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AHE-100-02S

SERVICE MANUAL

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This service and parts manual is designed to aid trained and qualified service technicians with the process of troubleshooting and servicing the Aqua-Hot AHE-100-02S Hydronic heating system.

The Aqua-Hot AHE-100-02S heating system features a 12 Volt-DC powered diesel-burner and a 120 Volt-AC, 1650 Watt electric heating element. These two heating sources are used in conjunction with an antifreeze/water heating solution in order to provide a continuous supply of domestic hot water, interior/fresh water tank heating, independent interior zone heating, and engine preheating. Be sure to reference Figures 3 for a complete component overview.

Please note that all Danger, Warning, Caution, and Note boxes, appearing as needed throughout this manual, must be reviewed and adhered to during any service procedure in order to avoid potential hazards, which could result in injury, product damage, or property damage.

Should additional assistance be needed, please contact the technical support department at 1-800-685-4298, Monday through Friday, between the hours of 7:00 AM and 4:00 PM Mountain Standard Time.

Danger, Warning, Caution, and Note Boxes:

Danger, Warning, Caution, and Note boxes appear throughout this manual as a means of alerting the service technician to important information.

⚠ DANGER! ⚠

INDICATES THAT PERSONAL INJURY IS LIKELY OR IMMINENT.

WARNING!

Indicates that serious damage to the heater will occur and personal injury is possible as well.

CAUTION:

Indicates that damage to the heater is possible.

NOTE: Indicates information that requires special attention by the service technician

Understanding the Aqua-Hot AHE-100-02S Major Systems:

The basis for the Aqua-Hot heating system's functionality is the antifreeze and water heating solution, which is comprised of water that is distilled, de-ionized, or soft, as well as antifreeze. Through this solution's ability to maintain and transfer heat, the Aqua-Hot's three major systems: the domestic water system, engine preheat system, and interior heating system, are able to function effectively. This antifreeze and water heating solution is contained within the Aqua-Hot's boiler tank and is heated by the diesel-burner when its operating criteria are met and/or the electric heating element when its operating criteria are met. In order for the diesel-burner to be considered as a heating source by the Aqua-Hot, it must have an adequate fuel supply, receive power from the fuse block, and be selected as a heating source from the interior switch panel. In order for the electric heating element to be considered as a heating source by the Aqua-Hot, it must receive power from either a generator or from shore power and be selected as a heating source. Once the antifreeze and water heating solution achieves operating temperature (as determined by the Aqua-Hot's control thermostat), the domestic water system, the engine preheat system, and the interior heating system are permitted to operate as needed.

Domestic Hot Water System:

When hot water is requested, domestic water from the motor home's fresh water tank is transported through a copper coil around the Aqua-Hot's boiler tank where heat is transferred from the heated antifreeze and water heating solution to the domestic water flowing through the copper coil. 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 requesting hot water.

Engine Preheat System:

The engine preheat system is responsible for heating the motor home's engine block in order to make it easier to start-up when cool weather conditions exist.

When the engine preheat system is activated via the interior switch, the motor home's engine coolant is circulated through a dedicated copper coil in the Aqua-Hot's boiler tank, where heat from the antifreeze and water heating solution is transferred to the motor home's engine coolant. The heated engine coolant is then transported back to the engine where it transfers the heat to the engine to gradually warm it.

Additionally, the Aqua-Hot includes a motor-aide feature, which uses the circulation of the motor home's engine to transport the engine's coolant from the Aqua-Hot's boiler tank to the motor home's warm engine and back to the boiler tank. Through this process, the boiler tank is kept heated, which reduces the time required to bring the tank to operating temperature for interior heat and continuous domestic hot water. This motor-aide feature is part of the engine preheating feature and plumbing system, and requires no action on the user's behalf to function.

Interior Heating System:

The interior heating system is responsible for providing heat to the motor home's interior in order to maintain the temperature at a comfortable level.

For interior heating, it is the room thermostats that trigger the Aqua-Hot's interior heating system. When a thermostat recognizes that heat is required in a particular area, it sends a signal to the Aqua-Hot's corresponding zone relay. The Zone Relay responds by activating the circulation pump for that zone, which sends the heated antifreeze and water heating solution through the Heating Loop corresponding to the zone requesting heat. The fans on the heat exchangers in the zone calling for heat are also activated; therefore, as the heated solution flows over the heat exchanger's fins, the heat is transferred to those fins and dispersed into the interior of the motor home by the fans. Until the thermostat signals that heat is no longer required, the Aqua-Hot will continue to send the heated antifreeze and water solution through the loop, which returns the cooled solution to the Aqua-Hot's boiler tank to be re-heated before being sent back through the loop again. This process continues until the pre-set temperature of the interior is reached, and the interior room thermostat signals the electronic controller that heat is no longer required.

AC Circuit:

Although the diesel-burner is the primary heating source for the Aqua-Hot and is necessary for providing continuous domestic hot water, an alternate heat source exists for moderate temperatures, which functions with an AC circuit. Whenever the motor home is connected to an AC power source - plugged into shore power or using a generator, the Aqua-Hot's electric heating element has the ability to function in order to provide heat for the boiler tank.

When the antifreeze and water heating solution falls below operating temperature (as determined by the control thermostat), the control thermostat closes, and allow AC power to flow to the electric heating element. When the electric heating element receives power, it becomes active and supplies heat to the boiler tank until operating temperature is reached.

Figure 1

Aqua-Hot AHE-100-02S Technical Specifications

Diesel-Burner, Heat Input (Firing Rate).....	50,000 BTU/hr
Diesel-Burner, Fuel Consumption (Continuous Operation)	0.50 gal/hr
Heater, Voltage/Maximum Power Consumption	12 Volt-DC/60 watts
Electric Heating Element specifications.....	120 Volt-AC/1650 watts
Zone Heat Circulation Pump specifications.....	(3) 12 Volt-DC/12 watt 3.5gpm Flow Rate
Number of Heating Zones	maximum of 3 plus Engine Preheat
Domestic Water Heating Capacity	continuous/on-demand
Antifreeze Type Used	Ethylene Glycol
Dimensions.....	18.5"H x 18.5"W x 36.75"L
Dry Weight	approximately 200lbs.

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

Figure 2

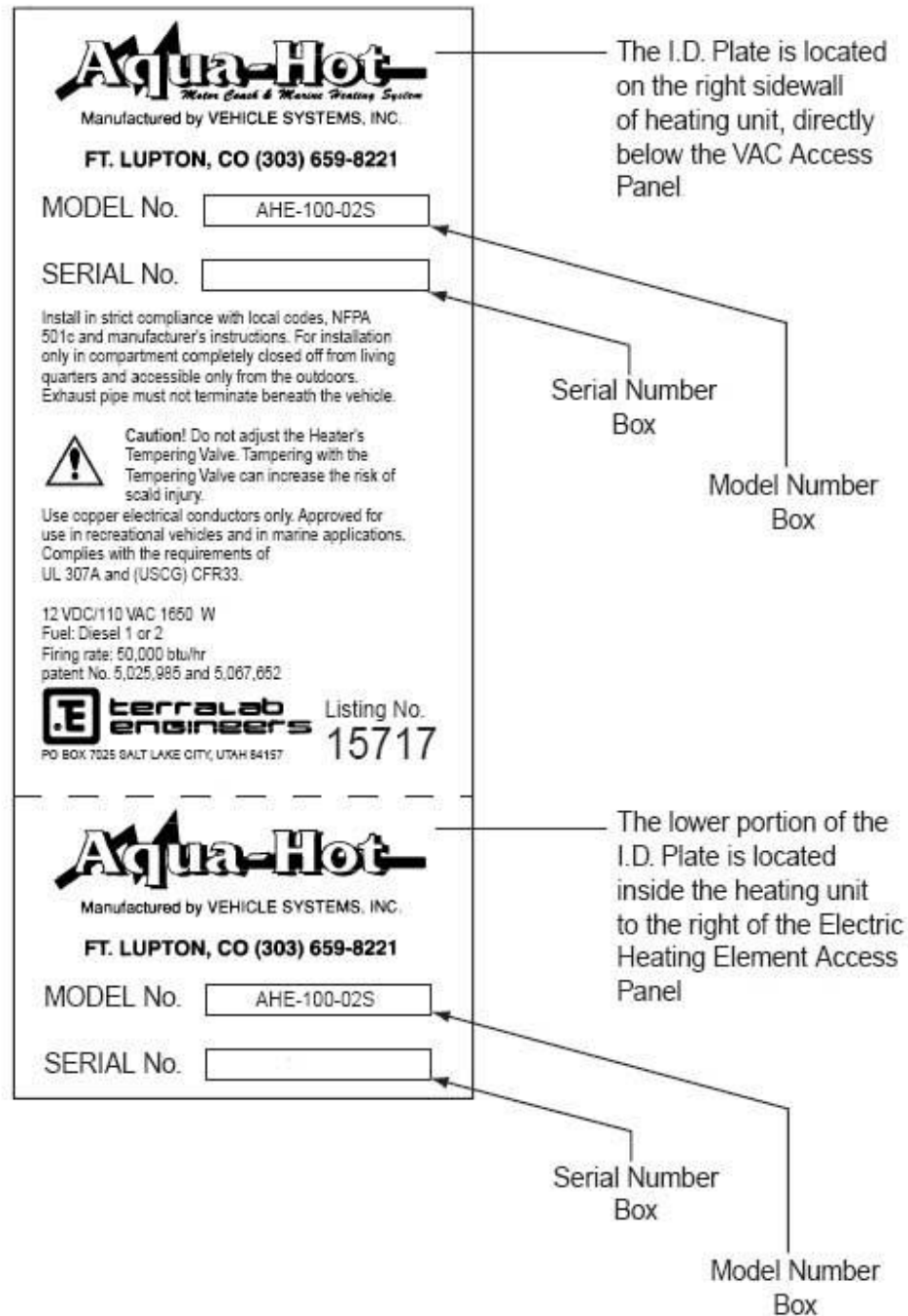
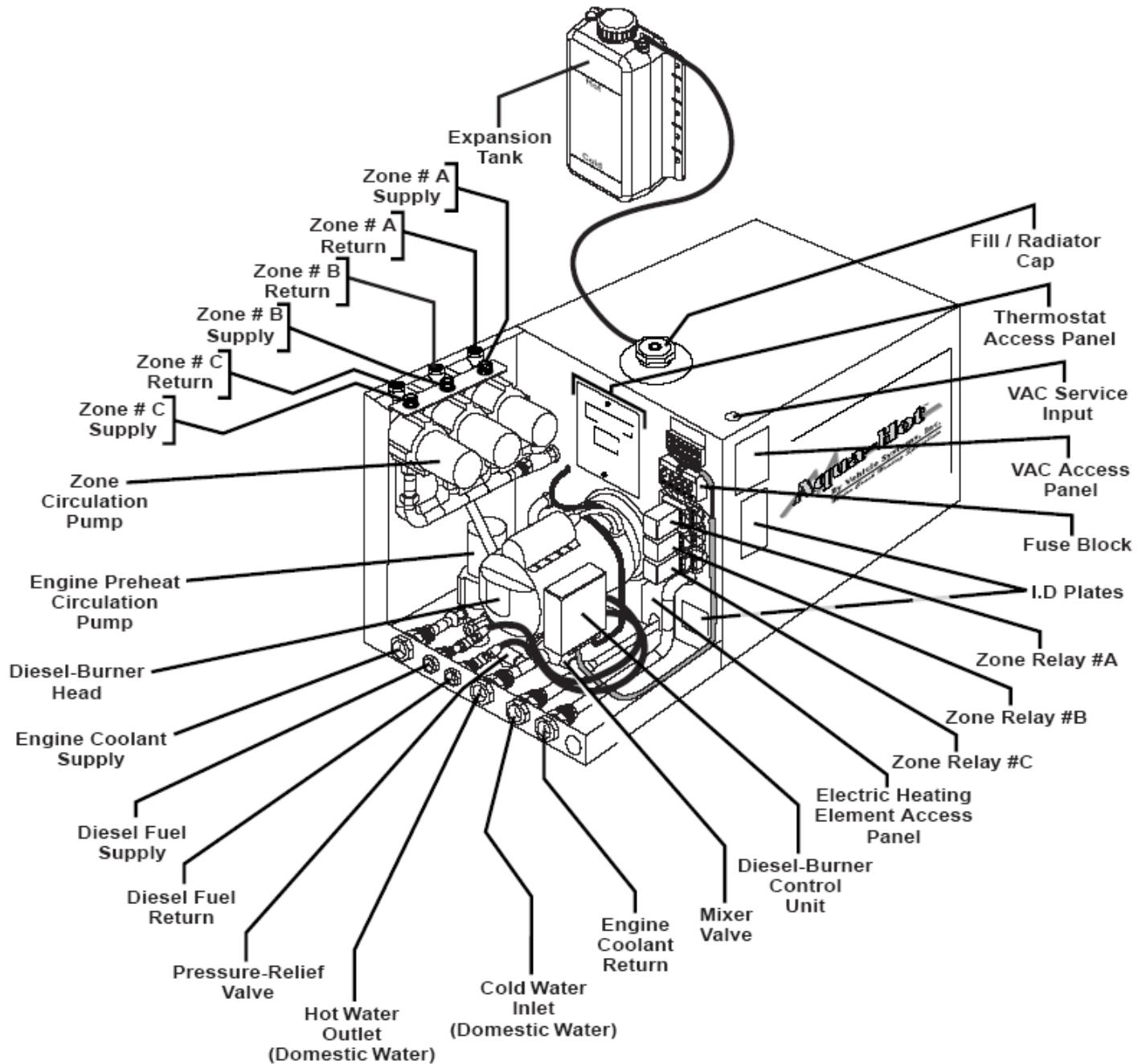
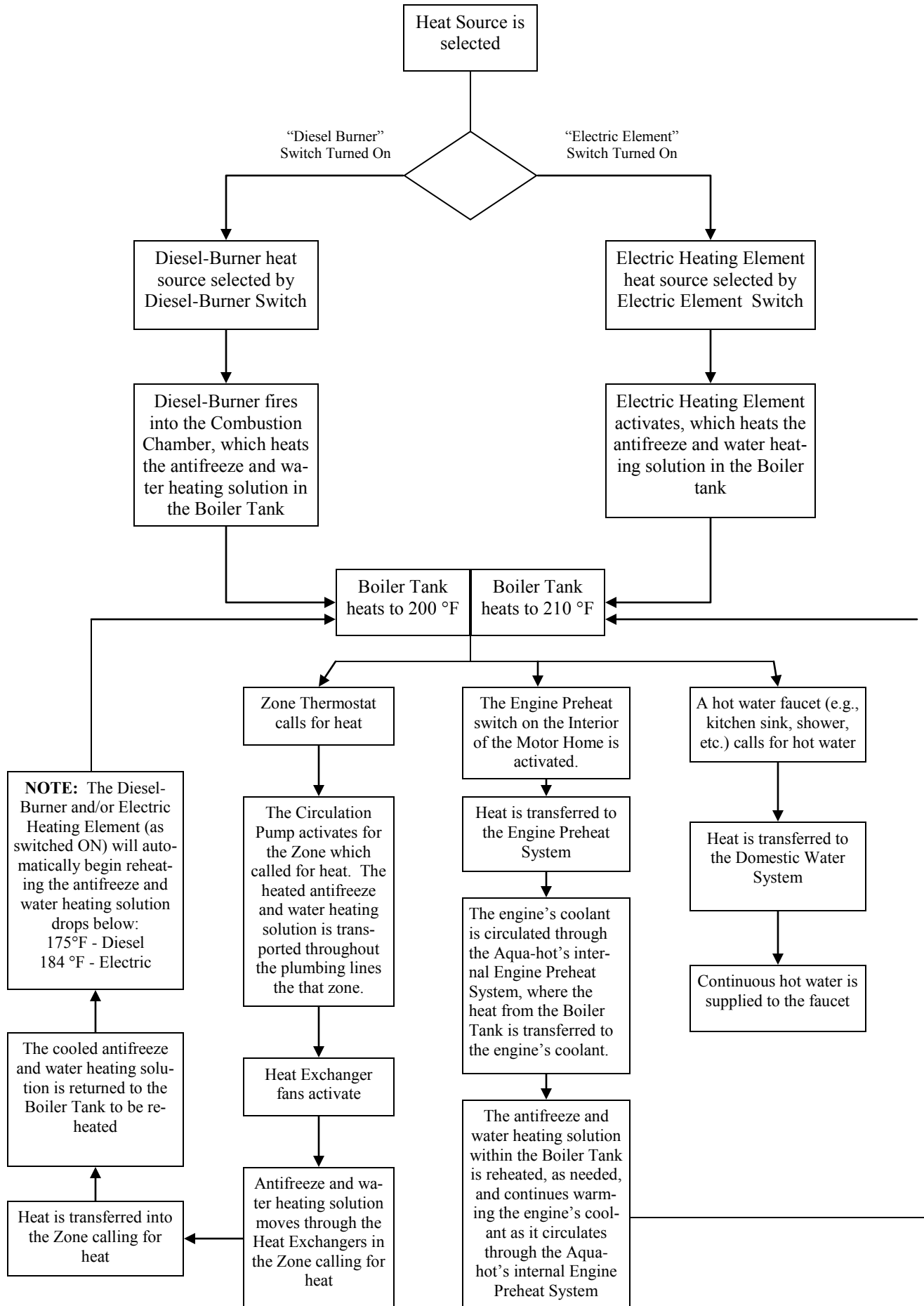


Figure 3



SECTION 2: AQUA-HOT AHE-100-02S OVERVIEW



NOTE: The Interior switches are supplied by the OEM.

Diesel-Burner Switch:

When the diesel-burner switch is in the on position, any time the control thermostat tells the Diesel Burner that heat is needed for the boiler tank, the diesel-burner will respond by firing up and providing heat. A cold boiler tank can expect to be brought to operating temperature by the diesel-burner in approximately 20 to 30 minutes. In order to obtain continuous hot water, the diesel-burner switch must be activated.

NOTE: If the diesel-burner fails to ignite, the diesel burner status light will go out, indicating to the customer the burner has gone into a default. To reset the default, the diesel burner switch must be turned off for 5 seconds and then turned back on.

Electric Element Switch:

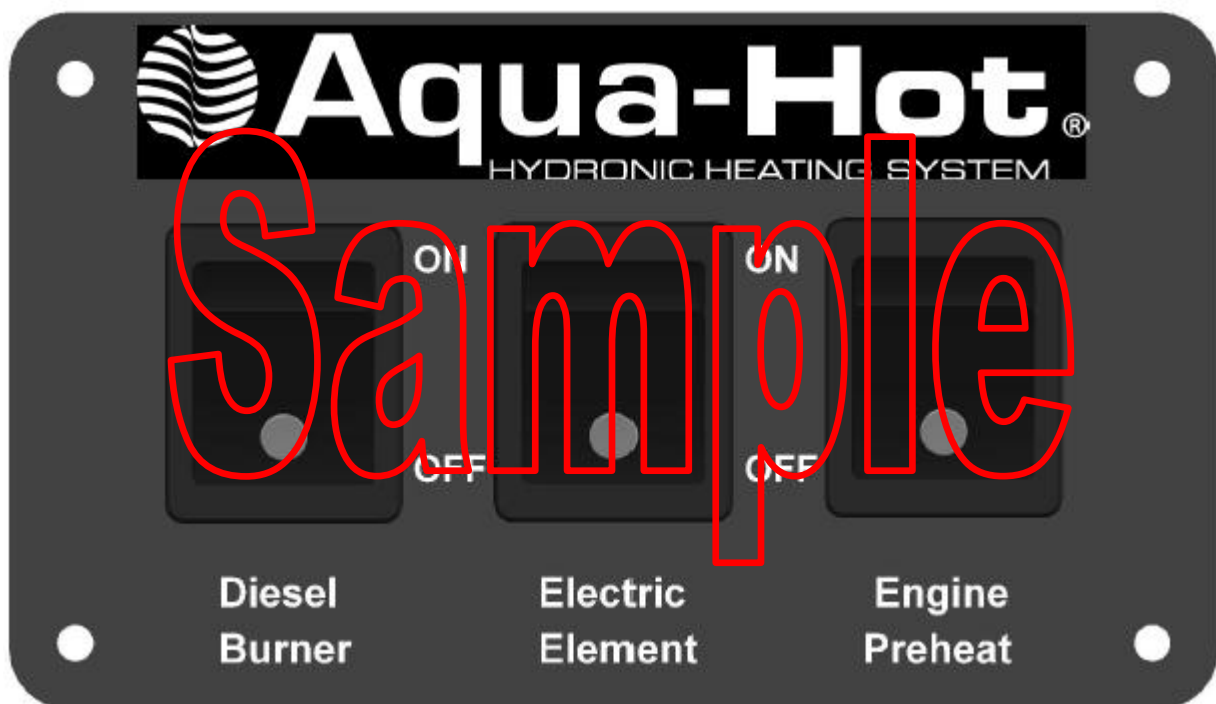
NOTE: If a 12 VDC switch is used to activate the 120 VAC heating element, there will be a relay, which the 12 VDC switch will activate to allow 120VAC power to be supplied to the 120VAC heating element.

When the motor home is plugged into an AC power source (e.g., shore power, generator, etc.) and the electric element switch is on, the electric heating element will be used to provide heat to the boiler tank if the need arises. A cold boiler tank can expect to be brought to operating temperature by the electric heating element in approximately 1 to 2 hours. The electric element, alone, will not be able to provide continuous hot water.

Engine Preheat Switch:

The engine preheat switch activates the engine preheat pump, which draws the motor home's engine coolant through the boiler tank to heat it before returning it to the engine block to transfer the heat there. The engine preheat switch does not need to be activated for the motor-aide feature to work and should be shut off when traveling.

Figure 4



SECTION 4: EXHAUST SYSTEM REQUIREMENTS

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

- The exhaust must not be directed downward as a fire could result when parked in dry, grassy areas.
- The exhaust must not terminate underneath the vehicle, underneath an open-able window or vent, in the awning area of the motor home (if applicable), or near slide-out areas.
- The exhaust must be able to freely exit away from the vehicle without any obstructions.
- 1 3/4" - 2" standard automotive-type exhaust piping should be used with a maximum of two 90-degree pipe bends and should not exceed 20 feet.
- The 3-inch and 4-inch black-pipe nipples and the exhaust elbow - originally supplied with the Aqua-Hot, must be present.

Figure 5

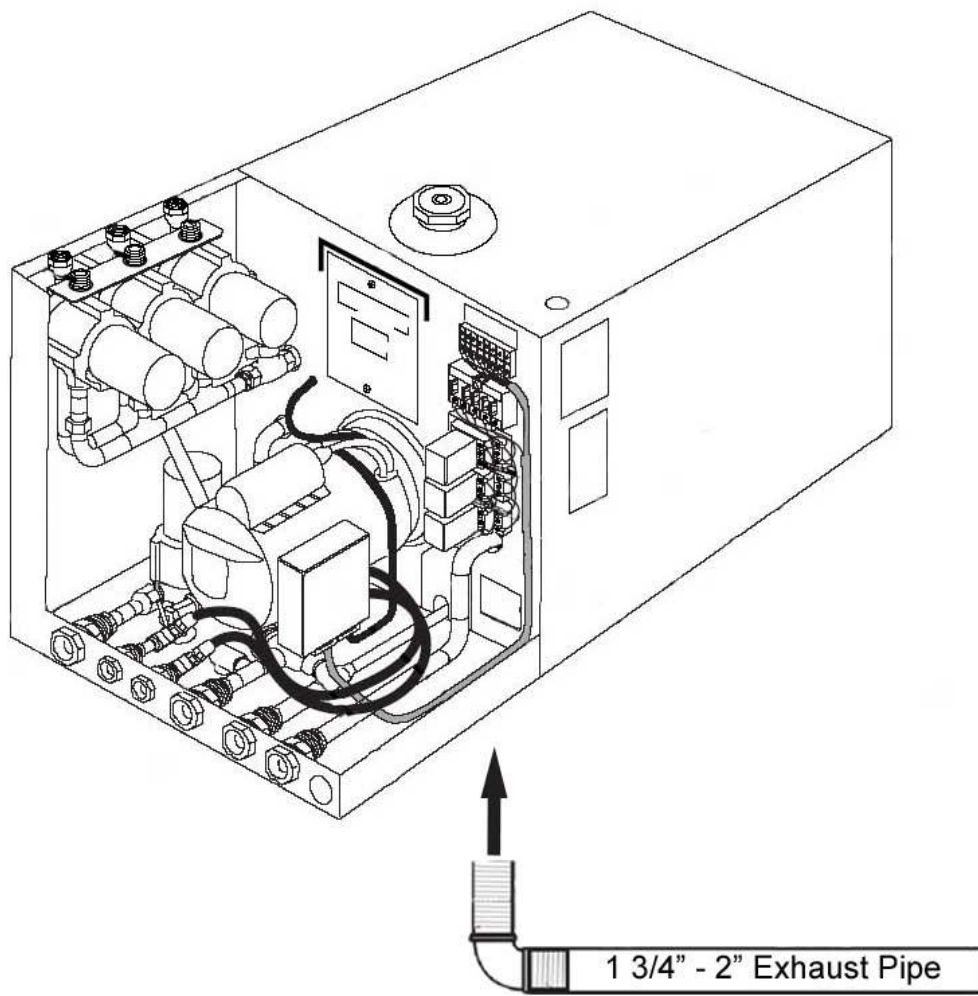


Figure 6

190 ° F Diesel Burner
Control Thermostat



Thermostats

Control Thermostat: Diesel Burner

The Diesel Burner control thermostat is installed onto the Aqua-Hot's boiler tank and monitors the temperature of the antifreeze and water heating solution to determine when it is at operating temperature and when it requires heat. The Aqua-Hot's Diesel Burner is considered to be at operating temperature between 175°F and 200°F.

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

- There is a lack of hot domestic water and interior heat.
- The Diesel Burner does not operate
- Excessive Blue or white smoke is expelled from the exhaust.

Troubleshooting:

1. Turn the diesel-burner switch on the interior switch panel on.

If the Diesel Burner comes on and runs, but there is still a lack of hot water verify that the control thermostat is operating within the proper operating temperature range.

- A. Using a digital temperature sensor, place the probe on the tank next to the thermostat. The proper operating temperature for the diesel burner is 175°F - 200°F.

2. If the Diesel Burner Does not come on and run:

- A. Verify that the temperature of the boiler tank has fallen below the 175°F minimum operating temperature by checking with a digital thermometer.
- B. Disconnect the control thermostat's wires from their connections, and, using an ohmmeter, check for continuity.

If there is no continuity, follow the instructions in this section for replacing the control thermostat.

If continuity exists, complete the following:

- a. Inspect the control thermostat's wiring and connections.
- b. Verify the Diesel Burner's Controller is sending power to the control thermostat.

Control Thermostat Replacement Procedure:



FAILURE TO DISCONNECT ALL POWER SUPPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIOUS DAMAGE OR PERSONAL INJURY.

1. Ensure that the Aqua-Hot has been completely shut down and that all power sources have been disconnected. Also, because this replacement procedure will involve the boiler tank and the potential for hot coolant, be sure the heater has adequately cooled.
2. Disconnect the defective control thermostat's wires by separating the quick-disconnect terminals.
3. Using a 1/4" nut driver, unscrew the two screws securing the control thermostat to the Aqua-Hot's boiler tank thermostat mounting bracket.
4. Install the replacement control thermostat into the thermostat mounting bracket and secure with the two screws previously removed.

Note: If a screw longer than 1/4" is used to secure the thermostat in place, it may cause the thermostat mounting bracket to be pushed away from the boiler tank, and may result in overheating.

5. Inspect the quick connectors on the thermostat wires. Replace if necessary. Re-Connect the control thermostat's wires (orange and white).
6. Test the Aqua-Hot for normal operation.

Note: If the control and overheat thermostat wires are hooked up to the wrong thermostat, the diesel burner will default every time the heater reaches the maximum operating temperature.

Figure 7



Figure 8**198 ° F Electric Element
Control Thermostat**

Thermostats

Control Thermostat: Electric Element

The Electric Element control thermostat is installed onto the Aqua-Hot's boiler tank and monitors the temperature of the antifreeze and water heating solution to determine when it is at operating temperature and when it requires heat. The Aqua-Hot's Electric Element is considered to be at operating temperature between 185°F and 210°F.

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

- There is a lack of hot domestic water and interior heat.

NOTE: For continuous domestic hot water to be present, the diesel-burner must also be selected as a heating source.

- The Electric Element does not operate

Troubleshooting:

NOTE: The Motor Home must be plugged into shore power, or the generator must be operating for the electric element to be working.

NOTE: The Motor Home's Manufacturer may not have installed a switch for the electric element. If that is the case ensure the A.C. breaker for the Aqua Hot's electric element is in the "ON" position.

1. Disconnect all power supplies.
2. Remove the thermostat access cover.
3. Verify that the boiler tank's temperature is below 230°F.
4. Locate the AC control thermostat and remove its wires, by loosening and removing the screws securing the wires in place.
5. Using an ohmmeter, check the thermostat for continuity.

If continuity is not present, follow the instructions in this section to replace the AC control thermostat.

Control Thermostat Replacement Procedure:



FAILURE TO DISCONNECT ALL POWER SUPPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIOUS DAMAGE OR PERSONAL INJURY.

1. Ensure that the Aqua-Hot has been completely shut down and that all power sources have been disconnected. Also, because this replacement procedure will involve the boiler tank and the potential for hot coolant, be sure the heater has adequately cooled.
2. Disconnect the defective control thermostat's wires by removing the screws securing the wires to the terminals.
3. Using a 1/4" nut driver, unscrew the two screws securing the control thermostat to the Aqua-Hot's boiler tank thermostat mounting bracket.
4. Install the replacement control thermostat into the thermostat mounting bracket and secure with the two screws previously removed.

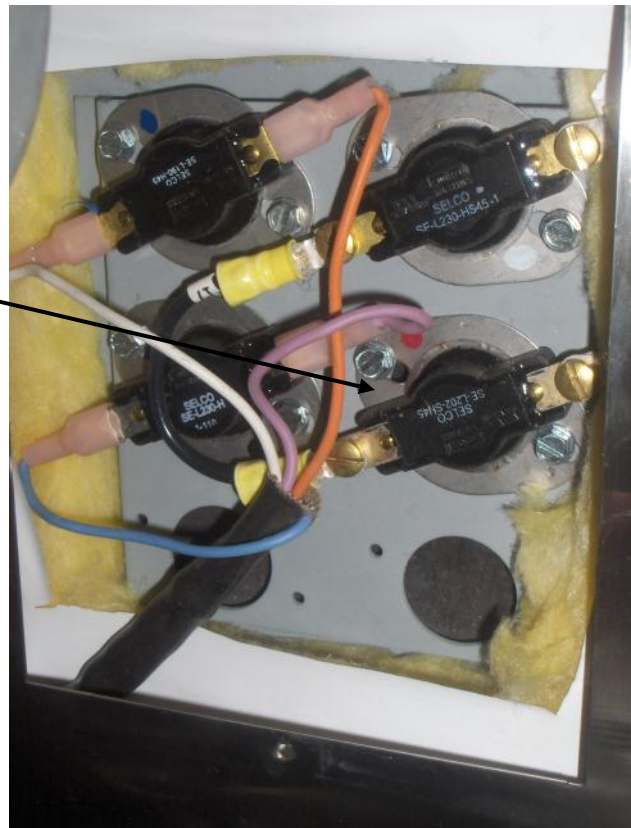
Figure 9



Note: If a screw longer than 1/4" is used to secure the thermostat in place, it may cause the thermostat mounting bracket to be pushed away from the boiler tank, and may result in overheating.

5. Inspect the wires going to the control thermostat. Replace if necessary. Re-Connect the control thermostat's wires and secure in place using the screws previously removed.
6. Test the Aqua-Hot for normal operation.

NOTE: The Motor Home must be plugged into shore power, or the generator must be operating for the electric element to be working.



AC High-Limit Thermostat:

The AC high-limit thermostat serves as a safety measure in the event that the electric heating element continues to operate after the maximum operating temperature is reached. The high-limit thermostat allows the current for the heating element to pass through it until the boiler tank reaches a temperature of 230°F. Should this temperature be reached, the high-limit thermostat blocks the current to the element, which prevents it from continuing to provide heat to the boiler tank.

Troubleshoot the AC high-limit thermostat if the following condition has occurred:

- The electric heating element fails to operate.

Troubleshooting:

1. Disconnect all power supplies.
2. Remove the thermostat access cover.
3. Verify that the boiler tank's temperature is below 230°F.
4. Locate the AC high-limit thermostat and remove its wires.
5. Using an ohmmeter, check the thermostat for continuity.

If continuity is not present, follow the instructions in this section to replace the AC high-limit thermostat.

Replacement Procedure:



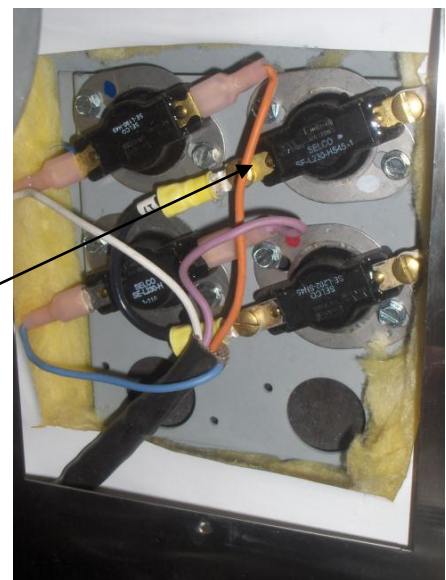
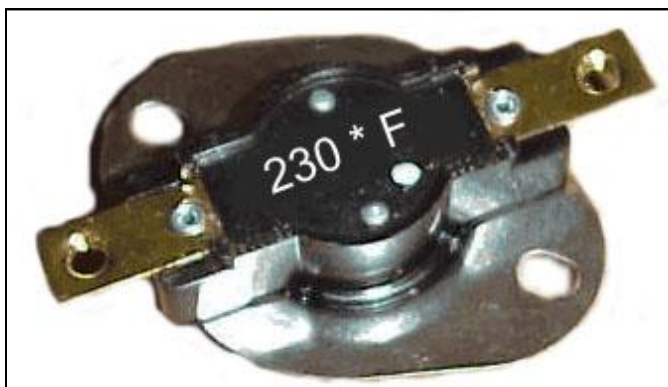
FAILURE TO DISCONNECT ALL POWER SUPPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIOUS DAMAGE OR PERSONAL INJURY.

