FORD

HEATERS

MODELS: **CTN 40DS/55DS/100DS/150DS**
CTN-0202/0203/0204/0205

REPAIR MANUAL

40004040

Reprinted

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PORTABLE SPACE HEATERS - LOW PRESSURE (Model CTN40DS, CTN55DS, CTN100DS, CTN150DS)
(Mfg. No. 50175/50176/50177/50178/50202/50203/50204/50205)

IMPORTANT: The replacement of any part on this product by other than the manufacturers' authorized replacement part may adversely affect the performance, durability or safety of this product.

The manufacturer reserves the right to make changes on and to add improvements upon its products at any time without notice or obligation. The manufacturer also reserves the right to discontinue manufacture of any product at its discretion at any time.

HEATERS
LOW PRESSURE

INTRODUCTION

This manual contains service and maintenance instructions for a low pressure heater. It has been prepared to provide the instructions the serviceman needs to correctly service and maintain this heater. All sections of this manual should be carefully studied by the serviceman before beginning to work on the heater.

Pay attention to all WARNINGS used throughout this manual and follow each one very closely. Failure to obey these rules could result in personal injury or death to yourself or others.

SAFETY

Safety is No Accident . . . . . Be Alert!

This symbol is used to attract your attention to the safety precautions that should be understood by the serviceman to avoid accidents.

Please read and follow these instructions on safety procedures before servicing this heater.

PERSONAL CONSIDERATIONS:

1. Never let shop rags, used for cleaning, lay around to become fire hazards.
2. Always use safety glasses when servicing or inspecting the heater.
3. DO NOT wear loose fitting clothing that might get caught in moving parts. Also, keep hands and feet away from moving parts.
4. Operate heater only in a well ventilated area. Keep a window or door partly open to provide this ventilation.
5. Always disconnect power cord when servicing or moving the heater.
6. Never make any mechanical adjustments to the heater while it is operating.

EQUIPMENT CONSIDERATIONS:

1. **Never use gasoline** in this heater, or to clean this heater.
2. Never operate heater with the top, or any parts removed. This can quickly overheat the unit causing the combustion chamber to burn out. It is also dangerous because all working parts are exposed.
3. Use **only** clean kerosene, No. 1 fuel oil or No. 1 diesel fuel. Kerosene is recommended for use when the temperatures drop below zero degrees fahrenheit. (-18 celsius).
4. The electric power cord to the heater must be plugged into a properly grounded three-prong outlet **only.**
5. Use a three-wire grounded type extension cord **only.**
6. Always make sure unit has been disconnected from power supply before any servicing is performed.
7. Be sure heater is level and do not overfill. Use a funnel or can with long fill spout. Wipe up any spilled fuel immediately.
8. DO NOT alter or permanently remove any parts of the heater. Replace with only genuine replacement parts.

OPERATIONAL CONSIDERATIONS:

1. Never operate the heater with any of the parts malfunctioning or out of adjustment.
2. Power supply must match voltage requirements as specified on the heater identification plate.
3. DO NOT operate heater in presence of volatile materials such as gasoline or paint.
4. Keep heater away from other combustible materials such as wood, paper or walls.
5. If test running is required, make sure you are thoroughly familiar with the complete operation of this heater. Know how to stop the heater.

Whenever you see this symbol  **it means:**
ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!

IDENTIFICATION PLATE LOCATION

The heater model and serial number identification plate is located on the right side of the heater frame above the fuel tank. (Fig. 1)

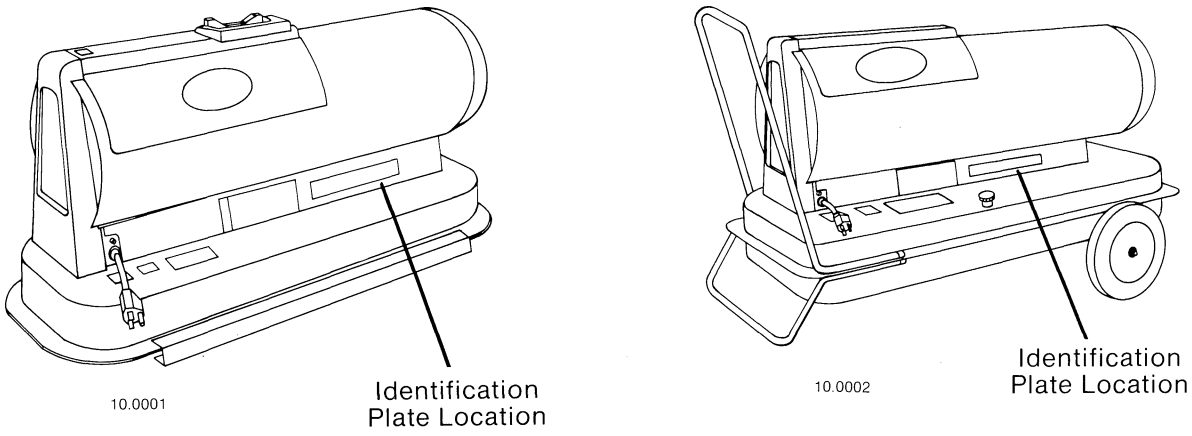
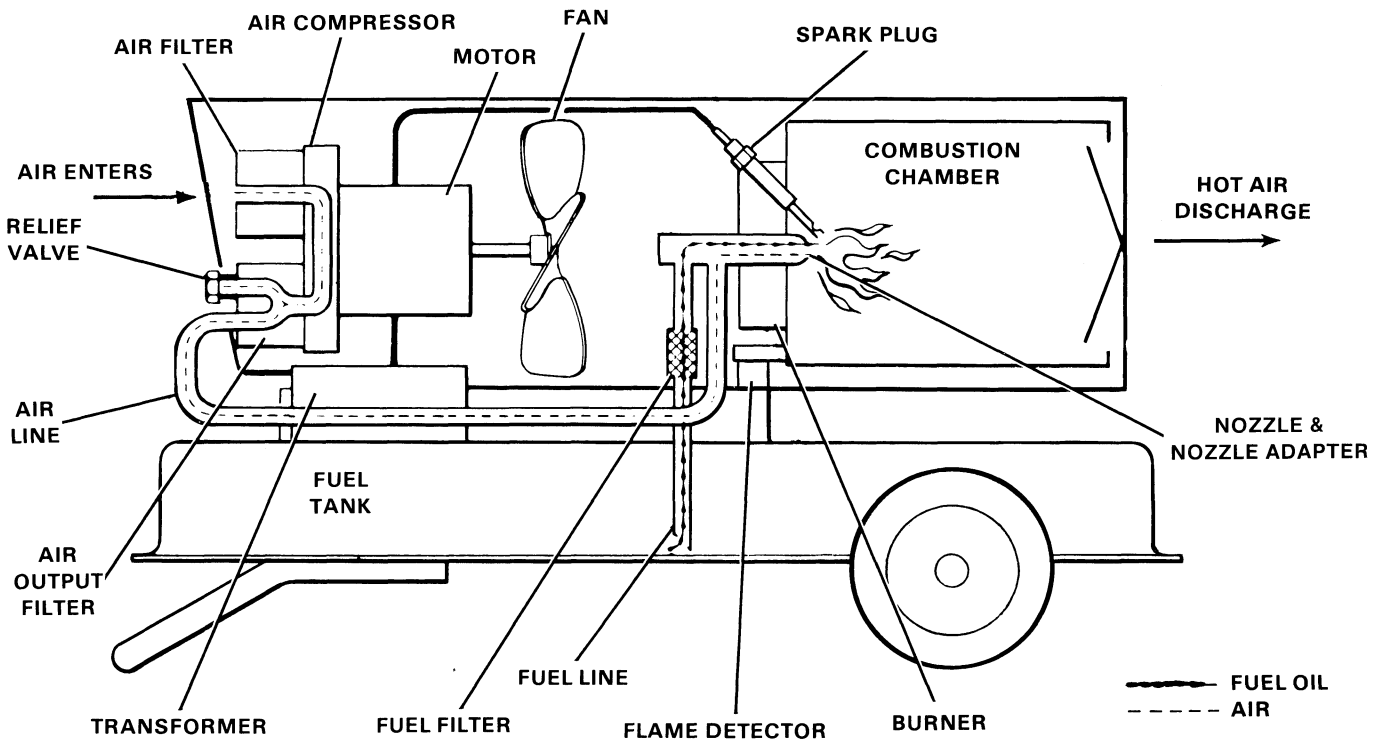


