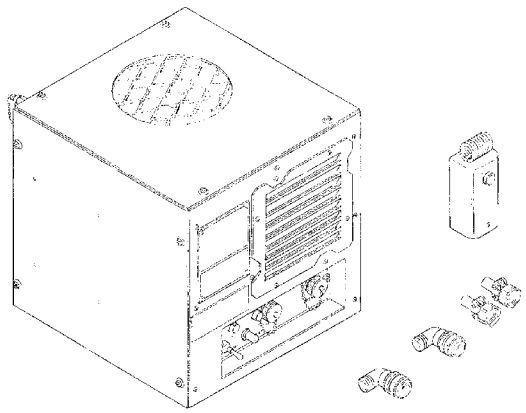
TECHNICAL MANUAL

**OPERATOR'S, UNIT,
AND DIRECT SUPPORT
MAINTENANCE MANUAL**



**HEATER, SPACE, DIESEL,
WITH BLOWER
15,000 BTU/HR, 28VDC
(MODEL UH48-E, TYPE IV)**

(NSN 4520-01-368-9594)

HEADQUARTERS, DEPARTMENT OF ARMY

30 JANUARY 1995

SHOCK HAZARD

The ignition system of this heater contains dangerous voltages which can cause severe electrical shock. Be extremely careful when making voltage measurements or other checks with the heater connected to the power source during troubleshooting. Always disconnect the power plug before making any continuity tests or before repairing the heater.

POISONOUS GAS HAZARD

Do not operate this heater in an enclosed area unless exhaust fumes are piped to the outside. Do not locate the heater where expelled exhaust fumes can be recirculated into inlet air openings of the heated space. The exhaust gases may contain carbon monoxide, a colorless, odorless, deadly poisonous gas. Inhalation of exhaust fumes can cause serious illness or death. Stop heater operation and check exhaust connections if exhaust gas odors are apparent in the enclosure.

HEALTH HAZARD

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 140°F (60°C).

Death or serious illness may result from inhalation of exhaust fumes. The heat exchanger confines the combustion gases and directs them to the exhaust pipe. It must be air tight to prevent harmful combustion products from entering the heated enclosure. Any crack or hole through the exchanger walls requires exchanger replacement.

Solder and flux contain materials which are hazardous to health. Avoid breathing vapors or fumes from soldering operations. Perform operations only in well-ventilated areas. Wash hands with soap and water after handling solder and flux.

Do not smoke or use an open flame in vicinity of the heater while servicing. Failure to comply may result in injury to personnel.

TECHNICAL MANUAL
NO. 9-4520-260-13

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHIINGTON, D.C., 30 January 1995

OPERATOR'S, UNIT, AND DIRECT SUPPORT MAINTENANCE MANUAL

HEATER, SPACE, DIESEL, WITH BLOWER 15,000 BTU/HR, 28VDC NSN 4520-01-368-9594

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this rnanual. If you find any mistakes or if you know of a way to improve these procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual directly to: Commander, US Army Aviation and Troop Command, ATTN: AMSAT-I-MP, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798 or E-mail to AMSATIMP@st-louis- emh7.army.mil.Fax to (314) 263-9033. A reply will be furnished directly to you.

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LIST OF ILLUSTRATIONS

HOW TO USE THIS MANUAL

You must familiarize yourself with the entire maintenance procedures before beginning the maintenance task.

Access to the information contained in this technical manual is made easy by the use of front cover index. This index lists the major divisions of the technical manual (i.e. chapters, appendices, glossary, and index) and relates each division title to the contents of that division by lining up heavy black margin marks on the cover with a corresponding heavy black margin mark on the right hand side of the first page of the related major division.

Personnel needing general information on the equipment should refer to Chapter 1.

Personnel tasked with operation of the equipment should refer to Chapters 2 and 3.

Personnel tasked with maintenance at unit and direct support maintenance echelons should refer to Chapters 4 and 5, respectively. Higher maintenance echelon personnel may use lower echelon procedures as needed.

This technical manual contains operating instructions and information, unit and direct support maintenance procedures for a 15,000 BTU/hour diesel space heater with blower.

A listing of general warnings associated with the equipment and the tasks covered in this technical manual is contained in the front of this technical manual. WARNINGS, CAUTIONS, and NOTES are used within the technical manual to alert the user to potential personnel hazards, equipment hazards, and helpful explanatory information.

