

Figure 5. Typical Manual Bypass Valve Installation

4. Too many restrictions in the water path which may include small pumps or 2 speed pumps (low), dirty filters, clogged pipes, or partially closed water valves to the heater.

Verify and correct the condition and then repeat the temperature rise test.

⚠ Caution

Operation with the temperature rise above maximum or below the minimum can damage the heater and will void the warranty.

2E-3. Adjusting the Manual Bypass Valve

After the manual bypass valve is installed, use the following procedures to set the bypass valve:

1. Close the manual bypass valve completely.
2. Repeat steps 7 through 12 of the temperature rise test (see Section 2E), slowly opening the manual bypass until the temperature falls between 18 and 22°F (10 and 12.2°C).
3. Once the temperature is within the correct range, wire the handle of the manual bypass valve to the pipe to prevent change in the water flow.

SECTION 3. Troubleshooting

3A. Supply Gas and Metering System

If the heater does not supply its rated output (heating too slow), or if a blue lazy flame (too little gas), or a bright flame (too much gas) is noticed, check the supply gas pressure. Proper operation of the fuel/air balancing system depends on the following:

1. Proper supply gas pressure to heater.
2. Correct gas pressure difference across the metering orifice.
3. Correct orifice for the fuel being used. Figure 3 shows how the system works.
4. Vent pipe length.

3A-1. Checking the Manifold Regulated Gas Pressure

The Hi-E heater's negative pressure gas valve regulates the gas to the heater based on the amount of air flow through the venturi. Proper operation of the heater depends on the proper settings of the gas flow. Symptoms of improper operation are either a blue lazy flame (too little gas) or a bright yellow flame (too much gas).

NOTE: Gas supply test, stack test, and air flow filter test should be completed before attempting this test or making any adjustments.

1. Check supply gas pressure (see Section 3B-2).
2. Check that all ports and tubes are clear that connect the gas valve and venturi.
3. Check for proper orifice (see Table 2).
4. Attach a manometer or a 1/2 inch (13 mm) negative pressure gauge between the outlet pressure tap on the gas valve and the venturi (lower) inlet pressure tap (see Fig. 6).

5. The pressure at the gas valve outlet will be 0.2 inch (5.08 mm) water column (W.C.) less than the pressure at the venturi (lower) inlet.
6. Take a reading. The ideal range should be between -0.1 and -0.3 inches (-2.5 and -7.6 mm) W.C. when the gas valve is energized.

IMPORTANT: Before the gas valve is energized, the pressure reading will be approximately 2.8 inches (71 mm) W.C. on outdoor units fitted with the standard vent stack. On indoor installations with vent piping as long as 60 feet (18 meters [m]), the pressure can be as low as 2.0 inches (51 mm) W.C.

3A-2. Checking the Supply Gas Pressure

To check the gas supply pressure:

1. Attach one end of a manometer hose to the fitting on the gas valve (see Fig. 6).
2. Remove threaded cap from T-fitting and replace with fitting from manometer.

Table 2. Gas Metering Orifice Size

| | Natural Gas | LP Gas |
|------------------|------------------------|------------------------|
| Orifice Diameter | 0.354 in. (8.99 mm) | 0.295 in. (7.49 mm) |
| Color Code | Brass | Silver |

