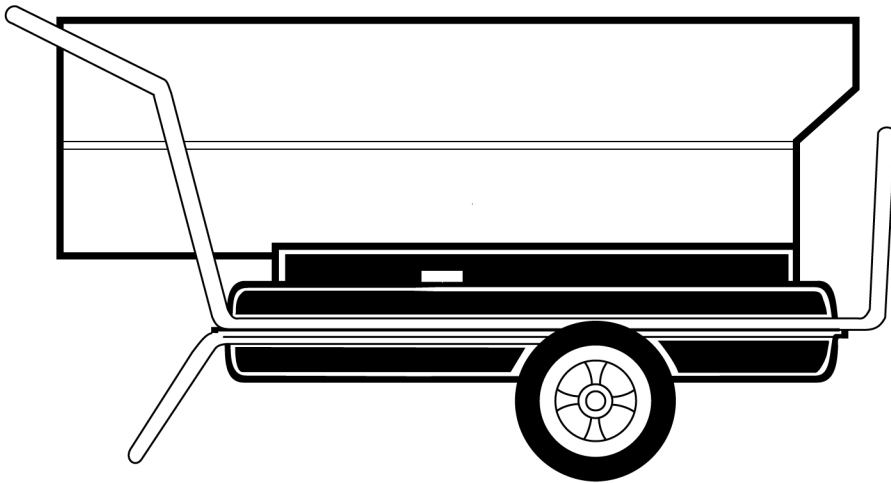
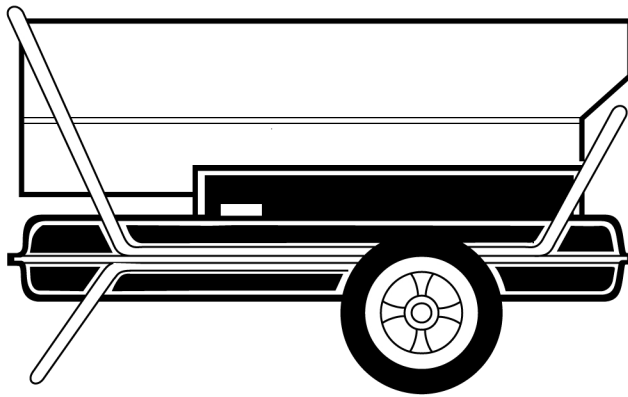


# SERVICE MANUAL

## HIGH PRESSURE PORTABLE FORCED AIR HEATERS



**DESA**  
INTERNATIONAL

Technical Service Department • P.O. Box 90004 • 2701 Industrial Drive • Bowling Green, Kentucky 42102-9004

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**SECTION 1 SAFETY INFORMATION****1****Safety Requirements**

This service manual is intended for use by individuals with adequate electrical and mechanical skills. Attempts to repair this heater by individuals without those skills can result in personal injury as well as property damage.

**IMPORTANT:** Read the Owner's Manual carefully and completely before trying to assemble, operate, or service this heater. Improper use of this heater can cause serious injury or death from burns, fire, explosion, electrical shock, and carbon monoxide poisoning.

Make certain you read and understand all Warnings.

**Warnings** 

- Use only kerosene or No. 1 fuel oil to avoid risk of fire or explosion. Never use gasoline, naphtha, paint thinners, alcohol, or other highly flammable fuels.
- Never use heater where gasoline, paint thinner, or other highly flammable vapors are present.
- Follow all local ordinances and codes when using heater.
- Use only in well vented areas. Provide at least three (3) square feet of fresh, outside air for each 100,000 BTU/Hr of rating. This heater produces carbon monoxide, which is listed by the State of California as a reproductive toxin under Proposition 65.
- Use only in places free of flammable vapors or high dust content.
- Use only with the electrical voltage and frequency specified on model plate.
- Use only a three-prong, grounded extension cord.
- Minimum heater clearances from combustibles:  
Outlet: 8 Ft.    Sides: 4 Ft.    Top: 4 Ft.    Rear: 4 Ft.
- Locate heater on a stable and level surface while hot or running or a fire may occur.
- When moving or storing, heater must be in a level position or fuel spillage may occur.
- Keep children and animals away from heater.
- Unplug heater when not in use.
- This heater is equipped with a thermostat. When plugged in, heater may start anytime.
- Never use heater in living or sleeping areas.
- Never block air inlet (rear) or air outlet (front) of heater.
- Never move, handle, refuel, or service a hot, operating, or plugged in heater.
- Never attach duct work to front or rear of heater.

SECTION 2 INTRODUCTION

2

**Arrangement Of Manual**

This manual contains information and service procedures that help the service person understand and correct problems on the DESA International High Pressure Portable Forced Air Heater. The first part of this manual contains basic information about the operation of different parts of the heater. Review this information. It provides a basic understanding of how the parts function in the working system. The last part of this manual is a troubleshooting section. It provides a quick reference concerning conditions which may result in customer complaints. These procedures will help the service person quickly diagnose a malfunctioning heater. The illustrations in this manual may not necessarily depict the actual heater model. They are intended for reference only.

**Technical Service Department**

The Technical Service Department, located in Bowling Green, Kentucky, is committed to help increase the service knowledge of those who service these heaters. This will enable service people to provide prompt, efficient service. This service manual covers the major problems that can occur with the heaters. However, as with any product, certain problems can arise which this manual does not cover. If such problems arise, please call the Technical Service Department at 1-800-323-5190. The Technical Service Department is open from 8:00 am to 4:00 pm Central Time. This number is only for servicing problems and cannot be used for ordering parts, billing questions, etc.

**Service Preparation**

A clean work area at the start of each job is essential for efficient service work. Clean extremely dirty heaters before servicing. Cleaning will sometimes uncover the problem area. Gather tools needed for the job before work is started. Having to locate tools causes delays that lead to lost time and wages.

Always use clean fuel when testing heater. Many problems are often caused by the wrong type of fuel or dirty fuel.

Use caution and common sense when working on heater. Always remember:

- Kerosene is combustible.
- Guard against electrical shock.
- Heater parts get hot during operation. Touching these parts can cause severe burns.

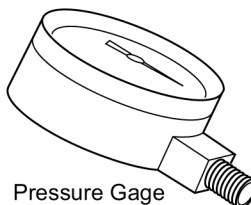
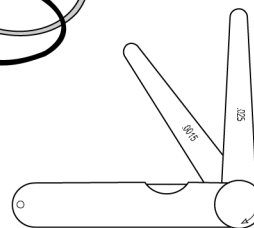
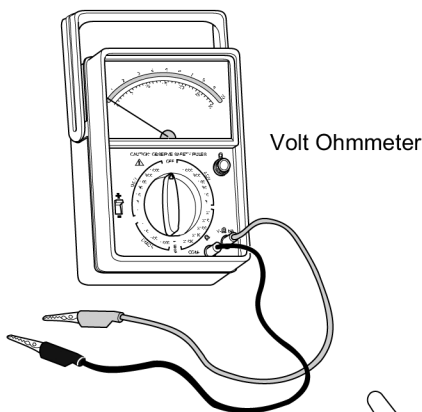
**Tools Required**

In addition to common hand tools, the service shop should have the following tools and instruments to properly repair the heater. These tools and instruments will be referred to throughout this manual.

Tool/ Instrument	Range	Part Number
Volt Ohmmeter	RX1/AC 250V	*
Feeler Gage	.001 to .1 inch	**
Pressure Gage	0-200 PSI	M4574
Flame Control/ Photocell Tester		HA1170

\* Available at most electronic stores.

\*\* Available at any auto parts store.



**SECTION 3 GENERAL SPECIFICATIONS AND APPLICATIONS INFORMATION**

**3**

**Fuel Selection**

One of the most critical specifications for trouble-free operation is the use of a clean, acceptable fuel. Listed below are guidelines and comments concerning operation of heaters with different fuels.

