

**OPERATING, MAINTENANCE AND SERVICE
INSTRUCTIONS
WITH
ILLUSTRATED PARTS LIST**

MARK 50 and MARK 50 DELUXE

PORTABLE HEATERS



SECTION I

INTRODUCTION

A. GENERAL

1. Purpose of heater. Use this heater wherever you need temporary portable heat. It must be used with adequate ventilation and proper electrical power.

2. Purpose of manual. This Service Manual gives complete instructions for operating, maintaining, trouble shooting, and servicing the heater. A complete parts list is included at the end of the manual.

B. PRINCIPLES OF OPERATION

Operation of the heater is easy to understand. It consists of three simple systems. (See Figure 1.)

1. Fuel System. An air pump on one end of the motor shaft forces air through the nozzle. The moving air lifts fuel from the tank by a siphon action, and forces it into the combustion chamber in a fine spray.

2. Ignition System. The electric arc of a spark plug that fires constantly while the heater is in operation ignites the mixture of fuel and air.

3. Air System. A fan on the other end of the motor shaft supplies additional air to the heater. Part of this air enters the burner through ports around its outer edge, and helps complete the combustion of the burning fuel-air mixture.

The rest of the air from the fan passes over and around the combustion chamber. At the front of the heater it mixes with the hot air coming from inside the combustion chamber. The air then flows out of the heater as a jet of clean, heated air.

4. Control System (Deluxe heaters). A control system consisting of a light-sensitive cell, a relay, and a circuit breaker will shut the heater off in case it fails to ignite or if it runs out of fuel. (The operation of this system is explained more fully in Section V, Service and Repair Instructions.)