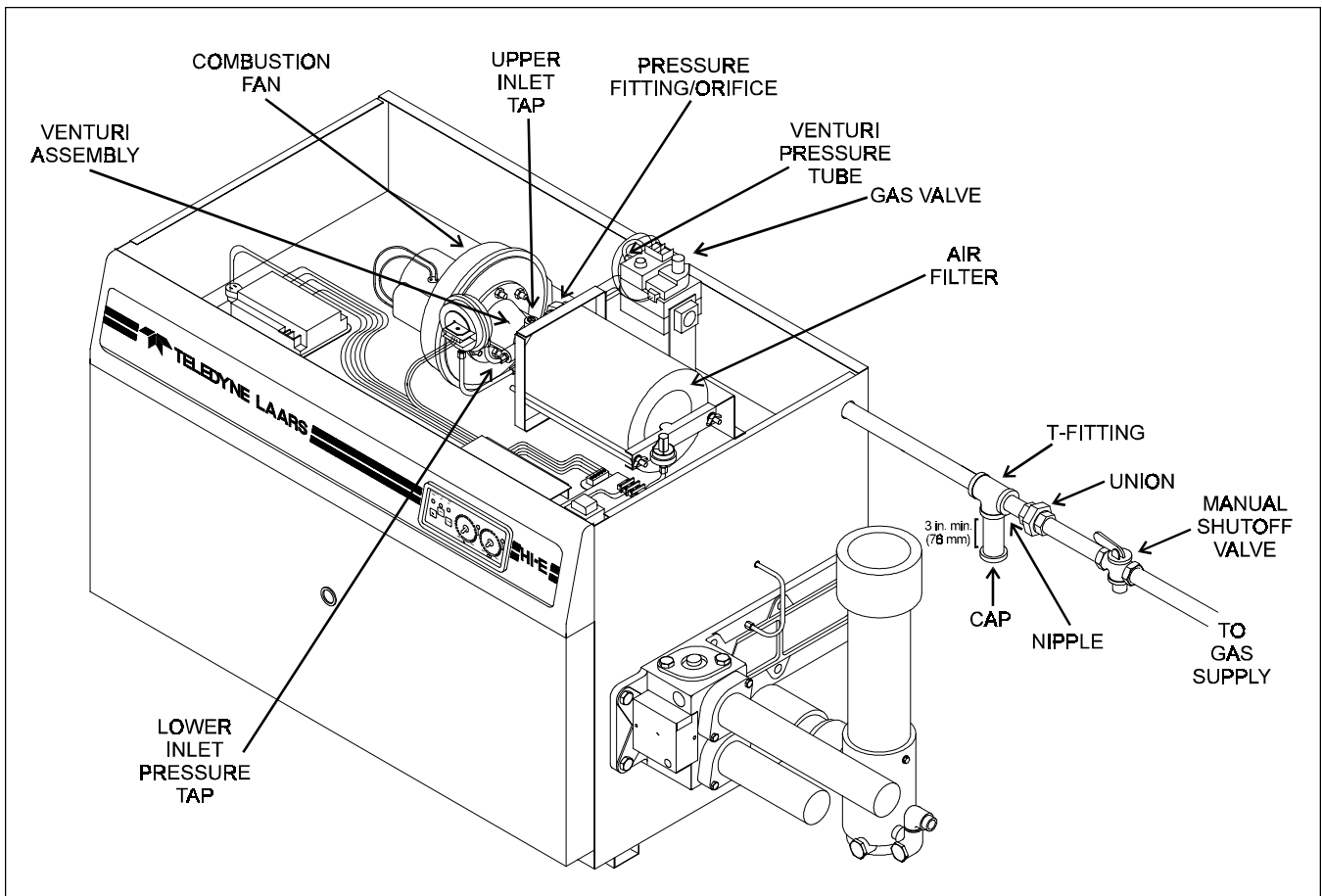


Figure 6. Checking the Gas Pressure

3. A minimum of 5 inches (127 mm) W.C. for natural gas and 11 inches (279 mm) W.C. for propane gas, when the burner is firing, is required.
4. If the supply gas pressure is less than the minimum, check for under-sized pipe between the meter and the heater, a restrictive fitting, an under-sized gas meter.

IMPORTANT: Any gas supply problem must be corrected. The source of the incorrect supply pressure must be found and corrected. If you cannot clear up the supply pressure problem, contact a qualified service technician or your local gas company.

3A-3. Checking the Metering Orifice

Gas flow is controlled by the orifice in the fitting between the gas valve and the venturi throat. The orifice must be the correct size for the fuel being used (see Table 2).

To inspect the gas orifice:

1. Disconnect the venturi pressure tube (see Fig. 6).
2. Carefully remove the fitting between the gas valve and the venturi throat.
3. Remove the orifice and inspect it.
4. Reassemble all parts properly after making sure the orifice size is correct.

3A-4. Checking the Venturi Pressure Switch

The venturi pressure switch is calibrated to open when the pressure falls below the minimum values, shutting off the heater. If a dull blue lazy flame is detected or it takes a long time for the heater to heat up, the cause may be:

1. A restriction in the combustion system flow by a partially blocked combustion air inlet or vent terminal.
2. Excessive vent pipe length or too many 90 degree elbows (see Document 3090B, Installation and Operation Manual).
3. Worn or dirty combustion air filter.
4. Internal blockage in the condensate trap or drain system.

To check the venturi pressure difference perform the following stack test:

1. Remove upper inlet pressure tap from the top of the venturi (see Fig. 6).
2. Attach the hose from the manometer to the upper tap on the venturi.

NOTE: The manometer must be able to read a negative pressure.

3. Start the heater and let the unit fire.
4. Take a reading. Readings should be:
 - a. -2.2 to -3.2 inches (-56 to -81 mm) W.C. for outdoor units with standard stack extensions.
 - b. - 1.4 to -3.2 inches (-36 to -81 mm) W.C. for indoor units with proper venting.

3A-5. Checking the Air Flow (Filter)

The amount of gas that flows to the burner is regulated by the amount of air through the venturi. Testing pressure readings at the gas valve pressure tap can determine if there is an air flow problem.

If the heater is heating slowly or cycling on and off, perform the following filter test:

1. Attach a manometer or a negative pressure gauge to the press tap opening on the gas valve.
2. Turn on the heater.

NOTE: The fan will come on and the heater will fire about 20 to 30 seconds later.

3. Take a reading. Reading should be -0.3 to -0.5 inches (-7.6 to -12.7 mm) W.C.
4. If the reading is less than -0.3 inches (-7.6 mm) W.C., check the tubing between the gas valve regulator and the venturi port for blockage.
5. If the reading is greater than -0.5 inches (-12.7 mm) W.C., there is a restriction of air through the heater. This will not harm the heater, only reduce its output British Thermal Unit (BTU) rating.

To correct the reduced air flow check the following:

1. Check and clean the air filter. It may be necessary to replace, if very dirty.
2. Check for excessive pipe length on vent.
3. Check for a dirty or worn fan unit.
4. Check to see if the “P” trap is clear.

⚠ WARNING

Do not attempt to adjust the gas pressure at the gas valve. Serious damage could occur.

3B. Electrical Troubleshooting

This section describes procedures for checking the electrical power and control components of the heater (see Fig. 7 for a typical example of a wiring diagram). Use the flowchart (see Fig. 8) and the following sections to troubleshoot the heater. Read all of these procedures before starting repairs.

The following tools are required for proper service and problem diagnosis of the heater and heater system:

1. Gas pressure test kit with range from 0 to 14 inches (0 to 356 mm) W.C.
2. Electric meter(s) with the following ranges:
 - a. 0 to 150 volts alternating current (VAC)
 - b. 0 to 25V direct current (DC)
 - c. 0 to 2,000 ohms resistance
3. A pressure gauge and a thermometer with proper ranges for heater operation.

