REDDY HEATER

MODEL MAV60

Spec. No. 3210G23

OPERATING, MAINTENANCE and SERVICE INSTRUCTIONS with PARTS LIST



KOEHRING®
ATOMASTER DIVISION
BOWLING GREEN, KENTUCKY 42101

4357

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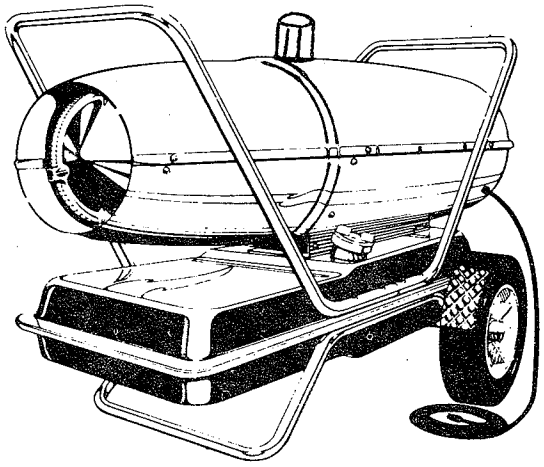
ASSEMBLY INSTRUCTIONS

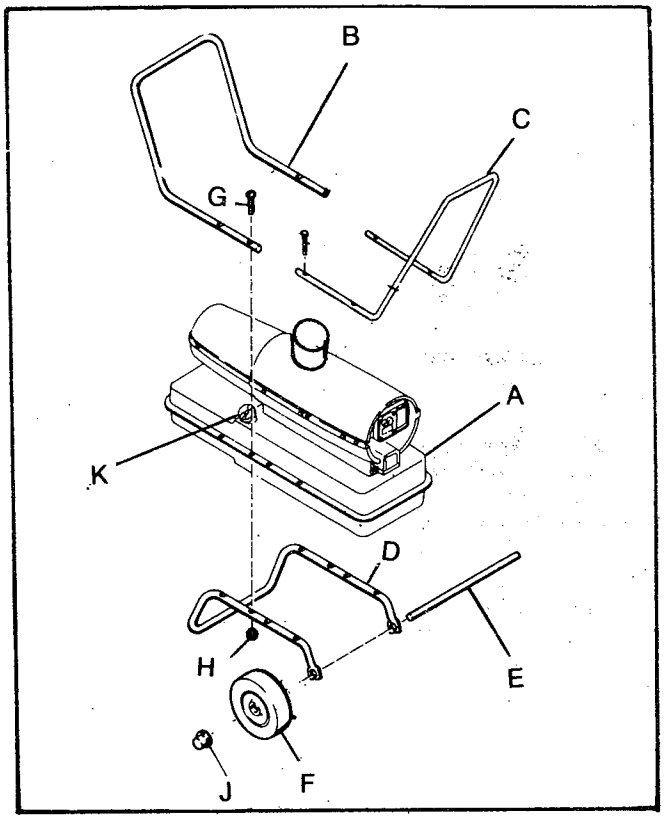
The Heater body is shipped assembled. Wheels and Handles are packed separately. Check to see that the following items are included:

A) Heater Body
B) Handles and Wheel Support Frame
C) 2 ea. Wheels, 1 ea. Axle
D) 8 ea. 10 x 24 x 1-3/4'' Screws
E) 8 ea. 10 x 24 Nuts
F) 2 ea. Cap Nuts
G) 1 ea. Fuel Cap

IMPORTANT Screws, Nuts and Cap Nuts are standard hardware items.

TOOLS REQUIRED Medium Phillips Screwdriver, 3/8'' Open or Adjustable Wrench, Lightweight Hammer.





A—Heater Body
B—Front Handle
C—Rear Handle
D—Wheel Suppot Frame
E—Axle
F—Wheel
G—Screw 10×24×1¾''
H—Nut 10×24
J—Cap Nut
K—Fuel Cap

ASSEMBLY INSTRUCTIONS

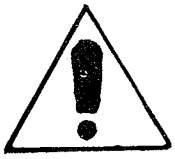
Step 1 - Slide the Axle through the Wheel Support Frame. Install Wheels. IMPORTANT - The extended hub of the Wheel should be positioned toward the Wheel Support Frame. Tap the Cap Nuts on the Axle ends.

Step 2 - Position the unit, Motor end over Wheels, on the Wheel Support Frame.

Step 3 - Use Screws and Nuts, attach Handles and Wheel Support Frame to Fuel Tank Flange with Screws and Nuts. Install all Screws and Nuts before tightening.

Step 4 - Tighten all Nuts.

Step 5 - Install Fuel Tank Cap.



WARNING — Safety Requirements

IMPORTANT: Read and Understand Instruction Manual before Starting or Servicing!

IMPROPER USE OF THIS HEATER CAN RESULT IN SERIOUS BODILY INJURY DUE TO HAZARDS OF FIRE OR EXPLOSION, CARBON MONOXIDE POISONING, BURN, AND ELECTRICAL SHOCK.

- Use ONLY Kerosene or Number 1 Fuel Oil. NEVER BURN GASOLINE, NAPTHA, PAINT THINNERS, ALCOHOL OR OTHER VOLATILE FUELS!
- Use ONLY in areas FREE OF FLAMMABLE VAPOR OR HIGH DUST CONTENT. NEVER USE HEATER WHERE GASOLINE, PAINT THINNER OR OTHER HIGHLY FLAMMABLE VAPORS ARE PRESENT.
- Make sure hot air outlet is AT LEAST 5 FEET from COMBUSTIBLE MATERIALS.
- Fill fuel tank or move heater ONLY when heater is UNPLUGGED.
- NEVER USE HEATER IN ROOMS USED FOR SLEEPING.
- USE ONLY IN WELL VENTILATED ROOMS. Provide ventilation of AT LEAST 3 SQUARE FEET FOR EACH 100,000 BTU OF RATING. (For example, a 30,000 BTU Heater would require a two foot wide window raised six inches.)
- When used with THERMOSTAT, HEATER MAY START ANYTIME!
- KEEP CHILDREN AWAY FROM HEATER AT ALL TIMES—NEVER LEAVE A HEATER PLUGGED IN WITHOUT AN ADULT PRESENT IF CHILDREN ARE LIKELY TO BE PRESENT.
- Use ONLY with electrical voltage and frequency specified on model plate.
- Use ONLY a PROPERLY GROUNDED THREE—WIRE EXTENSION CORD.
- DO NOT MOVE, HANDLE OR SERVICE WHILE HOT OR BURNING.
- Use ONLY in accordance with local ordinances and codes.

Safety requirements and model plate data comply with American National Standards Institute Safety requirements.

ANSI A10–1970

TUNE UP

To keep your heater in top operating condition, perform the following services at the start of each heater season then at the interval specified below:

Clean and flush fuel tank.	After every 150 hours operation.
Clean and/or replace fuel filter	Clean at least twice a season. More often if heater performance indicates the need. Replace if necessary.
Clean or replace air filters	Check air filter frequently. If a film of dust is apparent on the filter, remove and clean it. Replace after each 200 hours of heater operation.
Clean fan	Clean fan after every 500 hours of operation. Clean more frequently if heater is operating in dusty areas or if there is a build-up of dirt on the blades.
Clean burner nozzle.	Clean the nozzle at least once during the heater season or more often if heater performance indicates the need.
Clean and adjust spark plug	After every 300 hours of operation, clean and adjust spark plug electrodes. Adjust gap or replace the plug if electrodes have been burned or erroded.
Clean photo cell.	Clean the photo cell face with a soft cloth at least once during the heater season. If cell face tends to soot up, check with your nearest service station to determine the cause.