1. Ensure that the Aqua-Hot has been completely shut down and that all power sources have been disconnected. Also, because this replacement procedure will involve the boiler tank and the potential for hot coolant, be sure the heater has adequately cooled.
2. Disconnect the defective thermostat's wires by removing the screws securing the wires to the terminals.
3. Using a 1/4" nut driver, unscrew the two screws securing the thermostat to the Aqua-Hot's boiler tank thermostat mounting bracket.
4. Install the replacement thermostat into the thermostat mounting bracket and secure with the two screws previously removed.

Note: If a screw longer than 1/4" is used to secure the thermostat in place, it may cause the thermostat mounting bracket to be pushed away from the boiler tank, and may result in overheating.

5. Inspect the wires going to the thermostat. Replace if necessary. Re-Connect the thermostat's wires and secure in place using the screws previously removed.
6. Test the Aqua-Hot for normal operation.

Figure 10



DC High-Limit Thermostat:

The DC high-limit thermostat serve as a safety measure in the event that the diesel-burner continues to operate after the maximum operating temperature is reached. The high-limit thermostat allow the current for the diesel-burner to pass through it until the boiler tank reaches a temperature of 230°F. Should this temperature be reached, the high-limit thermostat blocks the current to the diesel-burner's fuel solenoid valve, which prevents the diesel-burner from operating.

Troubleshoot the DC high-limit thermostat if the following condition has occurred:

- The fuel solenoid on the diesel-burner fails to operate.

Troubleshooting:

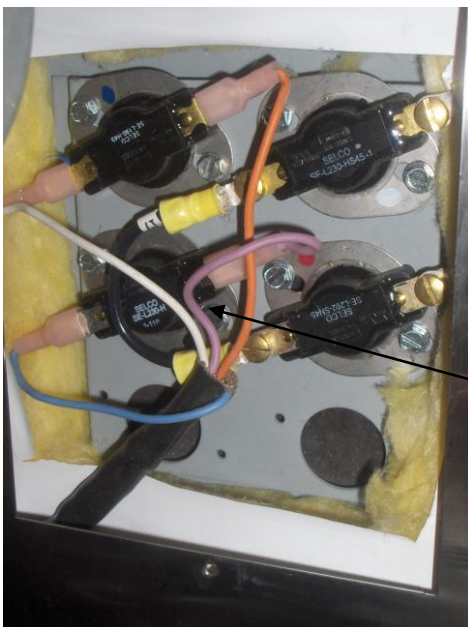
1. Place a jumper wire between the blue and purple wires on the diesel-burner's wire harness to bypass the high-limit thermostats. Check the Aqua-Hot for normal operation.

NOTE: Bypassing the high-limit thermostats is for testing only and must not be used for the Aqua-Hot's normal functioning.

2. Disconnect the DC high-limit thermostats' wires, then, using an ohmmeter, check the thermostat for continuity.

If there is no continuity, complete the following, follow the instructions in this section to replace the high-limit thermostat.

Figure 11



Replacement Procedure:

⚠ DANGER! ⚠
FAILURE TO DISCONNECT ALL POWER SUPPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIOUS DAMAGE OR PERSONAL INJURY.

1. Ensure that the Aqua-Hot has been completely shut down and that all power sources have been disconnected. Also, because this replacement procedure will involve the boiler tank and the potential for hot coolant, be sure the heater has adequately cooled.
2. Disconnect the defective thermostat's wires by separating the quick-disconnect terminals.
3. Using a 1/4" nut driver, unscrew the two screws securing the control thermostat to the Aqua-Hot's boiler tank thermostat mounting bracket.
4. Install the replacement thermostat into the thermostat mounting bracket and secure with the two screws previously removed.

Note: If a screw longer than 1/4" is used to secure the thermostat in place, it may cause the thermostat mounting bracket to be pushed away from the boiler tank, and may result in overheating.

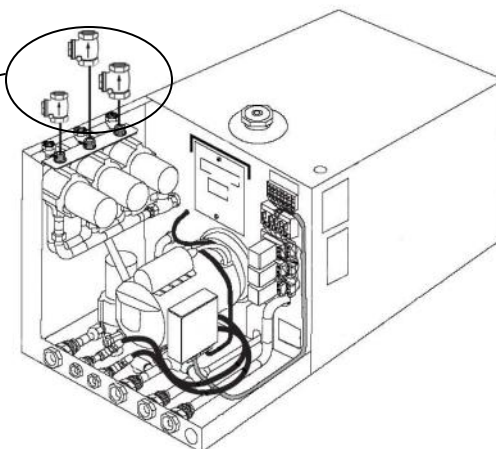
5. Inspect the quick connectors on the thermostat wires. Replace if necessary. Re-Connect the thermostat's wires (blue and purple).
6. Test the Aqua-Hot for normal operation.

Note: If the control and overheat thermostat wires are hooked up to the wrong thermostat, the diesel burner will default every time the heater reaches the maximum operating temperature.





Figure 12



Valves

Check Valve:

Check valves are installed into the zone outlet ports for each heating loop to ensure that the antifreeze and water heating solution only flows in one direction. If the heating solution attempts to backflow into the boiler tank, the check valve closes to prevent that from happening.

Troubleshoot the check valves if the following condition has occurred:

- There is a lack of interior heat in a particular zone.

NOTE: Before Troubleshooting the zone check valve it is important to remember that if the zone circulation pump is air locked, or if there is a kink in a zone heating loop plumbing line, the customer will experience the same symptoms as a stuck check valve.

Troubleshooting:

1. Verify that the heating zone is operating properly by checking the following:
 - A. Verify that the room thermostat inside the interior of the motor home is on and calling for heat.
 - B. Check the circulation pump for operation by feeling the pump for a vibration, indicating the pump is running.

2. With the circulation pump operating, tap on the check valve and wait five minutes to evaluate if interior heat is now present.

If interior heat is present after tapping the check valve, the check valve was stuck closed and no further action is necessary.

3. Check the Aqua-Hot's antifreeze and water heating solution's ratio of water to antifreeze. The mixture ratio should be approximately 50/50. If the solution is comprised fully of antifreeze (100%), the check valves will continue to stick.

NOTE: Storing the motor home for an extended period of time can cause the check valves to stick. If, after the initial release of the stuck check valve, it continues to stick, follow the instructions in this section to replace the check valve.

Replacement Procedure:

⚠ DANGER! ⚠

FAILURE TO DISCONNECT ALL POWER SUPPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIOUS DAMAGE OR PERSONAL INJURY.

1. Ensure that the Aqua-Hot has been completely shut down and that all power sources have been disconnected. Also, because this replacement procedure will involve the boiler tank and the potential for hot coolant, be sure the heater has adequately cooled.

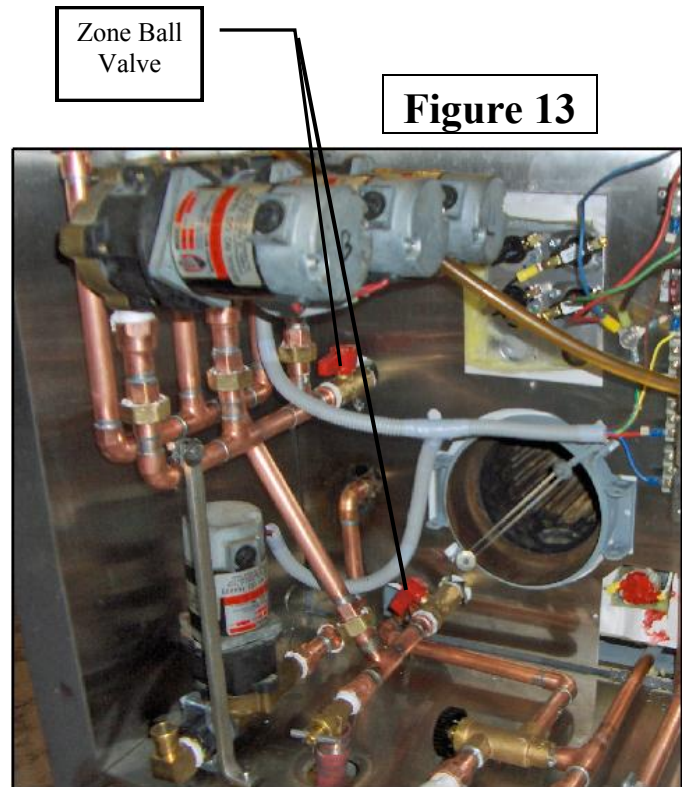
Replacement Procedure: (continued)

2. Shut off both the return and the supply ball valves coming out of the aqua hot's boiler tank..
3. Disconnect the interior heating zone line from the defective check valve..

NOTE: When the interior heating zone line is disconnected from the check valve, approximately 2 quarts of antifreeze will leak out of the interior heating zone line.

4. Unscrew the defective check valve from the Aqua-Hot's zone circulation pump.
5. Install the replacement check valve onto the Aqua-Hot's zone circulation pump. The arrow on the check valve must point away from the circulation pump.
6. Reconnect the interior heating zone fitting and line to the replacement check valve.
7. Refill the Aqua-Hot boiler tank with the antifreeze and water heating solution.
8. Test for proper operation

NOTE: The Aqua Hot zone circulation pump is not a self priming pump. If the circulation pump gets an air pocket, it will be necessary to bleed the air out of the zone circulation pump. Reference appendix ? For the proper zone circulation pump bleeding procedure.



Tempering Valve:

The tempering valve for the Aqua-Hot mixes the heated domestic water from the boiler tank with cold domestic water at a preset ratio to reduce the risk of scalding.

Troubleshoot the tempering valve if the following condition has occurred:

- There is a lack of hot domestic water.

Troubleshooting:

NOTE: Prior to trouble shooting the tempering valve, it is recommended to review the Lack of Hot Water Troubleshooting guide in section 9.

NOTE: If the Hot line coming out of the Aqua Hot into the tempering valve is hot, but the mix side of the tempering valve is luke warm/cold, The tempering valve may be faulty.

1. Inspect the tempering valve to ensure that it is not leaking.
2. Test the temperature of the hot water using a digital thermometer at one of the hot water faucets. Water Temperature should range between 115° F - 123° F. If the proper range cannot be set follow the instructions in this section to replace the tempering valve.
3. Test the tempering valve's functionality by turning the knob.

If the tempering valve's knob does not turn freely, follow the instructions in this section to replace the tempering valve's internal components

Replacement Procedure:

⚠ DANGER! ⚠

FAILURE TO DISCONNECT ALL POWER SUPPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIOUS DAMAGE OR PERSONAL INJURY.

1. Turn the motor home's water pump off.
2. Drain the water pressure by opening the faucets and allowing the water to drain.

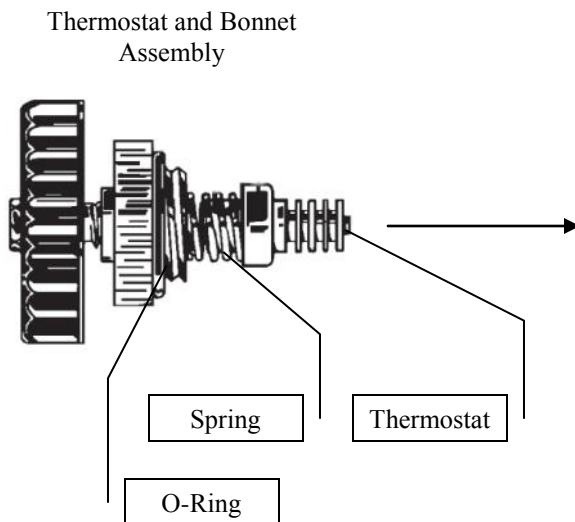
3. Follow the instructions for removing the diesel burner..
4. Using Channel Lock Pliers, remove the Thermostat and Bonnet Assembly.
5. Once the thermostat and bonnet assembly has been removed, replace the o-ring, stainless steel spring, and thermostat.
6. Re-Install the bonnet assembly, and tighten with channel lock pliers.
7. Turn the motor home's water pump back on and check for leaks.
8. Follow the instructions for re-installing the diesel burner.
9. Turn the diesel burner on and let the heater come up to full operating temperature.
10. Test heater for proper operation. Verify that the replacement tempering valve has been set to the proper setting by taking a digital thermometer to a hot water faucet and set the water temperature between 115°F - 123°F .

⚠ DANGER! ⚠

FAILURE TO PROPERLY SET THE HOT WATER TEMPERATURE BETWEEN 115°F - 123°F COULD RESULT IN SEVERE BURNS.

Tempering Valve:

Figure 14



Pumps

Replacement Procedure:

Circulation Pumps A, B, and C:

The Zone circulation pump first draw the heated antifreeze and water heating solution from the Aqua-Hot's boiler tank, then propel it through the hydronic heating system's interior heat plumbing.

Troubleshoot the Zone circulation pumps if the following condition has occurred:

- The Zone circulation pump is not operating.
- There is a lack of heat in the coach.

Troubleshooting:

NOTE: Reference wiring Schematic in Appendix A.

1. Turn on the interior room thermostat corresponding to the Zone pump not operating.

- Using a Volt Meter , Check for voltage on the Fuse Block for the zone pumps, Fuse C.
 - If No voltage, replace the fuse.
 - If Yes continue.
- Using a Volt Meter, Check and ensure that the corresponding zone relay is sending voltage to the pump at pin 6.
 - If No voltage is present troubleshoot the zone relay.
 - If Yes continue.

- Check the Zone pump for voltage.
 - If there is voltage and the zone pump is not operating, follow the zone pump replacement procedure in this book.

NOTE: Before Replacing the Pump remove and inspect the brushes on the pump. If they are less than 1/8" the brushes are to worn and will prevent the pump from operating.

NOTE: The zone pump can be tested by connecting it to an external 12 Volt-DC power source to verify that the pump is defective.

⚠ DANGER! ⚠

FAILURE TO DISCONNECT ALL POWER SUPPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIOUS DAMAGE OR PERSONAL INJURY.

- Ensure that the Aqua-Hot has been completely shut down and that all power sources have been disconnected. Also, because this replacement procedure will involve the potential for hot coolant, be sure the heater is adequately cooled.
- Shut off both the return and the supply ball valves coming out of the aqua hot boiler tank..
- Disconnect the interior heating zone line from the check valve.

NOTE: When the interior heating zone line is disconnected from the check valve, approximately 2 quarts of antifreeze will leak out of the interior heating zone line.

- Unscrew the check valve from the Aqua-Hot zone circulation pump.

NOTE: Once the check valve is removed there is pump nut, securing the pump in place that will also need to be removed.

- Disconnect the defective circulation pump's wires by removing the protective loom, and cutting both the positive and negative wires with wire cutters.
- Using a 3/4" and a 1 1/8" wrench disconnect the union securing the zone circulation pump in place.
- Remove the zone circulation pump.
- Using a 1" wrench remove the copper pump stand from the defective pump.

NOTE: Be sure to install the copper pump stand onto the inlet side of the zone circulation pump. Reference Fig. 15

- Wrap the threads of the new replacement pump with a thread seal tape.
- Install the copper pump stand onto the replacement zone circulation pump, and tighten down with a 1" wrench.

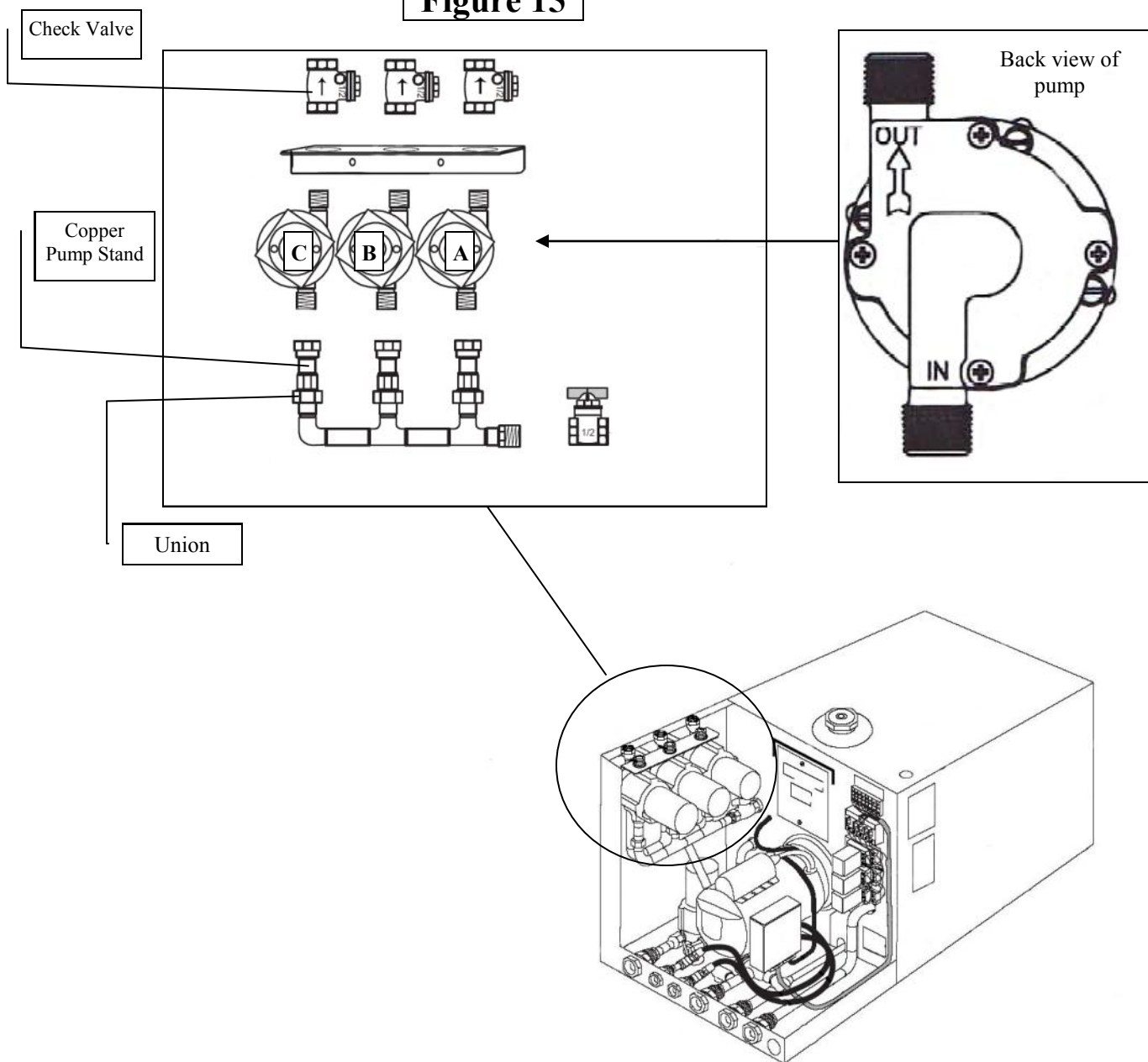
11. Install the replacement pump onto the Aqua Hot, and tighten down the union previously loosened.
12. Re-Install the check valve onto the Aqua-Hot zone circulation pump. The arrow on the check valve must point away from the circulation pump.
13. Reconnect the interior heating zone fitting and line to the check valve.
14. Reconnect the wires on the replacement pump to the wire harness on the heater by using a red butt connector.

Be sure to review the wiring schematic in appendix A for proper pump wiring.

15. Refill the Aqua-Hot boiler tank with the antifreeze and water heating solution.

NOTE: The Aqua Hot zone circulation pump is not a self priming pump. If the circulation pump gets an air pocket, it will be necessary to bleed the air out of the zone circulation pump. Reference appendix B For the proper zone circulation pump bleeding procedure.

Figure 15



Stir Pump / Circulation Pump B:

The stir pump circulates the antifreeze and water heating solution within the Aqua-Hot boiler tank in order to ensure even-heating of the solution. To accomplish this, the stir pump draws the solution from the supply port of the tank and deposits it back into the return port of the tank, after circulation through heating loop number 2.

Troubleshoot the stir pump if the following condition has occurred:

- There is a lack of hot domestic water.
- The Stir Pump does not operate when the diesel burner is running.

NOTE: In order for the stir pump to operate, the diesel-burner motor must be running.

Troubleshooting:

1. Verify that the Diesel Burner motor is running.
2. If the diesel burner motor is running and the stir pump still is not operating:
 - A. Locate the Diode Wire which runs from the diesel burner Controller C-2 pin, and hooks up to the B-Zone Relay Pin 6 terminal.
 - i. Verify the Diode Wire is connected and the screw for Pin 6 on the B-Zone relay is tight.

If diesel burner motor is running, and no voltage is present at Pin 6 on the B-Zone Relay replace the diode wire. If voltage is present at Pin 6 on the B-Zone Relay continue.

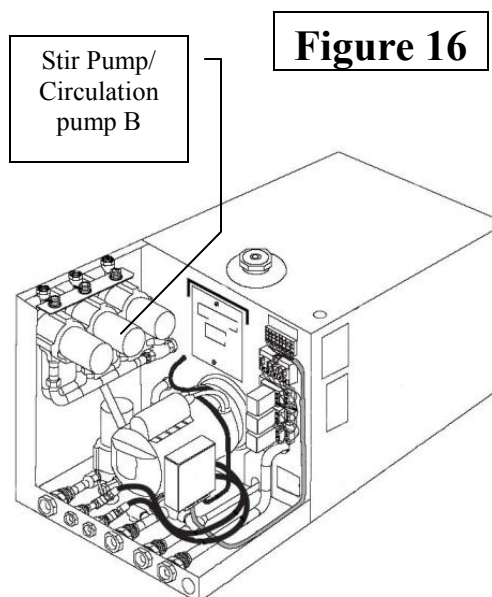
- C. Using a Volt Meter check the #2 zone pump for voltage.

If voltage is present and the pump still fails to operate follow the circulation pump replacement procedure in this book.

3. If it is determined that the pump is active, verify that the pump is operating properly by checking both connected hoses for heat.

If both hoses are hot, the pump is working properly.

If one hose is hot, or neither hose is hot, check the the heating loop for a blockage (i.e. stuck check valve, kinked line). If no blockage exists, follow the instructions in this section to replace the Zone pump #2.



Pumps

Engine Preheat Pump:

The Engine Preheat circulation pump draws the cold anti-freeze and water heating solution from the motor home's engine and then propels it through the Engine Preheat Heat exchanger, located inside the boiler tank.

Troubleshoot the Engine Preheat Pump if the following condition has occurred:

- The Engine Preheat Pump is not operating, and the Engine Preheat Switch inside the motor Home is in the ON position .

Troubleshooting:

NOTE: Either the diesel-burner switch or the electric element switch must also be activated in order for the engine preheat feature to function.

- Using a Volt Meter , Check for voltage on the Fuse Block for the Engine Preheat, Fuse A.
 - If No voltage, replace the fuse.
 - If Yes continue.
- Using a Volt Meter , Check for a Ground signal on the Terminal Strip for the Engine Preheat Pump.
 - If No ground is present use a jumper wire and jumper the engine preheat connection on the terminal strip to a ground. If the Engine Preheat pump comes on and runs check for loose wires. If no loose wires are present replace the engine preheat switch inside the motor home

If Yes continue.

- Check the Engine Preheat pump for voltage.
 - If there is voltage and the engine preheat pump is not operating, follow the engine pre heat pump replacement procedure in this book.

NOTE: Before Replacing the Pump Remove and inspect the brushes on the pump. If they are less than 1/8" the brushes are to worn and will prevent the pump from operating.

NOTE: The engine preheat pump can be tested by connecting it to an external 12 Volt-DC power source to verify that the pump is defective.

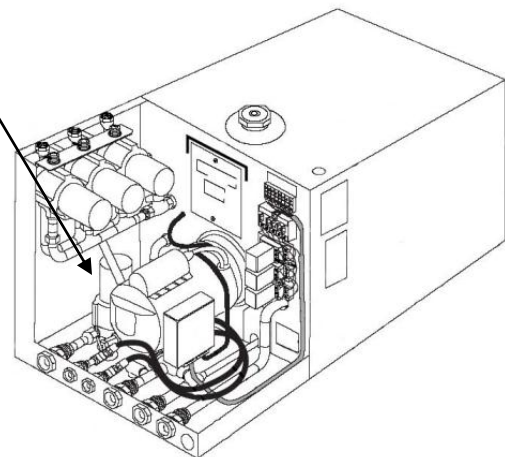
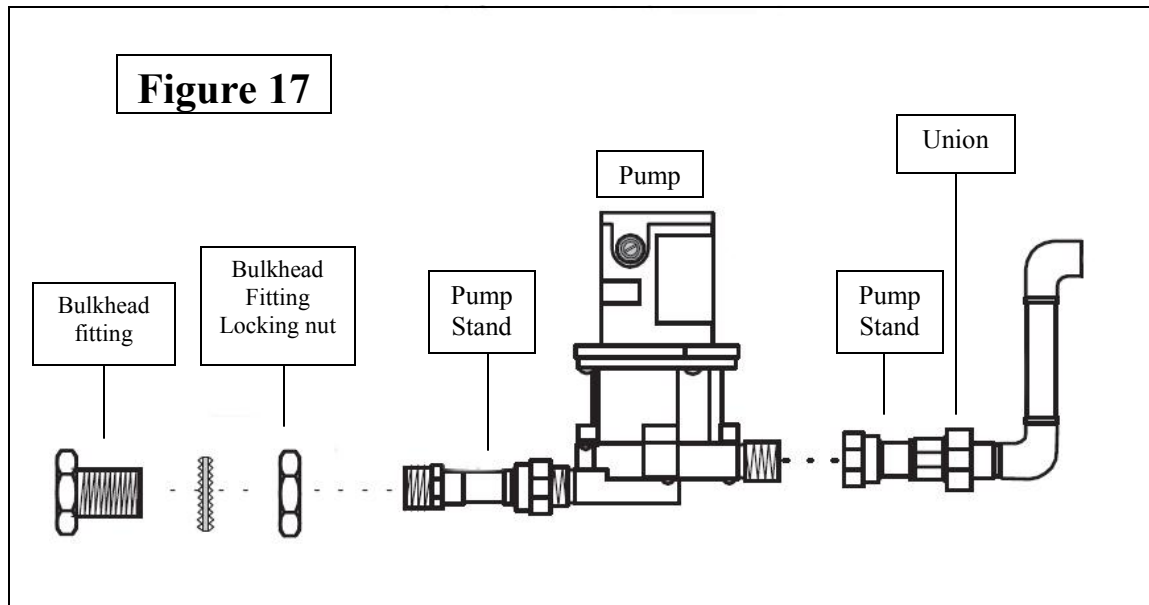
Replacement Procedure:

⚠ DANGER! ⚠
FAILURE TO DISCONNECT ALL POWER SUPPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIOUS DAMAGE OR PERSONAL INJURY.

- Ensure that the Aqua-Hot has been completely shut down and that all power sources have been disconnected. Also, because this replacement procedure will involve the potential for hot coolant, be sure both the heater and motor home engine are adequately cooled.
- Using hose pinch off pliers, clamp both hoses attached to the engine preheat loop, closed.
- Remove the Hose and hose barb fitting attached to the engine preheat pump bulk head fitting.
- Using a 1 1/4" and a 1 3/8" wrench loosen and remove the bulk head fitting.
- Using a 3/4" and a 1 1/8" wrench disconnect the union securing the engine preheat pump in place.
- Disconnect the defective circulation pump's wires by removing the protective loom, and cutting both the positive and negative wires with wire cutters.
- Remove the zone circulation pump.
- Using a 1" wrench remove both of the copper pump stands from the defective pump. Be sure to mark the location of each stand to ensure proper installation of the replacement pump.
- Wrap the threads of the new replacement pump with a thread seal tape.
- Install the pump stands onto the replacement pump, and tighten down with a 1" wrench.
- Reinstall the engine preheat pump. Be sure the arrow on the pump is pointing towards the aqua hot boiler tank.

12. Reinstall the bulk head fitting. Be sure to use a back up wrench on the pump stand to ensure the pump is properly positioned while tightening down the bulk head fitting.
13. Using a 3/4" and a 1 1/8 wrench tighten down the union.
14. Reconnect the hose barb fitting and hose to the engine preheat pump bulk head fitting.
15. Reconnect the wires on the replacement pump to the wire harness on the heater by using a red butt connector. Be sure to review the wiring schematic in appendix A for proper pump wiring.
16. Remove the hose pinch off pliers previously used to pinch off the hose.
17. Test for proper operation

NOTE: The Aqua Hot Engine Preheat pump is not a self priming pump. If the pump gets an air pocket, it will be necessary to bleed the air out of the pump. To bleed the air out of the engine preheat pump it may be necessary to turn on the motor home's engine and let it run for approximately 10 minutes.



Zone Relay: Interior Heat Exchanger Fans/Zone Pumps

The Zone relay is an electrical device where the DC circuit from the Interior Room Thermostat determines whether the DC power is permitted to flow to the circulation pump and the heat exchanger fans. This allows the Interior Room Thermostat to switch both the fans and circulation pump on.

Troubleshoot the Zone relay if either of the following conditions have occurred:

- The Interior fans fail to operate.
- The circulation pump fails to operate

Troubleshooting:

If the Interior heat exchanger Fans fail to operate:

1. Turn the corresponding room thermostat on, on the interior of the motor home, ensuring the thermostat is set at the maximum heat setting, to ensure they will call for heat.
2. Using a Digital Volt meter, verify that the room thermostat has sent a ground signal to the terminal strip for the corresponding zone.

If there is no ground signal from the interior room thermostat inspect the wire going to the room thermostat. If the wire is good, replace the interior room

NOTE: If there is no ground for pin 0, it is possible to bypass the motor homes' interior room thermostat by supplying an external ground to the terminal block for the particular zone being trouble shot. If the zone works with the interior room thermostat bypassed the problem is located in the motor home, not within the heating system.

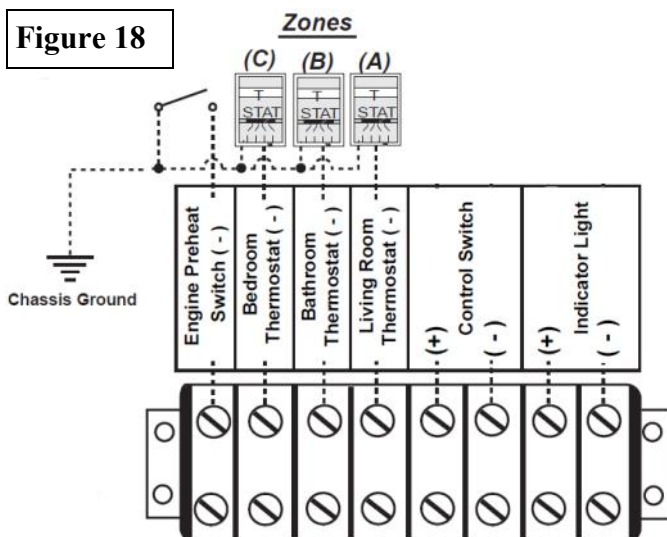
3. Locate the Fuse block, and using a volt meter, check for 12VDC on the C (Pumps) & D (Fans) Fuse.
If no power is present check the fuse.
4. On the Right-Hand side of the Zone relay check pins A, 7, and 9 for 12 VDC +
If no power is present: Inspect the wires and verify the C and D fuses are good.
5. On the Zone Relay check pin B for ground.
If there is not a ground present, verify that the room thermostat is calling for heat, and that it is sending a ground signal to the relay.
6. On the Left Hand Side of the zone relay, check pin 4 (Fans) or pin 6 (pumps) for 12 VDC +.
If no power is present replace the Zone Relay.

NOTE: If the new zone relay does not fix the problem, it is possible the relay socket has gone bad. The relay socket can be removed by pulling on the release tab on the right hand side of the relay socket

Replacement Procedure:

1. Release the clip securing the relay in place.
2. Pull the relay out of the relay socket.
3. Install the replacement relay into the relay socket.
4. Secure the relay in place with the relay clip.

