

By Vehicle Systems, Inc.

Motor Coach Heating Specialists

Shop Manual

Model Numbers

AHE-100-04S - 12 VDC

AHE-120-04X - 12 VDC

AHE-130-04X - 12 VDC

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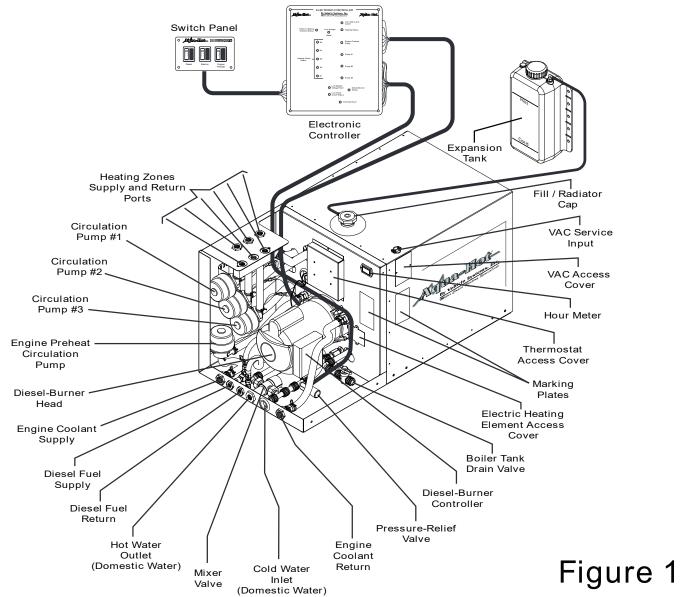
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1.1 Component Overview



1.2 Marking Plate

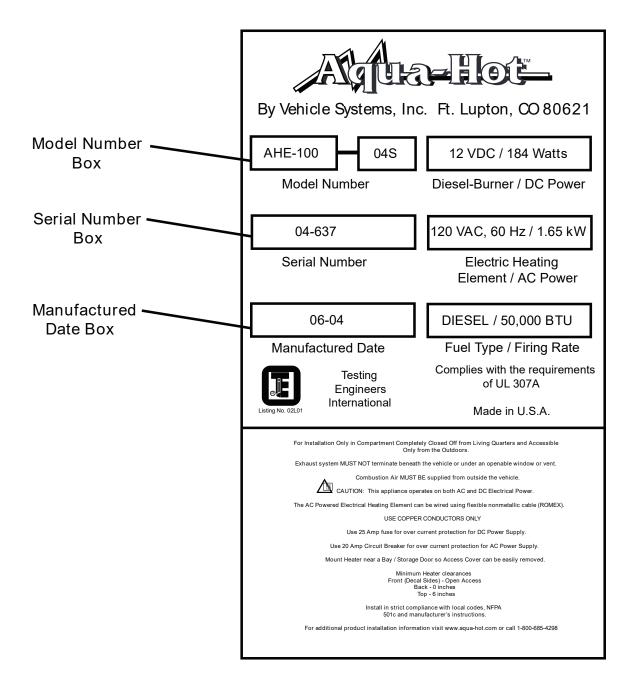
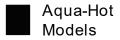


Figure 2

Reference Figure 1 for Marking Plate locations.



2.1 Aqua-Hot Model Differentiation

Vehicle Systems, Inc. manufactures three individual models of the Aqua-Hot Hydronic Heating System. The varying factor between these three models is the number of Electric Heating Elements featured, as well as the voltage employed by each Electric Heating Element. In order to determine which of the following Aqua-Hot models has been employed, locate the Marking Plate on the Heating System (reference Figures 1 and 2 for Marking Plate information) and view the Model number.

AHE-100-04S:

This model features a single 120 VAC/1650 Watt Electric Heating Element.

NOTE: Reference "Appendix A" for Wiring Diagram.

AHE-120-04X:

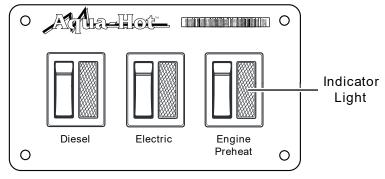
This model features one 120 VAC/1650 Watt Electric Heating Element and one 240 VAC/4500 Watt Electric Heating Element.

NOTE: Reference "Appendix A" for Wiring Diagram.

AHE-130-04X:

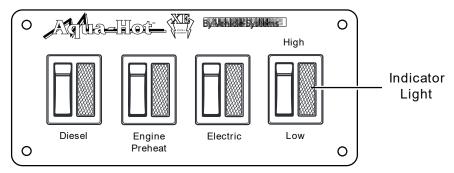
This model features two 120 VAC/2000 Watt Electric Heating Elements.

NOTE: Reference "Appendix A" for Wiring Diagram.



AHE-100-04S Model

Figure 4



AHE-120-04X and AHE-130-04X Models

Switch Panel

3.1 Interior Switch Panel

The Interior Switch Panel serves as an interior means of controlling the separate heating sources of the Aqua-Hot, as well as activating the "Engine Preheat" system, when necessary. The AHE-120-04X and AHE-130-04X dual element Heating Systems feature a "High/Low" switch, in addition to the "Diesel," "Electric," and "Engine Preheat" switches, as utilized by all three Aqua-Hot models; reference Figure 4. Please reference sections 3.2, 3.3, and 3.4 for information regarding the functions of the Interior Switch Panel.

3.2 Diesel Switch

<u>Function</u>: The "Diesel" switch activates the Diesel-Burner, thereby illuminating the indicator light on the switch; reference Figure 4. This procedure allows the Diesel-Burner to operate, which supplies heat to the Aqua-Hot's Boiler Tank. The Diesel-Burner will heat the Aqua-Hot System to the maximum operating temperature (190°F (+/- 5 degrees)) in approximately <u>10-20 minutes</u>. Please note that the Diesel-Burner is the Aqua-Hot's <u>primary heat source</u> for heating both the interior and/or the domestic hot water (such as when cool ambient temperatures exist and/or when there is a <u>high</u> demand for domestic hot water). It should also be noted that the "Diesel" switch indicator light will turn off anytime the Diesel-Burner malfunctions.

Additionally, the "Diesel" switch serves as a method of resetting the "Low Battery Voltage Fault." This reset can be accomplished by turning OFF the "Diesel" switch for approximately 30 seconds, then turning the switch back ON; reference Section 4.4 and 4.11.

3.3 Electric Switch

NOTE: The Electric Heating Element(s) is the Aqua-Hot's <u>secondary heat source</u> 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 <u>low</u> demand for domestic hot water). This feature is only operational whenever the Motorhome is connected to VAC power or when the generator is operating.

AHE-100-04S Model

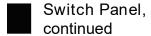
<u>Function:</u> The "Electric" switch activates the Aqua-Hot's Electric Heating Element, thereby illuminating the indicator light on the switch; reference Figure 4. This procedure allows the 120 VAC Electric Heating Element to supply heat to the Aqua-Hot's Boiler Tank. The 120 VAC Electric Heating Element will heat the Aqua-Hot System to the maximum operating temperature (190°F (+/- 5 degrees)) in approximately 1-2 hours.

AHE-120-04X Model

<u>Function</u>: The "Electric" switch, in conjunction with the "High/Low" switch, activates the Aqua-Hot's Electric Heating Element(s), thereby illuminating the indicator light on the switch; reference Figure 4.

Low:

The process of moving the "High/Low" switch to the "Low" position, in conjunction with the activation of the "Electric" switch, allows the 120 VAC/1650 Watt Electric Heating Element to supply heat to the Aqua-Hot's Boiler Tank. The 120 VAC/1650 Watt Electric Heating Element will heat the Aqua-Hot System to the maximum operating temperature (190°F (+/- degrees)) in approximately 1-2 hours.



High:

The process of moving the "High/Low" switch to the "High" position, in conduction with the activation of the "Electric" switch, allows both the 120 VAC/1650 Watt and the 240 VAC/4500 Watt Electric Heating Elements to supply heat to the Aqua-Hot¶ Boiler Tank. The 120 VAC/1650 Watt and 240 VAC/4500 Watt Electric Heating Elements will heat the Aqua-Hot System to the ma[imum operating temperature (1 10 11 (11 5 degrees)) in appro[imately 0.5-1 hour.

AHE-130-04X Model

Function: The "Electric" switch, in conditation with the "High/Low" switch, activates the Aqua-Hot Electric Heating Element(s), thereby illuminating the indicator light on the switch reference Figure

Low:

The process of moving the "High/Low" switch to the "Low" position, in condition with the activation of the "Electric" switch, allows one 120 VAC/2000 Watt Electric Heating Element to supply heat to the Aqua-Hot Boiler Tank. The 120 VAC/2000 Watt Electric Heating Element will heat the Aqua-Hot System to the ma[imum operating temperature (1) 5 degrees)) in appro[imately 1-2 hours.

High:

The process of moving the "High/Low" switch to the "High" position, in condition with the activation of the "Electric" switch, allows both 120 VAC/2000 Watt Electric Heating Elements to supply heat to the Aqua-Hot Boiler Tank. These 120 VAC/2000 Watt Electric Heating Elements will heat the Aqua-Hot System to the ma[imum operating temperature (1 1 degrees)) in appro[imately 0.5-1 hour.

3.4 Engine Preheat Switch

Function: The "Engine Preheat" switch activates the Aqua-Hots Engine Preheat Circulation Pump, thereby illuminating the indicator light on the switch beference Figure This procedure allows the Engine Preheat Circulation Pump to circulate the engine coolant through a separate double-wall copper coil in the Aqua-Hots Boiler Tank, resulting in a warm engine for easy start-ups in cool temperatures. Please note that this feature will be effective only if the "Engine Preheat" switch is ON in condition with either the "Diesel" and/or the "Electric" switch.



4.1 Electronic Controller

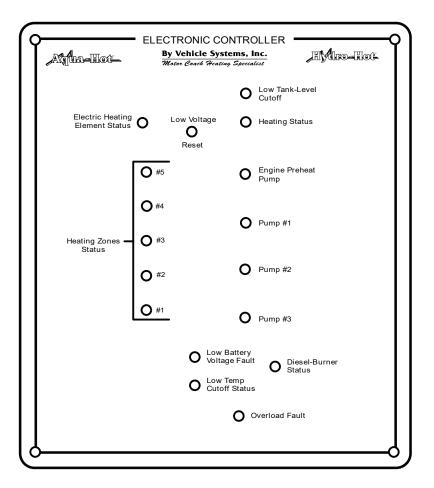


Figure 5

4.2 Electric Heating Element Status Indicator Light

This indicator light will illuminate GREEN whenever the Aqua-Hot's 120 VAC Electric Heating Element is operating and providing the heat to the Aqua-Hot's Boiler Tank; reference Figure 5. Please note that this light will only be active if the "Electric" switch is in the *ON* position; reference Figure 4. If this indicator light illuminates RED, it indicates an electrical or overload condition (i.e., a short) has occurred in the Electric Heating Element's VDC powered circuitry.

4.3 Heating Zone Status Indicator Lights

These five indicator lights (separately) will illuminate GREEN whenever a Zone Thermostat for a particular zone is calling for heat; reference Figure 5. The GREEN indicator lights also indicate that VDC power is being supplied to the particular interior heating zone's Heat Exchangers (i.e., fan motors). If any of the five indicator lights illuminate RED, it indicates that an electrical overload condition (i.e., a short) has occurred in a particular heating zone's circuitry.

NOTE: A short, in either a heating zone's <u>Thermostat</u> or a heating zone's <u>Heat Exchanger</u> circuit, will cause the indicator light to illuminate RED.



4.4 Low Voltage Reset

The Aqua-Hot's Electronic Controller must be manually reset whenever the Low Battery Voltage fault indicator light has been activated; reference Figure 5. The Electronic Controller can be manually reset either by depressing the "Low Voltage Reset" button located on the Electronic Controller (use a thin, straight object to access the reset button through the small hole in the faceplate) or by turning OFF the "Diesel" switch on the Heater's Interior Switch Panel for approximately 30 seconds, then turning the switch back ON.

4.5 Low Tank-Level Cutoff Indicator Light

This indicator light will illuminate RED when either the 120 VAC Electric Heating Element and/or the Diesel-Burner have automatically shut down due to a low water and antifreeze solution level inside the Aqua-Hot's Boiler Tank; reference Figure 5. This fault will automatically reset when the low-level condition is corrected.

4.6 Heating Status Indicator Light

This indicator light will illuminate GREEN whenever the Aqua-Hot's VDC/VAC Control Thermostat is calling for heat, allowing the water and antifreeze solution in the Aqua-Hot's Boiler Tank to be heated by either the Diesel-Burner and/or the 120 VAC Electric Heating Element; reference Figure 5. When this indicator light is off, no heat is being supplied to the Aqua-Hot's Boiler Tank. Please note that this light will only be active if either the "Diesel" and/or the "Electric" switch are turned ON; reference Figure 4.

NOTE: The Aqua-Hot's VDC/VAC Control Thermostat will automatically activate the Diesel-Burner and/or the 120 VAC Electric Heating Element only if the "Diesel" and/or the "Electric" switch is in the ON position. In order to heat the motorhome/domestic hot water, simply choose the desired heat source(s) and leave the switch(s) (i.e., "Diesel" and/or "Electric") ON.

4.7 Engine Preheat Pump Indicator Light

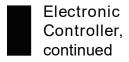
This indicator light will illuminate GREEN whenever the Engine Preheat Pump is operating; reference Figures 1 and 5. Please note that this light will only be active if the "Engine Preheat" switch is ON in conjunction with either the "Diesel" and/or the "Electric" switch; reference Figure 4. If this indicator light illuminates RED, it indicates an electrical overload condition (i.e., a short) has occurred in this particular component's circuitry.

4.8 Pump #1 Indicator Light

This indicator light will illuminate GREEN whenever Circulation Pump #1 is operating; reference Figures 1 and 5. Please note that this light will only be active if the Aqua-Hot is at normal operating temperature (i.e., between 160°F and 190°F) and Heating Zone #1 is calling for heat; reference Appendix A. If this light illuminates RED, it indicates an electrical overload condition (i.e., a short) has occurred in this particular component's circuitry.

4.9 Pump #2 Indicator Light

This indicator light will illuminate GREEN whenever Circulation Pump #2 is operating; reference Figures 1 and 5. Please note that this light will only be active if the Aqua-Hot is at normal operating temperature (i.e., between 160°F and 190°F) and if either Heating Zones #2, #3, or #4 are calling for heat; reference Appendix A. If this light illuminates RED, it indicates an electrical overload condition (i.e., a short) has occurred in this particular component's circuitry.



4.10 Pump #3 Indicator Light

This indicator light will illuminate GREEN whenever Circulation Pump #3 is operating; reference Figures 1 and 5. Please note that this light will only be active if the Aqua-Hot is at normal operating temperature (i.e., between 160°F and 190°F) and Heating Zone #5 is calling for heat; reference Appendix A. If this light illuminates RED, it indicates an electrical overload condition (i.e., a short) has occurred in this particular component's circuitry.

4.11 Low Battery Voltage Fault Indicator Light

This indicator light will illuminate RED whenever the VDC voltage level is too low for the Aqua-Hot to operate properly; reference Figure 5. This fault must be manually reset after the voltage level has been restored to the VDC battery system; reference Section 4.4 for reset instructions.

4.12 Low Temp Cutoff Status Indicator Light

NOTE: This indicator light circuitry is not utilized on these Aqua-Hot models.

4.13 Diesel-Burner Status Indicator Light

This indicator light will illuminate GREEN whenever the Aqua-Hot's Diesel-Burner is operating and supplying heat to the Aqua-Hot's Boiler Tank; reference Figures 1 and 5. Please note that this light will only be active if the "Diesel" switch is turned *ON*; reference Figure 4.

4.14 Overload Fault Indicator Light

This indicator light will illuminate RED (reference Figure 5) whenever one of the following conditions have occurred:

- 1. The Aqua-Hot is off due to an electrical overload (i.e., a short) in the main VDC power supply circuitry.
- 2. The Aqua-Hot is off due to a combination of high electrical VDC power loads and a high surface temperature of the Electronic Controller.

The Electronic Controller will automatically reset once the electrical overload (i.e., a short) and/or the high heat condition is corrected.

5.1 Component Overview

- 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

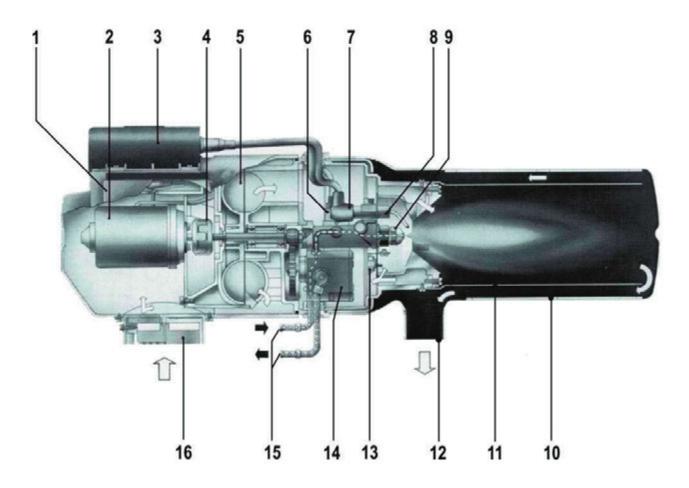


Figure 6

Operation sequence once the Aqua-Hot's Diesel switch is turned ON.

NOTE:

The Diesel switch's Indicator Light will illuminate (reference Figure 4), while the Aqua-Hot Heating Status and Diesel-Burner Status lights illuminate on the Electronic Controller; reference Figure 5.

The Motor (#2), which turns the Combustion Air Blower (#5) and drives the Fuel Pump (#14), will begin to operate.

NOTE:

If the Aqua-Hot's coolant temperature is approximately 190 (+/- 5) degrees Fahrenheit or higher, the Motor (#2) will not operate. Only when the coolant temperature has dropped below 160 (+/- 5) degrees Fahrenheit, and the VDC / VAC Control Thermostat (reference Figure 3) is calling for heat, will the Motor (#2) begin to operate.

After approximately 10 - 25 seconds, the Fuel Solenoid Valve (#6) opens and fuel is sprayed into the Combustion Chamber (#11) through the Fuel Nozzle (#9).

Simultaneously, the Ignition Coil (#3) produces a high voltage spark across the Ignition Electrodes (#8), which ignites the incoming air-fuel mixture.

Once the ignited air-fuel mixture (FLAME) is observed by the Flame Sensor (#13), the Ignition Coil (#3) will automatically switch OFF. The combustion process now continues to operate unassisted.

The combustion process will continue to operate in this manner until one of the following occurs:

A.) The VDC / VAC Control Thermostat (reference Figure 3), which senses coolant temperature, reaches the preset temperature of approximately 190 (+/- 5) degrees Fahrenheit.

NOTE:

If process "A" occurs, the Low Temp Cutoff Status, Aqua-Hot Heating Status, and Diesel-Burner Status lights on the Electronic Controller will go OFF; reference Figure 5.

B.) The Aqua-Hot's Diesel switch is turned OFF.

NOTE:

If process "B" occurs, the Diesel switch's Indicator Light, on the Switch Panel (reference Figure 4), will go OFF along with the Heating Status and Diesel-Burner Status lights on the Electronic Controller; reference Figure 5.

Once the heater switches OFF, thermostatically or manually, the Fuel Solenoid Valve (#6) closes, which interrupts the supply of diesel fuel to the Fuel Nozzle (#9).

The Motor (#2) will continue to run for approximately three (3) additional minutes. This process is refered to as the purge-cycle, which cools the heater's internal components and purges the Combustion Chamber (#11) of any residual exhaust gases.

NOTE:

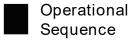
When the Aqua-Hot's Diesel-Burner is switched OFF by the VDC / VAC Control Thermostat (see Figure 3), the following process will take place:

- The Motor (#2) will shut off once the three (3) minute purgecycle has expired.

 -THEN
 -THEN-
 - 2.) The Aqua-Hot's Diesel-Burner will automatically turn back ON once the coolant reaches the preset temperature of approximately 160 (+/- 5) degrees Fahrenheit.