SECTION I

INTRODUCTION

A. GENERAL

The Model V60S Series Heater is designed for use where heated fresh air is needed, free of contamination from the combustion process. It must be used where an adequate amount of air is available for combustion and ventilation and where a flue pipe, smokestack or chimney can be arranged to carry the exhaust gases outside the heated area. Proper electrical power must be available for the heater.

Operating, maintenance and trouble-shooting instructions in addition to a service parts list is included in this manual.

B. THEORY OF OPERATION

There are four basic systems within the heater: the fuel system, the air system, the ignition system, and the flame-out control system. (Refer to Figure 1 for a schematic which depicts the operation.)

An air pump on one end of the motor shaft forces air through the air tube and out the burner nozzle. The moving air creates a pressure differential n the burner head causing fuel to be drawn from the tank. The fuel and air mix and the mixture is sprayed into the combustion chamber in a fine mist.

Additional air is supplied to the combustion chamber by a fan on the opposite end of the motor shaft. Ports around the burner head allow a portion of the air being moved by the fan to enter the combustion chamber from the nozzle. The remaining air is directed around and over the combustion chamber. This air mixes with the heated air from the combustion chamber and is ejected as a jet of clean, heated air.

The ignition system consists of a transformer and spark plug. The transformer increases the input voltage to a very high potential which causes an arc to be drawn between the electrodes of the spark plug. The arc is used to ignite the fuel and air mixture within the combustion chamber. The arc fires constantly during operation.

The flame-out control circuit essentially consists of three parts: a light-sensitive cell (flame sensor), a silicon-controlled rectifier (SCR), and the circuit breaker. The circuit breaker automatically trips if the flame fails, thereby causing the heater to shut down.

The SCR and its circuit are mounted on top of the circuit breaker and is replaceable only as a complete unit.

C. POWER REQUIREMENTS

The heaters are manufactured for use on 120 volt, 60 HZ power.

D. PREPARING FOR OPERATION

Check the heater for possible shipping damage, if any damage is found, IMMEDIATELY notify the dealer where you purchased the heater.

Some models are equipped with wheels and handles. These models are shipped with these items removed from the unit and can be found in the shipping carton along with the mounting hardware. The wheels, axle and mounting hardware are in a plastic package.

1. Remove all protective material which may have been applied to the heater for shipment.

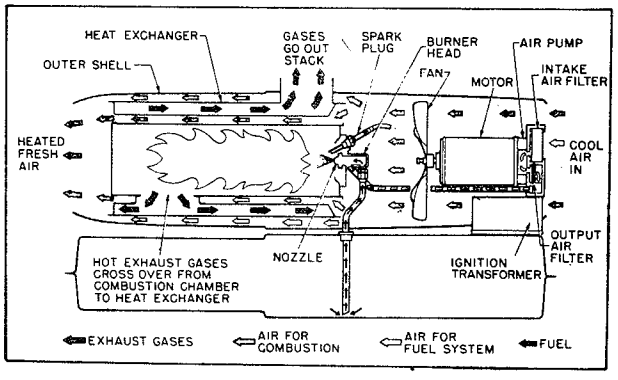


Figure 1. Schematic of Operation

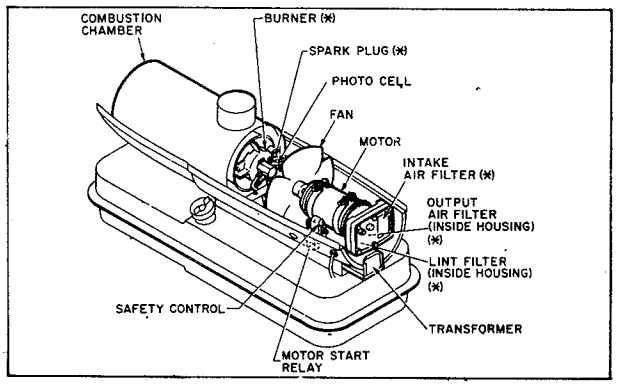


Figure 2. Heater Maintenance Points

SECTION II

OPERATION

ELECTRICAL

When using an extension cord, make certain that it is a 3-Wire (grounded) cord of proper wire size.

Cord Length (ft)	10-25	25-50	50-100	100-200
Wire Size (AWG)	#18	#16	#14	#12

FUEL

CAUTION

NEVER USE VOLATILE FUELS SUCH AS GASOLINE, NAPTHA OR ALCOHOL.

NEVER FILL FUEL TANK WHILE HEATER IS PLUGGED IN.

Be sure the tank is clean. Fill it with clean kerosene or No. 1 fuel oil ONLY. Do not use any other fuel.

When the heater is operated at very low temperatures (beyond 10 F below zero), the fuel may congeal.

To prevent this, add a non-toxic anti-icer to the fuel. Follow the mixing instructions contained on the anti-icer container.

Be sure the fuel is clean. Wipe up any spills or overflows.

VENTILATION

CAUTION

USE ONLY IN WELL VENTILATED AREAS. PROVIDE AT LEAST THREE (3) SQUARE FEET OR FRESH AIR FOR EACH 100,000 BTU RATING. IT IS PREFERRED TO HAVE CROSS VENTILATION OF THE AREA IF POSSIBLE.

DO NOT USE WHERE FLAMMABLE VAPOR IS PRESENT OR WITHIN FIVE (5) FEET OF COMBUSTIBLE MATERIAL.

NEVER USE HEATER IN SLEEPING AREAS.

NEVER LEAVE HEATER RUNNING UNATTENDED WHEN CHILDREN ARE IN THE AREA.

TO START HEATER (Without thermostat)

Plug the heater into a grounded power source of proper voltage and cycles capable of handling the load. The heater will ignite as soon as it is plugged into the outlet.

TO START HEATER (With Thermostat - optional accessory)

Set the thermostat control to the desired temperature. Plug the thermostat into a grounded power source of proper voltage and cycles. Then plug the heater into the thermostat receptacle as provided. The heater will start immediately provided that the surrounding air is cooler than the setting of the dial. The heater will continue to operate until the temperature of the surrounding air reaches the dial setting. It will then shut down and recycle when the temperature drops.

RESET BUTTON

Should the heater fail to ignite or stops during operation, press the red reset button at the rear of the heater as indicated by arrow. The heater should start immediately.

Should it fail to start within 15-25 seconds, the red reset button will pop out and the flame-out control will cut off all power to the heater.

Disconnect the heater and check the reason for failure. Refer to the TROUBLE SHOOTING section for determining the possible cause and possible correction.

To restart heater wait 2 to 3 minutes then pess the red reset button.

STOPPING

CAUTION

AIR DISCHARGE END OF HEATER WILL BE HOT. ALLOW TO COOL BEFORE MOVING OR HANDLING.

To stop the heater, unplug the power cord from the outlet. For units equipped with thermostats, the dial may be turned to the off or NO HEAT position to stop operation.

Disconnect power cord and allow the heater to cool, before transporting.

STORAGE

Drain fuel tank completely, prior to storing.

Remove and clean; or replace, air filters and spark plug as outlined in maintenance section.

Store in dry location free of corrosive fumes and dust.

When taking heater out of storage, it is suggessted that the maintenance procedures be followed if not done prior to storage.

SECTION III

MAINTENANCE

A. FUEL TANK MAINTENANCE

CAUTION

NEVER USE VOLATILE FUELS SUCH AS GASOLINE, NAPTHA OR ALCOHOL—THIS HEATER IS DESIGNED TO OPERATE ON KEROSENE OR NO. 1 FUEL OIL.