Figure 18



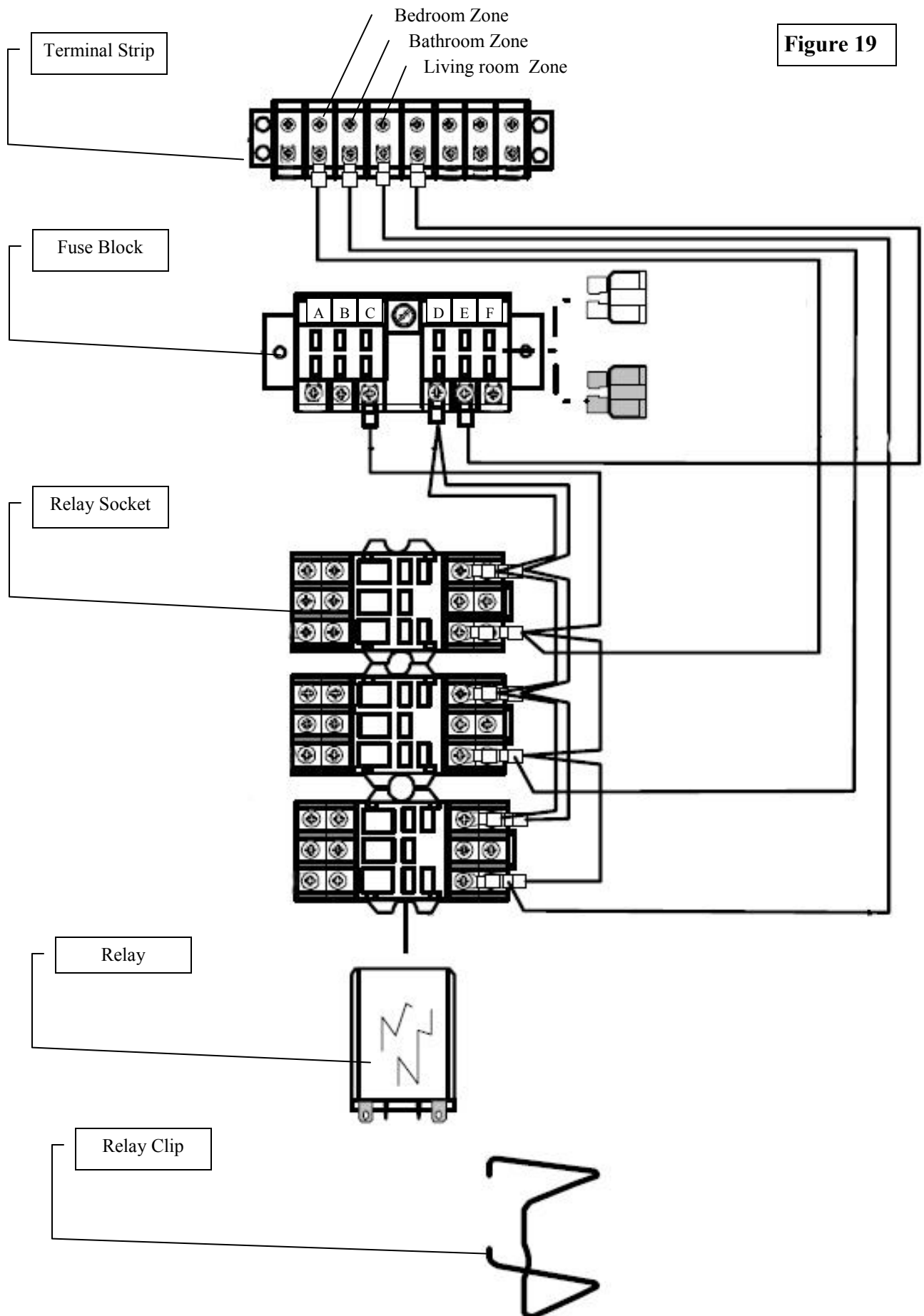


Figure 19

Electrical - AC

Electric Heating Element:

The electric heating element uses AC power as an alternate power source for heating the Aqua-Hot's boiler tank.

Troubleshoot the electric heating element if the following condition has occurred:

- There is a lack of hot domestic water and interior heat when the electric element is selected as the heating source.

Troubleshooting:

NOTE: For continuous domestic hot water to be present, the diesel-burner must be selected also as a heating source.

1. Verify that the motor home is either plugged into shore power or that the generator is running to provide AC power.
2. Verify that the "Electric" Switch is on, inside the motor home.

Note: This Model of Aqua Hot may not have a switch for the electric element. If no switch is found verify the A.C. Breaker for the Aqua Hot is in the On Position. If there is a 12 VDC switch activating a 120 VAC heating element there is a relay that is triggered by the 12 VDC switch, which then will activate and allow A.C. Power to the Aqua Hot.

If the Electric Switch\ A.C Breaker is on, and operating properly:

- A. Check the temperature of the Aqua-Hot's boiler tank.

If the boiler tank temperature is below 185°F, troubleshoot the control thermostat for the electric element.

If the boiler tank is above 210°F, the Aqua-Hot is at operating temperature and requires no heat.

3. Verify that the electric heating element is receiving adequate AC power by completing the following:

- A. Remove the AC access cover.
- B. Using an AC voltmeter, verify that 110 volts of AC power are present.

4. If Adequate AC power is present at the Aqua-Hot Check The following:

- A. Using a digital Clamp-On amp-meter, verify that 11.2 to 13 amps are present the element's wires. If the Electric Element wires show a 11.2 - 13 amp draw the electric element is working properly

5. Check the electric heating element for functionality by completing the following:

- A. Disconnect all power supplies.
- B. Remove all wires from the electric heating element.
- C. Using an ohmmeter, check the electric heating element for the proper ohms reading (8-9 ohms). If the proper ohms reading is not read, follow the instructions in this manual for replacing the electric heating element.

Replacement Procedure:

⚠ DANGER! ⚠

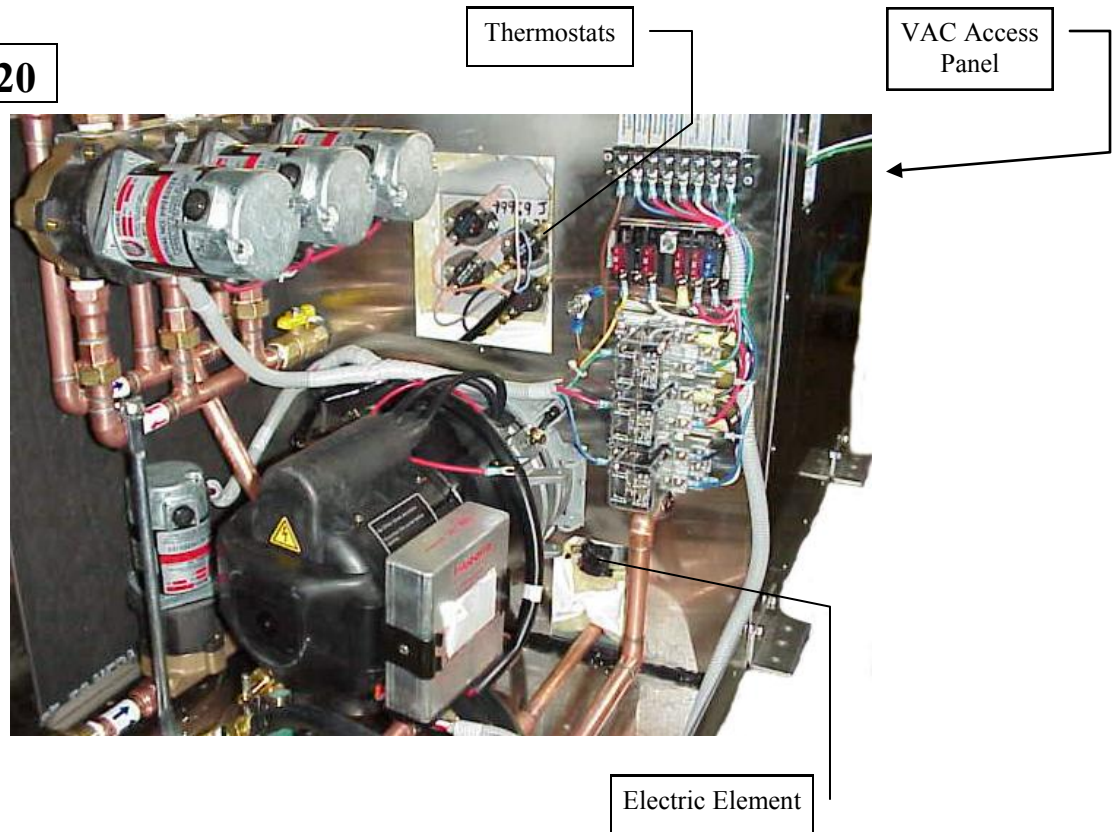
FAILURE TO DISCONNECT ALL POWER SUPPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIOUS DAMAGE OR PERSONAL INJURY.

1. Ensure that the Aqua-Hot has been completely shut down and that all power sources have been disconnected. Also, because this replacement procedure will involve the boiler tank and the potential for hot coolant, be sure the heater has adequately cooled.
2. Drain the antifreeze and water heating solution from the Aqua-Hot's boiler tank using the drain valve.
3. Remove the Electric Element access cover.

SECTION 5: AQUA-HOT COMPONENTS

4. Remove the two wires secured to the defective electric heating element by releasing the screw terminals.
5. Using a 1-1/2 inch socket, remove the defective electric heating element from the Aqua-Hot boiler tank.
6. Install the replacement 1650-watt electric heating element into the boiler tank ensuring that the “up” lettering on the element is installed in the up position.
7. Connect the wires removed from the defective electric heating element to the replacement electric heating element and tighten the screw terminals.
8. Reinstall the Electric Element access cover.
9. Refill the Aqua-Hot’s boiler tank with the antifreeze and water heating solution.
10. Test for proper operation

Figure 20



Diesel-Burner Overview

The Aqua-Hot's diesel-burner is a device that ignites a mixture of diesel fuel and air within a controlled setting to serve as a heat source. The flame is established in a combustion chamber within the Aqua-Hot's boiler tank, and the heat

from the flame is transferred to the antifreeze and water heating solution where it can be used for each system of the Aqua-Hot - domestic hot water, interior heat, and engine pre-heat.

Figure 21

Diesel-Burner I.D. Plate



5000015A	
Assembled in USA	
	
Heater Model	DBW2010.75
Voltage/Power	12V/60W
Output	13.2kW-45000Btu/h
Fuel Type	Diesel No.1/No.2 and Artic
Max. Operating Pressure	2 bar-29PSI
	
Heater No. 90915E Vers. 75 Serial No. 727107	
Year of Installation 08 09 10 11 12	

Figure 22

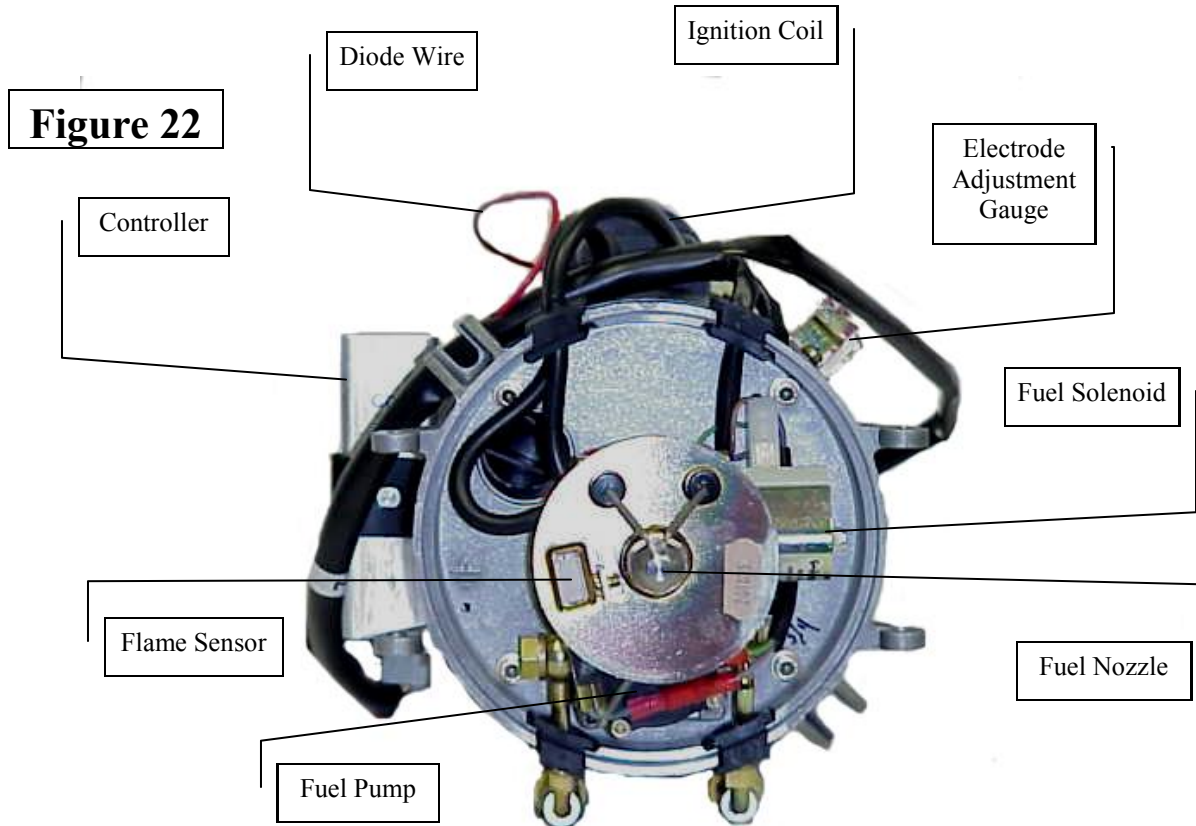
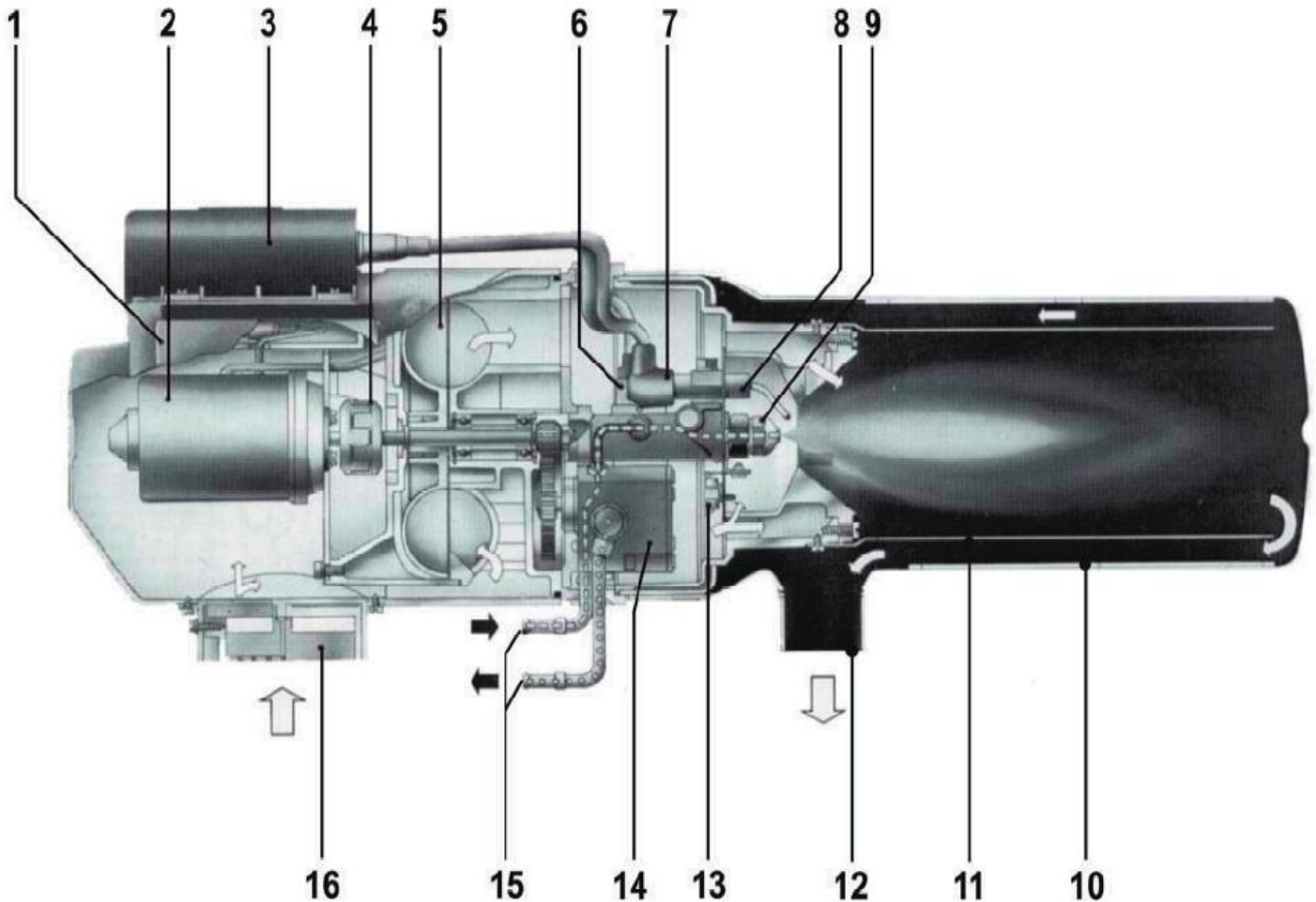
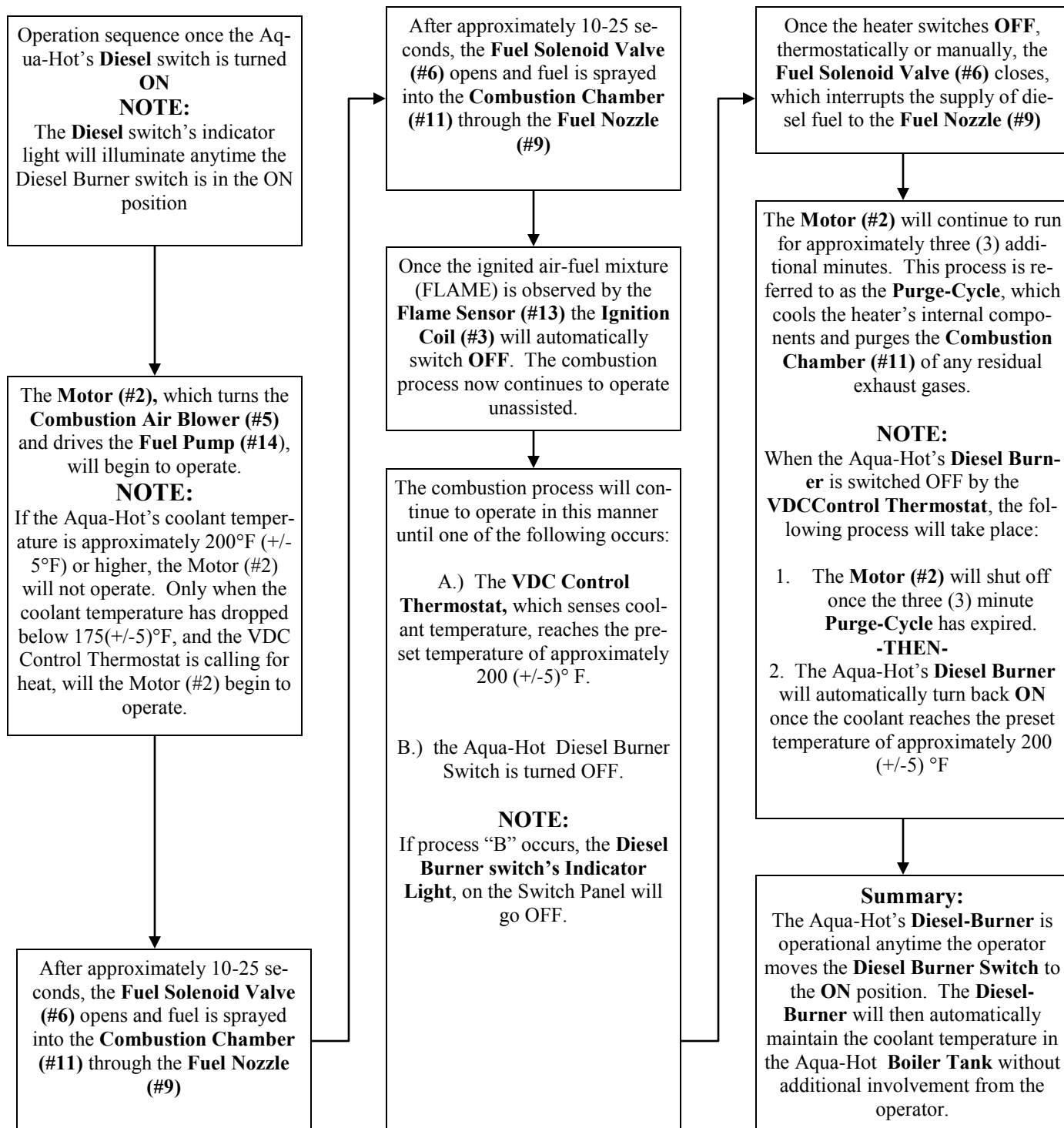


Figure 23

1. Diesel-Burner Controller
2. Motor
3. Ignition Coil
4. Clutch
5. Combustion Air Blower
6. Fuel Solenoid Valve
7. Electrode Boots
8. Ignition Electrodes
9. Fuel Nozzle
10. Heat Exchanger
11. Combustion Chamber
12. Exhaust Port
13. Flame Sensor
14. Fuel Pump
15. Fuel Tubes (Supply / Return)
16. Combustion Air Intake Port, with Adjustable Shutter



Operational Flow-Chart



Diesel-Burner Operations:

The following sequence illustrates how the Diesel-Burner operates once it is activated. Also, if diesel-burner malfunctions are experienced, use this sequence of operating events

as a diagnostic tool to determine at what point in the diesel-burner's operation the malfunction is occurring. Use the "KEY" provided to understand each symbol shown.

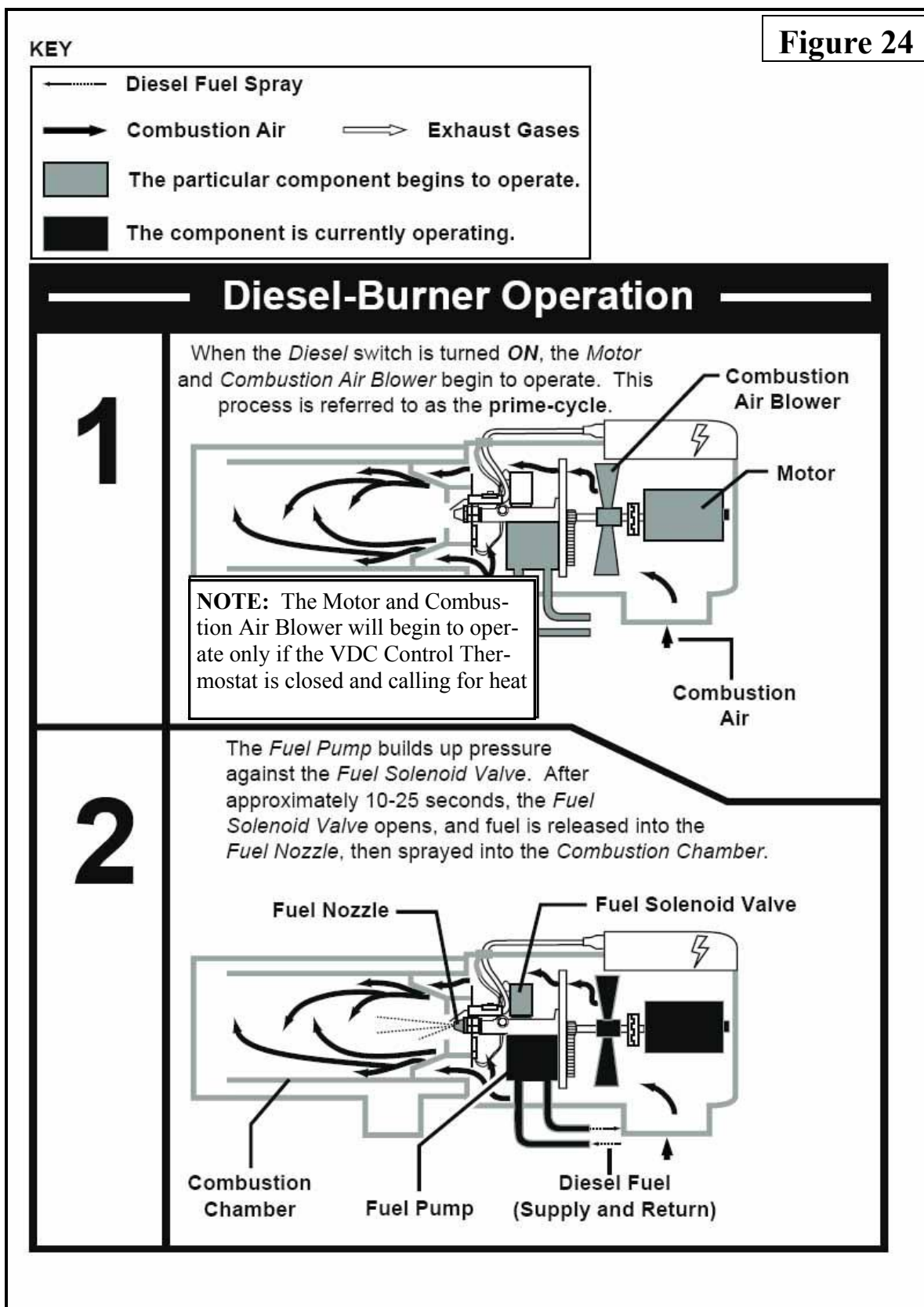







Figure 25

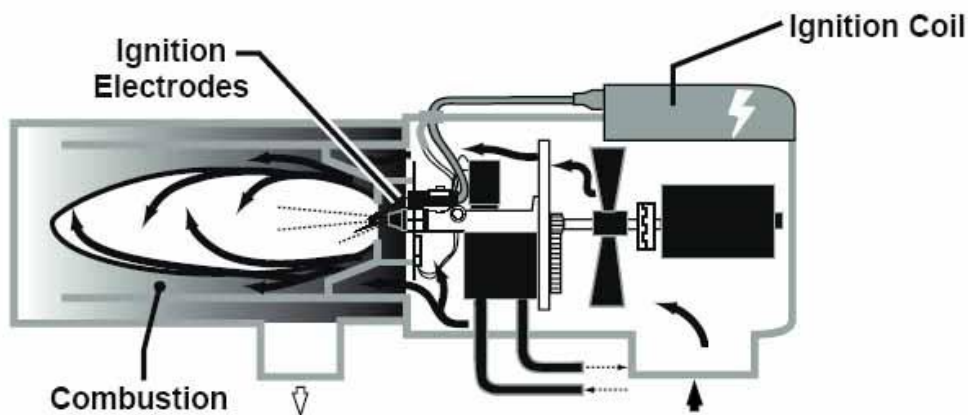
KEY

-  Diesel Fuel Spray
-  Combustion Air  Exhaust Gases
-  The particular component begins to operate.
-  The component is currently operating.

Diesel-Burner Operation, continued

3

The *Ignition Coil* produces a high voltage spark, which is transferred across the *Ignition Electrodes*. The incoming air-fuel mixture is then ignited, creating combustion.



4

The combustion's flame is detected by the *Flame Sensor* and the *Ignition Coil* is then automatically switched off (no more spark across the *Ignition Electrodes*).

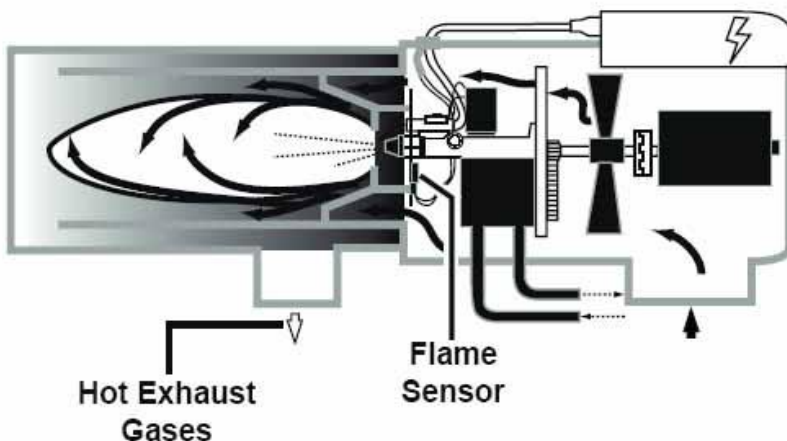







Figure 26

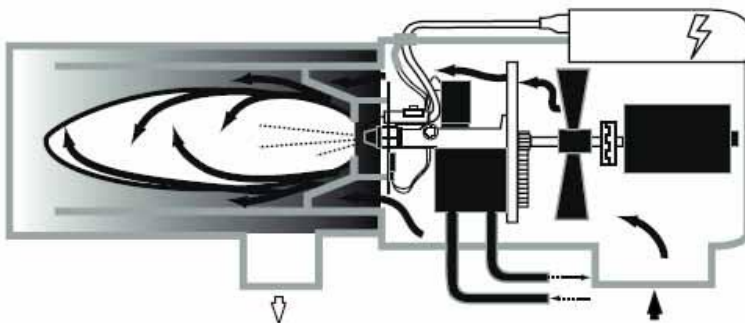
KEY

-  Diesel Fuel Spray
-  Combustion Air 
-  The particular component begins to operate.
-  The component is currently operating.

Diesel-Burner Operation, continued

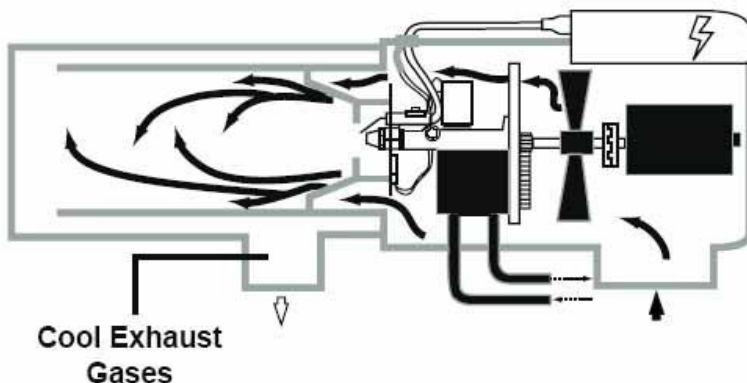
5

The Diesel-Burner will continue to produce heat in this manner until it is switched off either manually or by the VDC Control Thermostat, which occurs when the coolant temperature in the Aqua Hot's Boiler Tank Reaches 200 (+/- 5) degrees Fahrenheit.



6

Once the *Diesel-Burner* has switched **OFF**, the *Motor and Combustion Air Blower* will continue to operate for approximately 2-3 minutes. This process is referred to as the **purge-cycle**.



NOTE: Whenever the Diesel-Burner is switched off by the VDC Control Thermostat, it will automatically be reactivated once the Aqua-Hot Boiler Tank's coolant reaches the preset temperature of approximately 175 (+/-) 5 degrees Fahrenheit.

Instructions for Detaching the Diesel Burner

WARNING!

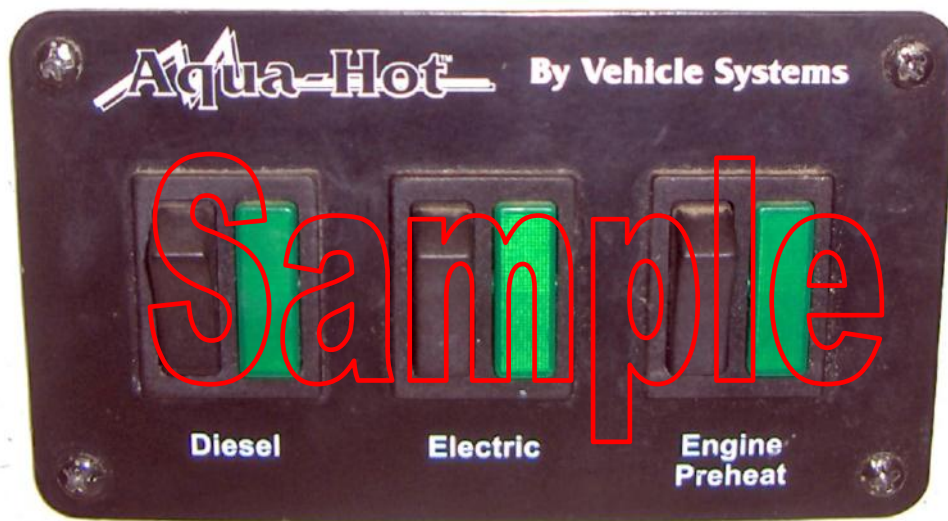
Be sure to move the Diesel-Burner switch on the Interior Switch Panel to the OFF position and disconnect the Diesel-Burner's power supply before detaching the Diesel-Burner from the Aqua-Hot. Failure to turn off the Diesel-Burner and disconnect power could result in serious bodily injury.

CAUTION!

Be sure to clamp off the Fuel Supply and Return lines at the ports on top of the Aqua-Hot prior to beginning this replacement procedure.

Step 1: Turn Off the Diesel Switch

Figure 27



1. Move the Interior Switch Panel's Diesel-Burner switch to the "OFF" position.

Step 2: Remove the Access Cover

Figure 28



1. Remove the Aqua-Hot's access cover by locating the screws securing it in place.
2. Unscrew the screws securing the cover in place.

Step 3: Disconnect the Diesel Burner's Controller

Figure 29



1. Locate the Diesel-Burner's Controller and disconnect both plugs.

Step 4: Remove the Diesel Burner from the Aqua-Hot

Figure 30a

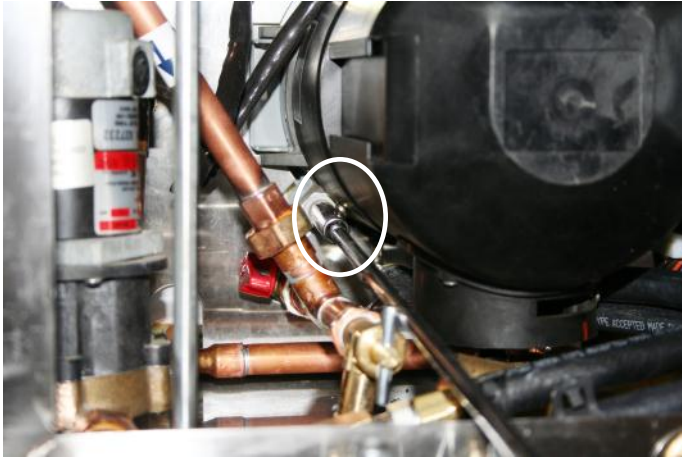


Figure 30b



1. The Diesel-Burner is secured to the Aqua-Hot with two nuts that can be loosened, and swung out of the way by using a 10mm socket wrench with a 10 inch long extension.