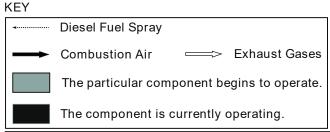
SUMMARY:

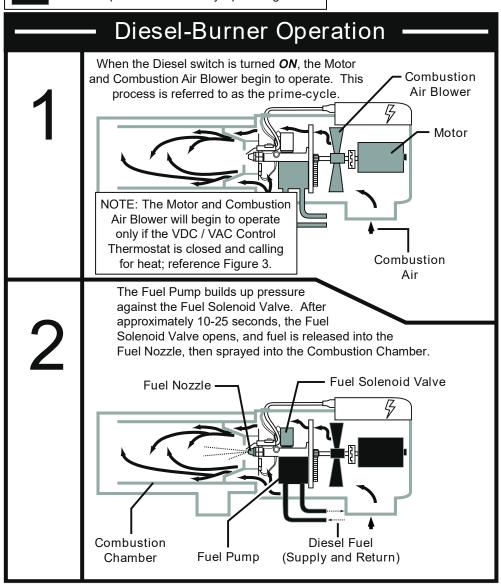
The Aqua-Hot's Diesel-Burner is operational anytime the operator moves the Diesel switch (reference Figure 4) to the ON position. The Diesel-Burner will then automatically maintain the coolant temperature in the Aqua-Hot's Boiler Tank without additional involvement from the operator.

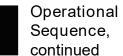


5.3 Operational Sequence

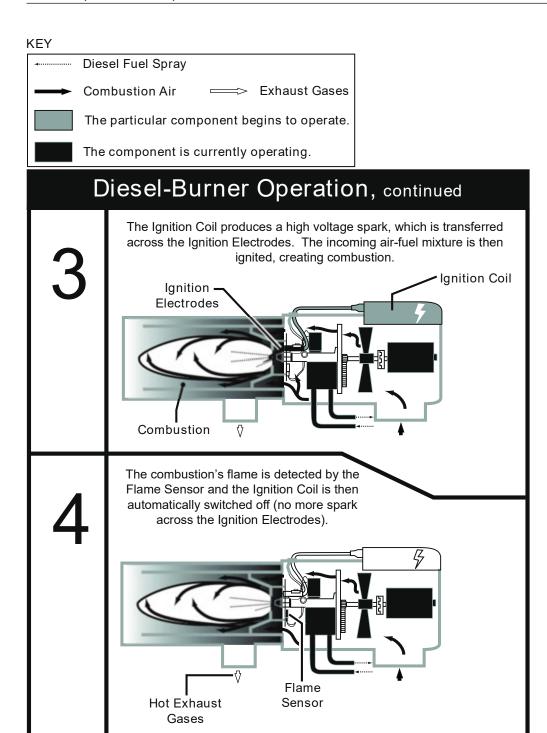
The following sequence illustrates how the Aqua-Hot's Diesel-Burner operates once it is activated. Also, if Diesel-Burner malfunctions are experienced, use the following sequence of operating events as a diagnostic tool to determine the point in the Diesel-Burner's operation that the malfunction occurs. Use the "KEY" provided to understand each symbol shown.







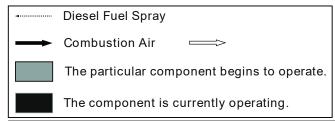
5.3 Operational Sequence



Operational Sequence, continued

5.3 Operational Sequence

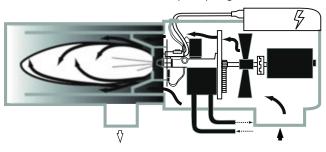
KEY



Diesel-Burner Operation, continued

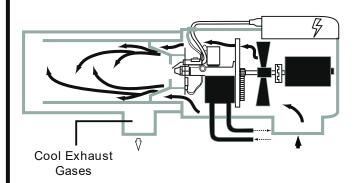
5

The Diesel-Burner will continue to produce heat in this manner until it is switched off either manually or by the VDC / VAC Control Thermostat, which occurs when the coolant temperature in the Aqua-Hot's Boiler Tank reaches 190 (+/- 5) degrees Fahrenheit.



6

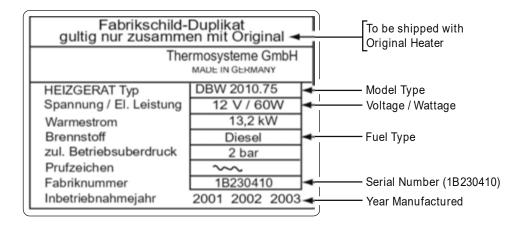
Once the Diesel-Burner has switched OFF, the Motor and Combustion Air Blower will continue to operate for approximately 2-3 minutes. This process is referred to as the purge-cycle.



NOTE: Whenever the Diesel-Burner is switched off by the VDC/VAC Control Thermostat, it will automatically be reactivated once the Aqua-Hot Boiler Tank's coolant reaches the preset temperature of approximately 160 (+/-) 5 degrees Fahrenheit.

I.D. Plate

5.4 Identification Plate



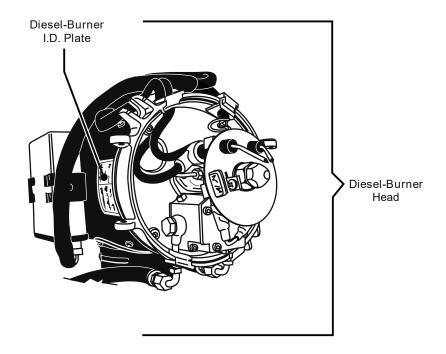


Figure 7

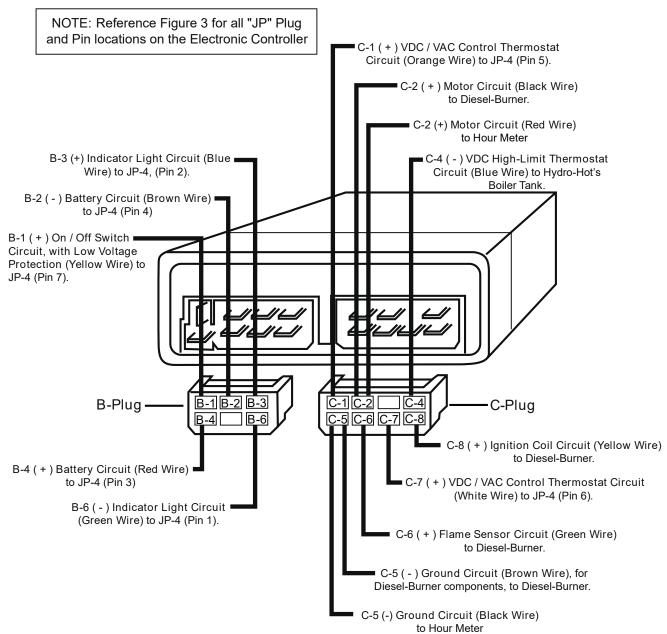


Figure 8

Troubleshooting

This Troubleshooting Section has been separated into various Aqua-Hot Troubleshooting Scenarios, which may be experienced by the heater. Each section listed below begins with the most probable cause and remedy and proceeds to the least probable cause and remedy. This concept has been put in place to expedite the troubleshooting process and pinpoint the problem quicker. However, if additional assistance is needed, please feel free to contact Vehicle Systems' Technical Support Department at 1-800-685-4298 or E-mail the issue to Vehicle Systems' Technical Support Department by going to www.vehiclesys.com and clicking on "Technical Support." Also, please review the following "KEY" prior to troubleshooting, as it may be helpful in understanding the abbreviations used.

KEY:

After turning the "Discol" quitab ON

TS#: (i.e., TS1, TS2,) = Troubleshooting Scenario 1, Troubleshooting Scenario 2,

Q#: (i.e., Q1, Q2,....) = Question 1, Question 2,

A: = Answer

| After turning the "Diesel" switch ON: | Section |
|--|---------|
| TS1 - The Aqua-Hot's Diesel-Burner fails to operate | 7.1 |
| TS2 - The Aqua-Hot's Diesel-Burner operates (3-minute prime cycle only), but does not ignite | 7.2 |
| TS3 - The Aqua-Hot's Diesel-Burner ignites after several starting attempts | 7.3 |
| TS4 - The Aqua-Hot's Exhaust System sputters | 7.4 |
| TS5 - The Aqua-Hot's Exhaust System produces white smoke after ignition | 7.5 |
| TS6 - The Aqua-Hot's Exhaust System produces black smoke after ignition | 7.6 |
| Other troubleshooting issues: | |
| TS7 - The Aqua-Hot is at operating temperature, but an Interior and/or Fresh Water Tank Heating Zone is not producing heat | 7.7 |
| TS8 - The Aqua-Hot is at operating temperature, however the fans of an Interior and/or Fresh Water Heat Exchanger fans are not operating | 7.8 |
| TS9 - The Aqua-Hot is at operating temperature, but the Domestic Hot Water System is not producing hot water | 7.9 |
| After turning the Electric switch ON: | |
| TS10 - The Aqua-Hot's 120 VAC Electric Heating Element does not operate (i.e., lack of hot water and/or interior heat) | 7.10 |
| After turning the Engine Preheat switch ON: | |
| TS11 - The Aqua-Hot's Engine Preheat System does not preheat the engine | 7.11 |

Section 7.1

After turning the "Diesel" switch ON:

TS1 : The Aqua-Hot's Diesel-Burner fails to operate.

NOTE (7.1-A): In order to perform the following checks, it is necessary to locate the Aqua-Hot's Electronic Controller and Switch Panel; reference "Illustration 7.1-1."

Q1: Is the Electronic Controller's Low Tank-Level Cutoff light illuminated?

A: If YES:

Perform each of the following procedures, as necessary, until the problem is resolved.

If NO:

Proceed to Q2.



WARNING: DO NOT remove the Aqua-Hot's Radiator Cap when the heater is at maximum operating temperature; reference Figure 1. Hot coolant can be present, and serious personal injury may result.

- Check the coolant level in the Aqua-Hot's Expansion Tank and the Boiler Tank, if necessary.
 - A: If coolant level is satisfactory:
 Continue troubleshooting.
 If coolant level is low:
 Add coolant and attempt heater restart.
- II. Check for continuity at the Float Switch; reference Figure 1 and Appendix A.

A: If continuity exists:

Continue troubleshooting.

If continuity does not exist:

The Float Switch must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

III. Remove the Electronic Controller's Faceplate and use a jumper wire to make a connection from Pin 15 to Pin 16 on the JP-3 Plug; reference Appendix A.

Does the Emergency Cutoff light go off? (continued on next page)

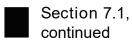
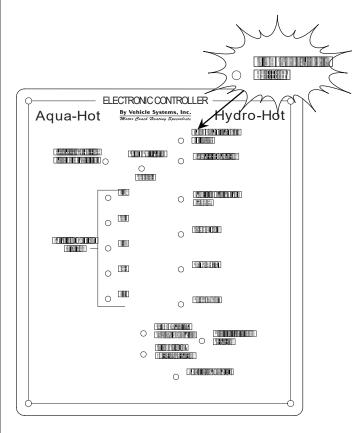
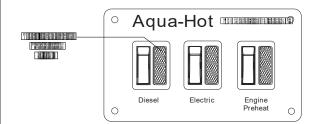


Illustration 7.1-1



Electronic Controller Faceplate



Switch Panel



A: If YES:

Check the JP-3 Plug for loose wire connections and/or harness damage

If NO:

The Electronic Controller must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

Q2: Is the Electronic Controller's Low Battery Voltage Fault light illuminated?

A: If YES:

Perform each of the following procedures, as necessary, until the problem is resolved.

If NO:

Proceed to Q3.

- I. Remove the Electronic Controller's Faceplate. Check the DC battery voltage at the supply batteries and at the Electronic Controller's Battery Connections; reference Appendix A. Both voltage readings should be between 11.5 and 14.0 volts.
 - A: If the voltage level is within specs:
 Continue Troubleshooting.
 If the voltage level is out of specs:
 Recharge and/or replace
 batteries.
- II. Reset the Low Voltage Reset (button) on the Electronic Controller (this can be accomplished either by using a thin, straight object to access the reset button through the small hole in the Faceplate or by turning OFF the "Diesel" switch on the Heater's Interior Switch Panel for approximately 30 seconds, then turning the switch back ON). Continue to read the voltage level at the Electronic Controller's Battery Connections, then, turn the "Diesel" switch ON.

Under load, is the voltage level within 0.5 volts of the supply battery's voltage?

A: If YES:

Reference "NOTE (7.1-B)." If NO:

Load-test the supply batteries, (continued in the next column)



Section 7.1, continued

inspect battery wiring for damage and/or loose connections, and ensure that all of the Aqua-Hot's electrical motors are operating normally when under load.

NOTE (7.1-B): If, after testing and correcting the battery system, the Low Battery Voltage Fault indicator light continues to illuminate, and/or the Low Voltage Reset (button) will not reset, the Electronic Controller must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

Q3: Is the Electronic Controller's Diesel-Burner Status light illuminated?

A: If NO:

Perform each of the following procedures, as necessary, until the problem is resolved.

If YES:

Proceed to Q5.

 Remove the Electronic Controller's Faceplate. Use a jumper wire to make a connection from the Diesel (O) to the Diesel (I) on the JP-2 Plug; reference Appendix A.

Does the Diesel-Burner Status light illuminate?

A: If YES:

The "Diesel" switch must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance. Attempt heater restart.

If NO:

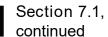
Continue Troubleshooting.

II. Turn the "Diesel" switch OFF (also, make sure the "Electric" switch is OFF). Use a jumper wire to make a connection from Pin 13 to Pin 14 on the JP-3 Plug; reference Appendix A. With the jumper wire in place, turn the "Diesel" switch ON.

Does the Diesel-Burner ignite and the Diesel-Burner Status light illuminate?

A: If YES:

The VDC/VAC Control Thermostat (continued on next page)



must be replaced; reference Appendix A. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

1 N 2 III

The Electronic Controller must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

NOTE (7.1-C): In problems were discovered up to this point, the problem most likely lies within the Diesel-Burner Head However, prior to troubleshooting the Diesel-Burner Head, please review the "Operational Flow-Chart" in Section 5.2, the "Operational Sequence" in Section 5.3, and the "Function" section ach each of the Diesel-Burner Components Headence Sections Through This in mation may help determine at what point the Diesel-Burner has to operate here.

Q4: Is the Diesel-Burner's Motor operating?

A: I he Motor does not seem to be operating

Reference Section 8.3 and perform the Motor's "Component Test."

I Me Motor is operating Continue troubleshooting.

Q5: Is the Diesel-Burner Controller functioning properly?

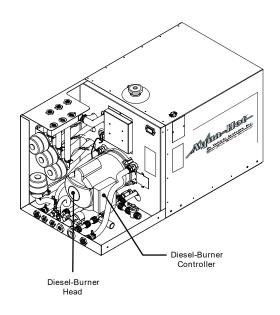
- I. In order to determine i the Diesel-Burner Controller is that ioning properly, reterence Section that pertain the Controller \$\\$^3\)Component Test
 - A: I he Diesel-Burner Controller is not
 The Controller must be replaced;
 reference Section 8.11 for
 replacement instructions.

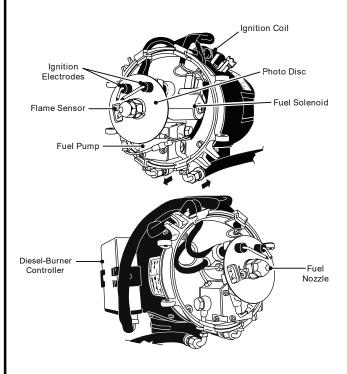
 I he Controller is hectioning properly

Reference "NOTE (7.1-D)."

Section 7.1, continued

Illustration 7.1-2





Section 7.1, continued

NOTE (7.1-D): If the Aqua-Hot still does not operate after performing all of the listed checks, contact the Technical Support Department at 1-800-685-4298 for additional assistance.

Section 7.2

After turning the "Diesel" switch ON:

TS2: The Aqua-Hot's Diesel-Burner operates
(3-minute prime cycle only) but does not ignite.

NOTES (7.2-A):

- A. It is ideal to have the Aqua-Hot's Fuel Filter replaced yearly; reference Section 8.1. A plugged Fuel Filter will not allow the Diesel-Burner to operate properly. Also, before proceeding to the following procedures, be sure to check that the vehicle's fuel tank has a sufficient level of fuel.
- B. In order to perform some of the following procedures, it may be necessary to detach the Diesel-Burner Head from the Aqua-Hot. Therefore, be sure to reference Section 8.2 for detaching and reattaching instructions.
- Q1: Has the Aqua-Hot's VDC High-Limit Thermostat tripped?
- Locate the VDC High-Limit Thermostat and check for continuity; reference Figure 1 and Appendix B.

Is continuity present?

A: If YES:

Proceed to Q2.

If NO:

Press the red reset button located on the VDC High-Limit Thermostat and attempt heater restart.

NOTE (7.2-B): Although the Diesel-Burner is now functioning, be sure to perform the following steps until the cause for overheating has been discovered and corrected. Failure to do so could result in additional overheating incidents.

Section 7.2, continued

- II. Turn the "Diesel" switch ON and allow the Aqua-Hot to reach operating temperature (i.e., until the Diesel-Burner cycles OFF). Locate both the VDC High-Limit Thermostat and the VAC/VDC Control Thermostat and check them for continuity; reference Figure 1 and Appendix B.
 - A: If there is no continuity at the VDC High-Limit Thermostat, but there is continuity at the VAC/VDC Control Thermostat:

The VAC/VDC Control Thermostat must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

If there is continuity at the VDC High-Limit Thermostat, but none at the VAC/VDC Control Thermostat:

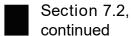
The overheat condition may have been caused by another faulty component, and no further troubleshooting is necessary; reference "NOTE (7.2-C)" and please contact the Technical Support Department at 1-800-685-4298 for additional assistance.

NOTE (7.2-C): If the VDC High-Limit Thermostat continues to trip, and no overheating problems were discovered (i.e., faulty VAC/VDC Control Thermostat or Diesel-Burner Controller), it may be that the VDC High-Limit Thermostat is not operating properly and may need to be replaced.

- Q2: Is the Diesel-Burner's Fuel Nozzle functioning properly?
- I. In order to determine if the Fuel Nozzle is functioning properly, reference Section 8.6 and perform the Fuel Nozzle's "Component Test."
 - A: If the Fuel Nozzle is not functioning properly:

The Fuel Nozzle must be replaced; reference Section 8.6 for replacement instructions.

If the Fuel Nozzle is functioning properly: Continue troubleshooting.



Q3: Is the Diesel-Burner's Fuel Solenoid Valve functioning properly?

- I. In order to determine if the Fuel Solenoid Valve is functioning properly, reference Section 8.7 and perform the Fuel Solenoid Valve's "Component Test."
 - A: If the Fuel Solenoid Valve is not functioning properly:

The Fuel Solenoid Valve must be replaced; reference Section 8.7 for replacement instructions.

If the Fuel Solenoid Valve is functioning properly:

Continue troubleshooting.

- Q4: Is the Diesel-Burner Controller functioning properly?
- I. In order to determine if the Controller is functioning properly, reference Section 8.11 and perform the Controller's "Component Test."
 - A: If the Controller is not functioning properly:

The Controller must be replaced; reference Section 8.11 for replacement instructions.

If the Controller is functioning properly: Continue troubleshooting.

Q5: Is the Diesel-Burner's Ignition Coil functioning properly?

- I. In order to determine if the Ignition Coil is functioning properly, reference Section 8.10 and perform the Ignition Coil's "Component Test."
 - A: If the Ignition Coil is not functioning properly:

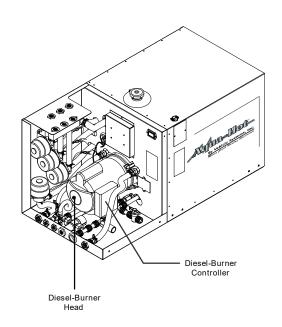
The Ignition Coil must be replaced; reference Section 8.10 for replacement instructions.

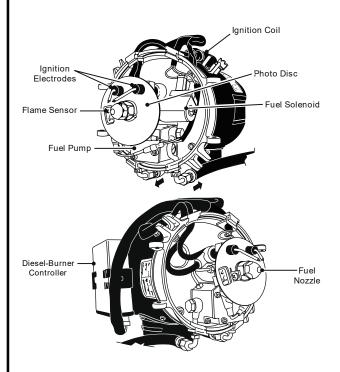
If the Ignition Coil is functioning properly: Continue troubleshooting.

