



from Calcutt Boats

Service and Troubleshooting Manual

Diesel Hot Water Heating System
for Boats and Recreational Vehicles

CE



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MANUFACTURED BY:

**International Thermal Research
2431 Simpson Road,
Richmond, BC, Canada, V6X 2R2
Tel: +1 604-278-1272
Fax: +1 604-278-1274
Email: itr@shaw.ca
Website: www.itrheat.com**

SOLE EUROPEAN DISTRIBUTORS:

**Calcutt Boats Ltd.
Tomlow Road, Stockton,
Southam, CV47 8HX, UK
Tel: +44 1926 813757
Fax: +44 1926 814091
Email: info@dieselheating.com
Website: www.dieselheating.com**

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General Information

TOOLS

The tools in this list should be considered the minimum required for performance of routine maintenance, servicing and minor repair work.

- Spanner sizes 11/32, 9/16, 5/8, 7/8, 15/16, 1 3/8
- Socket sizes 1/4, 5/16, 7/16, 11/32
- Adjustable crescent spanner
- Phillips head screwdriver No. 2
- Flat head screwdriver
- Pliers – vice grip
- Pliers – needle nose
- Multimeter

MAXIMUM TORQUE VALUES

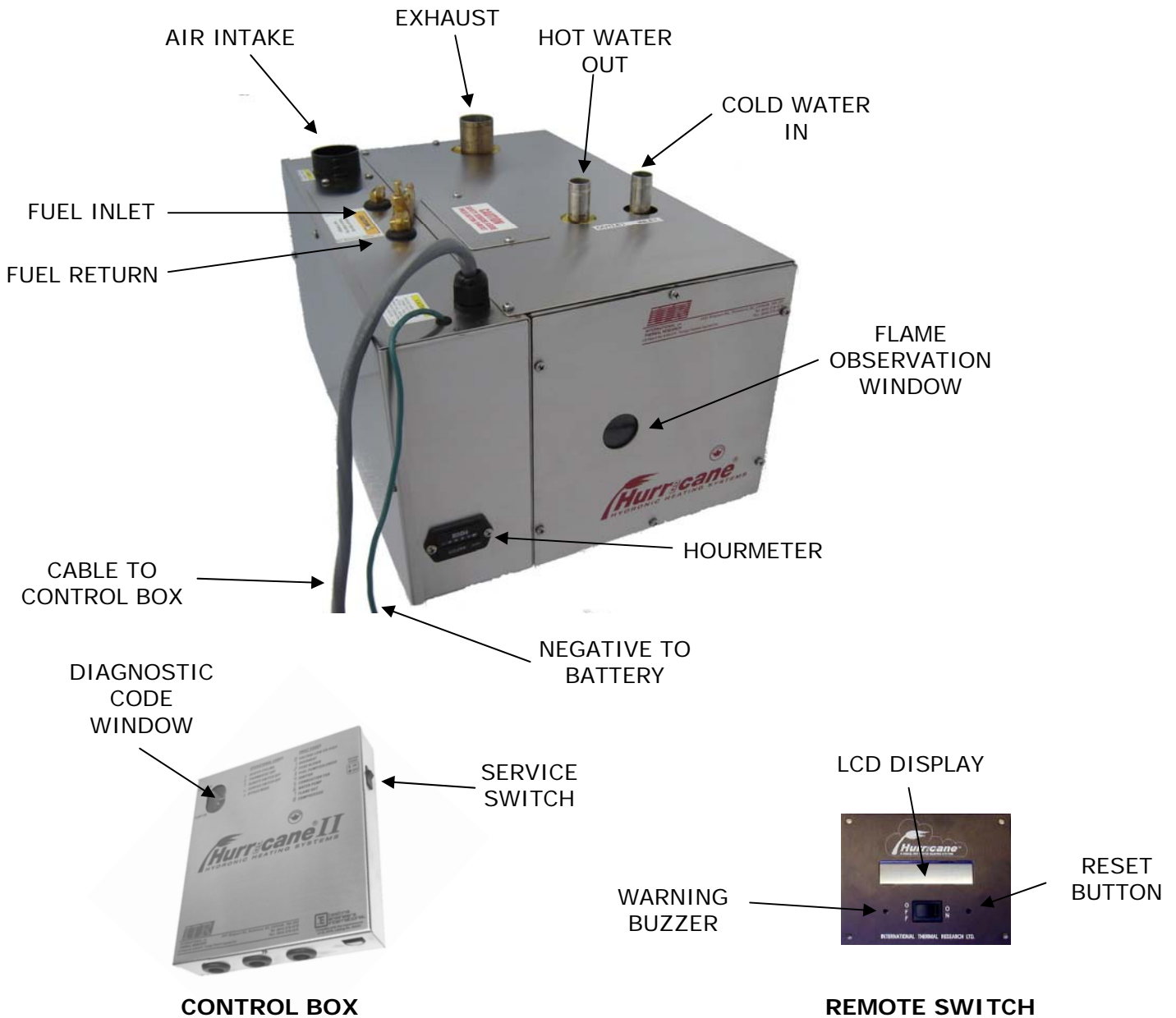
The fasteners used to assemble this heater are all US thread size. Most threaded fasteners should be tightened to a specific torque value. Over tightening the fastener can weaken it and cause it to break, while under tightening can cause it to eventually come loose. Below is a table with the specific torque values for each type of bolt/screw used in this heater. Be sure to follow the recommendations closely.

