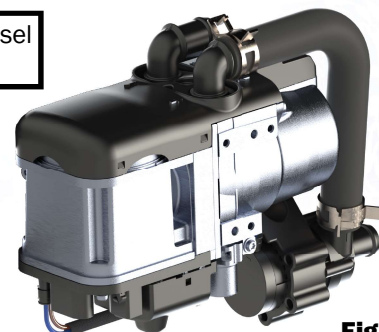


Figure 78

General Failure Symptoms of the Burner

This section will cover the typical failures of the diesel burner. Refer to the table more fails and their remedies.

Failure Symptom	Possible Cause	Remedy
Burner switches off automatically (fault lockout)	No combustion after start or automatic repeat start	Switch off burner and switch back on.
	Flame extinguishes during operation	<ul style="list-style-type: none"> Check coolant lines for obstructions, closed valves, and kinks. Check coolant level, purge any air. Allow burner to cool down. Check for failure codes.
	Burner overheats	<ul style="list-style-type: none"> Charge/replace batteries. Switch off burner and switch back on.
Heater is letting out black smoke from the exhaust	Combustion air and/or exhaust tube is blocked	Check combustion air intake and or/ exhaust tube.
Burner does not switch on	Heater is without electrical power	Check power supply to the unit and ground connections.
Burner switches off during operation (= fault lock-out)	Burner has overheated due to lack of coolant	Refill antifreeze and water mixture.

Service of the Burner

The service or maintenance should be done once a year to maintain the functional reliability of the burner. The service and any repairs must only be performed by trained technicians.

Proper preventive maintenance greatly improves the burner performance.

- Visual inspection of the burner for any external damage, fastening, and also external cleaning (make sure power is disconnected before any cleaning).
- Inspect electrical connections for corrosion, making sure they are all properly secured and free of any kinks, cracks, or damage.
- Check the exhaust and combustion air lines for signs of damage and make sure they are clear of debris or any blockages.
- Check fuel lines for any leaks, kinks, cracks, or damage.
- Check plumbing lines and circulation pump to make sure they are properly secured and free of any damage.
- Check the fuel pump and circulation pump for any damage.
- Run the burner for 20 minutes once a month.
- Clean the burner of any debris or dust with compressed air.
- Change the fuel filter once a year.