**Recommended**

Fuels	Comments
Kerosene	Best overall results. Minimum odor and minimum maintenance. No additives necessary for cold weather operation.
Fuel Oil No. 1	
Jet "A"	

**Alternate Fuels Comments**

Fuel Oil No. 2	Noticeable increase in odor. Requires frequent maintenance of fuel filter, nozzle and spark plug. Cannot be used at temperatures below +20°F.
Diesel No. 1	
Diesel No. 2	

**Electrical**

Connect heater to a standard electrical outlet (120V/60Hz) to operate. For safety, all heaters have a three-prong, grounded power cord. Plug power cord of heater into three-prong, grounded extension cord. Extension cord must be at least six feet long. Make sure you use extension cord large enough to carry the voltage the heater requires. Use the following chart to determine the proper size extension cord for heater.

**Length of Cord Wire Size (AWG)**

100 ft.	No. 14
200 ft.	No. 12
300 ft.	No. 10
400 ft.	No. 8
500 ft.	No. 6

**Ventilation**

Only use heater in well-ventilated areas. The following chart shows the minimum fresh, outside air opening needed for proper ventilation.

Heater Size (BTU/Hr)	Square Foot Opening
250,000	7.5
300,000	9.0
350,000	10.5
600,000	18.0

The above chart is based on ventilation requirements of at least a three (3) square foot fresh, outside air opening for each 100,000 BTU/Hr of rating. Provide extra fresh air if using more heaters. If possible, provide cross-ventilation for better air movement. This heater produces carbon monoxide, which is listed by the State of California as a reproductive toxin under Proposition 65.

**Heater Sizing**

Use heater which is properly sized for the area to be heated. Listed below is a simple formula that allows you to determine heater BTU/Hr size requirements.

$$\text{Cubic Feet of Area} \times .133 \times \text{Desired Temperature Rise } ^\circ\text{F} = \text{BTU size}$$

*Example*

Area: 100' x 100' x 8' = 80,000 Cubic Feet  
Desired Temperature Rise: 30°F

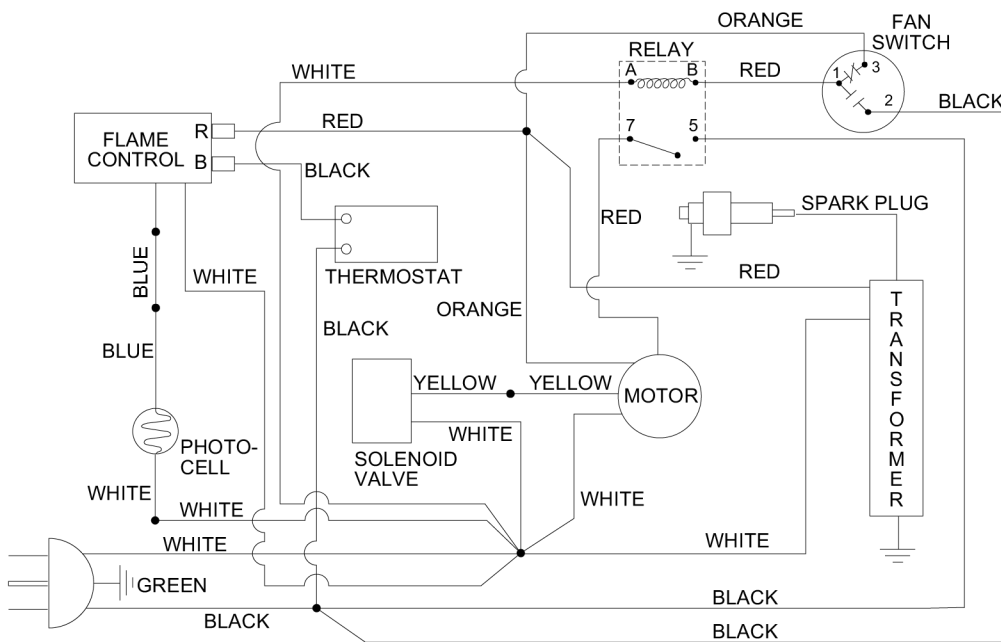
$$\begin{array}{r} 80,000 \text{ (Cubic Feet)} \\ \times .133 \text{ (Factor)} \\ \hline 10,640 \\ \times 30 \text{ (Temperature Rise)} \\ \hline 319,200 \text{ (BTUs/Hr Needed)} \end{array}$$

Answer: Use a 350,000 BTU/Hr heater for this heating example.

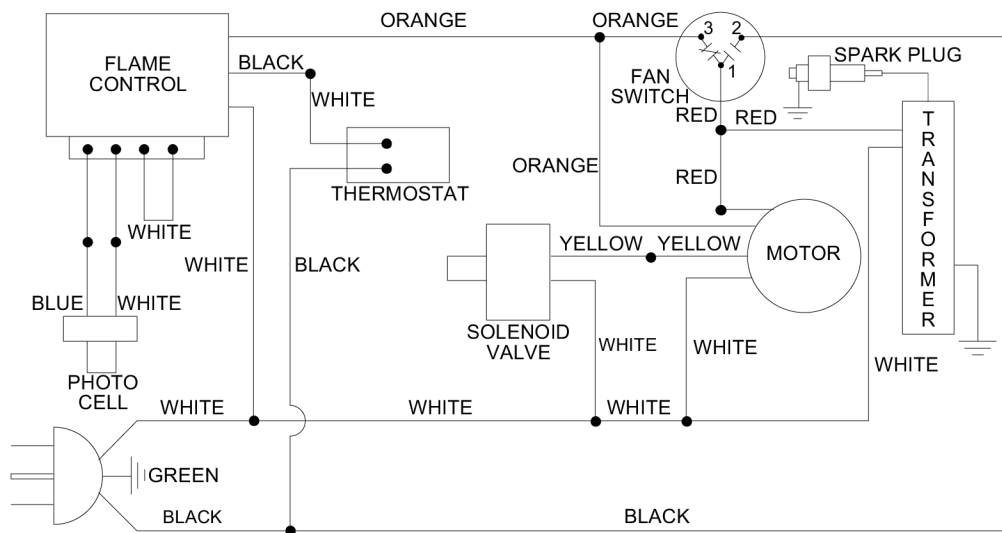
**Heater Performance Specifications**

	350,000 BTU/Hr	600,000 BTU/Hr
Output Rating (BTU/Hr)	350,000	600,000
Fuel	Use only kerosene or No. 1 fuel oil	
Fuel Tank Capacity (U.S. Gallons)	30	36
Fuel Consumption (Gallons Per Hour)	2.5	4
Electric Requirements	120V/60Hz	120V/60Hz
Amperage (Normal Run)	7.1	11.5
Motor RPM	1725	1725
Fuel Pump Pressure (PSI)	100	110
Spark Plug Gap	.050/.060"	.050/.060"
Weight (Approx. Lbs.)		
Dry	180	285
With Full Fuel Tank	390	550