Table 1: Fastener Torque values

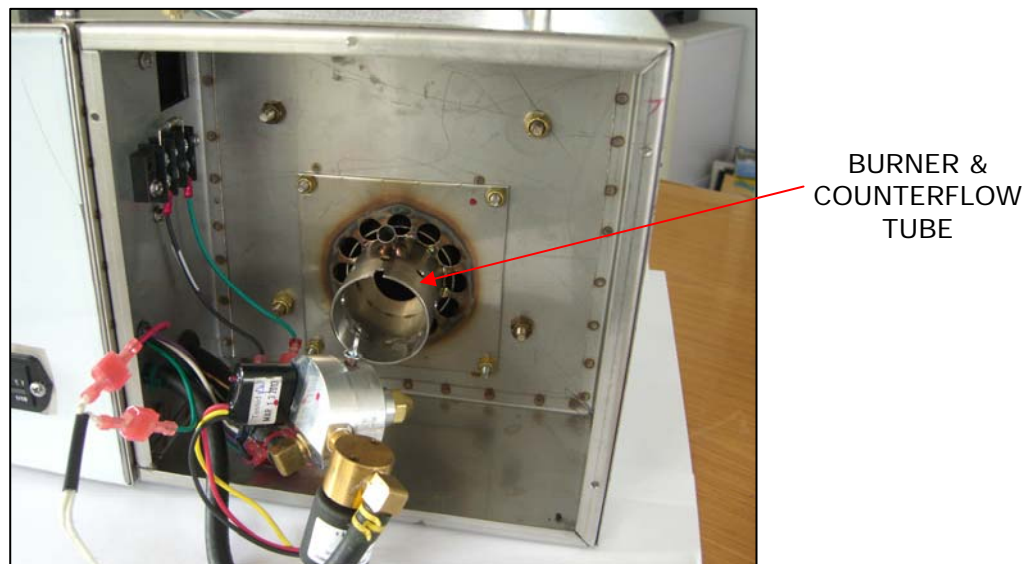
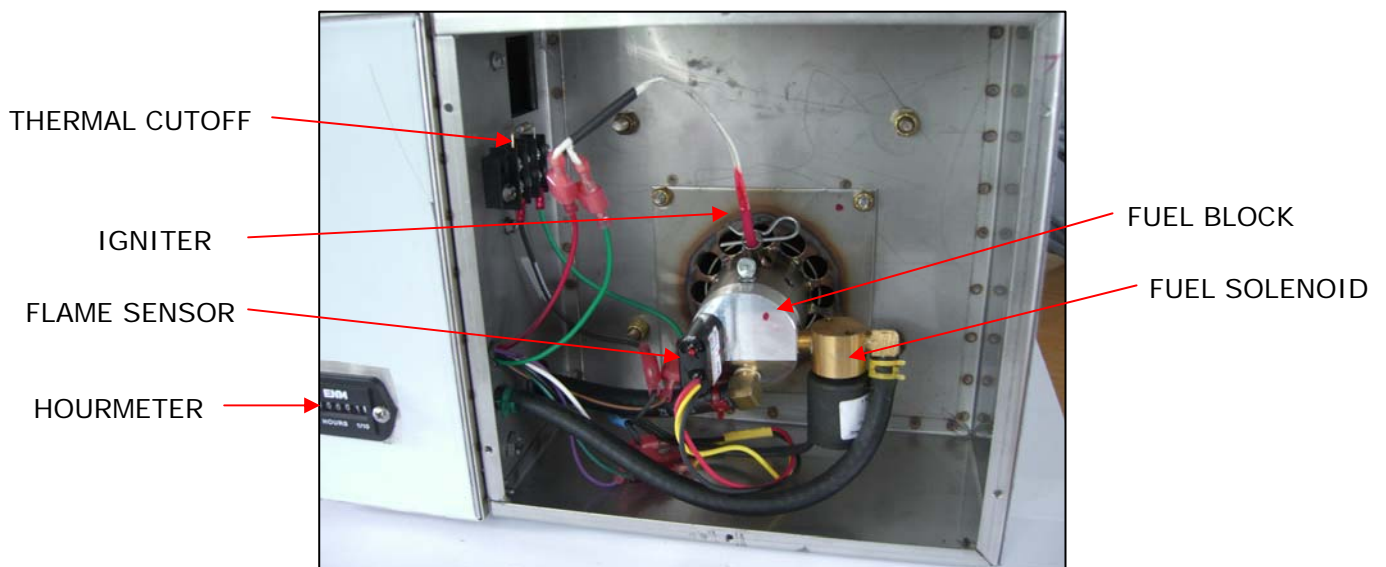
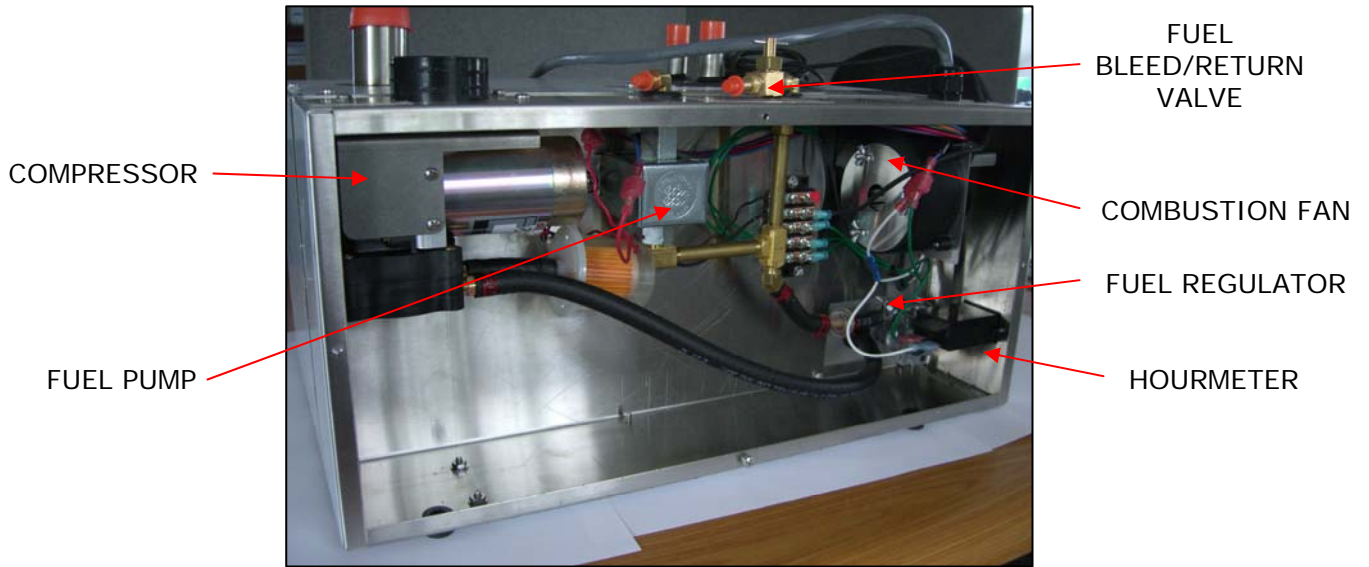
U.S. Thread Size	Ft-lbs	In-lbs	Nm
#8	2	24	3
#10	3	36	4.5
1/4-20	6 to 9	72 to 108	9 to 12
3/8-16	22 to 32	264 to 384	30 to 43

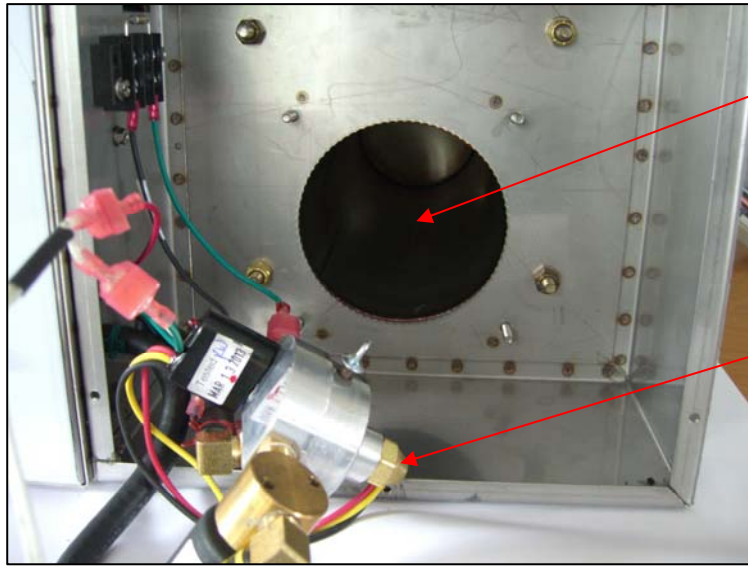
1. Operation of the Hurricane SCH25

The Hurricane SCH25 has a single source of heat; a 25,000 BTU burner.



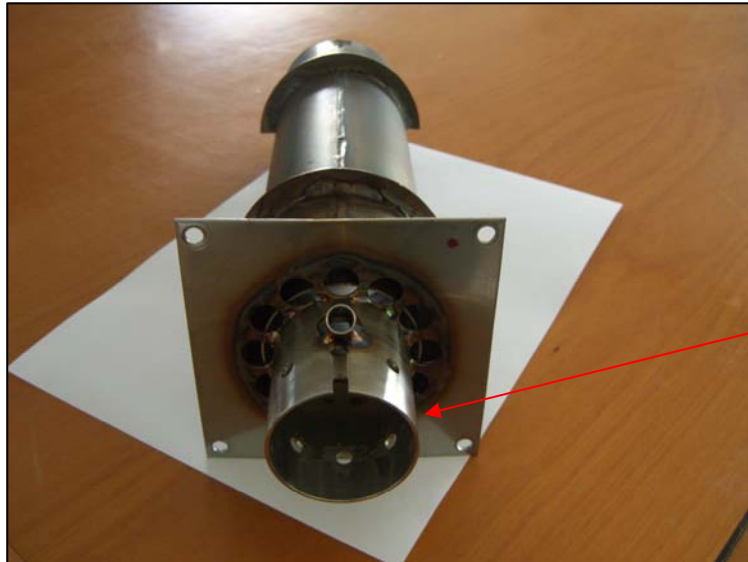
1.1. Component Views





COMBUSTION
CHAMBER

NOZZLE



BURNER &
COUNTERFLOW
TUBE

1.2. Burner

The burner consists of the following components:

1. Fuel inlet
2. Fuel Pump
3. Fuel return/bleed
4. Fuel filter
5. Fuel regulator
6. Fuel solenoid
7. Flame sensor
8. Nozzle block
9. Nozzle
10. Igniter
11. Combustion fan
12. Thermal cutoff
13. Compressor
14. Air filter