NEVER FILL FUEL TANK WHILE HEATER IS PLUGGED IN.

Drain the fuel tank after each 150 to 200 hours of operation and prior to storage. Flush it out with clean fuel. Wipe the inside of the fuel cap with a lint free cloth.

Refill the fuel tank with clean fuel if further operation of heater is needed.

B. AIR FILTERS

1. Check and clean the intake air filter often. The filter needs cleaning if you can see a film of dust on it. It will need cleaning more often if the heater is operated in dusty air. See Figure 4.

2. To clean the intake air flter, simply pull it out of the housing. Wash it with a mild detergent and hot or cold water. Dry it thoroughly, and replace it in the housing.

IMPORTANT: DO NOT OIL THE FILTER ELEMENT.

3. Replace the output air filter once each heating season.

4. To reach the output air filter, remove the four screws which attach the filter housing end cover. Remove the output air filter. See Figure 5.

NOTE: Cleaning the output air filter may cause a change in the air pump output pressure. If the heater burns improperly after cleaning, have the air pump pressure checked. See Section V, paragraph K, Figure

5. When changing the output air filter, clean the lint filter. Pick it out of the housing, wash with mild detergent and hot or cold water. Dry thoroughly. Do not oil.

C. REMOVING UPPER SHELL

Remove the upper shell by removing the screws that hold the upper shell to the lower shell. Lift the upper shell off.

CAUTION

WITH THE UPPER SHELL REMOVED AND THE SERVICE CORD PLUGGED IN, THE HEATER CAN BE DANGEROUS. ALWAYS UNPLUG THE HEATER WHEN PERFORMING THE FOLLOWING MAINTENANCE OPERATIONS.

D. CLEANING THE FAN

Clean the fan blades after every 500 hours of operation, or whenever you see that they are getting dirty. A build-up of dirt will reduce the air supply and cause faulty operation.

To clean, wipe the blades with a cloth moistened with kerosene or solvent. Be careful not to bend the blades. Dry the fan thoroughly.

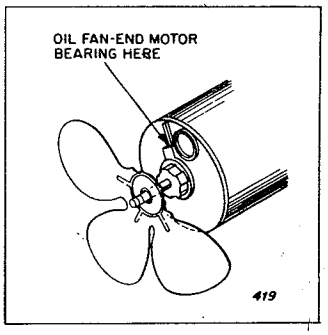


Figure 3. Lubrication of Motor Bearing

E. MOTOR LUBRICATION

The ball bearing on the pump-end of the motor is lubricated for the life of the motor. Do not lubricate it.

Oil the sleeve bearing on the fan-end of the motor (See Figure 3) once each year with 10 to 20 drops of Mobil DTE-LC or DTE-23 oil, or equivalent light machine oil.

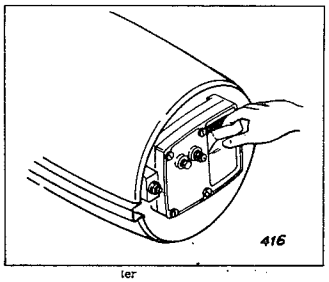


Figure 4. Removing Intake Air Filter

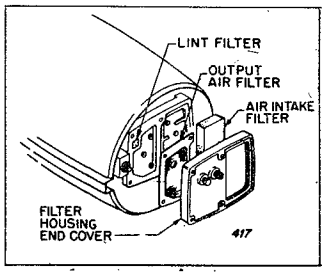


Figure 5. Access to Air Filter for Maintenance

ELECTRICAL

CAUTION

DO NOT SERVICE HEATER WHEN POWER CORD IS PLUGGED IN.

Electrical maintenance consists of inspection of electrical cord, wiring, connections and components for deterioration, damage and looseness.

Refer to wiring diagram located on under side of upper shell.

F. SPARK PLUG

CAUTION

BE SURE THE HEATER IS NOT PLUGGED INTO THE OUTLET. THE SPARK PLUG WIRE CARRIES HIGH VOLTAGE DURING HEATER OPERATION.

1. Disconnect the spark plug wire.

2. Remove the spark plug from the burner head, and check the gap between the electrodes. The gap must be within the limits shown in Figure 6. Some models have the automotive type spark plug, these will require correct positioning as shown in Figure 5.

3. Adjust the gap by bending the outside electrode where shown in Figure 4. If you do not install the plug immediately, pro-tect it from damage until it is reinstalled.

4. Install the plug into the burner head, if no further burner head maintenance is required. Make sure the spark plug is seated firmly in the burner head.

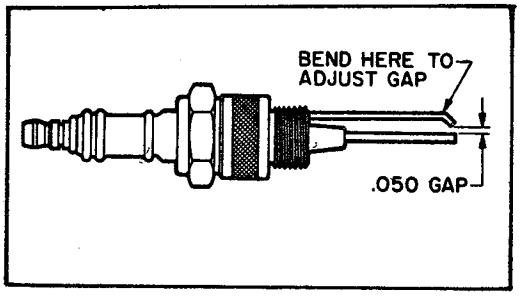


Figure 6. Spark Plug Gap Setting

G. CLEANING THE FUEL FILTER

The fuel filter is part of the fuel line that goes into the tank. Clean the filter twice each season, or if the trouble shooting chart indicates.

If the filter element is damaged or lost, it must be replaced with a new element. NEVER operate the heater without the element in place. Failure to use the filter element may result in clogging and permanent damage to the nozzle.

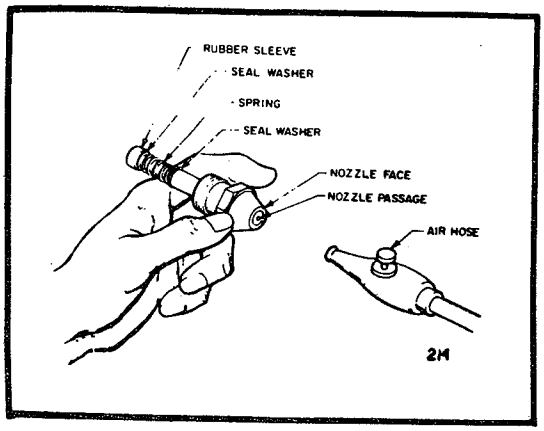


Figure 7. Blowing Out Nozzle

H. BURNER REMOVAL, CLEANING AND REPLACEMENT

1. Be sure the heater cord is unplugged, remove upper shell and remove the leadwire from the spark plug. Disconnect the air line from the nozzle adapter. Remove the spark plug and disconnect fuel line.

2. Remove the screws that fasten the burner head to the rear of the combustion chamber and remove the burner head.

3. Remove the nozzle carefully, using a socket wrench. Hold the nozzle adapter with another wrench or vise while removing the nozzle.

IMPORTANT

DO NOT ATTEMPT TO OPEN THE NOZZLE PASSAGE WITH A STEEL DRILL, A WIRE OR ANY OTHER TOOL, AS YOU WILL DAMAGE IT BEYOND REPAIR. PROTECT THE NOZZLE FACE FROM DAMAGE WHILE THE BURNER IS OUT OF THE HEATER. THIS IS IMPORTANT!

4. Soak the remaining parts of the burner head assembly for one hour in non-flammable liquid cleaning agent. (DO NOT use kerosene or fuel oil). Blow dry through the face (OUTLET) end ONLY. See Figure 7.

5. Re-check the spark plug electrode setting after cleaning the burner. See Paragraph F. of this Section.

6. Connect the fuel filter and the air line to their respective fittings on the nozzle adapter after burner is assembled.