FIG. 1

HEATER OPERATION



HOW IT WORKS

If you understand how this heater operates, you will be better able to service and maintain it. The principle is simple. No oil pump is needed. The oil is supplied by a siphon system. Air pressure is used for the siphon, therefore it is important to maintain proper air pressure adjustment. Correct air pressure is the most important factor for proper heater operation.

Air enters into the rear of the heater through the air intake filter. It is then drawn through the compressor, mounted on the motor. The compressor increases the air pressure, which is regulated by the pressure relief valve. Carbon, which may be picked up from the carbon vanes of the compressor, is removed from the air by the air output filter. The filtered air at the correct pressure then enters the nozzle adapter through the air line. As the air passes through and exits the nozzle, it creates a partial vacuum in the center of the orifice which siphons the oil from the tank. The filtered oil is atomized with the air as it is injected into the combustion chamber.

The transformer supplies power to the spark plug, which provides a constant spark inside the combustion chamber. Oil sprayed from the nozzle directly hits the spark and is immediately ignited.

The fan draws air through the back of the heater in the space around the fan motor and compressor assembly. This air performs three functions. It cools the motor, transformer and other heater components, insuring their long operating life. The air also conducts heat through convection from the combustion chamber providing heat to the area to be heated. The remainder of the air enters the burner at the rear of the combustion chamber through the vents in the burner in a swirling pattern. This air mixes in the combustion chamber with the aerated oil spray from the nozzle to give complete fuel combustion, burning without odors or waste.

Power is supplied to the heater by a three-wire electrical cord. When plugged in, the heater will begin to function. No switches are needed for operation; to stop merely pull the plug.

Your heater is equipped with a flame-out safety control. The purpose of this system is to stop all electrical power to the motor, transformer and spark plug in approximately 20 seconds if ignition should fail to occur on start up or lack of fuel.

MAINTENANCE

WARNING: To avoid accidental shock or injury, disconnect power prior to servicing heater.

FILTERS

Dirty air or oil filters will cause an inbalance in the air-fuel mixture for proper combustion. The best indication that this condition exists is an increase in odors or difficulty getting your heater to ignite. This heater should never be operated without the filters in place.

Air Intake Filter

Every 500 hours (or as necessary) wash with a mild detergent, dry thoroughly and replace. Do not oil the filter element. If your heater is used where there is considerable dust or dirt, check this filter daily and clean as often as necessary with soap and water.

IMPORTANT: Intake air filter must be completely dry before reinstallation. The compressor rotor and vanes are made of compressed carbon, and will be damaged by contact with water vapor.

To remove the intake filter simply pull it out of the housing, clean as instructed, and reinsert it.

The unit you are working with will either have a round filter system, or square type. The same care and cleaning procedures apply to both.

Air Output Filter

Every 500 hours (or as needed) remove the air output filter and tap the contaminated side gently on a solid object to remove contaminates. Compressed air or liquids should not be used to clean this filter. Replace cleaned filter in filter body in the same position as it was removed. If the filter appears extremely dirty, replace it with a new filter of the same type. When replacing the filter cover be sure the gasket (Fig. 3) is firmly in place and the screws in the filter cover are tight to prevent air leaks.

Removal of round filter packs. To remove and clean the input filter remove clip A, and cover B. The filter can now be removed and cleaned as instructed. See (Fig. 2)

Removal of square filter pack. Remove the filter cover screws, and the cover gasket. Both the input and output filters are now easily removable and can be cleaned as instructed. (Fig. 3)