Figure 30c

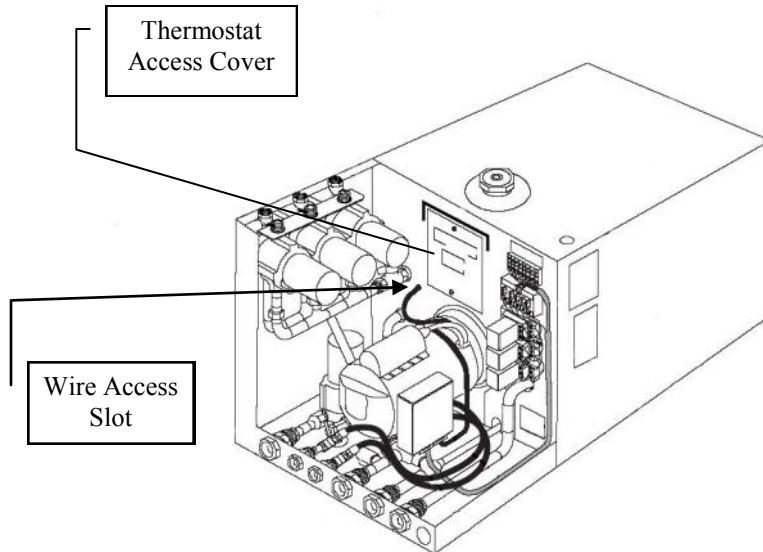


2. Carefully pull the Diesel-Burner away from the Aqua-Hot 4 to 5 inches before rotating the burner, and then remove.

SECTION 7: DETACHING AND REATTACHING THE DIESEL BURNER

Step 5: Disconnect the Diesel Burner's Thermostat Wires From the Aqua-Hot

Figure 31a



1. Using a Phillips head Screw Driver loosen the screws securing the thermostat access cover in place, and remove the thermostat access cover.

Figure 31b



1. Disconnect the thermostat wires by firmly pulling on the pink connectors. Remove the wires from the wire access slot.

Step 6: Disconnect the Fuel Lines From the Diesel Burner

NOTE: Before Disconnecting the fuel lines, it is recommended to use hose pinch off pliers on the rubber fuel lines, to shut the flow of fuel off, while the burner is removed.

Figure 32



1. Using Pliers loosen the constant tension clamps securing the fuel lines to the diesel burner, and slide away from the burner.
2. Remove the fuel lines from the diesel burner.

Reattaching the Diesel Burner to the Aqua-Hot

CAUTION!

When reattaching the diesel-burner be sure to properly align the diesel-burner before tightening the eye-bolt nuts. Also, visually inspect all of the rubber grommets on the top and bottom of the diesel-burner's cast-aluminum blower casing to ensure they are in place. **DO NOT** over tighten the eye-bolt nuts. Torque specifications are: approx. 20-40 in. lbs. An improper alignment and/or over tightening of the eye-bolt nuts can cause damage to the diesel-burner's cast aluminum blower casing.

Step 1: Reattach the Fuel Lines to the Diesel Burner

Figure 33



1. Install the fuel lines onto the fuel pipe banjo fittings.
2. Using pliers loosen, and slide the constant tension clamps back into place, to secure the fuel lines.
3. Remove the hose pinch off pliers.

CAUTION!

The Aqua Hot is equipped with a fuel supply check valve. If the fuel lines are hooked up backwards on the burner. Serious damage may occur to the diesel burner fuel pump.

Step 2: Reattach the Diesel Burner to the Aqua Hot

Figure 34a

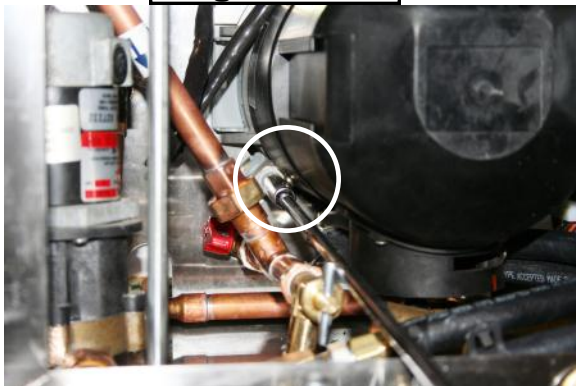


Figure 34b



1. Install the burner on the Aqua Hot and swing the eye bolts over the mounting tabs on the diesel burner. The eye-bolt nuts can then be tightened by using a 10mm socket wrench with a 10 inch long extension. Use extreme caution when tightening down the eye-bolt nuts, over tightening of the eye-bolt nuts can cause the aluminum blower casing to crack. (Torque Specifications = Approximately 20-40 in. lbs.)

Step 3: Plug in the diesel-burner's controller and mount

3. Locate the Diesel-Burner's Controller and connect both plugs.

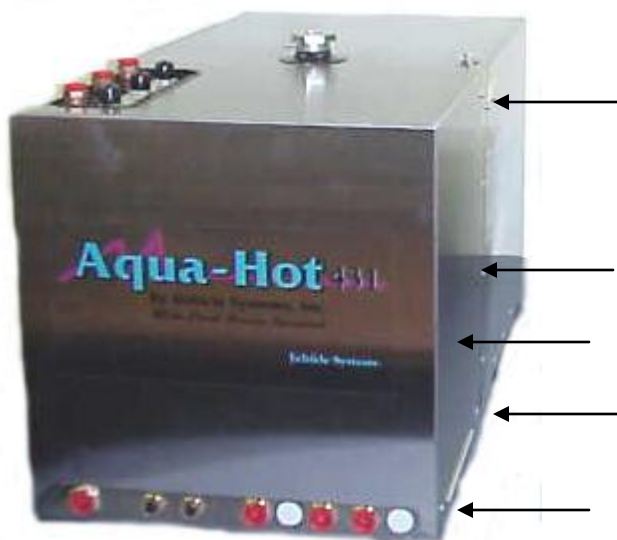
Figure 35



NOTE: The Diesel Burner's Controller might have to be mounted onto the side of the diesel burner, before the plugs are inserted into the control unit, otherwise it might not be possible to mount the control unit.

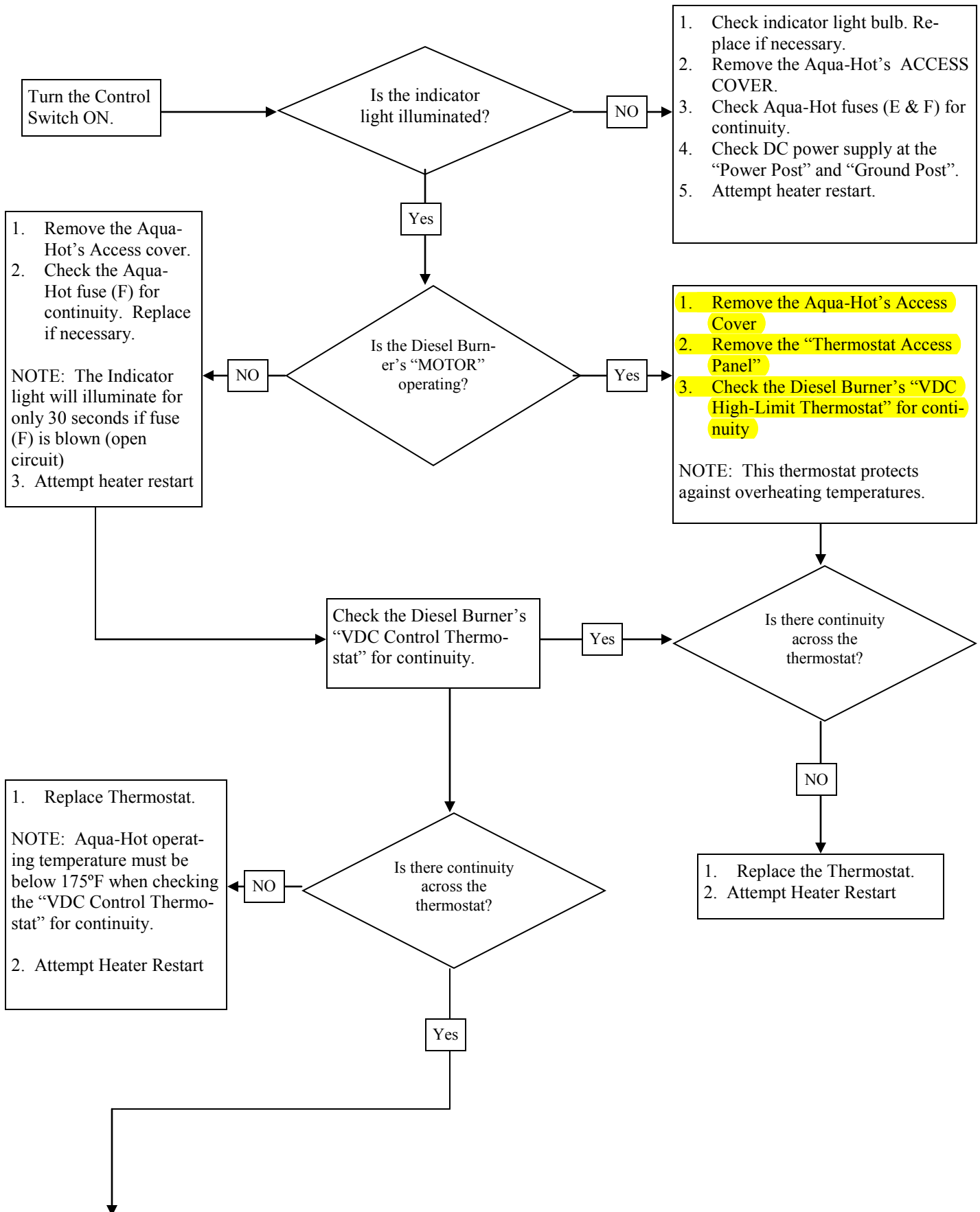
Step 4: Reinstall the Access Cover

Figure 36

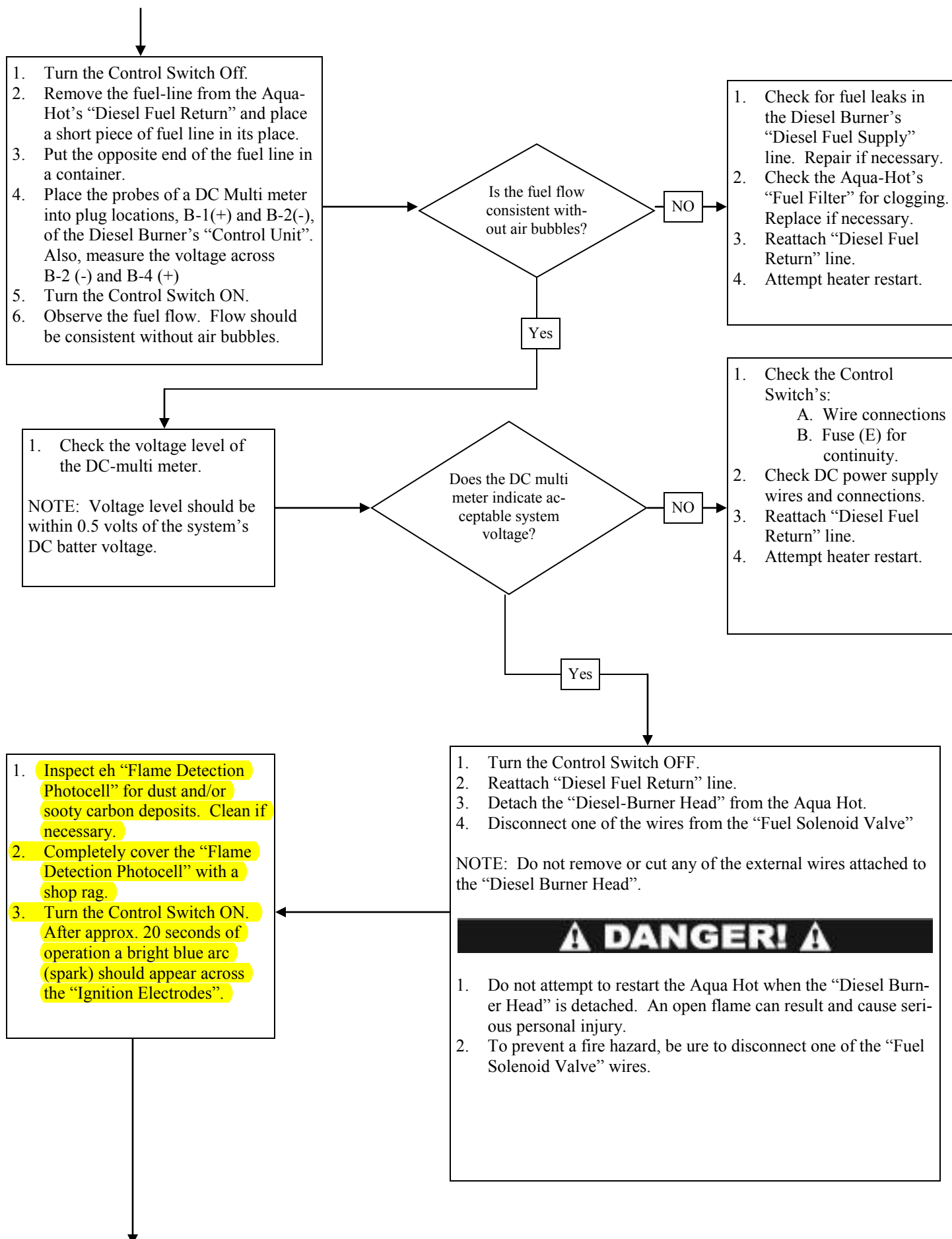


1. Reinstall the Aqua-Hot's access cover .
2. Securely tighten the screws securing the access cover in place.

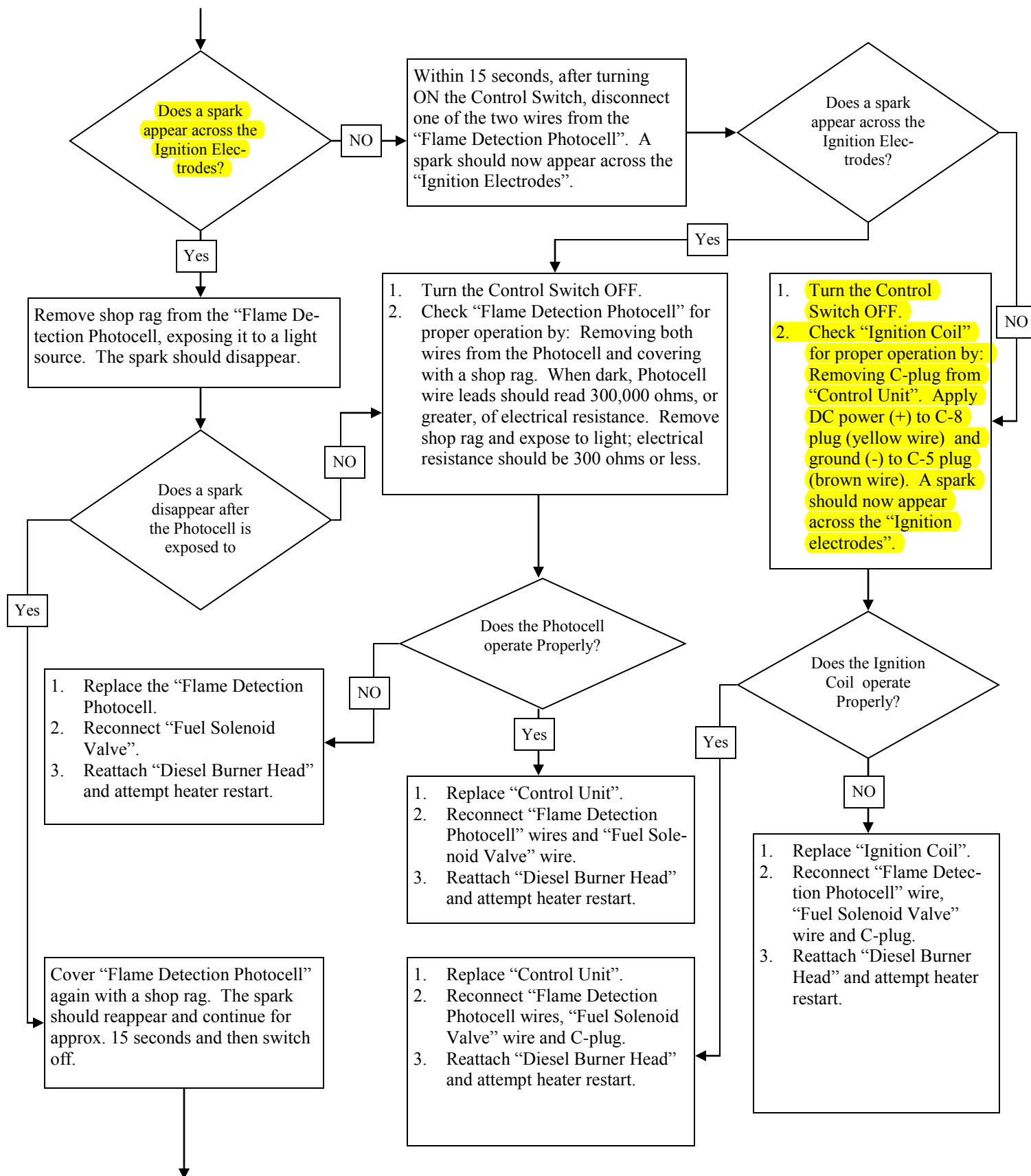
SECTION 8: DIESEL-BURNER COMPONENTS/TROUBLE SHOOTING



SECTION 8: DIESEL-BURNER COMPONENTS/TROUBLE SHOOTING



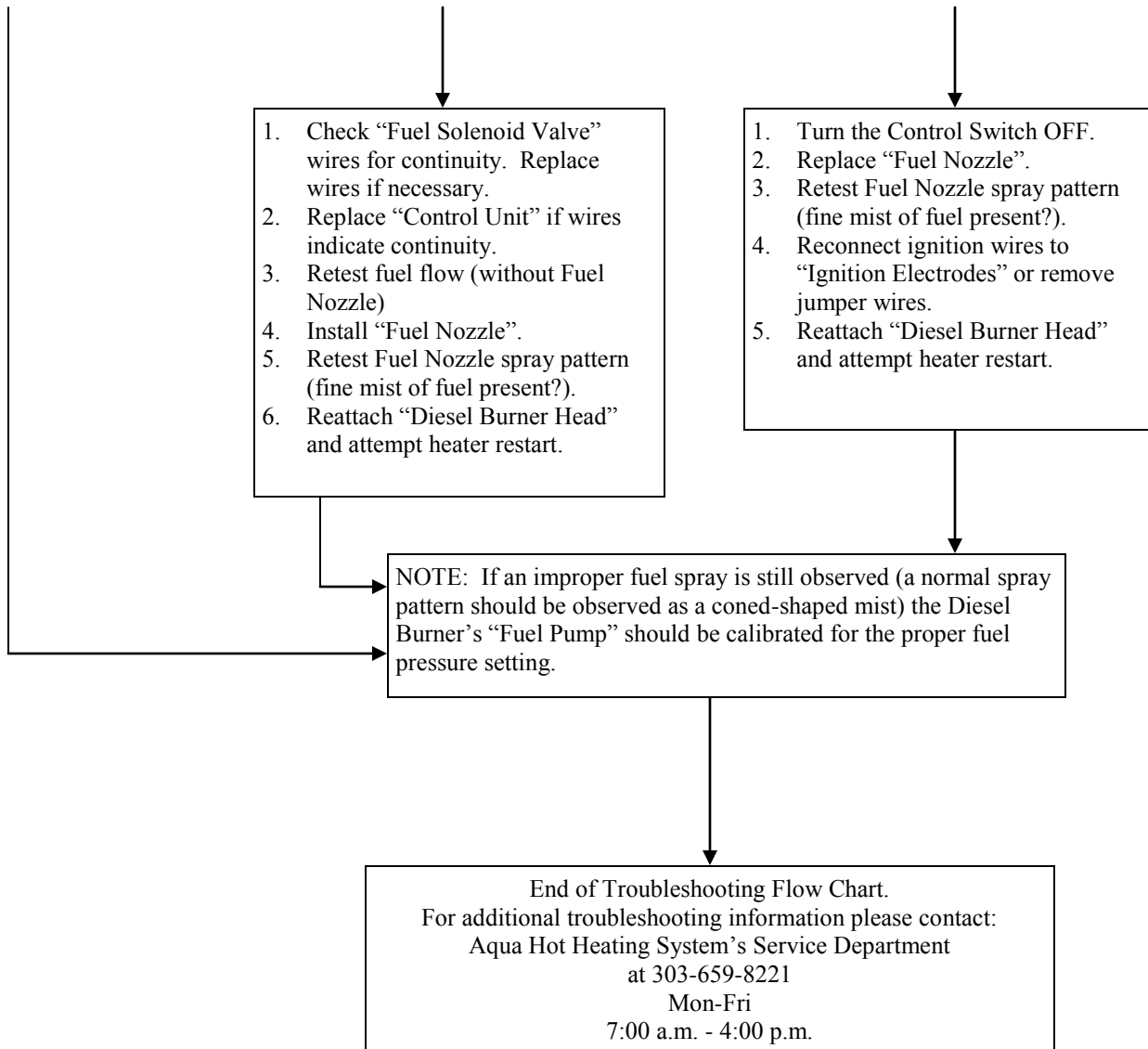
SECTION 8: DIESEL-BURNER COMPONENTS/TROUBLE SHOOTING



```

graph TD
    Start(( )) --> D1{Does the spark reappear?}
    D1 -- Yes --> Box1[1. Turn the Control Switch OFF.  
2. Reconnect "Fuel Solenoid Valve" wire.  
3. Remove both ignition wires from the "Ignition Electrodes" or connect a jumper wire across the Electrodes.  
⚠ DANGER! ⚠  
To prevent a HIGH VOLTAGE shock and or a fire hazard, be sure to remove both "Ignition Electrodes" (tape the ends and separate the wires) or connect a jumper wire across the Electrodes.  
4. Turn the Control Switch ON. After approx 20 seconds the "Fuel Solenoid Valve" should receive power from the "Control Unit". A fine mist of fuel should appear from the "Fuel Nozzle".]
    D1 -- NO --> Box2[1. Turn the Control Switch Off.  
2. Replace the "Control Unit".  
3. Reconnect "Fuel Solenoid Valve" wire.  
4. Reattach "Diesel Burner Head" and attempt heater restart..]
    Box1 --> D2{Is a mist of fuel (Cone-Shaped) present?}
    Box2 --> D2
    D2 -- Yes --> Box3[1. Turn the Control Switch Off.  
2. Reconnect ignition wires to "Ignition Electrodes" or remove jumper wire.  
3. Reattach "Diesel Burner Head" and attempt heater restart.]
    D2 -- NO --> Box4[1. Turn the Control Switch Off.  
2. Remove "Fuel Nozzle".  
3. Turn the Control Switch ON. After approx. 20 seconds fuel should flow freely from the fuel nozzle port.]
    Box3 --> D3{Does fuel flow freely from the port?}
    Box4 --> D3
    D3 -- Yes --> End1(( ))
    D3 -- NO --> Box5[1. Turn the Control Switch OFF.  
2. Check "Fuel Solenoid Valve" for proper operation by: Removing both wires from the Solenoid Valve and applying VDC Power (+) and ground (-) to the Solenoid Valve electrical terminals. "Fuel Solenoid Valve" should click when VDC power is applied.]
    Box5 --> D4{Does the Solenoid Valve operate properly (click)?}
    D4 -- Yes --> End1
    D4 -- NO --> Box6[1. Replace "Fuel Solenoid Valve".  
2. Retest fuel flow (without Fuel Nozzle).  
3. Install "Fuel Nozzle".  
4. Retest Fuel Nozzle spray pattern (fine mist of fuel present?).  
5. Reconnect Ignition wires to "Ignition Electrodes" or remove jumper wire.  
6. Reattach "Diesel Burner Head" and attempt heater restart.]
    Box6 --> D1
  
```

SECTION 8: DIESEL-BURNER COMPONENTS/TROUBLE SHOOTING



Diesel-Burner Motor:

The motor drives the combustion air blower and the fuel pump. In order to perform the following procedures, it may be necessary to detach the diesel-burner head.

NOTE: Before testing the diesel burner motor it is recommended to ensure that the ground post on the Aqua-Hot is securely tightened.

Component Test:

1. Turn the diesel switch **ON** and verify both the diesel burner switch (B1) and the diesel burner motor (B4) have 12VDC.

NOTE: If the B1 Terminal does not have power verify that the E-Fuse is good, and that the diesel burner switch is sending power to the diesel burner controller. If the B4 Terminal does not have power verify that the F-Fuse is good.

2. Verify that the control thermostat is calling for heat, which it should be when the boiler antifreeze temperature is below 175 °F.

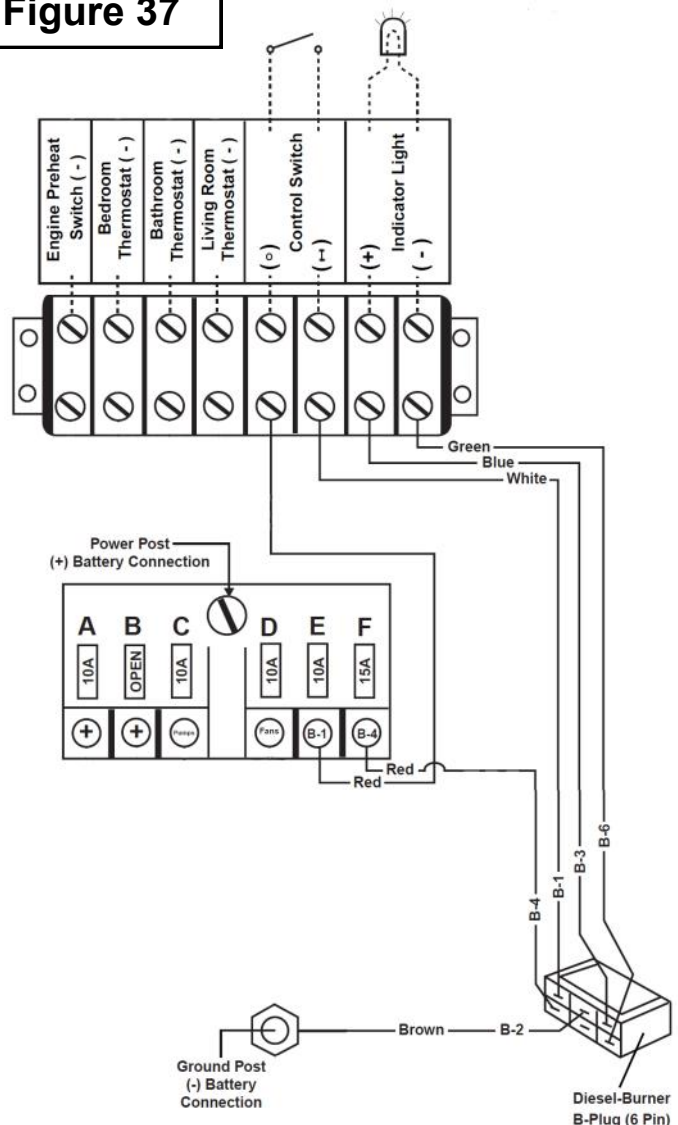
3. Locate the diesel-burner controller's C-Plug and insert the probes of a DC voltmeter into the C-2 (+) and the C-5 (-) locations.

If normal voltage is present inspect the C-Plug Harness for loose or damaged wire connections. If the C-Plug harness and connections are in good condition, but the motor is not operating the motor must be replaced.

If there is no 12 Volts D.C. present on the C-2 pin, The diesel burner controller will need to be replaced.

NOTE: Before replacing the diesel burner controller it is recommended to test the motor separately to ensure that it is not defective. It is possible for a bad motor to cause the C2 Pin to not have 12 volts D.C.

Figure 37



Diesel-Burner Motor (continued) -

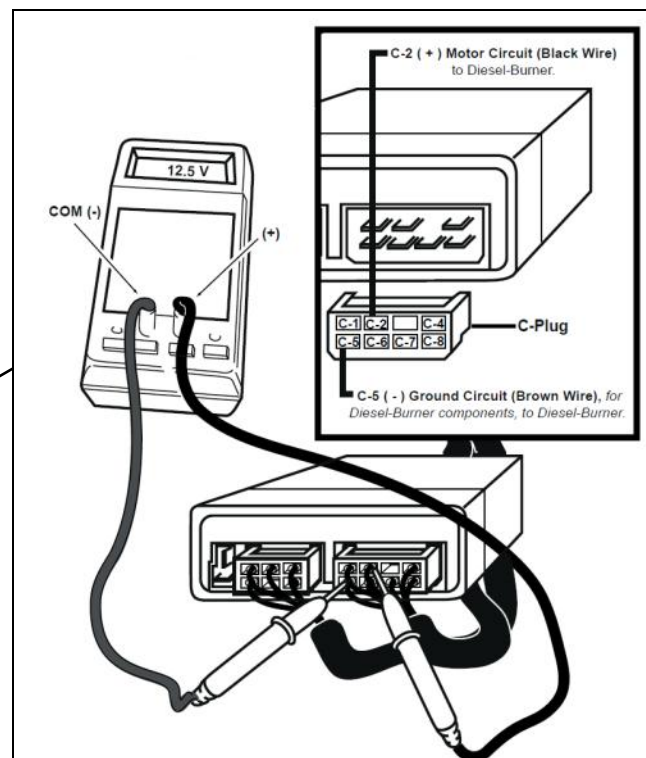
RPM Test:

1. Disconnect the ignition cables from the ignition electrodes.
2. Remove the four ignition coil screws that secure the ignition coil to the protection cap.
3. Lift the ignition coil and disconnect its wires from the C-Plug harness wires prior to removing.
4. Remove the protection cap from the diesel-burner so that the motor and clutch halves are exposed.
5. Place a few wraps of black electrical tape around the clutch halves and then place a small piece of reflective tape over the black tape.
6. Disconnect the motor's black (+) and brown (-) wires from the C-plug harnesses black (+) and brown (-) wires.
7. Connect the motor's wires directly to a 12 volt DC power supply.
8. Turn the power supply **ON** and use a photo-tachometer to test for a proper RPM reading.
9. At approximately 12 volts DC the RPM reading should be 4500 RPM's (+/- 300 RPM's.) If the motor's RPM reading is not within the above specs, the motor must be replaced.

NOTE: It may be necessary to remove the diesel-burner to remove the bottom two screws securing the protection cap in place. Follow the direction on detaching and reattaching the diesel burner.

NOTE: Test the diesel-burner's bearings prior to reattaching the diesel-burner head or replacing the motor. Worn bearings can cause lower than normal RPM readings and premature motor wear. To properly test for worn bearings, reference the bearings function test section.

Figure 38



SECTION 8: DIESEL-BURNER COMPONENTS/TROUBLE SHOOTING

Motor Replacement Procedure:



Be sure to move the Diesel-Burner switch on the Interior Switch Panel to the OFF position and disconnect the Diesel-Burner's power supply before detaching the Diesel-Burner from the Aqua-Hot. Failure to turn off the Diesel-Burner and disconnect power could result in serious bodily injury.

1. Follow the directions for detaching the diesel burner in section ?
2. Remove the four ignition coil screws that secure the ignition coil to the protection cap. Lift the ignition coil to disconnect its wires from the C-plug harness wires prior to removing. Remove the protection cap from the diesel-burner so that the motor clutch halves are exposed.
3. Remove the three hex head screws that secure the motor and flange assembly to the blower housing. Remove the motor and flange assembly along with the clutch halves. Disconnect the motor's black (+) and brown (-) wires from the C-plug harness' wires.

NOTE: Inspect the clutch halves for cracks and also ensure that the flat portion in each shaft hole is free of wear and tear. Too much play on the shaft produces a loud clacking noise. If any cracks or wear are detected, the clutch half must be replaced.

4. Detach the motor from the motor flange by removing the two Phillips heads screws that fasten the two parts together.

NOTE: The new blower motor may come mounted to a new motor flange.

5. The motor must be mounted to the flange with the wires and drain hole pointing downward and the recessed edge of the motor flange pointing upward. This will ensure a proper protection cap fit.

NOTE: Be sure to test the diesel-burner's bearings prior to reinstalling the motor. Worn bearings can cause lower than normal RPM readings and premature motor wear.

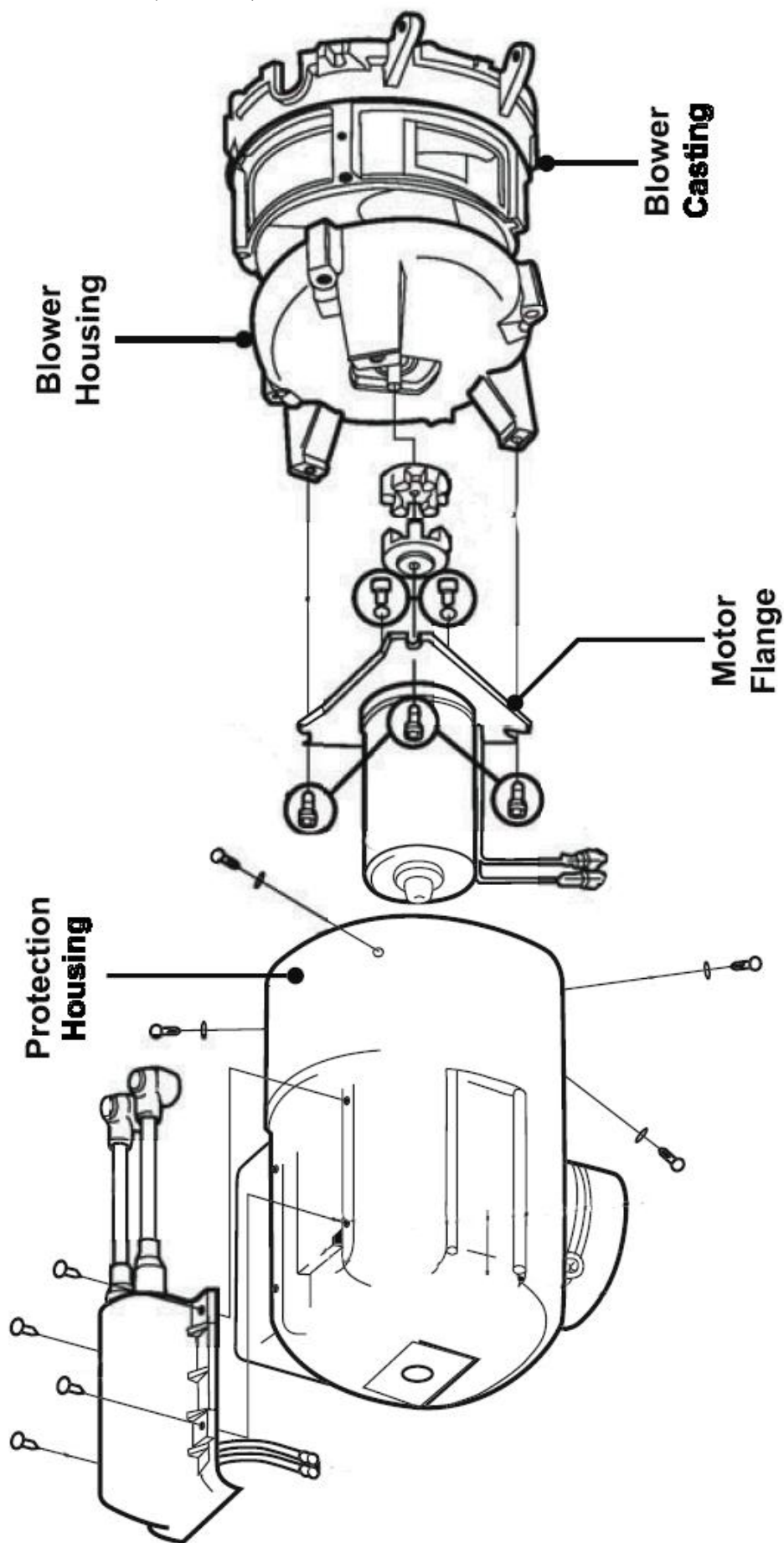
6. Reinstall a clutch half on both the new motor's shaft and the combustion air blower shaft. Attach the motor and flange assembly, with the recessed edge of the motor flange in-line with the wiring access slot of the blower casing, to the blower housing with the three hex head screws.