7. Install the spark plug (refer to paragraph F., step 4.), and snap the spark plug lead onto the terminal. It must snap, or it may not be tight enough to prevent loosening as the heater is moved.

I. FLAME OUT CONTROL SYSTEM

For servicing the flame-out control system, refer to Section V, paragraph M.

J. REASSEMBLY AFTER MAINTENANCE

Put the heater back together in the reverse order of disassembly. Be sure all parts are in place and all screws and electrical connections are tight before attempting to use the heater.

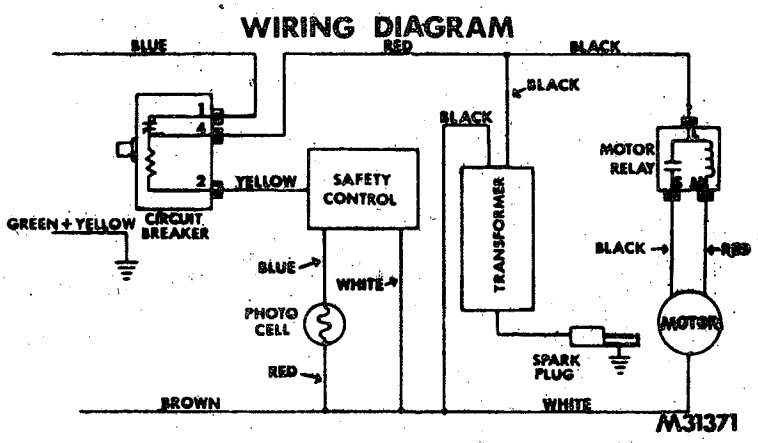


Figure 8. Wiring Diagram

SECTION IV
TROUBLE SHOOTING

A. GENERAL

If normal maintenance fails to keep a heater in good operating condition, it probably requires service or replacement of some parts. Examine it for clues as to why service is necessary, then test-fire it to gain first-hand knowledge of why service might be needed.

This section tells how to examine and test-fire the heater. It also gives a Trouble Shooting Chart for help in diagnosing heater troubles and finding the remedies.

B. EXAMINATION

1. Check the fuel tank for sludge and water. If you find it, expect to find a dirty nozzle and/or fuel filter.

2. Spin the fan to be sure it turns freely. If it is stiff, look for a worn or dry bearing on the fan-end of the motor, or for a binding pump rotor.

3. Check the heater for dirt and foreign materials around the pump, fan, and filters. Be sure the heater is clean before test-firing it.

4. Check the heater cord for obvious breaks or unsafe condition. If the cord is doubtful, repair it or install a new one before test-firing.

C. TEST-FIRING

1. Clean the fuel tank and fill it with at least 3 gallons of fuel. A minimum of 3/4 gallon of fuel must be in the tank for proper test-firing.

2. Clean the air intake filter. (See Section III, paragraph B.)

3. Check and adjust the air pressure, as described in Section V, paragraph L, except that fuel must be used for test-firing.

NOTE: It is not possible to test-fire a heater properly if this adjustment cannot be made.

4. Allow the heater to run for 15 minutes. Observe its operation during the test-run.

5. After making the pressure check, adjustment, and test-firing, remove the gage and reinstall the plug.

6. If any troubles show up during the test-firing, refer to the Trouble Shooting Chart to find out how to correct them.

D. TROUBLE SHOOTING

The following chart lists the problems you might find in a heater. For each problem, there is a list of "Possible Causes". The "Remedy" column tells you how to correct the problem, or tells you by means of a section and paragraph number where to find detailed instructions for correcting it.

In trouble shooting, remember that the air pump is part of the fuel system, because the air it supplies lifts the fuel from the tank and pushes it through the nozzle.

NOTE: Be sure to follow all cautions and warnings. They will help you prevent damage to the heater or injury to yourself.

TROUBLE SHOOTING CHART

PROBLEM	POSSIBLE CAUSE	REMEDY
1. Motor does not start.	Electrical Troubles	
	a. No power or low voltage at heater.	Be sure power is reaching heater; check condition of heater cord. Repair or replace as needed.
		Use extension cord with wires heavy enough to carry the electrical load of the heater.
		Be sure voltage at outlet is same as shown on heater instruction plate.

TROUBLE SHOOTING CHART (Continued)

PROBLEM	POSSIBLE CAUSE	REMEDY
1. (Continued) Motor does not start.	b. Damaged motor, motor starting capacitor, motor starting relay.	Check motor. Replace a defective motor (or motor starting relay). Install a starting capacitor that is known to be good.
	Mechanical Troubles c. Dry or binding bearing on fan-end of motor.	Lubricate motor (Fan-end only). If lubrication does not solve problem, check pump.
	d. Pump rotor binding or carbon blades worn out.	Rebuild or replace a binding pump.
	e. Fan obstructed by mechanical damage or dirt.	Check for bent outer shell. Check for damaged fan; replace if defective. Check for damaged motor mount.
2. Heater will not ignite, but motor runs until shut off by flame safety control.	Fuel System Troubles a. Fuel tank empty, water in fuel, wrong fuel.	Check for water in tank: Clean tank and fuel filter if water is found. (Water in the tank will form globules in the bottom, which you can see.) Fill tank with fresh, clean kerosene or No. 1 fuel oil.
	b. Fuel filter clogged.	Remove and wash in clean fuel. Blow dry and replace.
	c. Nozzle plugged or defective.	Clean by blowing compressed air through nozzle from outlet end of nozzle. Replace nozzle if cleaning does not solve the problem.
	d. Low air pump pressure.	Check pressure; adjust, rebuild, or replace air pump as needed. Check rubber sleeve around shank of nozzle; replace if leaking. Check to be sure all air line connections from pump to burner are secure. Check to be sure air filter end cover is securely fastened, without air leaks. Be sure air filters are clean.

TROUBLE SHOOTING CHART (Continued)

PROBLEM	POSSIBLE CAUSE	REMEDY
2. (Continued) Heater will not ignite, but motor runs until shut off by flame safety control.	e. Air leak at fuel filter.	Check fuel filter for air leaks and for tightness of fitting where filter is connected to burner head.
	Ignition Troubles f. Defective spark plug. (Wrong gap, plug wet with fuel or electrodes carboned, or plug damaged.)	Measure gap between electrodes. Adjust electrode gap. Inspect plug for broken porcelain or electrodes. Discard a damaged spark plug.
	g. Spark plug wire disconnected from plug or from terminal of transformer.	Disconnect heater cord! Check at plug and transformer to be sure wire is tight at both ends.
	h. Defective transformer.	Disconnect heater cord! Disconnect spark plug wire from transformer, reconnect heater cord, and check transformer for spark; replace transformer if no spark can be obtained.
3. Heater puffs smoke; heater will not burn steady; heater burns with odor; heater smokes continuously.	Improper Fuel-Air Mixture (Not enough fuel) a. Heater running out of fuel; water condensation in fuel tank; wrong fuel.	Shut heater off; check fuel tank. If you can see globules of water in the bottom, drain and flush the tank and filter with clean fuel. Refill with fresh, clean kerosene or No. 1 fuel oil.
	b. Dirty air filters causing reduced air flow through nozzle, resulting in low fuel flow.	Remove and clean the air filters. Be sure air intake is not blocked.
	c. Fuel filter loose, leaky, dirty or loose connection.	Remove and wash fuel filter in clean fuel. Check condition of connection between fuel filter and burner head. Replace with new filter assembly.
	d. Dirty nozzle.	Remove and clean the burner head. Blow compressed air through nozzle from outlet end.