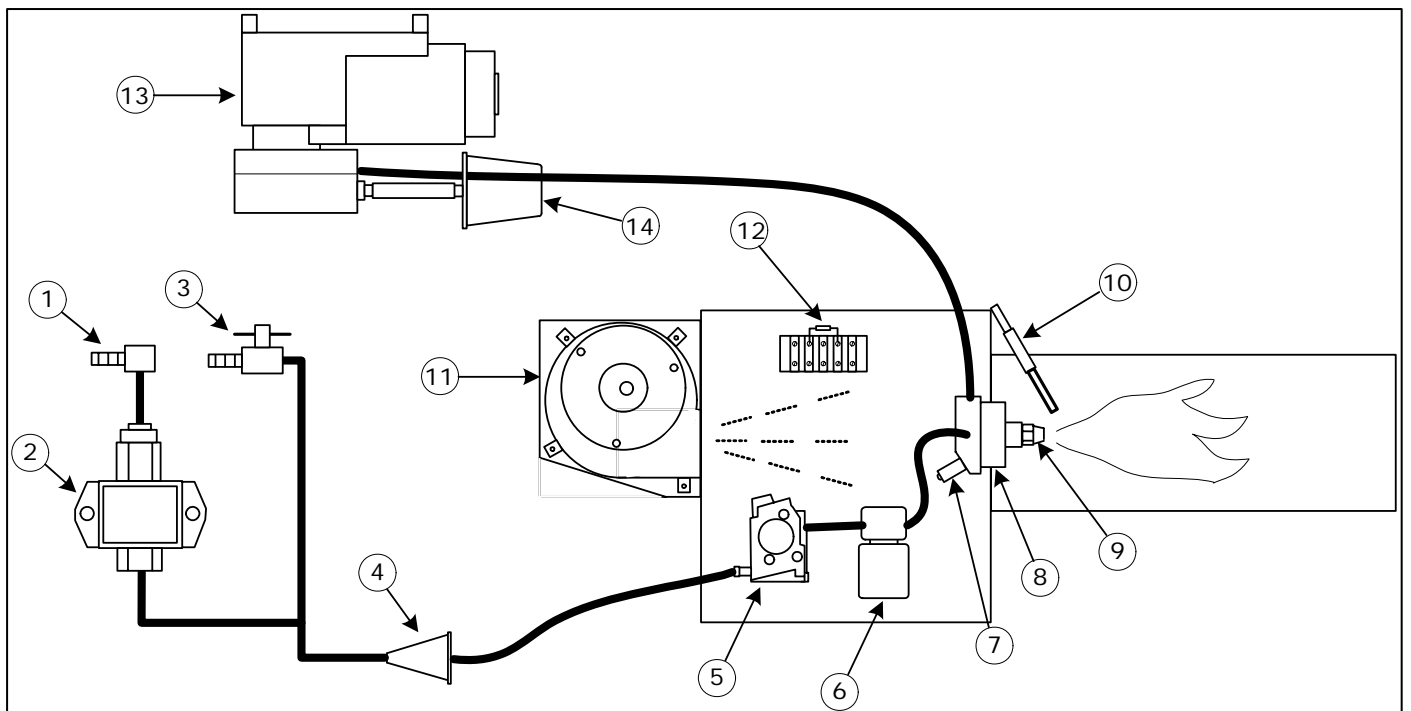


Figure 1: Burner schematic

When the heater is turned on (service switch on and remote switch on) and there is a call for heat from either the room thermostat and/or the cylinder thermostat, it will go through the following ignition sequence:

1. The combustion fan will turn ON and run for 20 seconds.
2. The igniter will turn ON and the combustion fan will turn OFF.
3. The igniter will glow for 10 seconds to allow it to reach ignition temperature.
4. After the igniter has been glowing for 10 seconds, the air compressor, fuel pump, fuel solenoid and combustion fan will turn ON.
5. The air compressor provides a constant air supply to the nozzle under a specific pressure and flow rate. The air is filtered before it enters the compressor. In the nozzle the compressed air is guided over the tip of the nozzle where it creates a negative pressure in the centre tube. This negative pressure is used to draw fuel from the fuel regulator. All fuel lines from the regulator to the nozzle must be airtight. Any leaks will have an adverse effect on the flame. The nozzle produces a solid cone spray pattern with extremely fine particles of fuel. This spray is then ignited when it makes contact with the igniter.
6. The fuel pump pumps fuel from the fuel tank up to the fuel regulator. Before the fuel enters the fuel pump, it should pass through an external filter. There is also an internal filter between the fuel pump and the fuel regulator. Fuel is only allowed to pass the regulator when there is a negative pressure between the regulator and the nozzle. In between the fuel regulator and the nozzle is a fuel solenoid. This fuel solenoid prevents the fuel being drawn back from the nozzle when the burner is off. This allows for a clean ignition.
7. The combustion fan draws outside air. This is used to create a forced air flow through the combustion chamber. This is for optimal combustion and to exhaust the combustion gases through an exhaust pipe system into the atmosphere.
8. After ignition takes place, the igniter will remain ON for an additional 5 seconds. This is so if there are any air bubbles in the fuel system, the atomised fuel will continue to be ignited.
9. After 5 seconds, the igniter will turn OFF and the air compressor, fuel pump, fuel solenoid and combustion fan will remain ON. At this point the flame sensor will also look for a flame.
10. The burner will continue to run until one of the following occurs:
 1. The coolant inside the heater reaches the set operating temperature range
 2. The heater is switched off
 3. One of the components faults
 4. A flame out occurs
 5. A voltage fault occurs

Note: After any of the above situations, the combustion fan will run for 2 minutes to purge exhaust gases from the system. The only time the combustion fan will not run after the system cycles or faults is when the

combustion fan has faulted. In this case all of the burner components will shut down immediately.

2. Control Board

- **Control box and board** – The main control board is contained in a stainless steel control box and is connected to the heater via a 15ft/4.6m long, ½in/13mm diameter interface cable.

All components in the heater unit are pre-wired to the main terminal block on the control board - Figure 3 shows the connections.

- **Fuses** – The control board contains four fuse holders with fuses pre-installed. These are standard, automotive, spade type fuses available from most auto parts stores. The fuses are (from left to right):
 - Fan/Logic – 10 amps
 - Main – 15 amps
 - Pump – 10 amps
 - Zone Fans – 10 amps
- **Accessory terminal block** – The following components need to be wired into the accessory terminal block on the control board:
 - Thermostats (up to four). Additional 4 zone board available for larger applications.
 - Fan heaters / Solenoid Valves / Motorised Valves
 - Fan speed switches (if any)
- **Fault bypass and reset buttons** – These buttons allow testing of the heating system by bypassing the fault-sensing circuit. This fault bypass feature is engaged by depressing and holding the top button, depressing and releasing the bottom button, and then releasing the top button. To reset the heater, turn the heater service switch OFF, then ON again.

Do not leave heater running unattended in bypass mode. Bypass mode runs for five (5) minutes.

- **Test points** – These points on the control board allow troubleshooting of the heating system. For detailed information on the use of each test point, see 3.19.
- **Diagnostic display** – This is an LED indicator for the diagnostics of the heater. It also has signal lights for the heater power and circulating pump.
- **Circulating pump jumper** – This jumper on the control board allows you to run the circulating pump and test the system circulation without turning the heater on.

- **Battery connector** – Connection points for the positive and negative power from the house battery to the heater.
- **Remote connector** – Connection point for the cable from the remote LCD panel.
- **Service switch** – The service switch allows full (service switch on) or partial (service switch off) operation of the functions of the heater control board. In the OFF position, it will only allow the circulating pump and cabin fan circuitry of the control board to run in response to both a thermostat calling for heat and an external heat source (engine) supplying adequate heat to the system. The operating circuitry of the burner in the heater itself is non-functional. In the ON position, all operations and features of the heater and control board are functional. In normal operation, the service switch is left ON.

NOTE: The service switch has an additional short circuit fault (# 3 – 4 – 5 – 6 – 8) reset function. This is performed by turning the service switch OFF, then ON.