NOTE: Inspect the blower casing's O-ring for damage or wear prior to reinstalling the diesel-burner head's protection cap. If damage or wear exists, replace the O-ring.

7. Connect the black (+) and the brown (-) wires of the new motor to the C-Plug harness' yellow (+) and brown (-) wires. Feed the C-plug harness' yellow and brown wires back through wiring access hole in the protection cap.
8. Reinstall the protection cap. Reconnect the black (+) and brown (-) wires.
9. Reinstall the ignition coil and secure to the protection cap with the four ignition coil screws.
10. Follow the directions for reattaching the diesel burner in section ?
11. Test for proper operation

Motor Replacement Procedure: (continued)

Figure 39



Flame Sensor:

The flame sensor is a photo resistive device which supplies the diesel-burner's controller with a DC voltage signal when it detects a flame. When the flame sensor senses the light of the flame, it will shut the ignition coil off, and send a signal to the diesel burner controller indicating that everything is working properly. If the flame sensor does not sense the flame, it will shut the diesel burner down in a default after 20 seconds.

NOTE: In order to perform the following procedures it is necessary to detach and reattach the diesel-burner head. Be sure to review the detaching/attaching instructions.

Component Test: Ohms

NOTE: Be sure to calibrate your ohmmeter prior to checking the flame sensor to proper resistance values.

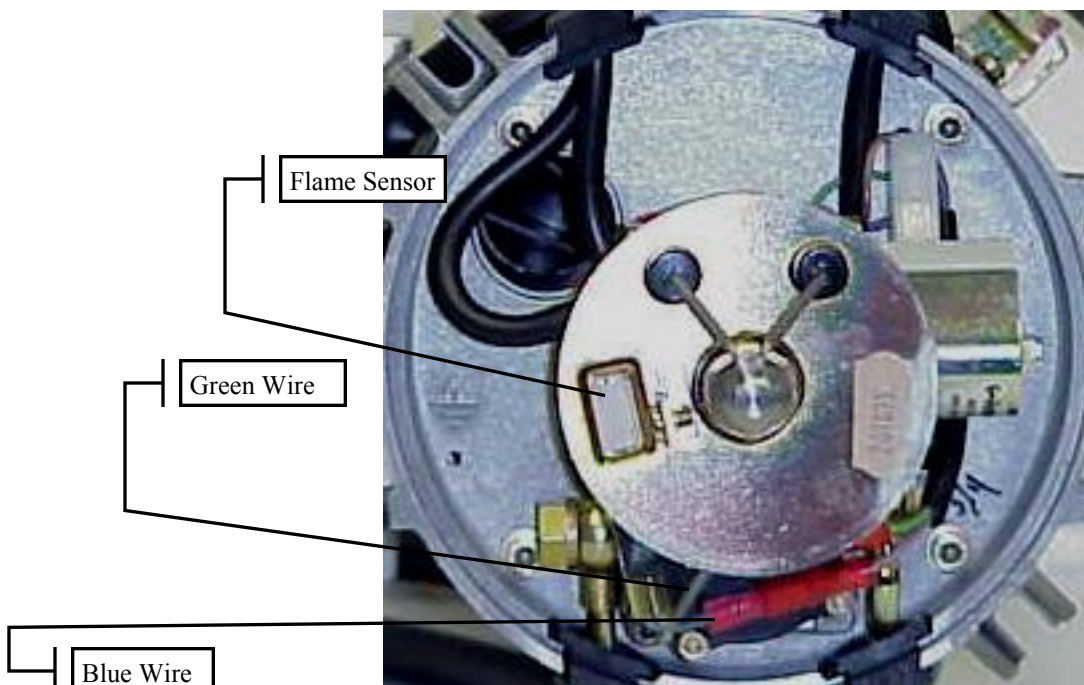
1. In order to perform the following procedures it is necessary to detach the diesel-burner. Be sure to review the detaching/attaching instructions in section 7.
2. Once the diesel burner has been removed, Locate and detach the flame sensor's green and blue wires from the C-plug harness wires.

3. Connect the flame sensor's green and blue wires to an ohmmeter.
4. Check resistance by placing a shop rag over the flame sensor's glass surface, to simulate a no flame condition, and then remove the rag and expose to a light source, to simulate a flame condition.
5. If the flame sensor is operating properly, the ohmmeter should register high resistance, over 100K Ω when the glass surface is covered, and less than 200 Ω when exposed to a light source.
6. If these resistance numbers cannot be obtained, verify the flame sensor's glass surface is clean. If the flame sensor is clean and the resistance numbers cannot be obtained, the flame sensor must be replaced.

Flame Sensor Maintenance:

1. For light dirt, dust, and/or carbon deposits, simply wipe off the flame sensor with a soft cloth.
2. Should heavy carbon deposits be present, completely remove the flame sensor from the photo disc and clean with brake cleaner.

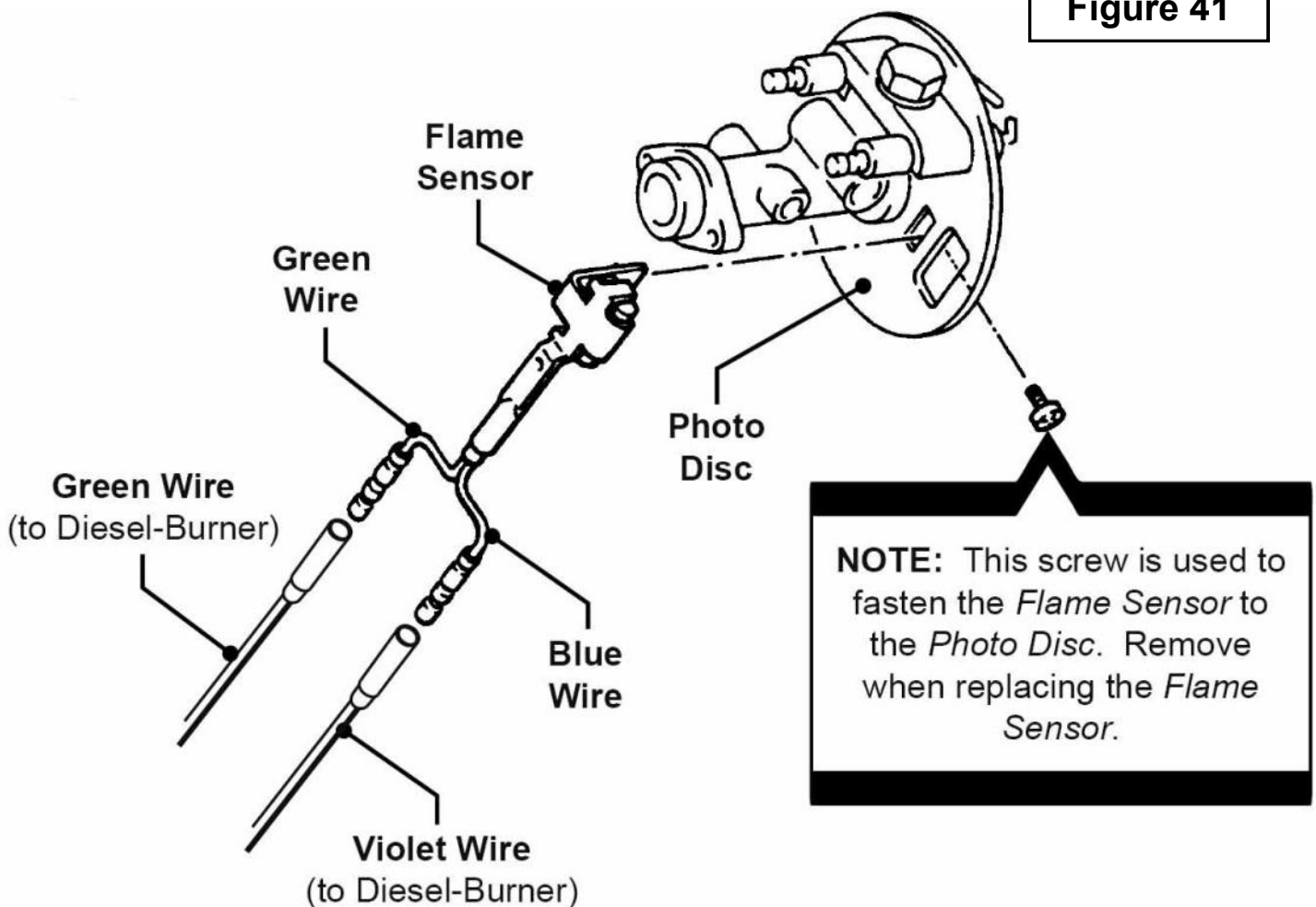
Figure 40



Flame Sensor Replacement Procedure:

1. In order to perform the following procedures it is necessary to detach diesel-burner head. Be sure to review the detaching/attaching instructions in section 7.
2. Remove the screw that fastens the flame sensor to the photo disc and detach the sensor's green and blue wires from the C-plug harness' green and violet wires, and remove flame sensor.
3. Slide the tab of the new flame sensor into the provided slot in the photo disc and secure in place with the screw. Connect the flame sensor's green wire to the green C-plug harness wire and the blue wire to the C-plug harness' violet wire.
4. Follow the directions for reattaching the diesel burner, in section 9 of this manual.

Figure 41



Ignition Electrodes

The diesel-burner's ignition coil produces a high voltage ignition spark across the ignition electrodes, which ignites the incoming air/fuel mixture.

Cleaning and Maintenance:

1. Polish away any carbon deposits that may have baked onto the metal tips of the ignition electrodes with a course sponge.
2. If the ignition electrode's electrical insulator is cracked or damaged, the ignition electrode must be replaced.

NOTE: The electrode adjustment gauge is used to set the gap between the ignition electrodes. The electrode adjustment gauge is located on the outside surface of the diesel-burner head on the left hand side.

Ignition Electrode Adjustment Procedure:

1. Follow the directions for detaching/reattaching the diesel burner in section 7 Of this manual.
2. Using a 10mm socket, slightly loosen the retaining clamp bolt.
3. Place the electrode adjustment gauge on the nozzle manifold hex and insert the metal tips of the ignition electrodes into the appropriate notches of the electrode adjustment gauge.

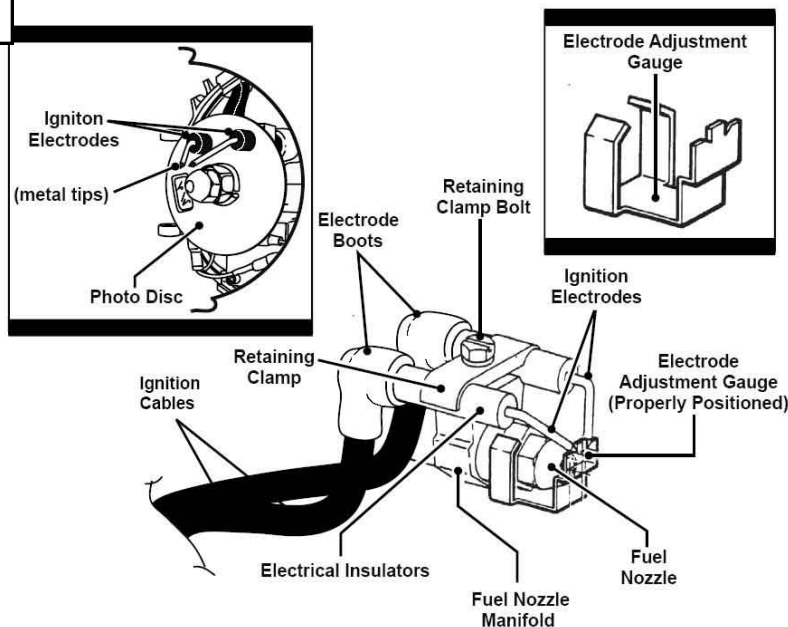
NOTE: Be sure not to over-tighten the retaining clamp bolt when readjusting the ignition electrodes. Over-tightening the retaining clamp bolt will bend the retaining clamp and prevent the photo disc from floating freely. Not allowing the photo disc to float freely will cause poor combustion and result in a smoky exhaust. A bent retaining clamp can be re-straightened with a punch and hammer. Lay the clamp's beveled side down on a solid flat surface and align the thick end of the punch at dead center. Tap the punch lightly until the retaining clamp returns to proper form.

4. Using a 10 mm socket, tighten the retaining clamp bolt.
5. Remove the electrode adjustment gauge and reattach to the diesel-burner head.

Replacement Procedure:

1. Using a 10mm socket, loosen and remove the retaining clamp bolt, and the retaining clamp.
2. Slide the electrode out of the photo disc.
3. To remove the electrode, hold onto the orange electrode boot, and pull firmly on the electrode.
4. Once the electrode has been removed Inspect inside the orange electrode boot for the retaining clip, which holds the electrode in place. If it is missing, replace the electrode boot.

Figure 42



Ignition Electrodes

Replacement Procedure: (continued)

5. Insert the new electrode into the orange electrode boot, and snap into place. Pull firmly on the electrode to make sure the retaining clip has secured the electrode in place.
6. Slide the electrode into the photo disc.
7. Install retaining clamp and retaining clamp bolt and finger tighten.
8. Follow steps 2 - 5 to properly adjust the electrodes.

2. Remove both the ignition cables from the ignition electrodes, or connect a jumper wire (with alligator clips) across the metal tips of the electrodes.

⚠ DANGER! ⚠

Failure to connect a jumper wire across the ignition electrodes, or to remove the ignition cables from the ignition electrodes will result in a HIGH VOLTAGE shock and/or a fire. If the ignition cables are removed, be sure to place a piece of electrical tape on the end of each cable.

3. Remove the B-plug from the diesel-burner head's controller.
4. Turn the diesel switch **ON** and then plug the B-plug back into the diesel-burner controller to activate the diesel-burner. After approx. 20 seconds the fuel solenoid will "click" and a fine mist of fuel should appear from the fuel nozzle in a cone shaped spray pattern.

Fuel Nozzle:

The fuel nozzle is simply a fuel atomizer. It reduces the diesel fuel into a fine spray which is mixed with incoming combustion air and is ignited within the combustion chamber.

NOTE: In order to perform the following procedures it is necessary to detach and reattach the diesel-burner head. Be sure to review section 7 for detaching and reattaching instructions.

Fuel Nozzle Component Test:

1. Follow the directions for detaching the diesel burner, in section 7, of this manual.

Figure 43



Fuel Nozzle:

5. Remove the B-plug from the diesel-burner controller.
6. If the cone shaped spray pattern did not appear, follow the troubleshooting guides for the following components and verify they are operating properly:
 - A. Fuel Solenoid
 - B. Fuel pump
 - C. D.C. High Limit thermostats
7. If the components listed above are operating properly, and there is still no fuel coming out of the nozzle, replace the fuel nozzle.

Fuel Nozzle Cleaning and Maintenance:

The fuel nozzle is a precision calibrated part and **cannot** be cleaned or serviced. A replacement of the fuel nozzle is recommended annually.

Fuel Nozzle Replacement Procedure:

1. Use a 3/4 in. wrench to hold the fuel nozzle stand hex while loosening the fuel nozzle with a 5/8 in. wrench and remove.

NOTE: Be sure to use care when handling the new fuel nozzle. Oils and/or small dust or dirt particles from your hands may plug the nozzle's small orifice. A partially plugged orifice will restrict fuel flow, which will affect the combustion process of the diesel-burner.

2. When replacing the fuel nozzle, be sure to tighten the nozzle, loosen it a 1/4 turn, and then firmly re-tighten. This will establish a seated fit and avoid any leaks.

NOTE: An adjustment of the ignition electrodes may be necessary after replacing the fuel nozzle. Follow the ignition electrode adjustment procedure found in the ignition electrode section of this manual.

3. After replacing the fuel nozzle, reattach the diesel-burner head.

⚠ DANGER! ⚠

Be sure to reattach the diesel-burner head prior to switching the heater ON. Failure to do so may result in ignition of the diesel-burner and serious bodily injury.

4. Turn **ON** the diesel switch for 5 seconds, then turn it **OFF**. This will activate the diesel-burner's prime-cycle and flush the fuel system of any potential contaminants. Perform this procedure twice.
5. Test for normal operation.

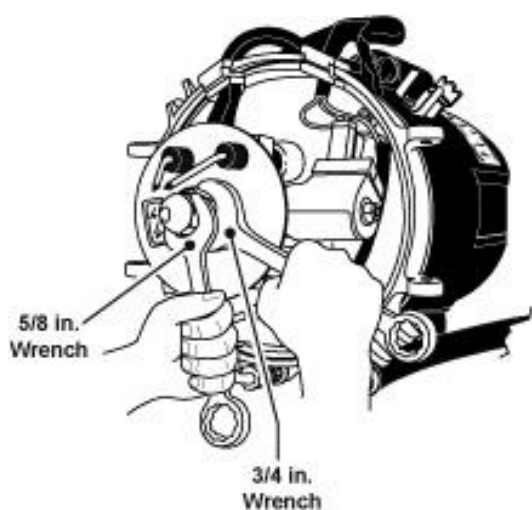
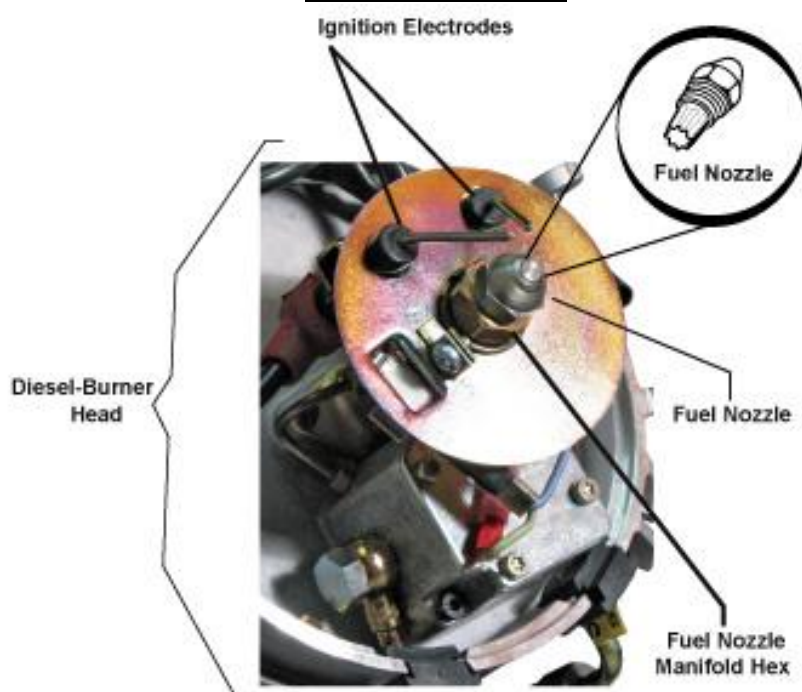


Figure 44



Fuel Solenoid:

The fuel solenoid allows the flow of diesel fuel to the diesel-burner's fuel nozzle.

NOTE: If a long after-smoking condition exists during the diesel-burner's purge cycle, the fuel solenoid valve kit may need to be replaced.

NOTE: In order to perform the following procedures it is necessary to detach and reattach the diesel-burner head. Be sure to review the detaching/attaching instructions.

Fuel Solenoid Component Test:

NOTE: If the fuel solenoid is not working troubleshoot the diesel burner's hi-limit thermostats. If they are tripped they will not allow the fuel solenoid to operate.

1. Locate and detach the C-plug harness' violet (+) and Brown (-) wires from the fuel solenoid.
2. Connect the (-) lead of a 12 volt DC power supply to the fuel solenoid's (-) electrical terminal.
3. Intermittently apply the (+) lead of the power supply to the fuel solenoid's (+) electrical terminal.
4. Listen for the fuel solenoid to click (i.e. open and close).
5. If the fuel solenoid does not click, it must be replaced.

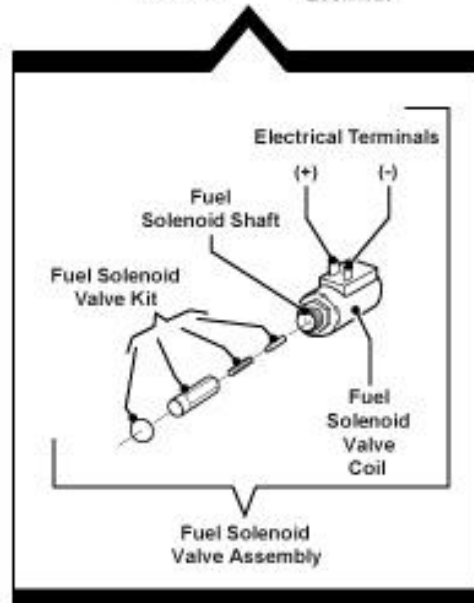
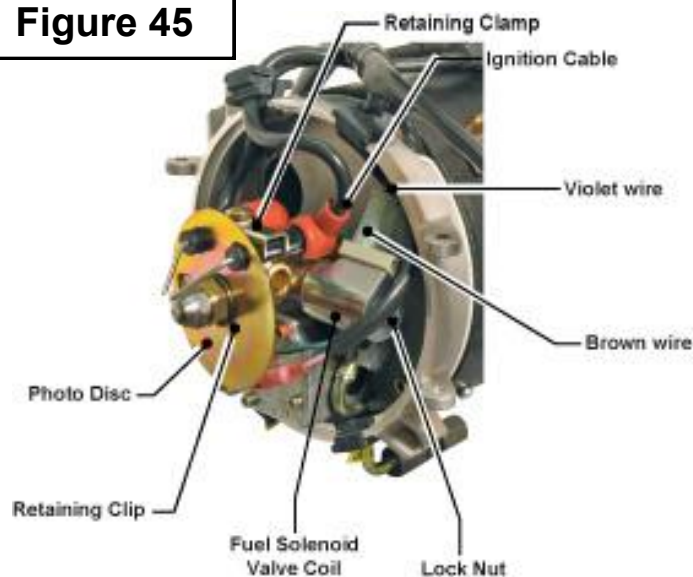
Fuel Solenoid Replacement Procedure:

1. Disconnect the C-plug harness' violet (+) and brown (-) wires from the fuel solenoid.
2. Using an 8mm wrench, remove the lock nut and flat washer from the end of the fuel solenoid shaft and then pull the fuel solenoid away from the nozzle

stand approximately 1/2". Remove the fuel solenoid shaft from the nozzle manifold using a 16mm wrench.. Discard the shaft and valve kit, as replacements are provided with the new fuel solenoid assembly.

3. Insert the contents of the new fuel solenoid valve kit into the new fuel solenoid shaft. Slide the new fuel solenoid onto the fuel solenoid shaft. Thread the new fuel solenoid shaft with fuel solenoid to the fuel nozzle manifold and tighten. Secure the fuel solenoid in place with the new flat washer and lock nut.
4. Connect the C-plug harness' violet (+) and brown (-) wires to the fuel solenoid's (+) and (-) electrical terminals.

Figure 45



Fuel Pump:

The fuel pump draws diesel fuel from the vehicle's fuel tank and creates a preset pressure of 145 PSI, which is required for proper fuel atomization. Reference the illustration below for a basic overview and understanding of how the fuel pump functions.

Fuel Pump Testing Procedure:



Do not remove the diesel burner at this time. Failure to do so may result in serious bodily injury.

1. Clamp off and remove the fuel return and fuel supply lines coming into the Aqua-Hot unit.
2. Attach a short piece of fuel line to both the fuel return and fuel supply ports.
3. Submerge the opposite end of the temporary fuel supply line in a container of diesel fuel.
4. Place the opposite end of the temporary fuel return line in an empty container.
5. Turn the diesel switch **ON** to activate the diesel burner, and wait ten seconds.
6. If fuel does not flow out of the return line into the empty container, the fuel pump must be replaced.

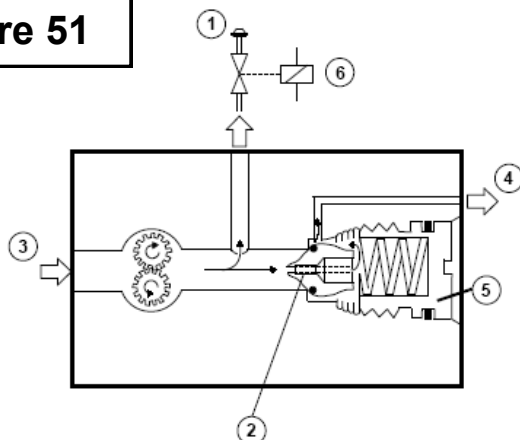
NOTE: Prior to replacing the fuel pump, be sure to inspect the screen filter in the supply inlet of the fuel pump for dirt particles. Clean and/or replace if necessary. A plugged screen filter will restrict fuel from entering the fuel pump.

7. If fuel does flow through the fuel pump when ran off an external source inspect the following in the motor home:
 - A. Check the motor home fuel tank for fuel. If the fuel level is below 1/4 the Aqua-Hot diesel burner will not operate.
 - B. Inspect the supply fuel line for kinks which would prohibit fuel flow.
 - C. Inspect the supply fuel line for cuts, which would cause the diesel burner to suck air.
 - D. Inspect the fuel filter, to make sure all fittings are tight, including hose clamps. Also, make sure the fuel filter is tight.
 - E. Inspect the Aqua-Hot for loose or cracked fittings.
 - F. Inspect the supply fuel system for loose hose clamps throughout
 - G. Inspect the fuel pick-up tube in the tank., for loose connection and pin holes in the pick-up tube

Fuel Pump Cleaning and Maintenance:

1. Check all fuel connections for tightness.
2. Check the screen filter located in the fuel supply inlet of the fuel pump for dirt particles. Clean and/or replace if necessary.
3. To adjust the fuel pressure refer to Appendix C: Fuel pressure check and adjustment..

Figure 51



FUEL PUMP OVERVIEW

1. Fuel Nozzle
2. Air Relief Bore
3. Fuel Supply Line
4. Fuel Return Line
5. Fuel Pressure Regulator
6. Fuel Solenoid

Fuel Pump Replacement Procedure:

NOTE: To perform the following procedure it will be necessary to remove the diesel burner. Follow the section on detaching and reattaching the diesel burner, section 7 of this manual.

1. Locate and disconnect the C-Plug harness wires that connect to the flame sensor and the fuel solenoid. Also, disconnect the ignition cables from the ignition electrodes.
2. Remove the retaining clip that secures the photo disc in place. Gently lift the photo disc so that it releases from the nozzle stand and the ignition electrodes.
3. Loosen the supply and return banjo bolts to remove the fuel supply and return pipes from the fuel pump. Also, disconnect the high pressure fuel pipe from both the fuel pump and the nozzle stand. Discard the high pressure fuel pipe, gasket rings, and banjo bolts, as replacements are provided in the new fuel pump kit.
4. Remove the four nozzle stand plate screws that secure the nozzle stand plate in place. Remove the nozzle stand plate by pulling on the nozzle stand until the plate releases from the cast-aluminum blower casing.
5. Remove the two pump mounting screws that secure the fuel pump in place. Turn the nozzle stand plate over and remove the snap ring from the fuel pump shaft, using snap ring pliers. Remove the nylon drive gear and then the fuel pump.
6. Attach the new fuel pump to the nozzle stand plate with the two pump mounting screws. Turn the nozzle stand plate over to install the nylon drive gear on the fuel pump's shaft and secure in place with the snap ring. Dab the teeth of the nylon drive gear with white lithium grease (Isoplex LDS-18 is recommended.)

NOTE: Do not adjust the fuel pressure regulator of the new fuel pump, as it has been factory preset.

CAUTION:

Inspect the nylon drive gear's cavity inside the cast aluminum blower casting for fuel stains. If fuel stains are present, a replacement of the bearings and/or the entire blower casing may be necessary. Leaking fuel could cause bearing seizure, resulting in potential damage to the internal bore/bearing of the blower casing.

7. Fit the nozzle stand plate inside the cast-aluminum blower casing and secure in place with the four nozzle stand plate screws. Install the grommets on the fuel return and supply banjo pipes and secure the pipes to the fuel pump with the new banjo bolts and gasket rings.

NOTE: Failure to use the new gasket rings or the correct order placement could result in a fuel leak.

8. Reconnect the C-plug harness' violet (+) and brown (-) wires to the fuel solenoid's (+) and (-) electrical terminals.
9. Insert both the ignition cables into the rubber grommet and slide into the appropriate notch on the blower casing.
10. Reconnect the ignition cables to the ignition electrodes.
11. Reinstall the photo disc and secure it in place with the retaining clip.
12. Reconnect the flame sensor's green wire to the green C-plug harness and the blue wire to the C-plug harness' violet wire. Install rubber grommet around the harness wires, and set into place.

NOTE: Check the ignition electrodes for proper adjustment prior to reattaching the diesel burner.

13. Follow the directions for reattaching the diesel burner in section 7 of this manual.

Bearings:

The bearings support the combustion air blower's shaft and allows the blower to turn smoothly.

NOTE: In order to perform the following procedures it is necessary to detach and reattach the diesel-burner head. Be sure to review section 7 for detaching and reattaching the diesel burner instructions

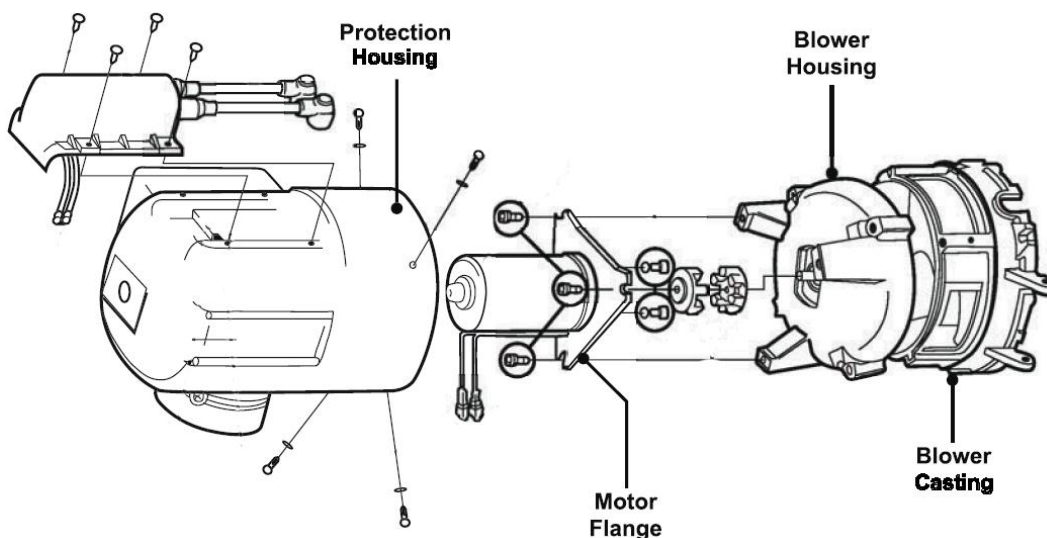
Bearing Test:

1. In order to perform the following procedure it is necessary to detach and reattach the diesel-burner head. Be sure to review the detaching and reattaching section for detaching and reattaching instructions.
2. Locate and disconnect the C-plug harness wires that connect to the flame sensor and fuel solenoid. Also, disconnect the ignition cables from the ignition electrodes.
3. Remove the four nozzle stand plate screws that secure the nozzle stand plate in place. Remove the nozzle stand plate by pulling on the nozzle stand until the plate releases from the cast-aluminum blower casing.
4. Remove the four ignition coil screws that secure the ignition coil to the protection cap. Lift the ignition coil and disconnect its black (+) and brown (-) wires from the C-plug harness wires, prior to removing. Remove the protection cap from the diesel-burner so that the motor and clutch halves are exposed.
5. Remove the three hex head screws that secure the motor and motor flange to the blower housing. Remove the motor and flange assembly along with the clutch halves. Disconnect the motor's black (+) and brown (-) wires from the C-plug harness' wires.
6. Remove the four blower housing screws that secure the blower housing to the blower casing. Remove the blower housing so that the combustion air blower is exposed.
7. Spin the combustion air blower by hand. Placing one of the clutch halves to the end of the shaft, assists with the spinning of the bearings.
8. If the combustion air blower rotates smoothly without any friction or noise, the bearings are in proper working condition. If the combustion air blower does not rotate smoothly and/or produces noise, the bearings are worn and must be replaced.

Replacement:

1. In order to perform the following procedure it is necessary to detach and reattach the diesel-burner head. Be sure to review the detaching and reattaching section for detaching and reattaching instructions.
2. Locate and disconnect the C-plug harness wires that connect to the flame sensor and fuel solenoid. Also, disconnect the ignition cables from the ignition electrodes.