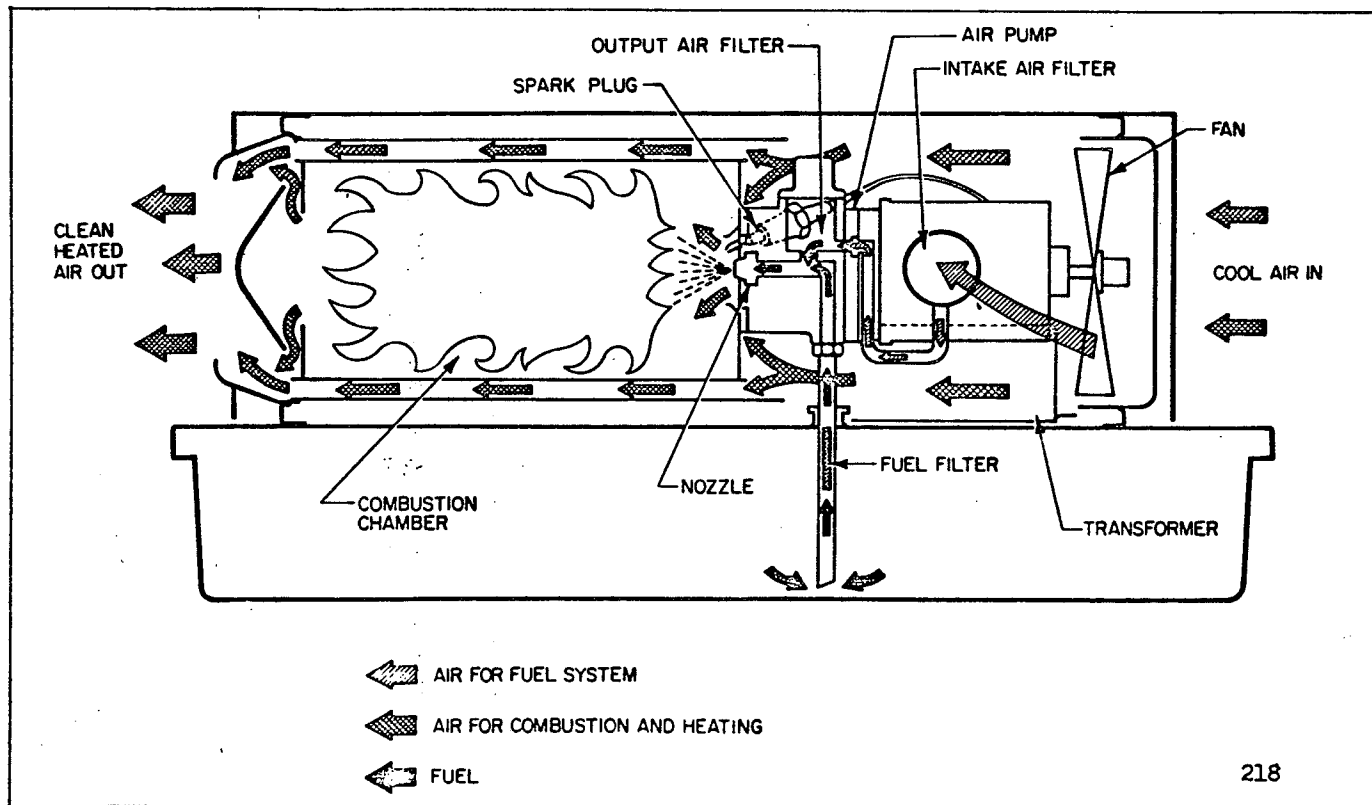


Figure 1. Flow Diagram

SECTION II

OPERATION

A. OPERATING CAUTIONS

1. Use the heater in a well-ventilated area only. A partly-opened door or window near the heater will give adequate ventilation.
2. Use only kerosene or No. 1 fuel oil. DO NOT USE GASOLINE, AS IT IS VOLATILE AND DANGEROUS. Do not use No. 2 or No. 3 fuel oil, as they contain tars which will contaminate the heater.
3. Use the heater only on electrical power that is the same as specified on the heater instruction plate.
4. Plug the heater into a grounded receptacle, or use the grounding adapter supplied with the heater. Be sure the heater is grounded whenever you work on it.
5. Keep the heater at least 4 feet away from any combustible material.
6. Do not use the heater in the presence of volatile fumes like those from paint or gasoline.
7. Do not add fuel while the heater is operating.

WARNING

The motor has an automatic thermal overload protector. It may stop due to low voltage or overload, then RE-START automatically. Be sure to disconnect the heater before inspecting the motor.

B. EXTENSION CORD SIZES

Be sure to use an extension of the proper size to assure adequate voltage at the heater.

Length of Cord (Feet) . . .	100	200	300	400	500
Wire Size (AWG)	14	12	10	8	6

C. FUEL

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

When the heater is operated at extremely low temperatures (beyond 10°F below zero), the fuel may congeal. To prevent this, add Frostex or similar anti-icer to the fuel (approximately 2 tablespoonfuls of anti-icer to each 5 gallons of fuel) to keep the fuel from congealing. Be sure the tank is clean before filling.

D. STARTING

1. Standard Heater. To start the heater, plug the cord into an outlet that will give power of the same voltage and frequency as the instruction plate. The heater will start operating immediately.

2. Deluxe Heater. To start the heater:

- a. Plug the cord into an outlet that will give power of the same voltage and frequency as stated on the instruction plate.
- b. Press the red reset button on the rear of the heater. The heater should start immediately.
- c. If the heater fails to start, the red button will pop out in from 15 to 40 seconds, depending on surrounding temperature. If it pops out, wait from 3 to 5 minutes for the circuit breaker to cool, then press the red button again.

E. STOPPING

To stop the heater, unplug the heater cord from the outlet.

D. OUTPUT AIR FILTER MAINTENANCE

1. Check the output air filter after every 150 hours of operation, or at least twice every heating season.

2. To remove, take out the two screws that attach the valve body. Lift off the valve body and gasket, then lift out the output air filter element and the lint filter.

3. Wash the filter element and the lint filter in hot or cold water with a mild detergent. Dry thoroughly. Do not oil either filter. Be sure the gasket is tight when replacing the valve body.

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

E. SPARK PLUG MAINTENANCE

WARNING

Be sure the heater is not plugged in. The spark plug wire carries high voltage when the heater operates.

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 given in Figure 3. This is about the thickness of a dime.

3. Adjust the gap by bending the outside electrode.

4. Reinstall the spark plug if no further maintenance is needed for the burner head. If you do not reinstall the spark plug at this time, protect it from damage.

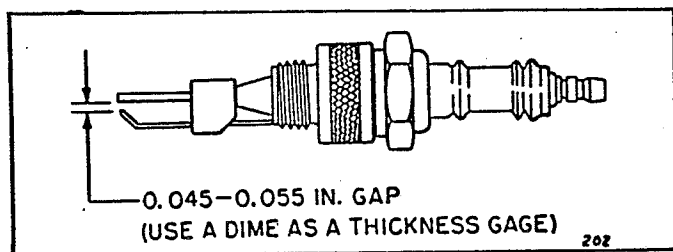


Figure 3. Spark Plug Gap Setting

F. MOTOR LUBRICATION

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

2. Oil the sleeve bearing at the fan-end of the motor once every heating season with a few drops of No. 30 or Arctic C oil, or electric motor oil. Do not over-oil.