Q6: Are the Diesel-Burner's Ignition Electrodes in good condition and properly adjusted? (continued on next page)

Section 7.2, continued

Illustration 7.2-1





Section 7.2, continued

- I. In order to determine if the Ignition Electrodes are in good condition and properly adjusted, reference Section 8.5.
 - A: If the Ignition Electrodes are in poor condition:

The Ignition Electrodes must be replaced; reference Section 8.5 for replacement instructions.

If the Ignition Electrodes are not properly adjusted:

> Adjust the Ignition Electrodes; reference Section 8.5 for adjustment instructions.

If the Ignition Electrodes are both in good condition and properly adjusted: Continue troubleshooting.

- Q7: Is the Diesel-Burner's Flame Sensor functioning properly?
- I. In order to determine if the Flame Sensor is functioning properly, reference Section 8.4 and perform the Flame Sensor's "Component Test."
 - A: If the Flame Sensor is not functioning properly:

The Flame Sensor must be replaced; reference Section 8.4 for replacement instructions. If the Flame Sensor is functioning properly:

Continue troubleshooting.

- Is the Diesel-Burner's Fuel Pump functioning properly?
- I. In order to determine if the Fuel Pump is functioning properly, reference Section 8.8 and perform the Fuel Pump's "Component Test."
 - A: If the Fuel Pump is not functioning properly:

The Fuel Pump must be replaced; reference Section 8.8 for replacement instructions.

If the Fuel Pump is functioning properly: Reference "NOTE (7.2-D)."



Section 7.2, continued

NOTE (7.2-D): If the Aqua-Hot still does not ignite after performing all of the listed checks, contact the Technical Support Department at 1-800-685-4298 for additional assistance.

Section 7.3

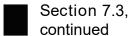
After turning the "Diesel" switch ON:

TS3: The Aqua-Hot's Diesel-Burner ignites after several starting attempts.

NOTES (7.3-A):

- Α. It is ideal to have the Aqua-Hot's Fuel Filter replaced yearly; reference Section 8.1. A plugged Fuel Filter will not allow the Diesel-Burner to operate properly. Also, before proceeding to the following procedures, be sure to check that the vehicle' fuel tank has a sufficient level of fuel
- В. In order to perform the following procedures, it is necessary to detach the Diesel-Burner Head from the Aqua-Hot. Be sure to reference Section 8.2 for detaching and reattaching instructions.
- Q1: Is the Diesel-Burner's Fuel Nozzle functioning properly?
- ١. In order to determine if the Fuel Nozzle is functioning properly, reference Section 8.6 and perform the Fuel Nozzle's "Component Test."
 - A: If the Fuel Nozzle is not functioning properly:

The Fuel Nozzle must be replaced; reference Section 8.6 for replacement instructions. If the Fuel Nozzle is functioning properly: Continue troubleshooting.



Q2: Is the Diesel-Burner's Flame Sensor functioning properly?

- In order to determine if the Flame Sensor is functioning properly, reference Section 8.4 and perform the Flame Sensor's "Component Test."
 - A: If the Flame Sensor is not functioning properly:

The Flame Sensor must be replaced; reference Section 8.4 for replacement instructions. If the Flame Sensor is functioning properly:

Continue troubleshooting.

- Q3: Are the Diesel-Burner's Ignition Electrodes in good condition and properly adjusted?
- In order to determine if the Ignition Electrodes are in good condition and properly adjusted, reference Section 8.5.
 - A: If the Ignition Electrodes are in poor condition:

The Ignition Electrodes must be replaced; reference Section 8.5 for replacement instructions.

If the Ignition Electrodes are not properly adjusted:

Adjust the Ignition Electrodes; reference Section 8.5 for adjustment instructions.

If the Ignition Electrodes are both in good condition and properly adjusted:

Continue troubleshooting.

- Q4: Is the Diesel-Burner's Fuel Pump functioning properly?
- In order to determine if the Fuel Pump is functioning properly, reference Section 8.8 and perform the Fuel Pump's "Component Test."
 - A: If the Fuel Pump is not functioning properly:

The Fuel Pump must be replaced; reference Section 8.8 for replacement instructions.

If the Fuel Pump is functioning properly: Continue troubleshooting.

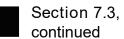
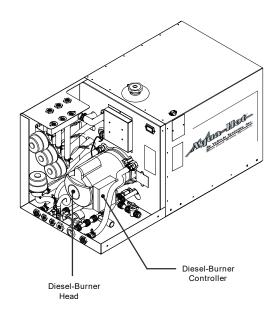
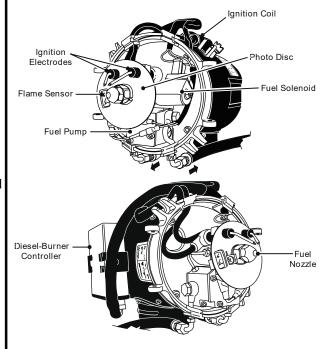


Illustration 7.3-1





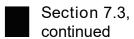
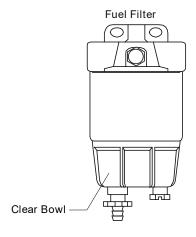
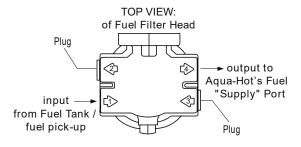
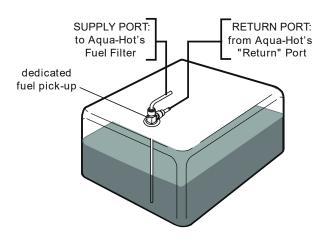


Illustration 7.3-2







Fuel Pick-up Pipe Illustration



Section 7.3, continued

Q5 :

Is the Diesel-Burner's Fuel Supply System functioning properly?

<u>Quick Check</u>: With the Diesel-Burner ignited, listen for constant sputtering from the Aqua-Hot's exhaust system.

A: If constant sputtering exists:

Continue troubleshooting.

If constant sputtering does not exist:

Proceed to Q6.

NOTE (7.3-B): Inspect the clear bowl of the Fuel Filter for water. If water exists, be sure to purge the Aqua-Hot's entire fuel system prior to replacing the Fuel Filter. Attempt heater restart; reference "Illustration 7.3-2."

I. Clamp off and remove the Aqua-Hot's Fuel Return Line; reference Figure 1. Now attach a short piece of fuel line to the Aqua-Hot's Fuel Return Port and place the other end in a container of diesel fuel. Remove the clamp and ensure that the fuel line is completely submersed in the fuel, then, turn the "Diesel" switch ON.

Are air bubbles visible in the container of fuel when the Diesel-Burner is operating?

A: If air bubbles are not visible:

Proceed to Q6.

If air bubbles are visible:

You will need to inspect the fuel system (supply side) for air leaks. Therefore, be sure to perform the inspections listed below until the air leak has been detected:

 Inspect the fuel system (supply side) from the vehicle's fuel tank to the Diesel-Burner. Inspect the fuel system for loose fuel connections at the Aqua-Hot and Diesel-Burner, as well as the vehicle's fuel tank. Tighten, if necessary. Also, check that all Fuel Filter Head fittings are securely tightened; reference "NOTE (7.3-C)."

Section 7.3, continued

NOTE (7.3-C): Be sure to check that each fitting at the Fuel Filter Head contains thread sealant. A fitting without thread sealant could result in an air leak. Be sure to clamp off both fuel lines at the filter head prior to any fitting removal. If fittings are removed and reinstalled, be sure to remove the fuel line clamps prior to attempting a heater restart. Failure to do so could result in serious damage to the Diesel-Burner's Fuel Pump.

2. Once the potential air leak has been discovered and corrected, reattach the Aqua-Hot's Fuel Return Line and attempt heater restart. Does the Aqua-Hot's exhaust system still sputter?

If the exhaust system is still sputtering:

Continue performing air leak
inspections until all air leaks have
discovered and corrected.

Q6: Is the Diesel-Burner's Controller functioning properly?

- I. In order to determine if the Controller is functioning properly, reference Section 8.11 and perform the Controller's "Component Test."
 - A: If the Controller is not functioning properly:

The Controller must be replaced; reference Section 8.11 for replacement instructions.

If the Controller is functioning properly: Continue troubleshooting.

Q7: Is the Diesel-Burner's Ignition Coil functioning properly?

- In order to determine if the Ignition Coil is functioning properly, reference Section 8.10 and perform the Ignition Coil's "Component Test."
 - A: If the Ignition Coil is not functioning properly:

The Ignition Coil must be replaced; reference Section 8.10 for replacement instructions. (continued in the next column)

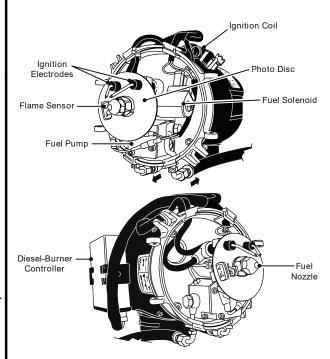


Section 7.3, continued

Illustration 7.3-3

If the Ignition Coil is functioning properly: Reference "NOTE (7.3-D)."

NOTE (7.3-D): If the Aqua-Hot still does not ignite after several starting attempts and all of the listed checks were performed, contact the Technical Support Department at 1-800-685-4298 for additional assistance.



Section 7.4

After turning the "Diesel" switch ON:

TS4: The Aqua-Hot's exhaust system sputters.

NOTE (7.4-A): Before advancing to the following procedures, be sure to check that the vehicle's fuel tank has a sufficient level of fuel.

Q1: Is the Diesel-Burner's Fuel Nozzle functioning properly?

 In order to determine if the Fuel Nozzle is functioning properly, reference Section 8.6 and perform the Fuel Nozzle's "Component Test."

A: If the Fuel Nozzle is not functioning properly:

The Fuel Nozzle must be replaced; reference Section 8.6 for replacement instructions. If the Fuel Nozzle is functioning properly:

Continue troubleshooting.

Q2: Is the Diesel-Burner's Fuel Supply System functioning properly?

<u>Quick Check:</u> With the Diesel-Burner ignited, listen for constant sputtering from the Aqua-Hot's exhaust system.

A: If constant sputtering exists:

Continue troubleshooting.

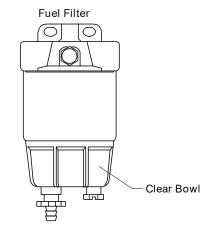
NOTE (7.4-B): Inspect the clear bowl of the Fuel Filter for water. If water exists, be sure to purge the Aqua-Hot's entire fuel system prior to replacing the Fuel Filter. Attempt heater restart; reference "Illustration 7.4-1."

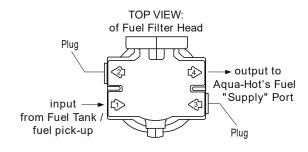
I. Clamp off and remove the Aqua-Hot's Fuel Return Line; reference Figure 1. Now attach a short piece of fuel line to the Aqua-Hot's Fuel Return Port and place the other end in a container of diesel fuel. Remove the clamp and ensure that the fuel line is completely submersed in the fuel, then, turn the "Diesel" switch ON.

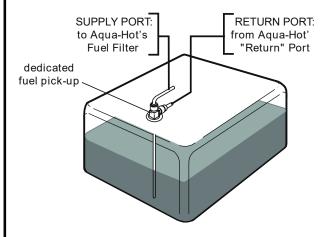
Are air bubbles visible in the container of fuel when the Diesel-Burner is operating? (continued on next page)

Section 7.4, continued

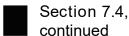
Illustration 7.4-1







Fuel Pick-up Pipe Illustration



A: If air bubbles are not visible:

Reference "NOTE (7.4-D)."

If air bubbles are visible:

You will need to inspect the fuel system (supply side) for air leaks. Therefore, be sure to perform the inspections listed below until the air leak has been detected:

 Inspect the fuel system (supply side) from the vehicle's fuel tank to the Diesel-Burner. Inspect the fuel system for loose fuel connections at the Aqua-Hot and Diesel-Burner, as well as the vehicle's fuel tank. Tighten, if necessary. Also, check that all Fuel Filter Head fittings are securely tightened; reference "NOTE (7.4-C)."

NOTE (7.4-C): Be sure to check that each fitting at the Fuel Filter Head contains thread sealant. A fitting without thread sealant could result in an air leak. Be sure to clamp off both fuel lines at the filter head prior to any fitting removal. If fittings are removed and reinstalled, be sure to remove both clamps prior to attempting a heater restart. Failure to do so could result in serious damage to the Diesel-Burner's Fuel Pump.

2. Once the potential air leak has been discovered and corrected, reattach the Aqua-Hot's Fuel Return Line and attempt heater restart. Does the Aqua-Hot's exhaust system still sputter?

If the exhaust system is still sputtering:

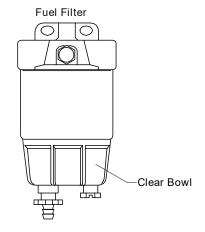
Continue performing air leak
inspections until all air leaks have
been discovered and corrected.

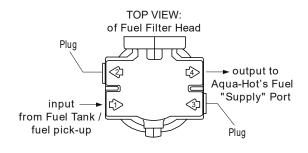
NOTE (7.4-D): If the Aqua-Hot's exhaust system still sputters after performing all of the listed checks, contact the Technical Support Department at 1-800-685-4298 for additional assistance.

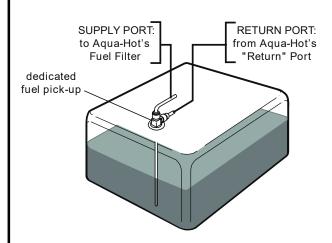


Section 7.4, continued

Illustration 7.4-2







Fuel Pick-up Pipe Illustration

Section 7.5

After turning the "Diesel" switch ON:

TS5: The Aqua-Hot's exhaust system produces white smoke after ignition.

Q1: Is the Diesel-Burner's Fuel Nozzle functioning properly?

I. In order to determine if the Fuel Nozzle is functioning properly, reference Section 8.6 and perform the Fuel Nozzle's "Component Test."

A: If the Fuel Nozzle is not functioning properly:

The Fuel Nozzle must be replaced; reference Section 8.6 for replacement instructions.

If the Fuel Nozzle is functioning properly: Continue troubleshooting.

Q2: Is the Diesel-Burner's Fuel Pump producing the proper pressure?

I. In order to determine if the Fuel Pump is producing the proper pressure, reference Section 8.8 and perform the Fuel Pump's "Fuel Pressure Adjustment Check."

A: If the Fuel Pump is not producing the correct pressure:

Adjust the fuel pressure to 145 psi.

If the Fuel Pump is producing the correct pressure:

Continue troubleshooting.

NOTE (7.5-A): Be sure to check that the Ignition Electrode's Retaining Clamp Bolt has not been overtightened; reference Figure 16. Overtightening can result in a bound-up (i.e., rigid) Photo Disc. Not allowing the Photo Disc to float freely (i.e., a loose fit) will cause poor combustion and result in smoky exhaust. If a tight Photo Disc exists, reference Section 8.5 and perform the "Ignition Electrode Adjustment Procedure."

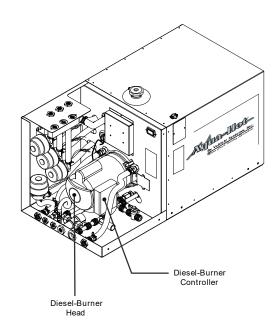
Q3: Is the Diesel-Burner's Fuel Supply System functioning properly?

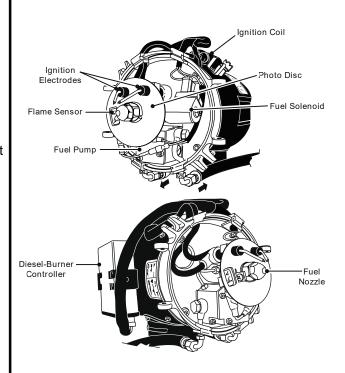
<u>Quick Check</u>: With the Diesel-Burner ignited, look for constant white smoke from the Aqua-Hot's exhaust system.

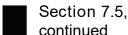
(continued on next page)



Illustration 7.5-1







A: If constant white smoke exists:

Continue troubleshooting.

NOTE (7.5-B): Inspect the clear bowl of the Fuel Filter for water. If water exists, be sure to purge the Aqua-Hot's entire fuel system prior to replacing the Fuel Filter. Attempt heater restart; reference "Illustration 7.5-2."

I. Clamp off and remove the Aqua-Hot's Fuel Return Line; reference Figure 1. Now attach a short piece of fuel line to the Aqua-Hot's Fuel Return Port and place the other end in a container of diesel fuel. Remove the clamp and ensure that the fuel line is completely submersed in the fuel, then, turn the "Diesel" switch ON.

Are air bubbles visible in the container of fuel Zhen the Diesel-Burner is operating?

A: If air bubbles are not visible:

Proceed to Q6.

If air bubbles are visible:

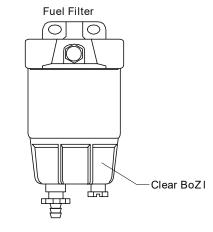
<ou Zill need to inspect the fuel system (supply side) for air leaks. Therefore, be sure to perform the inspections listed beloZ until the air leak has been detected:

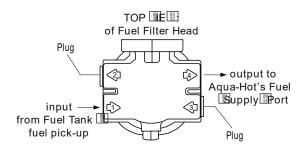
 Inspect the fuel system (supply side) from the vehicle's fuel tank to the Diesel-Burner. Inspect the fuel system for loose fuel connections at the Aqua-Hot and Diesel-Burner, as Zell as the vehicle's fuel tank. Tighten, if necessary. Also, check that all Fuel Filter Head fittings are securely tightened; reference "NOTE (7.5-C)."

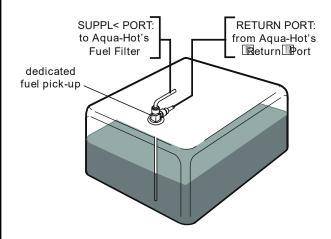
NOTE (7.5-C): Be sure to check that each fitting at the Fuel Filter Head contains thread sealant. A fitting without thread sealant could result in an air leak. Be sure to clamp off both fuel lines at the filter head prior to any fitting removal. If fittings are removed and reinstalled, be sure to remove both clamps prior to attempting a heater restart. Failure to do so could result in serious damage to the Diesel-Burner's Fuel Pump.

Section 7.5, continued

Illustration 7.5-2







Fuel Pick-up Pipe Illustration

Section 7.5, continued

 Once the potential air leak has been discovered and corrected, reattach the Aqua-Hot's Fuel Return Line and attempt heater restart. Does the Aqua-Hot's exhaust system still sputter?

If the exhaust system is still sputtering:

Continue performing the air leak inspection until all air leaks have been discovered and corrected.

NOTE (7.5-D): If the Aqua-Hot's exhaust system still produces white smoke after performing all of the listed checks, contact the Technical Support Department at 1-800-685-4298 for additional assistance.

Section 7.6

After turning the "Diesel" switch ON:

TS6: The Aqua-Hot's exhaust system produces black smoke after ignition.

NOTE (7.6-A): In order to perform the following checks, it is necessary to locate the Aqua-Hot's Electronic Controller and Switch Panel; reference "Illustration 7.6-1."

Q1: Is the Electronic Controller's Low Battery Voltage Fault light illuminated?

A: If YES:

Perform each of the following procedures, as necessary, until the problem is resolved.

If NO:

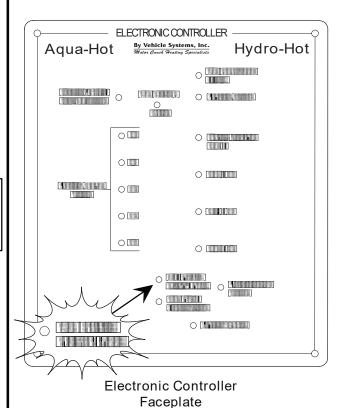
Proceed to Q2.