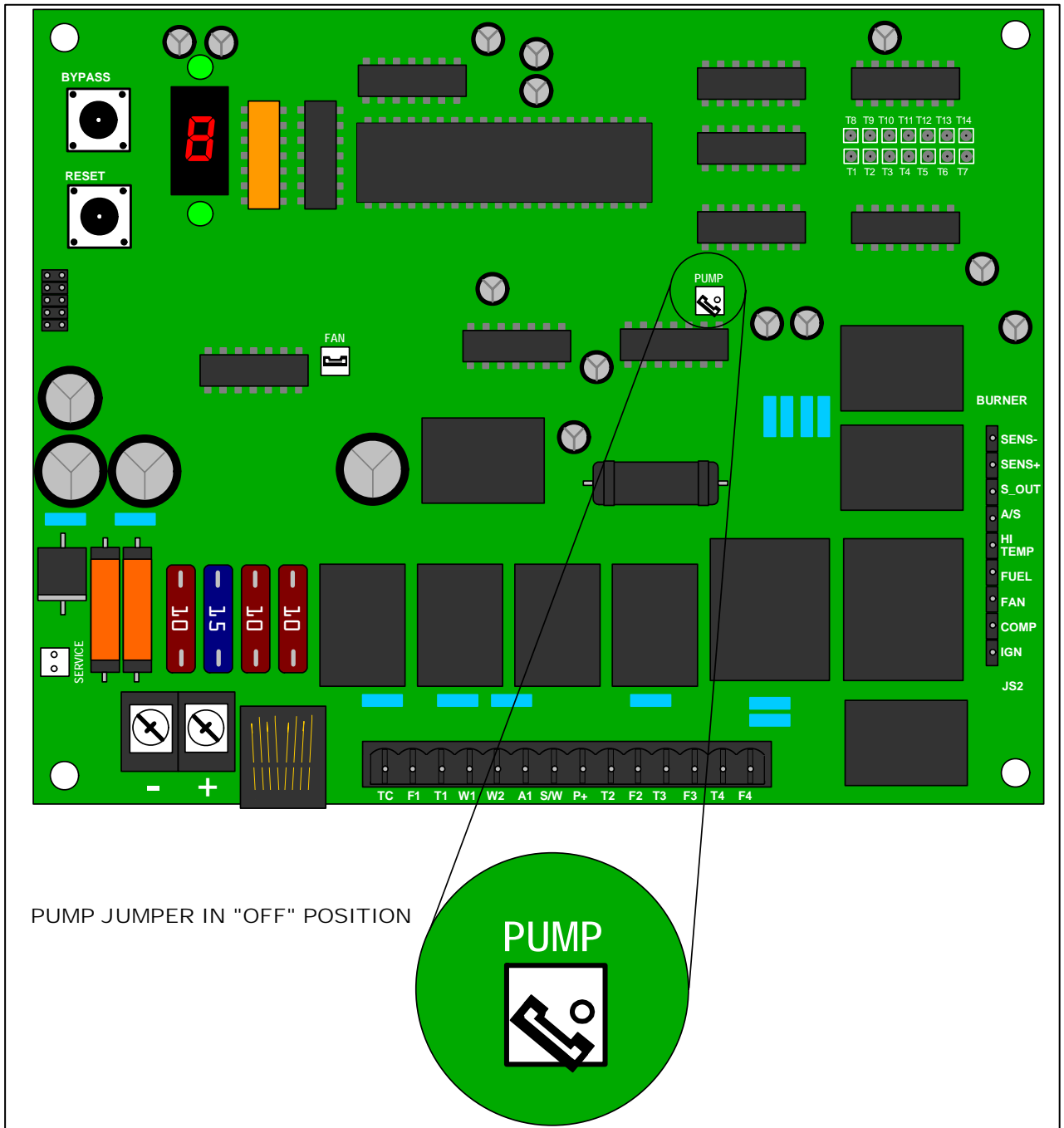


Figure 2: Control Board

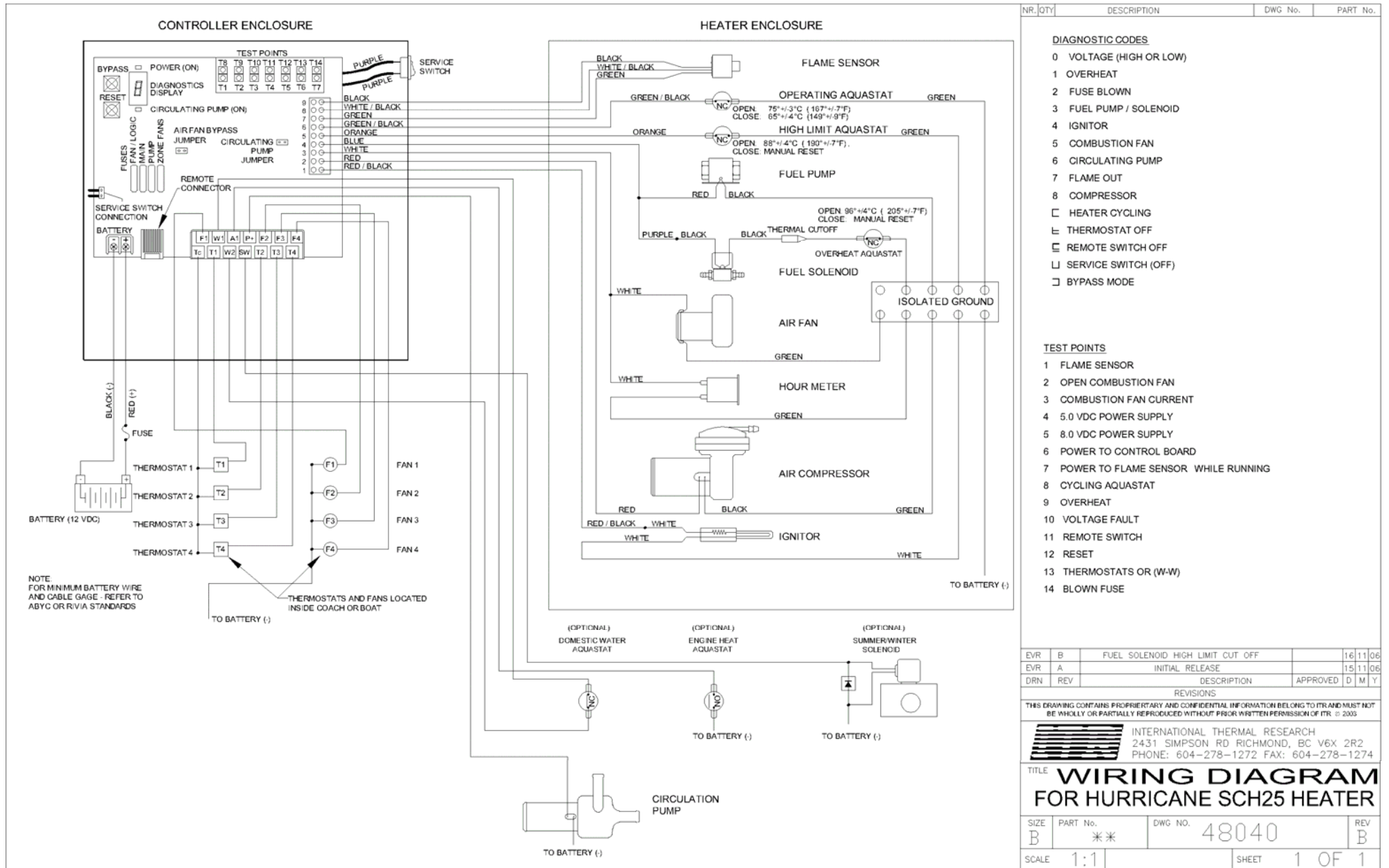


Figure 3: Wiring Diagram

3. Troubleshooting

3.1. Overview

The electronic board consists of a flash micro controller programmed to monitor the timing and safety function of the heater. Each time the board is energized by a call for heat, it will check its own circuits for any problems. Should a problem exist, the board will shut down.

You can easily monitor your HURRICANE® SCH25 heater's operation by checking the electronic control box. Any fault or problem will be immediately picked up by the control board and an LED diagnostic code indicator will light up to pinpoint the fault. Once the fault has been corrected, it can be reset by switching the service or remote switch OFF, then ON again. The diagnostic codes are described below.

3.2. Power On (Green)

The POWER ON indicator is lit whenever the service switch on the control box is ON and if the remote panel is switched ON, a small red LED near the lower right hand side of the digit on the remote panel will also glow. If this light does not come on, check to see if the service switch is ON.

If the power on light does NOT come on:

- Check for a blown fuse.

3.3. Burner On

No diagnostic code will be displayed on the main board or the remote panel when the burner is ON and operating normally. A small red LED will glow near the lower right hand side of the digital on the remote panel indicating it is ON.

3.4. **U** - Service Switch Off

The service switch is switched OFF.

- The burner will shut down if it has been running.
- The diagnostic code, **U** will be displayed.
- The control board will purge the system with the combustion fan and circulating pump for two minutes. At the end of the purge period, the system will power down and will go into a low power consumption mode (10mA max.). There will not be any display or LEDs lit.

3.5. **E** - Remote Switch Off

The remote panel is switched OFF.

- The burner will shut down.

- The diagnostic **E** code will be displayed.
- The control board will purge the system with the combustion fan and circulating pump for two minutes.
- If the remote switch is put in the ON position, the control board will resume operation and a small red LED will glow near the lower right hand corner of the digit. If there is no diagnostic code displayed or small LED glowing:
 - Make sure the service switch is ON.
 - Make sure the remote switch cable is plugged into the control box and remote switch.
 - Make sure the remote rocker switch is working.
 - Check the cable continuity.

3.6. **E** - Heater Cycling (Normal Operation)

The operating aquastat installed on the water jacket has been satisfied.

- The burner will shut down.
- The diagnostic code, **E** will be displayed.
- The control board will purge the burner with the combustion fan for two minutes and then stop. The circulating pump will run until the last thermostat is satisfied, then purge for two minutes and stop.
- To maintain the system temperature the operating aquastat will cycle the burner off at 170° F (77°C) and on again at 140°F (60°C).
- If the heater cools and fails to resume operations and the diagnostic code **E** continues to be displayed, the aquastat is faulty or has an open connection.

3.7. **F** - Thermostats Off (Normal Operation)


All thermostats and aquastats are satisfied.

- The burner will shut down.
- The diagnostic code, **F** will be displayed.
- The control board will purge the system with the combustion fan and circulating pump for two minutes. When any thermostat or aquastat calls for heat, the heater will resume normal operation.

- If the heater fails to resume operations, check the thermostat and their connections.

3.8. - Voltage Low or High




The battery or power supply voltage is below 11Vdc or above 15Vdc

- The burner will shut down.
- The diagnostic code,  will be displayed.
- The buzzer will sound for 10 seconds.
- The control board will purge the system with the combustion fan and circulating pump for two minutes while it is checking if the voltage fault is still present.

If the voltage fault has cleared, the control board will reset the alarm and restart the burner. If the condition has not cleared by the end of the purge period, the diagnostic code 0 will remain displayed. The control board will continue to check the voltage every half hour until the voltage fault has cleared and then restart the burner. To manually reset the fault, switch the service switch or the remote panel switch OFF then ON again.