G. FAN MAINTENANCE

1. Clean the fan blades 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. Remove the fan guard to reach the fan for cleaning.

2. Wipe the blades clean with a cloth moistened with kerosene or solvent. Be careful not to bend the blades. Dry the fan thoroughly.

3. Reinstall the fan guard if the motor, pump and burner head assembly is not going to be removed at this time.

H. DISASSEMBLY

NOTE: It will be necessary to remove the combustion chamber and the burner, pump and motor assembly in order to reach the fuel filter for maintenance.

1. Remove the wire nuts and disconnect the wires.

2. Take off the combustion chamber by loosening the screw that holds it to the burner head. You can reach this screw by inserting a screwdriver into the hole near the rear of the left side of the combustion chamber. As you face the outlet of the heater, rotate the combustion chamber to the left (counterclockwise) to release it from the burner. Pull it out through the end cap.

3. Remove the motor starting relay from its bracket at the left side of the heater. Loosen the air filter and starting relay bracket. Disconnect the air intake tube from the pump. Remove the motor clamps. Loosen the fan guard.

4. Disconnect three motor leads. Lift out the assembly of the motor, pump, and burner head.

5. When you reinstall the combustion chamber, position it so that the drain holes will be at the bottom. Check to be sure the combustion chamber fits tight against the face of the burner head. If not, see Section V, paragraph L-1-g.

I. FUEL FILTER MAINTENANCE

1. Remove the filter from the burner head, using a wrench. (The fuel filter is the open-ended tube which extends from the burner down into the fuel tank.)

2. Rinse the filter several times in clean fuel. Blow it dry through the fitting end.

3. When you reinstall the filter, be sure the "O" ring is in place and undamaged, then tighten the filter firmly into the burner head. The grommet must be in place in the fuel tank before you insert the fuel filter.

J. REASSEMBLY

Be sure all parts are in place and all screws and electrical connections are tight before attempting to use the heater. Take care not to damage the spark plug and to keep the proper gap between its electrodes.

When installing the heater housing, be sure the holding clips at the bottom edges are engaged with the tank skirt.

TROUBLE SHOOTING CHART

PROBLEM	POSSIBLE CAUSE	REMEDY	FOR FURTHER DETAILS SEE:
1. Motor does not start. (Circuit breaker's red button stays in when pressed.)	<u>Electrical Troubles</u>		
	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 the voltage at the outlet is same as shown on heater instruction plate.	Sec. II, Para. B.
	b. Defective motor or starting relay.	Check motor and relay. Replace a defective motor or starting relay.	Sec. V, Para. D.
	<u>Mechanical Troubles</u>		
	c. Dry bearing on fan-end of motor.	Lubricate motor. If lubrication does not solve problem, check pump.	Sec. III, Para. F. Sec. V, Para. J.
2. Heater will not ignite, but motor runs. (Red button on circuit breaker pops out after 15 to 45 seconds.)	d. Pump rotor binding or carbon blades worn out.	Rebuild pump.	Sec. V, Para. J.
	e. Fan striking end shield due to damaged end shield or broken motor mount support.	Check for damaged end shield; repair or replace if damaged. Replace fan if damaged. Check for broken weld on motor mount. If broken return to dealer for replacing or re-welding.	Sec. V, Para. F.
	<u>Fuel System Troubles</u>		
	a. Fuel tank empty, water in fuel, wrong fuel.	Check for water in tank, clean tank and fuel filter if water is found. Fill tank with new, clean kerosene or No. 1 fuel oil.	
	b. Fuel filter clogged.	Remove and wash in clean fuel.	Sec. III, Para. I.
	c. Nozzle plugged or defective.	Clean by blowing compressed air through nozzle from outlet end of nozzle. Replace nozzle if cleaning does not solve problem.	Sec. V, Para. I.
	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 seal between burner head and air pump port plate; be sure seal is in place.	Sec. V, Para. J & K Sec. V, Para. I. Sec. V, Para. L.