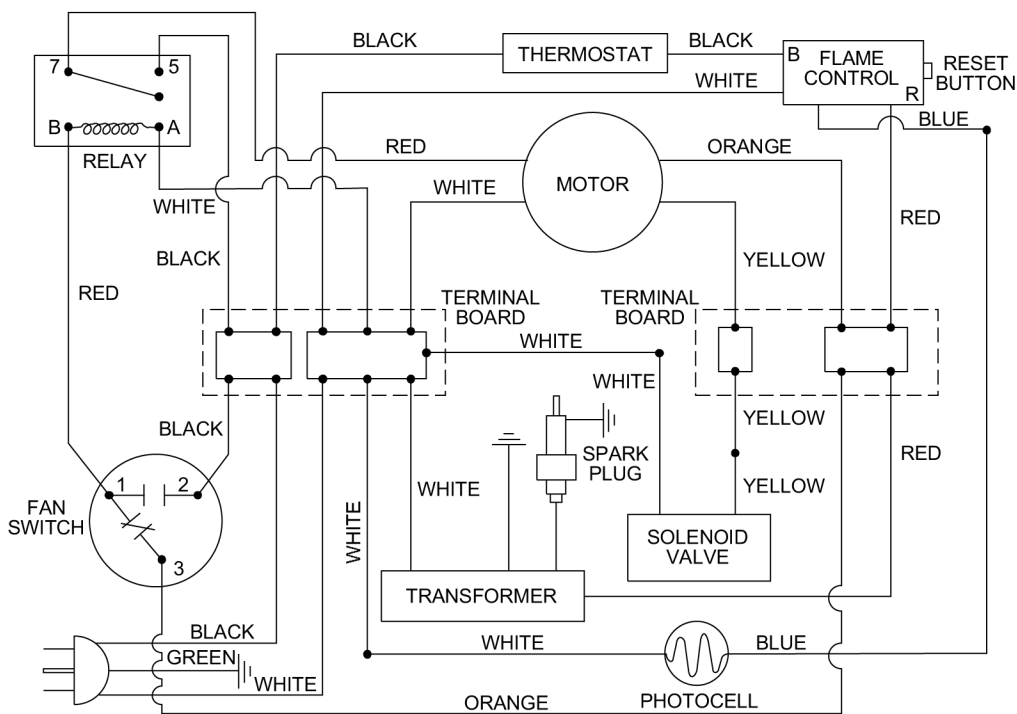
**Wiring Diagrams**



*Wiring Diagram for Non-Terminal Block Heater with Standard Flame Control*



**Wiring Diagram for Non-Terminal Block Heater with White-Rogers/Robert Shaw Flame Control**



**Wiring Diagram for Terminal Block Heater with Standard Flame Control**

## SECTION

## 4

## COMPONENT OPERATION

## All Systems Working Together

There are four basic systems within the heater: the fuel system, the air system, the ignition system, and the flame control system.

**The Fuel System:** The fuel pump pulls fuel from the fuel tank and pressurizes it. The fuel pump pushes fuel through a filter and a solenoid valve and out the burner head nozzle. A fine mist of fuel is sprayed into the combustion chamber.

**The Air System:** The motor turns the fan. The fan pushes air into and around the

combustion chamber. The air that goes into the combustion chamber mixes with the fuel for combustion. The air is heated and provides a stream of clean, hot air.

**The Ignition System:** The transformer sends voltage to the spark plug. The spark plug ignites the fuel and air mixture.

**The Flame Control System:** This system causes the heater to shut down if the flame goes out. It also allows the fan to continue running after normal shutdown of heater. This cools the combustion chamber.

## FUEL SYSTEM

## Fuel Pump

The fuel pump is a single stage gear-type pump designed for two-pipe usage. The term "two-pipe usage" means that provisions must be made to return excess fuel from the pump back to supply tank. Figure 1 shows position of pump on heater.

The fuel pump is directly connected to motor shaft. When motor on heater runs, the fuel pump starts working. The fuel pump draws fuel into one of the ports marked "INLETS." After fuel pump draws fuel into INLET port, the fuel is then pressurized in the pump. The fuel pump then forces fuel to the burner head nozzle thru the port marked NOZZLE.

The port marked "PRESS ADJ" contains an adjustment screw. Turning this screw will increase or decrease the fuel pump pressure. Check fuel pump pressure by attaching high pressure gauge into the port marked "GAGE."

As mentioned above, the port marked "RETURN" is used to return excess fuel back to supply tank.

Be careful when working on fuel pump. Fuel pump operates under high pressure.

<u>MODEL</u>	<u>PUMP PRESSURE</u>
350,000 BTU/Hr.	100 psi
600,000 BTU/Hr.	110 psi

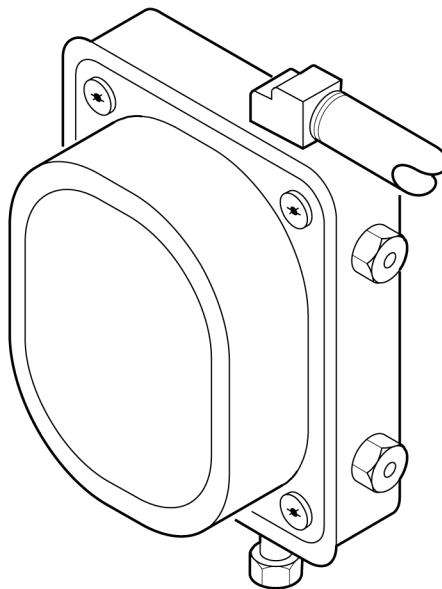
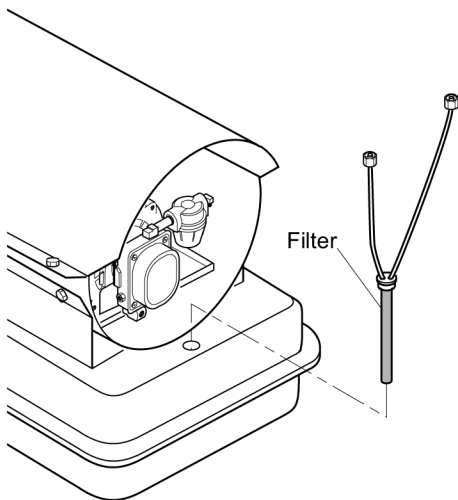


Figure 1 - Fuel Pump



## Fuel Filters

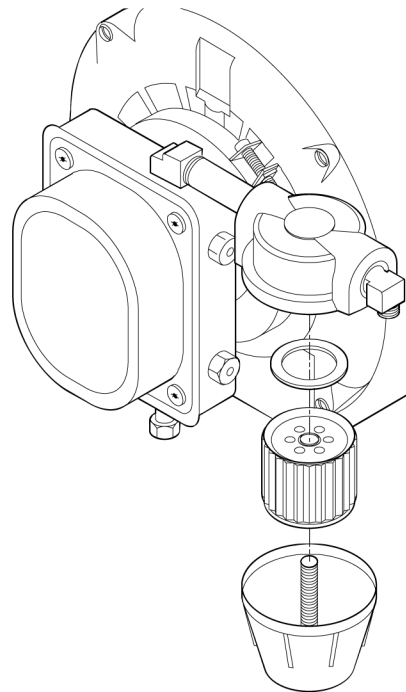
The fuel filtering system has two filters. The first filter is a 50-mesh screen type. It is located in the fuel tank below the grommet where fuel suction and return lines enter the tank. The filter is connected to both the fuel input (suction side) and the return line from the fuel pump. This unique design allows the filter to backflush or clean itself of sediment by the action of the excess flow returning from the pump.



**Figure 2 - Fuel Filter in Fuel Tank**

The second filter is a canister type. The two-piece canister contains a replaceable drop-in filter element. This filter will filter out very small particles which may be present in the fuel

system. This high degree of filtering is needed to prevent any sediment or foreign material from reaching the nozzle. Make sure to clean or replace this filter element every 250 hours of operation. Clean or replace this filter more often if fuel quality is bad.

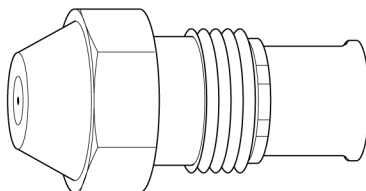


**Figure 3 - Canister Type Fuel Filter**

## Nozzle

The nozzle could be classified as the heart of the fuel system. The nozzle works similar to a standard garden hose nozzle. The kerosene passes through the nozzle. Under pressure, the oil expands through the nozzle orifice and

breaks into a fine spray. The flow rate and the spray angle is designed into each nozzle. Do not substitute with a nozzle having a different flow rate or spray pattern. Use only replacement parts supplied by DESA International.