3B-1. Testing the Electrical Supply Power

The electrical components of the Hi-E heater operate with supply voltage ranging from 103 to 126VAC at 60 Hertz (Hz). To test the electrical power supply:

1. Measure the voltage at the hot and neutral wirenut connections in the heater electrical junction box.
2. Voltage outside of the required range may be due to poor wiring connections, to other loads (e.g., air conditioning compressors), or to an electrical utility company problem.

3B-2. Testing the Pressure Switch

All new heaters are provided with pressure switches preset to work at an optimum elevation of 3

feet (0.91 m) above or below the water surface level of the pool/spa to be heated (see Fig. 9). However, the switch can be adjusted to operate correctly in heaters installed a maximum of 10 feet (3.05 m) below the water surface of the pool/spa and to a maximum of 6 feet (1.83 m) above the water surface.

NOTE:
Pressure switches are only adjusted to turn heater off, not on.

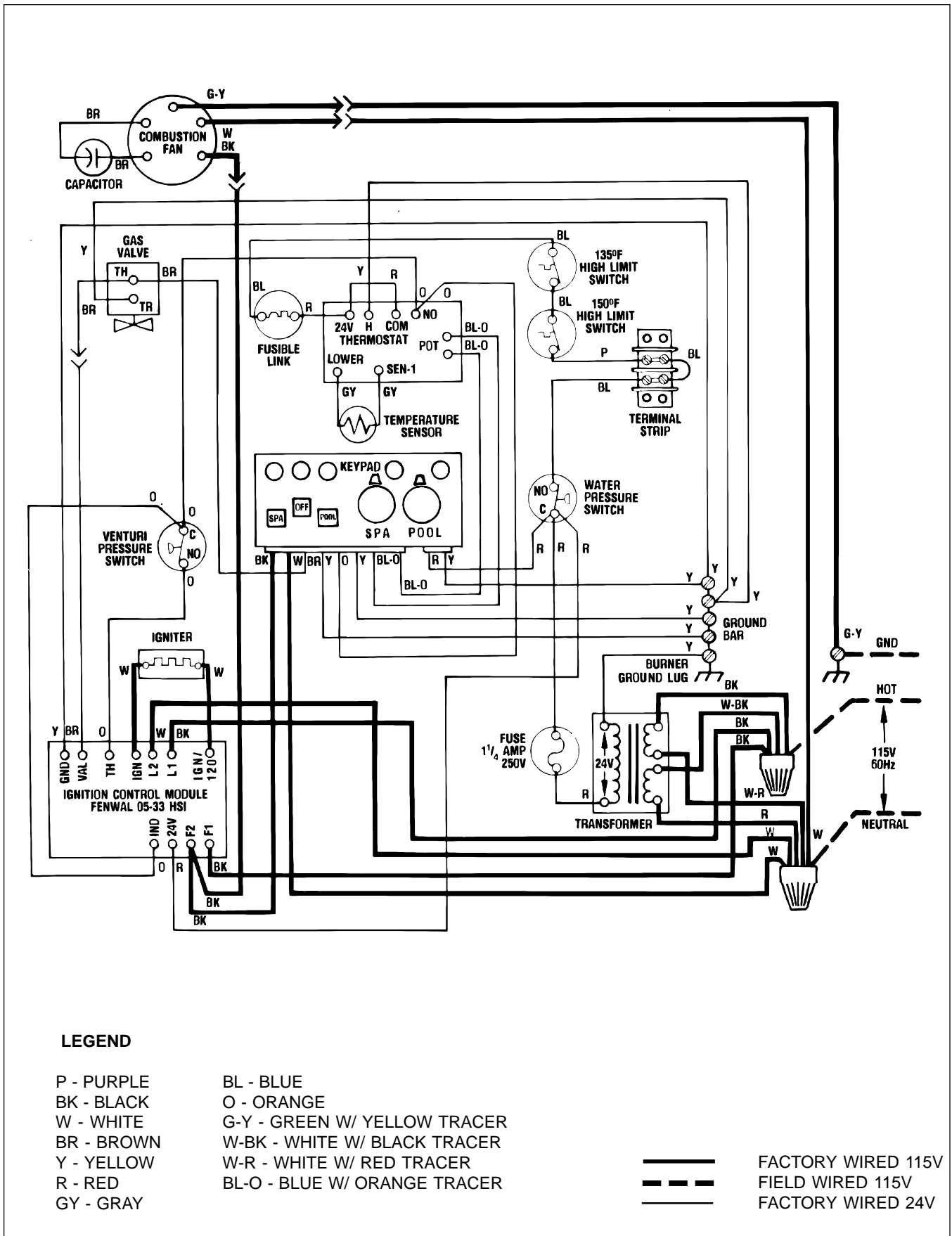
- *DO NOT* adjust the pressure switch if the heater is installed at elevations of more than 6 feet (1.83 m) above the water surface or more than 10 feet (3.05 m) below the water surface. Instead, contact your Teledyne Laars representative for instructions.

If it is known positively that too much water pressure is preventing the switch from opening and turning the heater off, adjust the pressure switch (see Sections 3B-5). If the heater is installed within the recommended range, but does not fire, perform the following back pressure test to check the water pressure switch:

1. Use a volt-ohmmeter and check the voltage at the water pressure switch.
2. If voltage is found at one terminal and not the other, the pressure switch is keeping the heater from firing.
3. To further isolate the problem, remove the copper tube from the pressure switch.
4. Attach a pressure gauge to the tube and turn on the pump.
5. If the pressure gauge reads less than 2 psi (14 kPa), there is a pressure related problem. The problem may be caused by low water pressure.