TROUBLE SHOOTING CHART (Continued)

PROBLEM	POSSIBLE CAUSE	REMEDY	FOR FURTHER DETAILS SEE:
3. Heater burns, but smoke or puffs of smoke can be seen; heater will not burn steady; heater burns with odor. (Continued)	e. Low pump output pressure. (Low motor speed, worn pump, pump out of adjustment.)	Check pump output pressure; adjust pressure; repair pump if adjustment cannot be made. Check to see that no dirt or trash (or dirty fan blades) could cause motor slowdown. Lubricate fan-end bearing of motor.	Sec. V, Para. K. Sec. III, Para. F.
	f. (Remote possibility) Rubber sleeve on shank of nozzle is leaking.	Check for bubbles in fuel tank while heater is operating. If bubbles appear, replace rubber sleeve.	Sec. V, Para. I.
	g. (Remote possibility) Combustion chamber not tight against burner head, allowing too much air to enter combustion chamber.	Adjust fins for good fit of combustion chamber to burner head.	Sec. V, Para. L-1g
4. Flames come out front of heater.	<u>Improper Fuel-Air -- Mixture (Too much fuel, or not enough air for amount of fuel.)</u>		
	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 too high.	Check and adjust pump output pressure.	Sec. V, Para. K.
	c. Fan loose or improperly located on shaft.	Check; correct if not right.	Sec. V, Para. F.
	d. Housing holding clips not properly engaged over fuel tank skirt.	Check housing fit; correct if not tight.	
5. Heater cycles intermittently.	<u>Electrical System Troubles (Motor overload protector tripping out.)</u>		
	a. Low voltage, causing trip-out of motor overload protector.	Check power line voltage. Use correct size extension cord. Be sure extension cord and heater cord are in good condition, without intermittent open circuits.	Sec. II, Para. B.
	b. 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.	Sec. III, Para. F. Sec. V, Para. E & J

A. GENERAL

Whenever a part needs to be replaced, you can identify it on the exploded view, and order the part by name and part number from the parts list, in Section VI.

The following tools and equipment should be available for complete servicing of the heater.

2. Oil Burner Nozzle Wrench, or any 5/8-inch socket wrench.

- 3. Clean fuel, either kerosene or No. 1 fuel oil.**

4. Non-flammable cleaning solvent, such as carbon tetrachloride.

CAUTION: Fumes are poisonous, use with GOOD ventilation!

5. Compressed air is advisable, but not absolutely necessary.

C. TRANSFORMER

NOTE: To begin the transformer test, first be sure the heater is NOT plugged in.

1. Remove the spark plug wire from the transformer output terminal.

WARNING

A transformer in good condition produces a high voltage at the output terminal. Be EXTREMELY careful when checking the transformer.

2. Plug the heater cord into an outlet of the proper voltage and frequency. Place a screwdriver with a GOOD INSULATED HANDLE across the output terminal and bring the tip of the screwdriver near a metal part of the heater. If no spark jumps, and the wiring to the transformer is good, the transformer is defective and must be replaced.

3. Be sure the mounting surfaces of the new transformer are scraped clean, and the mounting

Figure 4. Wiring Diagram for Standard Heaters
(See Figure 9 for Deluxe Heater Wiring Diagram.)

D. CHECKING THE MOTOR AND RELAY

In case the motor fails to start when the heater is plugged in, check the motor and relay as follows.

1. Spin the fan by hand. Any stiffness indicates that the fan-end bearing is dry or worn, or that the pump is binding. If the motor spins freely, make the following electrical check.

2. Take the black wire from the motor off its terminal on the relay. See the Wiring Diagram, Figure 4. Plug the heater cord into an outlet of the proper voltage.

CAUTION: Avoid touching the bare wires.

3. Touch the black wire from the motor to the terminal of the red motor wire, on the relay. The motor should start. As soon as the motor reaches operating speed, remove the black wire from contact. The motor should continue to run.

4. If the motor starts, replace the relay.

5. If the motor fails to start, or if it fails to continue running when the black wire is disconnected, it is defective. Replace it, or return it to a factory-approved authorized service organization.

6. Be sure the seal washer, spring, and second seal washer are in place on the nozzle before installing the rubber sleeve.

7. When seating the nozzle firmly against the burner head, do not apply so much pressure with the wrench that the nozzle could be distorted.

J. AIR PUMP REPAIR

NOTE: Because of the close tolerances and critical positioning involved, 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. The motor end plate also serves as one of the end plates of the pump.

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

If pump repair is required, you may order a complete pump package, or individual pump parts, as shown in the Parts List, Section VI.