A detailed table of contents is provided that will allow the user to locate specific chapters and sections within the technical manual.

The instructions, information, and procedures in this technical manual are divided into chapters and sections. Each chapter is specifically targeted to the intended user of that chapter, as described in the chapter titles. Examples of these chapter titles are: OPERATING INSTRUCTIONS, OPERATOR MAINTENANCE INSTRUCTIONS, and DIRECT SUPPORT MAINTENANCE INSTRUCTIONS. These chapters attempt to communicate to a user having specific skills and capabilities. Appendices contain supplementary information to support the user of this technical manual. The types of information contained in the appendices are:

- Appendix A, References, contains a listing of other documents that are related to the equipment covered in this technical manual.

- Appendix B, Maintenance Allocation Chart, identifies all maintenance and repair functions authorized at various maintenance levels, designates overall responsibility for performance of maintenance functions, lists tools and test equipment needed for specific maintenance functions, and supplemental instructions and explanatory notes.

- Appendix C, Components of End Item (COEI) and Basic Issue Items (BII) Lists, provides information that will help using activities to inventory items required for safe and efficient operation of the equipment.

- Appendix D, Additional Authorization List, lists additional items the using activity is authorized for support of the equipment.

- Appendix E, Expendable and Durable Items List, provides information on supplies and materials required to operate and maintain the equipment.

- Appendix F, Illustrated List of Manufactured Items, provides illustrations, a list of required materials, and necessary dimensions and procedures for items that must be manufactured.

- Appendix G, Torque Limits, provides standard torque values for various fasteners.

- Appendix H, Mandatory Replacement Parts, provides a list of parts that are automatically replaced during maintenance procedures.

A glossary is provided after Appendix H. It contains information on abbreviations and terns used in this technical manual. Following the glossary is an alphabetical index to allow the user to easily find specific information contained in the technical manual.

Procedures and instructions contained in this technical manual are simply written and heavily illustrated to make them easy to understand and use.

With the exception of Chapters 1 and 2, the order of presentation of the instructions, information, and procedures contained within each chapter is in the order of the Maintenance Allocation Chart contained in Appendix B.