3.9. - Overheat

The high temperature limit has been reached.

- The burner will shut down.
- The diagnostic code,  will be displayed.
- The buzzer will sound for 10 seconds.
- The control board will purge the system with the combustion fan and circulating pump for two minutes while it is checking if the overheat condition exists. If the condition exists, the diagnostic code  will continue to be displayed.
- In order to restart the burner, first check the circulating pump, the level of the coolant, and the movement of the coolant while the circulating pump is running. Reset the high limit aquastat (inside heater) and the fault (switch service or remote switch OFF then ON again). If the fault does not reset, check for a faulty aquastat and proper ground. If equipped with AC elements, reset the AC hi-limit aquastat also.
- If a number  diagnostic code lights up and the heater is not in an overheat condition, check the ground from the heater ground wire to

the battery. The ground wire should be a minimum 10 gauge and connected directly to the battery.

3.10. **2** - Fuse Blown

One of the fuses on the control board has blown.

- The burner will shut down.
- The diagnostic code, **2** will be displayed.
- The buzzer will sound for 10 seconds.
- The control board will purge the system with the combustion fan and circulating pump for two minutes while it is checking for a blown fuse.
- If a blown fuse exists, the diagnostic code **2** will continue to be displayed.
- In order to restart the burner, replace any blown fuses with one of the proper size. Then reset the fault by switching the service switch or the remote panel switch OFF then ON again.

3.11. **3** - Fuel Pump/Solenoid

The fuel pump or fuel solenoid has shorted.

- The burner will shut down.
- The diagnostic code, **3** will be displayed.
- The buzzer will sound for 10 seconds.
- The control board will purge the system with the combustion fan and circulating pump for two minutes.
- In order to restart the burner, check the fuel pump and solenoid for a short circuit. Then reset the fault by switching the service switch OFF then ON again.

The remote panel switch does not reset short circuit faults.

3.12. **4** - Ignitor

The ignitor is open or shorted

- The burner will shut down.
- The diagnostic code, **4** will be displayed.

- The buzzer will sound for 10 seconds.
- The control board will purge the system with the combustion fan and circulating pump for two minutes.
- In order to restart the burner, check the ignitor and connections. Then reset the fault by switching the service switch or the remote panel switch OFF then ON again if the ignitor is open or by the service switch only if the ignitor is shorted.
- The remote panel switch does not reset a short circuit fault.

3.13. **5** - Combustion Fan

- The combustion fan is open circuit or shorted.
- The burner will shut down.
- The diagnostic code, **5** will be displayed.
- The buzzer will sound for 10 seconds.
- The control board will purge with the circulating pump for two minutes.
- In order to restart the burner, check the combustion fan. Then reset the fault by switching the service switch or the remote panel switch OFF then ON again if the combustion fan is open, or by the service switch only if the combustion fan has shorted.
- The remote panel switch does not reset a short circuit fault.

3.14. **6** - Water Pump

The water pump is shorted.

- The burner will shut down.
- The diagnostic code, **6** will be displayed.
- The buzzer will sound for 10 seconds.
- The control board will purge with the combustion fan for two minutes.
- In order to restart the burner, check the water pump. Then reset the fault by switching the service switch OFF then ON again.
- The remote panel switch does not reset a short circuit fault.

3.15. **7** - Flame Out

The flame went out or did not ignite.

- The burner will shut down.
- The diagnostic code, **7** will be displayed.
- The control board will try to restart the burner two more times. After two unsuccessful restart attempts, the buzzer will sound for 10 seconds.
- The control board will purge with the combustion fan and circulating pump for two minutes. The diagnostic code **7** will continue to be displayed.
- The single most common reason for flame out faults is when air gets into the fuel system. This is normally caused by loose fittings or when your fuel supply is teed off a fuel line used by your engine or generator. As air accumulates and passes through the nozzle, it interrupts the fuel and shuts down the burner. When this happens, it may be necessary to reset the fault a few times to ensure all air has passed through the system. If the burner resumes normal operation, you must find the source of the air leak, otherwise, this fault will continue to occur.
- Check the connections on the fuel tank, fuel pump, the regulator, and at the nozzle for air leaks. Find source of air entry and repair. Make sure the nozzle or fuel filter is not clogged.
- Check the air line hoses for any restriction of airflow through the compressor. Restrictions may be caused by a crimped hose, clogged air filter, or a loose or leaking air hose from the compressor outlet to the nozzle. Check the air filter inlet for any obstructions.
- Check for negative pressure in the area around the heater. When the engine is running, it can draw air back through the heater's exhaust pipe. All intake air and exhaust connections must be tight.
- Check for restrictions or leaks in the combustion air intake hose or exhaust pipe.
- Check for open circuit on fuel pump/solenoid and compressor.
- To restart the burner, check the fuel supply and clean the nozzle. Then reset the fault by switching the service switch or the remote switch OFF then ON again.
- If when reset, the board shuts down without trying to restart the burner, the board or flame sensor is defective.

- If the conditions that caused the flame fault have been addressed and the heater still does not ignite, the thermal cutoff may have been activated by an overheat condition within the burner box. Using a multimeter, check for continuity across the leads of the thermal cutoff. The thermal cutoff is located inside the burner box, and is mounted at the top middle of the box. If there is no continuity, the heater **MUST** be inspected and the reason for the overheat condition determined and corrected before further use. A replacement thermal cutoff must be obtained from your dealer.

Notes on flame out:

If the flame goes out, the flame sensor will detect a flame-fault after 2 seconds. If the flame goes out during the ignition period (5 seconds), the flame sensor will detect a flame fault 2 seconds after the ignition period (i.e. 7 seconds from the start of the ignition period).

3.16. **B** - Compressor

The air compressor has shorted.

- The burner will shut down.
- The diagnostic code, **B** will be displayed.
- The buzzer will sound for 10 seconds.
- The control board will purge the system with the combustion fan and circulating pump for two minutes.
- In order to restart the burner, check the air compressor. Then reset the fault by switching the service switch OFF then ON again.
- The remote panel switch does not reset a short circuit fault.

3.17. **J** - Bypass Mode

The bypass mode is a service feature to be used by authorized service personnel only. The bypass mode overrides the remote switch, voltage fault, fuse blown fault, flame out fault, open ignitor fault, open fan fault, and thermostats. All these safety devices will be bypassed for five minutes.

- While in the bypass mode, the diagnostic code, **J** will be displayed and the Power ON LED will flash rapidly.
- If the heater cycling aquastat is satisfied or the overheat limit is reached, the burner will stop and purge for two minutes while displaying the diagnostic codes, heater cycling, **c** or **i**, for overheat, and the Power ON LED will flash slowly. You will have to wait for the heater to cool before continuing in the bypass mode. The bypass

mode will timeout in five minutes. After the first three minutes running, it will automatically purge for the last two minutes.

3.18. Water Pump On (Green)

The green light located directly under the LED digit on the main board will come on whenever the circulating water pump is energized.

3.19. Test Points

The test points on the electrical control board allow for testing and troubleshooting of the ITR heater's electrical system. You will need a voltage meter to plug into the test points.

Test Point	Component	Results / Optimal Condition
TP1	Flame Sensor	A voltage meter should show a voltage of 0 to 4 volts if the flame sensor detects a flame. If not, the voltage will be 0 volts. An oscilloscope will show a 0 to 5 volt square wave with a frequency of 20 Hz to 2000 Hz, if the flame sensor is detecting a flame.
TP2	Combustion Fan	The voltage will be between 4 and 5 volts if the combustion fan is operating correctly; 1 volt if the combustion fan is not drawing any current (open).
TP3	Combustion Fan Current	The voltage will be between 1 and 5 volts if the combustion fan is drawing normal current, and 0 volts if the combustion fan is not drawing current.
TP4	5v Power Supply	The voltage should be between 4.8 and 5 volts. A lower voltage indicates a problem with the voltage supply to the logic of the control board.
TP5	8v Power Supply	The voltage should be between 7.9 and 8 volts. A lower voltage indicates a problem with the voltage supply to the logic of the control board.
TP6	Power To Control Board	This is the battery voltage supplied to the control board; it should be between 11 and 15 volts.
TP7	Power To Flame Sensor	The power to the flame sensor should read between 11 and 15 volts (same as battery voltage).
TP8	Cycling Aquastat	The voltage will be between 4.8 and 5 volts if the heater is cycling (cycling aquastat is open), and 0 if the cycling aquastat is closed.