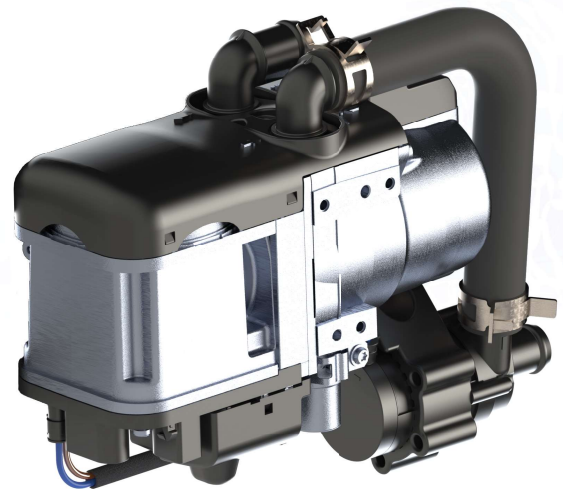
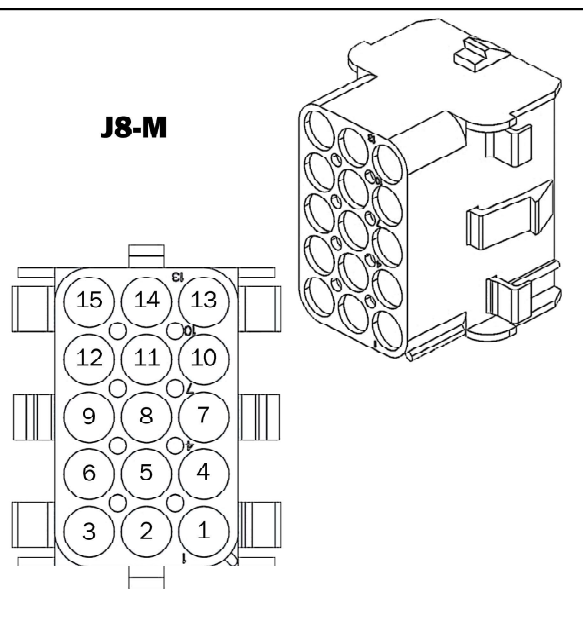
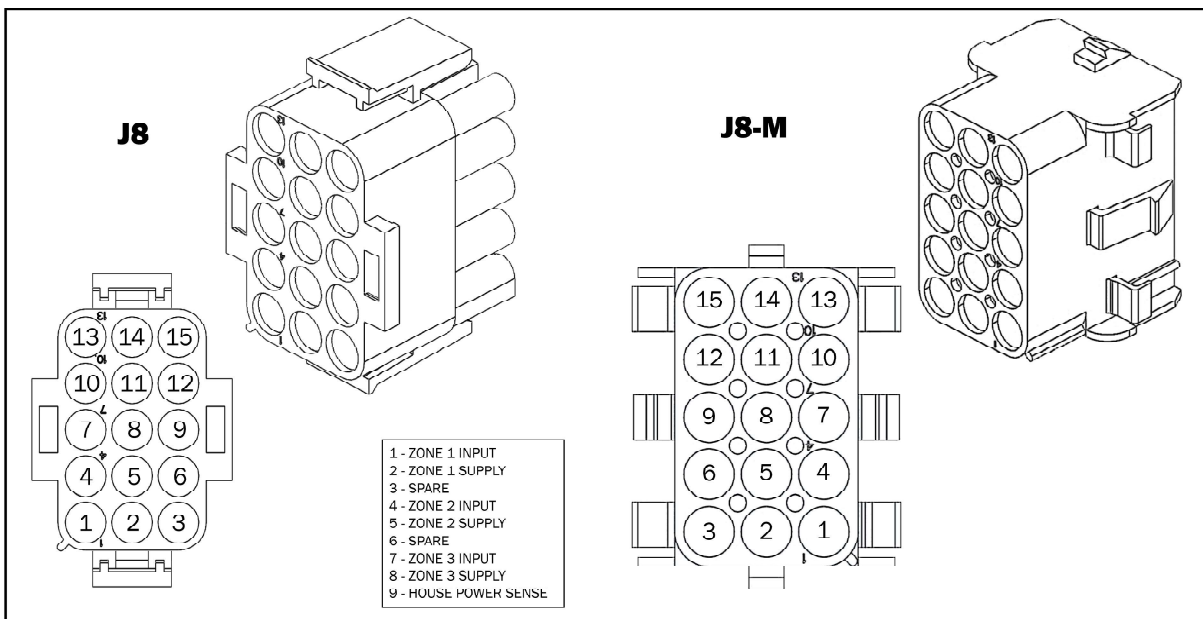