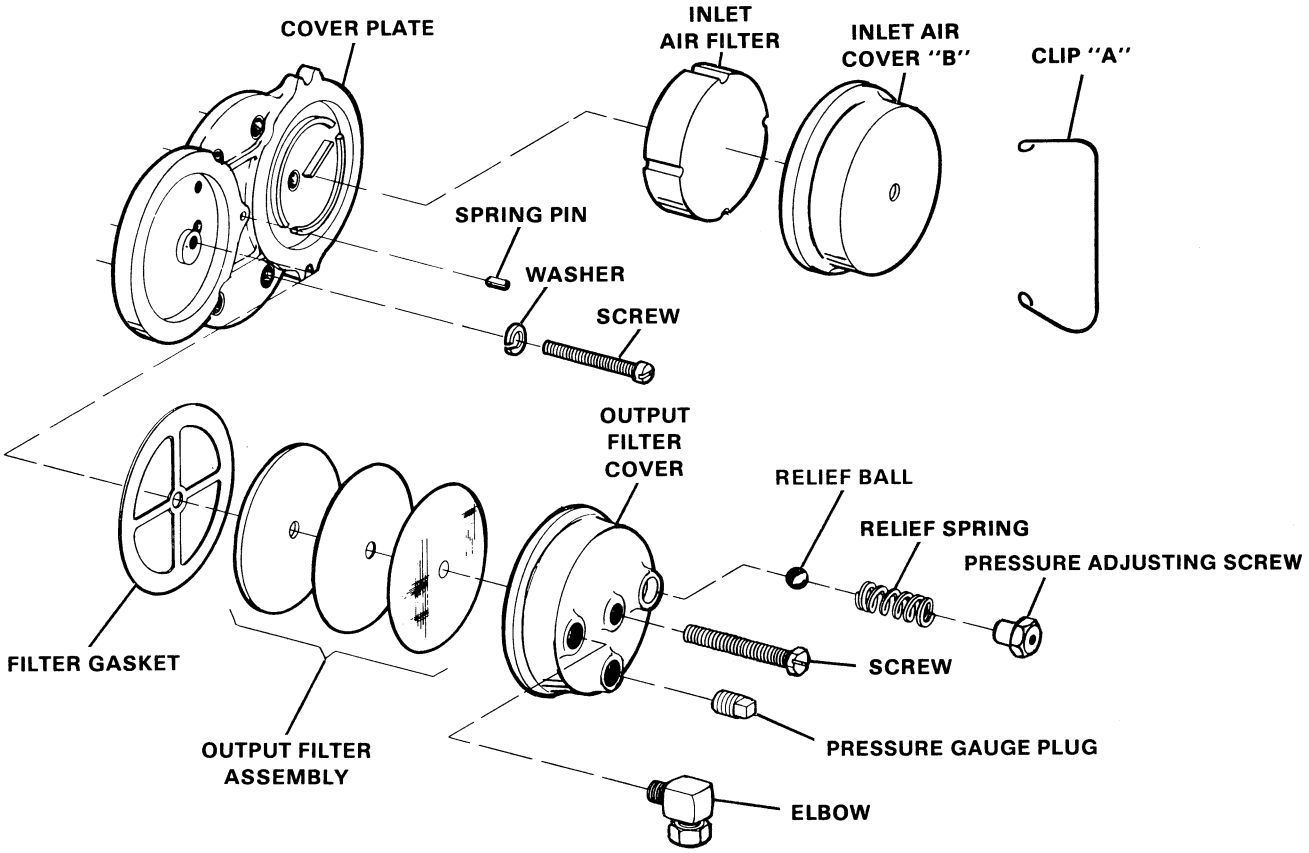


FIG. 2

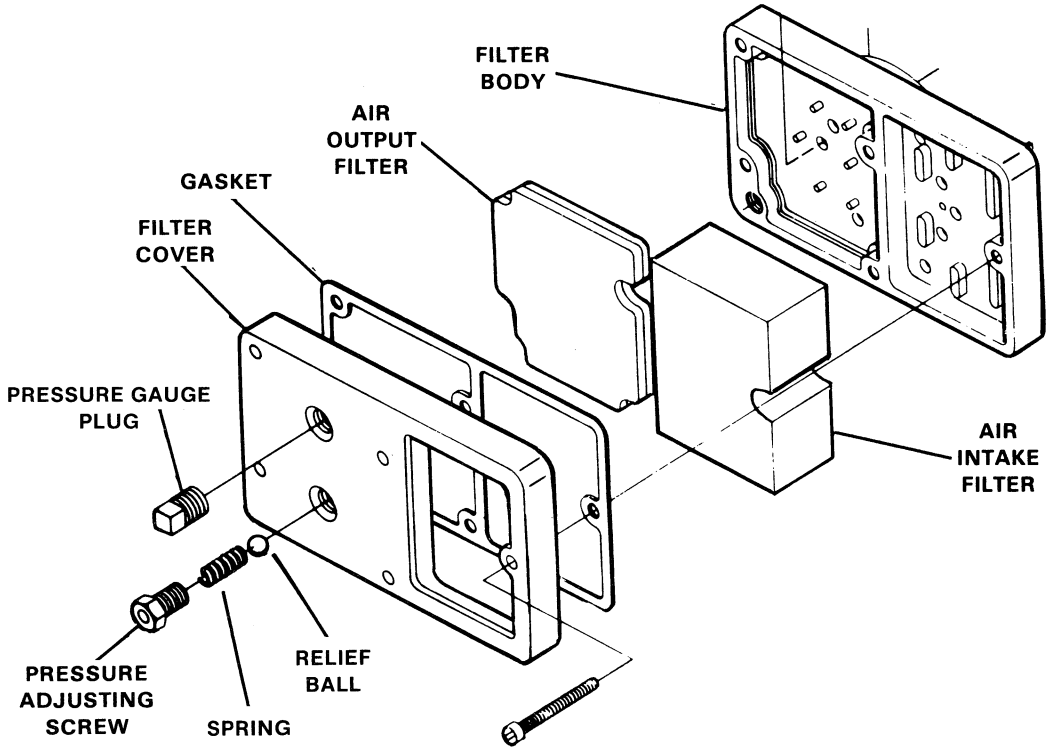


FIG. 3

Fuel Filter

Annual (or as needed). Remove the filter from the fuel line and blow compressed air through it in the opposite direction of fuel flow. **Safety glasses should be worn when using compressed air.**If compressed air does not clean the filter, replace it. (Fig. 4)

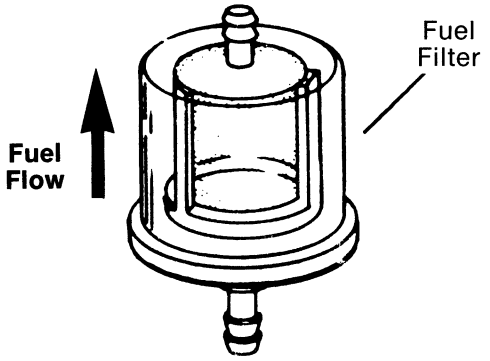


FIG. 4

FUEL TUBE DIMENSIONS

The lower fuel tube is made of special material that does not react to various fuels. Substitute fuel tubes may swell and cause air leaks or may deteriorate or dry-out and crack prematurely. Replace with **only** original replacement parts.

The length of the lower fuel tube and pick-up tube is critical. Excessive length may cause fuel starvation due to bending or kinking. If replacing the lower fuel tube use **only** original replacement parts, as its length will affect the positioning of the pick-up tube. If pick-up tube is replaced, install pick-up tube into lower fuel tube as shown in (Fig. 4A) for the various models of heaters.