**Figure 4 - Nozzle**

**ELECTRICAL SYSTEM**

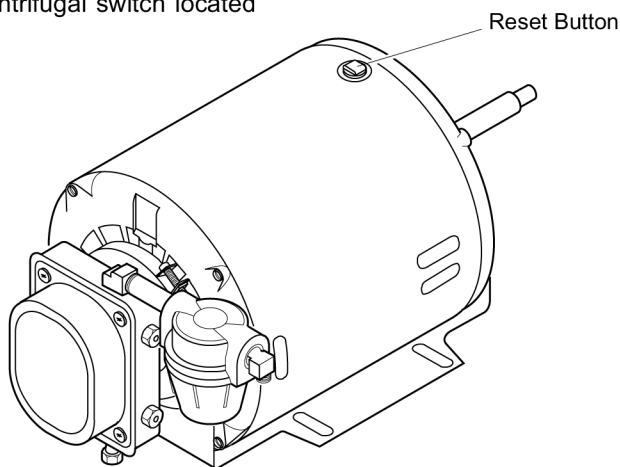
**Motor**

The motor is a fractional horsepower motor. The motor drives the fuel pump and rotates the fan. The turning fan delivers air into and around the combustion chamber.

The motor contains two separate internal windings. The first winding is the start winding. The second winding is the main winding. The motor switches power from the start winding to the main winding after the motor reaches 75% of its rated speed. This switching is done by a centrifugal switch located

inside the motor. The centrifugal switch also supplies voltage to the fuel solenoid valve.

The motor also has a temperature/current sensitive thermal protector wired in series with both windings. This device protects the motor from overheating if the fan/pump locks up. If the fan/pump locks up, this device will shut the motor off. Before motor will run again, press red reset button located on top of the motor housing (see Figure 5).

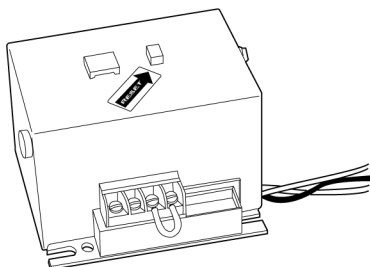


**Figure 5 - Motor**

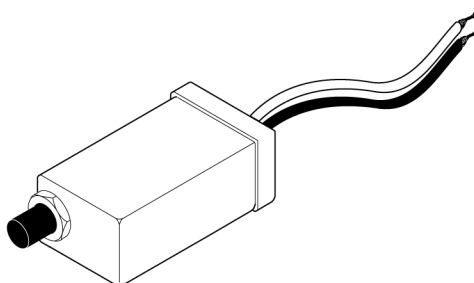
**Flame Control Assembly**

The heater is equipped with one of two flame controls — a White-Rogers/Robert Shaw or a standard flame control. The flame control monitors the combustion chamber flame. The control will shut off power to the heater if the combustion flame goes out or if an

unusual flame color is present. A photocell (attached to the burner head) monitors light within the chamber. If the photocell detects improper combustion or loss of flame, the flame control will shut off power to the heater.



**Figure 6 - White-Rogers/Robert Shaw Flame Control**



**Figure 7 - Standard Flame Control**

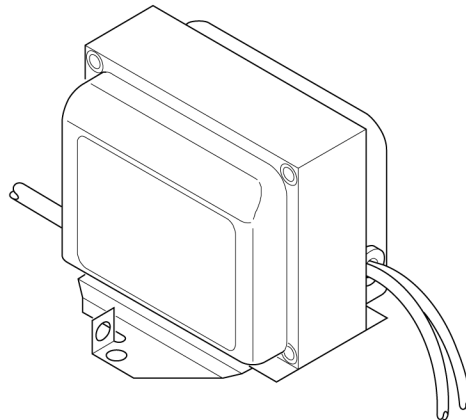
### Ignition Transformer

The ignition transformer operates on 120V/60Hz. It delivers approximately 5,000 volts to the spark plug. The spark plug ignites the fuel sprayed from the nozzle assembly. The ignition transformer operates continuously while the heater is running.

The ignition transformer has no internal service parts. Replace the ignition transformer if defective.

#### **⚠ WARNING**

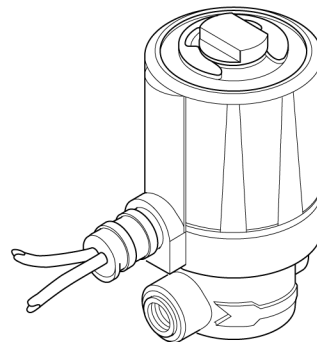
**Transformer has high voltage output. Always unplug heater before replacing transformer. Use extreme caution when testing transformer. Severe electrical shock can occur.**



*Figure 8 - Ignition Transformer*

### Fuel Solenoid Valve

The solenoid valve is an electro-magnetic device. It is mounted directly behind the burner head body. The solenoid valve acts as an on/off valve for fuel flow to the nozzle. When the thermostat on the heater turns heater on, the solenoid valve opens, allowing fuel to flow to the nozzle. When the thermostat on the heater turns heater off, the solenoid valve closes, preventing fuel from reaching the nozzle.



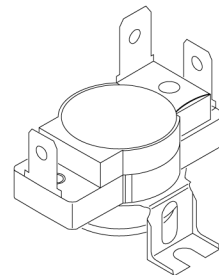
*Figure 9 - Fuel Solenoid Valve*

### Fan Switch

The fan switch is a two-position, temperature-activated, bi-metal switch. The switch allows the motor to continue turning fan after thermostat shuts off heater. This helps cool the combustion chamber.

When the heater is first turned on, power to the motor is routed thru the thermostat, flame control, and the normally closed contacts one and three of the fan switch. After a few minutes of operation, the temperature of the combustion chamber increases. This causes the bi-metal material within the fan switch to warp and close contacts one and two and open contacts one and three. Power to the motor is then routed thru contacts one

and two, bypassing the flame control and the thermostat. This switch allows the motor and fan to continue to run. When the chamber cools enough to allow the fan switch to close contacts one and three, the motor will shut off.



*Figure 10 - Fan Switch*

## SECTION 5 TROUBLESHOOTING

## 5

## Safety Requirements

**⚠ WARNING**

This service manual is intended for use by persons with adequate electrical and mechanical skills. Only attempt to repair heater if you have these skills. Personal injury and property damage can occur to those who attempt to repair heater without these skills.

**⚠ WARNING**

- Unplug heater and let cool before servicing. Note: Certain test require you to connect heater to electrical outlet. If so, only connect heater for time needed to complete test.
- Do not bypass any safety devices.

**⚠ CAUTION**

- If replacement parts are needed, only use factory authorized replacement parts. Do not substitute with non-factory parts.
- Make sure all electrical connections are secure and all harness leads are in place before connecting heater to electrical outlet.

**Using an Ohmmeter**

Throughout the diagnostic procedures, we require you to check continuity of the electrical circuits. You will do this using an ohmmeter. To set up the ohmmeter for these test, follow the instructions below.

**Setting Up the Ohmmeter**

1. There is a small plastic screw in the center of the ohmmeter, just under the meter needle. Turning this screw will move the needle. Turn the screw to adjust the meter needle to the zero "0" mark on the far left of the scale (see Figure 11).
2. Make sure batteries are in ohmmeter. Set ohmmeter on the RX1 position.
3. Plug test leads into ohmmeter. If test leads do not have alligator clips, install alligator clips to leads.