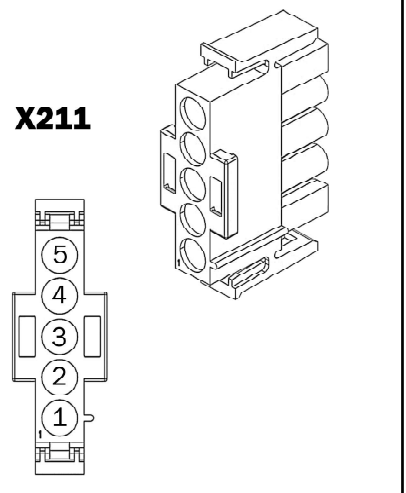
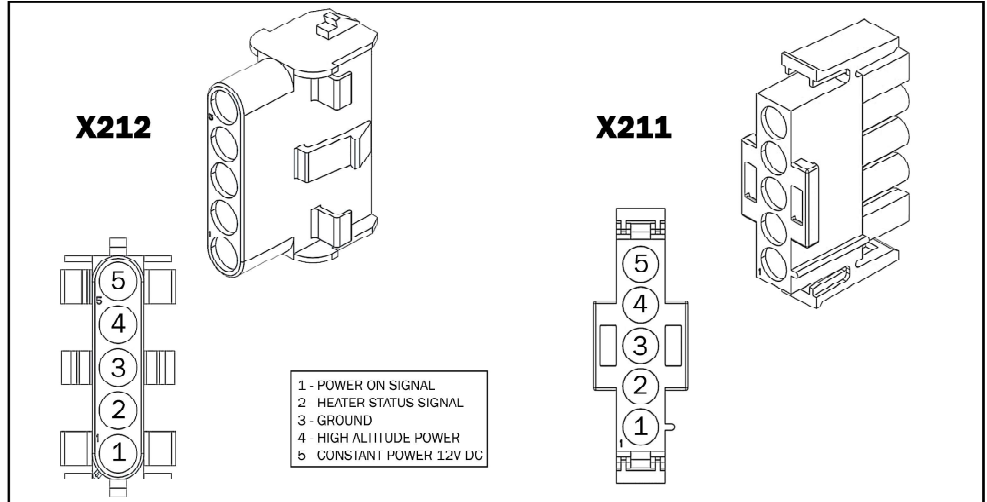
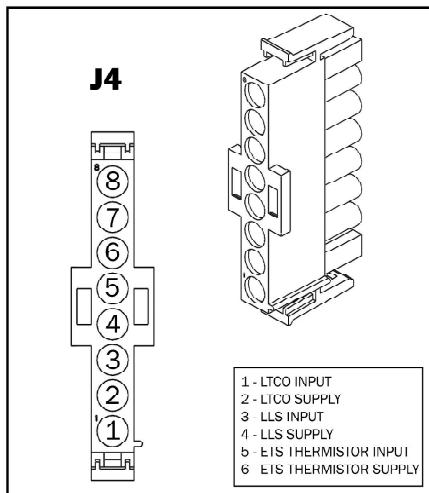
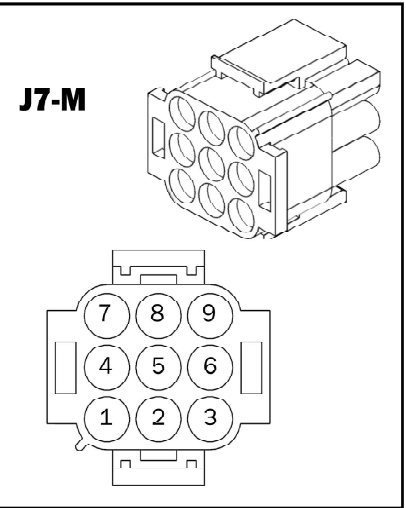