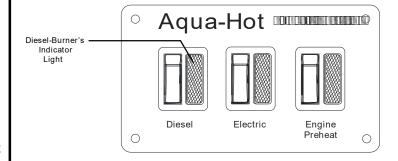
- I. Remove the Electronic Controller's Faceplate. Check the DC battery voltage level at the supply batteries and at the Electronic Controller's Battery Connections; reference Appendix A. Both voltage readings should be between 11.5 and 14.0 volts.
 - A: If the voltage level is within specs:
 Continue troubleshooting.

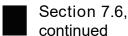
 If the voltage level is out of specs:
 Recharge and/or replace batteries, if necessary.

Section 7.6, continued

Illustration 7.6-1







II. Reset the Low Voltage Reset (button) on the Electronic Controller (this can be accomplished either by using a thin, straight object to access the reset button through the small hole in the Faceplate or by turning OFF the "Diesel" switch on the Heater's Interior Switch Panel for approximately 30 seconds, then turning the switch back ON). Continue to read the voltage level at the Electronic Controller's Battery Connections and then turn the "Diesel" switch ON.

Under load, is the voltage level within boots of the supply batteries' voltage.

A: If YES:

Reference "NOTE (7.6-A)." If NO:

Load-test the supply batteries, inspect battery wiring for damage and/or loose connections, and ensure that all of the Aqua-Hot lectrical motors are operating normally when under load.

NOTE (7.6-B): If, after testing and correcting the battery system, the Low Battery Voltage Fault indicator light continues to illuminate, and/or if the Low Voltage Reset (button) will not reset, the Electronic Controller must be replaced. Please contact the Technical Support Department at 1-44-44-45 assistance.

NOTE (7.6-C): In order to perform some of the following procedures, it may be necessary to detach the Diesel-Burner Head from the Aqua-Hot. Therefore, be sure to reference Section 8.2 for detaching and reattaching instructions.

Q2: Is the Diesel-Burner's Fuel Nozzle functioning properly?

- In order to determine if the Fuel Nozzle is functioning properly, reference Section 8.6 and perform the Fuel Nozzle's "Component Test."
 - A: If the Fuel Nozzle is not functioning properly:

The Fuel Nozzle must be replaced; reference Section for replacement instructions. (continued on ne[t page)

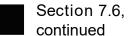
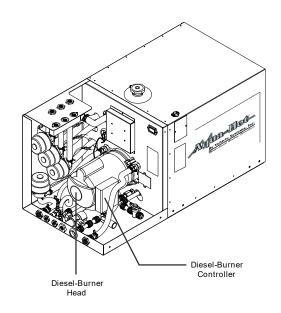
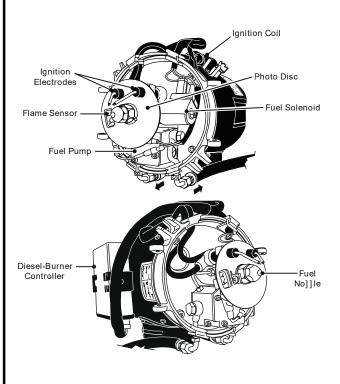


Illustration 7.6-1







Section 7.6,

continued

If the *Fuel Nozzle* is functioning properly: **Continue troubleshooting.**

Q3: Is the Diesel-Burner's *Motor* operating at the proper RPM speed?

I. In order to determine if the *Motor* is operating properly, reference Section 8.3 and perform the Motor's "RPM Test."

A: If the *Motor* is not operating at the proper RPM:

The *Motor* must be replaced; reference Section 8.3 for replacement instructions.

If the *Motor* is operating at the proper RPM:

Continue troubleshooting.

Q4: Is the Diesel-Burner's Combustion Air Intake adjusted properly?

A: See the "NOTE" below.

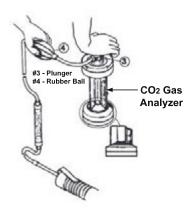
NOTE (7.6-D): In order to determine if the Diesel-Burner's *Combustion Air Intake* is adjusted properly, a CO₂ Gas-Analyzer will be required; reference "Illustration 7.6-3." Also, reference Section 11 for the Bacharach Fyrite CO₂ Analyzer's part number information, if necessary.

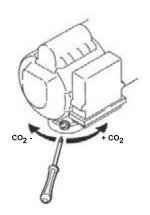
- I. When using the Bacharach Fyrite CO₂ Analyzer, turn the "Diesel" switch ON and allow the Diesel-Burner to ignite and operate for approximately 2 minutes. Then perform the following procedures:
 - 1. Place the small end of the CO₂
 Analyzer's suction hose into
 the Aqua-Hot's *Exhaust Pipe*.
 - Place the round plunger connection of the suction hose on the CO₂ Analyzer's "Plunger." Press down on the suction hose with the palm of your hand until the CO₂ Analyzer's "Plunger" is fully compressed. This will allow a sample of the Aqua-Hot's exhaust to enter the CO₂ Analyzer; reference "Illustration 7.6-3."



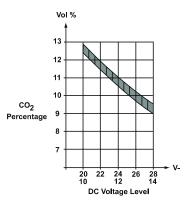
Section 7.6, continued

Illustration 7.6-3





Combustion Air Intake Adjustment



CO2 - Value Chart



- 3. Pump the rubber ball 18 times.
- 4. Release the suction hose from the CO₂ Analyzer's plunger.
- Turn the CO₂ Analyzer upside down to allow the fluid to advance to the top, then, turn the Analyzer right side up again. Perform this procedure twice.
- 6. Place the CO₂ Analyzer on a flat surface and read the CO₂ level.
- 7. The CO₂ level should be between 10.5 and 11.5 percent (at a nominal 12 volts-DC). If the CO₂ level is not within the specs, an adjustment of the Diesel-Burner's Combustion Air Intake will be necessary; reference "Illustration 7.6-3." Once the proper CO₂ adjustment has been made, be sure to tighten the adjustment screw.

NOTE (7.6-E): In temporary high altitude situations (less available oxygen) the CO₂ will rise by 0.3% CO₂ per 1,000 feet of elevation (e.g., a Diesel-Burner adjusted at sea level should register approximately a 1.5% higher CO₂ reading when in Denver, Colorado (5,000 above sea level)). If permanently residing in a high altitude area, be sure to properly adjust the Diesel-Burner so that it operates within the 10.5% - 11.5% CO₂ range.

Section 7.6, continued

NOTES (7.6-F): If the proper CO₂ value cannot be obtained, perform each of the following inspections, as necessary, until the cause has been detected:

- A. Check the rubber Grommets on the top and bottom of the Diesel-Burner Head's cast-aluminum Blower Casing to ensure they are securely in place.
- B. Check the Diesel-Burner Head for proper alignment (torque specification = approximately 20-40 in.lbs.); reference Section 8.2.
- C. Check to ensure that the Diesel-Burner's Fuel Pump is producing the proper pressure. In order to determine if the Fuel Pump is producing the proper pressure, reference Section 8.8 and perform the Fuel Pump's "Fuel Pressure Adjustment Check."
- D. Check and reset the Combustion Air Blower gap, if applicable. In order to determine if the Combustion Air Blower's gap is set properly, reference Section 8.9 and perform Steps 1-6 and 11-17 of the Bearings "Replacement Procedure."
- E. Reference "NOTE (7.6-F)."

NOTE (7.6-G): If the Aqua-Hot's exhaust system still produces black smoke after performing all of the listed checks, contact the Technical Support Department at 1-800-685-4298 for additional assistance.

■ Section 7.7

After turning the "Diesel" switch ON:

TS7: The Aqua-Hot is at operating temperature, but an Interior and/or Fresh Water Tank Heating Zone is not producing heat.

Q1: Is the particular Heating Loop's Circulation Pump operating?

Quick Check - Remove the Aqua-Hot's Access Cover and determine if the problem Heat Exchanger(s) is plumbed with Circulation Pump #1, Circulation Pump #2, or Circulation Pump #3; reference Figure 1 and "Appendix B." Once the particular Circulation Pump has been isolated, locate and activate the Room Thermostat for that particular heating zone. View the Circulation Pump's Motor through the clear, plastic cover to check for operation.

Is the Circulation Pump operating/rotating?

A: If YES:

Check the particular Heating Loop's plumbing system for kinks and/or any other types of flow restrictions.

If NO:

Perform each of the following procedures, as necessary, until the problem is resolved:

- 1. Locate the Electronic Controller and remove the Faceplate.
- Locate the Electronic Controller's JP-3 Plug and insert the probes of a DC voltmeter into the particular Circulation Pump's Pin locations; reference Appendix A:

Circulation Pump #1 Pins 6(-) and 5(+)

Circulation Pump #2 Pins 4(-) and 3(+)

Circulation Pump #3 Pins 2(-) and 1(+)

Section 7.7, continued

Observe the DC voltage on the voltmeter.

Does a nominal 12 Volt-DC voltage reading register on the voltmeter?

A: If YES:

The Circulation Pump must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

If NO:

The Electronic Controller must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

Section 7.8

After turning the "Diesel" switch ON:

TS8: The Aqua-Hot is at operating temperature; however, the Interior and/or Fresh Water

Tank Heat Exchanger fans are not operating.

Q1: Is the Tank Sensor Pin Jumper on the Electronic Controller properly installed?

I. Remove the Faceplate from the Electronic Controller, allowing the Electronic Controller's Printed Circuit Board to be exposed. Locate the "TANK SEN" Pins located on the bottom right-side of the Electronic Controller's Printed Circuit Board; reference "Illustration 7.8-1."

Is the Pin Jumper properly installed with the Pin Jumper covering both pins in order to provide continuity?

A: If YES:

Continue troubleshooting.

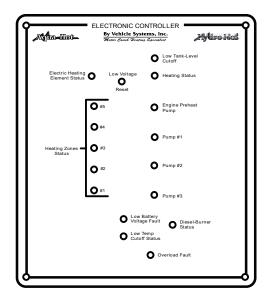
If NO:

Reseat the Pin Jumper on both pins.

NOTE: If reseating the Pin Jumper does not correct the non-functioning Heat Exchanger Fan failure, the Electronic Controller may need to be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

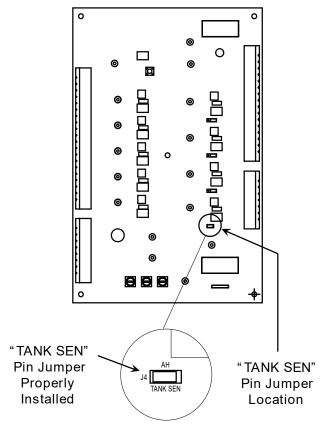
Section 7.8, continued

Illustration 7.8-1



Electronic Controller Faceplate

Electronic Controller Printed Circuit Board



Section 7.9

After turning the "Diesel" switch ON:

TS9: The \$Tua-+ot is at operating temperature, but the domestic hot water system is not producing hot water.

Is the Aqua-Hot's 7empering 9alYe properly set?

<u>Hick Check:</u> The Tempering Valve should be preset on the valve's number "3" setting; reference "Illustration 7.9-1."

A: If YES:

Continue troubleshooting. If NO:

AdMst the 7empering 9alYe to the number "3" setting and retest the domestic hot water system.

Is the Aqua-Hot's Keating solution utili] ing the proper mixture of antifree] e and water?

NOTE (7.9-A): This Aqua-Hot product utilizes an FDA approved GRAS Propylene Glycol (P.G.) antifreeze and water heating solution. This P.G. based heating solution utilizes a Boiler type antifreeze, which is Generally Recognized as Safe ("GRAS") by the FDA. A 50/50 heating solution of P.G. antifreeze and water is recommended to provide the best overall domestic hot water and interior heating performance (50% P.G. antifreeze and 50% water).

refractometer (reference Section 11 for special tools information), test the concentration of the antifreeze and water heating solution. An antifreeze concentration higher than 50% will cause poor domestic hot water performance.

A: If YES:

Continue troubleshooting. If NO:

AdMst the antifree] e and water Keating solution accordingly until the proper concentration is obtained.

Is the shower's IbZ rate (i.e., Gallons per Inute), of domestic hot water, too high? Reference "NOTE (7.9-B)."



Section 7.9, continued

NOTE (7.9-B): Domestic hot water flow rates exceeding 1.5 Gallons per Minute (GPM) can contribute to poor domestic hot water performance. However, this is directly dependent upon the temperature of the incoming domestic cold water to the Aqua-Hot's domestic hot water system. Therefore, please be sure to reference the informational graph, contained within Section 7.9, regarding the theoretical performance of the Aqua-Hot's domestic hot water system.

Cylinder (or an equivalent one-gallon Graduated Cylinder (or an equivalent one-gallon container), measure the time it takes the shower to produce one gallon of hot water, then utilize the chart below to determine the shower's GPM flow rate:

15 seconds = 4.0 GPM 20 seconds = 3.0 GPM 25 seconds = 2.4 GPM 30 seconds = 2.0 GPM 35 seconds = 1.7 GPM 40 seconds = 1.5 GPM 45 seconds = 1.3 GPM 50 seconds = 1.2 GPM 55 seconds = 1.1 GPM 60 seconds = 1.0 GPM

A: If YES:

Please contact the Technical Support Department at 1-800-685-4298 for additional assistance.

If NO:

If the shower's IDZ rate is less than 1.5 GP II and the Aqua-Hot still fails to produce hot water, please contact the Technical Support Department at 1-800-685-4298 for additional assistance.

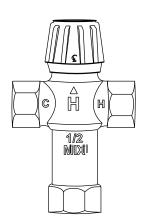
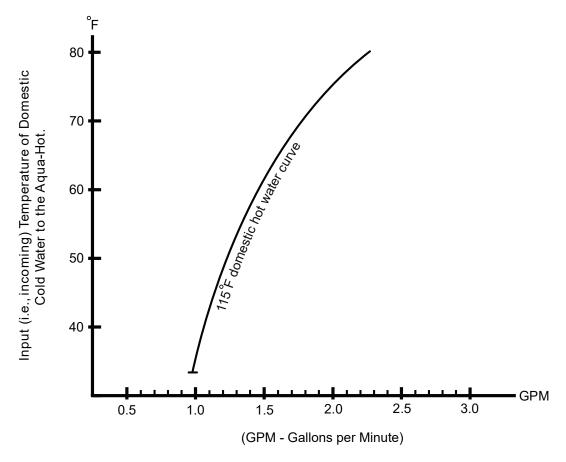


Illustration 7.9-1

Tempering Valve correctly set to "3."

Section 7.9, continued

The chart below is a graphical representation of how the Aqua-Hot's Domestic Hot Water System theoretically performs under varying incoming domestic cold water temperatures. Because each Aqua-Hot has a performance tolerance, this graphic should be used as a general guideline and not as actual domestic hot water performance data.



The estimated domestic cold water flow rate required to maintain an approximate 115°F domestic hot water output temperature.

Notes of Interest

When water is heated to...

156 degrees - Hot water causes a third-degree burn in one second

149 degrees - Hot water causes a third-degree burn in two seconds

133 degrees - Hot water causes a third-degree burn quickly

115-120 degrees - General purpose temperatures

107 - 109 degrees - Average "Hot-Tub" temperatures

105 degrees - Average "Shower" temperature

Section 7.10

After turning the "Electric" switch ON:

TS10: The Aqua-Hot's 120 VAC Electric Heating
Element does not operate (i.e., lack of hot
water and/or interior heat).

Q1: Is the Electronic Controller's Electric Heating Element Status light illuminated? (Reference Figure 5.)

NOTE (7.10-A): The temperature of the Aqua-Hot's Boiler Tank must be below 160°F prior to performing this test.

A: If YES:

Perform each of the following procedures, as necessary, until the problem is resolved.

- Locate the Electronic Controller and remove the Faceplate.
- With the "Electric" switch ON, locate the Electronic Controller's JP-3 Plug and check for DC voltage at Pin 11 (+) and Pin 12 (-); reference Appendix A.

If voltage is present:

Check for loose wire connections at Pin 11 (+) and Pin 12 (-) of the JP-3 Plug. If the wire connections are in good condition, proceed to Q2.

If no voltage is present:

The Electronic Controller must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

If NO:

Perform each of the following procedures, as necessary, until the problem is resolved.

- 1. Locate the Electronic Controller and remove the Faceplate.
- Locate the Electronic Controller's JP-2 Plug. Use a jumper wire to make a connection from the Electric (O) pin to the Electric (I) pin; reference Appendix A.

Does the Electronic Controller's Electric Heating Element Status light illuminate? (continued in next column)

Section 7.10, continued

A: If YES:

Check for loose wire connections at the "Electric" switch and at the JP-2 Plug's Electric (O) and Electric (I) pins. If connections are in good condition, replace the "Electric" switch.

If NO:

Locate the Electronic Controller's JP-2 Plug and check for DC voltage at the Electric (O) and Electric (I) pins; reference Appendix A and "NOTE (7.10-B)."

NOTE (7.10-B): Both "Electric" pins (i.e., (O) and (I)) should indicate a positive (+) DC voltage. Therefore, be sure to utilize the "JP7 GND" stud as a ground (-) source when performing this DC voltage check.

If no voltage is present:

The Electronic Controller must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

Q2: Has the Aqua-Hot's VAC High-Limit Thermostat tripped?



WARNING: Turn the VAC breaker OFF prior to performing the following checks. Failure to do so may result in serious bodily injury (i.e., electrical shock).

 Remove the Aqua-Hot's Thermostat Access Cover and locate the VAC High-Limit Thermostat; reference Figure 1. Check for continuity at the VAC High-Limit Thermostat.

Is continuity present?

A: If YES:

Proceed to Q3.

If NO:

Press the red reset button located on the VAC High-Limit Thermostat and retest for continuity.

NOTE (7.10-C): Although the 120 VAC Electric Heating Element should now function properly, be sure to perform the following steps until the cause for overheating has been discovered and corrected. Failure to do so could result in additional overheating incidents.



Section 7.10,

continued

- I. Turn the "Diesel" switch **ON** and allow the Aqua-Hot to reach maximum operating temperature (i.e., until the Diesel-Burner cycles **OFF**). Locate both the VAC High-Limit Thermostat and the VAC/VDC Control Thermostat and check for continuity; reference Figure 1.
 - **A:** If there is no continuity at the VAC High-Limit Thermostat, but there is continuity at the VAC/VDC Control Thermostat:

The VAC/VDC Control Thermostat must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

If there is continuity at the VAC High-Limit Thermostat, but none at the VAC/VDC Control Thermostat:

The overheat condition may have been caused by another faulty component, and no further troubleshooting is necessary; reference "NOTE (7.10-D)." Please contact the Technical Support Department at 1-800-685-4298 for additional assistance.

NOTE (7.10-D): If the VAC High-Limit Thermostat continues to trip, and no overheating problems were discovered (i.e., faulty VAC/VDC Control Thermostat), it may be that the VAC High-Limit Thermostat is not operating properly and may need to be replaced.

Q3: Is VAC power being supplied to the VAC Relay?



WARNING: The following checks need to be performed with the motorhome connected to VAC power. Therefore, be sure to use extreme caution when performing each check, as 120 VAC power will be present at each of the electrical components. Failure to do so may result in serious bodily injury (i.e., an electrical shock).



Section 7.10,

continued

NOTE (7.10-E): The Temperature of the Aqua-Hot's *Boiler Tank* must be below 160°F prior to performing this test.

I. Turn the "Electric" switch **ON** and uncover the VAC Relay located on the reverse side of the Thermostat Access Cover; reference Figure 1. Check for AC voltage at both Black (+) wires ("120 VAC Power Supply") connections on the VAC Relay; reference Appendix A. Be sure to utilize the "JP7 GND" stud as a ground source when performing this AC voltage check.

Is voltage present?

A: If YES:

Proceed to Q4.

If NO:

- 1. Check for loose wire connections at the Motorhome's VAC junction box.
- 2. If the VAC wire connections are in good condition, please proceed to step 3.
- 3. Check the VAC Relay to ensure that it is functioning properly.

NOTE (7.10-F): Inspect the *VAC Relay* for damage. If visual signs of damage exist, the *relay* must be replaced.

I. Disconnect both Black VAC wires from the VAC Relay terminals. Activate the "Electric" switch ON and OFF, then check for continuity across the two open terminals. Please note, with the "Electric" switch ON, continuity should be present at the relay's terminals. With the "Electric" switch OFF, no continuity should be present.

Is continuity present across the two terminals of the VAC Relay?

A: If YES:

Proceed to Q4.