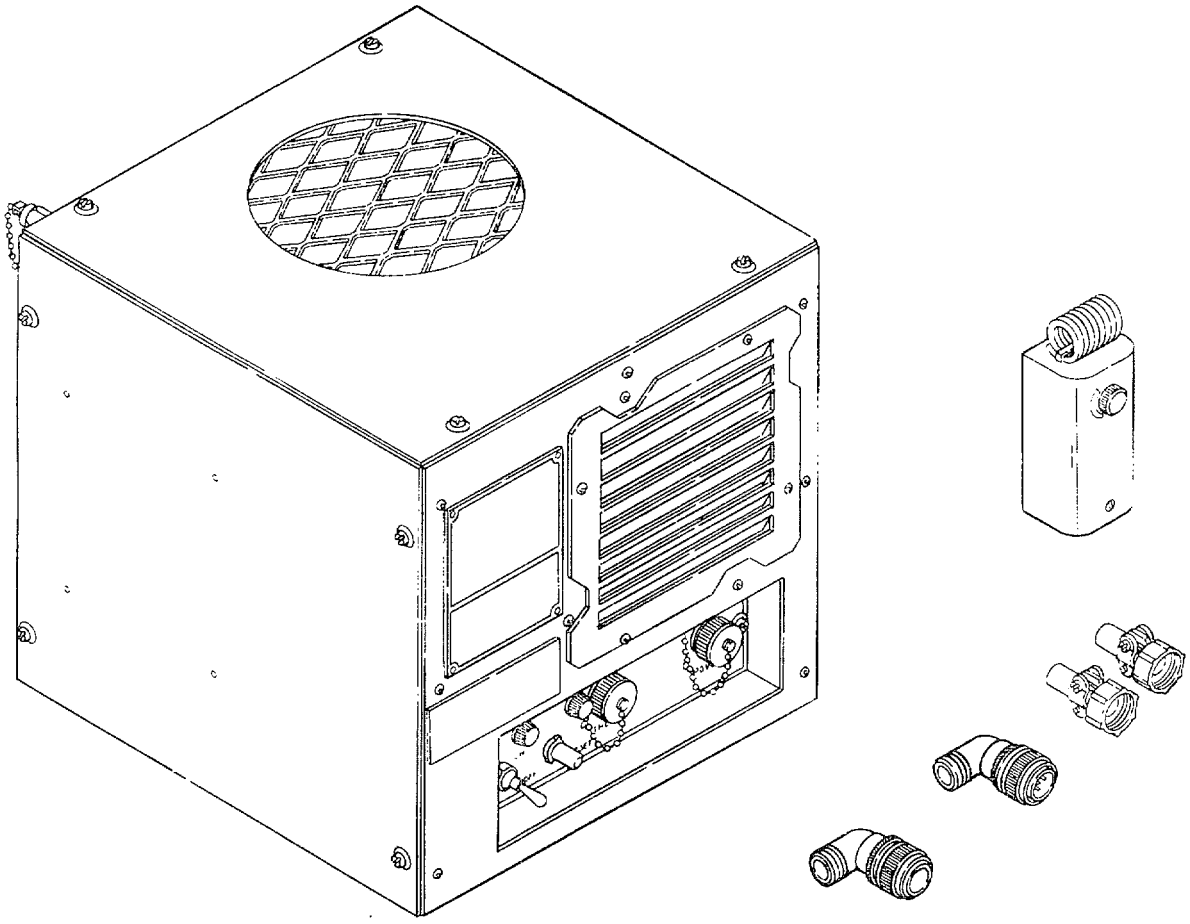


Figure 1-1. Diesel Space Heater With Blower.

CHAPTER 1

INTRODUCTION

SECTION I. GENERAL INFORMATION

1-1. SCOPE.

a. Type of Manual. Operator's, Unit, and Direct Support Maintenance Manual.

b. Model Number and Equipment Name. Model UH48-E, Type IV; Heater, Space, Diesel, with Blower, 15,000 BTU/hour, 28 VDC.

c. Purpose of Equipment. Heats enclosed areas.

1-2. MAINTENANCE FORMS, RECORDS, AND REPORTS.

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738- 750, The Army Maintenance Management System; DA Pam 738-751, Functional Users Manual for The Army Maintenance Management System - Aviation (TAMMS-A); or AR 700-138, Army Logistics Readiness and Sustainability.

1-3. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE.

For destruction procedures for materiel, refer to TM 750-244-3.

1-4. PREPARATION FOR STORAGE OR SHIPMENT.

See unit maintenance instructions (paragraph 4-29) for procedures that ensure safe storage or shipment of the heater.

1-5. QUALITY ASSURANCE (QA).

Workmanship shall be of the highest quality and shall permit no defects not repaired in accordance with the instructions in this manual. All metal parts shall be clean and free of sand, dirt, etc. The inside and outside of the heater shall be clean and free of foreign material.

1-6. OFFICIAL NOMENCLATURE, NAMES, AND DESIGNATIONS.

Shortened nomenclature is used in this manual to make procedures easier for you to read. A cross-reference between the shortened nomenclature and the official nomenclature is shown in the following table.

Table 1-1. Nomenclature Cross-Reference

Manual Nomenclature	Official Nomenclature
Heater	Heater, Space, Diesel, With Blower, 15,000 BTU/hour, 28 VDC

1-7. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR).

If your heater needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 368 (Product Quality Deficiency Report). Mail it to Commander, U.S. Army Aviation and Troop Command, ATTN: AMSAT-I-MDO, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. We will send you a reply.

1-8. REPAIR PARTS; TOOLS; SPECIAL TOOLS; TEST, MEASUREMENT AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT.

Repair parts and special tools are listed and illustrated in TM 9-4520-260-23P. Special tools are also listed in Section III of the Maintenance Allocation Chart (MAC) located in Appendix B of this manual.

1-9. SAFETY, CARE, AND HANDLING.

a. General Safety. The heater does not present any safety hazards; however, during maintenance some parts may be expose which are subject to high temperatures.

(1) Be careful when testing the heater with top and side cover panels removed. Electrical parts have a potential of high voltage during operation.

(2) During normal operation, with all cover panels installed, electrical parts and burner parts subject to heat are enclosed and guarded in the heater.

(3) Observe all warning and caution notes that appear before each maintenance operation. Refer also to the Warning Page.

b. Handling. The heater weighs approximately 34 pounds and may require two personnel for lifting and moving.