Figure 48



3. Remove the four nozzle stand plate screws that secure the nozzle stand plate in place. Remove the nozzle stand plate by pulling on the nozzle stand until the plate releases from the cast-aluminum blower casing.

NOTE: It is recommended to mark the internal components of the diesel burner prior to disassembling of the burner. Make a mark between the motor flange and the blower housing, and also between the blower housing and the blower casing. If the burner is assembled improperly the protection cap will not go on.

4. Remove the four ignition coil screws that secure the ignition coil to the protection cap. Lift the ignition coil and disconnect its black (+) and brown (-) wires from the C-plug harness wires, prior to removing. Remove the protection cap from the diesel-burner so that the motor and clutch halves are exposed.
5. Remove the three hex head screws that secure the motor and motor flange to the blower housing. Remove the motor and flange assembly along with the clutch halves. Disconnect the motor's black (+) and brown (-) wires from the C-plug harness' wires.
6. Remove the four blower housing screws that secure the blower housing to the blower casing. Remove the blower housing so that the combustion air blower is exposed.
7. Hold side-B of the blower casing and loosen the retaining nut located in side-A of the blower casing. Remove the retaining nut, steel drive gear and thick flat washer from the combustion air blower's shaft. Lightly tap the threaded end of the shaft so that the combustion air blower can be easily removed from the blower casing.

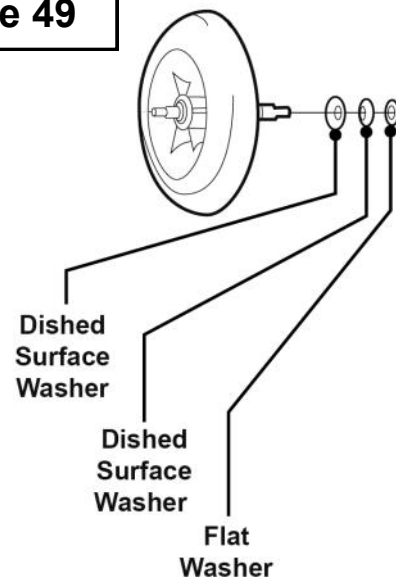
NOTE: Be sure to observe the placement of the three washers of the bearing kit. To ensure proper tension, the same order and direction of the dished surfaces of the washers must be followed when reassembling.

8. With a pair of snap-ring pliers, remove the snap rings from both side-A and side-B of the blower casing. Push all the contents of the bearing kit out of the blower casing's bore/bearing cavity. Discard the retaining nut, steel drive gear, snap rings, bearings, spacer tube, and washers, as replacements are provided in the new bearing kit.

NOTE: Be sure to inspect the blower casing's bore/bearing cavity for signs of damage due to potentially seized bearings. If damage is present, the blower casing must be replaced.

9. Install a new snap ring into side-A of the blower casing. Once the snap ring is in place, insert the remaining contents of the new bearing kit into side-B of the blower casing, starting with the wave washer. Secure the bearing kit assembly in place with the remaining snap ring.
10. Inspect the combustion air blower for warping and/or damage. If warping or damage is visible, the combustion air blower must be replaced.
11. Reference Figure 49 for exact placement of the three washers that slide over the threaded end of the combustion air blower's shaft prior to installation. Failure to follow the correct order and direction of the dished surfaces on the washers will result in a restricted rotation of the combustion air blower.
12. Slide the combustion air blower's shaft (with the three washers) up through the bearing kit assembly until the threaded portion appears on side-A of the blower casing. Place the new thick flat washer and steel drive gear on the threaded end of the combustion air blower's shaft. Thread the new retaining nut on the combustion air blower's shaft until it is finger tight (**DO NOT TIGHTEN.**)

Figure 49



12. Place a feeler gauge between the combustion air blower and the flat surface of the blower casing. Slowly tighten (or loosen) the retaining nut, holding the combustion air blower, until a .003-.005 gap is achieved. Remove feeler gauge.
13. Spin the combustion air blower to ensure a friction free rotation.

NOTE: If the combustion air blower is rubbing, loosen the retaining nut slightly and lightly tap on the combustion air blower's shaft (opposite side) then readjust the gap.

14. Reattach the blower housing to the blower casing using the four blower housing screws. Reinstall the clutch half on both the motor's shaft and the combustion air blower's shaft. Attach the motor and flange assembly, with the recessed edge of the motor flange in-line with the wiring access slot of the blower casing, to the blower housing with the three hex head screws. Reconnect the black (+) and brown (-) wires of the motor to the C-plug harness' black (+) and brown (-) wires. Feed the C-plug harness' yellow and brown wires back through the wiring access hole in the protection cap.

NOTE: Inspect the clutch halves' for cracks and also ensure that the flat portion in each shaft hole is free of wear and tear. Too much play on the shaft produces a loud clacking noise. If any cracks or wear are detected, the clutch half must be replaced.

15. Reinstall the protection cap. Reconnect the black (+) and brown (-) wires of the ignition coil to the C-plug harness' yellow (+) and brown (-) wires. Reinstall the ignition coil and secure to the protection cap with the four ignition coil screws. Reconnect the ignition cables to the ignition electrodes.
16. Fit the nozzle stand plate inside the cast aluminum blower casing and secure in place with the four nozzle stand plate screws. Reattach the fuel supply and return lines to the diesel-burner head.
17. Reconnect the blue (+) and brown (-) wires to the fuel solenoid's (+) and (-) electrical terminals. Also, reconnect the flame sensor's green wire to the green C-plug harness wire and the blue wire to the C-plug harness' violet wire.
18. Follow the instructions for reattaching the diesel burner, in the detaching/reattaching section in this manual.

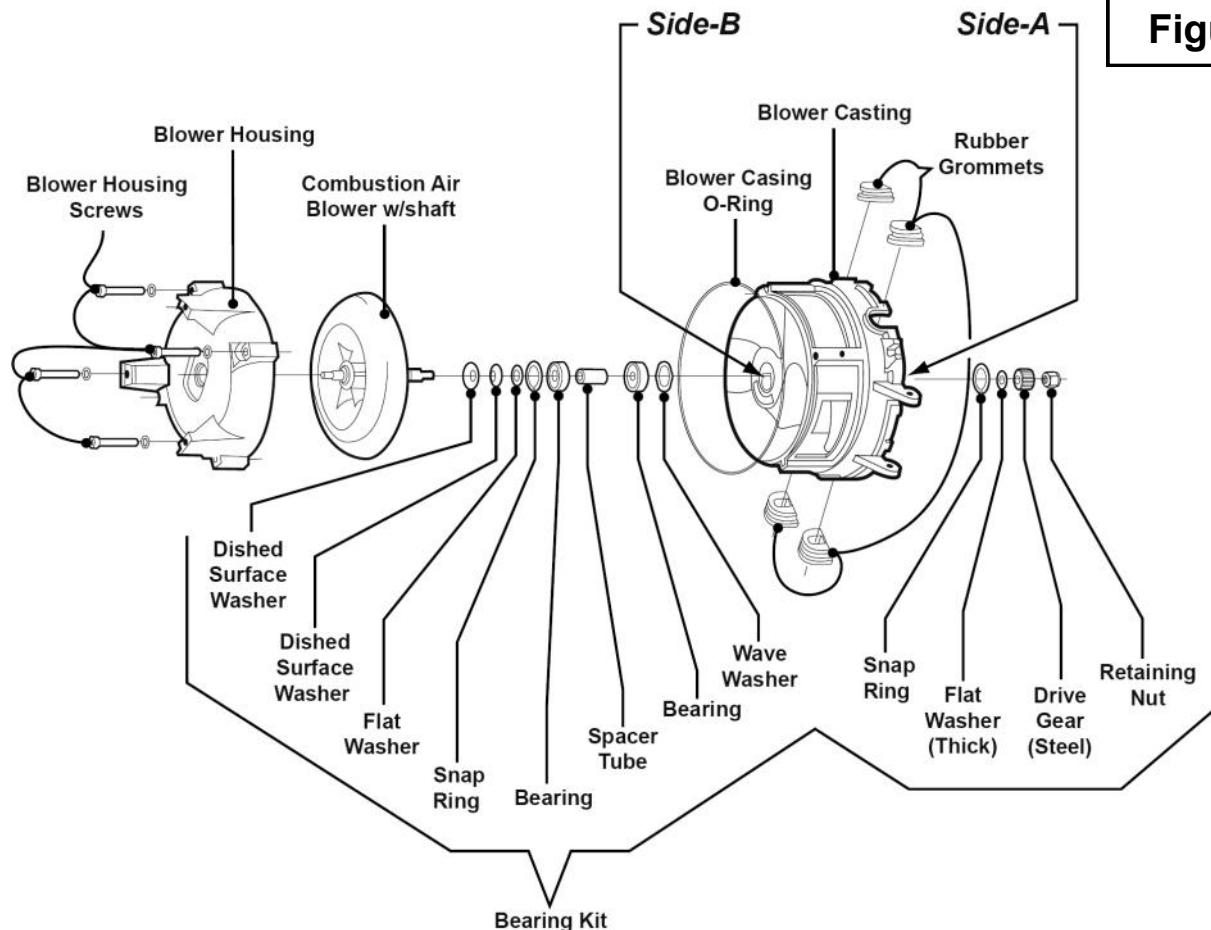


Figure 50

Ignition Coil:

The ignition coil produces a high voltage ignition spark (approx. 8000 volts), which is released across the metal tips of the ignition electrodes during the initial diesel-burner start-up.

Use extreme care when testing the ignition coil, as a High Voltage Shock may result.

NOTE: In order to perform the following procedures it is necessary to detach and reattach the diesel-burner head. Be sure to review the section for detaching and reattaching the diesel burner..

Component Test:

1. Remove the four ignition coil screws that secure the ignition coil in place.
2. Disconnect the ignition coil's black (+) and brown (-) wires from the C-plug harness' yellow (+) and brown (-) wires.
3. Connect the ignition coil wires directly to a 12 volt DC power supply (i.e. black (+) wire to (+) lead and brown (-) wire to (-) lead).
4. Turn the power supply **ON** and watch for a spark to appear across the metal tips of the ignition electrodes. If a spark does not appear, the ignition coil must be replaced.

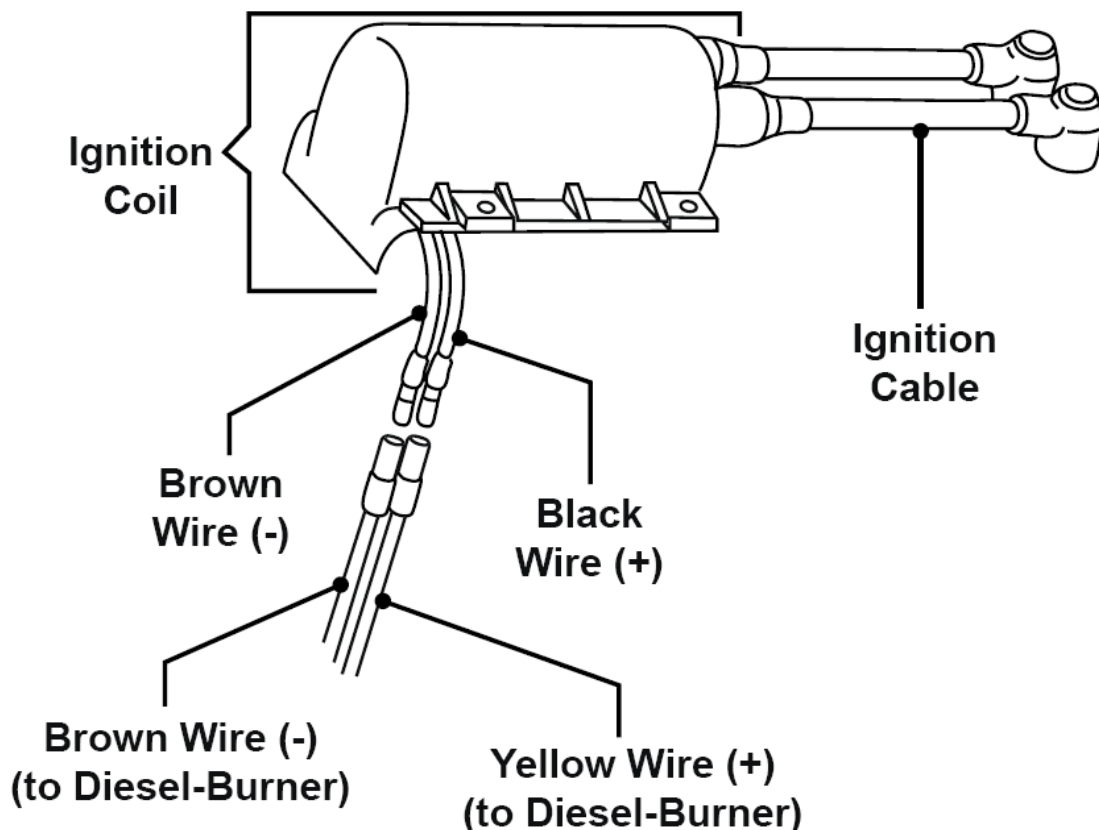
NOTE: Some ignition coils are intermittent and will need to be tested numerously

CAUTION:

Before replacing the ignition coil:

1. Verify the ignition electrodes are not cracked or broken.
2. Verify that the ignition electrodes are adjusted properly.
3. Ensure the electrode boots are securely holding the electrodes in place.
4. Ensure the electrode boots are not broken inside the ignition coil wires.

Figure 51



Ignition Coil:

NOTE: In order to perform the following procedures it is necessary to detach and reattach the diesel-burner head. Be sure to review the section for detaching and reattaching the diesel burner..

Replacement Procedure:

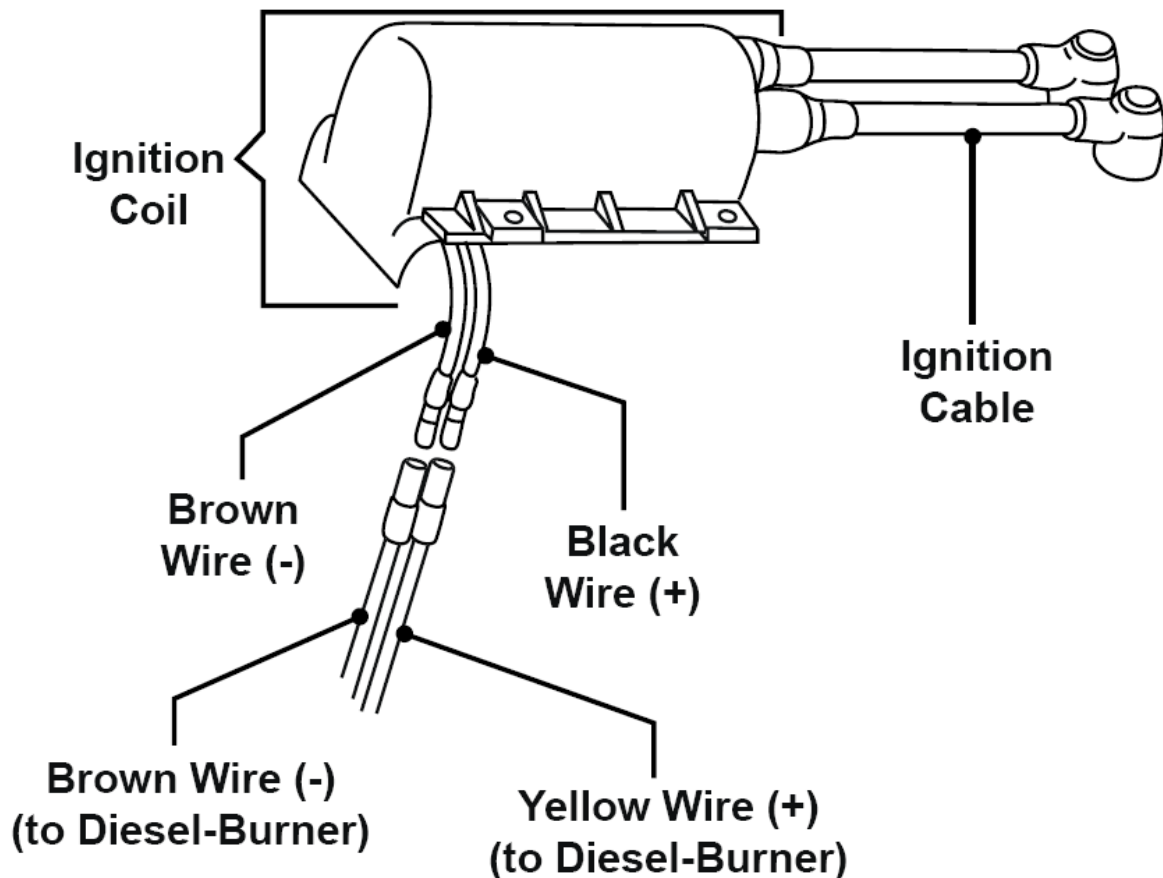
1. Disconnect the ignition cables from the ignition electrodes. Remove the four ignition coil screws that secure the ignition coil to the protection cap. Lift the ignition coil and disconnect its wires from the C-plug harness wires, prior to removing.

2. Connect the new ignition coil's black (+) and brown (-) wires to the C-plug harness' yellow (+) and brown (-) wires. Attach the ignition coil to the protection cap with the four ignition coil screws, then reconnect the ignition cables to the ignition electrodes.

NOTE: If the new ignition coil does not function, check wire connections and ensure they are properly connected.

3. Follow the instructions for reattaching the diesel burner and test for proper operation.

Figure 52



Diesel-Burner Controller:

The diesel-burner controller operates all the components of the diesel-burner head and safely shuts the heater **OFF** in the event of an overheat, flameout, and low voltage condition. It also receives diesel-burner operation status signals from the flame sensor, VDC control thermostat, and VDC high-limit thermostat.

Component Test:

The following conditions must exist prior to performing the diesel-burner controller circuit tests on the following page. If one of the conditions below does not exist, please contact our technical support department at 1-800-685-4298 for additional assistance.

Condition #1

A battery voltage level between 11.5 to 14.0 volts DC must be present at the diesel-burner controller during all testing. It may be necessary to perform a voltage check to ensure that this condition exists. To perform the voltage check, locate the diesel-burner controller's B-plug, and insert the probes of a DC voltmeter into the B-4 (+) and B-2 (-) locations.

Condition #2

A voltage level of between 11.5 to 14.0 volts must be present at the diesel **ON/OFF** switch circuit of the diesel-burner controller during all testing. It may be necessary to perform a voltage check to ensure that this condition exists. To perform the voltage check, locate the diesel-burner controller's B-plug, and insert the probes of a DC voltmeter into the B-1 (+) and B-2 (-) locations. Turn the diesel switch **ON** and observe the voltage level.

Ground Circuit Test:

Locate the diesel-burner controller's B-plug and C-plug. Insert the probes of a DC voltmeter into the B-4 (+) and C-5 (-) locations and turn the diesel switch **ON**. If a voltage reading does not register on the voltmeter, the diesel-burner controller must be replaced. If voltage is present, proceed to the next circuit test.

VDC/VAC Control Thermostat Circuit Test:

Locate the diesel-burner controller's B-plug and C-plug. Insert the probes of a DC voltmeter into the C-1 (+) and B-2 (-) locations and turn the diesel switch **ON**. If a voltage reading does not register on the voltmeter, the diesel-burner controller must be replaced. If voltage is present, proceed to the next circuit test.

VDC High-Limit Thermostat Circuit Test:

Locate the diesel-burner controller's B-plug and C-plug. Insert the probes of a DC voltmeter into the C-4 (+) and B-2 (-) locations and turn the diesel switch **ON**. If a voltage reading does not register on the voltmeter, the diesel-burner controller must be replaced. If voltage is present, proceed to the next circuit test.

Motor Circuit Test:

Locate the diesel-burner controller's B-plug and C-plug. Use a jumper wire to make a connection from the C-1 location to the C-7 location. Turn the diesel switch **ON** and insert the probes of a DC voltmeter into the C-2 (+) and C-5 (-) locations. If no voltage reading registers on the voltmeter, the diesel-burner controller must be replaced. If voltage is present, proceed to the next circuit test.

Be sure to remove the jumper wire that was used to make the connection from the C-1 location to the C-7 location. A failure to do so will result in an overheating condition during normal operation.

Ignition Coil Circuit Test:

Turn the diesel switch **OFF** and locate the diesel-burner controller's C-plug. Also, locate the VDC high-limit thermostat and disconnect its 2-way male plug from the (white plastic) 6-way female connector. Insert the probes of a DC voltmeter into the C-8 (+) and C-5 (-) locations and turn the diesel switch **ON**. If a voltage reading does not register on the voltmeter 18-25 seconds after the initial start-up the diesel-burner controller must be replaced.

NOTE: Be sure to reconnect the VDC high-limit thermostat's wires to the thermostat. The diesel-burner will not ignite during normal operation if the VDC high-limit thermostat is left disconnected.

SECTION 8: DIESEL-BURNER COMPONENTS/TROUBLE SHOOTING

Be sure to remove the jumper wire that was used to make the connection from the C-1 location to the C-7 location. Failure to do so will result in an overheating condition during normal operation.

Replacement Procedure:

1. Remove both the B-plug and the C-plug from the diesel-burner controller. Gently pry away each side of the diesel-burner controller bracket from the diesel-burner controller's locking posts with a flat-head screw driver. Once the locking posts have been released, pull on the diesel-burner controller to remove it from the diesel-burner head.
2. Slide the new diesel-burner controller into the diesel-burner controller bracket. Push down on the diesel-burner controller until the locking posts snap into the bracket slots.
3. Reconnect the B-plug and the C-plug.

NOTE: Be sure to install the diesel-burner controller with its C-plug and B-plug ports facing downward. Failure to do so, will result in moisture collecting in the ports and potential damage to the diesel-burner controller's internal circuitry.

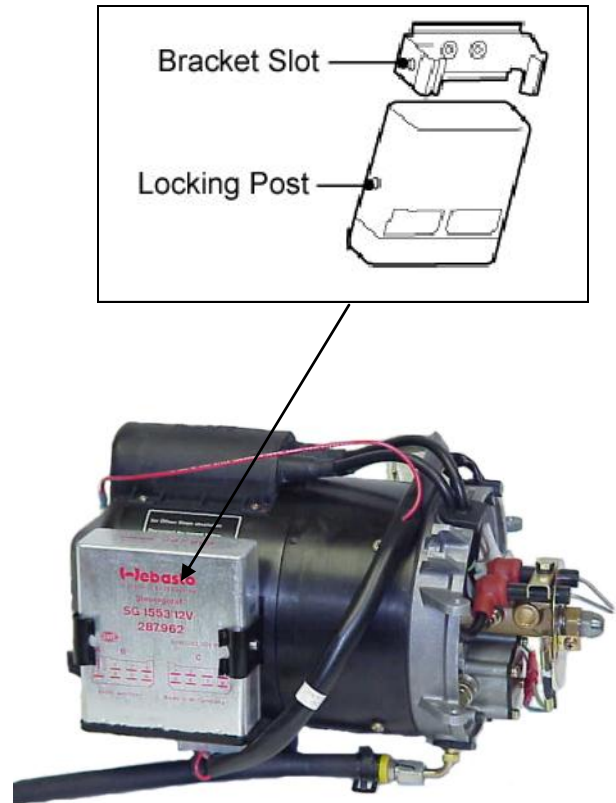


Figure 53a

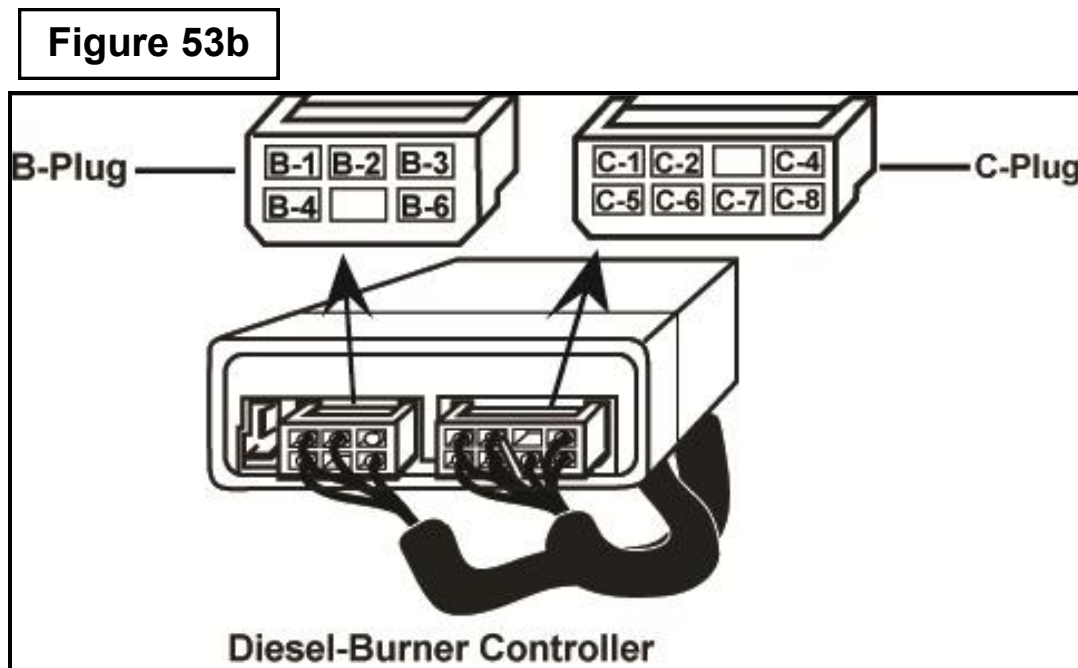


Figure 53b

IF THE AQUA-HOT IS BLACK SMOKING:**1. Things to check before opening up heater**

1. Low Voltage - Fire up generator/plug coach into shore power
2. Damaged or Restricted exhaust pipe - Inspect exhaust pipe for damage

2. Access cover must be removed to check the following:

1. Air Intake Closed off - on the bottom of the burner is the air adjustment, set at the half way point.
2. Broken Protection Cap - Check cap for cracks or missing pieces.
3. Worn OUT Grommets — run hands over grommets, on top and bottom, and feel for excessive air
4. Burner not seated properly or Loose - run hands along the seal of the burner, and check for excessive air
5. Air Intake Sleeve collapsed

3. Diesel Burner must be removed to check the following:

1. Photo Disc Bent or Tight — The photo disc must be loose, so it will seal on the combustion chamber properly
2. Combustion Chamber Warped/Melted — Inspect for signs of warping/melted aluminum.
3. Bad Nozzle - If nozzle is spraying poorly, it must be replaced
4. Fuel Pressure not at 145 PSI — Check fuel pressure with fuel pressure gauge

4. Diesel Burner must be torn down to check the following:

1. Slow Motor (Less Than 4500rpms at 12v) - a slow motor acts the same as low voltage. Check motor rpm with an rpm tester, under full load.
2. Bearings are worn out - Bearings should spin freely, and sound smooth. If they are starting to seize up, they will slow the motor down.
3. Impeller Fan Not Gapped Properly — The impeller needs to be gapped at 3-5 thousands or tighten fan down until it rubs, back it off ¼ turn.

IF THE AQUA-HOT IS BLUE/WHITE SMOKING:**1. If The Heater Smokes on Start up/Shut down.**

- a. Fuel solenoid
 - plunger worn out
 - plastic/metal in the way of plunger
 - fuel solenoid intermittent.
- b. Nozzle Tower
 - cracked
 - poorly machined
- c. Short cycling
 - control t-stat bad
 - someone turned heater off/on repeatedly
- d. Return Fuel Check Valve
 - heaters manufactured before 2001

<p>NOTE: It is normal for the heater to blue/white smoke for 3-5 seconds on start up and shut down.</p>
--

2. If The Heater Smokes During The Burn Cycle.

- a. Electrodes out of adjustment
- b. Air in the fuel system
- c. Bad nozzle
- d. Fuel pressure
- e. Fuel Pump
- f. Intermittent Ignition Coil
 - If the coil doesn't turn on, the fuel sprays for 20 seconds, before the photo eye shuts the fuel off.

IF ONE OF THE AQUA-HOT HEATING ZONES WILL NOT GET HOT:

1. General Problems

- A. Diesel/Electric not operating (antifreeze cold)
- B. Heater is Not up to operating Temperature
(antifreeze is cold)
- C. Interior Zone Thermostat Not calling for heat
- D. Zone Circulation Pump Not Operating
- E. Heat Exchanger Fans Not Operating

2. If Fans and Pumps *are* Running

- A. Stuck Check Valve
- B. Kinked Line
- C. No Antifreeze in system

IF THERE IS A LACK OF DOMESTIC HOT WATER:**1: General information**

1. The heater is only rated for water flow of 1.5 GPM
2. The heater is only rated for a 55°F temperature Rise on the cold water coming into the unit
3. The diesel burner must be on for continuous hot water, the electric element is for limited use only.

2: Things to test for a lack of hot water problem.

1. Aqua-Hot Heater Bypassed
2. Outside Water Faucet is left on.
3. Washing Machine Valve has gone bad
4. Antifreeze Concentration is incorrect.
 - a. 30%-50% antifreeze concentration
5. Operating Range of the heater (I.E. Control Thermostat) is incorrect
 - a. 175° F - 210° F
6. Water Flow is too fast
 - a. Must be 1.5 GPM or Less.
7. Mixer Valve is stuck (knob does not turn freely)
8. Copper Coil is not bonded properly to the outside of the boiler tank.

IF THERE IS ANTIFREEZE LEAKING:

NOTE: To find an antifreeze leak, the system must be Hot (up to operating temperature)
Or pressurized to 17 PSI.

Inspect the following components on the Aqua-Hot Heating System for Leaks:

1. On the Front-Side of Aqua-Hot -**1. Electric element****2. Circulation/Stir pump**

c. Copper plumbing

d. Tank ports

- It might be necessary to cut away some of the insulation around the tank ports to locate the leak.

e. Pump

6. Burn Chamber Leak

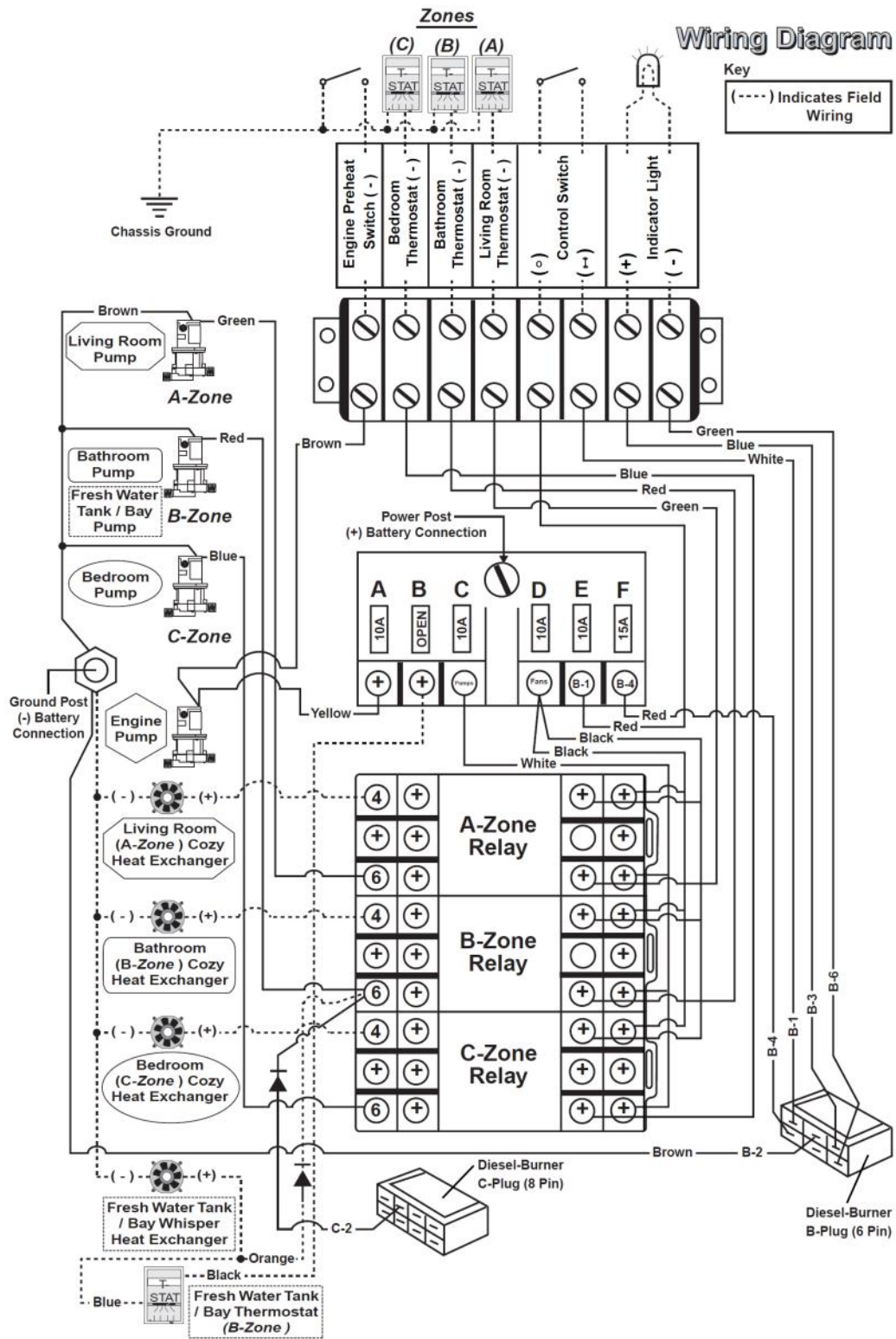
a. If Antifreeze is running out of the tip of the exhaust pipe remove the burner, and combustion chamber and inspect inside the burn chamber for leaks.