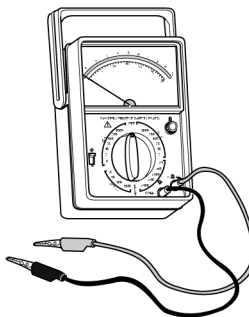


Figure 11 - Ohmmeter Adjusted to "0" Mark

**Calibrating the Ohmmeter**

1. Connect the alligator clips to each other (see Figure 12). The meter needle should move to the far right of the ohms scale ( $\Omega$ ).

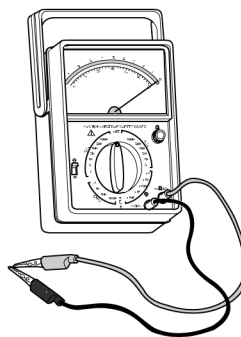


Figure 12 - Ohmmeter with Alligator Clips Connected

2. Use the OHM thumb adjustment knob to adjust the meter needle to the zero "0" mark on the far right of the ohm scale ( $\Omega$ ).

*Note:* If you are using a digital ohmmeter, calibrate according to manufacturer's instructions.

**Diagnostic Information**

The following pages contain various diagnostic information. To use the information, determine what problem conditions exist and follow the test procedures listed for that problem.

**TROUBLESHOOTING — PROBLEM CONDITIONS****OBSERVED PROBLEM****Frequent spark plug fouling/delayed ignition****POSSIBLE CAUSES**

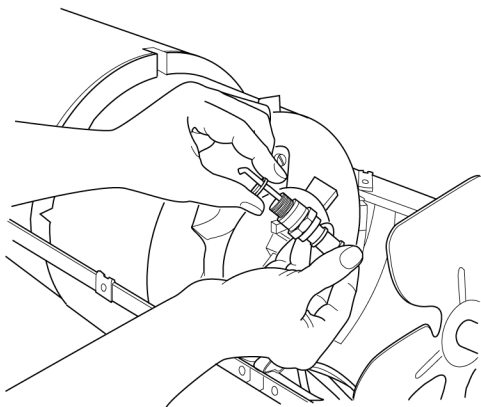
- A. Poor fuel quality
- B. Spark plug tip is too close to spray pattern of nozzle
- C. Incorrect fuel pump pressure
- D. Dirty or damaged nozzle

**TEST PROCEDURES****A. Poor fuel quality**

Use good quality fuel. See GENERAL SPECIFICATIONS AND APPLICATIONS INFORMATION, page 5, for fuel guidelines.

**B. Spark plug tip is too close to spray pattern of nozzle**

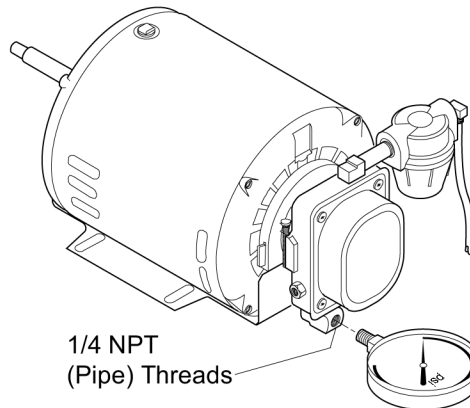
1. Remove upper shell of heater.
2. Remove spark plug from burner head.
3. Clean and regap spark plug. Correct gap for spark plug is .05/.06 inch.
4. Install plug in burner head.
5. Replace upper shell on heater.
6. Connect heater to electrical supply to test fire heater.
7. Shut heater off, unplug heater, and remove spark plug to determine if electrode is wet. If electrode is wet, place a 0.1" metal washer/spacer between burner head and spark plug. This will keep the plug out of the spray pattern of nozzle.
8. Retest heater. Install additional metal washer(s)/spacer(s) if needed.



**Figure 13 - Adding Metal Washer/Spacer to Spark Plug**

**C. Incorrect fuel pump pressure**

1. Install pressure gage to fuel pump port marked "GAGE." This gage should have a full scale reading of 150-200 psi.

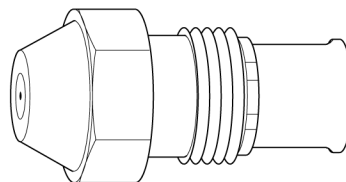


**Figure 14 - Checking Fuel Pump Pressure**

2. Connect heater to electrical power to test fire heater.
3. Adjust pump pressure by turning slotted screw at fuel pump port marked "PRESS ADJ." Turn screw clockwise to increase pressure. Turn screw counterclockwise to decrease pressure. See HEATER PERFORMANCE SPECIFICATIONS on page 6 for proper fuel pump pressure.

**D. Dirty or damaged nozzle**

1. Remove upper shell of heater.
2. Remove burner head from combustion chamber.



**Figure 15 - Nozzle**

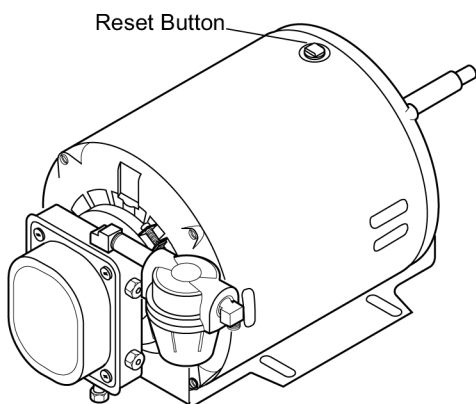
3. Remove nozzle from burner head.
4. If nozzle is dirty, do not attempt to clean by inserting wire into orifice opening. Soak nozzle in a non-flammable solvent and use compressed air to dislodge any dirt in nozzle. Replace worn or damaged nozzle with new nozzle.

**TROUBLESHOOTING — PROBLEM CONDITIONS****OBSERVED PROBLEM****Spark plug sparks, but motor does not start.****POSSIBLE CAUSE**

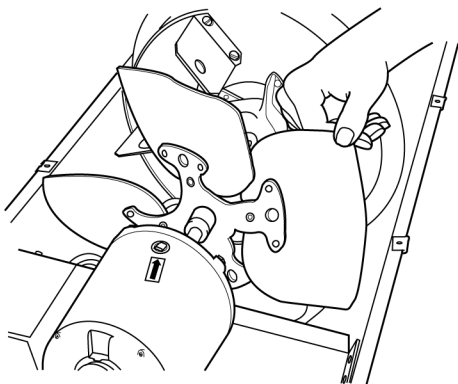
- A. Motor protector tripped
- B. Fuel pump seized
- C. Defective motor
- D. Defective relay (if equipped)
- E. Defective fan switch

**TEST PROCEDURES****A. Motor protector tripped**

Depress red motor protector reset button on top of motor case. This resets the motor protector for proper operation. Determine causes for motor protector trips before returning heater to customer.

**Figure 16 - Reset Button Location****B. Fuel pump seized**

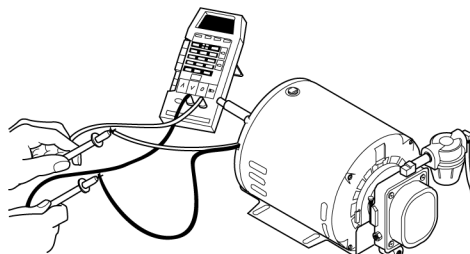
1. Unplug heater.
2. Remove upper shell of heater.

**Figure 17 - Rotating Fan by Hand**

3. Rotate fan by hand to determine if pump is free to turn.
4. If fan is difficult or impossible to rotate, loosen clamp which holds fuel pump to motor. Rotate fan and retighten clamp.
5. If fan is still difficult or impossible to rotate, replace fuel pump.