1. 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 pump body to replace the carbon blades.)

b. Wash the rotor, end cover and pump body in non-flammable cleaning solvent and blow them dry before you install the new blades.

c. Install the carbon blades into the slots with the notched ends of the blades inside the slots, and the rounded ends toward the outside.

2. Disassembly of Air Pump.

a. Remove the four screws which attach the end cover, and remove the end cover. Then take out the two screws which attach the pump body to the motor, and take off the pump body.

NOTE: Hold a clean, dry cloth under the pump while you take it apart, to catch the carbon blades as they fall out when the pump body is removed.

b. Take the carbon blades out of the rotor. Pull the rotor and spring off the motor shaft.

3. Replacing the Rotor.

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

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To remove the rotor, first remove the pump body. When installing the rotor, take care to keep it perpendicular to the shaft.

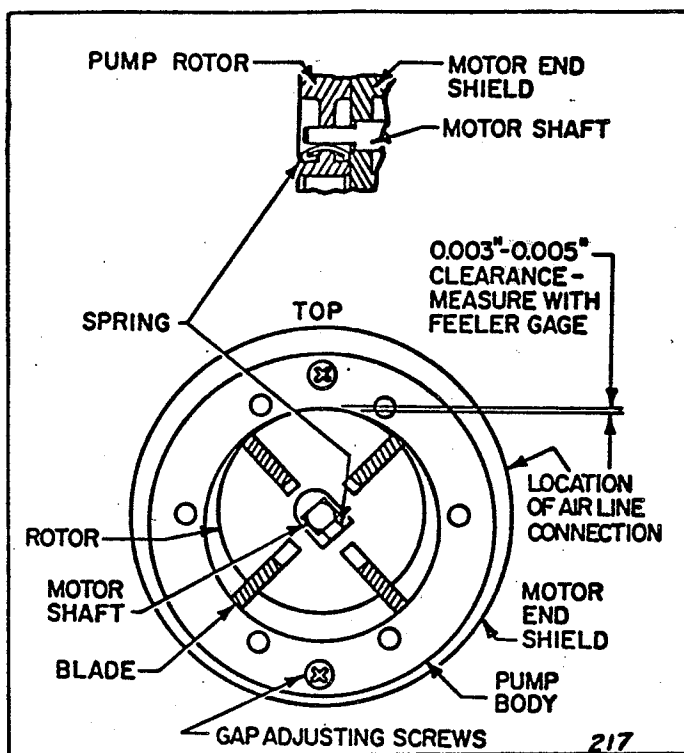


Figure 6. Air Pump Assembly and Rotor Clearance

4. Reassembly of Air Pump.

a. Install the spring in the pump rotor as shown in Figure 6, then assemble the rotor on the motor shaft. Attach the pump body to the motor with the two screws which were removed.

b. Adjust the pump body to provide 0.003-0.005 inch clearance at the point shown in Figure 6. 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 screws are tight after adjusting the clearance.

c. Insert the carbon blades, as described above.

d. Install the end cover, with the air line connection located as shown in Figure 6, using the four screws.

e. Install burner head, air filter, and nozzle assembly. Adjust pump pressure.

K. ADJUSTMENT OF AIR PUMP PRESSURE

1. Install the pressure gage into the output air filter housing. (See Figure 7.)

2. Start the heater. (Fuel need not be in the tank.)

3. Pump pressure must be 4-1/8 pounds per square inch, plus or minus 1/8 pound without fuel in tank or housing in place. If pressure is not within this range, adjust relief valve.

N. CONTROL SYSTEM

1. Description.

The control system used in Deluxe heaters is designed to shut the heater off in case it does not ignite, or in case the flame should go out during operation.

The control consists of three main parts: (1) A light-sensitive cell which "sees" into the combustion chamber; (2) A control relay whose coil is controlled by the cell; and (3) A circuit breaker whose internal heating coil is controlled by the relay contacts.

2. Operation.

When the heater is first plugged in, the heating coil inside the circuit breaker starts to warm up.

If no ignition takes place, the circuit breaker will trip. When it trips, it shuts off all power to the heater.

After a trip-out, the circuit breaker must be manually reset by pressing the red button.

If ignition takes place, the cell "sees" the flame. It then allows enough current to flow to operate the control relay. The relay breaks the circuit to the internal heating coil in the circuit breaker, and the circuit breaker's main contacts will then stay closed to keep the heater operating.

If the heater should lose its fire during operation, the circuit breaker will trip after a short time, shutting off all power to the heater.