If NO:

The VAC Relay must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.



Section 7.10, continued

Q4: Is the 120 VAC Electric Heating Element functioning properly?



WARNING: The following checks need to be performed with the Motorhome connected to VAC power. Therefore, be sure to use extreme caution when performing each check, as 120 VAC power will be present at each of the electrical components. Also, be sure to disconnect VAC power prior to replacing any electrical components. Failure to do so may result in serious bodily injury (i.e., an electrical shock).

I. Disconnect the Motorhome from VAC shore power and switch-off the Motorhome's Generator. Uncover the 120 VAC Electric Heating Element located behind the Electric Heating Element Access Cover; reference Figure 1. Remove both the Black and White wires from the 120 VAC Electric Heating Element terminals. Check for continuity across the two open terminals.

Is continuity present?

A: If YES:

Reference "NOTE (7.10-F)." If NO:

> The 120 VAC Electric Heating Element must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

NOTE (7.10-F): If the 120 VAC Electric Heating Element still does not seem to operate after performing all of the listed checks, contact the Technical Support Department at 1-800-685-4298 for additional assistance.

Section 7.11

After turning the "Engine Preheat" switch ON:

TS11: The Aqua-Hot's Engine Preheat System does not preheat the engine.

NOTE (7.11-A): The "Diesel" or "Electric" switch must be activated, along with the "Engine Preheat" switch, prior to performing the following checks.

Q1: Is the Electronic Controller's Engine Preheat Pump light illuminated? (Reference Figure 5.)

A: If YES:

Perform each of the following procedures, as necessary, until the problem is resolved.

- 1. Locate the Electronic Controller and remove the Faceplate.
- 2. Locate the Electronic Controller's JP-3 Plug and check for DC voltage at Pin 7 (+) and Pin 8 (-); reference Appendix A.

If voltage is present: Check for loose wire connections at Pin 7 (+) and Pin 8 (-) of the JP-3 Plug. Also, check the wire connections at the Engine Preheat Pump. If all connections are in good condition, observe the Engine Preheat Pump to ensure that it is operating/rotating; reference Figure 1. If the Engine Preheat Pump is not operating/rotating, it must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance. If no voltage is present: The Electronic Controller must be replaced. Please contact the

If NO:

Perform each of the following procedures, as necessary, until the problem is resolved.

1-800-685-4298 for assistance.

Technical Support Department at

- 1. Locate the Electronic Controller and remove the Faceplate.
- 2. Locate the Electronic Controller's JP-2 Plug. Use a jumper wire to make a connection from the Preheat (O) pin to the Preheat (I) pin; reference Appendix A.

Section 7.11, continued

Does the Electronic Controller's Engine Preheat Pump light now illuminate?

A: If YES:

Check for loose wire connections at the "Engine Preheat" switch and at the JP-2 Plug's Preheat (O) and Preheat (I) pins; reference Appendix A. If connections are in good condition, the "Engine Preheat" switch must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

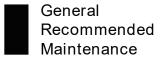
If NO:

Locate the Electronic Controller's JP-2 Plug and check for DC voltage at the Preheat (O) pin; reference Appendix A.

NOTE (7.11-B): Be sure to utilize the "JP7 GND" stud as a ground (-) source when performing this DC voltage check.

If no voltage is present: The Electronic Controller must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance. If voltage is present: Reference "NOTE (7.11-C)."

NOTE (7.11-C): If the Engine Preheat Pump still does not appear to operate after performing all of the listed checks, contact the Technical Support Department at 1-800-685-4298 for additional assistance.



8.1 General Recommended Maintenance

Monthly

Check the Aqua-Hot's water and antifreeze solution to ensure that it is at the proper level. Do this by visually checking the coolant level in the Aqua-Hot's Expansion Tank; reference Figure 1. This should be checked <u>only</u> when the Aqua-Hot is at maximum operating temperature (i.e., when the Diesel-Burner cycles OFF), "HOT."



WARNING: When the Aqua-Hot is at maximum operating temperature (HOT), <u>DO NOT</u> loosen the Radiator Cap. If removed, scalding by hot vapor or coolant could result.

If the coolant needs replenishing, fill the Aqua-Hot's Expansion Tank to the FULL HOT level mark. Be sure to reference the Aqua-Hot "Owner's Manual" for the proper antifreeze type and mixture. If coolant frequently needs replenishing, please contact the Technical Support Department at 1-800-685-4298 for assistance.

Annually

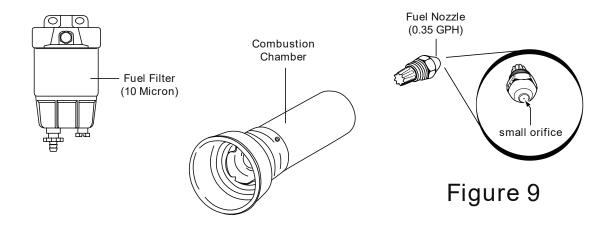


WARNING: Before cleaning or servicing, disconnect all power supplies.

To keep the Aqua-Hot running smoothly, it is ideal 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, if necessary (reference Figure 9). To ensure maximum Diesel-Burner performance, always use the recommended Fuel Nozzle and Fuel Filter (i.e., 10 Micron) when replacing these parts. Reference Section 10 for spare parts information.

NOTE: Be sure to use care when handling the 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 (i.e., excessive smoking).

CAUTION: Operating the Aqua-Hot's Diesel-Burner or the 120 VAC Electric Heating Element without the water and antifreeze solution will cause serious damage to the heater.



Detaching and Reattaching the Diesel-Burner Head

8.2 Detaching and Reattaching the Diesel-Burner Head

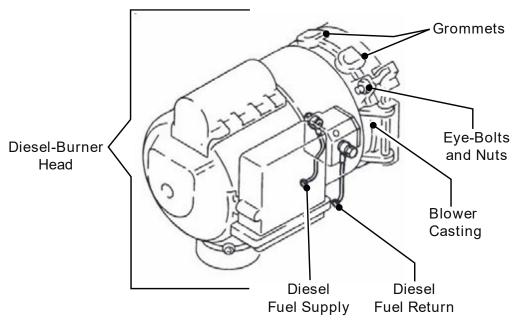


Figure 10



WARNING: Be sure to turn the "Diesel" switch OFF and disconnect the B-Plug Harness from the Diesel-Burner's Controller prior to detaching the Diesel-Burner Head; reference Figures 8 and 26. Failure to do so may result in the ignition of the Diesel-Burner and serious bodily injury.

- 1. Loosen the two Eye-Bolt Nuts and swing the Eye-Bolts out of the way; reference Figure 10.
- 2. With both hands, carefully pull the Diesel-Burner Head away from the Aqua-Hot (approximately 4-5 inches). Please note that you may have to lift the Diesel-Burner Head slightly while pulling it away from the Aqua-Hot.
- 3. Rotate the Diesel-Burner Head upward until all internal components are visible.

CAUTION: When reattaching the Diesel-Burner Head, be sure to properly align the Diesel-Burner Head before tightening the Eye-Bolt Nuts. Also, visually inspect all of the rubber Grommets on the top and bottom of the Diesel-Burner Head's cast-aluminum Blower Casting to ensure they are in place. DO NOT overtighten the Eye-Bolt Nuts (torque specification = approximately 20-40 in. lbs.). An improper alignment and/or an overtightening of the Eye-Bolt Nuts can cause damage to the Diesel-Burner Head's cast-aluminum Blower Casting; reference Figure 10.

Motor 8.3 Motor

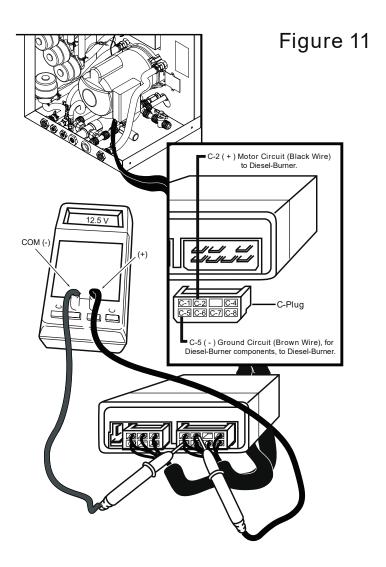
Function: The Motor drives the Combustion Air Blower and the Fuel Pump.

NOTE: In order to perform the following procedures, it may be necessary to detach and reattach the Diesel-Burner Head. Therefore, be sure to reference Section 8.2 for detaching and reattaching instructions.

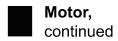
NOTE: The functionality of each component can be determined by completing the manual checks, as listed in the "Component Test," or the components can be tested by using a "Controller Tester." Reference Section 11 for Special Tools information.

Component Test: Locate the Diesel-Burner Controller's C-Plug and insert the probes of a DC voltmeter into the C-2 (+) and C-5 (-) locations; reference Figure 11. Turn the "Diesel" switch **ON** and observe the voltage level. If a nominal voltage registers on the voltmeter and the Motor is not operating, inspect the C-Plug Harness for loose or damaged wire connections. If the C-Plug Harness and connections are in good condition, the Motor must be replaced; reference the Motor's "Replacement Procedure" in this section.

Cleaning Tips/Maintenance: N/A



SECTION 8: DIESEL-BURNER SERVICE, MAINTENANCE, AND REPAIR INFORMATION

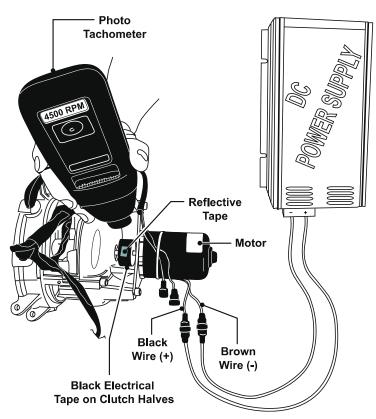


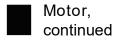
Adjustment Procedure: N/A

RPM Test: Disconnect the *Ignition Cables* from the *Ignition Electrodes*; reference Figure 16. Remove the four *Ignition Coil Screws*, which secure the *Ignition Coil* to the *Protection Housing*; reference Figure 13. Lift the *Ignition Coil* and disconnect its *wires* from the C-Plug Harness *wires* prior to removing. Remove the *Protection Housing* from the *Diesel-Burner*, allowing the *Motor and Clutch Halves* to be exposed; reference Figures 12 and 13. Place a few wraps of black electrical tape around the *Clutch Halves*, then, place a small piece of reflective tape over the black tape as illustrated in Figure 12. Disconnect the Motor's *Black* (+) and *Brown* (-) wires from the C-Plug Harnesses' *Black* (+) and *Brown* (-) wires; reference Figures 12 and 13. Connect the Motor's *wires* directly to a 12 Volt-DC power supply; reference Figure 12. Turn the power supply *ON* and use a photo-tachometer to test for a proper RPM reading; reference Figure 12. At approximately 12.5 Volts-DC, the RPM reading should be 4500 RPMs (+/- 300 RPMs). If the Motor's RPM reading is not within the above specs, the *Motor* must be replaced; reference the Motor's Replacement Procedure" in this section. Reference Section 10 for spare part number information.

NOTE: Prior to reattaching the *Diesel-Burner Head* or replacing the *Motor* (if applicable), be sure to test the Diesel-Burner's *Bearings*. Worn *Bearings* can cause lower than normal RPM readings and premature *Motor* wear. To properly test for worn *Bearings*, reference Section 8.9 for the Bearings "Function Test."







Replacement Procedure:

- Remove the four Ignition Coil Mounting Screws, which secure the Ignition Coil to the Protection Housing; reference Figure 13. Lift the Ignition Coil to disconnect its wires from the C-Plug Harness wires prior to removing. Remove the Protection Housing from the Diesel-Burner to expose the Motor and Clutch Halves; reference Figures 13 and 14.
- 2. Remove the three Hex Head Screws, which secure the Motor and flange assembly to the Blower Housing; reference Figure 13. Remove the Motor and flange assembly along with the Clutch Halves; reference Figures 13 and 14. Disconnect the Motor's Black (+) and Brown (-) wires from the C-Plug Harness' wires; reference Figure 13.

NOTE: Inspect the Clutch Halves for cracks and 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. Reference the Aqua-Hot's "Parts Manual" for spare parts information.

3. Detach the Motor from the Motor Flange by removing the two Phillips Head Screws, which fasten the two parts together; reference Figure 13.

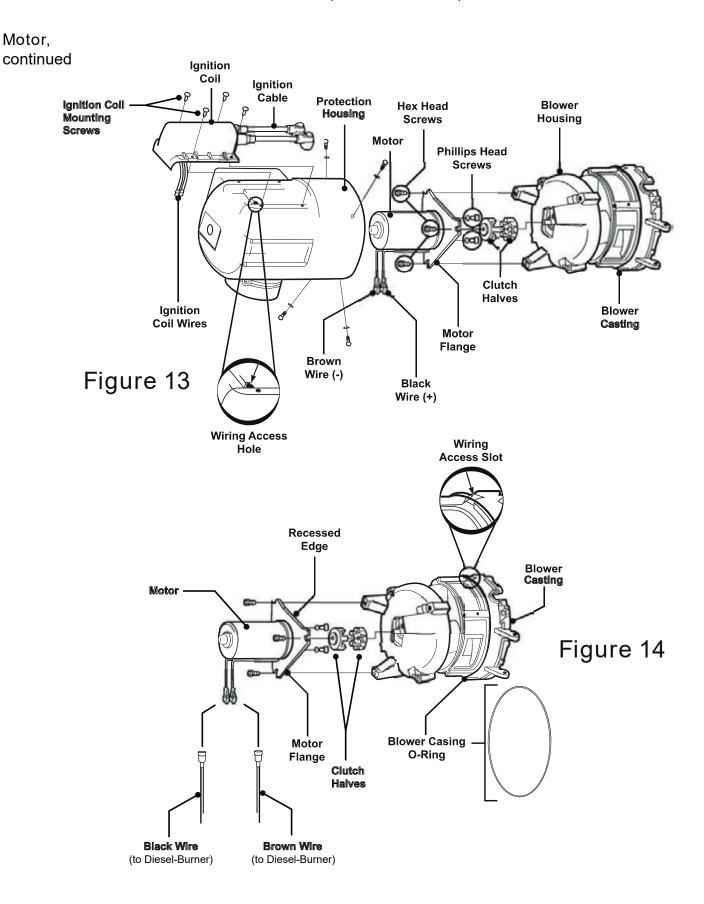
NOTES:

- A: 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. To properly test for worn Bearings, reference Section 8.9 for the Bearings "Function Test."
- B: 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; reference Figure 14. This will ensure a proper Protection Housing fit.
- 4. Reinstall a Clutch Half on both the new Motor's shaft and the Combustion Air Blower's shaft. Attach the Motor and the flange assembly, with the recessed edge of the Motor Flange in-line with the Wiring Access Slot of the Blower Casting, to the Blower Housing with the three Hex Head Screws; reference Figure 14.

NOTE: Inspect the Blower Casing's O-Ring for damage or wear prior to reinstalling the Diesel-Burner Head's Protection Housing; reference Figure 14.

If damage or wear exists, replace the O-Ring. Reference the Aqua-Hot's "Parts Manual" for spare parts information.

- 5. Connect the Black (+) and Brown (-) wires of the new Motor to the C-Plug Harness' Black (+) and Brown (-) wires; reference Figure 13. Feed the C-Plug Harness' Yellow and Brown wires back through the Wiring Access Hole in the Protection Housing; reference Figure 13.
- 6. Reinstall the Protection Housing. Reconnect the Black (+) and Brown (-) wires of the Ignition Coil to the C-Plug Harness' Yellow (+) and Brown (-) wires; reference Figure 24. Reinstall the Ignition Coil and secure to the Protection Housing with the four Ignition Coil Mounting Screws; reference Figure 13.





8.4 Flame Sensor

<u>Function</u>: The Flame Sensor is a photoresistive device, which supplies the Diesel-Burner's Controller with a DC voltage signal when it detects a flame (i.e., a light source).

NOTE: The functionality of each component can be determined by completing the manual checks, as listed under the "Component Test" area for each individual component, or the components can be tested by using a "Controller Tester." Reference Section 11 for Special Tools information

NOTES:

A: In order to perform the following procedures, it is necessary to detach and reattach the Diesel-Burner Head. Therefore, be sure to review Section 8.2 for detaching and reattaching instructions.

B: Be sure to calibrate your ohmmeter prior to checking the Flame Sensor for proper resistance values.

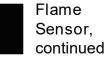
Component Test: Locate and detach the Flame Sensor's Green and Blue wires from the C-Plug Harness wires; reference Figure 15. Connect the Flame Sensor's Green and Blue wires to an ohmmeter; reference Figure 15. Check resistance by placing a shop rag over the Flame Sensor's glass surface to simulate a no-flame condition, then, remove the rag (and expose to a light source) to simulate a flame condition. If the Flame Sensor is operating properly, the ohmmeter should register high resistance (i.e., $100K\ \Omega +)$ when the glass surface is covered and less than $300\ \Omega$ when exposed to a light source. If these resistance numbers cannot be obtained, the Flame Sensor must be replaced; reference the Flame Sensor's "Replacement Procedure" in this section. Reference Section 10 for spare parts information.

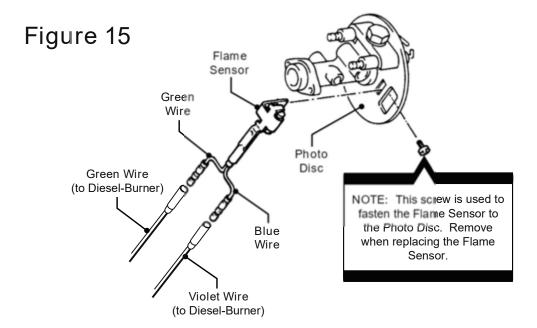
<u>Cleaning Tips/Maintenance</u>: For light dirt, dust, and/or carbon deposits, simply wipe off the Flame Sensor with a soft cloth. Should heavy carbon deposits exist, completely remove the Flame Sensor form the Photo Disc and clean with brake cleaner; reference Figure 15.

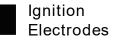
Adjustment Procedure: N/A

Replacement Procedure:

- Remove the Screw, which 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; reference Figure 15.
- Slide the tab of the new Flame Sensor into the provided slot in the Photo Disc and secure in place with the screw; reference Figure 15. 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; reference Figure 15.







8.5 Ignition Electrodes

<u>Function</u>: The Diesel-Burner's Ignition Coil (reference Figure 24) produces a high voltage ignition spark across the Ignition Electrodes, which ignites the incoming air/fuel mixture.

NOTE: The functionality of each component can be determined by completing the manual checks, as listed under the "Component Test" area for each individual component, or the components can be tested by using a "Controller Tester." Reference Section 11 for Special Tools information.

NOTE: In order to perform the following procedures, it is necessary to detach and reattach the Diesel-Burner Head. Therefore, be sure to review Section 8.2 for detaching and reattaching instructions.

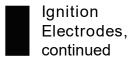
Component Test: N/A

Cleaning Tips/Maintenance: Polish away any carbon deposits, which may have baked onto the metal tips of the Ignition Electrodes with a Scotch Brite® pad (or similar); reference Figure 16. If the Ignition Electrode's electrical insulator (reference Figure 16) is cracked and/or damaged, the Ignition Electrode must be replaced; reference the Ignition Electrode "Replacement Procedure" in this section. Reference Section 10 for spare parts information.

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 side.

Adjustment Procedure: An adjustment of the Ignition Electrodes can be accomplished by performing the following procedure:

- 1. Slightly loosen the Retaining Clamp Bolt; reference Figure 16.
- 2. Place the Electrode Adjustment Gauge on the Fuel Nozzle Manifold Hex (reference Figure 17) and insert the metal tips of the Ignition Electrodes



into the appropriate notches of the Electrode Adjustment Gauge as illustrated in Figure 16.

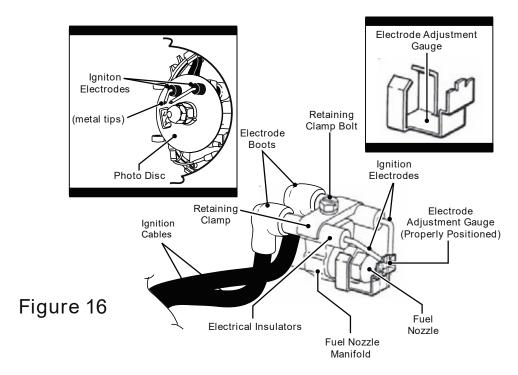
3. Tighten the Retaining Clamp Bolt.