**C. Defective motor**

1. Depress red motor protector reset button on top of motor case before testing motor.
2. Unplug heater.
3. Disconnect the red and white motor wires at their wire connection.
4. Set ohmmeter on the RX1 position.
5. Connect ohmmeter test leads to red and white motor wire. If the resistance indicated reads 0 ohms or indicates an open circuit, the motor is defective and must be replaced. *Note:* Proper resistance for motor is 1.0 to 1.5 ohms. Make sure you properly calibrate ohmmeter before testing motor.

**Figure 18 - Testing Motor with Ohmmeter****D. Defective relay (if equipped)**

Replace defective relay.

**E. Defective fan switch**

Follow steps under DEFECTIVE FAN SWITCH, procedure "D" on page 20.

**TROUBLESHOOTING — PROBLEM CONDITIONS**

**OBSERVED PROBLEM**

**Motor starts, but heater will not ignite.**

**POSSIBLE CAUSE**

**If No Spark Observed at Spark Plug**

- A. Spark plug has incorrect gap
- B. Defective transformer or transformer not grounded properly
- C. Cracked spark plug

**POSSIBLE CAUSE**

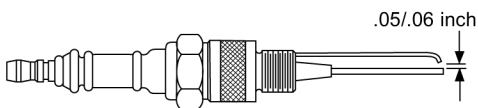
**If Spark Observed at Spark Plug**

- D. Incorrect fuel pump pressure
- E. Defective fuel solenoid valve
- F. Fuel line leak on suction side of pump
- G. Dirty or damaged nozzle
- H. Dirty fuel filter

**TEST PROCEDURES**

**A. Spark plug has incorrect gap**

1. Unplug heater.
2. Remove upper shell of heater.
3. Remove spark plug from burner head.
4. Check gap between spark plug electrodes with feeler gage. Correct gap for spark plug is .05/.06 inch. Reset gap if needed.
5. Follow steps in procedure "B" to test for spark at spark plug electrodes.



**Figure 19 - Proper Gap between Spark Plug Electrodes**

**B. Defective transformer**

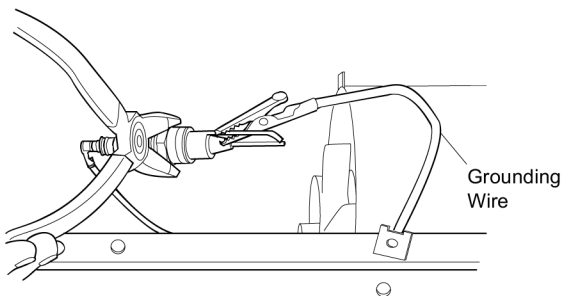
**⚠ WARNING**

Before attempting this test procedure, remove fan from motor and disconnect electrical leads from fuel solenoid valve. This will prevent injury from turning fan or accidental ignition of fuel.

**⚠ WARNING**

After connecting heater to electrical supply, do not touch spark plug electrodes. Spark plug produces high voltage. Electrical shock will occur.

1. Unplug heater.
2. Remove upper shell of heater.
3. Remove spark plug from burner head. Make sure spark plug is properly gapped (see test procedure "A" for spark plug gap)
4. Check to make sure the transformer is properly grounded by the 2 mounting screws. Look for loose fasteners, corrosion, broken tabs, etc.
5. Connect the transformer secondary lead to the spark plug.
6. Establish a good ground between the spark plug body and heater. To do this, attach a grounding wire to heater shell. Clip grounding wire to grounding (outer) electrode on spark plug (see Figure 20). Use insulated pliers to hold spark plug at spark plug hex (see Figure 20). *Note:* Only use pliers with plastic or rubber-sleeved handles.



**Figure 20 - Grounding Spark Plug**

7. Connect heater to electrical supply.
8. Look for spark between electrodes. If the ground is good and there is no spark between electrodes, the transformer is defective. *Note:* No spark between electrodes may be caused by cracked porcelain on the spark plug. Before replacing transformer, see test procedure "C" on page 16. If porcelain on spark plug is not cracked, proceed with replacing defective transformer.

*Continued*

**C. Cracked spark plug**

Follow steps under DEFECTIVE TRANSFORMER, procedure "B" on page 15, to test for spark at spark plug electrodes. If spark is seen at any place on the spark plug other than the electrodes, the porcelain insulator is cracked. Replace spark plug.

**D. Incorrect fuel pump pressure**

Follow steps under INCORRECT FUEL PUMP PRESSURE, procedure "C" on page 13.

**E. Defective fuel solenoid valve****⚠ WARNING**

Before attempting this test procedure, remove fan from motor and spark plug wire from spark plug. This will prevent injury from turning fan or accidental ignition of fuel.

**⚠ WARNING**

Do not touch metal end of spark plug wire while heater is running. Make sure metal end of spark plug wire does not touch any part of heater. Spark plug wire produces high voltage. Electrical shock will occur.

1. Remove upper shell of heater.
2. Check for fuel flow to nozzle. Do this by turning thermostat knob to warmest position and connecting heater to electrical supply. With motor running, look through air openings on rear of combustion chamber. See if nozzle is spraying out fuel. If nozzle is spraying out fuel, solenoid valve is working properly. If nozzle is not spraying out fuel, unplug heater and follow steps below to determine if solenoid valve is defective.
3. Disconnect yellow and white wires from solenoid valve.
4. Set ohmmeter on the 250VAC position.

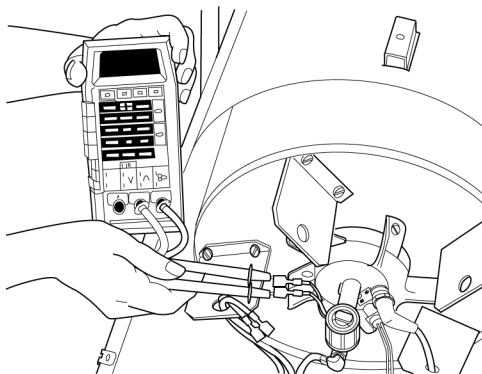


Figure 21 - Checking Fuel Solenoid Valve

5. Connect ohmmeter test leads to yellow and white wires that were connected to solenoid valve.
6. Connect heater to electrical supply. If 120VAC is being sent to solenoid valve and fuel pump pressure is correct, the solenoid valve is defective. Replace defective solenoid valve.



### F. Fuel line leak on suction side of pump

Check all fuel lines on the suction side of the pump for tightness. An air leak in one of these fittings can allow air to enter the system. This will result in improper pump pressure.

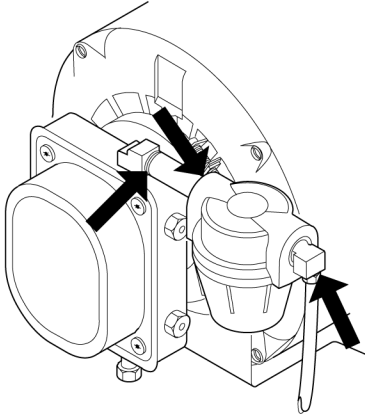


Figure 22 - Fuel Line Check Points

### G. Dirty or damaged nozzle

Follow steps under DIRTY OR DAMAGED NOZZLE, procedure "D" on page 13.

### H. Dirty fuel filter

The fuel filter at fuel pump is housed in the fuel filter canister.

1. Remove canister bottom from canister top.
2. Remove fuel filter from canister bottom.
3. Inspect canister bottom and fuel filter for water or accumulated dirt.
4. Rinse canister bottom in clean kerosene.
5. Wipe dry with a clean cloth.
6. If fuel filter is dirty and made of wire mesh, clean it thoroughly in clean kerosene.
7. If fuel filter is dirty and made of fiber, replace with new fuel filter and gasket.