3. Service.

Since no adjustment is possible on the parts of the control system, service is limited to cleaning the glass face of the light-sensitive cell, cleaning the dirt from the exposed contacts of the relay (if the contacts are exposed), and replacing defective parts of the system with parts that are known to be good.

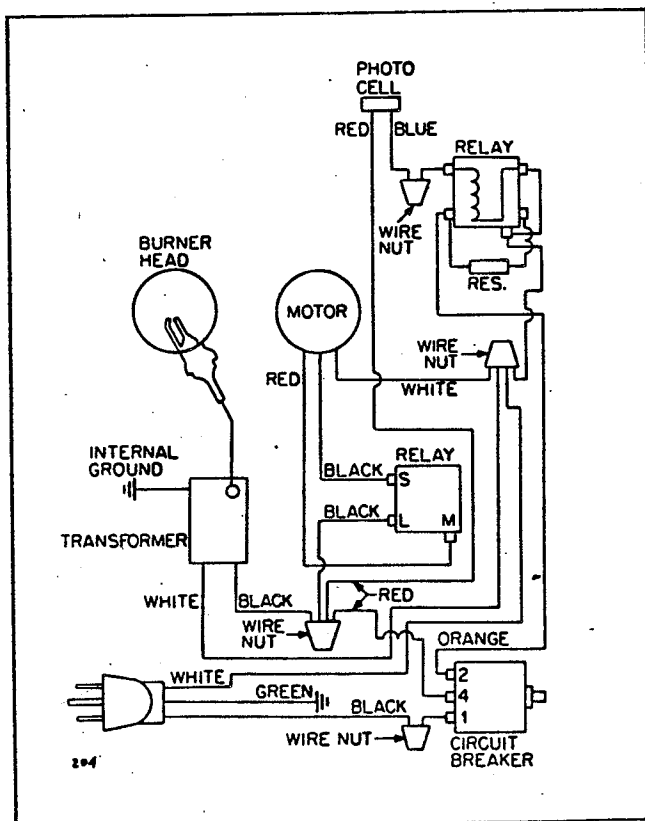
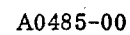


Figure 9. Wiring Diagram for Deluxe Heaters



HOW TO SUBMIT A WARRANTY CLAIM:

- (1) A separate warranty service claim Form (#2003) must be submitted for each warranty repair performed. The original and one copy are required. Important: Each entry is of equal importance and, if not shown, claim will not receive consideration for payment.
- (2) Each defective part must be tagged with defective parts tag, Form #2004.
- (3) Defective warranty parts are to be kept by you until your warranty claim has been approved and payment received. The Company reserves the right to request return of any part before approval of claim. After claim is approved, all parts shall then be scrapped by you.
- (4) All warranty claims should be marked direct to the Company within 72 hours. Send original to the Company -- retain copy for your file.

HANDLING OF WARRANTY CLAIMS AT FACTORY:

All approvals or disapprovals will be based on the information shown on the Warranty Service Claim.

- (1) Approved Claim - Factory will:
 - (a) Forward check (or credit memo when appropriate) promptly to service agency submitting claim.
 - (b) Forward copy of "Warranty Credit Notice" to responsible distributor.
- (2) Disapproved Claim - Factory will:

Advise service agency direct (with copy to responsible distributor) reason for claim rejection. If service agency chooses to contest the factory decision, all facts concerning the claim should be presented to your distributor for review and recommendations, if any, to the factory.
- (3) Labor rate shall be \$3.00 per hour. Reasonable time shall be allowed for all labor performed.
- (4) All parts used for warranty repair shall be credited at the service agency's cost PLUS 20%.

SUMMARY:

- (1) Do not return units to the factory without prior written permission.
- (2) The Company warranty does not cover motors.
- (3) Warranty does not cover accident, shipping damage, misuse or abuse.
- (4) No allowance made for pick-up, delivery or service calls.
- (5) A separate warranty service claim must be made for each unit repaired.
- (6) Warranty service claim must be filled out completely.
- (7) Submit warranty service claim directly to factory within 72 hours from time repairs are completed.
- (8) Defective parts are not to be returned to factory unless requested.
- (9) Warranty payment made direct to service agency submitting claim.
- (10) Labor credit will be issued at \$3.00 per hour.
- (11) Parts will be at service agency's cost PLUS 20%.

REDDY HEATER COMPANY

DIVISION OF MASTER CONSOLIDATED INC.

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AREA CODE 513 461-4860