A drop in the water pressure may be caused by:

1. A very short pipe run from the heater to the pool or spa may prevent sufficient back pressure from developing and prevent the pressure switch from closing. If this occurs, lengthen the piping between the heater and the pool where the return line enters, or install directional fittings or elbows.



LEGEND

- | | |
|------------|------------------------------|
| P - PURPLE | BL - BLUE |
| BK - BLACK | O - ORANGE |
| W - WHITE | G-Y - GREEN W/ YELLOW TRACER |
| BR - BROWN | W-BK - WHITE W/ BLACK TRACER |
| Y - YELLOW | W-R - WHITE W/ RED TRACER |
| R - RED | BL-O - BLUE W/ ORANGE TRACER |
| GY - GRAY | |

- | | |
|--|--------------------|
| | FACTORY WIRED 115V |
| | FIELD WIRED 115V |
| | FACTORY WIRED 24V |

Figure 7. Wiring Diagram

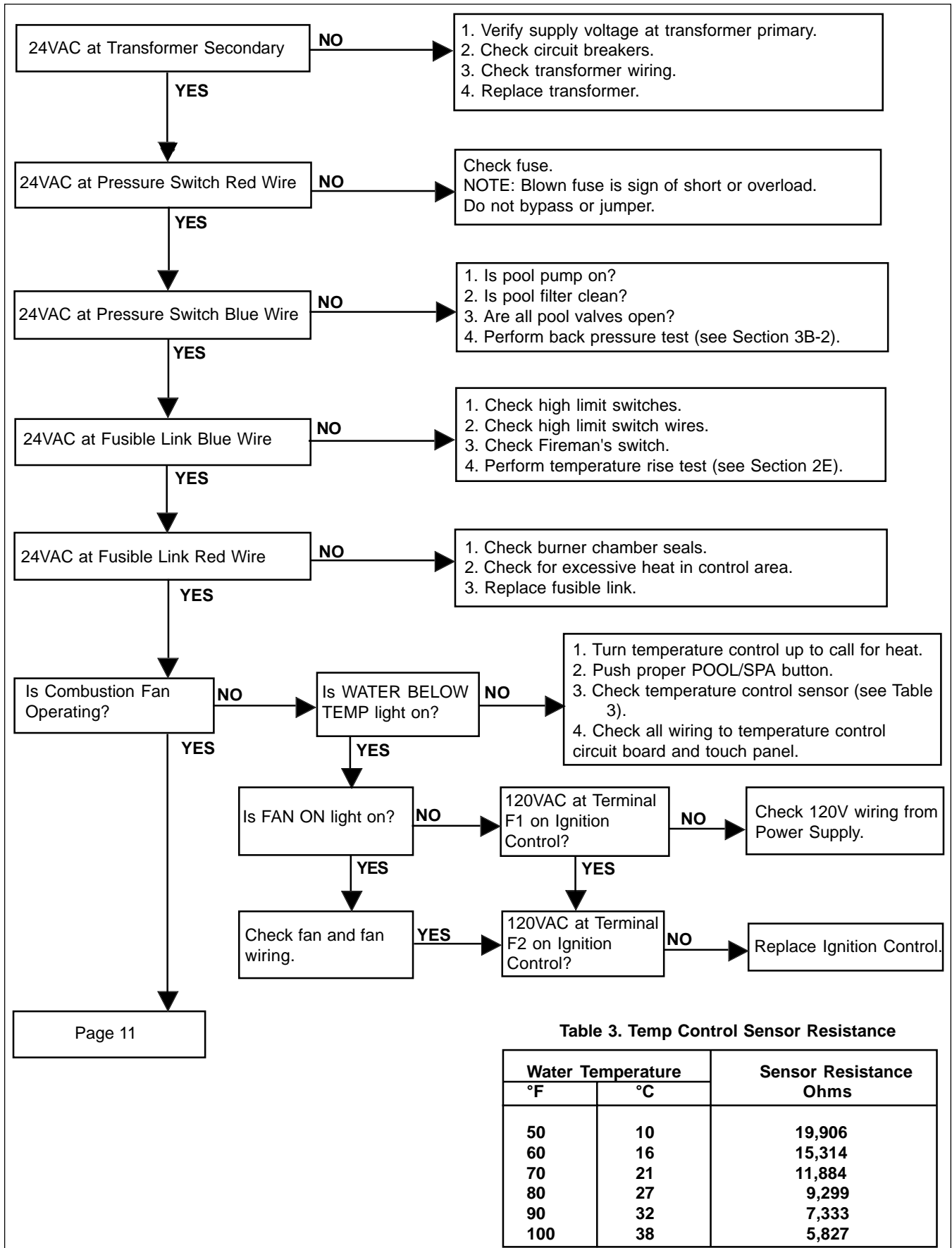


Table 3. Temp Control Sensor Resistance

| Water Temperature | | Sensor Resistance Ohms |
|-------------------|----|---------------------------|
| °F | °C | |
| 50 | 10 | 19,906 |
| 60 | 16 | 15,314 |
| 70 | 21 | 11,884 |
| 80 | 27 | 9,299 |
| 90 | 32 | 7,333 |
| 100 | 38 | 5,827 |