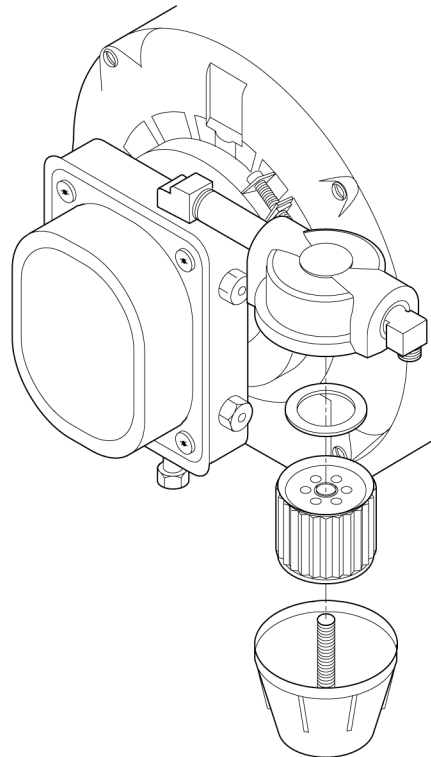


Figure 23 - Removing Fuel Filter

**TROUBLESHOOTING — PROBLEM CONDITIONS****OBSERVED PROBLEM**

Heater ignites, and flame is established, however, flame control trips, and heater shuts off.

**POSSIBLE CAUSE****If Flame Control Trips Out within First Minute of Operation**

- A. Defective flame control
- B. Defective or dirty photocell
- C. Loose wire nut connection

**POSSIBLE CAUSE****If Flame Control Trips Out after Several Minutes of Operation**

- D. Defective fan switch
- E. Incorrect fuel pump pressure
- F. Restricted fuel filter
- G. Dirty photocell

**TEST PROCEDURES****A. Defective flame control**

The heater is equipped with one of two flame controls.

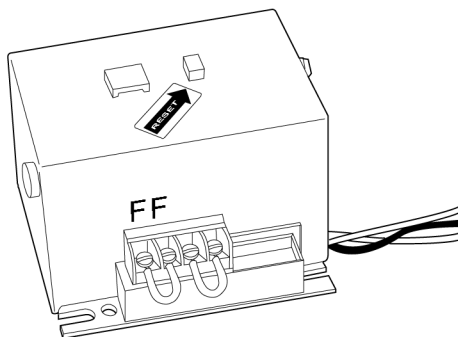
1. White-Rogers/Robert Shaw flame control
2. Standard flame control

The White-Rogers/Robert Shaw flame control is large and square. It is mounted beside the motor on the wiring cover plate. It is either black or grey in color with the reset button located on top. The standard flame control is much smaller than the White-Rogers/Robert Shaw flame control. It is located beside the motor and covered by the wiring cover plate. The reset button is located on the side of the motor support.

Follow the directions below that match the flame control on your heater.

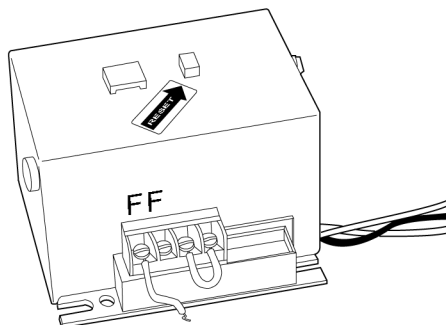
**White-Rogers/Robert Shaw Flame Control Part Number M50230**

1. Unplug heater.
2. Remove upper shell of heater.
3. Disconnect the two photocell wires from the terminals marked F-F on flame control.
4. Make a jumper wire. Connect jumper wire to terminals marked F-F on flame control.



**Figure 24 - Flame Control with Jumper Wire Connected to F-F Terminal**

5. Depress reset button on flame control.
6. Remove one end of jumper wire from one of the F-F terminals.



**Figure 25 - Flame Control with One End of Jumper Wire Removed from F-F Terminal**

7. Replace upper shell on heater.
8. Connect heater to electrical supply.
9. When motor starts, securely reconnect jumper wire to F-F terminal.  
*IMPORTANT:* Make this connection within 10 seconds after motor starts.
10. If reset button on flame control pops out and heater shuts off, the flame control is defective and must be replaced.
11. If heater continues to run for 5 minutes and reset button does not pop out, the problem is not in the flame control.

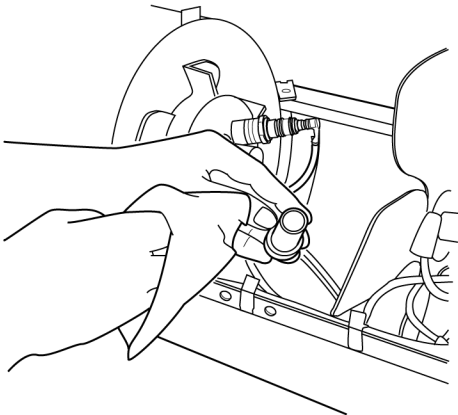
**Standard Flame Control**

Part Number M50671-01

1. Unplug heater.
2. Remove upper shell of heater.
3. Check flame control with HA1170 tester or use the following procedure.
  - A. Disconnect blue and white flame control wires from blue and white photocell wires. These wires are connected by small wire nuts near photocell.
  - B. Connect blue flame control wire to white flame control wire. Use wire nut to make connection. Make sure wires are clear of fan.
  - C. Replace upper shell on heater.
  - D. Connect heater to electrical supply.
  - E. If reset button on flame control pops out and heater shuts off, the flame control is defective and must be replaced. If heater continues to run and reset button does not pop out, the problem is not in the flame control.

**B. Defective or dirty photocell**

1. Unplug heater.
2. Remove upper shell of heater.
3. Remove photocell from photocell bracket attached to burner head.
4. If lens is dirty, wipe off with clean, soft cloth.

**Figure 26 - Cleaning Lens of Photocell**

5. Replace photocell.
6. Replace upper shell on heater.
7. Connect heater to electrical supply. If problem remains, continue with steps below.
8. Unplug heater.

9. Remove upper shell of heater.
10. Remove photocell from photocell bracket attached to burner head.
11. Check photocell with HA1170 tester or use the following procedure.
  - A. Disconnect blue and white photocell wires from blue and white flame control wires. These wires are connected by small wire nuts near photocell.
  - B. Set ohmmeter on the RX1K position.
  - C. Connect the ohmmeter test leads to the photocell wires.
  - D. Hold photocell lens up to a light source (60 watt light bulb or direct sunlight). Make sure lens is facing light source. The resistance indicated on the ohmmeter should be less than 500 ohms.
  - E. Block off light source completely by holding the opening of photocell against a smooth, flat surface such as the fuel tank. Within 10 seconds the resistance indicated on the ohmmeter should be greater than 250,000 ohms.
  - F. Replace photocell if any of these conditions are not met during testing.

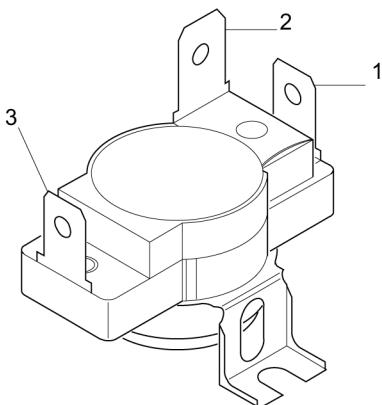
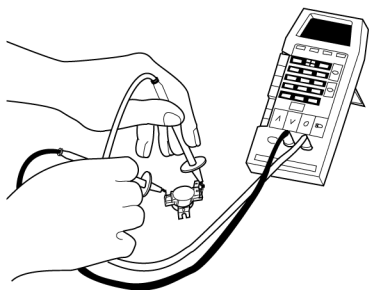
**C. Loose wire nut connection**

Check all electrical connections for tightness.