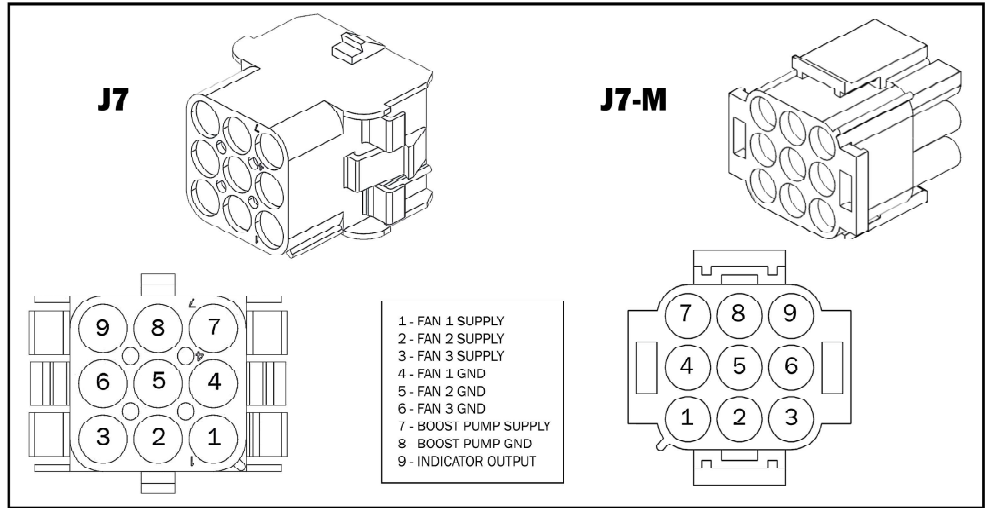
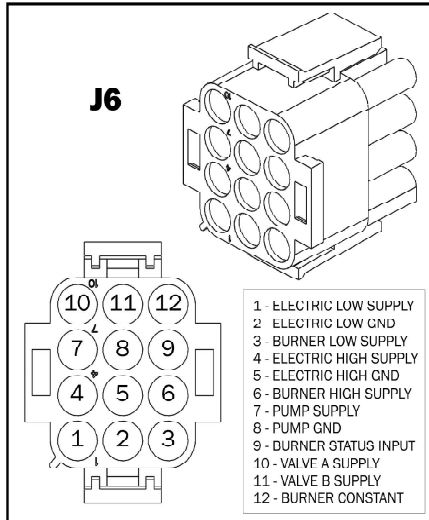
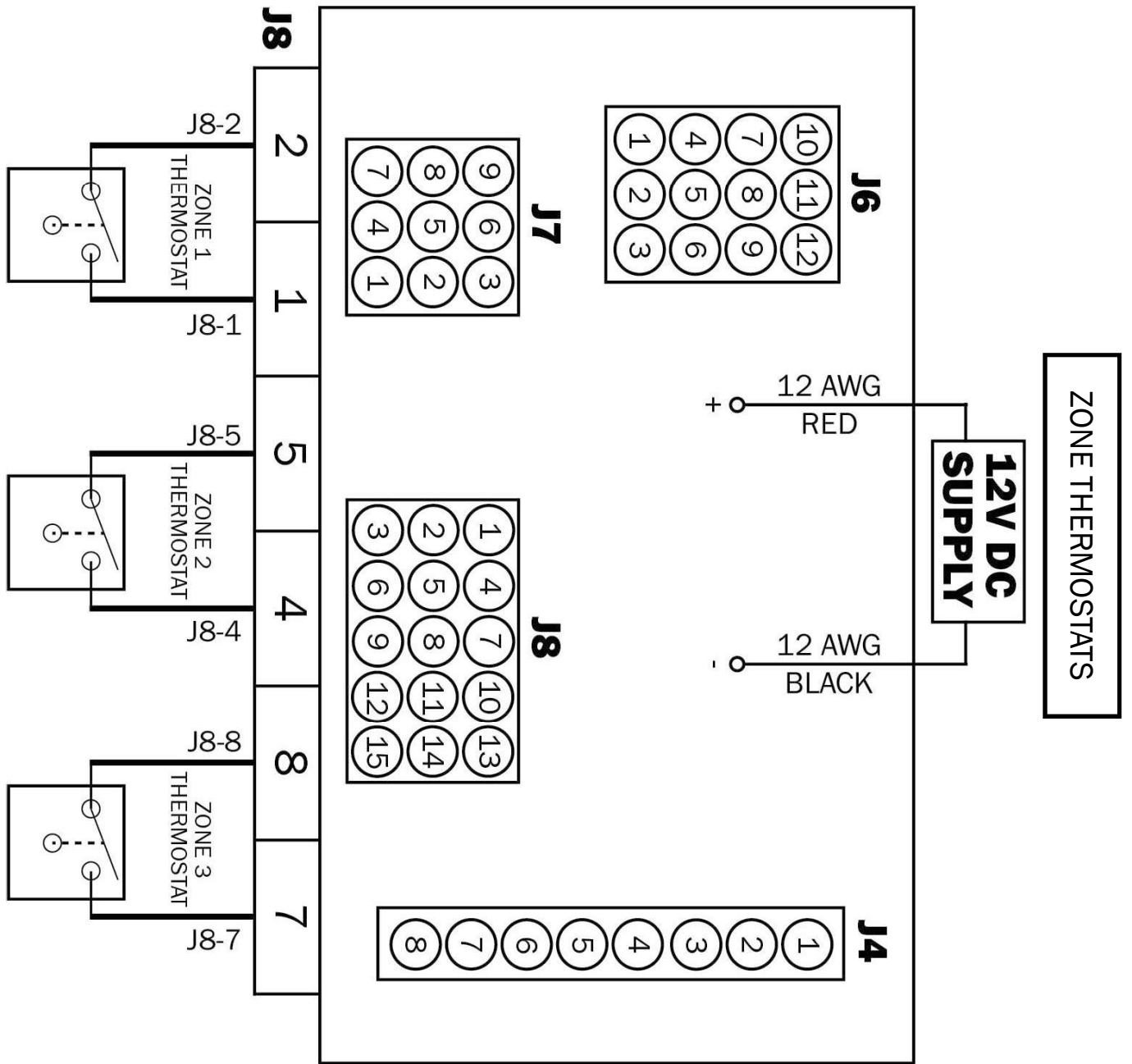