Figure 8. Troubleshooting Flowchart

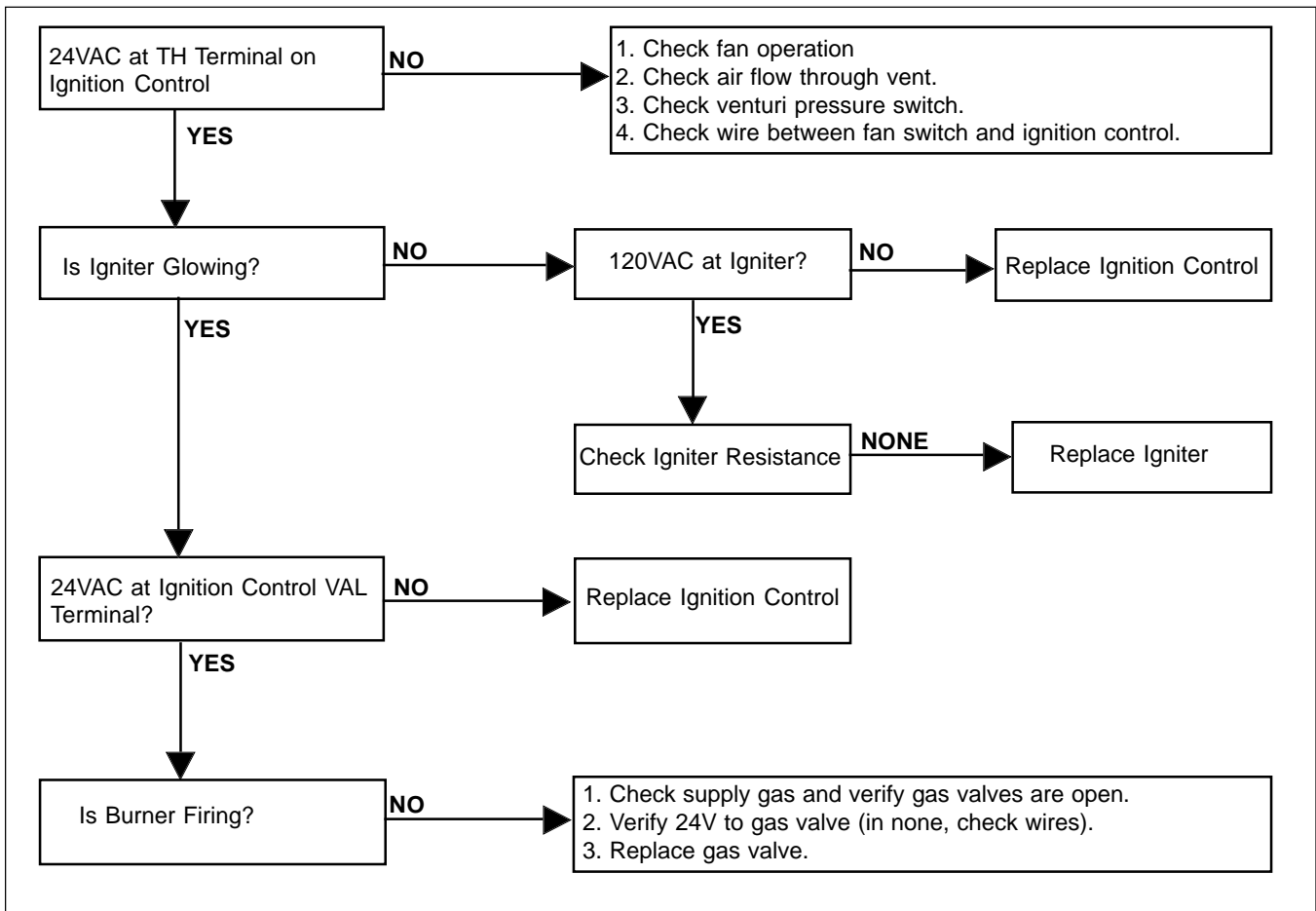


Figure 8. Troubleshooting Flowchart (Continued)

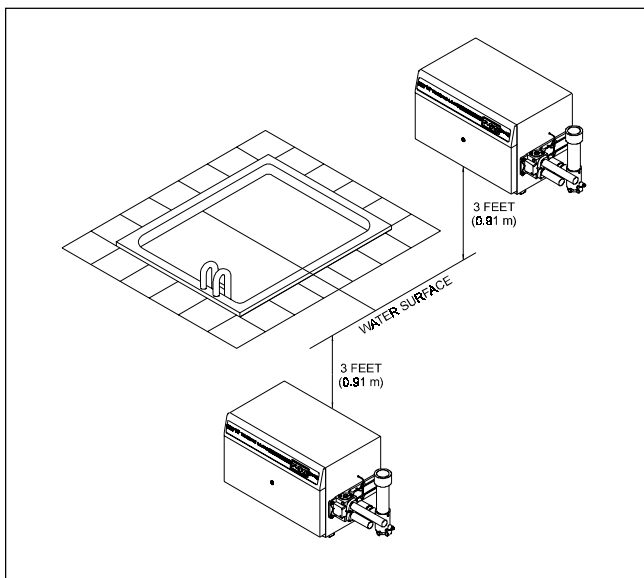


Figure 9. Optimum Elevation Between the Heater and the Pool/SPA

- 2. A dirty or clogged pool filter or leaf trap may restrict the water flow and cause pressure loss. The dirtier the filter or trap, the greater the loss.

- 3. A filter pump with a bad motor or impeller develops less pressure.

3B-3. Adjusting the Pressure Switch

When the heater is installed between 3 and 10 feet (0.91 and 3.05 m) *below* the water surface of the pool or spa, the pressure switch senses the increased weight of the water, remains closed, and allows the heater to fire when insufficient water is present. Adjust the pressure switch as follows:

- 1. Turn heater to OFF position.
- 2. Disconnect wires to the pressure switch.
- 3. Clip leads of a voltmeter across the pressure switch.
- 4. Set voltmeter to lowest resistance scale.
- 5. Use a 7/32 inch (5.55 mm) Allen wrench to adjust the switch. Slowly turn the adjustment clockwise (raising the setting) until the pump turns OFF (see Fig. 10).