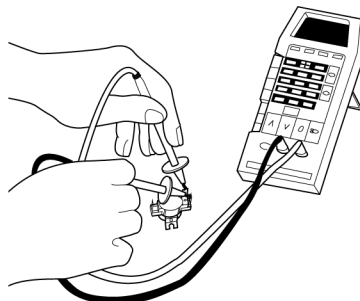
*Continued*

**D. Defective fan switch**

1. Unplug heater.
2. Remove upper shell of heater.
3. Remove fan switch from heater.
4. Set ohmmeter to RX1K scale.
5. Connect test leads from ohmmeter to terminals marked 1 and 3 on fan switch. The ohmmeter should move upscale and read continuity (0 ohms). *Note:* Make sure fan switch is at room temperature before performing this test.

**Figure 27 - Fan Switch****Figure 28 - Testing Terminals 1 and 3 of Fan Switch**

6. Connect test leads from ohmmeter to terminals marked 1 and 2 on fan switch.

**Figure 29 - Testing Terminals 1 and 2 of Fan Switch**

7. Apply a low level of heat to the face of the switch. Do this with a lit match, heated soldering iron, etc. Ohmmeter should read continuity (0 ohms) when fan switch is heated.
8. Replace fan switch if any of these conditions are not met during testing.

**E. Incorrect fuel pump pressure**

Follow steps under INCORRECT FUEL PUMP PRESSURE, procedure "C" on page 13.

**F. Dirty fuel filter**

Follow steps under DIRTY FUEL FILTER, procedure "H" on page 17.

**G. Dirty photocell**

Follow steps 1 thru 5 under DEFECTIVE OR DIRTY PHOTOCCELL, procedure "B" on page 19.

**TROUBLESHOOTING — PROBLEM CONDITIONS****OBSERVED PROBLEM**

**Heater does not start. Motor and transformer do not operate.**

**POSSIBLE CAUSES**

- A. Blown fuse or tripped circuit breaker
- B. Frayed or broken wires on extension cord
- C. Flame control tripped
- D. Defective thermostat
- E. Defective fan switch
- F. Defective flame control

**TEST PROCEDURES****A. Blown fuse or tripped circuit breaker**

Check for blown fuse or tripped circuit breaker at electrical supply. Correct if needed.

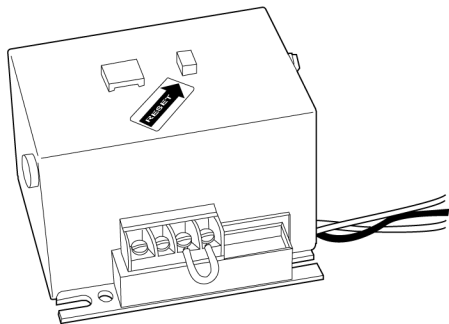
**B. Frayed or broken wires on extension cord**

Check for frayed or broken wires. Replace cord if highly worn, cut, or broken.

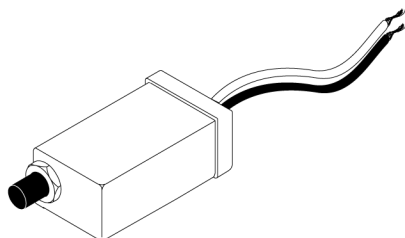
**C. Flame control tripped**

The heater is equipped with one of two flame controls.

1. White-Rogers/Robert Shaw flame control
2. Standard flame control



**Figure 30 - White-Rogers/Robert Shaw Flame Control**



**Figure 31 - Standard Flame Control**

The White-Rogers/Robert Shaw flame control is large and square. It is mounted beside the motor on the wiring cover plate. It is either black or grey in color with the reset button located on top. The standard flame control is much smaller than the White-Rogers/Robert Shaw flame control. It is located beside the motor and covered by the wiring cover plate. The reset button is located on the side of the motor support.

Depress reset button on flame control. This will reset the flame control for proper operation.

**D. Defective thermostat**

1. Unplug heater.
2. Remove outer cover of thermostat. Do this by removing the set screw on thermostat cover. *Note:* Newer thermostats require you to remove thermostat knob before removing cover.
3. Set ohmmeter on the RX1 position.
4. Connect test leads of ohmmeter to two screw terminals inside thermostat.
5. Turn thermostat knob to a temperature setting that is higher than room temperature. Ohmmeter should read continuity (0 ohms).
6. Turn thermostat knob to a temperature setting that is lower than room temperature. Ohmmeter should show an open circuit.
7. Replace thermostat if any of these conditions are not met during testing.

**E. Defective fan switch**

Follow steps under DEFECTIVE FAN SWITCH, procedure "D" on page 20.

**F. Defective flame control**

Follow steps under DEFECTIVE FLAME CONTROL, procedure "A" on page 18.

**TROUBLESHOOTING — PROBLEM CONDITIONS****OBSERVED PROBLEM****Carbon build-up inside combustion chamber****POSSIBLE CAUSE**

- A. High altitude
- B. Incorrect fuel pump pressure
- C. Wrong fuel
- D. Restricted air flow to heater

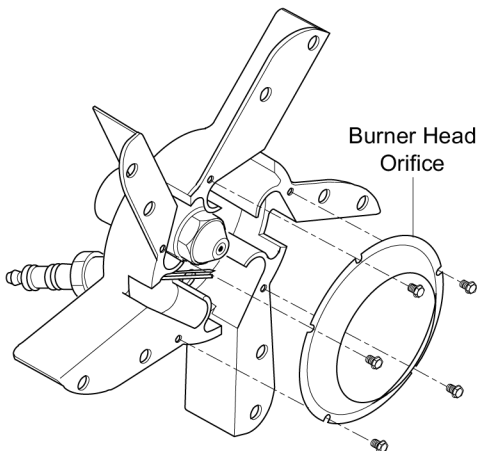
**TEST PROCEDURES****A. High Altitude**

All heaters are designed and tested for use at elevations less than 3,000 feet above sea level. Using heater at altitudes higher than 3,000 feet above sea level results in an unbalance in the air/fuel mixture. Air is less dense at higher altitudes. This causes the unbalance in the air/fuel mixture. This unbalance may result in carbon build-up inside combustion chamber.

If heater has been used at elevations above 3,000 feet, follow the instructions below to correct carbon build-up. If heater has been used at elevations below 3,000 feet, check for other possible causes listed above.

**600,000 BTU/Hr Model**

1. Remove upper shell of heater.
2. Remove burner head orifice if heater is equipped with one (see Figure 32).



**Figure 32 - Burner Head and Head Orifice**

3. Replace existing nozzle with a 3.5 gph, 70 degree, type A, hollow-spray-pattern nozzle (DESA part number M14969).

4. Check pump pressure. Make sure pump pressure is 110 psi.

*Note:* Reinstall original nozzle and burner head orifice (if heater was equipped with one) if moving heater to lower altitudes.

**350,000 BTU/Hr Model**

1. Remove upper shell of heater.
2. Remove burner head orifice if heater is equipped with one (see Figure 32).
3. Replace existing nozzle with a 2.25 gph, 80 degree, type A, hollow-spray-pattern nozzle (DESA part number M22626).
4. Check pump pressure. For 350,000 BTU/Hr model, high altitude pump pressure must be 110 psi.

*Note:* Reinstall original nozzle and burner head orifice (if heater was equipped with one) if moving heater to lower altitudes.

**B. Incorrect fuel pump pressure**

Follow steps under INCORRECT FUEL PUMP PRESSURE, procedure "C" on page 13.

**C. Wrong fuel**

Use proper fuel. See GENERAL SPECIFICATIONS AND APPLICATIONS INFORMATION on page 5 for fuel guidelines.

**D. Restricted air flow to heater**

Make sure air flow to air inlet (rear) of heater is not blocked. Less air entering rear of heater will result in an unbalance in the air/fuel mixture. This unbalance may result in carbon build-up inside combustion chamber.