Test Point	Component	Results / Optimal Condition
TP9	Overheat Aquastat	The voltage will be 0 volts if an overheat condition is occurring or has occurred in the past two minutes (overheat aquastat is open). The voltage will be between 4.8 and 5 volts if the overheat aquastat is closed.
TP10	Voltage Fault	The voltage will be 0 volts if there is no voltage fault, and between 4.8 and 5 volts when there is a voltage fault.
TP11	Remote Switch	The voltage will be 0 volts when the remote switch is off, and between 4.8 and 5 volts when the switch is on.
TP12	Reset	The voltage will be 0 volts when the reset button is pressed, and between 4.8 and 5 volts when the reset button is not engaged.
TP13	Thermostats Or Domestic Water	The voltage will be 0 volts when the thermostat or domestic water system calls for heat and between 4.8 and 5 volts when heat is not called for.
TP14	Blown Fuse	Blown fuses for the burner, pump, or cabin fans will show a voltage of between 4.8 and 5 volts. Good fuses will show 0 volts.

3.20. LCD Readout Remote Panel

This panel will display the diagnostic explanation, which will match up to the diagnostic code on the main board. A small buzzer will sound for 10 seconds to alert you of a fault.

If the LCD panel does not display anything when the heater is switched on, insert a paper clip in the right hand hole to press the reset button.

3.21. Flame Sensor Module

The Flame Sensor consists of a sealed module with a photodiode aimed at the flame, a red LED indicator light and 3 wires, red (+), black (-), and yellow (signal) connected to the main board. Under normal operating conditions whenever the burner ignition begins, the red LED will flash once indicating the red and black wires are connected and the module is receiving power and working properly. Once the burner is ignited, the LED will begin to flicker like the flame. If for any reason the flame is extinguished, the flickering will stop and the board will shut down the heater. If the yellow (signal) wire is disconnected, the board will shut down. If all the wires are properly connected with module

flashing and the board still shuts down, diagnostic code 7 Flame Out, the board may be defective.

3.22. Reduced Output

The heater may run without faulting, but at a reduced output. If this is noticed, it could be caused by the following:

- High altitude
- Dirty nozzle
- Defective regulator
- Too small a nozzle
- Poor water circulation
- Ash deposit in combustion chamber

3.23. Smokey, Smelly Exhaust

The heater may run without faulting, but you may experience signs of soot, exhaust smoke and/or a pungent smell. This is usually caused by the wrong fuel to air mixture. This can be affected by the following:

- Low voltage
- High altitude
- Dirty compressor air filter
- Low compressor air output
- Restricted combustion air flow (intake hose / exhaust hose / combustion chamber)
- Low combustion fan output (defective motor / wrong rotation / dirty fan blade)
- Partially clogged grooves in nozzle distributor

4. Step-by-step Troubleshooting

4.1. Flame Out

Check the following before continuing with the troubleshooting:

- The fuel supply from the diesel tank to the fuel inlet of the heater must be from a dedicated fuel pickup on the top of the tank.
- The fuel level in the diesel tank must be above the level of the bottom of the fuel pickup tube.
- The total rise from the bottom of the fuel pickup tube to the fuel inlet on the heater should not exceed 60 inches.
- The fuel line from the diesel tank to the inlet of the heater must not have any kinks or leaks.
- External fuel filter and pipe work must be clear of any contaminants obstructing the flow of fuel.
- The first time that the fuel line is connected, or if the fuel has run and been refilled, there will be air in the line. This should be bled using the bleed tap on the top of the heater whilst the heater is restarted a few times.

If any of the above issues were found to be a problem, correct the situation and restart the heater.

Refer to the following underlined statements that best describe the problem that is being encountered:

When the heater attempts to light, there is no flame and a flame-out occurs after 7 seconds.

Restart the heater and look through the flame observation window and check for a glow from the igniter – this should occur after the combustion fan stops and should last for about 10 seconds.

Q1: Is there a glow in the burner chamber when the igniter should be on?

IF NO:

1. Install a new igniter. To install the igniter, refer to 5.3.2.
2. Once the igniter is installed, turn on the heater.

IF YES:

During the first 7 seconds when the fuel pump is running, open the fuel bleed valve and check the fuel is coming out of the tap. Proceed to Q2.

Q2: When the fuel pump is running, does fuel come out of the bleed valve?

IF YES:

Place your finger on the air compressor's air filter. Once the air compressor turns on, there should be enough suction to keep your finger in place. Proceed to Q3.

IF NO:

1. Check the internal fuel filter to see it is clogged. If it is, replace the filter.
2. Once the fuel filter has been replaced, restart the heater. During the first 7 seconds when the fuel pump is running, ensure the fuel bleed tap is open and check that fuel is flowing. Proceed to Q4.

Q3: Once the air compressor turns on, is there enough suction at the inlet of the air filter to hold your finger in place?

IF NO:

Change the air compressor.

IF YES:

Check the glow of the igniter. Turn off the service switch and allow the heater to completely power down (this will take 2 minutes). To check the glow of the igniter, do the following:

1. **IMPORTANT:** Disconnect the air compressor wires from the main harness. Disconnecting the wires ensures that the heater will not attempt to fire if the heater is accidentally turned ON. This will make it safe to view the igniter with an open burner box.
2. Remove the screws on the front cover and remove the cover.
3. Loosen the thumb screw on top of the fuel block and pull the fuel block out from its mounting position.
4. Ensure that the igniter tip is in a horizontal plane.
5. With the fuel block out of the way, turn on the heater and observe the igniter during the first 10 seconds.
Note: the heater will stop and show a flame out.
Proceed to Q6.

Q4: Once the fuel filter has been changed and the fuel pump is running, is there fuel coming from the opened return bleed valve?

IF YES:

Problem solved.

IF NO:

1. Change the fuel pump.

2. Once the fuel pump has been replaced, attempt to restart the heater. When the fuel pump starts running, ensure that fuel flows from the open fuel return bleed valve. Proceed to Q5.

Q5: Once the fuel pump has been replaced, attempt to restart the heater. When the fuel pump is running, is fuel flowing from the open return bleed valve.

IF YES:

Problem solved.

IF NO:

Contact Calcutt Boats for further assistance.

Q6: Is the igniter glowing bright yellow?

IF YES:

1. Clean the fuel nozzle. To clean the fuel nozzle, refer to 5.3.3.
2. Once the fuel nozzle has been cleaned, attempt to restart the heater. Proceed to Q7.

IF NO:

Replace the igniter. Refer to 5.3.2.

Q7: Does the heater fire once the fuel nozzle has been cleaned?

IF YES:

Problem solved.

IF NO:

Check the fuel solenoid. Turn off the service switch and allow the heater to completely power down (this will take 2 minutes). **IMPORTANT:** Disconnect the main power (12VDC) from the heater. Disconnecting the 12VDC power ensures that the heater will not attempt to fire if the service switch is accidentally turned ON. If the heater were to attempt to fire with the front cover off, it will project open flame towards the user. To check the fuel solenoid, do the following:

1. Remove the screws on the front cover and remove the cover.
2. Disconnect the wires to the fuel solenoid.
3. Being careful the O-ring stays in place on the brass head, unscrew the fuel solenoid from the brass head and remove the plunger (inside of fuel solenoid).
4. Screw the solenoid body back in place (note this is temporary to test if the fuel solenoid is a problem).
5. Screw the front cover back in place.
6. Connect the main 12VDC power to the heater.

Turn on the service switch and attempt to run the heater.
Proceed to Q8.

Q8: Does the heater fire once the plunger from the fuel solenoid is removed?

IF YES:

Problem solved. Replace the fuel solenoid. To replace the fuel solenoid, refer to 5.3.1.

IF NO:

Contact Calcutt Boats for further assistance.

When the Heater attempts to fire, a stable flame comes on for 7 seconds. After 7 seconds the heater flames out.

IMPORTANT: Disconnect the main power (12VDC) from the heater. Disconnecting the 12VDC power ensures that the heater will not attempt to fire if the heater is accidentally turned ON. If the heater were to attempt to fire with the front cover off, it will project open flame towards the user.

Remove the screws on the front cover and remove the cover. Check that the connections to the RED, BLACK, and YELLOW wires on the flame sensor (see 5.3.4) are secure. This connection will have YELLOW heat-shrink on both sides of the matching connectors. Proceed to Q1.

Q1: Are all flame sensor connections secure and correct?

IF YES:

1. Disconnect the flame sensor wires and unscrew (counter-clockwise) the flame sensor from the fuel block.
2. Check for soot build-up on the flame sensor eye.
3. Check for soot build-up in the flame sensor hole in the fuel block (using a flashlight). This hole should have a clear line of sight into the burner chamber. Proceed to Q2.

IF NO:

1. Correct the connections.
2. Screw front cover back in place.
3. Connect the main 12VDC power to the heater.
4. Attempt to run the heater.

Q2: Does the flame sensor eye have soot on it, or is soot blocking the flame sensor hole in the fuel block?

IF YES:

1. Clean the soot off the flame sensor eye.

2. Clean the flame sensor hole using high pressure air.
3. Screw the flame sensor (clockwise) into the fuel block.
4. Connect the flame sensor wires to the connectors with matching YELLOW heat-shrink.
5. Screw the front cover back in place.
6. Connect the main 12VDC power to the heater.
7. Attempt to run the heater.