TROUBLE SHOOTING CHART (Continued)

PROBLEM	POSSIBLE CAUSE	REMEDY
3. (Continued) Heater puffs smoke; heater will not burn steady; heater burns with odor; heater smokes continuously.	d. Dirty nozzle. (Continued)	Never use a drill, wire, or other tool to open a nozzle passage. Replace a defective nozzle.
	e. Low pump output pressure. (Low motor speed, worn pump, pump out of adjustment.)	Check and adjust pump output pressure; repair or replace pump if adjustment cannot be made. Check to be sure that no dirt or trash (or dirty fan blades) could be causing motor slowdown. Lubricate fan-end bearing of motor.
	f. Loose air output line connections between filter housing and burner.	Be sure connections are tight.
	g. (Remote possibility) Rubber sleeve on shank of nozzle is leaking.	If heater puffs intermittently, replace the rubber sleeve. (Handle parts carefully to prevent damage; assemble them carefully to preserve airtightness.)
	h. (Remote possibility) Combustion chamber not tight against burner head, allowing too much air to enter combustion chamber.	Tighten screws. If parts are warped from heat, replace warped parts. There must be no air gap between face of burner head and back of combustion chamber.
4. Flames come out venting outlet of heater.	Improper Fuel-Air Mixture (Too much fuel, or not enough air for amount of fuel being supplied.)	
	a. Dirty fan, or air passageway through heater blocked by dirt or trash.	Clean the fan. Be sure the air passageway through the heater is clean. Keep the heater clean.
	b. Pump output pressure is too high, causing too much fuel to be supplied.	Check and adjust pump output pressure.
	c. Fan loose or improperly located on shaft.	Check fan; correct if not right.
	d. Bent or damaged fan.	Replace. Do not attempt repair of fan.
5. Heater occasionally stops operating.	a. Low voltage causing tripout of motor overload protector.	Check power line voltage. Use extension cord with proper size wire.

TROUBLE SHOOTING CHART (Continued)

PROBLEM	POSSIBLE CAUSE	REMEDY
5. (Continued) Heater occasionally stops operating.	b. Defective electrical supply or defective connections.	Be sure extension cord and heater service cord are in good condition, without intermittent open circuits. Check mechanical and electrical soundness of all wiring connections in the heater and service cord.
	c. Motor overload protector tripping out due to motor trouble or binding pump.	Lubricate fan-end bearing. Keep motor and fan area clean. Replace defective motor or rebuild defective pump. CAUTION: Keep fingers away from fan when heater service cord is plugged in.
6. Control System Troubles		
6A. Heater ignites, but red button of control unit pops out anyway.	a. Defective photo cell.	Check to see if glass face of cell is so dirty it can't "see" the flame; clean glass if dirty. Replace with a cell that is known to be good.
	b. Defective control. (Remote possibility of this).	Replace with a control unit that is known to be good.
	c. Defective electrical connections in circuit through cell and control.	Be sure all solder joints and wiring connections are secure. Check wiring diagram.
6B. Control unit fails to trip when a "no-flame" condition exists.	a. Defective control unit.	Replace with a control unit that is known to be good.
6C. Button on control unit won't stay in when pressed.	a. Resetting is tried too soon after the control trips.	Wait 5 minutes and try again.
	b. Defective control unit.	Replace with a control unit that is known to be good.

SECTION V

SERVICE AND REPAIR

A. GENERAL

This section covers replacement of parts, repair and rebuilding of heater components, and the making of adjustments. Check to be sure the maintenance of the heater has been done, before going into the more extensive service operations.

Whenever a part needs to be replaced, you can identify it on the exploded views in the parts list portion of the model manual. Be sure when ordering you give the model number and the specification number along with the part number and description of part.

B. THERMOSTAT ACCESSORY

1. Turn the knob slowly, through the full range of the thermostat, two or three times. If the heater does not start, proceed as follows:

2. Take the thermostat accessory out of the circuit by unplugging the heater from the thermostat accessory.

3. Plug the heater service cord into an outlet. If the heater operates properly, the thermostat is defective and must be replaced.

C. REMOVAL OF UPPER SHELL

It will be necessary to remove the upper shell in order to perform the following service operations on the heater. See Section III, paragraph C.

D. TRANSFORMER

CAUTION

TO BEGIN THE TRANSFORMER TEST, FIRST BE SURE THE HEATER IS NOT PLUGGED IN. THEN, WHEN POWER IS REQUIRED, BE EXTREMELY CAREFUL WHEN CHECKING THE TRANSFORMER. A TRANSFORMER IN GOOD CONDITION PRODUCES VERY HIGH VOLTAGE AT THE OUTPUT TERMINALS.

Check the transformer as follows:

1. Connect the transformer lead to a properly gapped spark plug. The gap should be 0.050 inch, plus or minus 0.005 inch. See Figure 6.

2. Establish a good ground between the spark plug and the heater. Be careful not to let any part of your person become a portion of the ground circuit.

3. Plug the heater cord into an outlet of the proper voltage. Observe the spark between the plug's electrodes. If the ground is good and a spark does not jump between the electrodes, the transformer is defective. Replace it.

E. CHECKING THE MOTOR STARTING CIRCUITS

In case the motor fails to start when the cord is plugged in, check the motor and its starting circuit components as described in the following paragraphs:

1. Mechanical Check. Spin the motor by turning the fan blades by hand. If the motor turns freely, make the electrical check as described in paragraph 2. Any stiffness of the motor indicates mechanical troubles.

2. Electrical Check. These heaters use fractional horsepower motors, and some models use a motor start relay in the electrical circuit. See the specifications in your model manual.

NOTE: The starting relay is "position-sensitive" and must be tested in the same position as when installed in the heater (with the contacts on the bottom).

a. If your model has a relay, take it out of the heater by taking out the screws which holds its bracket to the left side of the lower shell, near the motor.

CAUTION

AVOID TOUCHING THE BARE WIRES ON THE EXPOSED WIRE TERMINALS.

b. Take the blue motor wire off its terminal of the starting relay. Touch this wire to the terminal of the red motor wire, at the relay. The motor should start. As soon as the motor reaches operating speed, remove the blue wire from contact. The motor should continue to run.

c. If the motor starts, install a new relay, and reconnect the wiring according to the Wiring Diagram found in your model manual.

d. Failure of the motor to start could result from either of the following, assuming that all other circuits in the heater are operating correctly.

(1) Internal fault in the motor, such as burned-out stator.

(2) Failure of the starting relay.

e. If the motor fails to start and the relay is found not to be the cause of failure to start, remove the motor and install a new or rebuilt motor. Send the defective motor to the nearest authorized service station for repair.

NOTE: When sending the motor away for repairs, remove the fan, the air filter housing, and the pump end cover. Take out the pump rotor, the carbon blades, then remove the pump body, which is the ring attached to the end of the motor. (See paragraph J for pump service instructions.)

F. MOTOR SERVICE (MOTORS WITH FRONT END PORT ONLY)

1. Apply a few drops of oil to the fan-end bearing of a stiff motor. If this fails to correct the starting difficulty, rebuild the pump, as described in Paragraph J of this section.

2. When you install the motor, be sure it is not misaligned after tightening the clamps.

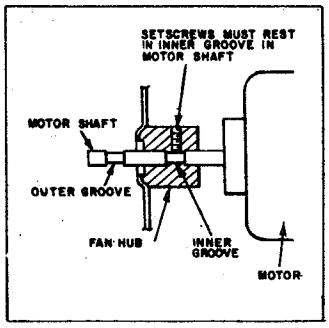


Figure 9. Fan Location

G. FAN SERVICE

Always replace a damaged or bent fan. Do not attempt repair. Loosen two setscrews to remove the fan from the motor shaft.