NOTE: Be sure not to overtighten the Retaining Clamp Bolt when readjusting the Ignition Electrodes. Overtightening the Retaining Clamp Bolt will bend the Retaining Clamp and prevent the Photo Disc from floating freely (i.e., loose fit). Not allowing the Photo Disc to float freely will cause poor combustion and result in a smoky exhaust. A bent Retaining Clamp can be restraightened 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 (i.e., flat).

4. Remove the Electrode Adjustment Gauge and reattach to the Diesel-Burner Head.

Replacement Procedure:

- Disconnect the Ignition Cables from the Ignition Electrodes and slightly loosen the Retaining Clamp Bolt just enough to allow the Ignition Electrodes to be removed; reference Figure 16.
- 2. Slide the new Ignition Electrodes up through the Retaining Clamp and Photo Disc. Do not tighten the Retaining Clamp Bolt at this time.
- 3. Perform Steps 2 through 4 of this section's "Adjustment Procedure" to complete the Ignition Electrode installation. Once Steps 2 through 4 have been performed, reconnect the Ignition Cables to the Ignition Electrodes; reference Figure 16.





8.6 Fuel Nozzle

<u>Function</u>: 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 ignited within the Combustion Chamber.

NOTE: The functionality of each component can be determined by completing the manual checks, as listed under the "Component Test" area for each individual component, or the components can be tested by using a "Controller Tester." Reference Section 11 for Special Tools information.

NOTE: In order to perform the following procedures, it is necessary to detach and reattach the Diesel-Burner Head. Therefore, be sure to review Section 8.2 for detaching and reattaching instructions.

<u>Component Test</u>: Remove both Ignition Cables from the Ignition Electrodes; reference Figure 16.



WARNING: Failure to remove the Ignition Cables/Electrode Boots from the Ignition Electrodes (reference Figure 16), will result in a <u>HIGH</u>

<u>VOLTAGE</u> shock and/or a fire. Also, be sure to place a piece of electrical tape on the end of each Electrode Boot.

Remove the B-Plug from the Diesel-Burner's Controller; reference Figure 8. Turn the "Diesel" switch *ON* (reference Figure 4), then, plug the B-Plug back into the Controller to activate the Diesel-Burner. After approximately 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. Remove the B-Plug from the Controller. If the cone-shaped spray pattern did not appear, the Fuel Nozzle must be replaced; reference the Fuel Nozzle's "Replacement Procedure" in this section. Reference Section 10 for spare parts information.

<u>Cleaning Tips/Maintenance</u>: The Fuel Nozzle is a precision calibrated part and <u>cannot</u> be cleaned or serviced. A replacement of the Fuel Nozzle is recommended annually. Reference Section 8.1 for maintenance information.

Adjustment Procedure: N/A

Replacement Procedure:

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; reference Figure 17.

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 (i.e., excessive smoking).

2. When replacing the Fuel Nozzle, be sure to tighten the nozzle, loosen it a 1/4 turn, then, firmly retighten. 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. Reference Section 8.5 for the Ignition Electrode "Adjustment Procedure."

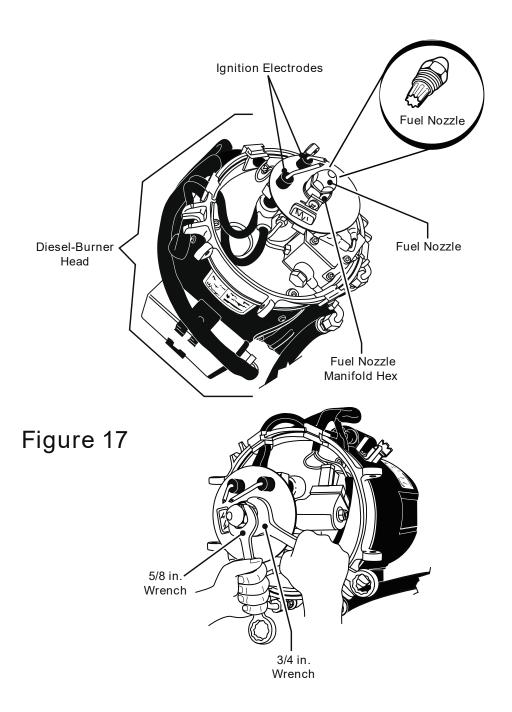
3. After replacing the Fuel Nozzle, reattach the Diesel-Burner Head.





WARNING: 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 (reference Figure 4) for 5 seconds, then turn it OFF. This will activate the Diesel-Burner's prime-cycle (will operate the Diesel-Burner's "Motor" for 2-3 minutes) and flush the fuel system of any potential contaminants. Perform this procedure twice.





8.7 Fuel Solenoid Valve

<u>Function</u>: The Fuel Solenoid Valve allows the flow of diesel fuel to the Diesel-Burner's Fuel Nozzle.

NOTE: In order to perform the following procedures, it is necessary to detach and reattach the Diesel-Burner Head. Therefore, be sure to review Section 8.2 for detaching and reattaching instructions.

NOTE: The functionality of each component can be determined by completing the manual checks, as listed under the "Component Test" area for each individual component, or the components can be tested by using a "Controller Tester." Reference Section 11 for Special Tools information.

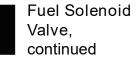
Component Test: Locate and detach the C-Plug Harness' Violet (+) and Brown (-) wires from the Fuel Solenoid Valve. Connect the (-) lead of a 12 Volt-DC power supply to the Fuel Solenoid's (-) Electrical Terminal; reference Figure 18. Now, intermittently apply the (+) lead of the power supply to the Fuel Solenoid's (+) Electrical Terminal and listen for the Fuel Solenoid to click (i.e., open and close). If the Fuel Solenoid does not click, it must be replaced; reference the Fuel Solenoid Valve's "Replacement Procedure" below. Reference Section 10 for spare parts information.

Cleaning Tips/Maintenance: N/A

Adjustment Procedure: N/A

Replacement Procedure:

- 1. Disconnect the Ignition Cables from the Ignition Electrodes and loosen the Retaining Clamp Bolt; reference Figure 16.
- Remove the Retaining Clip, which secures the Photo Disc in place. Gently lift the Photo Disc (with Flame Sensor attached) so that it releases from the Fuel Nozzle Manifold and the Ignition Electrodes; reference Figures 16 and 19.
- 3. Disconnect the C-Plug Harness' Violet (+) and Brown (-) wires from the Fuel Solenoid Valve; reference Figure 18.
- 4. Remove the four Fuel Nozzle Manifold Plate Screws, which secure the Fuel Nozzle Manifold Plate in place; reference Figure 19. Remove the Fuel Nozzle Manifold Plate by pulling on the Fuel Nozzle Manifold until the plate releases from the cast-aluminum Blower Casting; reference Figures 13 and 19.
- 5. Remove the Lock Nut and Flat Washer from the end of the Fuel Solenoid Shaft, then, remove the Fuel Solenoid Valve Coil. With a 5/8 wrench, now remove the Fuel Solenoid Shaft from the Fuel Nozzle Manifold. Discard the shaft and valve kit, as replacements are provided with the new Fuel Solenoid Assembly; reference Figure 18.
- 6. Insert the contents of the new Fuel Solenoid Valve Kit into the new Fuel Solenoid Shaft as illustrated in Figure 18. Thread the new Fuel Solenoid Shaft to the Fuel Nozzle Manifold and tighten. Slide the new Fuel Solenoid Valve Coil onto the Fuel Solenoid Shaft and secure in place with the new Flat Washer and Lock Nut.



- 7. Fit the Fuel Nozzle Manifold Plate inside the cast-aluminum Blower Casting and secure in place with the four Fuel Nozzle Manifold Plate Screws.
- 8. Reinstall the Photo Disc and secure in place with the Retaining Clip. Connect the C-Plug Harness' Violet (+) and Brown (-) wires to the Fuel Solenoid Valve's (+) and (-) Electrical Terminals; reference Figure 18.
- 9. Perform the Ignition Electrodes' "Adjustment Procedure" in Section 8.5 to complete the Fuel Solenoid Valve installation.

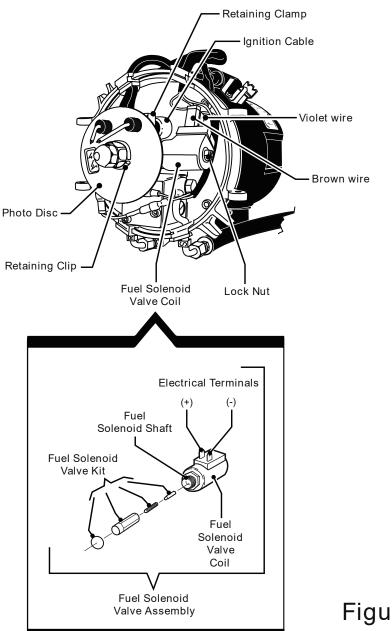
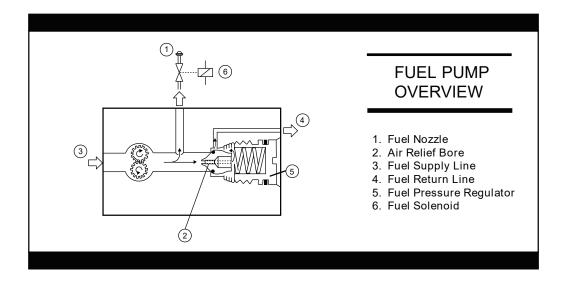


Figure 18

■ Fuel Pump

8.8 Fuel Pump

<u>Function</u>: The Fuel Pump draws diesel fuel from the vehicle's fuel tank and creates a preset pressure of 145 psi (required for proper fuel atomization). Reference the illustration below for a basic overview and understanding of how the Fuel Pump operates.



NOTE: The functionality of each component can be determined by completing the manual checks, as listed under the "Component Test" area for each individual component, or the components can be tested by using a "Controller Tester." Reference Section 11 for Special Tools information.

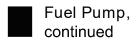
NOTE: In order to perform some of the following procedures, it may be necessary to detach and reattach the Diesel-Burner Head. Therefore, be sure to reference Section 8.2 for detaching and reattaching instructions.

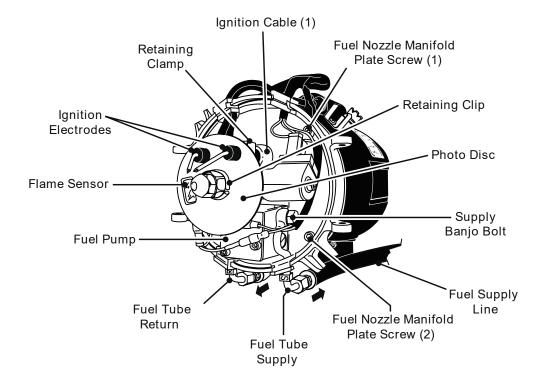
Component Test:

Clamp off and remove the Aqua-Hot's Fuel Return and Fuel Supply Lines; reference Figure 1. Attach a short piece of fuel line to both the Aqua-Hot's Fuel Return and Fuel Supply ports; reference Figure 1. Submerse the opposite end of the temporary fuel supply line in a container of diesel fuel. Place the opposite end of the temporary fuel return line in an empty container. Turn the "Diesel" switch *ON* to activate the Diesel-Burner; reference Figure 4. If fuel does not flow out of the return line into the empty container, the Fuel Pump must be replaced; reference the Fuel Pump's "Replacement Procedure" in this section. Reference Section 10 for spare parts information.

Cleaning Tips/Maintenance:

1. Check all Fuel Connections for tightness (i.e., Banjo Bolts, High Pressure Fuel Pipe Connections); reference Figure 19.





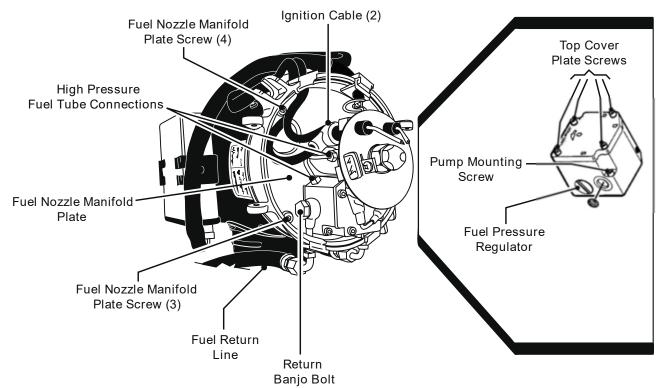
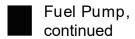


Figure 19



Fuel Pressure Function Test:

NOTES:

- A: A Fuel Pressure Gauge (reference Section 11 for special tools information) is used to properly check the Fuel Pump's pressure setting; reference Figure 21. The Fuel Pump is preset to 145 psi (the pressure required for proper fuel atomization at the Fuel Nozzle). Perform the following procedures to check for a proper fuel pressure setting.
- B: Be sure to use care when handling the Fuel Nozzle. Oils and/or small dust or dirt particles from your hands may plug the nozzle's small orifice; reference Figure 9. A partially plugged orifice will restrict fuel flow, which will affect the combustion process of the Diesel-Burner (i.e., excessive smoking from the exhaust pipe).
- 1. Remove the Fuel Nozzle (reference Figure 17) and replace it with the Fuel Pressure Gauge; reference Figure 21.



WARNING: A spark will appear across the Ignition Electrodes (reference Figure 16) for a brief moment after the Diesel-Burner has been activated.

<u>DO NOT</u> attempt to make any fuel pressure adjustments until the spark has disappeared. Failure to do so may result in serious bodily injury (i.e., an electrical shock).

- 2. Turn the "Diesel" switch ON; reference Figure 4. A pressure will register on the Fuel Pressure Gauge once the Fuel Solenoid opens (after approximately 10-25 seconds).
- If the Fuel Pressure Gauge registers a 145 psi pressure reading, no pressure adjustment is necessary. Turn the "Diesel" switch OFF and wait until the motor stops running. Remove the Fuel Pressure Gauge and reinstall the Fuel Nozzle (reference Section 8.6 for the Fuel Nozzle's "Replacement Procedure"). Reattach the Diesel-Burner Head.

NOTE: If the Fuel Pressure Gauge registers below or above 145 psi, perform the adjustment procedures listed below.

Fuel Pressure Adjustment Procedure:

 Turn the "Diesel" switch ON and wait until a pressure reading registers on the Fuel Pressure Gauge (after approximately 10-25 seconds).
 Then, adjust the fuel pressure by simply turning the Pressure Regulator Adjustment Screw clockwise to increase fuel pressure or counterclockwise to decrease fuel pressure; reference Figure 21.

NOTE: If the fuel pressure will not maintain a 145 psi setting, the Fuel Pump must be replaced; reference the Fuel Pump's "Replacement Procedure" in this section. Also, reference Section 10 for spare parts information.

Once the pressure adjustment has been made, turn the "Diesel" switch
OFF and wait until the motor stops running. Remove the Fuel Pressure
Gauge and reinstall the Fuel Nozzle (reference Section 8.6 for the Fuel
Nozzle's "Replacement Procedure"). Reattach the Diesel-Burner Head.



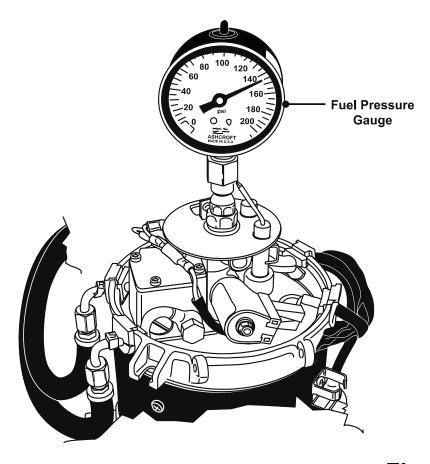


Figure 20

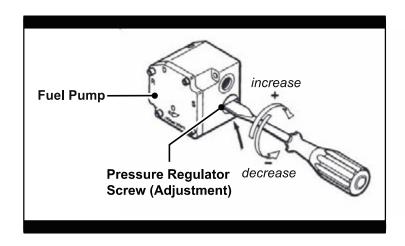
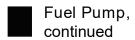


Figure 21

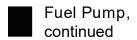


Replacement Procedure:

- Locate and disconnect the C-Plug Harness wires, which connect to the Flame Sensor and the Fuel Solenoid Valve; reference Figures 3, 15, and 18. Also, disconnect the Ignition Cables from the Ignition Electrodes; reference Figures 16 and 19.
- Remove the Retaining Clip, which secures the Photo Disc in place; reference Figure 19. Gently lift the Photo Disc (with Flame Sensor attached) so that it releases from the Fuel Nozzle Manifold and the Ignition Electrodes; reference Figures 16 and 19.
- 3. Clamp off both the Fuel Supply Line and Return Line from the Diesel-Burner Head; reference Figures 19 and 22. Loosen the Supply and Return Banjo Bolts to remove both Fuel Tubes (with the fuel lines attached) from the Fuel Pump; reference Figures 19 and 22. Also, disconnect the High Pressure Fuel Tube from both the Fuel Pump and the Fuel Nozzle Manifold; reference Figures 19 and 22. Discard the High Pressure Fuel Tube, Gasket Rings, Banjo Bolts, and Grommets, as these replacements are provided in the new Fuel Pump Kit. Reference Section 10 for spare parts information.
- 4. Remove the four Fuel Nozzle Manifold Plate Screws, which secure the Fuel Nozzle Manifold Plate in place; reference Figure 19. Remove the Fuel Nozzle Manifold Plate by pulling on the Fuel Nozzle Manifold until the plate releases from the cast-aluminum Blower Casting; reference Figures 13 and 19.
- 5. Remove the two Fuel Mounting Screws, which secure the Fuel Pump in place; reference item 70 of Figure 22. Turn the Fuel Nozzle Manifold Plate over and remove the Snap Ring from the Fuel Pump shaft using Snap Ring pliers; reference item 77 of Figure 22. Remove the nylon Fuel Pump Gear, then the Fuel Pump; reference items 88 and 72 of Figure 22.
- 6. Attach the new Fuel Pump to the Fuel Nozzle Manifold Plate with the two Fuel Pump Mounting Screws. Turn the Fuel Nozzle Manifold Plate over to install the nylon Fuel Pump Gear on the Fuel Pump's shaft and secure in place with the Snap Ring. Dab the teeth of the nylon Fuel Pump Gear with white lithium grease (Isoflex LDS-18 is recommended).

NOTES:

- A: All new Fuel Pumps are factory preset to 145 PSI; therefore, no fuel pressure adjustment is necessary.
- B: Inspect the nylon Fuel Pump 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 Casting may be necessary (leaking fuel could cause Bearing seizure, resulting in potential damage to the internal bore/bearing cavity of the Blower Casting). Reference Section 8.9 for the Bearing "Replacement Procedure" and contact the Technical Support Department at 1-800-685-4298 for additional assistance.
- 7. Fit the Fuel Nozzle Manifold Plate inside the cast-aluminum Blower Casting

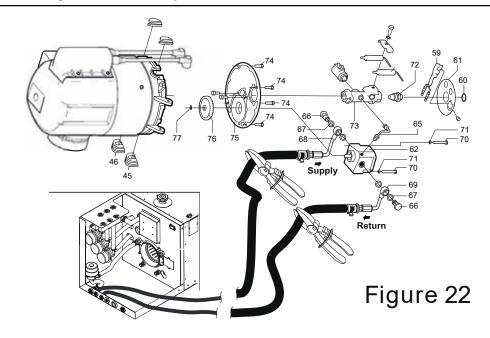


and secure in place with the four Fuel Nozzle Manifold Plate Screws. Install the new Grommets on both Fuel Tubes (Supply and Return) and secure the tubes to the Fuel Pump with the new Banjo Bolts and Gasket Rings; reference Figures 19 and 22.

NOTE: Reference Figure 22 for the correct order placement of the (4) Gasket Rings. Failure to use the new Gasket Rings, and/or the correct order placement, will result in a leaky Fuel Pump.