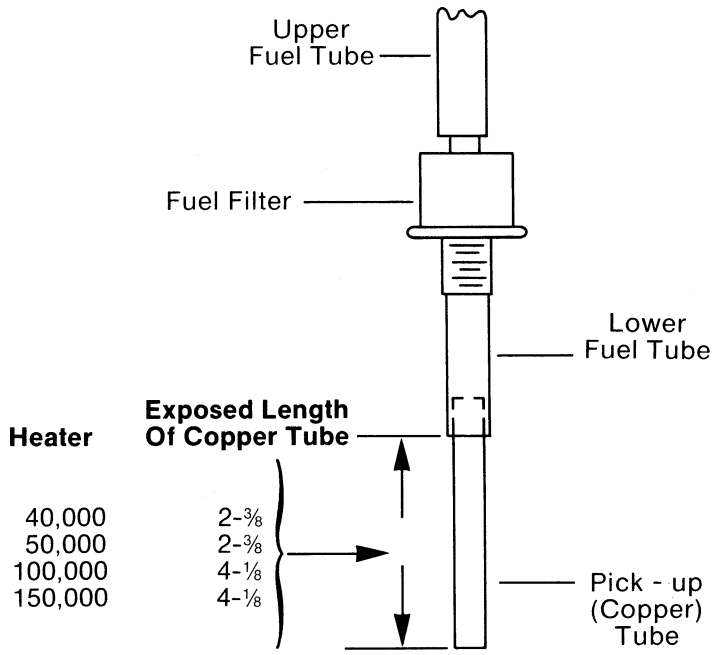


FIG. 4A

AIR COMPRESSOR

The air compressor is built to very close tolerances, so handle all of the parts with care and keep them clean. Dirt, oil and other foreign material will interfere with the proper performance of the compressor.

To check the air compressor for wear remove the air filter assembly completely. The compressor rotor and vanes can then be removed. (Fig. 5)

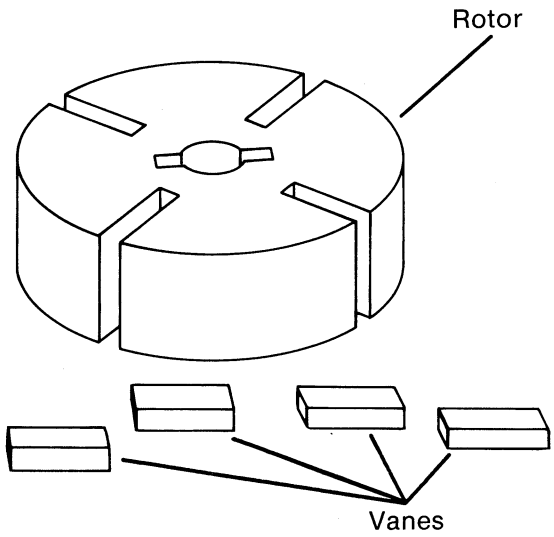


FIG. 5

IMPORTANT: Both the rotor and the vanes are made of carbon and are very brittle, and can easily be cracked or chipped. The vanes in the rotor are loose, take care that these are not dropped when removing the rotor from the compressor. Wipe all compressor parts clean with a soft, **dry** cloth. Loose dirt particles or oil will cause rapid wear of parts. Inspect all parts excessive wear or damage. The compressor rotor will need to be replaced only if it shows deep grooves, or uneven wear. If the vanes are worn or damaged, and need to be replaced, they must be replaced as a set.

NOTE: Compressor vanes are longer than they are wide. When they are properly installed, the vanes will be flush with rotor sides. Refer to ADJUSTMENTS AND SERVICING - Air Pressure Adjustment to reset the rotor air gap.

AIR AND FUEL LINES

If the tubing is brittle or cracked replace only with genuine replacement parts. Substitute tubing will prematurely fail because it will be damaged by the extreme heat and by the fuel.

FUEL TANK

Every 300 hours (about twice a month during frequent use) drain and flush with clean fuel oil.

NOZZLE

Accumulation of dirt from fuel and carbon from the compressor vanes will eventually fill up the passages in the nozzle, resulting in reduction of fuel and air flow.

WARNING: To avoid eye injury, safety glasses should be worn for the next step.

To clean the nozzle, usually compressed air is sufficient. (Fig. 6) Blow air through the delivery rear end of the nozzle. If air does not clear the nozzle, wipe the nozzle with a soft cloth. In extreme cases, it may be necessary to remove the end part of the nozzle.

To disassemble the nozzle, remove the nozzle tip cap from the adapter. Care should be used to avoid damaging the nozzle adapter. Remove the "O" ring seal from the nozzle tube. Place the nozzle tube between two pieces of wood to prevent damaging the air passages on the tube. Clamp the protected tube securely in a vise and loosen the nozzle tip.

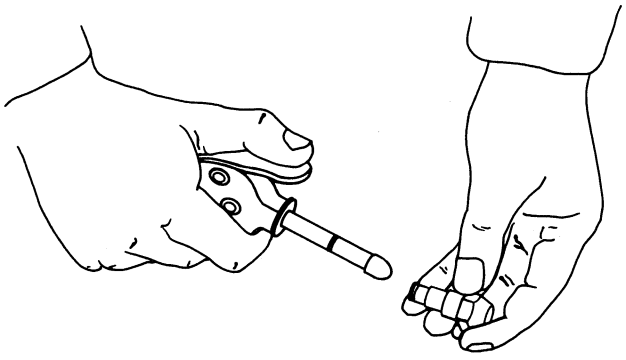


FIG. 6

Carefully remove the nozzle tip which will expose the stainless steel spinner. The spinner can now be lifted from the nozzle tube and cleaned with a soft cloth or a wood toothpick. Do not use an orifice cleaner or metal object to clean spinner. Using a dry cloth, wipe the nozzle tip and tube clean. Never clean the nozzle parts in kerosene of fuel oil as these fluids will leave an oil film which could cause an accumulation of contaminants to build in the air passages. See (Fig. 7)

After cleaning, be sure to install the spinner before replacing the nozzle tip. Carefully clamp the nozzle tube between two wood blocks in a vise and tighten nozzle tip. Check "O" ring seal for damage or cracks before replacing on the nozzle tube. If damage is evident, replace the seal. Firmly screw the nozzle tip into the adapter. Do not overtighten as damage could occur to the threads inside the nozzle adapter. Reinstall the nozzle making sure it is tight against the burner casting. Tighten setscrew and replace air and oil lines.