1-10. CORROSION PREVENTION AND CONTROL (CPC).

a. Corrosion Prevention and Control of Army materiel is a continuing concern. It is important that any corrosion problems with this item be reported so that the problem can be corrected and improvements can be made to prevent the problem in future items.

b. While corrosion is typically associated with rusting of metals, it can also include deterioration of other materials, such as rubber and plastic. Unusual cracking, softening, swelling, or breaking of the materials may be a corrosion problem.

c. If a corrosion problem is identified, it can be reported using Standard Form 368, Product Quality Deficiency Report. Use of key words such as "rust," "deterioration," "corrosion," or "cracking" will ensure that the information is identified as a CPC problem. The form should be submitted to the address specified in DA Pam 738-750.

SECTION II. EQUIPMENT DESCRIPTION AND DATA

1-11. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.

a. The heater is designed to operate from a 28 VDC source. The heater has a maximum output of 15,000 British Thermal Units (BTU) per hour. The heater is designed for wall or floor mounting. Heater control is provided by a remotely controlled room thermostat to maintain temperature within 35° to 95F (1.7° to 35°C) up to the rated output of the heater.

b. The heater is equipped with a removable discharge louver for directing the outlet air. A screened air inlet opening provides entry of circulating air. Combustion air for the burner head is provided by a separate blower and enters the heater through the rain shield at the rear of the heater.

c. The Electronic Control Unit (ECU) controls the starting and stopping of the heater as the room thermostat reaches its desired setting.

d. The proper fuels (Item 7, Appendix E) to use at various ambient temperatures are listed in Table 1-2.

Table 1-2. Types of Fuel

Ambient Temperature	Specification	Military Symbol
Above 20°F (-6.70C)	VV-F-800	DF-2
+20°F (-6.7°C) to -25°F (-32.2°C)	VV-F-800	DF-1
Below -25°F (-32.20C)	VV-F-800	DF-A

1-12. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.

a. Cover Panels (1). The side cover panel and the top cover panel are interchangeable to provide alternate air intake installation.

b. Rain Shield (2). The rain shield provides combustion air intake to the burner. It has a removable rain shield cover. The rain shield cover is reversible for use in outside installations.

c. Bulkhead Fitting (3). The bulkhead fuel inlet fitting is mounted to the back of the case and to the strainer to provide fuel to the fuel pump.

d. Control Panel (4). The control panel controls the heater operation with an ON-OFF switch, a reset circuit breaker, a fuse, a spare fuse holder, a power receptacle, and a thermo receptacle.

e. Fuel Pump (5). The 28 VDC pulsating-type electric fuel pump draws fuel from the strainer and fuel supply and pumps it to the carburetor. A filter removes contaminants which may have passed through the strainer.

f. Ignition Pack (6). The ignition pack converts 28 VDC input to the high voltage output necessary to provide a hot spark at the igniter in the burner head. This spark ignites fuel vapors to start combustion. A shielded high voltage cable connects the secondary of the ignition pack to the igniter.

g. Burner (7). The burner head is mounted to the heat exchanger. It provides mounting for the glow plug, igniter, and carburetor. Combustion air is supplied to the burner head by the motor fan assembly. The air and fuel mixture ignites in the burner head combustion chamber.

h. Strainer (8). The strainer traps and holds dirt, moisture, and other contaminants to keep them from entering the heater fuel system. A metal disc-type element is contained in the sediment bowl.