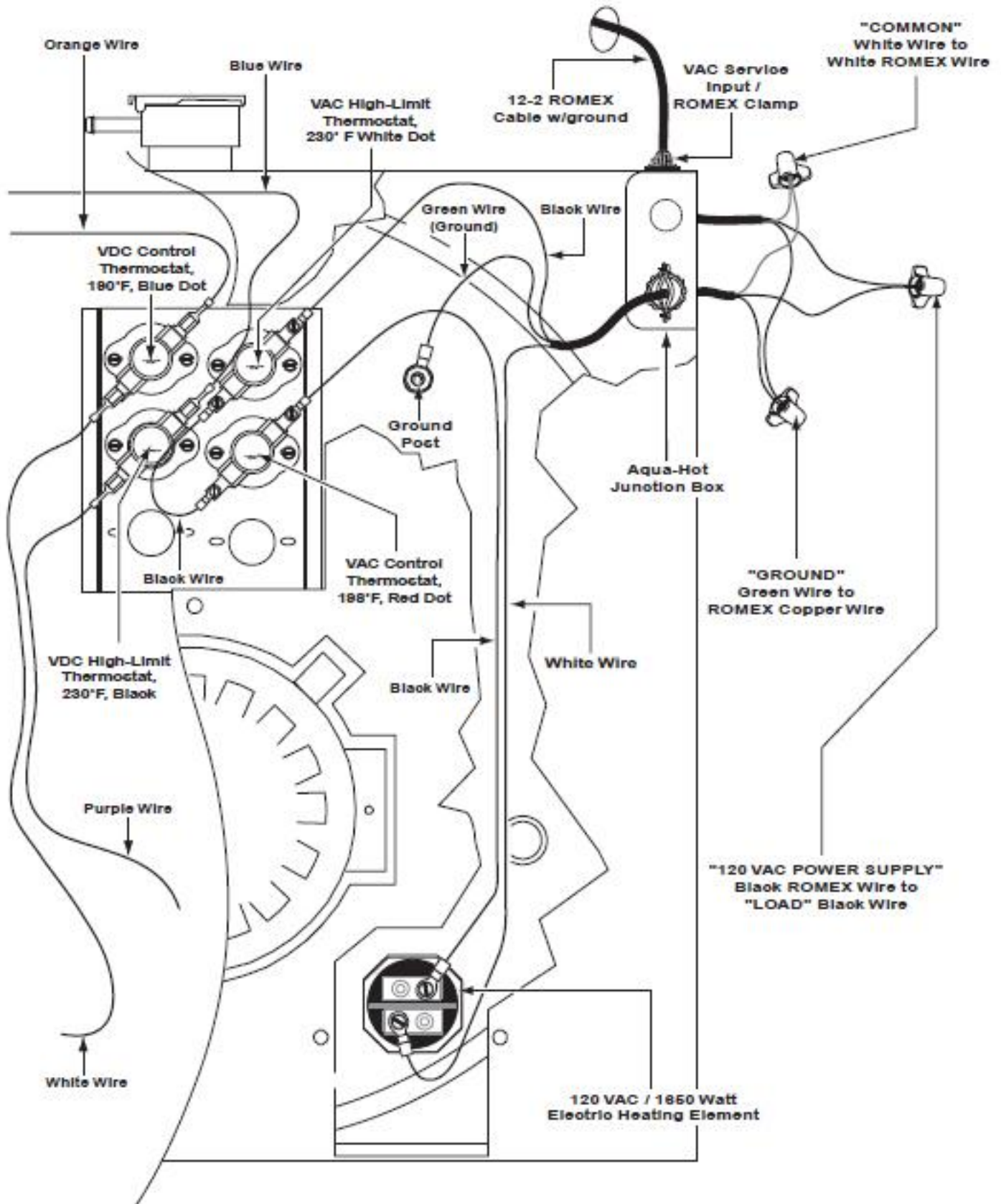
IF THERE IS ANTIFREEZE LEAKING: (CONTINUED)

2. On the Top-Side of Aqua-Hot -

- 1. Expansion Tank Connection**
 - a. Cracked expansion tank tubing
 - b. Radiator Cap
 - c. Filler neck/Filler neck solder joining
- 2. Supply/Return Ports**
 - A. Defective fitting
 - B. Leaking fitting

Note: If no leaks are found on the Aqua-Hot, it is possible that there is a leak within the motor home. Check all Heat exchangers, connections, and tubing for leaks.





APPENDIX B: BLEEDING THE INTERIOR HEATING ZONE CIRCULATION PUMP

- A. Place a bucket underneath the coach, where the Aqua-Hot's Drain Valve is located.

NOTE: Be sure to check that the drain valve is completely closed.

- B. Remove the Aqua-Hot's Radiator Cap and pour 15 gallons of a 50/50 solution of water and antifreeze, reference figure B1.
- C. Place the radiator cap back onto the Aqua-Hot and tighten.
- D. Close both pump and return manifold valves, reference Figure B2
- E. Activate the Bedroom Zone Pump.
- F. Pressurize the system by applying air pressure to the filler neck overflow tube, reference figure B3. Pressurize until the pressure release tab releases (blows out the excess air pressure).

NOTE: The system may also be pressurized using a Cooling System Tester. Reference Figure B4

- G. Open the pump manifold valve (upper valve). Reference Figure B2. This will allow the solution to enter into the heating system (i.e. zone pumps, heat exchangers and plumbing lines).
- H. Slowly open the drain valve to allow the air to escape. Reference Figure B2.

- I. Close the Drain Valve.

- J. Close the pump manifold valve.

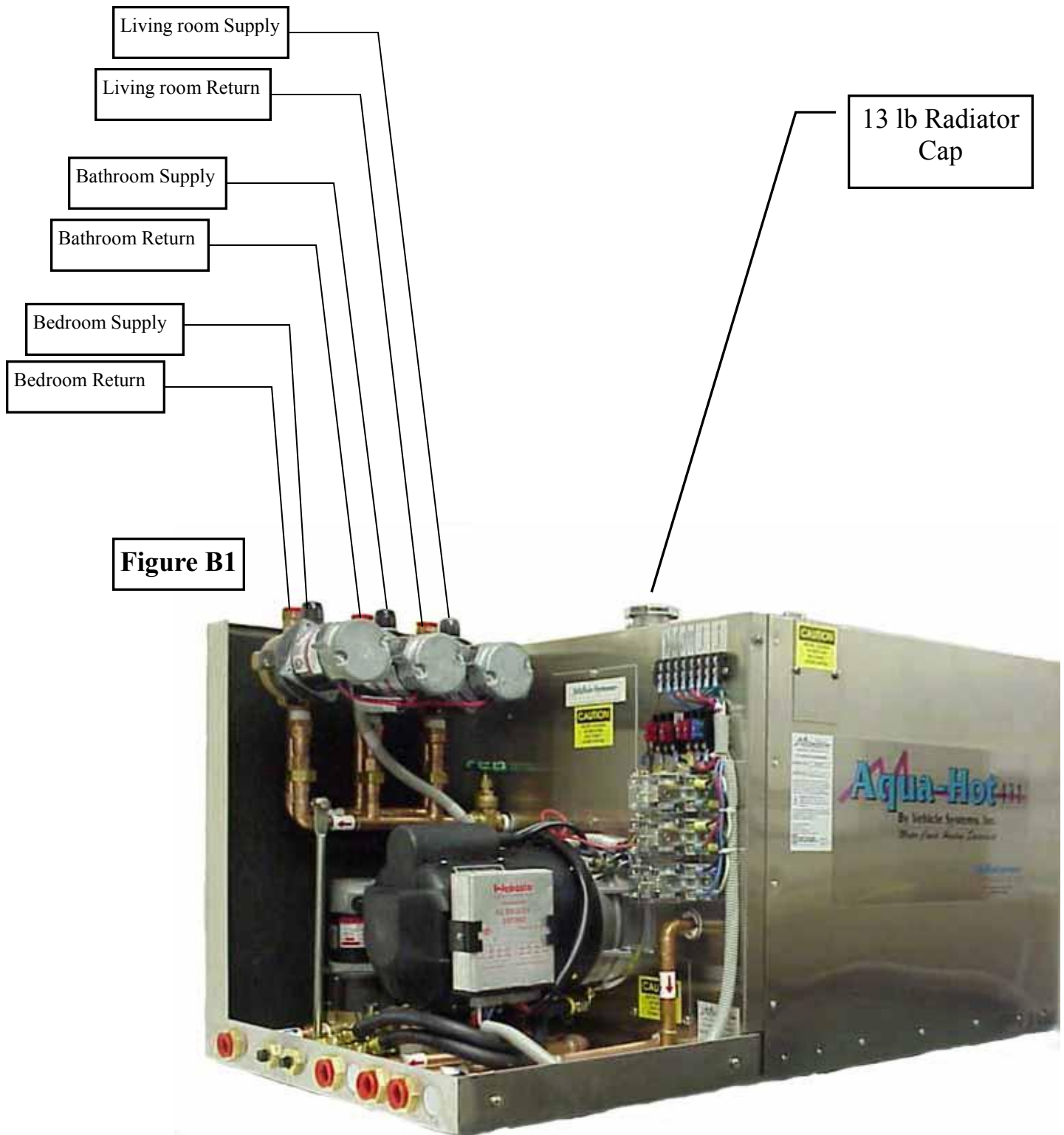
- K. Repeat steps B-J for all three zone pumps (i.e. Bedroom, Bathroom, and Living Room).

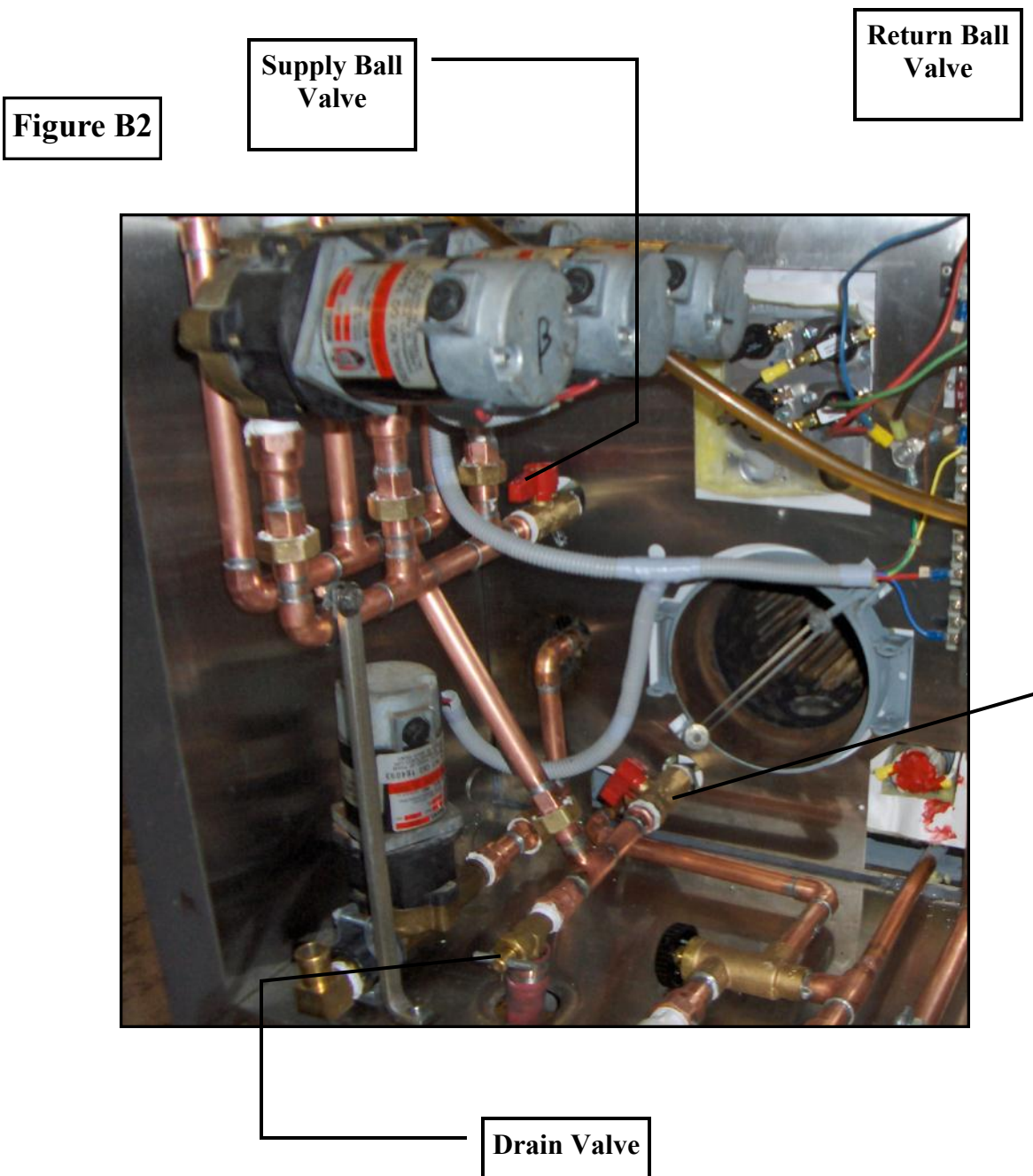
NOTE:

1. Depending on the plumbing lines diameter and total length it may be necessary to repeat B-J several times before any of the solution appears.
2. Be sure to close both the drain valve and the pump manifold valve each time that the boiler tank is refilled and pressurized.
3. Make sure that the Aqua-Hot's boiler tank has a minimum of 11 gallons of solution in it at all times while bleeding the heating system. If the capacity should drop below the 11 gallon minimum, air will enter back into the heating system and the bleeding process will need to be repeated.

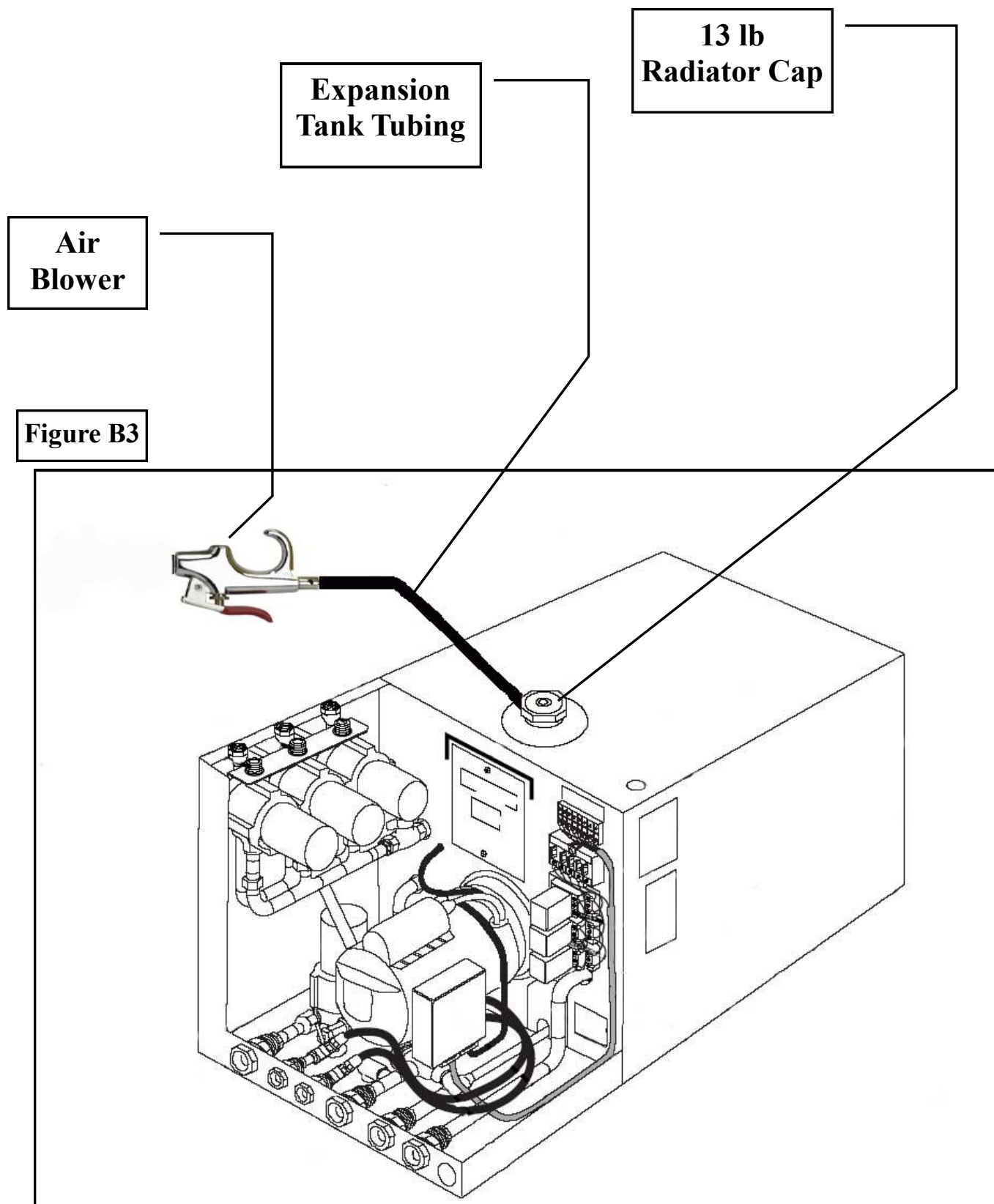
- L. Once all air had been bled from the system, be sure that both the return manifold valve (lower), located on the left side of the diesel burner and the pump manifold valve (upper) are completely opened. Reference Figure B2.

- M. Once all air has been bled from the system, be sure to connect and clamp the overflow tubing to the Aqua-Hot's Expansion tank.





Using an Air Blower to pressurize the Boiler Tank



NOTE: If too much air pressure is applied to the boiler tank, it will leak out around the radiator cap's rubber seal.

Using a Coolant System Tester to pressurize the Boiler Tank

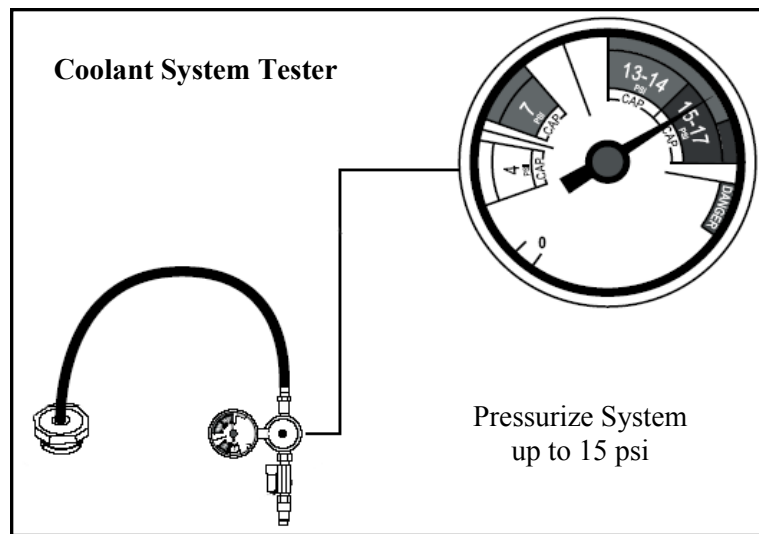


Figure B4



Instructions for Checking Fuel Pressure

NOTE:

A fuel pressure gauge is used to properly check the fuel pump's pressure setting. The fuel pump is preset to 145 PSI. Perform the following procedures to check for a proper fuel pressure setting.

NOTE: In order to perform the following procedure it is necessary to detach and reattach the diesel-burner head. Be sure to review the detaching/attaching instructions.

Step 1: Remove the diesel-burner



Figure C1

1. Refer to the section on detaching/reattaching the diesel burner, to detach the diesel burner.

Step 2: Installing the fuel pressure gauge



Figure C2

1. Using a 5/8" and a 3/4" wrench remove the fuel nozzle.

Instructions for Checking Fuel Pressure



Figure C3

2. Using a 5/8" and a 3/4" wrench install the fuel pressure gauge.

WARNING!

A spark will appear across the ignition electrodes for a brief moment after the diesel burner has been activated. **DO NOT** attempt to make any fuel pressure adjustments until the spark has disappeared. Failure to do so may result in serious bodily injury. In some installations it may be necessary to shine a light on the flame sensor to simulate a flame condition to shut off the ignition coil.

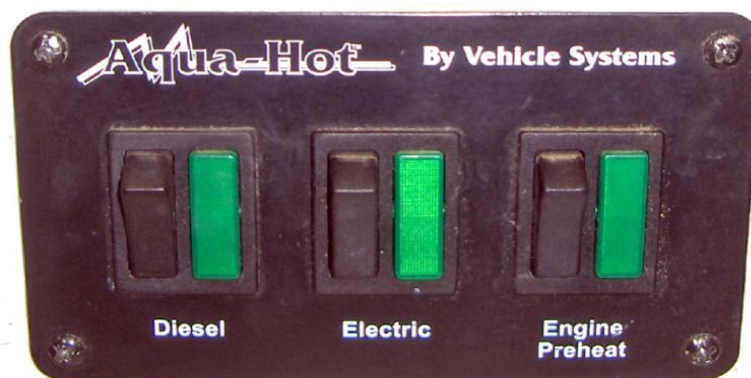


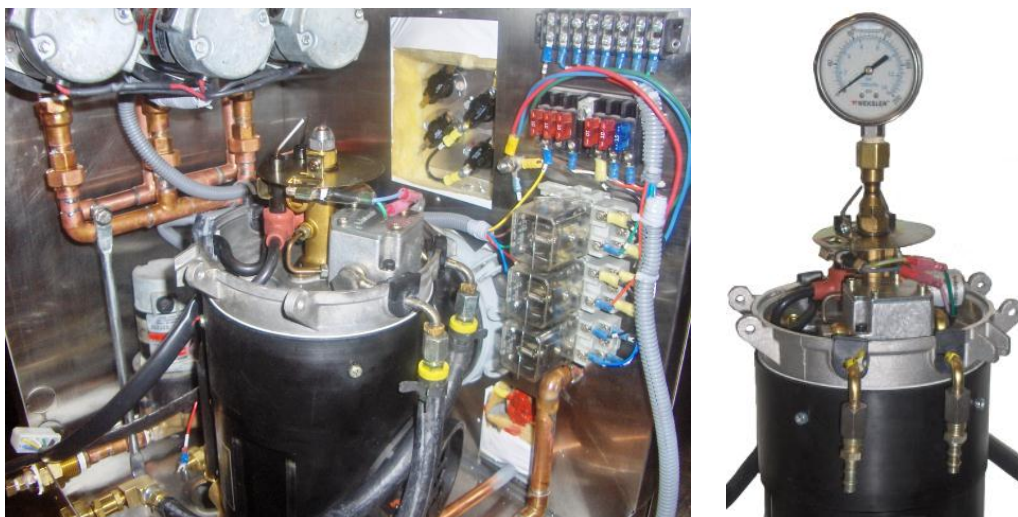
Figure C4

2. Turn the diesel burner switch to the on position. A pressure will register on the fuel pressure gauge once the fuel solenoid opens (after approx. 10-20 seconds).

Instructions for Adjusting Fuel Pressure

Step 1: Follow the directions for Checking the Fuel Pressure in this section.

Figure C5



1. Remove the Diesel Burner and install the Fuel Pressure Gauge .

WARNING!

A spark will appear across the ignition electrodes for a brief moment after the diesel burner has been activated. **DO NOT** attempt to make any fuel pressure adjustments until the spark has disappeared. Failure to do so may result in serious bodily injury. In some installations it may be necessary to shine a light on the flame sensor to simulate a flame condition to shot of the ignition coil.

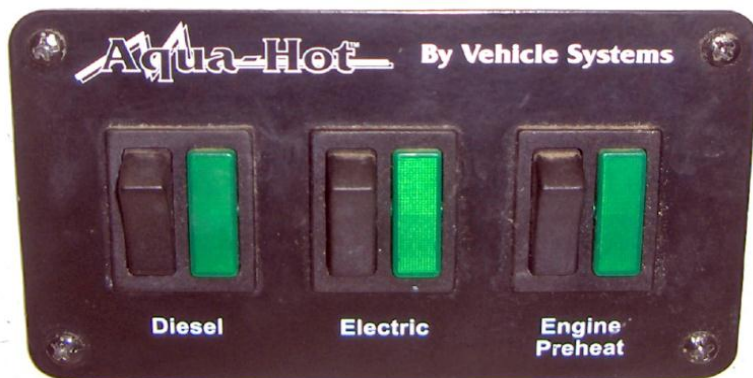


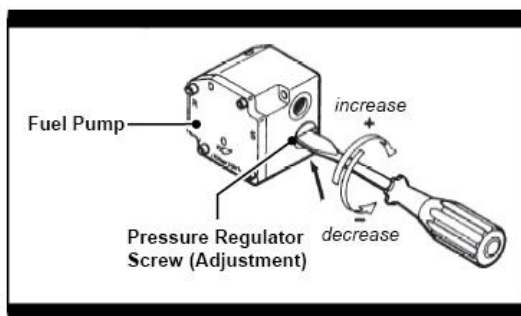
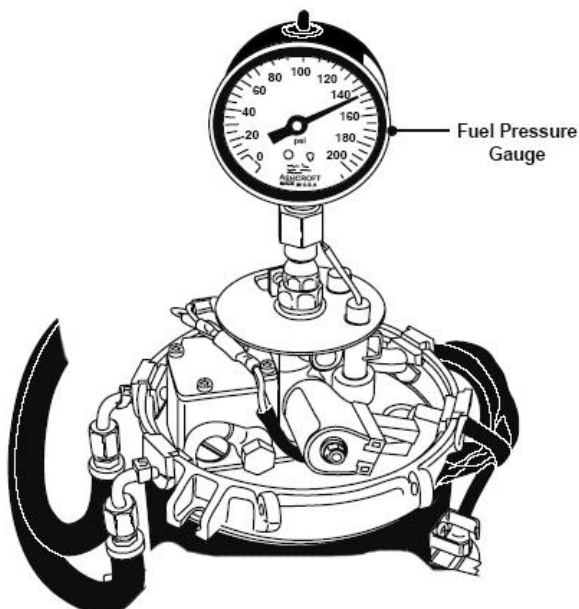
Figure C6

2. Turn the diesel burner switch to the on position. A pressure will register on the fuel pressure gauge once the fuel solenoid opens (after approx. 10-20 seconds.)

Instructions for Adjusting Fuel Pressure

Step 2: Adjust the Fuel pressure to 145 PSI.

Figure C7



1. Once the fuel solenoid has been activated, and the fuel pressure gauge is registering a pressure, the fuel pressure can be adjusted. To increase the fuel pressure turn the pressure adjustment screw clockwise, and to reduce the fuel pressure, turn the pressure adjustment screw counter clockwise.

NOTE: If the fuel pressure cannot be adjusted refer to the fuel pump section in section 8 Of this manual for troubleshooting tips.

WARNING!

When storing the Motorhome: Not winterizing the Aqua-Hot when freezing temperatures are present will result in serious damage to the Aqua-Hot's Domestic Water Heating System. Also, be sure to use an FDA approved, "GRAS" rated antifreeze for winterization.

NOTE: The Aqua-Hot can continue to be used for interior zone heating once the domestic water heating system has been drained and winterized.

Diesel-Burner

1. If the Diesel burner Fails to operate:
 - A. Is the Diesel Fuel in the motor home winter fuel or summer fuel?
 - B. Is the Diesel Fuel liquid or Jelled?
 - C. Are the electrodes properly adjusted?
 - D. When was the last time an Annual Service was performed?

120 Volt-A.C. Electric Heating Element

Please note that the 120 Volt-AC Electric Heating Element is the Aqua-Hot's **secondary heat source** for heating both the interior and/or the domestic hot water during low heating demand situations (such as when moderate ambient temperatures exist and/or when there is a low demand for domestic hot water).

If the 120 Volt-AC Electric Heating Element is not providing enough heat, turn the Diesel-Burner on, in conjunction with the 120 Volt-AC Electric Heating Element.

Figure D1



If there is a lack of interior Heat:

Note: The 120 Volt-AC Electric Heating Element is the Aqua-Hot's **secondary heat source** for heating both the interior and/or the domestic hot water during low heating demand situations (such as when moderate ambient temperatures exist and/or when there is a low demand for domestic hot water). If the ambient temperature is ex-

1. Is the Diesel Burner activated?
2. Is the Diesel Burner operating Properly?
3. What is the antifreeze concentration, inside of the Aqua-Hot Boiler Tank?
4. Was the heating system properly installed, following the Aqua Hot installation manual?
 - A. Are there at least 5 heat exchangers installed in the Interior of the motor home?
 - B. Are there cold air returns installed for every heat exchanger? Reference Figure D2
 - C. Are the heat exchangers mounted as close to the hot air outlet grill as possible? Reference Figure D2.

Figure D2

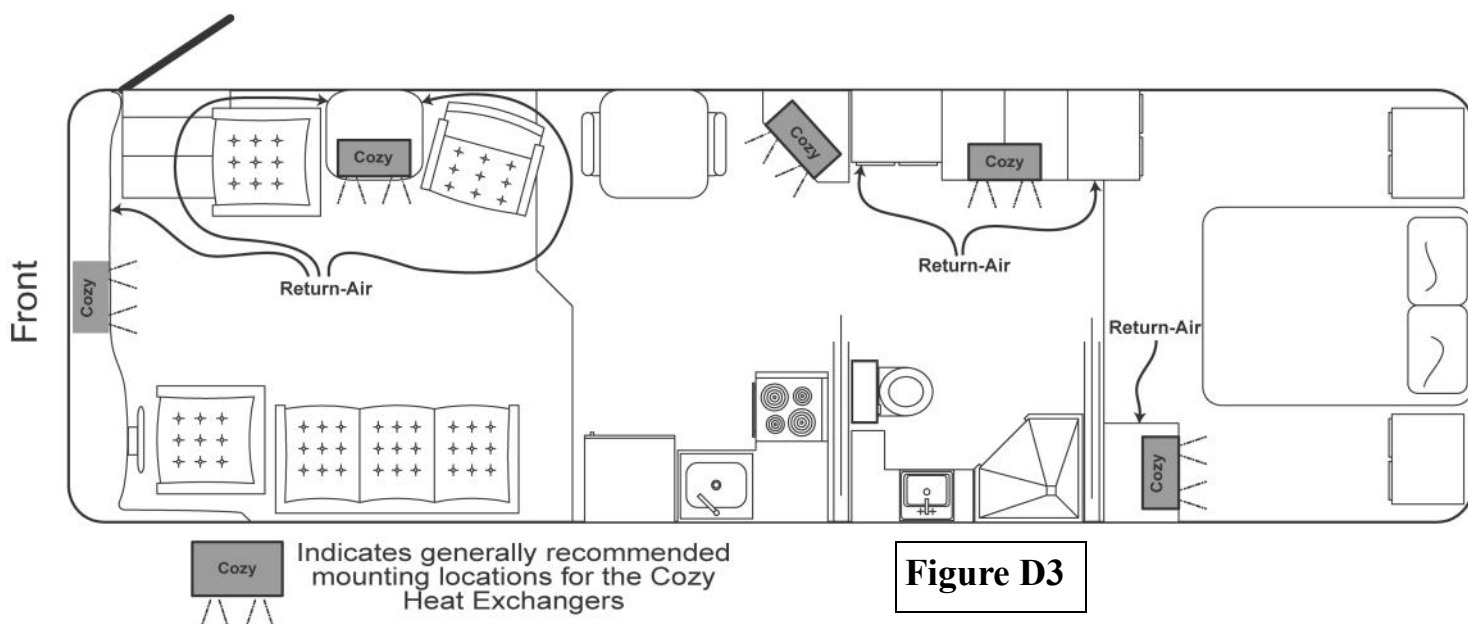
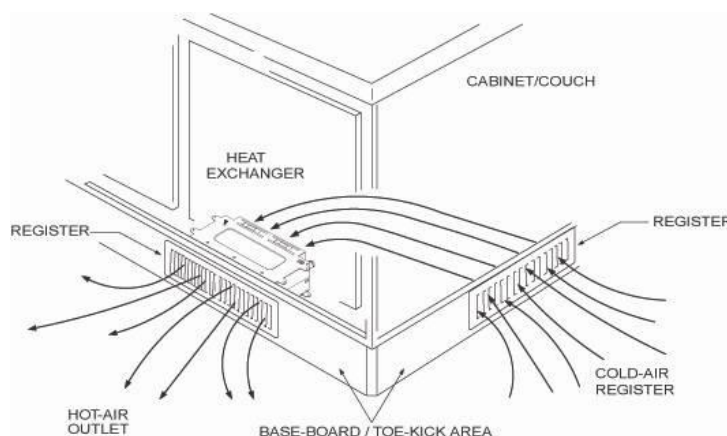


Figure D3

Monthly Maintenance:

Check the antifreeze and water heating solution to ensure that it is at the proper level by visually checking the solution level in the expansion tank. The level of the antifreeze and water heating solution within the expansion tank should only be checked when the Aqua-Hot is at maximum operating temperature.

If additional antifreeze and water heating solution is required, fill the expansion tank to the “HOT” level mark.

Additionally, it is recommended that the diesel-burner be fired and allowed to run monthly to keep it in good working order.

Annual Maintenance:

⚠ DANGER! ⚠

FAILURE TO DISCONNECT ALL POWER SUPPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIOUS DAMAGE OR PERSONAL INJURY.

To keep the Aqua-Hot running smoothly, it is recommended to have the diesel-burner tuned up annually. A tune-up should consist of a new fuel nozzle and fuel filter, along with a thorough cleaning of the combustion chamber. To ensure maximum diesel-burner performance, always use the recommended fuel nozzle and fuel filter when replacing these parts.

NOTE: Be sure to use care when handling the fuel nozzle. Oils and/or small dust or dirt particles from the hands may plug the nozzle's small orifice. A partially plugged orifice will restrict fuel flow, which will affect the combustion process of the diesel-burner.

Figure E1



Aqua-Hot Maintenance Procedure:

Note: Before performing an annual maintenance, it is recommended to test run the Diesel-Burner. While testing inspect exhaust for smoke.