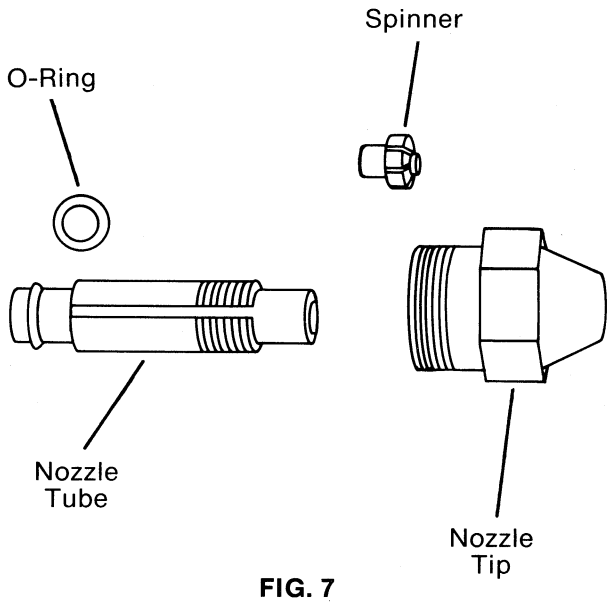


FIG. 7

FAN BLADES

Fan blades should be cleaned twice a season or more often if used in extremely dusty conditions. Wipe them with a clean cloth. If a solvent is used, dry blades thoroughly before operating unit.

MOTOR

Periodically remove accumulated dust from the motor with compressed air for proper cooling.

BURNER

Remove lint, straw or similar foreign material from around the burner.

TRANSFORMER

Wipe dirt and dust from high voltage terminal and wire from transformer to the spark plug.

FLAME DETECTOR

Clean the glass portion of the detector with a soft dry cloth.

GENERAL

Always use the correct fuel, free of dirt and water. Keep filters clean and all air and oil connections tight. Be sure spark plug, nozzle and pressure settings are correct.

ROUTINE MAINTENANCE

PRE-SEASON CHECK-UP ALL MODELS

1. Remove, clean and/or replace air filters.
2. Drain, flush and refill tank with fresh fuel.
3. Remove top.
4. Remove, clean or replace fuel filter.
5. Remove spark plug, clean, set gap and re-install in proper position.
6. Remove nozzle adapter from burner head. Remove nozzle stem. Clean with air. Replace nozzle seal if damaged. Reassemble.
7. Clean flame detector.
8. Check line fittings. Replace hoses if necessary.
9. Check fan for cracks or bent blades. Replace if damaged.
10. Tighten setscrew holding fan to drive shaft.
11. Check air filter gasket for air leaks, tighten all screws to prevent air leaks.
12. Replace top.
13. Adjust air pressure to proper setting.

STORAGE OF HEATER

The storage of the unit may be handled in one of two ways. These procedures prevent condensation from occurring in the fuel tank.

1. Completely drain the fuel tank and leave out the drain plug and fill cap.
2. Fill the fuel tank completely for storage during the off season.

ADJUSTMENTS AND SERVICING

AIR PRESSURE ADJUSTMENT:

NOTE: Before adjusting air pressure, be sure all air and oil filters are clean, all air and oil lines are tight and not leaking, and all screws, gasket and "O" rings are firmly in place.

1. Fill the tank with fresh, clean fuel.
2. Remove the service plug from the air output filter cover.
3. Attach a good pressure gauge with calibrations easily read between 3 and 5 psi. (0-15 psi guage)
4. Start the heater.
5. While it is running, note the pressure on the gauge.

Model	Pressure Setting
40,000 BTU	3 psi
55,000 BTU	3 psi
97,000 BTU	5 psi
150,000 BTU	5 psi

6. To increase pressure, slowly turn the pressure adjusting screw located on the air output filter cover, in. To decrease the pressure, turn the pressure adjusting screw, out. (Figs. 8 & 9)

   IMPORTANT: Do not block the hole in the adjusting screw.

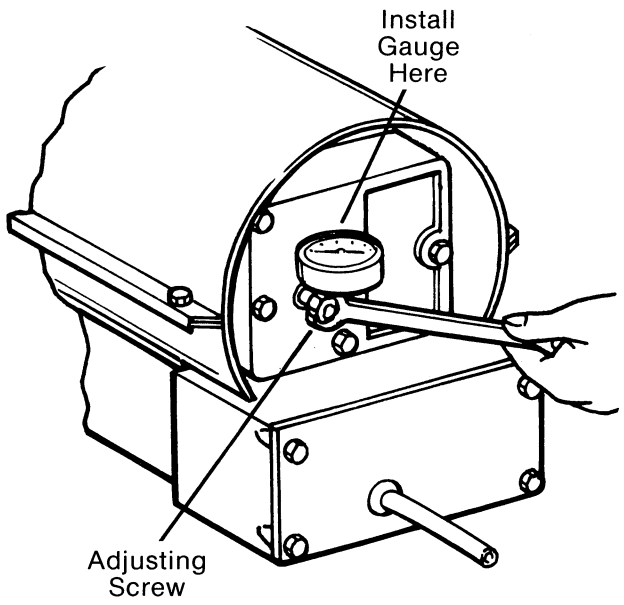


FIG. 8

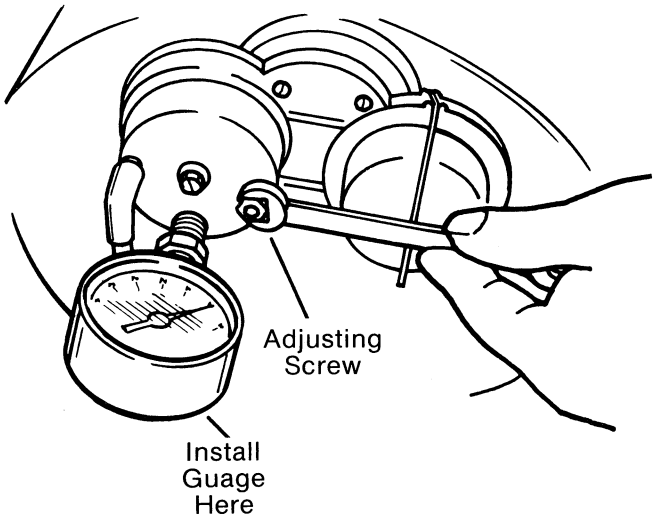


FIG. 9

7. When the correct pressure is reached, unplug the heater.
8. Disconnect the guage.
9. Replace the service plug.
10. If the correct air pressure cannot be obtained, remove the pressure adjusting screw to determine if the spring free length is 19/32", or if the relief ball is sticking or not seating properly. Repair or replace defective parts and re-set to correct air pressure.
11. If the correct air pressure still cannot be obtained after inspecting the pressure adjusting screw, check the clearance between the compressor ring and the rotor. An improperly adjusted compressor ring will prevent the air compressor from generating sufficient air pressure.