- 8. Reconnect the C-Plug Harness' Violet (+) and Brown (-) wires to the Fuel Solenoid's (+) and (-) Electrical Terminals; reference Figure 18. Insert both Ignition Cables into the new rubber Grommet and slide into the appropriate notch on the Blower Casting; reference Figure 19. Reconnect the Ignition Cables to the Ignition Electrodes, then remove the fuel line clamps from both the Fuel Return Line and the Fuel Supply Line; reference Figure 19.
- Reinstall the Photo Disc and secure it in place with the Retaining Clip; reference Figure 19. 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; reference Figure 15.

NOTE: Check the Ignition Electrodes for proper adjustment; reference Steps 2 through 4 of the "Adjustment Procedure" in Section 8.5 to ensure proper Ignition Electrode adjustment.



- 45 Grommet, Blower Casting, Left
- 46 Grommet, Blower Casting, Right
- 59 Sensor, Flame
- 60 Clip, Retaining, Photo Disc
- 61 Disc, Photo
- 62 Pump, Fuel
- 65 Tube, Fuel, High Pressure
- 66 Bolt, Banjo
- 67 Gasket, Ring, Copper
- 68 Tube, Fuel, Banjo, Supply

- 69 Tube, Fuel, Banjo, Return
- 70 Screw, Mounting, Fuel Pump
- 71 Washer, Lock, Fuel Pump
- 72 Nozzle, Fuel, 0.35 GPH
- 72 Nozzie, Fuel, 0.35 GFH
- 73 Manifold, Fuel Nozzle, Brass
- 74 Screw, Manifold Plate
- 75 Plate, Manifold
- 76 Gear, Fuel Pump, Nylon
- 77 Ring, Snap

Bearings

8.9 Bearings

<u>Function</u>: The Bearings support the Combustion Air Blower's shaft and allows the blower to turn smoothly.

NOTE: The functionality of each component can be determined by completing the manual checks, as listed under the "Component Test" area for each individual component, or the components can be tested by using a "Controller Tester." Reference Section 11 for Special Tools information.

NOTE: In order to perform some of the following procedures, it is necessary to detach and reattach the Diesel-Burner Head. Therefore, be sure to review Section 8.2 for detaching and reattaching instructions.

Function Test: Remove the Motor (reference Section 8.3 for the Motor's "Replacement Procedure") and spin the Combustion Air Blower by hand (place one of the Clutch Halves to the end of the shaft to assist with this spinning exercise). If the Combustion Air Blower rotates smoothly without any friction or noise, the Bearings are in proper working condition. However, if the Combustion Air Blower does not rotate smoothly and/or produces noise, the Bearings are worn and must be replaced; reference the Bearings "Replacement Procedure" in this section.

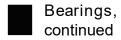
Component Test: N/A

Cleaning Tips/Maintenance: N/A

Adjustment Procedure: N/A

Replacement Procedure:

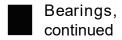
- 1. Clamp off and remove the Fuel Supply Line and Fuel Return Line from the Diesel-Burner Head; reference Figures 19 and 22.
- Locate and disconnect the C-Plug Harness wires, which connect to the Flame Sensor and Fuel Solenoid; reference Figures 3, 15, and 18.
 Also, disconnect the Ignition Cables from the Ignition Electrodes; reference Figures 16 and 19.
- 3. Remove the four Fuel Nozzle Manifold Plate Screws, which secure the Fuel Nozzle Manifold Plate in place; reference Figure 19. Remove the Fuel Nozzle Manifold Plate by pulling on the Fuel Nozzle Manifold until the plate releases from the cast-aluminum Blower Casting; reference Figures 13, 16, and 19.
- 4. Remove the four Ignition Coil Mounting Screws, which secure the Ignition Coil to the Protection Housing; reference Figure 13. Lift the Ignition Coil and disconnect its Black (+) and Brown (-) wires from the C-Plug Harness wires, prior to removing; reference Figures 3 and 24. Remove the Protection Housing from the Diesel-Burner to expose the Motor and Clutch Halves; reference Figures 12, 13 and 14.
- 5. Remove the three Hex Head Screws, which secure the Motor and Motor Flange to the Blower Housing; reference Figure 13. Remove the Motor and flange assembly along with the Clutch Halves; reference Figures 13 and 14. Disconnect the Motor's Black (+) and Brown (-) wires from the C-Plug Harness' wires; reference Figure 13.



- NOTE: Inspect the Clutch Halves for cracks and 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. Reference the Aqua-Hot's "Parts Manual" for spare parts information.
- 6. Remove the four Blower Housing Screws, which secure the Blower Housing to the Blower Casting; reference Figure 23. Remove the Blower Housing to expose the Combustion Air Blower; reference Figure 23.
- NOTE: Be sure to observe the placement of the three Washers of the Bearing Kit illustrated in Figure 23. To ensure proper tension, the same order and direction of the dished surfaces of the Washers must be followed when reassembling.
- 7. Hold Side-B of the Blower Casting and loosen the Retaining Nut located in Side-A of the Blower Casting. 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 the Combustion Air Blower can be easily removed from the Blower Casting.
- 8. With a pair of Snap-Ring pliers, remove the Snap Rings from both Side-A and Side-B of the Blower Casting; reference Figure 23. Push all the contents of the Bearing Kit out of the Blower Casting'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 Casting's bore/bearing cavity for signs of damage due to potentially seized Bearings. If damage is present, the Blower Casting must be replaced. Reference the Aqua-Hot's "Parts Manual" for spare parts information.
- 9. Install a new Snap Ring into Side-A of the Blower Casting; reference Figure 23. Once the Snap Ring is in place, insert the remaining contents of the new Bearing Kit into Side-B of the Blower Casting starting with the Wave Washer, as illustrated in Figure 23. Secure the Bearing Kit assembly in place with the remaining Snap Ring (Side-B).

NOTES:

- A: Prior to installation, reference Figure 23 for the exact placement of the three Washers, which slide over the threaded end of the Combustion Air Blower's shaft. 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.
- B: Inspect the Combustion Air Blower for warpage and/or damage. If warpage or damage is visible, the Combustion Air Blower must be replaced. Reference the Aqua-Hot's "Parts Manual" for spare parts information.
- 10. 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 Casting; reference Figure 23. 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).

- 11. Place a feeler gauge between the Combustion Air Blower and the flat surface of the Blower Casting. Slowly tighten (or loosen) the Retaining Nut, holding the Combustion Air Blower, until a .003 .005 gap is achieved.
- 12. 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 (i.e., Side-B)), then readjust the gap (repeat Steps 11 and 12).

- 13. Reattach the Blower Housing to the Blower Casting using the four Blower Housing Screws. Reinstall a Clutch Half on both the Motor's shaft and on 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 Casting, to the Blower Housing with the three Hex Head Screws; reference Figures 13 and 14. Reconnect the Black (+) and Brown (-) wires of the Motor to the C-Plug Harness' Black (+) and Brown (-) wires; reference Figures 13 and 14. Feed the C-Plug Harness' Yellow and Brown wires back through the Wiring Access Hole in the Protection Housing; reference Figure 13.
- 14. Reinstall the Protection Housing. Reconnect the Black (+) and Brown (-) wires of the Ignition Coil to the C-Plug Harness' Yellow (+) and Brown (-) wires; reference Figure 24. Reinstall the Ignition Coil, securing it to the Protection Housing utilizing the four Ignition Coil Mounting Screws; reference Figure 13.
- 15. Fit the Fuel Nozzle Manifold Plate inside the cast-aluminum Blower Casting and secure in place with the four Fuel Nozzle Manifold Plate Screws. Reattach the Fuel Supply Line and Fuel Return Line to the Diesel-Burner Head.
- 16. Reconnect the Violet (+) and Brown (-) wires to the Fuel Solenoid's (+) and (-) Electrical Terminals; reference Figure 18. 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; reference Figure 15.



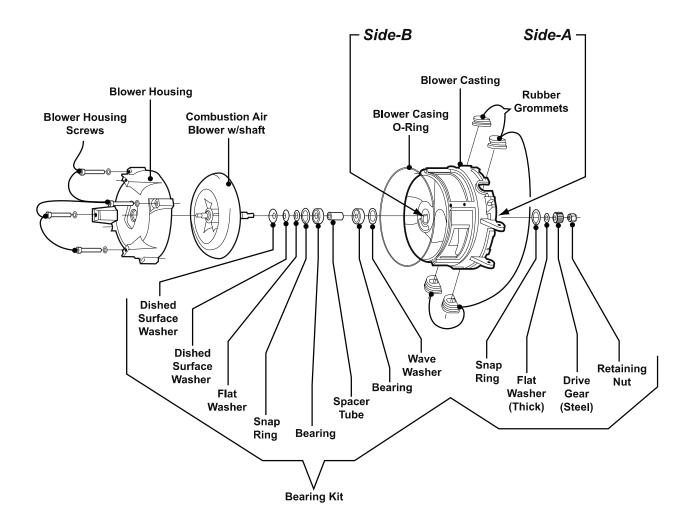


Figure 23

Ignition Coil

8.10 Ignition Coil

<u>Function</u>: The Ignition Coil produces a high voltage ignition spark (approximately 8000 volts), which is released across the metal tips of the Ignition Electrodes during the initial Diesel-Burner start-up.



WARNING: Use extreme care when testing the Ignition Coil, as a <u>High Voltage</u> Shock may result.

NOTE: The functionality of each component can be determined by completing the manual checks, as listed under the "Component Test" area for each individual component, or the components can be tested by using a "Controller Tester." Reference Section 11 for Special Tools information.

NOTE: In order to perform some of the following procedures, it is necessary to detach and reattach the Diesel-Burner Head. Therefore, be sure to review Section 8.2 for detaching and reattaching instructions.

Component Test: Remove the four Ignition Coil Mounting Screws, which secure the Ignition Coil in place; reference Figure 13. Disconnect the Ignition Coil's Black (+) and Brown (-) wires from the C-Plug Harness' Yellow (+) and Brown (-) wires. Connect the Ignition Coil wires directly to a 12 Volt-DC power supply (i.e., Black (+) wire to (+) lead and Brown (-) wire to (-) lead). Turn the power supply *ON* and watch for a spark to appear across the metal tips of the Ignition Electrodes; reference Figure 16. If a spark does not appear, the Ignition Coil must be replaced; reference the Ignition Coil's "Replacement Procedure" below. Reference Section 10 for spare parts information.

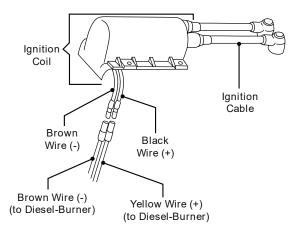
Cleaning Tips/Maintenance: N/A

Adjustment Procedure: N/A

Replacement Procedure:

- Disconnect the Ignition Cables from the Ignition Electrodes; reference Figures 16 and 19. Remove the four Ignition Coil Mounting Screws, which secure the Ignition Coil to the Protection Housing; reference Figure 13. Lift the Ignition Coil and disconnect its wires from the C-Plug Harness wires, prior to removing; reference Figures 3 and 24.
- Connect the new Ignition Coil's Black (+) and Brown (-) wires to the C-Plug Harness' Yellow (+) and Brown (-) wires; reference Figure 24.
 Attach the Ignition Coil to the Protection Housing with the four Ignition Coil Mounting Screws; then, reconnect the Ignition Cables to the Ignition Electrodes.

Figure 24





8.11 Diesel-Burner Controller

<u>Function</u>: The Controller operates all the components of the Diesel-Burner Head and safely shuts the heater OFF in the event of an overheat, flameout, or low voltage condition. It also receives Diesel-Burner operation status signals from the Flame Sensor, VDC Control Thermostat, and VDC High-Limit Thermostat.

NOTE: The functionality of each component can be determined by completing the manual checks, as listed under the "Component Test" area for each individual component, or the components can be tested by using a "Controller Tester." Reference Section 11 for Special Tools information.

<u>Component Test</u>: The following conditions must exist prior to performing the Controller circuit tests in this section. If one of the conditions below does not exist, please contact the Technical Support Department at 1-800-685-4298 for additional assistance.

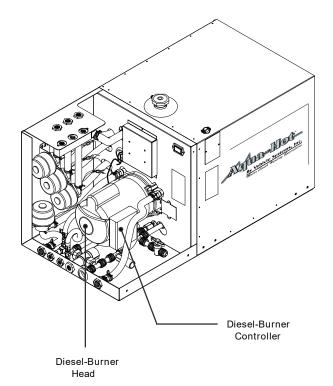
Condition #1

A battery voltage level of between 11.5 and 14.0 Volts-DC must be present at the Diesel-Burner's Controller during all testing; reference Figure 25. It may be necessary to perform a voltage check to ensure that this condition exists. To perform the voltage check, locate the Controller's B-Plug, and insert the probes of a DC voltmeter into the B-4 (+) and B-2 (-) locations; reference Figure 26.

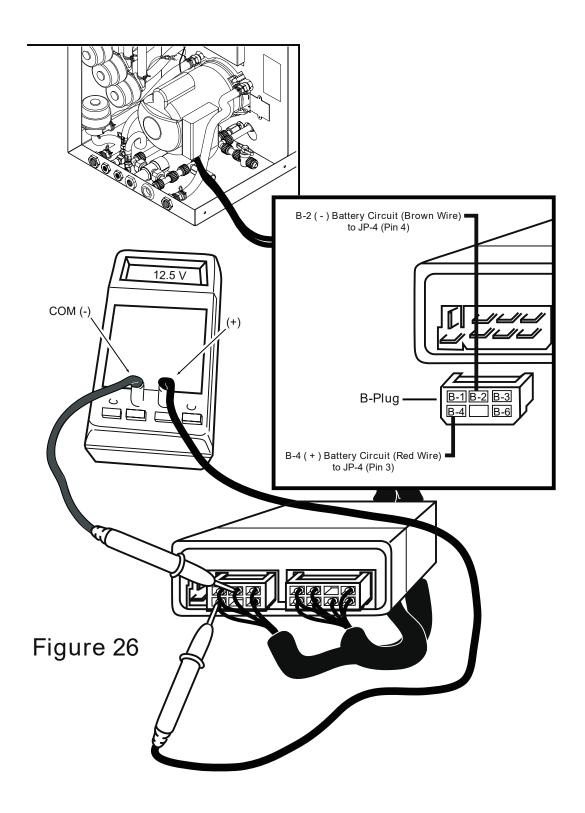
Condition #2

A voltage level of between 11.5 and 14.0 volts must be present at the Diesel-Burner Controller's ON/OFF switch circuit 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 Controller's B-Plug, and insert the probes of a DC voltmeter into the B-1 (+) and B-2 (-) locations; reference Figures 8 and 26. Turn the "Diesel" switch ON and observe the voltage level; reference Figure 4.











NOTE: If, after performing the following circuit tests, the Controller is determined to be defective and must be replaced, reference the Controller's "Replacement Procedure" in this section. Reference Section 10 for spare parts information.

Ground Circuit Test

Locate the Controller's B-Plug and C-Plug; reference Figure 8. Insert the probes of a DC voltmeter into the B-4 (+) and C-5 (-) locations and turn the "Diesel" switch *ON*; reference Figures 4 and 8. If a voltage reading does not register on the voltmeter, the Controller must be replaced. If voltage is present, proceed to the next circuit test.

NOTE: The temperature of the Aqua-Hot's Boiler Tank must be below 160°F prior to performing the following tests.

VAC/VDC Control Thermostat Circuit Test

Locate the Controller's B-Plug and C-Plug; reference Figure 8. Insert the probes of a DC voltmeter into the C-1 (+) and B-2 (-) locations and turn the "Diesel" switch *ON*; reference Figures 4 and 8. If a voltage reading does not register on the voltmeter, the Controller must be replaced. If voltage is present, proceed to the next circuit test.

VDC High-Limit Thermostat Circuit Test

Locate the Controller's B-Plug and C-Plug; reference Figure 8. Insert the probes of a DC voltmeter into the C-4 (+) and B-2 (-) locations and turn the "Diesel" switch **ON**; reference Figures 4 and 8. If a voltage reading does not register on the voltmeter, the Controller must be replaced. If voltage is present, proceed to the next circuit test.

Motor Circuit Test

Locate the Controller's C-Plug; reference Figure 8. Insert the probes of a DC voltmeter into the C-2 (+) and C-5 (-) locations and turn the "Diesel" switch **ON**; reference Figures 4 and 8. If no voltage reading registers on the voltmeter, the Controller must be replaced. If voltage is present, proceed to the next circuit test.

Ignition Coil Circuit Test

Locate the Controller's C-Plug; reference Figure 8. Insert the probes of a DC voltmeter into the C-8 (+) and C-5 (-) locations and turn the "Diesel" switch *ON*; reference Figures 4 and 8. If no voltage reading registers on the voltmeter 18-25 seconds after the Diesel-Burner's initial start-up, the Controller must be replaced. If voltage is present, proceed to the next circuit test.

SECTION 8: DIESEL-BURNER SERVICE, MAINTENANCE, AND REPAIR INFORMATION



Cleaning Tips/Maintenance: N/A

Adjustment Procedure: N/A

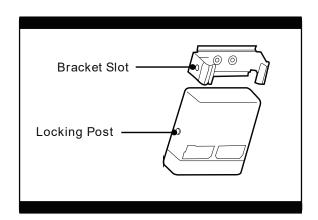
Replacement Procedure:

- 1. Remove both the B-Plug and C-Plug from the Controller; reference Figure 8. Gently pry away each side of the Controller Mounting Bracket from the Controller's locking posts with a flat-head screwdriver. Once the locking posts have been released, pull on the Controller to remove it from the Diesel-Burner Head.
- 2. Slide the new Controller into the Controller Mounting Bracket; reference Figure 27. Push down on the Controller until the locking posts snap into the bracket slots. Reinstall both the B-Plug and C-Plug.

NOTE: Be sure to install the 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 Controller's internal circuitry; reference Figure 27.

Diesel-Burner Controller, continued

7.11 Diesel-Burner Controller



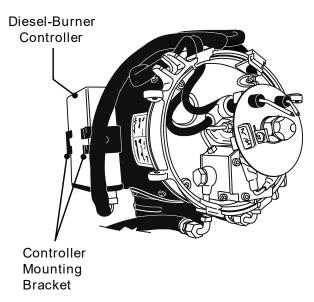


Figure 27

WARRANTY INFORMATION

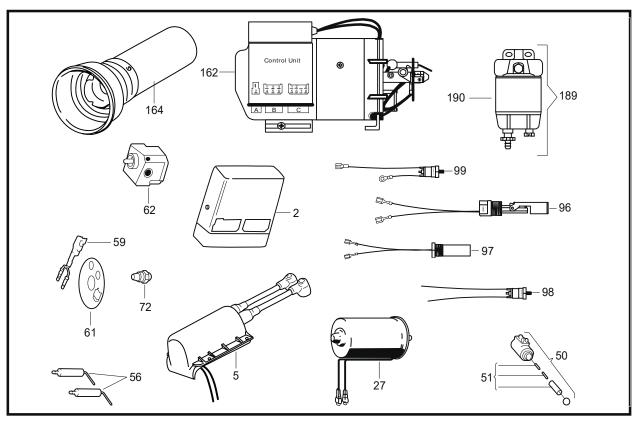
- FOR ALL AQUA-HOT MODELS -

Vehicle Systems, Inc. warrants the AQUA-HOT Heater to be free from defects in material and workmanship under normal use and service for a period of two (2) years on both parts and labor commencing upon the original date of registration of the vehicle. The warranty period may not, however, exceed 36 months from the original "Manufactured Date" by Vehicle Systems, Inc. Replacement parts are warranted for the remainder of the Heater's standard warranty period or for six months (180 days), whichever is greater.