IF NO:

1. Replace the flame sensor. To replace the flame sensor, refer to 5.3.4.
2. Attempt to run the heater. Proceed to Q3.

Q3: Did the new flame sensor allow the heater to continue running after 7 seconds?

IF YES:

Problem solved.

IF NO:

Contact Calcutt Boats for further assistance.

The heater sputters intermittently and eventually flames out.

The sputtering effect is due to air in the fuel system. When the burner chamber is hot, this sputtering effect can cause the heater to backfire. Intermittent sputtering is commonly caused by leaks in the fuel line. To check the fuel line, do the following:

1. Turn off the fuel supply to the heater before proceeding with the next step.
2. Remove the fuel line from the fuel inlet of the heater and replace it with a short piece of fuel line. Secure this line with a hose clamp.
3. Put a fuel filter on the other end of the fuel line and place the end in a jerry can filled with diesel fuel.
4. Attempt to run the heater.
5. There will be air in this new fuel line. It may be necessary to restart the heater to bleed the air from the fuel line.
6. Proceed to Q1.

Q1: Does the heater continue to sputter after the jerry can is put in place?

IF YES:

If the fuel block was taken out or the fuel solenoid replaced, then the fuel line from the outlet of the fuel regulator to the

inlet of the fuel solenoid could have been damaged. To check this fuel line for leaks, do the following:

Turn off the service switch and allow the heater to completely power down (this will take 2 minutes).

1. **IMPORTANT:** Disconnect the main power (12VDC) from the heater. Disconnecting the 12VDC power ensures that the heater will not attempt to fire if it is accidentally turned ON. If the heater were to attempt to fire with the front cover off, it will project open flame towards the user.
2. Remove the screws on the front cover and remove the cover.
3. Inspect the fuel line from the regulator to the fuel solenoid for leaks. The hose clamps must be secured on the outlet of the fuel regulator and on the inlet of the fuel solenoid.
4. Also, if the fuel solenoid was replaced, check for proper sealant on the threads. Proceed to Q2.

IF NO:

The problem is not with the heater. There may be a cut in the fuel line running from the fuel tank to the fuel inlet of the heater, or the hose clamps may not be secured in place.

Q2: Is the fuel line leaking or does the fuel solenoid not have proper sealant on the threads?

IF YES:

- If the fuel line is leaking, replace the fuel line with 1/4" I.D. diesel approved fuel line.
- If the fuel solenoid does not have sealant on the threads, refer to 5.3.1 to put on the appropriate sealant.

IF NO:

Refer to the next section (continuous sputtering).

The heater sputters continuously and eventually flames out.

The sputtering effect is due to air in the fuel system. When the burner chamber is hot, this sputtering effect can cause the heater to backfire. Continuous sputtering is commonly caused by a damaged O-ring in the fuel nozzle. To check the nozzle, refer to 5.3.3. Proceed to Q1.

Q1: Is the O-ring in the fuel nozzle damaged?

IF YES:

Replace the fuel nozzle. To replace the fuel nozzle, refer to 5.3.3.

IF NO:

Refer to the previous section (intermittent sputtering). If this section does not solve the problem, contact Calcutt Boats for further assistance.

4.2. Voltage

Check the DC voltage to the heater using a multi-meter. Note that the voltage at the battery is not necessarily the voltage supplied to the heater. Depending on the gauge and length of the power wires, there will be a voltage drop between the battery and the heater. To ensure the correct voltage is being measured, measure the voltage at the terminals on the control board. Proceed to Q1.

Q1: Is the voltage range between 10.5 and 16 Volts?

IF NO:

If the voltage is below 10.5V, correct the situation by charging the battery. If the voltage is above 16V, then there is a problem with charging. Once the situation is corrected, restart the heater.

If YES:

Check the voltage to the heater using a multi-meter, and at the same time, restart the heater. At this point the heater will begin its ignition sequence. Monitor the voltage during the ignition sequence. If at any time the voltage drops below 10.5V and stays below 10.5V for longer than 10 seconds, the heater will indicate a voltage fault (code 0) and shut down. The heater will attempt to re-start one more time, and if the same thing happens, it will shut down and indicate a voltage fault. The heater will re-try every 30 minutes. Proceed to Q3.

Q3: Once the burner fires, does the voltage drop below 10.5V?

IF YES:

The battery is discharged and showing a voltage that it is not capable of supporting under load. Once a load is put onto the battery (i.e. when the burner attempts to fire), the battery voltage will drop. This situation indicates that the battery needs to be charged or possibly replaced. Once the battery is charged attempt to restart the heater.

IF NO:

Contact Calcutt Boats for further assistance.

5. Servicing the Hurricane SCH25

5.1. Indications Service Is Required

The flame is a dirty orange colour.

Start the heater and place your finger on the air compressor's air filter. Once the air compressor turns on, there should be enough suction to keep your finger in place. Proceed to Q1.

Q1: Once the air compressor turns on, is there enough suction at the inlet of the air filter to hold your finger in place?

IF NO:

Replace the air compressor. Once the air compressor has been replaced, attempt to run the heater. Proceed to Q2.

IF YES:

Clean the fuel nozzle. To clean the fuel nozzle, refer to Servicing the 5.3.3. Once the fuel nozzle has been cleaned, attempt to run the heater. Proceed to Q2.

Q2: Is the flame a bright yellow colour after replacing the air compressor or cleaning the fuel nozzle?

IF YES:

Problem solved.

IF NO:

Contact Calcutt Boats for further assistance.

The flame is small and has a blue colour.

Clean the fuel nozzle. To clean the fuel nozzle, refer to 5.3.3.

Once the fuel nozzle has been cleaned, attempt to run the heater. Proceed to Q1.

Q1: Is the flame a bright yellow colour after cleaning the fuel nozzle?

IF YES:

Problem solved.

IF NO:

Replace the internal fuel filter. Attempt to run the heater. Proceed to Q2.

Q2: Is the flame a bright yellow colour after replacing the fuel filter?

IF YES:

Problem solved.

IF NO:

Contact Calcutt Boats for further assistance.

1000 hours has passed since the last service.

The following service needs to be done after 1000 hours of operation:

- Replace the internal fuel filter.
- Clean or replace the fuel nozzle; refer to 5.3.3.
- Replace the air filter on the air compressor.
- Clean the combustion chamber; refer to 5.2.

5.2. Cleaning the Combustion Chamber

To clean out the combustion chamber, do the following:

1. Turn off the service switch and allow the heater to completely power down (this will take 2 minutes).
2. **IMPORTANT:** Disconnect the main power (12VDC) from the heater. Disconnecting the 12VDC power ensures that the heater will not attempt to fire if the service switch is accidentally turned ON. If the heater were to attempt to fire with the front cover off, it will project open flame towards the user.
3. Remove the screws from the front cover (using a Philips head screw driver) and remove the cover.
4. Disconnect igniter supply wire(s).
5. Remove R-clip securing igniter.
6. Remove igniter. Examine for damage/wear. Replace if necessary.
7. Loosen thumbscrew which retains fuel block and withdraw from burner chamber.
8. Remove the 4 locknuts (using 7/16" socket) that are holding the burner/counter-flow tube in position.
9. Cover fuel block and nozzle assembly with a cloth and withdraw burner/counter-flow tube from chamber.
10. Clean out the ash from inside the combustion chamber (using a vacuum or pressurized air).
11. Place the burner/counter-flow tube back in position and secure it in place using the 4 locknuts.
12. Screw front cover back in place.
13. Connect the main 12VDC power to heater.

5.3. Parts Replacements

5.3.1. Fuel Solenoid

To install the fuel solenoid, do the following:

1. Turn off service switch and allow the heater to completely power down (this will take 2 minutes).
2. **IMPORTANT:** Disconnect the main power (12VDC) from the heater. Disconnecting the 12VDC power ensures that the heater will not attempt to fire if the service switch is accidentally turned ON. If the heater were to attempt to fire with the front cover off, it will project open flame towards the user.
3. Remove the screws from the front cover (using a Philips head screw driver) and remove the cover.
4. Disconnect the wires to the fuel solenoid.