WARNING: To avoid personal injury, unplug the power cord from the power supply.

Remove the filter cover, filter body and compressor plate from the motor. With a feeler gauge, check the clearance between the rotor and the compressor ring at the point where these parts are the closest to each other. (Fig. 10) If the gap at this point is more than .005 inches (.127MM), loosen the two gap adjusting screws that hold the compressor ring to the motor. Adjust the compressor ring to the motor. Adjust the compressor ring to the required gap and tighten the adjusting screws. Remove the feeler gauge and reassemble, making sure all gaskets and "O" rings are firmly in place and all screws are tight to prevent air leaks. Reset to correct pressure as described in steps 1 through 9.

NOZZLE ADJUSTMENT:

Nozzle adjustments may be necessary to alter the spray pattern-to-spark plug relationship, due to changes in climate, oil, altitude, or after cleaning. If the heater operates properly there is no reason to change the factory setting. However, if the unit starts sluggishly in cold weather, make the following adjustments.

NOTE: Before adjusting nozzle as outlined in this procedure, be sure:

- All air and fuel filters are clean.
- Nozzle is clean.
- Air and fuel lines are tight.
- Air filter housing screws are tight.
- All gaskets or "O" rings are properly in place.
- Proper air pressure has been set.

WARNING: To avoid personal injury, unplug the power cord from the power supply.

1. Remove the service cover or top.
2. Loosen the setscrew in the burner casting which holds the nozzle adapter in place. (Fig. 11)
3. Pull the nozzle back one notch (about 1/16"). See (Fig. 11)
4. Retighten the setscrew.
5. Replace the service cover or top and plug in the power cord. Test unit.

   NOTE:If excessive wear on the spark plug electrode is noticed, the nozzle is set back too far, and should be adjusted in the opposite direction.

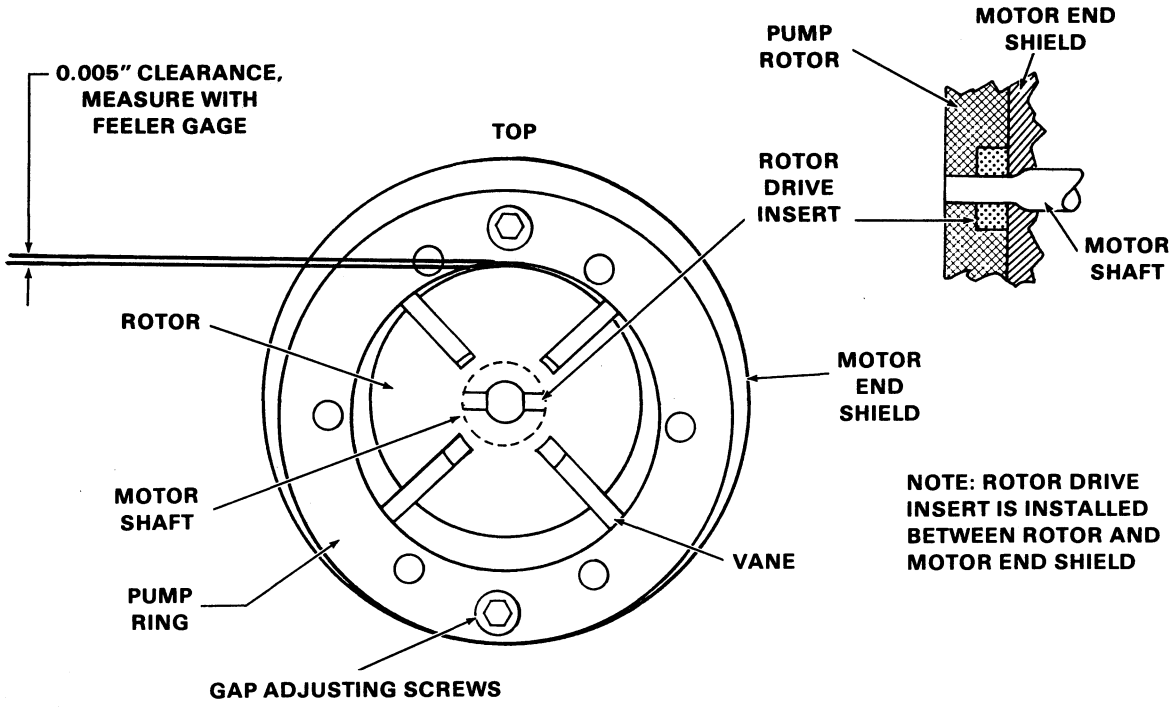


FIG. 10

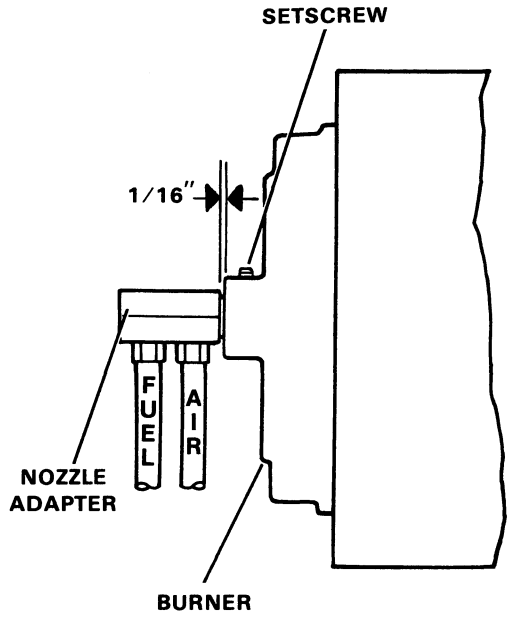


FIG. 11

IGNITION FAILURE:

NOTE: Before proceeding with these testing procedures make sure that the malfunction was not caused by a tripped circuit breaker. Push the reset button before re-starting the heater.

WARNING: To avoid personal injury, unplug the power cord from the power supply.

1. Remove the service cover or top. Remove the plug from the air filter cover (Fig. 16) to prevent fuel from entering the combustion chamber.
2. Loosen setscrew (Fig. 12A), located above the spark plug in the burner casting, and carefully pull the spark plug from the burner, leaving the wire connected to the plug.
3. Clean off any deposits and check the spark gap with an automotive wire gauge. The gap should be .060. If a wire gauge is not available a penney can be used, it also is .060 in thickness. (Fig. 12)

4. Lay the spark plug on the side of the heater so that the metal portion of the spark plug body (not the electrodes) is touching a non-moving metal part of the heater. (Fig. 13)

WARNING: To avoid personal injury, use extreme caution when testing unit with top cover removed. Keep hands, loose clothing and wires away from revolving fan blades.