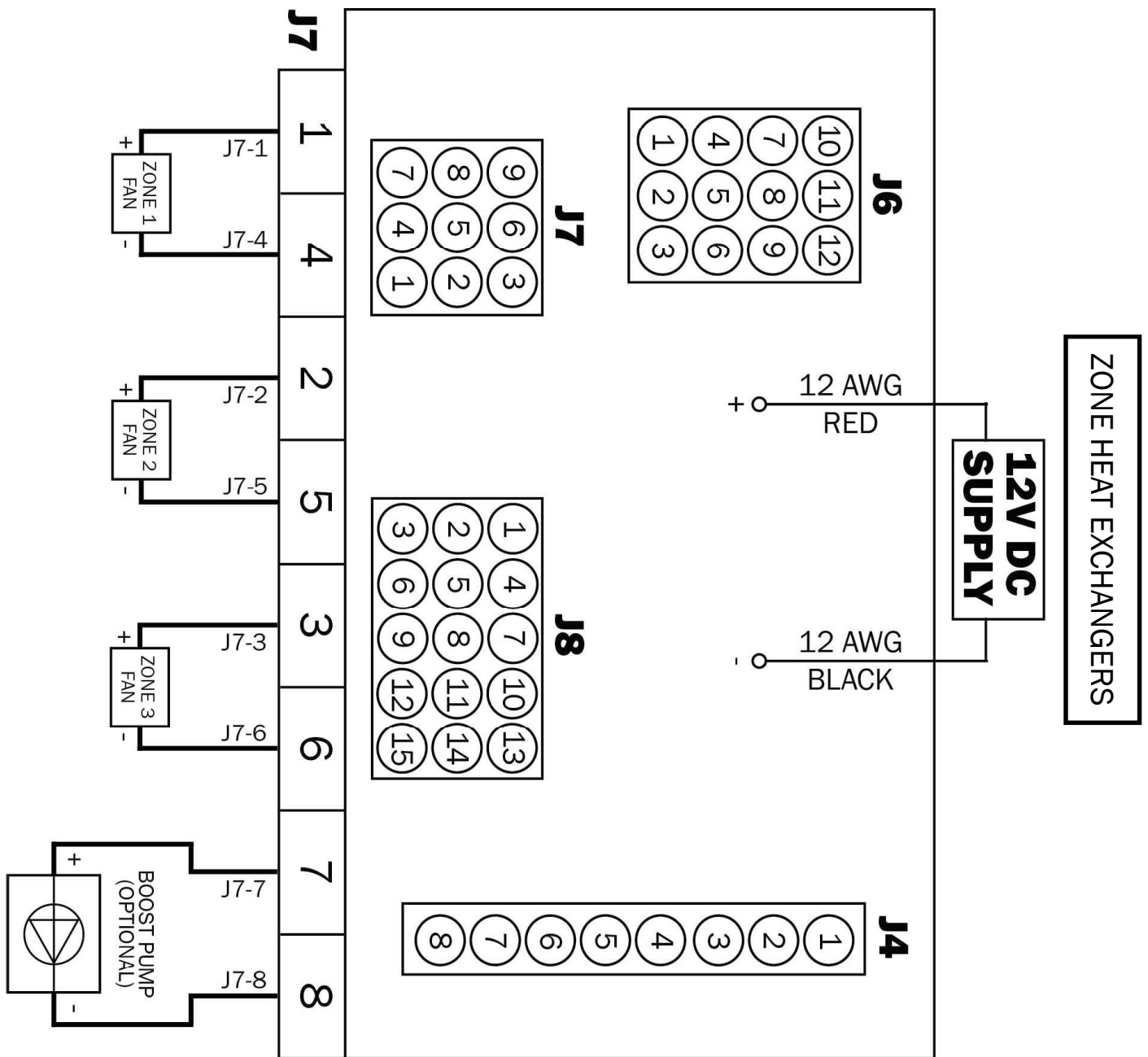
Figure 79

PIN OUT INFORMATION

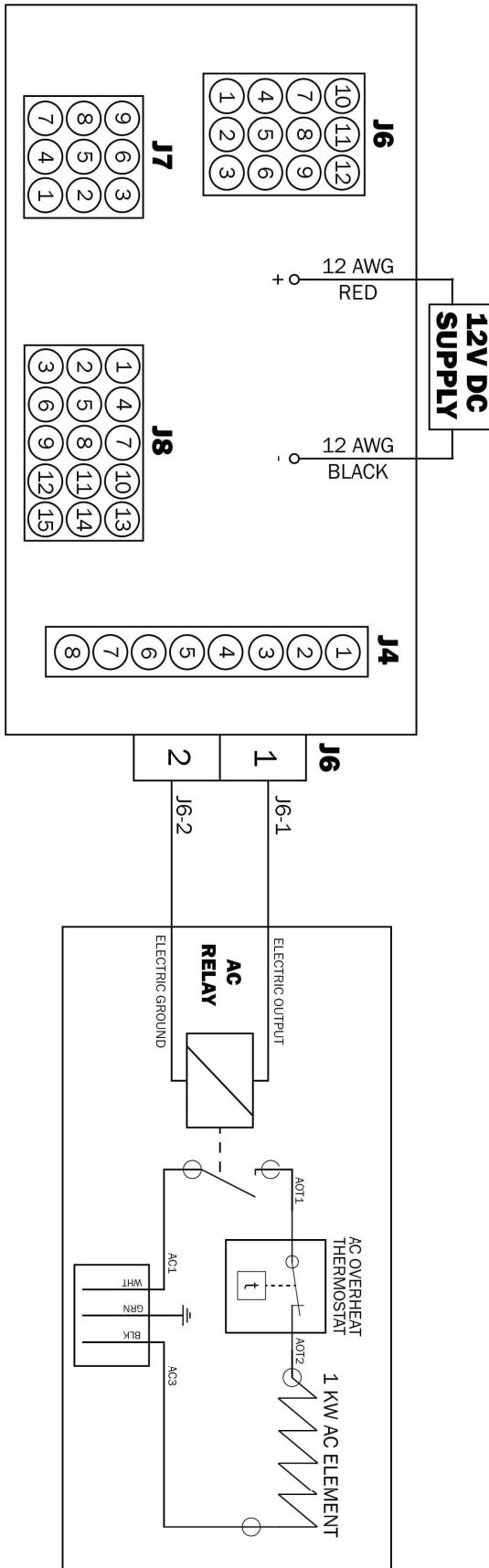


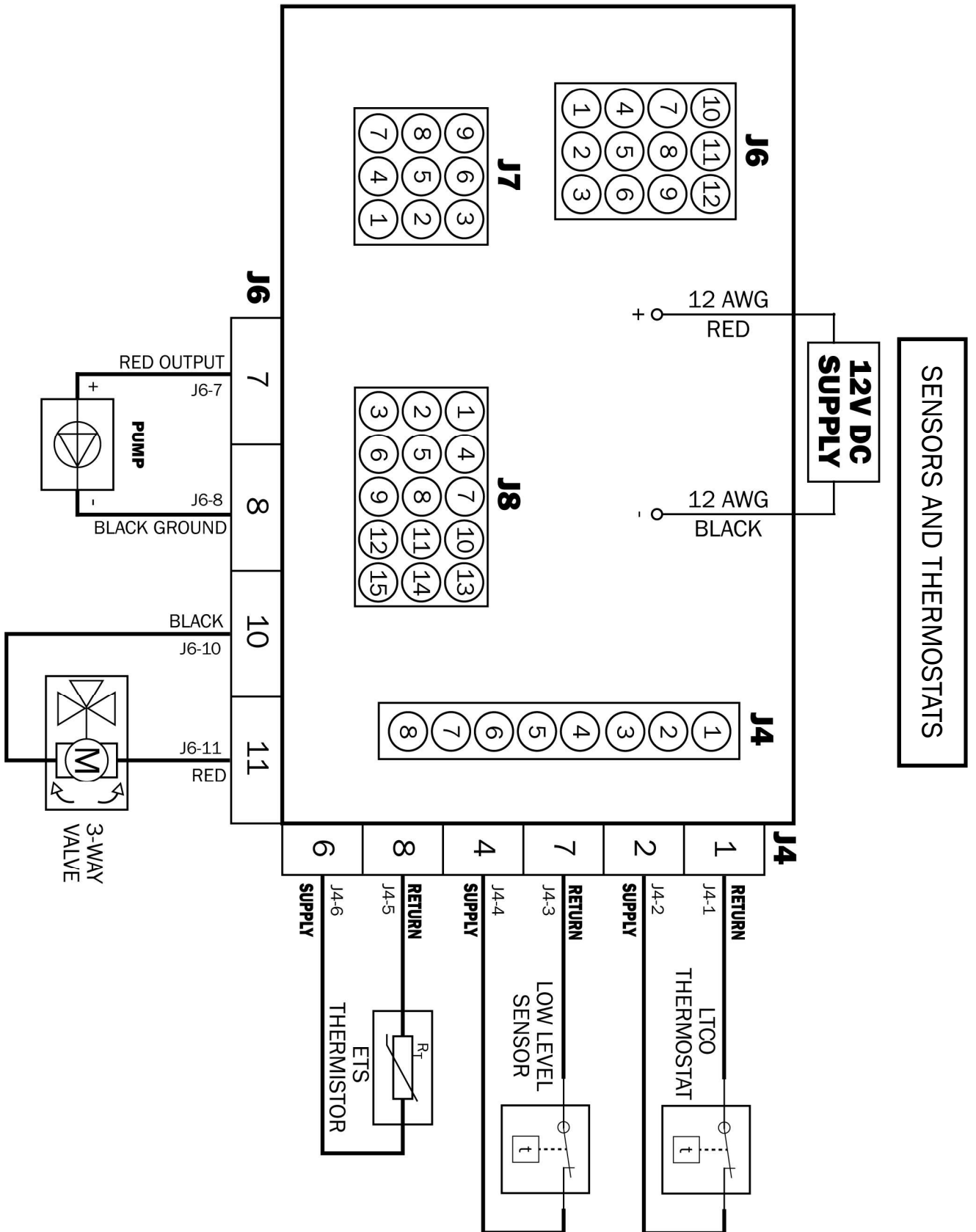
NOTE: All connectors are shown from Pin insertion side.





ELECTRIC ELEMENT







ELE-014-711
Thermistor, Tank Temperature Sensor



ELX-THM-309 (white) or ELX-THM-310 (black)
Thermistor