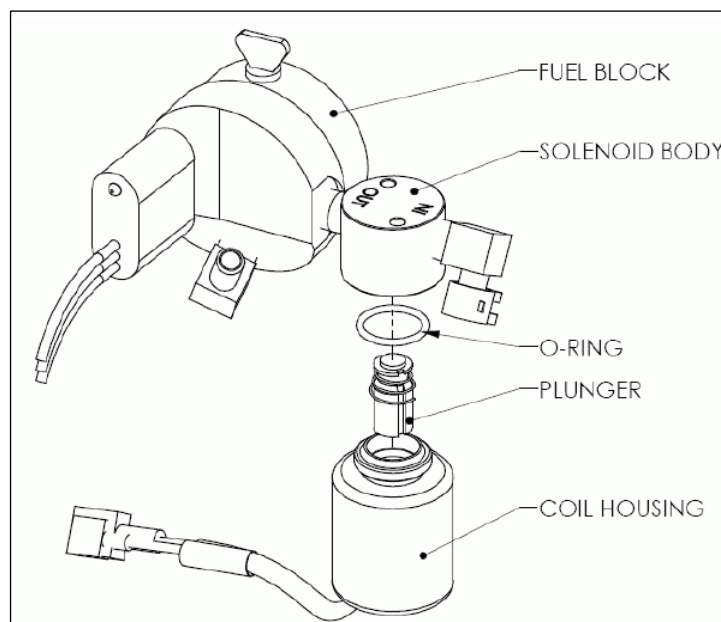


Figure 4: Fuel Solenoid

5. Unscrew the fuel solenoid coil housing from the solenoid body (counter-clockwise).
6. Make sure the old O-ring and plunger are removed as well.
7. Unscrew the coil housing from the new solenoid including the new O-ring.
8. Carefully screw back the new solenoid coil housing into the body without damaging the O-ring.
9. Connect the fuel solenoid wires to the main harness ensuring the connectors and the fuel solenoid wires have matching BLUE heat-shrink on both sides of the connectors.
10. Screw the front cover back in place.
11. Connect the main 12VDC power to the heater.

5.3.2. Igniter

To install the igniter, do the following:

1. Turn off service switch and allow the heater to completely power down (this will take 2 minutes).
2. **IMPORTANT:** Disconnect the main power (12VDC) from the heater. Disconnecting the 12VDC power ensures that the heater will not attempt to fire if the service switch is accidentally turned ON. If the heater were to attempt to fire with the front cover off, it will project open flame towards the user.
3. Remove the screws from the front cover (using a Philips head screwdriver) and remove the cover.
4. Disconnect the igniter wires.

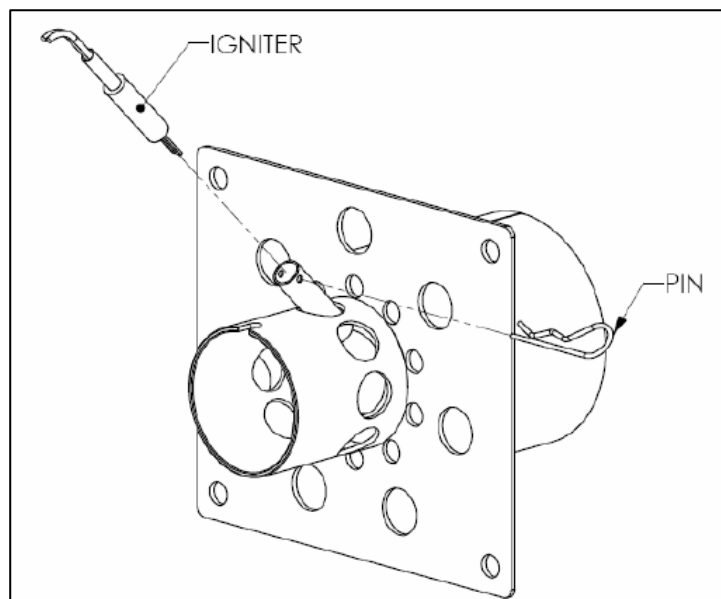


Figure 5: Igniter

5. Remove the pin that holds the igniter in the igniter tube and remove the igniter.
6. Place the new igniter in the igniter tube, being careful the igniter tip does not hit the sides of the igniter tube.
7. Once the igniter is fully inserted into the igniter tube, secure the pin that holds the igniter in place, being careful not to pierce the heat shrink on the igniter. Note that the pin can go in only if the igniter tip is in the horizontal plane.
8. Connect the igniter wires to the main harness ensuring both sides of the connectors have matching BLACK heat-shrink.
9. Screw the front cover back in place.
10. Connect the main 12VDC power to the heater.

5.3.3. Fuel Nozzle

To install the fuel nozzle, do the following:

1. Turn off service switch and allow the heater to completely power down (this will take 2 minutes).
2. **IMPORTANT:** Disconnect the main power (12VDC) from the heater. Disconnecting the 12VDC power ensures that the heater will not attempt to fire if the service switch is accidentally turned ON. If the heater were to attempt to fire with the front cover off, it will project open flame towards the user.
3. Remove the screws from the front cover (using a Philips head screwdriver) and remove the cover.
4. Loosen the thumb screw on top of the fuel block and remove it from its mounting position.

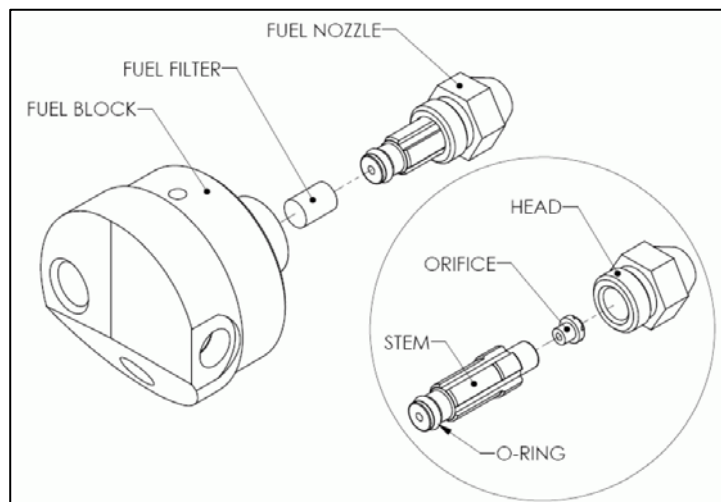


Figure 6: Fuel Nozzle

5. Unscrew the fuel nozzle (counter-clockwise) using a 5/8" wrench.
6. When the fuel nozzle is removed, a fuel filter is visible inside the fuel block. Remove this filter and clean it using solvent and high pressure air.
7. For the following procedure, **keep the nozzle vertical** so the distributor does not fall out when the nozzle is taken apart.
8. Hold the fuel nozzle using a 5/8" wrench and turn the stem counter-clockwise using a crescent wrench.
9. Clean the distributor orifice and air slots of any debris using solvent and high pressure air. Check the 'O' rings for nicks and replace if in doubt.
10. When putting the nozzle head and stem back together, ensure the distributor is fitted properly in position. Also, **keep the nozzle vertical** when putting the nozzle head and stem back together. If this is not done, the nozzle will get damaged.

11. Place the filter in the fuel block and screw the cleaned fuel nozzle (clockwise) back in place. When doing this, position the fuel block so the fuel nozzle is vertical when being screwed into the fuel block. If this is not done, the fuel filter can fall out.
12. Place the fuel block back in its mounting position and tighten the thumb screw on top of the fuel block to secure it in place.
13. Clean up any diesel fuel that was spilt
14. Screw the front cover in place.
15. Connect the main 12VDC power to the heater.

5.3.4. Flame Sensor

To install the flame sensor, do the following:

1. Turn off service switch and allow the heater to completely power down (this will take 2 minutes).
2. **IMPORTANT:** Disconnect the main power (12VDC) from the heater. Disconnecting the 12VDC power ensures that the heater will not attempt to fire if the service switch is accidentally turned ON. If the heater were to attempt to fire with the front cover off, it will project open flame towards the user.
3. Remove the screws from the front cover (using a Philips head screwdriver) and remove the cover.
4. Disconnect the flame sensor wires and unscrew (counter-clockwise) the flame sensor from the fuel block.

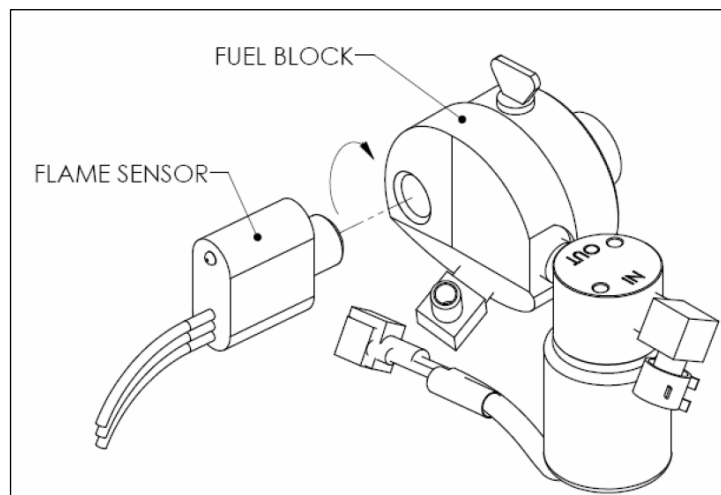


Figure 7: Flame Sensor

5. Screw (clockwise) a new flame sensor into the fuel block.
6. Connect the flame sensor wires to the main harness ensuring both sides of the connectors have matching YELLOW heat-shrink.
7. Screw the front cover in place.
8. Connect the main 12VDC power to the heater.

Appendices

Appendix 1 - Technical Bulletins