5. Carefully plug in the power cord.
6. If you observe a strong spark across the gap between the electrodes, you can conclude that the ignition system and its parts are working correctly. Check nozzle for dirt. Completely reassemble heater and retest.
7. If you do not get a good spark, unplug the power cord and disconnect the spark plug from the transformer wire.
8. Lay the tip of the wire close to a non-moving metal part of the heater, or hold it with insulated pliers.

WARNING: To avoid personal injury, use extreme caution when testing unit with top cover removed. Keep hands, loose clothing and wires away from revolving fan blades.

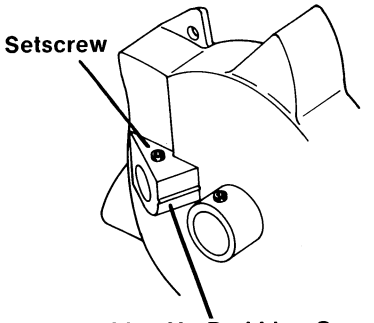


FIG. 12A

9. Carefully plug in the power cord. If you are able to pass a good spark from the wire to the metal part of the heater, you can assume that the transformer and wire are both good, and that the problem must lie in the spark plug, which should be replaced.
10. If only a weak spark or no spark at all is noted, check the wire for breaks, loose connections on the primary transformer leads, or badly worn insulation.
11. Finding none of these, the transformer is defective and must be replaced. (Fig. 13)

TESTING THE FLAME-OUT SAFETY CONTROL

Another testing procedure you should understand involves the safety monitor control. When performed in a step-by-step manner, this test can save you considerable time in troubleshooting a malfunctioning heater.

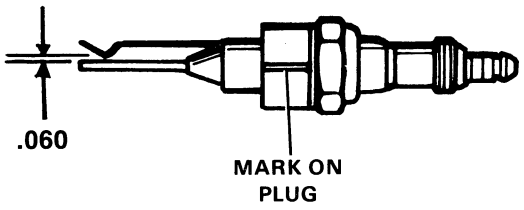


FIG. 12

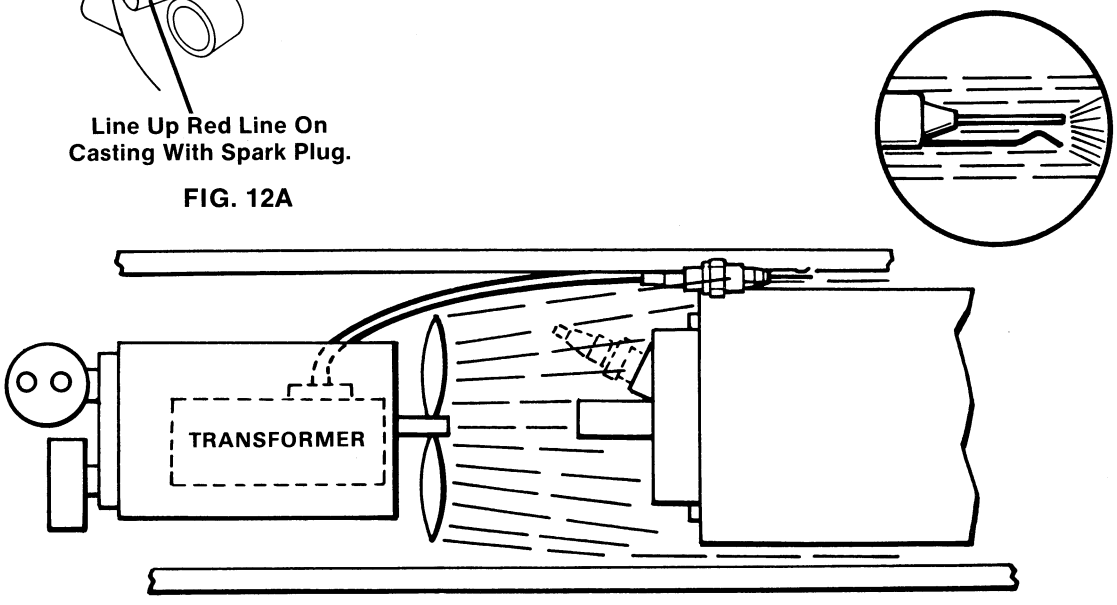


FIG. 13

Form No. 620-800
1/85

The function of the flame-out safety control is to monitor the flame in the combustion chamber, and to shut off power to the heater if no flame is present after about 20 seconds. The control is comprised of three separate components; a flame detector, circuit breaker and a printed circuit board. (Fig. 14)

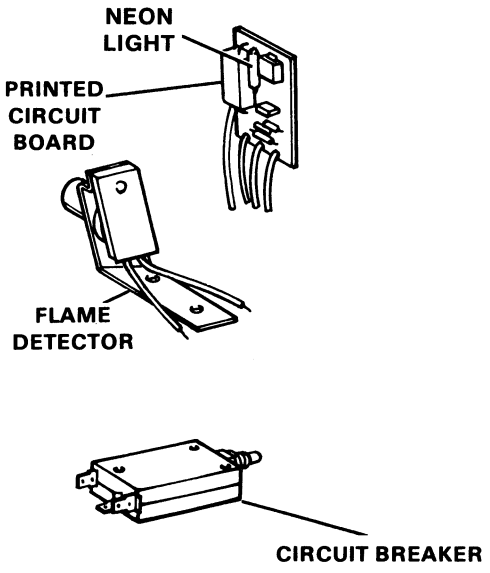


FIG. 14

In all heaters, the flame detector is mounted in alignment with a hole in the combustion chamber, so that it can "see" light from the flame. (Fig. 15)

The printed circuit board and circuit breaker are located at the rear of the heater.

All power is supplied to the heater through the circuit breaker. The circuit breaker is controlled by the printed circuit (PC) board which receives a sensing signal from the flame detector.