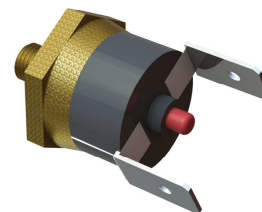
ELE-102-211
Burner DC Harness



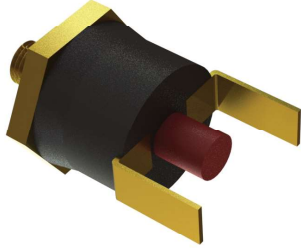
ELE-102-201
Aqua-Hot AC Harness



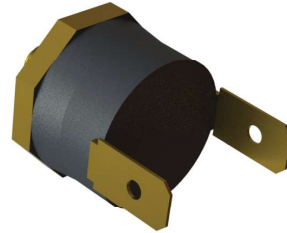
ELE-400-900
Harness, Buehler C20 Pump



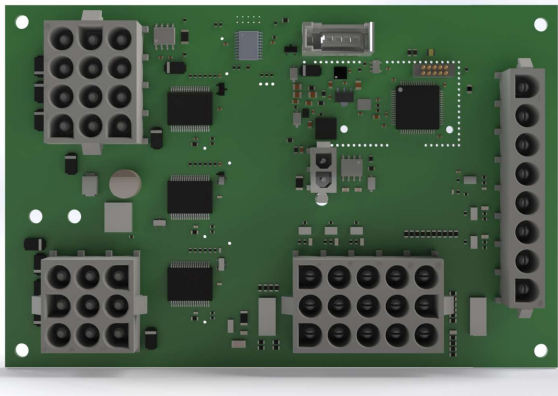
ELE-HLT-425
VAC High Limit 215°F Thermostat w/ Spade Connectors