Be sure the replacement fan has the same blade pitch as the fan that was removed. This is important in order to retain the air flow and combustion characteristics of the heater.

Check for proper fan location of the motor shaft. Make sure the fan is in the same position and location as before it was removed. See Figure 9.

H. FUEL FILTER SERVICE

1. Remove the fuel filter from the heater and clean it, as described in Section III, Paragraph G.

2. Before reinstalling the fuel filter, check the rubber bushing where it enters the fuel tank. Be sure the bushing is in good condition—not cut or cracked. Replace a damaged bushing.

3. Reinstall the fuel line according to Section III, Paragraph G. Replace with a new filter if the connecting parts will not provide an air tight connection.

I. BURNER HEAD SERVICE

1. Take out the spark plug and remove the burner head. Clean the entire burner head, as described in Section III, Paragraph H.

2. If there is any sign of damage to the nozzle, or if it is impossible to clean out the nozzle by blowing compressed air into it through the outlet-end, replace with a new nozzle. Always blow a nozzle out thoroughly with air, from the outlet-end, before installing it into the burner. See Figure 7.

IMPORTANT

NEVER TRY TO OPEN A NOZZLE PASSAGE WITH A DRILL. ANY CHANGE IN THE SIZE OR SHAPE OF THE PASSAGE WILL ALTER THE FLOW CHARACTERISTICS. PROTECT THE PASSAGE FROM DAMAGE WHENEVER YOU WORK ON THE BURNER OR NOZZLE.

3. Always install a new rubber sleeve whenever you install a nozzle into the burner. The sleeve is the part that helps maintain the needed pressure difference between the air and fuel chambers of the burner head. If bubbles have appeared in the fuel tank during operation, the rubber sleeve is probably leaking and should be replaced.

4. Be sure the seal washer, spring, and second seal washer are in place on the nozzle before you install the rubber sleeve. See Figure 7.

J. AIR PUMP REPAIR

NOTE: Because of the close tolerances and critical positioning of the parts, we recommend that only skilled mechanics attempt any repair of the air pump.

The heater's air pump consists of a rotor with four carbon blades, rotating inside a pump body. The rotor is driven directly by the motor, and is supported by the ball-bearing end of the motor.

Handle all pump parts with care and keep them clean. The parts are made with close tolerances. Dirt and oil on pump parts will hinder the performance of the pump.

If pump repair is required, you may order a complete pump package, or individual parts, as shown in the Parts List of your model manual.

1. Disassembly.

IMPORTANT

DO NOT TAKE THE PUMP APART ANY FURTHER THAN NEEDED TO REACH THE PARTS WHICH MUST BE REPLACED.

a. Remove the end cover and take out the intake and outlet air filters and the lint filter. Disconnect the air line from the elbow.

b. Hold a clean, dry cloth under the pump and remove the six screws that hold the end cover to the pump body. Catch the carbon blades in the cloth, if they fall out as the pump body is removed.

c. Take all four carbon blades out of the rotor. Pull the rotor and the insert off the motor shaft.

2. Replacing Carbon Blades.

a. Worn or sticking carbon blades cause loss of air pressure. If the blades are worn, or are sticking in the rotor slots, replace them. (It is not necessary to remove the rotor or the pump body to replace the carbon blades.)

b. Install the carbon blades into the rotor slots.

3. Replacing the Rotor.

Use a new rotor only if deep grooves or uneven wear appear on the surfaces. Check the insert for wear, and replace it if worn or loose.

4. Reassembly of Air Pump.

a. Install the insert in the pump rotor as shown in Figure 10, then assemble rotor on the motor shaft. When installing the rotor, take care to keep it perpendicular to the motor shaft. Attach the pump body to the motor with the two recessed screws which were removed to take it off.

b. Adjust the pump body to provide 0.005 to 0.006 inch clearance at the point shown in Figure 10. Measure the clearance with a feeler gage. Spin the motor by hand to be sure the rotor does not rub on the pump body. The proper clearance must be maintained. Be sure the recessed screws are tight after adjusting.

c. Insert carbon blades in the rotor slots.

d. Install the end cover, using the six screws which were removed. Reconnect the air line.

K. ADJUSTMENT OF PUMP PRESSURE

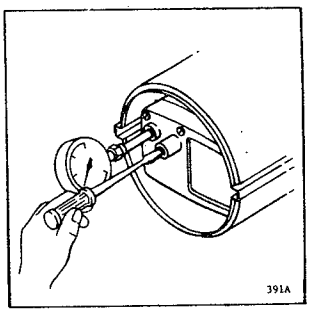
1. Remove the plug from the air filter housing, and install the pressure gage into the hole. See Figure 10.

2. Remove the upper shell. Install a jumper lead across the photocell to bypass it. Tape these connections to prevent accidentally grounding against the shell. Reinstall the shell, then start up the heater.

3. Pump pressure must be set to the PSI as shown in the specifications, contained in Model Manual. If not, adjust the pressure relief valve.

4. To adjust the pump pressure, screw the valve stem in to raise the pressure; out to lower it.

5. Remove shell and disconnect jumper wire from photocell connections. Install upper shell, then remove the gage and replace the plug.



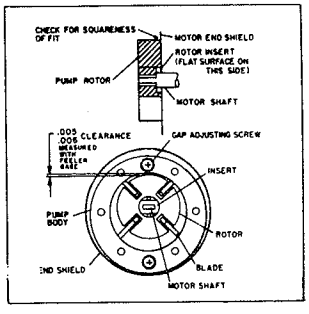


Figure 10. Air Pump Pressure

L. REASSEMBLY OF HEATER

Reassemble heater together in the reverse order of disassembly.

1. Check all wiring to be sure it agrees with the wiring diagram. Be sure all electrical connections are tight.

2. Tighten the connections at both ends of the air line, and tighten the connection where the fuel filter is assembled to the burner head.

3. Make sure the electrode lead is snapped onto the spark plug.

N. FLAME-OUT CONTROL CIRCUIT

1. Testing

NOTE: The following test procedures should be performed only if the trouble indicates the flame-out control circuit may be at fault. Before starting any test procedure, always check the wiring to be sure the connections are tight and it is in accordance with the wiring diagram.

The flame-out control problems are in two categories.

A. The control does not shut off the heater while the unit is running but no flame has been established.

B. The control shuts down the heater within 15 to 20 seconds although the heater is performing normally.

2. Testing for Category "A"

Disconnect the blue wire from the terminal on the control. Connect the heater into an electrical outlet. If the unit starts and burns for 15 to 20 seconds, then shuts down, the control is good. The photocell should then be checked; this should be done with the use of an ohmmeter:

A. Disconnect the heater.

B. Remove the photocell from the heater.

C. Measure the resistance while pointing the photocell to a strong light. The reading should be less than 5,000 ohms.

D. Measure the resistance while placing the photocell against a metal surface. The reading should be greater than 500,000 ohms.

E. If "C" and "D" above do not read as indicated, the photocell should be replaced.

3. Testing for Category "B"

A. Disconnect the heater.

B. Disconnect the blue wire from the terminal on the control; and reconnect the wire to the group of five (5) white wires. This will simulate a "light" condition within the circuit.

C. Connect the heater in a proper electrical outlet and if the circuit breaker trips, the flame-out control is defective and must be replaced.

D. During this test if the heater does not shut down, recheck the wiring and proceed through the photocell test; as outlined in "A" above.

4 . Replacement.

To replace the photo cell, disconnect the wires at the cell and work the cell out of it's bracket. Install replacement in reverse order of removal. Use care to prevent bending bracket when installing cell.