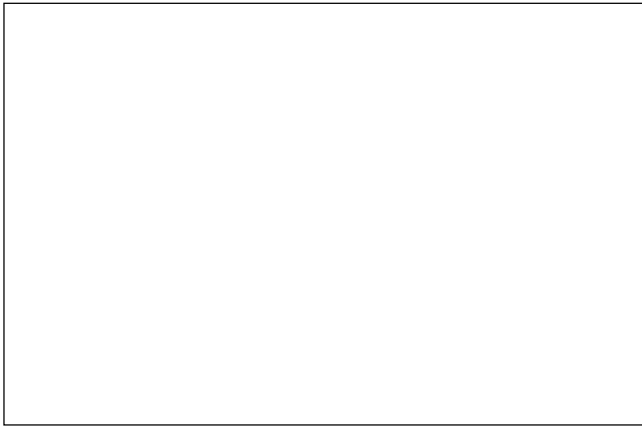


Figure 10. Adjusting the Pressure Switch

6. Turn pump ON. If pressure switch does not open, turn pump OFF and repeat step 5. When pressure switch opens, go to step 7.
7. Slowly turn the adjustment **clockwise** until the pressure switch closes.
8. Then slowly turn the adjustment **counterclockwise** until the pressure switch opens again.
9. Turn the pump OFF and ON to check the adjustment. Pause after each attempt. The pressure switch should open immediately after the pump stops.
10. Reconnect wires to the pressure switch.
11. After pressure switch is adjusted, the rise should be taken to verify water flow.
12. Turn the heater ON following the instructions found on the inside of the heater.
13. Set the temperature control to the desired temperature.
14. If a satisfactory adjustment cannot be made, contact a Teledyne Laars representative for assistance.

3B-4. Testing the Ignition Control

⚠ Caution

The ignition control and igniter operate on 120V power. Keep this in mind while servicing the heater, and take care to avoid electrical shock.

To test the ignition control:

1. Turn the heater on and observe the ignition sequence.
2. If the igniter doesn't glow, turn the power off and disconnect the igniter from the ignition control.
3. Connect the leads of the voltmeter to the igniter and igniter/120 terminals of the ignition control.
4. Set the voltmeter on the AC scale with a range of at least 150V.
5. Turn the heater on.
6. Turn the temperature control knob all the way to the right. After about 15 seconds, the voltmeter should read about 120V.
7. If the voltmeter does not read voltage, replace the ignition control.

3B-5. Testing the Igniter

If there is proper voltage, but the igniter does not glow, the igniter may be open. To test the igniter:

1. Switch the volt-ohmmeter to read resistance or ohms, on a range which can read from zero to about 500 ohms.
2. With the igniter unplugged from the ignition control, connect the leads of the ohmmeter to the ends of the igniter wiring (see Fig. 11). A cold igniter should have resistance in the range of 50 to 400 ohms.
3. If the reading is above or below the range of 50 to 400 ohms, replace the igniter.

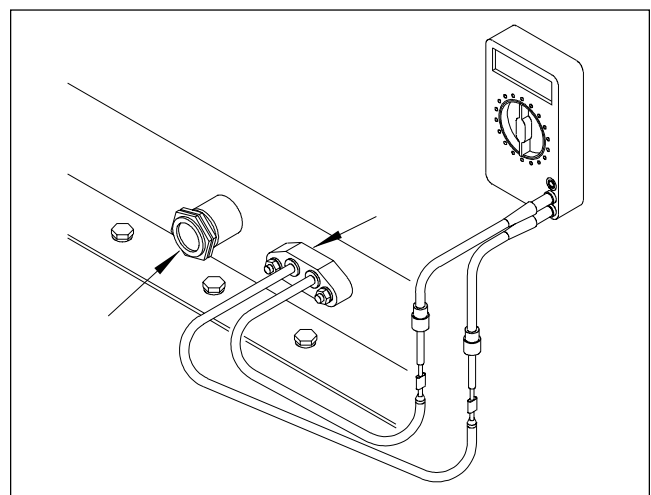


Figure 11. Igniter Resistance Test

3B-6. Testing the Combustion Fan Motor

If the combustion fan will not run, the motor or ignition control may be at fault. To test the combustion fan:

1. If the FAN ON indicator light is on, and the fan is not on, check for 120VAC at the motor.
2. If there is voltage, replace the combustion fan.
3. If there is no voltage, replace the ignition control.

3B-7. Testing the Gas Valve

If the igniter glows, but no flame appears at the burner surface, test the gas valve as follows:

1. Clip one lead of the voltmeter to the gas valve terminal having two brown wires attached to it.
2. If the voltmeter does not read voltage, replace the ignition control.

⚠ WARNING

Never attempt to repair the gas valve. Such attempts will void the warranty, and could lead to dangerous results.

3. If the voltmeter shows voltage, verify that the gas is on and the gas locks are open. If the gas is on and the gas locks are open, then replace the gas valve.

SECTION 4. Maintenance

4A. Replacing the Combustion Air Filter

The Hi-E EPH 300 heater uses a high efficiency paper, fiber matrix filter covered with a foam sleeve. The sleeve stops large particles and extends the life of the paper element. A dirty air filter can reduce the combustion air so that the venturi pressure switch does not sense enough air flow. If this occurs, replace the combustion air filter as follows:

1. Remove the top of the heater.
2. Loosen the thumbnuts at the right end of the filter assembly.
3. Remove the retainer and combustion air filter cap, then remove the filter assembly (see Fig. 12).