ELE-HLT-426
VAC High Limit Thermostat 215° F w/ Leads



ELE-LTC-200
Low-Temperature Cutoff Thermostat w/ Spade Terminals



ELE-PCB-100
Controller, Aqua-Hot PCB



ELX-2E7-102
125DN Element, 1" NPSM, 120 VAC, 1500W, Heating



EXE-103-0EX
Heat Exchanger, Cozy III



MSX-907-162
Refractometer



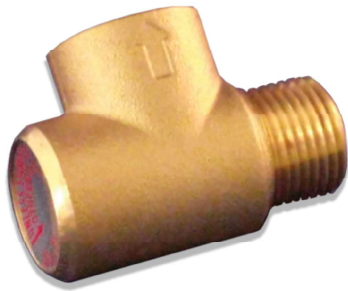
PLE-063-200

3 Qt. Expansion Tank w/Internal Fluid Level Sensor, 5/8" Barb



PLX-100-900

Fluid Circulation Pump



PLX-111-125

Pressure Relief Valve, 125 PSI



PLX-125-3WV

Kit, Three-Way Motorized Valve, 1/2" NPT



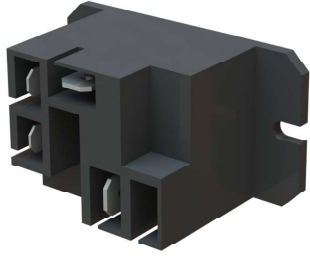
PLX-362-100

Tempering Valve

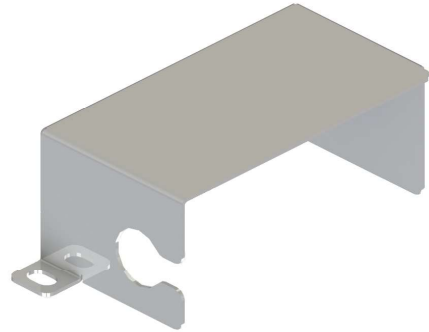


PLX-CTB-290

Clamp, Hose, Constant Tension, 1-1/16"