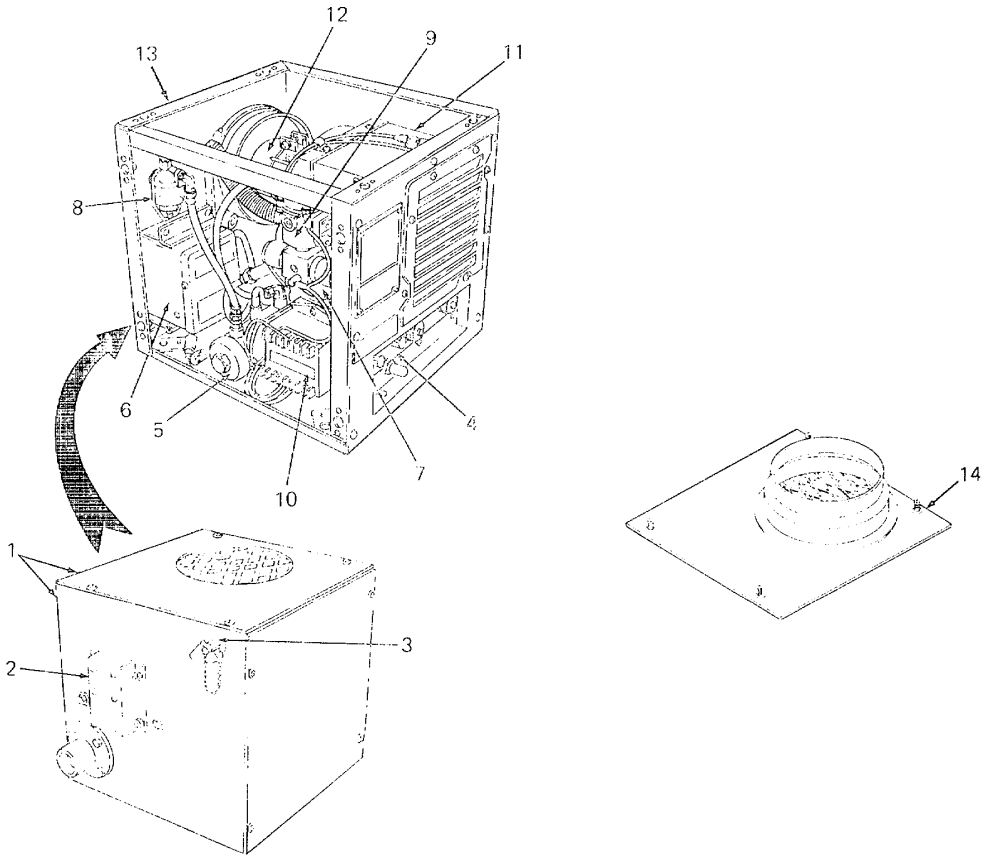


Figure 1-2. Major Components of Model UH48-E Heater (With Top and Side Cover Panels Removed).

i. Carburetor (9). The carburetor meters the flow of fuel to the burner head to achieve efficient combustion. A fuel adjustment needle enables manual adjustment of flow rate. Solenoid valves control the fuel flow from the float bowl to the fuel nozzle. Fuel lines carry fuel from the strainer to lice fuel pump and from the fuel pump to the carburetor.

j. Electronic Control Unit (ECG') (10). The electronic control unit controls automatic heater operation. After ignition, the control unit will start and stop the heater as the thermostat reaches the desired setting. The unit controls the glow plug, igniter, and fuel heater. Starting and stopping is controlled by relay switching and time delays. The ECU will purge the system after shutdown.

k. Heat Exchanger (11). The heat exchanger is open to the burner head at one end and contains an exhaust outlet at the other end. The burning air and fuel mixture heats the heat exchanger walls. A ventilation air blower blows air around the outside of the heat exchanger and picks up heat before it passes through the warm air louver to the enclosure to be heated.

l. Motor/Blower Assembly (12'). The blower motor assembly consists of a 28 VDC motor and two blower assemblies. One blower is mounted on the motor at the rear of the heater and provides air through an air hose to the burner head. The other blower is mounted to the heat exchanger and provides air around the outside of the heat exchanger. The heated air passes through the louver to the enclosure to be heated..

m. Heater Case (13). The heater case is constructed of sheet metal and has top and side cover panels that are interchangeable. Quick release 1/4-turn fasteners provide easy removal. Four captive nuts are used to mount the heater. An air intake screen is used to prevent foreign matter from entering the heater. A louver is mounted on the front of the heater case. It is adjustable to direct the discharge of air. The power receptacles are mounted on the control panel not less than 3 inches apart. All heater components are mounted inside the heater case.

n. Cover Assembly (14). The cover assembly is supplied with, but is not part of, the heater. It can be used in place of the top cover to attach ducting to provide outside air to heater.

o. Room Thermostat (Figure 1-3). The room thermostat is remotely mounted away from the heater and not in direct line with the warm air output. The thermostat will withstand 15 to 20 cycles per hour within the range of +55°F (12.8°C) or less to 85°F (29.4°C) or more. The thermostat is encased in metal and all nonmetal parts are protected against breakage.