Step 1: Test Run the Diesel Burner

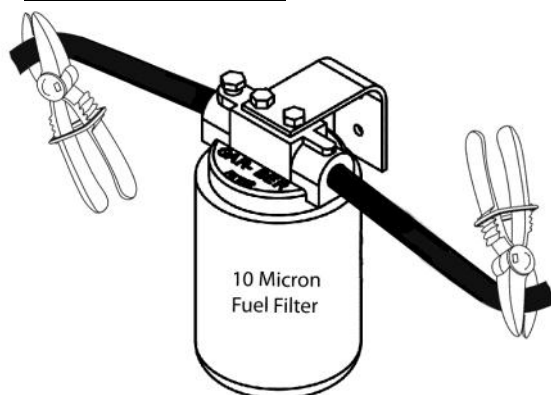
1. Turn the Diesel-Burner Switch to the on position.
2. After the Diesel-Burner has ignited, inspect the exhaust for smoke.
3. Shut the Diesel-Burner off, and wait for unit to completely shut off.

NOTE: The diesel-burner can either be shut off by:
1. Turning the Diesel Burner switch to the off position.
2. Disconnecting the control thermostat wires
3. Unplugging the diesel burner controller.
Reference Figure ??

Step 2: Replace the Fuel Filter

1. Locate Fuel Filter.
2. Using hose pinch off pliers, clamp off both fuel lines going to the fuel filter. Reference figure ??.

Figure E2



3. Replace fuel filter, with proper replacement canister.

NOTE: It is recommended that the replacement fuel filter be filled with clean diesel fuel, prior to installation

4. Remove hose pinch off pliers.

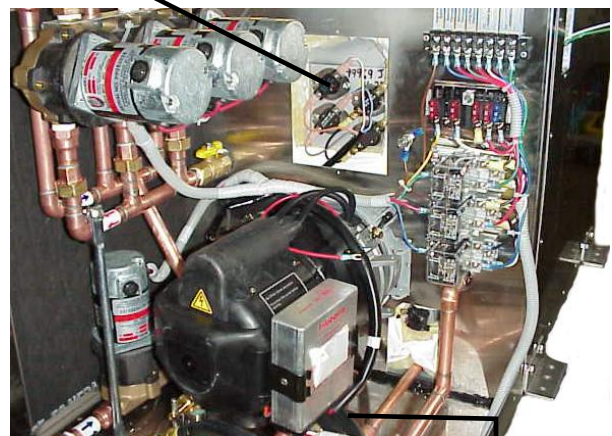
Step 3: Run the Diesel Burner

1. Turn the Diesel-Burner Switch to the on position.
2. After the Diesel-Burner has ignited, let it burn for 1 - 2 minutes to purge the old fuel out of the nozzle holder, to prevent contamination of the replacement nozzle.
3. Shut the Diesel-Burner off, and wait for unit to completely shut off.

NOTE: The diesel-burner can either be shut off by:
1. Turning the Diesel Burner switch to the off position.
2. Disconnecting the control thermostat wires
3. Unplugging the diesel burner controller.
Reference Figure ??

**Thermostat
Connector**

Figure E3



**Diesel Burner
Controller Plugs**

Aqua-Hot Maintenance Procedure:

Step 4: Remove The Diesel Burner

Figure E4a



1. Locate the Diesel-Burner's Controller and disconnect both plugs.

Figure E4b



Figure E4c



3. The Diesel-Burner is secured to the Aqua-Hot with two nuts that can be loosened, and swung out of the way by using a 10mm socket wrench with a 10 inch long extension.

Aqua-Hot Maintenance Procedure:

Step 5: Remove The Diesel Burner (continued)

Figure E5



4. Carefully pull the Diesel-Burner away from the Aqua-Hot 4 to 5 inches before rotating the burner, and then remove.

NOTE: To remove the diesel burner, it may be necessary to disconnect the wires from the control and hi limit thermostats. It may also be necessary to disconnect the Diode Wire.

Step 6: Clean and Inspect the Combustion Chamber and Heat Transfer Tabs.

⚠ DANGER! ⚠

Use caution when handling the combustion chamber, it may be extremely hot, and serious burns could result from touching a hot combustion chamber.

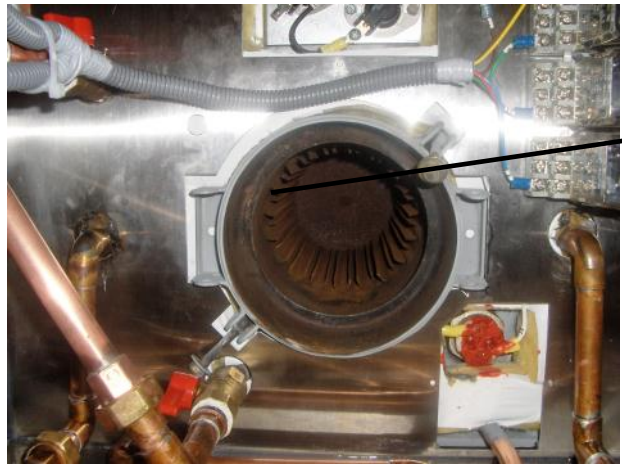
Heat Transfer
Tabs

Figure E6a



1. Remove the combustion chamber by pulling it straight out, approximately 16 inches.

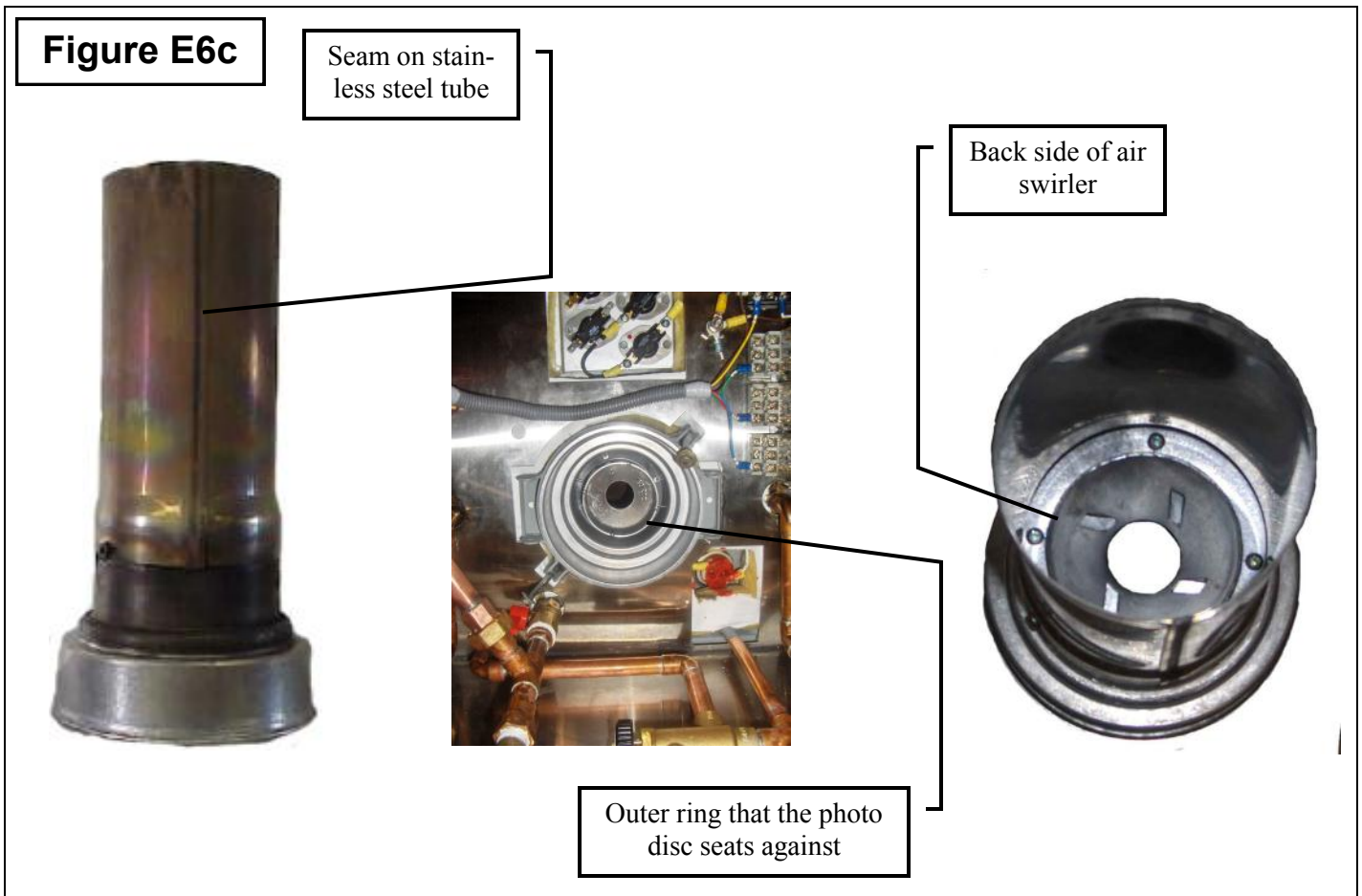
Figure E6b



2. Once the combustion chamber has been removed. Use a long handled wire brush, and brush the heat transfer tabs, to loosen soot deposits. Failure to do so will reduce the Aqua-Hot's heat transfer capabilities.

NOTE: If the heat transfer tabs are excessively sooty, it may be necessary to vacuum the soot out of the heat transfer tabs. If there is a minimal amount of soot, it may be left in the heat transfer tabs, and will be evacuated out the exhaust pipe, upon start up of diesel burner.

Step 6: Clean and Inspect the Combustion Chamber and Heat Transfer Tabs.



3. Inspect the combustion chamber for damage or signs of warping.
 1. Inspect the combustion chamber for cracks appearing along the seam of the stainless steel tube.
 - A. If the crack is over 1" in length, the combustion chamber must be replaced.
 2. Inspect the aluminum Air Swirler for signs of warping. If any part of the air swirler is warped the combustion chamber must be replace.
 - A. Inspect the outer ring that the photo disc seats against for signs of warping.
 - B. Inspect the back side of the Air Swirler for signs of warping between screws.

Step 7: Reinstall the Combustion Chamber

CAUTION!

Failure to reinstall the combustion chamber will result in serious damage to the diesel burner.

Figure E7

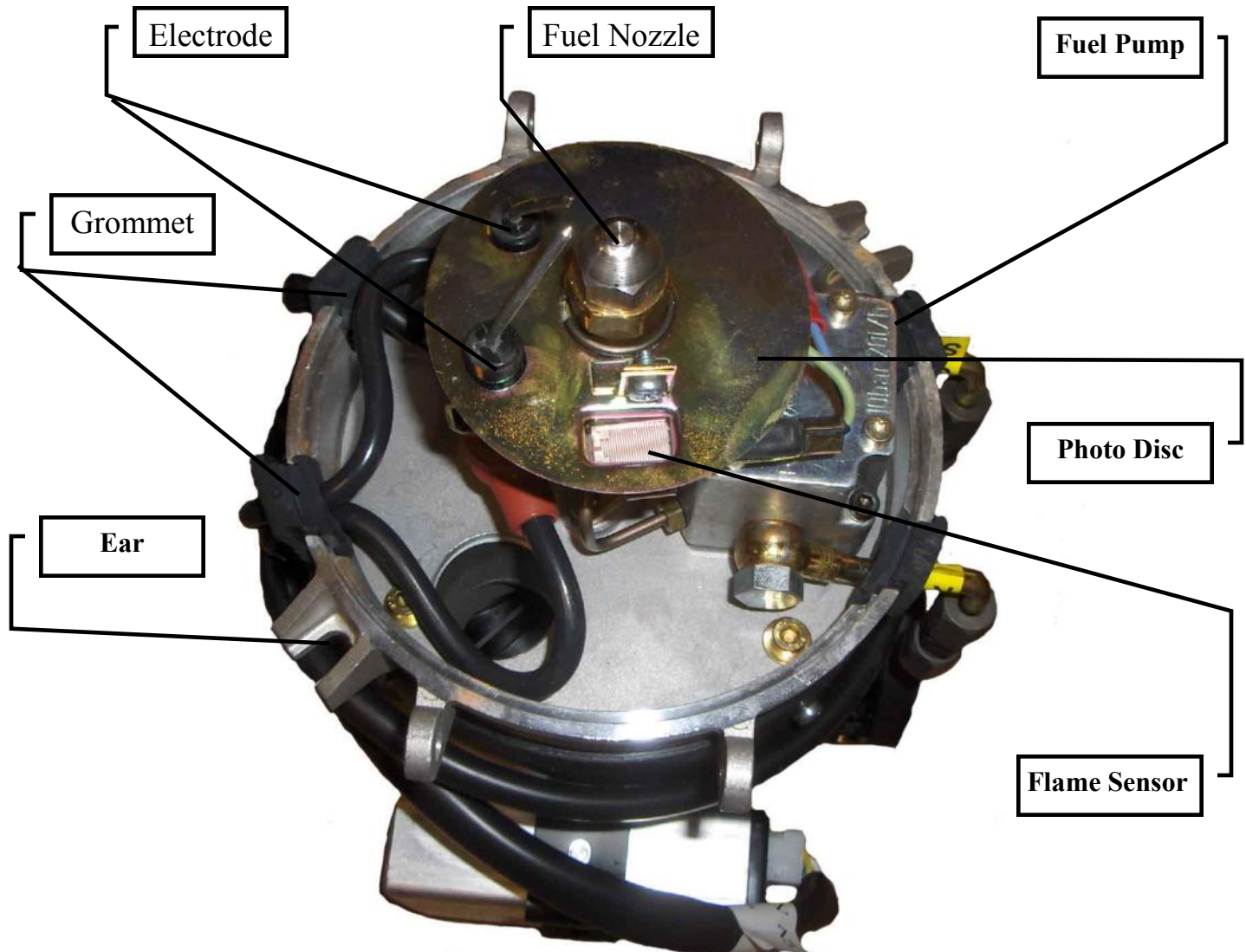


Seam on stainless
steel tube

1. Reinstall the combustion chamber into the Aqua-Hot. Please note: the seam on the stainless steel tube must be in the “up” position. Failure to do so could result in premature failure of the combustion chamber.

Step 8: Inspect Diesel-Burner

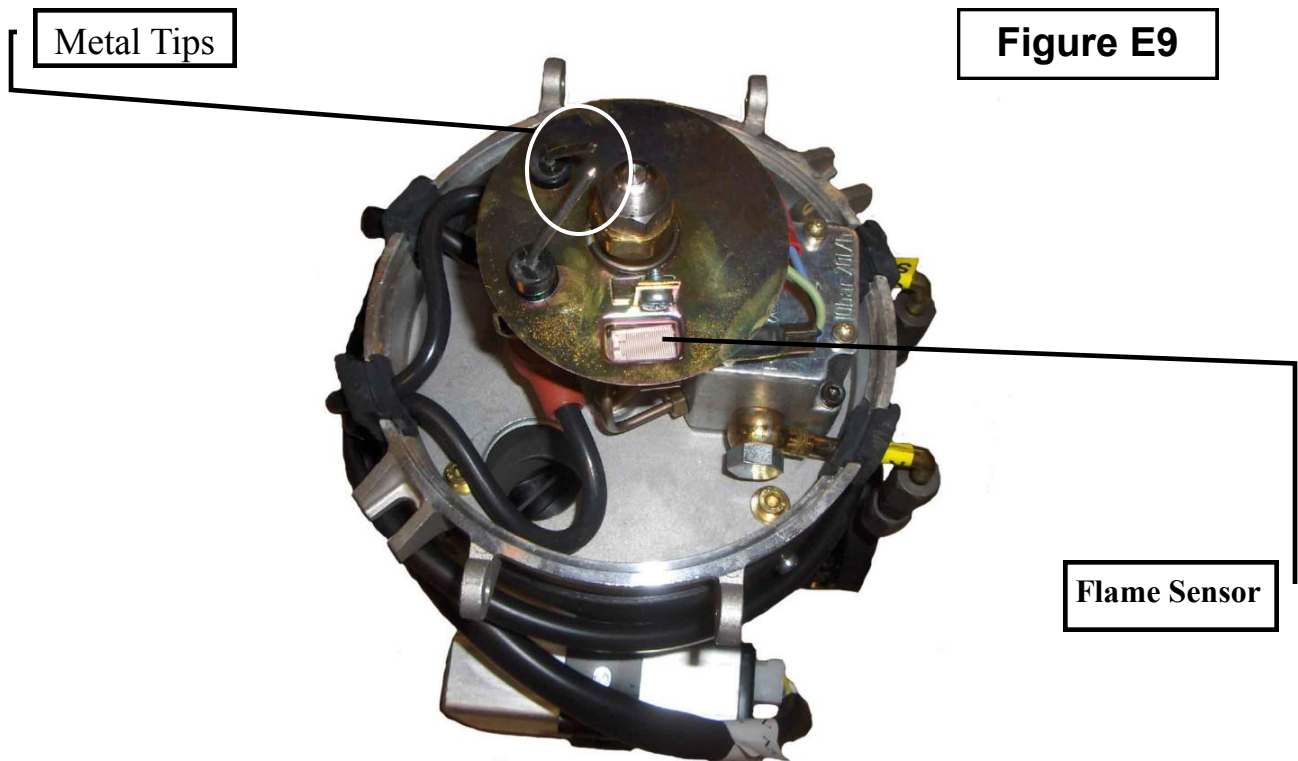
Figure E8



Inspect the following:

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. Electrodes <ul style="list-style-type: none"> - damaged - improperly adjusted 2. Fuel Pump <ul style="list-style-type: none"> - leaks 3. Photo disc <ul style="list-style-type: none"> - warped - bent 4. Harness & Ignition Coil Wires <ul style="list-style-type: none"> - crack or bare wires - Hard or brittle wires | <ol style="list-style-type: none"> 5. Flame Sensor <ul style="list-style-type: none"> - cracked - overheated (purple color) - melted wires - dirty 6. Rubber Grommets <ul style="list-style-type: none"> - hard/brittle - rubber has been cut out - right/left 7. Broken or cracked “Ears” <ul style="list-style-type: none"> - due to over tightening of eyebolts. |
|---|---|

Step 9: Clean Ignition Electrodes and Flame Sensor

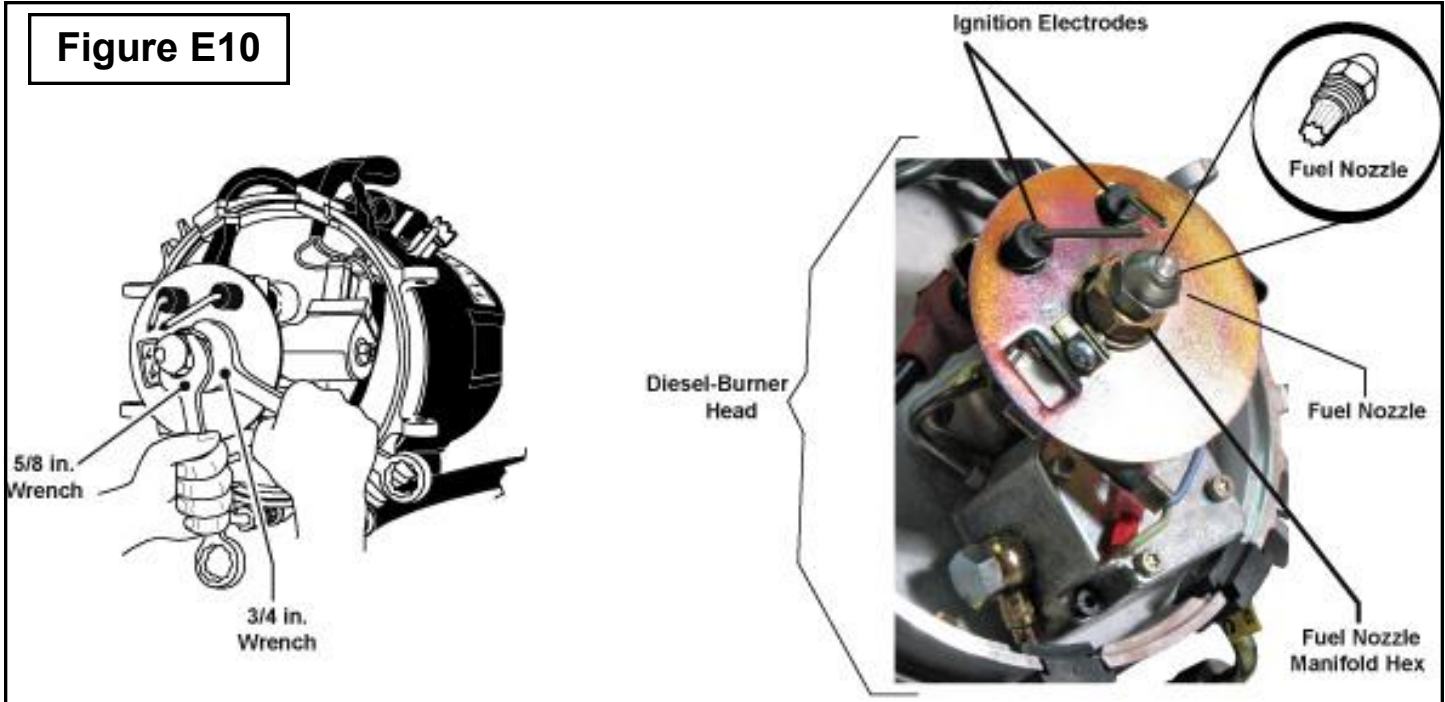


1. Ignition electrodes -

- A. Polish away any carbon deposits that may have baked onto the metal tips of the ignition electrodes with a course sponge.

2. Flame Sensor -

- A. For light dirt, dust, and/or carbon deposits, simply wipe off the flame sensor with a soft cloth.
- B. Should heavy carbon deposits be present, completely remove the flame sensor from the photo disc and clean with brake cleaner.

Step 10: Replace The Fuel Nozzle**Figure E10**

1. Use a 3/4 in. wrench to hold the fuel nozzle manifold hex, while loosening the fuel nozzle with a 5/8 in. wrench and remove.

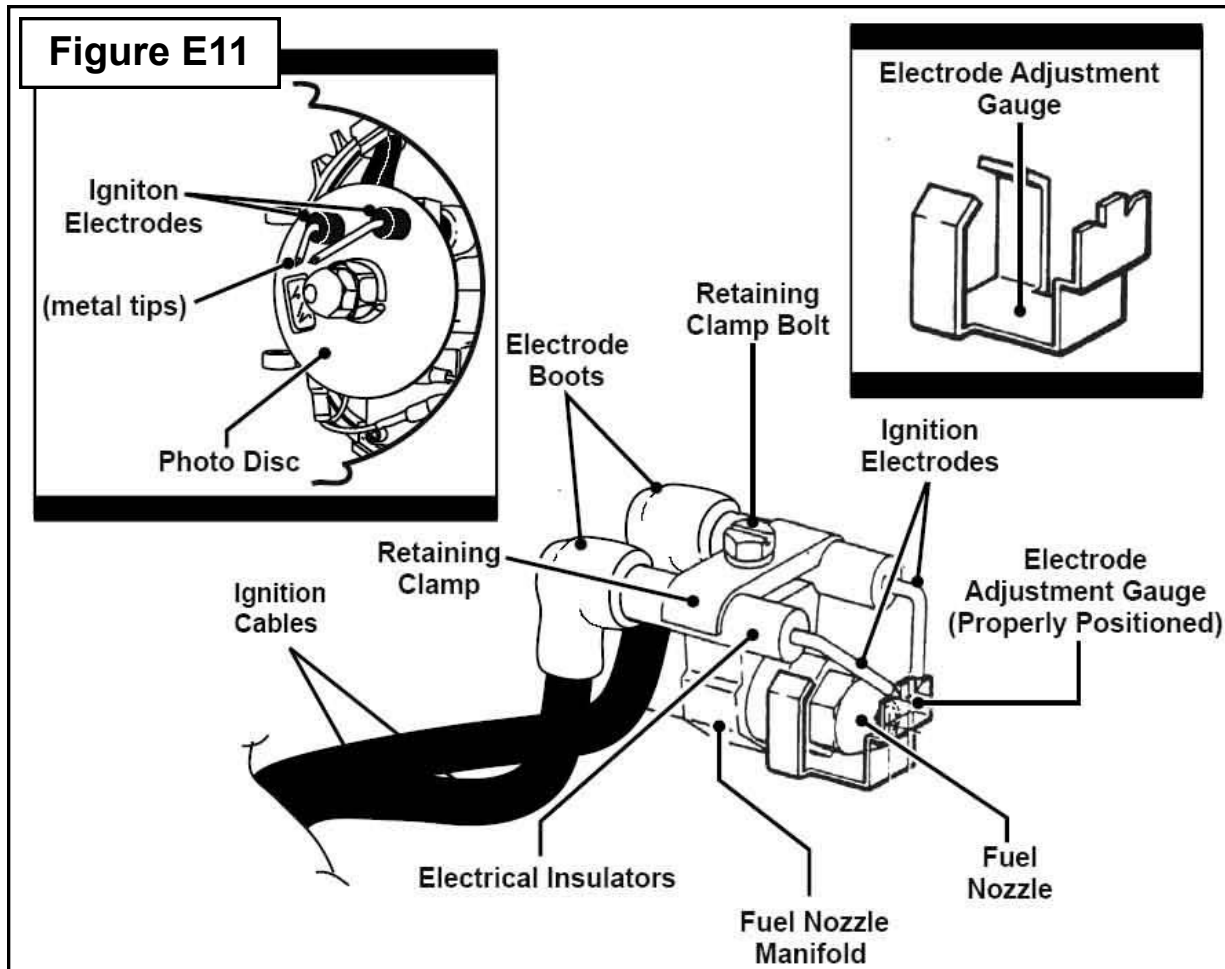
NOTE: Be sure to use care when handling the new fuel nozzle. Oils and/or small dust or dirt particles from your hands may plug the nozzle's small orifice. A partially plugged orifice will restrict fuel flow, which will affect the combustion process of the diesel-burner.

2. When replacing the fuel nozzle, be sure to tighten the nozzle, loosen it a 1/4 turn, and then firmly retighten. This will establish a seated fit and avoid any leaks.

⚠ DANGER! ⚠

Be sure to reattach the diesel-burner head prior to switching the heater ON. Failure to do so may result in ignition of the diesel-burner and serious bodily injury.

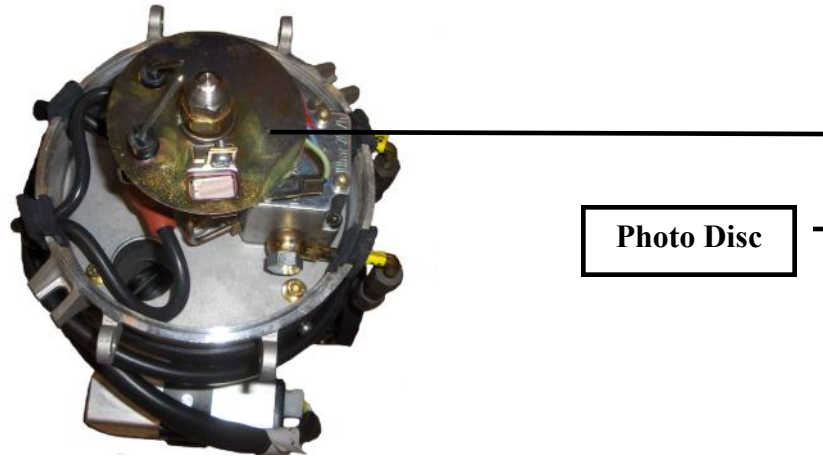
Step 11: Adjust Ignition Electrodes



1. Using a 10mm socket, slightly loosen the retaining clamp bolt.
2. Place the electrode adjustment gauge on the nozzle manifold hex and insert the metal tips of the ignition electrodes into the appropriate notches of the electrode adjustment gauge.
3. Using a 10 mm socket, tighten the retaining clamp bolt.

NOTE: Be sure not to over-tighten the retaining clamp bolt when readjusting the ignition electrodes. Over-tightening the retaining clamp bolt will bend the retaining clamp and prevent the photo disc from floating freely. Not allowing the photo disc to float freely will cause poor combustion and result in a smoky exhaust. A bent retaining clamp can be re-straightened with a punch and hammer. Lay the clamp's beveled side down on a solid flat surface and align the thick end of the punch at dead center. Tap the punch lightly until the retaining clamp returns to proper form.

4. Remove the electrode adjustment gauge.

Step 12: Inspect Photo Disc**Figure E12**

1. If the photo disc is not free floating, the electrode clamp bolt has been over-tightened, and has bent the electrode clamp. Using a 10mm socket remove the electrode clamp, and re-straighten.

-Lay the clamp's beveled side down on a solid flat surface and align the thick end of the punch at dead center. Tap the punch lightly until the retaining clamp returns to proper form.

Step 13: Re-Install Diesel Burner**Figure E13a****Figure E13b**

NOTE: When reinstalling the diesel burner be careful not to damage the photo disc or bend the electrodes. Also, be careful to not pinch any wires between the burner and the Aqua-Hot Tank.

1. Align the Diesel-Burner with the Aqua-Hot, using the alignment tabs welded on the Aqua-Hot.
2. Swing the Eye Bolts around the "Ears" on the diesel burner and securely tighten, using a 10mm socket with a 10 inch long extension.

Use extreme caution when tightening down the eye-bolt nuts, over tightening of the eye-bolt nuts can cause the aluminum blower casing to crack. (Torque Specifications = Approximately 20-40 in. lbs.)

Step 14: Plug in the diesel-burner's controller and mount

Figure E14a



1. Locate the Diesel-Burner's Controller and connect both plugs.

NOTE: The Diesel Burner's Controller might have to be mounted onto the side of the diesel burner, before the plugs are inserted into the control unit, otherwise it might not be possible to mount the control unit.

Step 15: Re-Install the Aqua-Hot Access Cover

1. Reinstall the Aqua-Hot's access cover .
 2. Securely tighten the screws securing the access cover in place.
-

Step 16: Test for Normal Operation

- A. Turn the Diesel-Burner switch on, and let the diesel burner run for a complete cycle, until it shuts off on it's own..
- B. After the Diesel-Burner has shut off, turn on the interior heat/run hot water, until the Diesel Burner cycles back on. When the diesel burner cycles back on, check the exhaust for signs of smoke.

WARNING!

Not winterizing the Aqua-Hot when freezing temperatures are present will result in serious damage to the Aqua-Hot's Domestic Water Heating System. Also, be sure to use an FDA approved, "GRAS" rated antifreeze for winterization.

NOTE: The Aqua-Hot can continue to be used for interior zone heating once the domestic water heating system has been drained and winterized.

The Aqua-Hot's Domestic Water Heating System must be completely drained of domestic water any time the heater is stored where freezing temperatures may be experienced.

Winterizing the Domestic Water Heating System:

Please follow these instructions when winterizing the Aqua-Hot's Domestic Water Heating System; reference Figure F1:

1. Completely drain the fresh water storage tank.
2. Disconnect the domestic water demand pump's 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 FDA-approved "GRAS" RV Antifreeze, and turn on the demand water pump.

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 the hot and cold faucets.
6. Turn off Demand Water pump and remove the hose and re-connect the domestic water demand pump's suction line to the fresh water storage tank.

WARNING!

An FDA approved "GRAS" rated winterization antifreeze must be used. **YOU CANNOT BLOW DOMESTIC WATER COIL OUT WITH AIR TO WINTERIZE AQUA-HOT.**

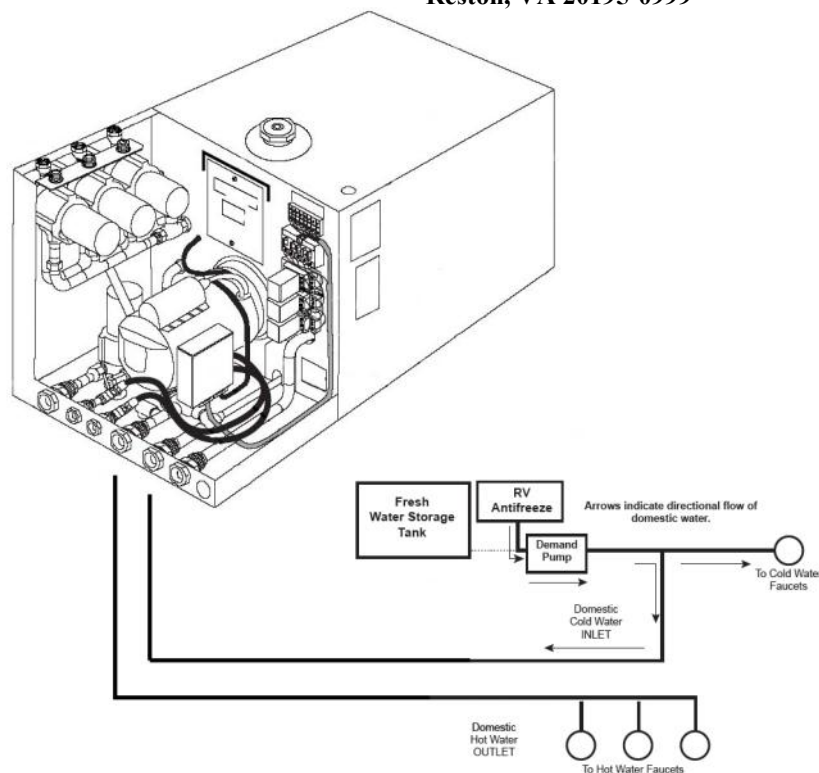
De-Winterizing the Domestic Water Heating System:

For de-winterization, completely fill the fresh water storage tank. Turn on demand water pump and open and close all interior and exterior water faucets, one at a time, until only clear water is present/visible. Reference Figure F1.

If disinfecting the potable water system after de-winterizing, be sure to follow RVIA's "Instructions for Disinfection of Potable Water Systems on Recreation Vehicles." These instructions can be obtained by contacting the Recreational Vehicle Industry Association at (703) 620-6003, visiting them online at www.rvia.com, or writing to them at the following address:

Recreation Vehicle Industry Association
1896 Preston White Drive
P.O. Box 2999
Reston, VA 20195-0999

Figure F1





AHE-100-02S

SERVICE MANUAL



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