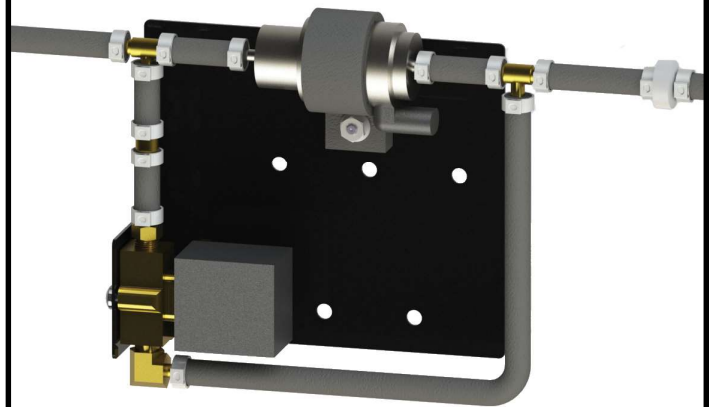
ELX-232-948
AC Relay



SME-102-080
Cover, AC Element Cover for 125DN & 100DE

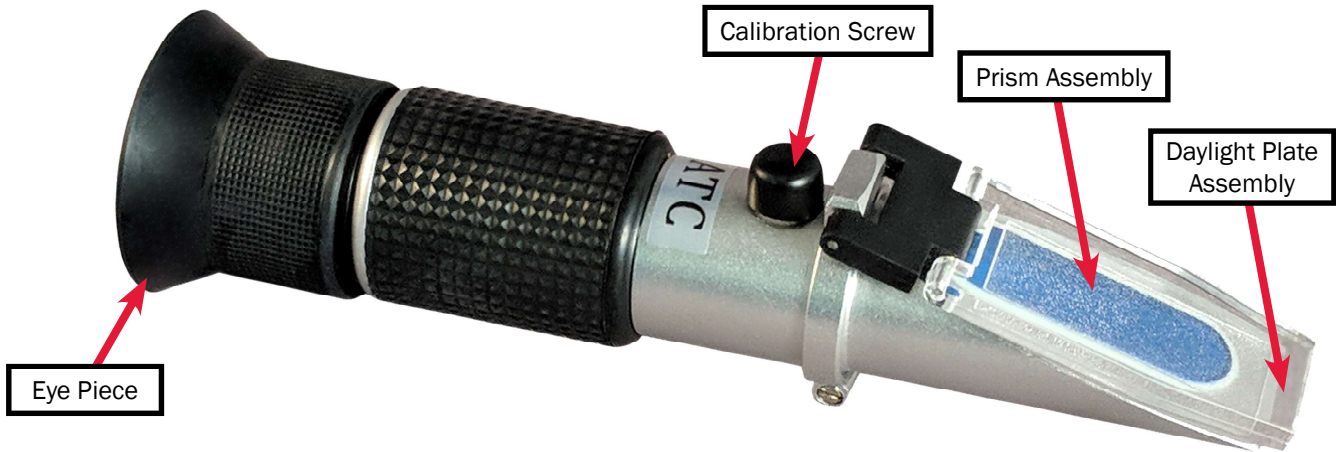


PLE-125-FL1
Kit, Fuel Line, 125DN



PLX-125-HA1
Kit, High Altitude Assembly, 125DN

Measuring Antifreeze Using a Refractometer

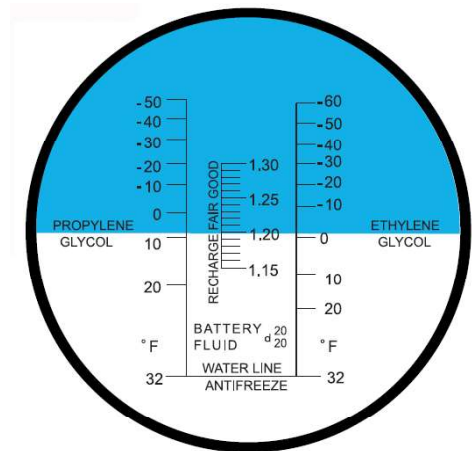


Properly Apply Antifreeze to the Prism Assembly

Use the guide below to properly apply the ethylene 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.

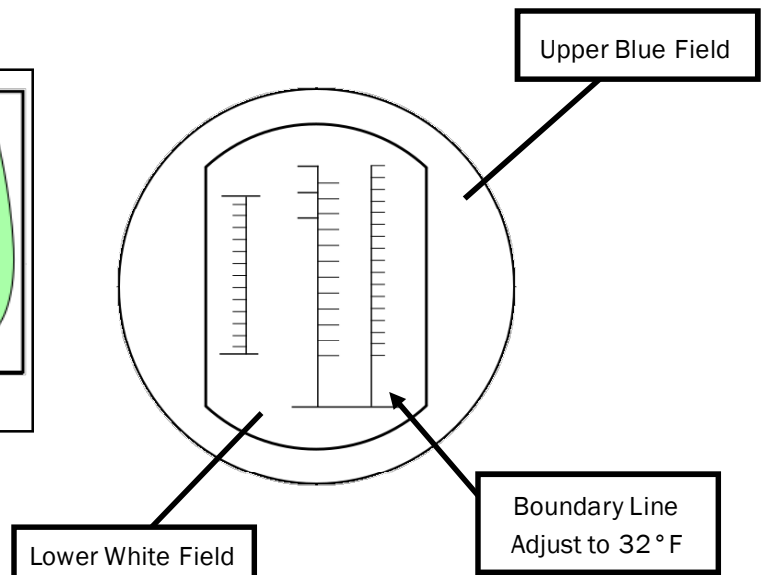
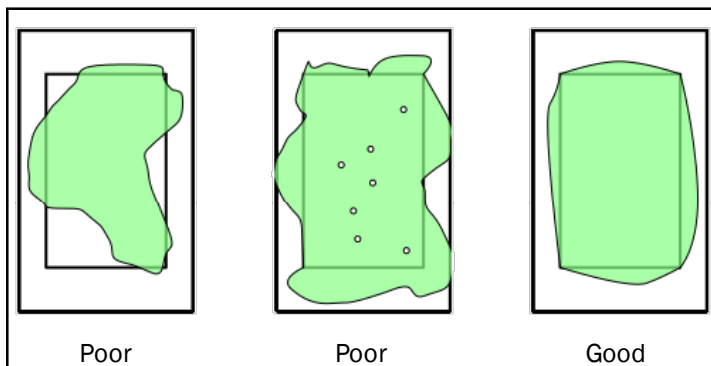
Adjust the Boundary Line

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



Service Manual

100_{SERIES}

 **Aqua-Hot**[®]
An AIRXCEL Brand



Aqua-Hot Heating Systems, LLC
7501 Miller Drive, Frederick, CO 80504

Visit us online at www.aquahot.com
Call us at 574-AIR-XCEL (574-247-9235).

©2021 Aqua-Hot Heating Systems, LLC. Printed in the USA