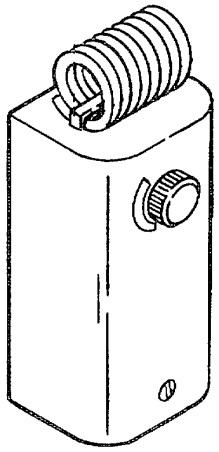


Figure 1-3. Room Thermostat.

1-13. EQUIPMENT DATA.

Equipment data is listed in Table 1-3.

Table 1-3. Equipment Data

Manufacturer	Hunter Manufacturing Company
Model number	UH48-E, Type IV, Diesel
Volts DC	28
BTU output	15,000
Dimensions	
Height	12 inches
Width	12 inches
Depth	13-5/8 inches
Weight	34 pounds

SECTION III. PRINCIPLES OF OPERATION

1-14. FUNCTIONAL DESCRIPTION (Figure 1-4).

a. Control Panel. Control of the heater is provided by the control panel ON-OFF switch for starting and stopping. The room thermostat controls the starting and stopping as the thermostat reaches its desired setting.

b. ECU Control. The ECU relay switching controls the blower motor, glow plug control, ignition pack control for igniter, and receives flame switch and overheat switch conditions from the heat exchanger. If overheat switch opens, heater will shut down; if flame switch closes, the glow plug will shut off.