If the trigger circuit or the safety control has been determined to be defective, replace both as an assembly. These parts cannot be replaced separately.

SPECIFICATIONS

Output Rating (BTU per hour)	56,000
Cold Air Flow	97 cfm
Amperage (During normal run)	4.0
Air Pump Pressure (PSI)	4
Weight (Approx. Lbs.)	
Dry (net)	50 lbs.
Fuel Tank Capacity, U.S. Gallons ...	4.5
Fuel Consumption, Approx. U.S. Gallons per hour	0.45
Electrical Requirements	
Voltage	230V
Cycles	50
Motor RPM	2825
Fuel	Kerosene or No. 1 Fuel Oil Only
Vent	3-3/16 in.

VENTING INSTRUCTIONS

Be sure that the heater is vented properly, in order to assure proper combustion and avoid contamination of the ventilating air with exhaust gases. The draft regulator, vent pipe and fittings described in the following paragraphs are not supplied with the heater, and must be furnished at installation. See Figure 2.

1. If the run of vent pipe (either horizontal, vertical, or combined horizontal and vertical) is 20 feet or less, it is NOT necessary to use a draft regulator.

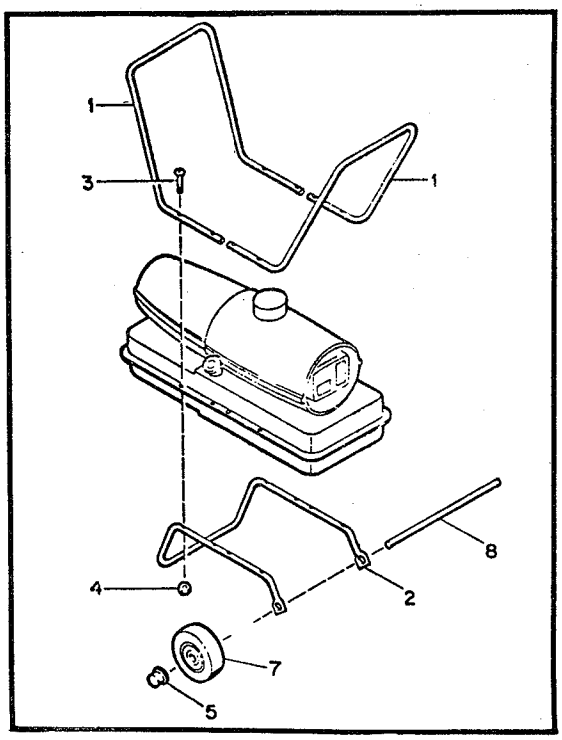
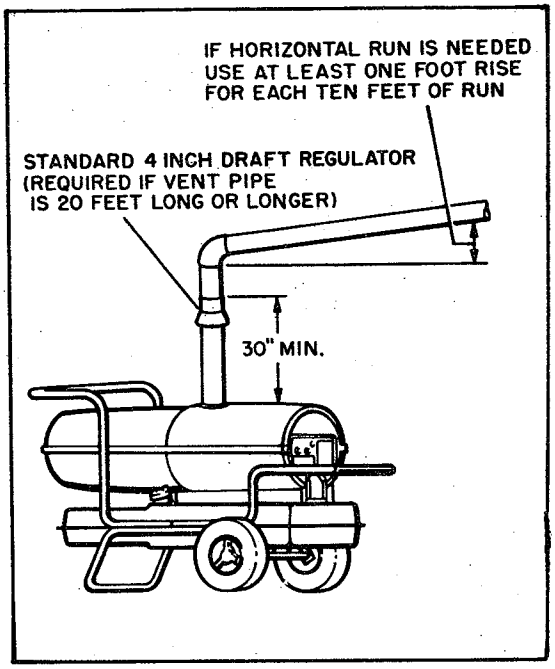


Figure 11, Handles & Wheels



Index No.	Part Number	Part Name	Qty.
1	M26287-3	Handle, Front and Rear	2
2	M26205-3	Frame, Wheel Support	1
3	M12345-33*	Screw, Oval hd., 10-24 x 1-3/4 in.	8
4	NTC-3C*	Nut, Torque Lock No. 10-24	8
5	M28526	Nut, Cap	2
7	M26307	Wheel	2
8	M16801-6A	Axle	1

When ordering your part, be sure to provide all pertinent facts when you call or visit your service dealer.
The model and serial number of your portable heater will be found on a decal toward the rear (motor end) of your unit.
When ordering repair parts always give the following:

A) Part Number **B) Model Number** **C) Description**

NOTE: All painted service parts will be shipped painted a common color. Parts may be repainted if necessary.

Index No.	Part Number	Part Name	Qty.
1	M26589D	Shell, Upper	1
	M11084-26	Screw, Hex hd., 10-12 x 3/8 in. (AP)	6
	M11271-6	Nut, Tinnerman	6
2	M26548-1	Combustion Chamber Assy.	1
	M11084-26	Screw, Hex hd., 10-12 x 3/8 in. (AP)	4
3	M27367-4	Burner Body Assembly	1
	M11084-26	Screw, Hex hd., 10-12 x 3/8 in. ; (AP)	3
4	M16656-4	Photo Cell and Bushing Assembly	1
6	M16789-8	Assm. Fuel Filter	1
7	M13849	Nut, Flared	1
8	M26317	Fan	1
	SF4-2½K	Setscrew, Socket hd., cup pt. ¼-28 x 5/16	2
9	M31306-02	Motor Package Assembly	1
10	NPC-4C	Nut, Plain, Hex, ¼-20	2
11	WLM-4	Lockwasher, ¼ in.	2
12	HC4-10C	Screw, Hex hd., ¼-20 x 1¼ in. (AP)	2
13	M16661	Clamp, Motor	4
14	M31305	Air Line	1
15	M25059	Bracket, Support	1
	M11084-27	Screw, Hex hd., 10-12 x ½ in.	4
16	1000576	Grommet	4
17	10000577	Grommet	1
18	M25645-2	Strap, Retainer	1
	M11084-26	Screw, Hex hd., 10-12 x 3/8 in.	2
19	M50416-03	Safety Control Assembly	1
20	M16841-16	Wire Assembly, Red	1
21	M9900-62	Wire Assembly, Black	1
22	M25061-2	Relay, Motor Start	1
	RC2-2.5C	Screw, Rd. hd., 8-32 x 5/16 in.	1
	WLI-2	Lockwasher, No. 8	1
23	M25035	Bracket, Motor start relay	1
	M11084-26	Screw, Hex hd., 10-12 x 3/8 in. (AP)	2
24	M13942-7	Connector, Wire	3
25	M23284	Cap, Filler Neck	1
26	M18053	Screen, Filler Neck	1
28	M25024-2	Transformer, 5000 volt	1
	M11084-27	Screw, Hex hd., 10-12 x ½ in.	2
29	M30833-02	Bushing, Strain Relief	1
30	M15779-22	Extension Cord Assy.	1
31	M15779-22		
31	M26208-2A	Shell Assembly, Lower	1
32	M27417	Plug, Drain	1
33	M27553-04C	Fuel Tank Assembly	1
34	M10990-3	Bushing	1
35	M27485-1	Interrupter	1
36	M50141	Guard, Fan (not shown)	1