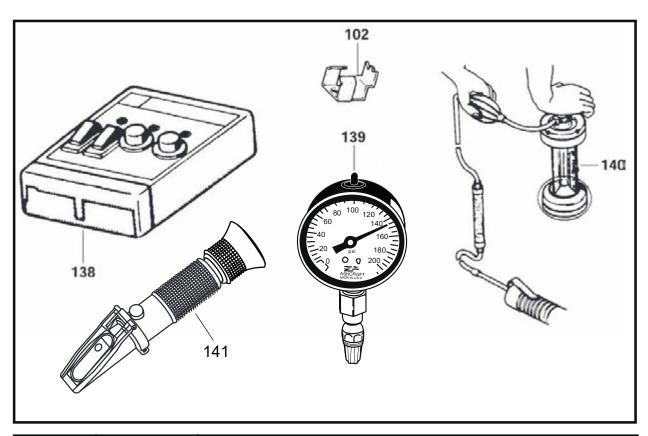
This warranty is conditional upon proper use of the Heater by the end-user. This warranty does not apply to damage or failure of the AQUA-HOT Heater, or the vehicle into which it was installed, due to improper installation, assembly, maintenance, abuse, neglect, accident, or the use of parts no supplied by Vehicle Systems, Inc. Vehicle Systems is not responsible for incidental or consequential damages.

The intent of this warranty is to protect the end-user of the heating system from such defects, which would occur in the manufacture of the product. The warranty is not intended to protect the end-user from problems, which are outside the ability of Vehicle Systems' control.

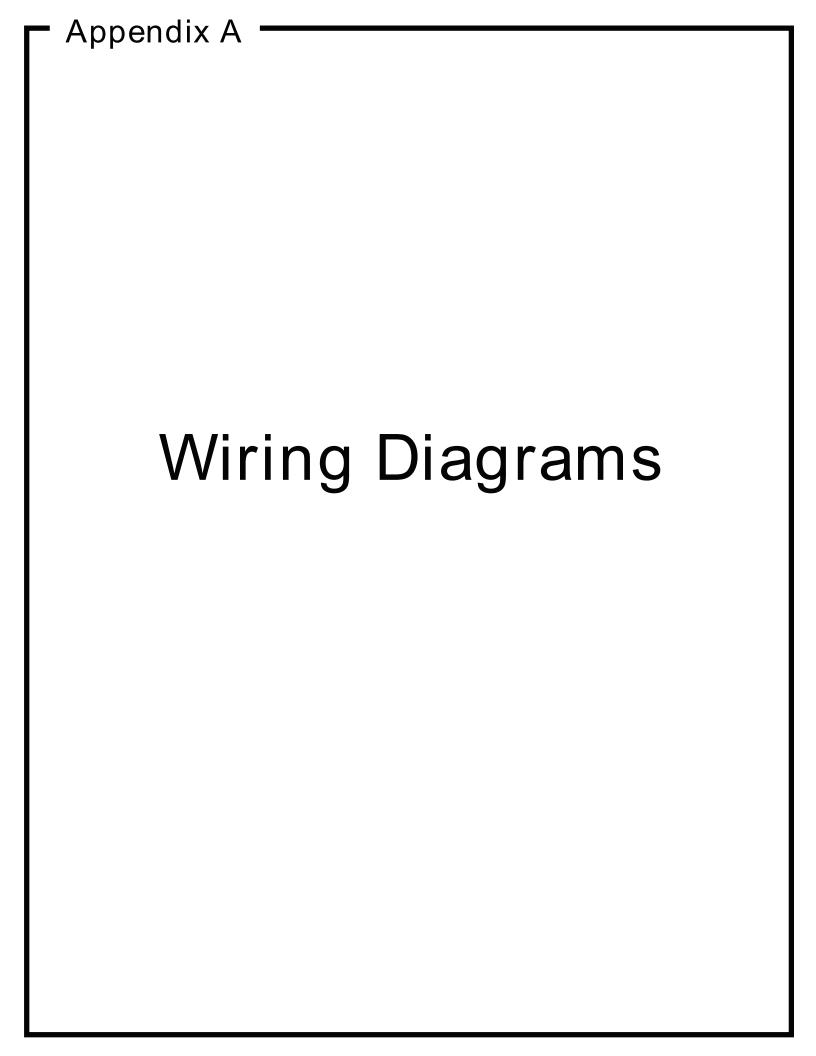
To obtain warranty repair authorization or for additional product information, please contact the Technical Support Department at 1-800-685-4298 (7 AM to 4 PM Mountain Standard Time).

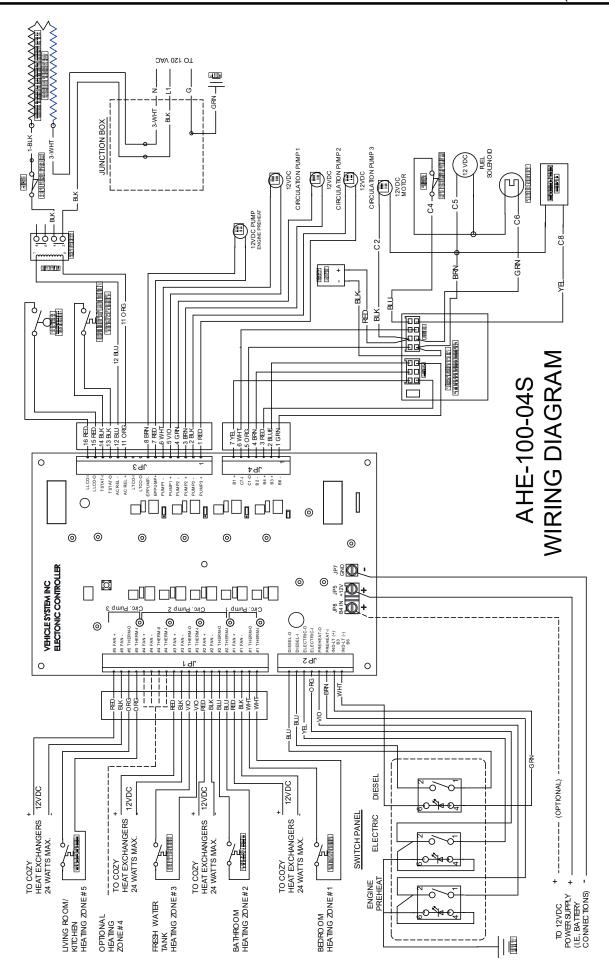


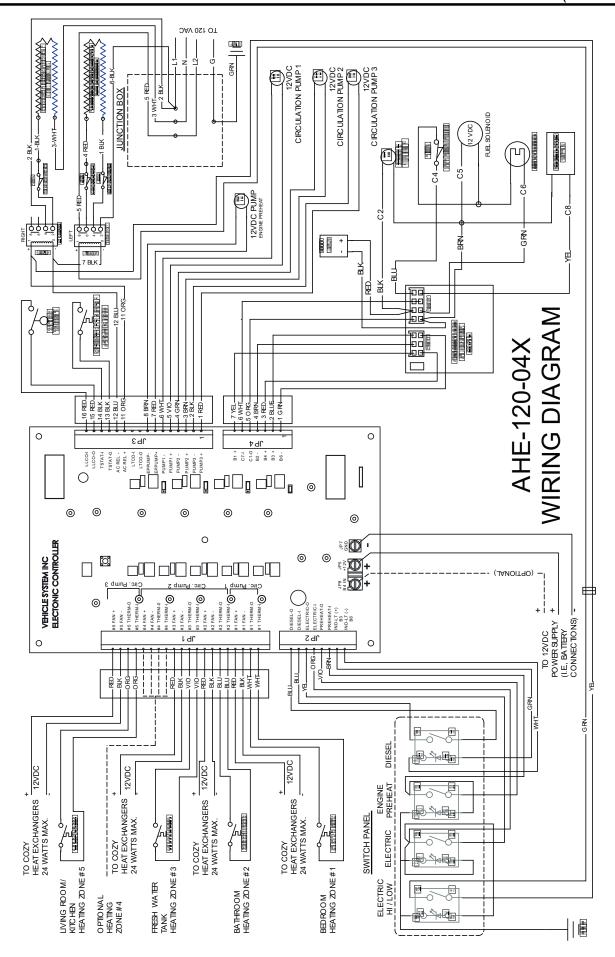
| 2 | WPX-287-962 | Controller, Diesel-Burner, 12 VDC |
|-----|-----------------|---|
| 5 | WPX-101-838 | Coil, Ignition, 12 VDC |
| 27 | WPX-425-060 | Motor, Combustion Air/Fuel Pump, 12 VDC |
| 50 | WPX-322-083 | Valve, Fuel Solenoid, 12 VDC |
| 51 | WPX-386-650 | Valve, Fuel Solenoid, Kit |
| 56 | WPX-274-313 | Electrode, Ignition |
| 59 | WPX-638-78A | Sensor, Flame |
| 61 | WPX-887-71A | Disc, Photo |
| 62 | WPX-503-03A | Pump, Fuel |
| 72 | WPX-886-41A | Nozzle, Fuel, 0.35 GPH |
| 96 | ELE-800-002 | Switch, Float |
| 97 | ELE-800-100 | Thermostat, Control 190*F |
| 98 | ELE-HLT-322 | Thermostat, High-Limit, 220* F 12 VDC |
| 99 | ELE-ASY-300-FRU | Thermostat, High-Limit, 220* F 120 VAC |
| 162 | WPE-905-834 | Burner, Diesel, 12 VDC |
| 164 | WPX-265-53A | Chamber, Combustion |
| 189 | FLX-120-VS1 | Filter, Fuel, Kit (DISCONTINUED) |
| 190 | FLX-R12-TRA | Filter, Fuel |
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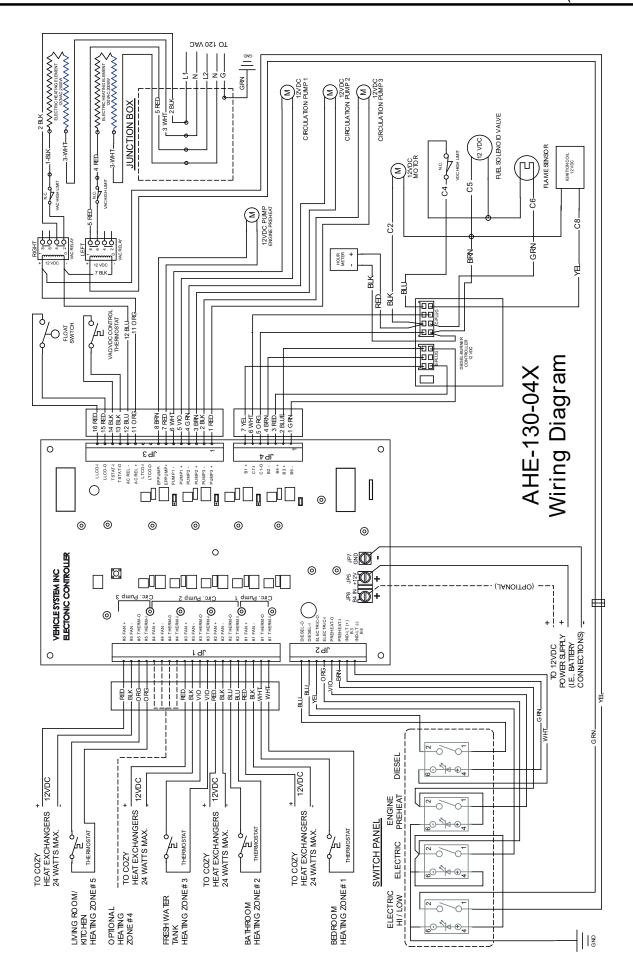


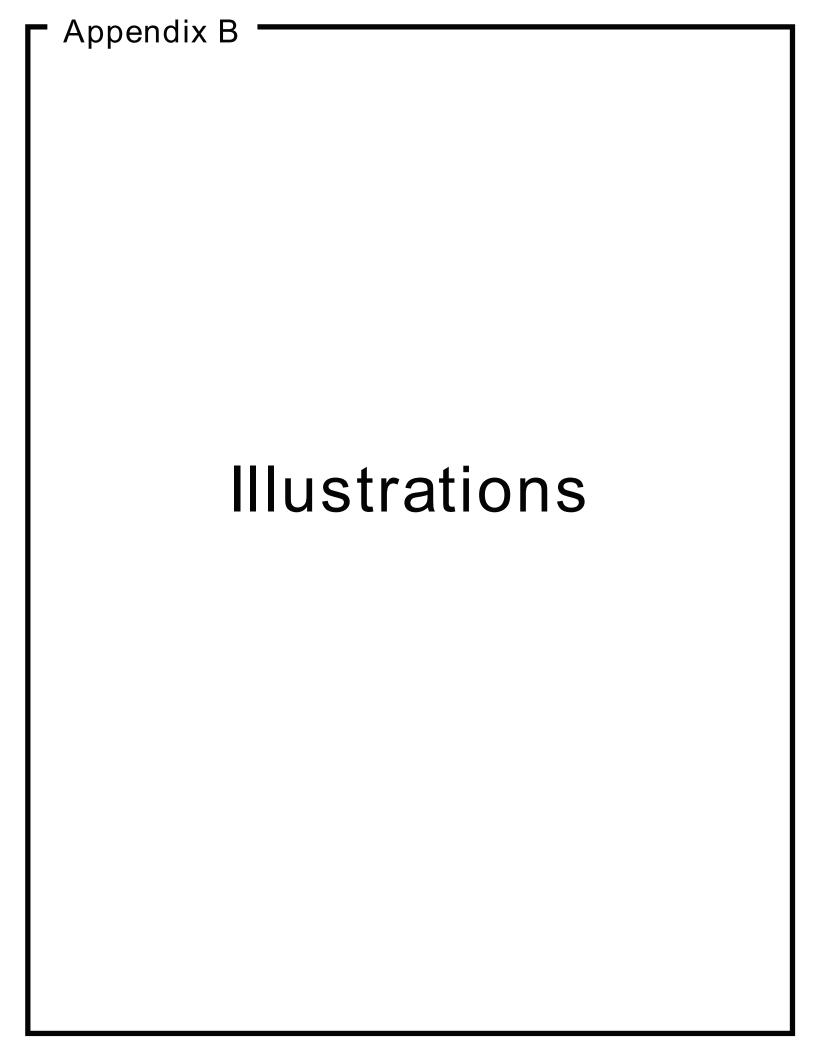
| 102 138 139 140 | WPX-310-646 WPX-440-280 WPE-600-190 | Gauge, Adustment, Electrode Tester, Controller Gauge, Fuel Pressure Gas Anal\zer, Curicular der Grainger Part T153 dom a Grainger Industrial Suppl\ Store near \ ou or visit the Grainger website at |
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| 141 | | www.grainger.com. Relectometer, Batter\/Coolant der Grainger Part MY57 dem a Grainger Industrial Suppl\ Store near \ ou or visit the Grainger website at www.grainger.com. |

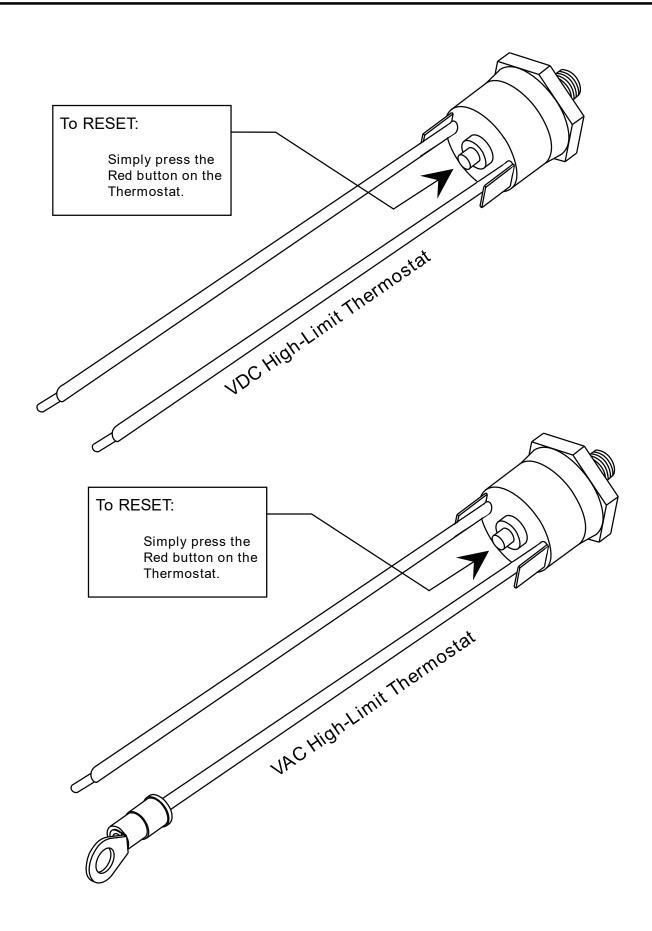




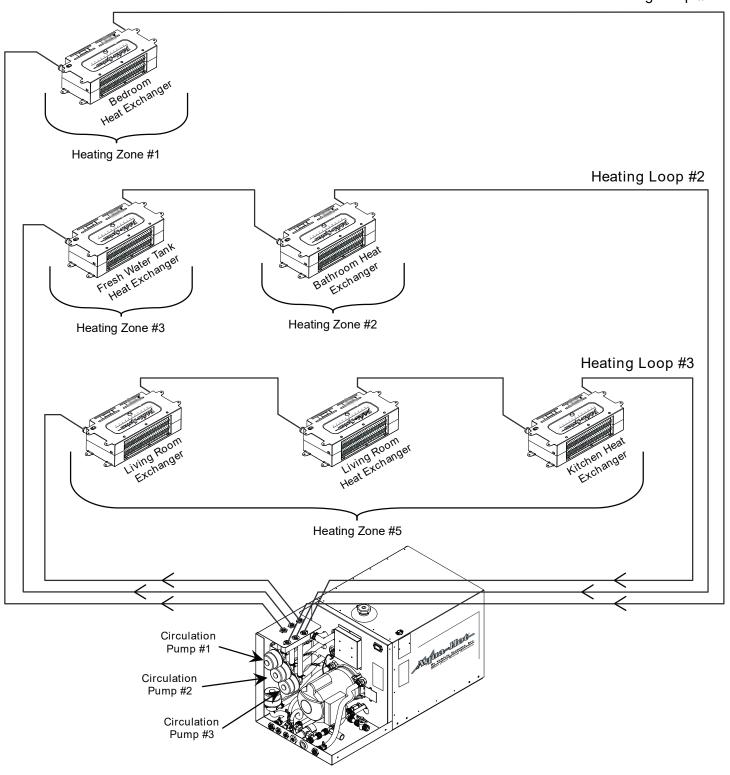


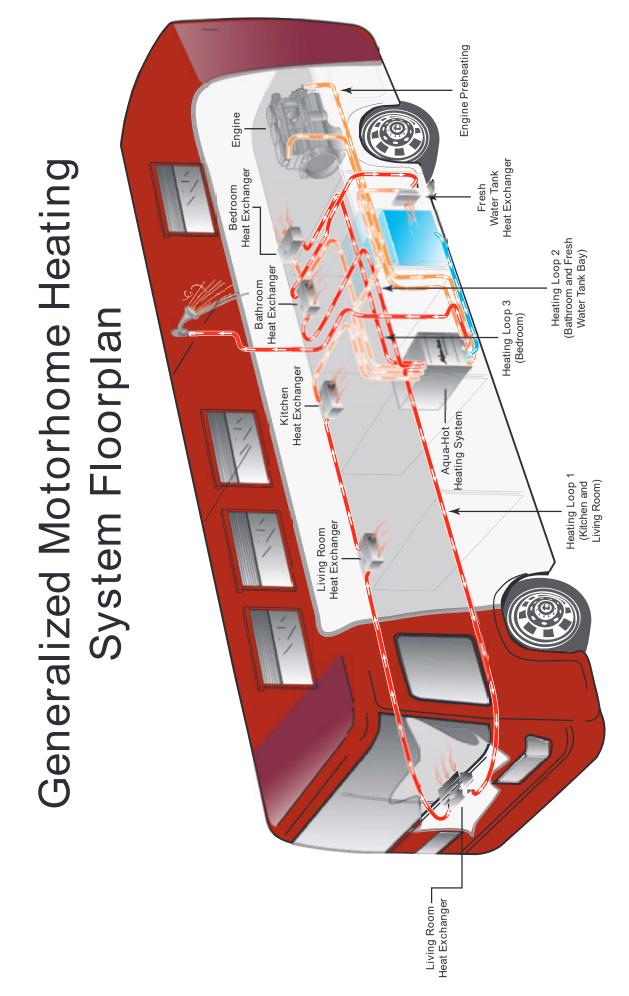






Heating Loop #1







N C O R P O R A T E D

7501 Miller Drive Frederick, Colorado 80504 1-800-685-4298 Fax: 303-651-5699

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