4. Remove the foam sleeve and clean it with warm water and detergent, if necessary.
5. Take out the paper element and shake or gently brush the element to remove any dust that may have collected. Compressed air may be used for this process. If the paper element cannot be cleaned satisfactorily, replace it.

⚠ Caution

When using compressed air, be careful not to damage component or direct compressed air at anyone. Failure to comply could result in damage to component or injury from flying dust.

6. Reinstall the paper element, the foam sleeve, and the retaining hardware. Make sure the air filter is seated tightly at the venturi inlet, and the cap is in place so that air cannot bypass the filter element.

4B. Inspecting the Flow Control Valve

The flow control valve maintains the correct volume of water through the heater over varying conditions (e.g., water pressure and pool filter cleanliness) up to a maximum flow rate of 125 GPM (474 LPM). If the system's filter flow rate exceeds 125 GPM (474 LPM), a bypass valve is required.

The flow control valve normally does not require service, but chemical imbalances can damage the flow control valve, shaft, or spring which, over time, can slow or eventually shut down the valve. Either condition can cause erratic heater operation and shorten heater life.

Perform a temperature rise test (see Section 2E) to confirm proper operation of the flow control valve.

To inspect the flow control valve:

1. Turn OFF the filter pump.
2. Remove the cap from the flow control valve (see Fig 13).
3. Inspect the disk to make sure it is properly seated.
4. If the disc is not properly seated, disassemble the valve and overhaul it. Replace any corroded parts.

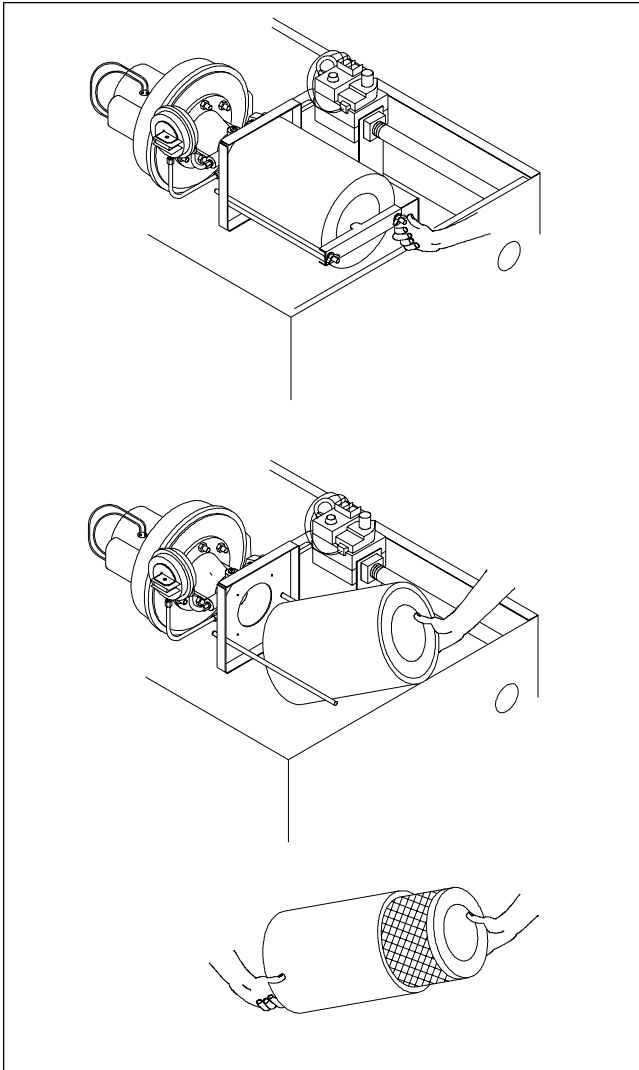


Figure 12. Filter Removal

4C. Removing the Venturi Assembly and Combustion Air Fan

1. Turn off the electrical power and gas supply outside the heater.
2. Remove the top panel.
3. Disconnect the supply gas pipe from the gas valve.

⚠ Caution

Label all wires prior to disconnection. Wiring errors can cause improper and dangerous operation.