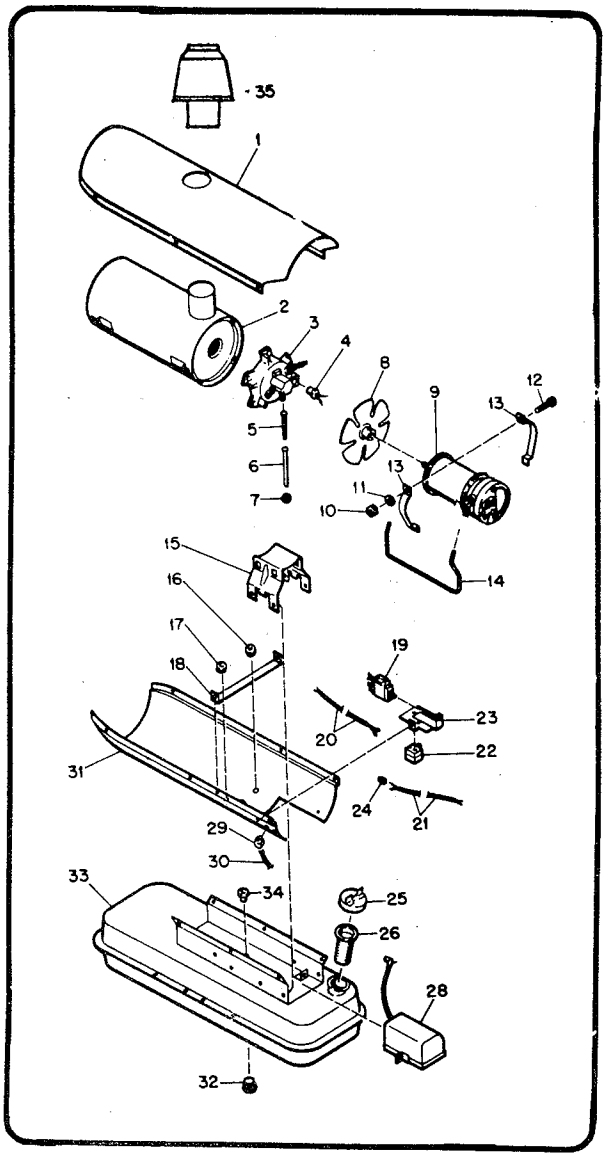


Figure 13. Exploded View Heater Assembly

DECALS

M19457	Tradename	1
M20532-6	Pump Pressure	1
M22743	Warning	1
M22823	Flag	1
M25325	Reset	1
M31371	Wiring Diagram	1
M50623	Operation Instruction	1
M50624-59	Model Data	1

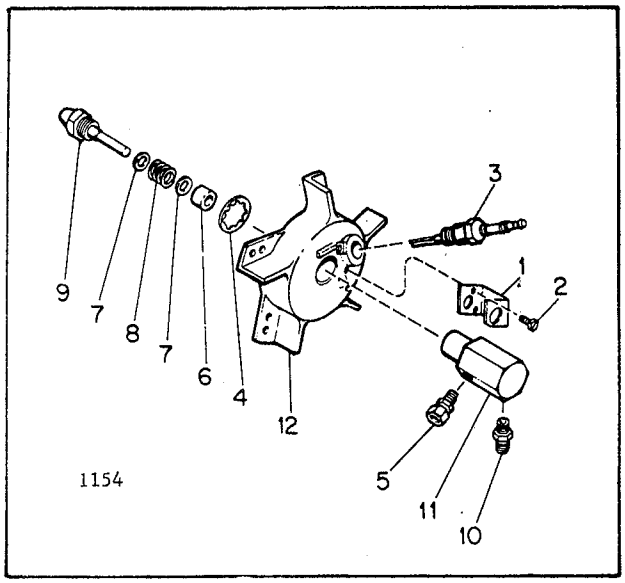


Figure 14. Burner Head Assembly

Index No.	Part Number	Part Name	Qty.
14-	M27367-4	Burner Head Assembly	Ref.
1	M16660	Bracket, Photo Cell	1
2	*M10908-½	. Screw, Hex hd., Self-tapping, No. 6-32 x 3/8	2
3	M10962-2	. Spark Plug	1
4	M16741-18	. Ring, Retaining	1
	M23151-7	. Nozzle Adapter Assy.	1
5	M5976	. . Connector, Male	1
6	M8882	. . Sleeve, Nozzle Seal	1
7	M10659-1	. . Washer, Nozzle Seal	2
8	M10809-1	. . Spring, Nozzle Seal	1
9	M27014	. . Nozzle, Aspirating	1
10	M16791	. . Connector, Male	1
11	M16535	. . Adapter, Nozzle	1
12	M26732	. Body, Burner Head	1

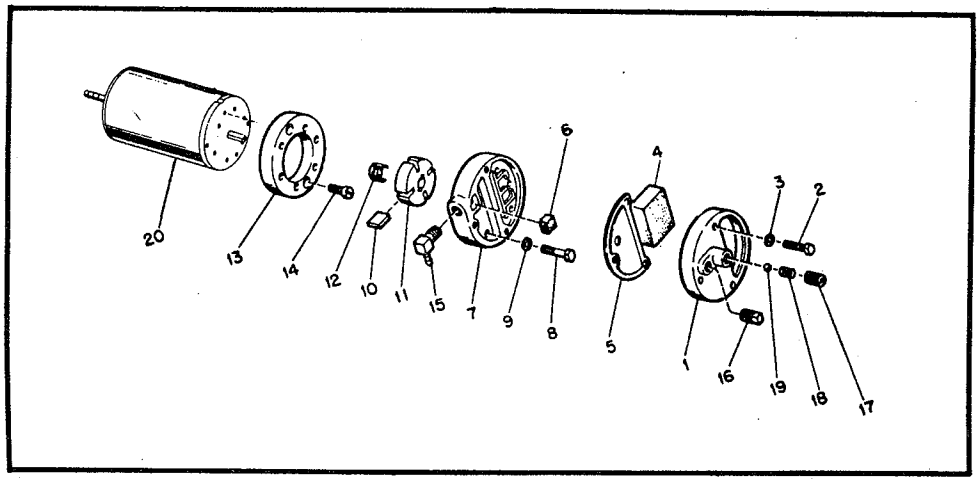


Figure 15. Motor and Pump Assembly

Index No.	Part Number	Part Name	Qty.
	M31306-02	Motor Package Assembly	Ref.
1	M29609	. End Cover, Filter	1
2	M12461-31	. Screw, Hex hd., No. 10-32 x 1 (AP)	3
4	M29633	. Intake Air Filter	1
5	M29612-01	. Output Filter Assy.	1
6	M29632	. Filter, Lint	1
7	M29608	. Front Cover, Pump (Port Plate)	1
8	*M12461-32	.Screw, Hex hd., No. 10-32 x 1-1/8 (AP)	6
10	M8643	. Blade, Pump	4
11	M22456-1	. Rotor Pump	1
12	M22009	. Insert, Rotor	1
13	M8645	. Pump Body	1
14	*FHPF3-4C	. Screw (Pump Body to Motor), No. 10-32 x ½	2
15	69248	. Elbow, 90o	1
16	M22997	. Plug	1
17	M27694	. Screw, Pressure Adjustment	1
18	M10993-1	. Spring, Compression (Pressure Relief)	1
19	M8940	. Ball, ¼ in. dia.	1
20	M25022-2	. Motor	1

AP Indicates attaching parts.
Standard Hardware. Purchase locally.

Ⓔ

ALWAYS SPECIFY MODEL AND SERIAL NUMBERS WHEN COMMUNICATING WITH THE FACTORY.

WE RESERVE THE RIGHT TO AMEND THESE SPECIFICATIONS AT ANY TIME WITHOUT NOTICE. THE ONLY WARRANTY APPLICABLE IS OUR STANDARD WRITTEN WARRANTY. WE MAKE NO OTHER WARRANTY, EXPRESSED OR IMPLIED.

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