During normal operation the flame detector is energized by the light of the burner flame, and safety circuit is not activated. In a flame-out situation, the

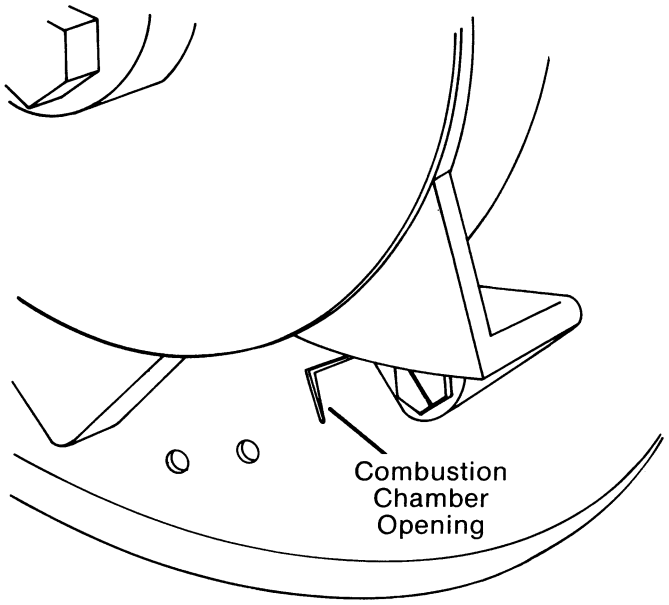


FIG. 15

flame detector does not sense the light of the flame, and activates the safety circuit. When the safety circuit is energized a small neon light located on the PC board will light up. This indicates that the timer has started, and if the burner does not ignite within 5 to 40 seconds the main circuit breaker will trip, cutting all power to the heater.

There are two conditions that will alert you to a defective system. They are:

1. The motor will continue to run with no flame present in the combustion chamber.
2. The circuit breaker will trip prematurely with a well established flame present in the combustion chamber.

Extreme care must be used in determining which of the systems components are defective. Follow this test procedure very carefully.

CONDITION 1

There are two possible causes for this condition to occur.

1. Defective flame detector.
2. Defective PC board.

Test Procedures

WARNING: To avoid accidental shock or injury, unplug the power cord from the power supply before servicing or replacing any electrical component.

1. All low pressure size heaters have the circuit breaker and the printed circuit board mounted on the air intake end of the heater. See (Fig. 16) The flame detector on these heaters is mounted at the rear of the combustion chamber and is connected to the electrical terminal block. The circuit breaker on these heaters is mounted on a sevice panel located above the tank adjacent to the power cord. (Fig. 17) On all heaters, check and make sure that the control is wired correctly. A wire diagram is fastened to the bottom side of the service cover or top on all model heaters.

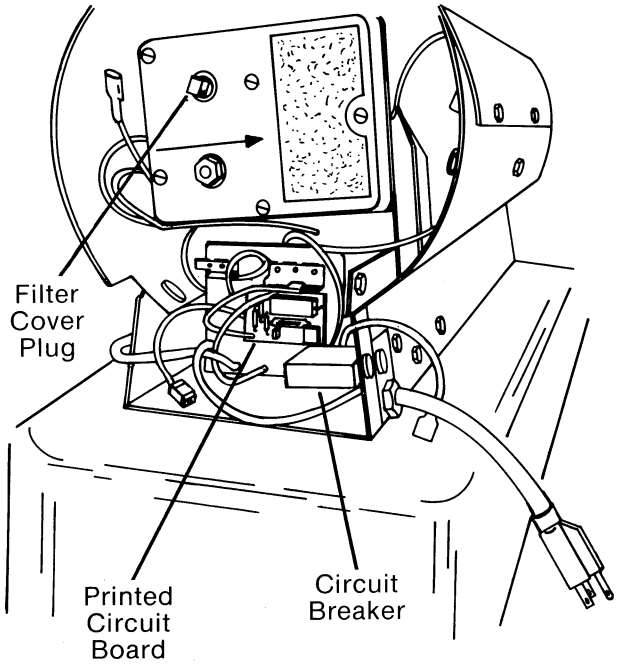


FIG. 16

2. Disconnect the air line from the air output filter body or remove the plug from the filter cover. (Fig. 16) This will prevent fuel from entering the combustion chamber during the tests.

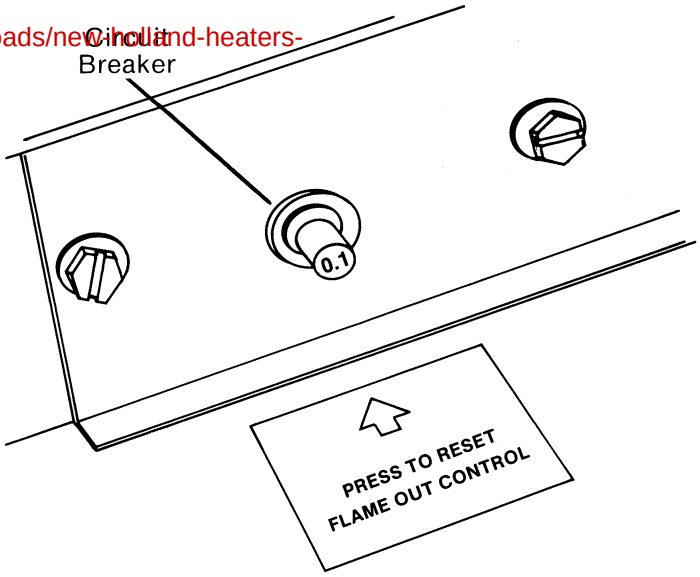


FIG. 17

3. Locate and observe the three major components of the system. Note the neon light on the printed circuit board. (Fig. 18) The neon light can be observed by carefully looking into the AIR INTAKE end of the heater on the lower right side while the motor is running.

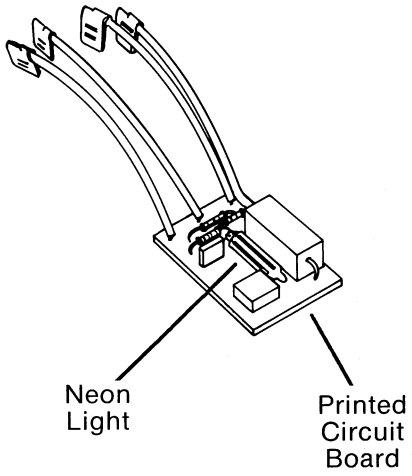


FIG. 18

4. Position the heater so no light shines on the flame detector.
5. Plug in the heater and observe the neon light on the printed circuit board. If the neon light does not glow and the motor continues to run after 20 seconds, disconnect the power cord and replace the PC board.
6. If the neon light does glow in step 5, disconnect the power cord. If proper test equipment is not available, it will be necessary to replace the flame detector.
7. If an ohmeter is available, the high and low resistance of the flame detector can be measured. Connect the ohmeter wires to the lead wires of the