4. Disconnect all wires from the venturi pressure switch.

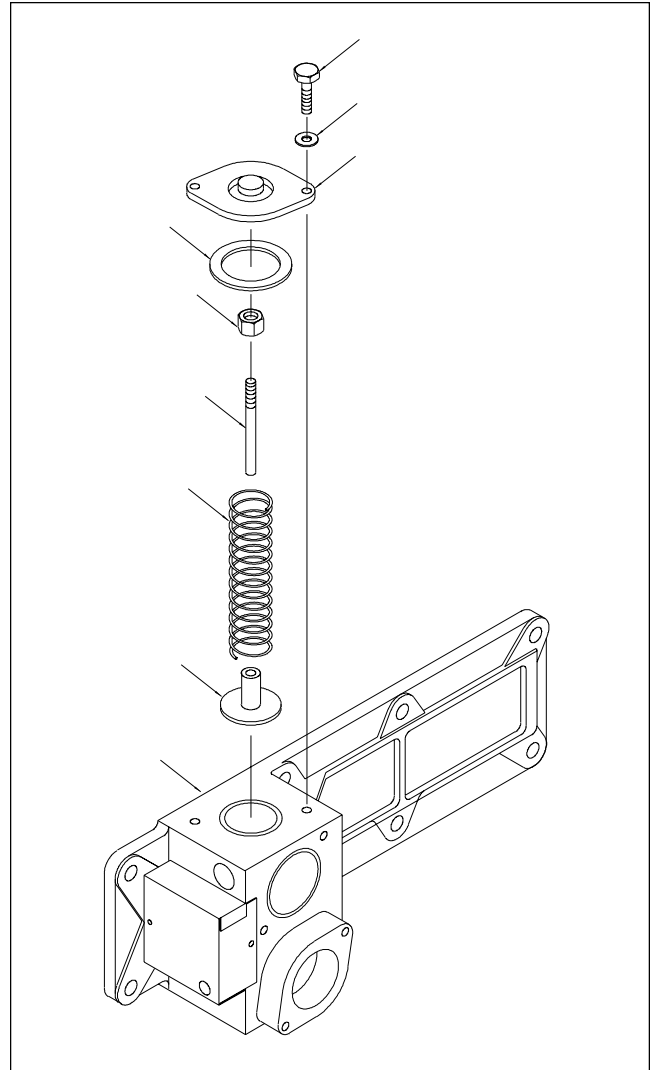


Figure 13. Flow Control Valve

5. Disconnect the brown and yellow wires from the gas valve.
6. Separate the four-wire connector located near the combustion air fan (see Fig. 14).
7. Remove the four nuts and washers attaching the combustion air fan to the top of the burner shroud.
8. Lift the entire venturi assembly off the burner shroud and place it on a suitable work bench.
9. Remove the six nuts and washers attaching the combustion air fan to the venturi.
10. Hold the combustion air fan with one hand, and separate from the venturi.
11. Reverse the previous steps to install a new fan.

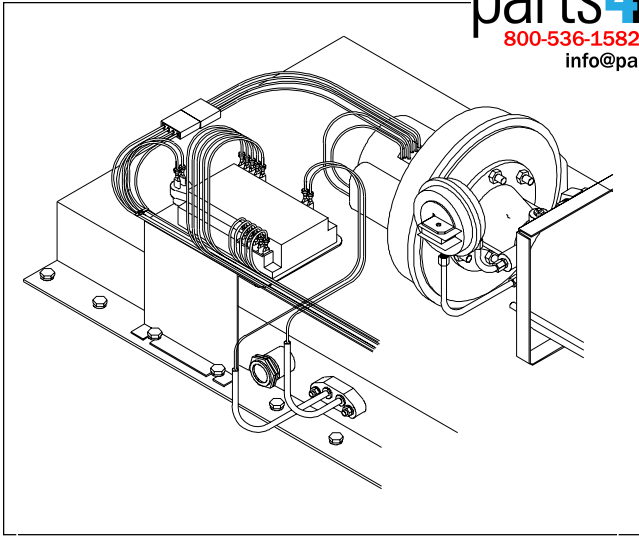


Figure 14. Removing the 4-Wire Fan Connector

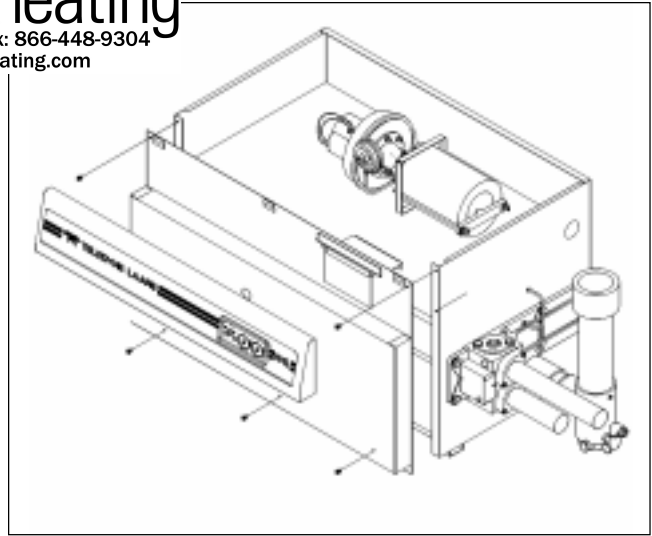


Figure 15. Upper and Lower Front Panel Removal

4D. Replacing the Burner, Heat Exchanger, and Condensate Pan

Due to the complexity of the procedures required to replace these components, the instructions are included in the replacement kits. The appropriate kit numbers can be found in the parts list (see Section 5).

4E. Removing the Igniter

NOTE: One of the screws also attaches the ground lug to the outside right panel.

1. Remove two retaining screws from the temperature control circuit board.
2. Carefully slide the temperature control circuit board into the heater compartment.
3. On the right side of the heater, remove the three screws that fastens the electrical junction box to the right side panel.
4. Remove the upper front panel by removing the screw located on the left side, inside the heater compartment (see Fig. 15).
5. Lift the upper front panel out of the three slots and set it aside (see Fig. 15).
6. Remove the lower front panel assembly by removing the three screws along the base of the heater,

and the four screws on the sides (see Fig. 15). Two of these screws are inside the heater compartment.

7. Remove the hex bolts that fastens the igniter and pull the igniter out of the heater. Make sure you do not damage the refractory material around the opening.
8. Install the new igniter so that the black igniter surface doesn't touch the chassis or refractory material when it is in place. The igniter should be $1/2$ inch $\pm 1/16$ inch (13 mm ± 1.58 mm) from the burner surface and parallel to it (see Fig. 16). Make sure there is no leakage from the combustion chamber. A small leak of hot gas will erode the leak area, make it larger, and cause a problem.
9. Install new gaskets.
10. If the igniter glows, but flame appears only briefly, there may be a problem with the fuel supply, igniter or ignition control, or the piping to the venting system.
11. If a new installation or the fuel gas piping has been serviced, remove any air in the gas supply line, so the heater will operate normally. Using an incorrect fuel will result in the fuel/air mixture being wrong and a flame that is not normal. The fuel gas must be the same as specified on the heater rating plate.