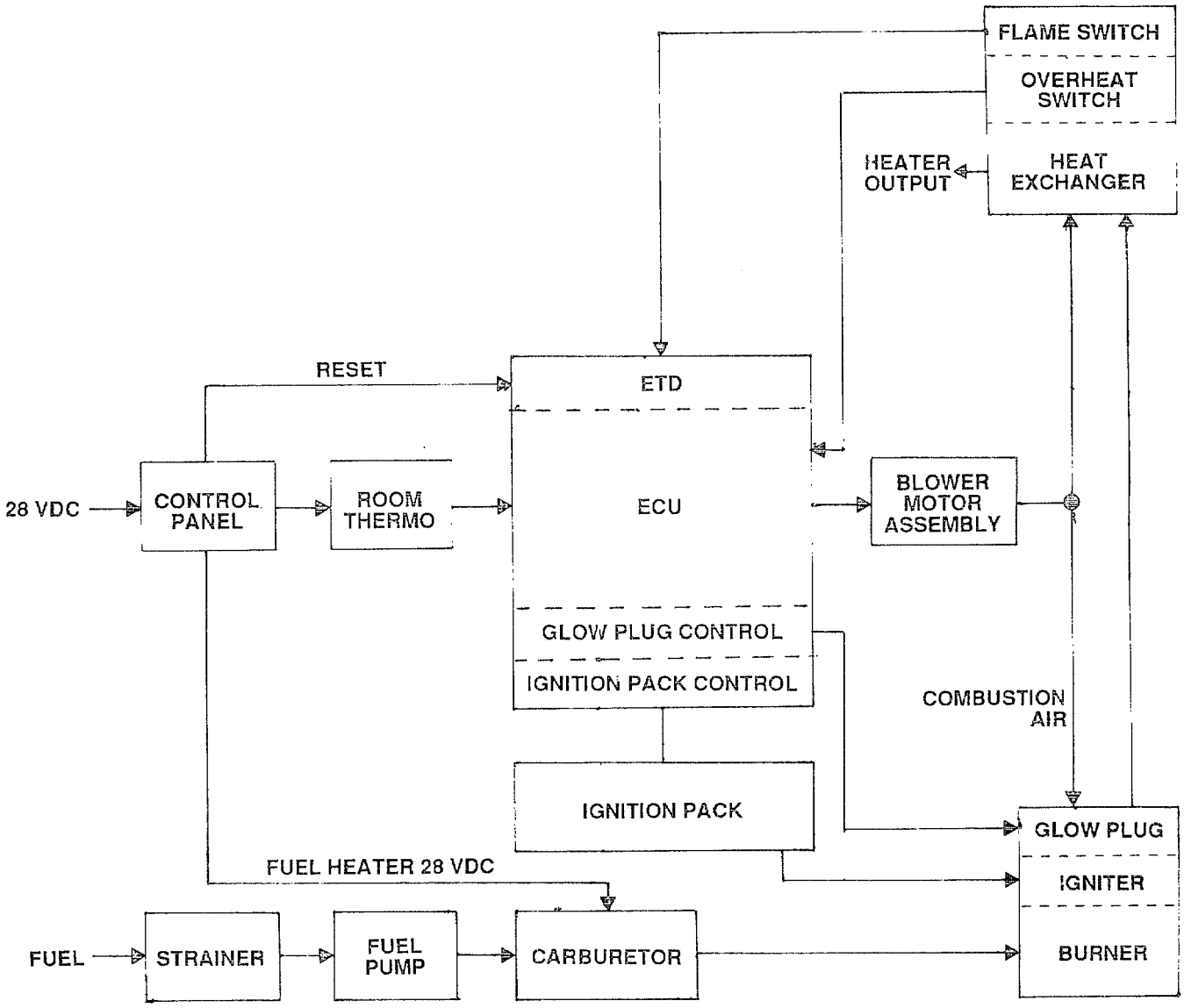


Figure 1-4. Functional Block Diagram.

c. Motor/Fan Subassembly. This unit contains a DC motor, a fan (heated air), and a wheel blower assembly (combustion air). The drive shaft of the DC motor extends out each end of motor.

(1) A fan is attached to one end drive shaft. This fan brings in air from outside the heater and forces airflow across the heat exchanger. The heated air is discharged into the area to be heated. This airflow is breathable and safe and completely isolated from combustion gases.

(2) A wheel blower assembly is attached to the opposite end of the drive shaft. This blower brings in air from outside the heater and forces airflow into the burner assembly to support combustion within the burner and heat exchanger. Hot combustion air and gases, driven by this blower, are forced through the heat exchanger. Hot combustion air and gases are safely exhausted outside of the area being heated.

d. Burner Assembly. Within this unit fuel is mixed with combustion air and ignited. Fuel flow, air flow, and ignition continues as long as the heater controls do not sense an unsafe condition and the temperature requirements of the thermostat have not been met. Combustion air and gases expand and are forced, by new incoming combustion air, into the heat exchanger.

e. Heat Exchanger Assembly. Within the heat exchanger, the heat given off by the combustion of the fuel and air is safely transferred to the heated air being discharged to the area where the thermostat is installed. This unit also provides a mounting area for the burner assembly and additional room for combustion to occur. This hot mix of air and gases is then safely exhausted outside of the area being heated.

1-15. CIRCUIT DESCRIPTION (Figure FO-1).

a. Starting.

(1) The 28 VDC power source is received through power receptacle J1 pins A and C (B is ground), then through fuse F1 and reset circuit breaker CB when switch S1 is pressed ON. With S1 OFF, 28 VDC is supplied to coil of relay K2 in ECU.

(2) Then 28 VDC goes through thermostat receptacle J2 pins A and C if thermostat is set above ambient temperature of the enclosure to be heated.

(3) Then 28 VDC goes through deenergized contacts of K1 to glow plug GP1 and coil L3 to heat the burner chamber. 28 VDC is also present from K1 deenergized contacts to K3 coil.

(4) With CB1 reset switch on, 28 VDC is supplied to electronic time delay (ETD) in ECU.

(5) When K3 in ECU energizes, 28 VDC is supplied through closed contacts of overheat switch S4 causing igniter to spark providing ignition.

(6) When flame switch S2 closes, relays K1 and K2 energize, glow plug GP1 stops heating, and motor B1 starts; ground is applied to ETD.

b. Stopping. The heater will stop under the following conditions:

(1) When the thermostat reaches its desired setting removing 28 VDC from J2.

(2) When overheat switch S4 opens, ignition stops.

(3) When fuel supply is gone, ignition stops.

(4) When ON-OFF switch S1 is placed in OFF position, or reset switch CB1 opens.

(5) Blower B1 will run until flame switch S2 opens or relay K3 deenergizes.

CHAPTER 2

OPERATING INSTRUCTIONS

SECTION I. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS

2-1. GENERAL.

a. This section contains information and instructions for personnel responsible for operating this heater. The information includes starting and stopping procedures and basic heater operations.

b. Before operating the heater, you must become familiar with the controls and indicators provided on the unit. The operating controls are installed on the control panel (Figure 2-1), and on the room thermostat (Figure 2-2).

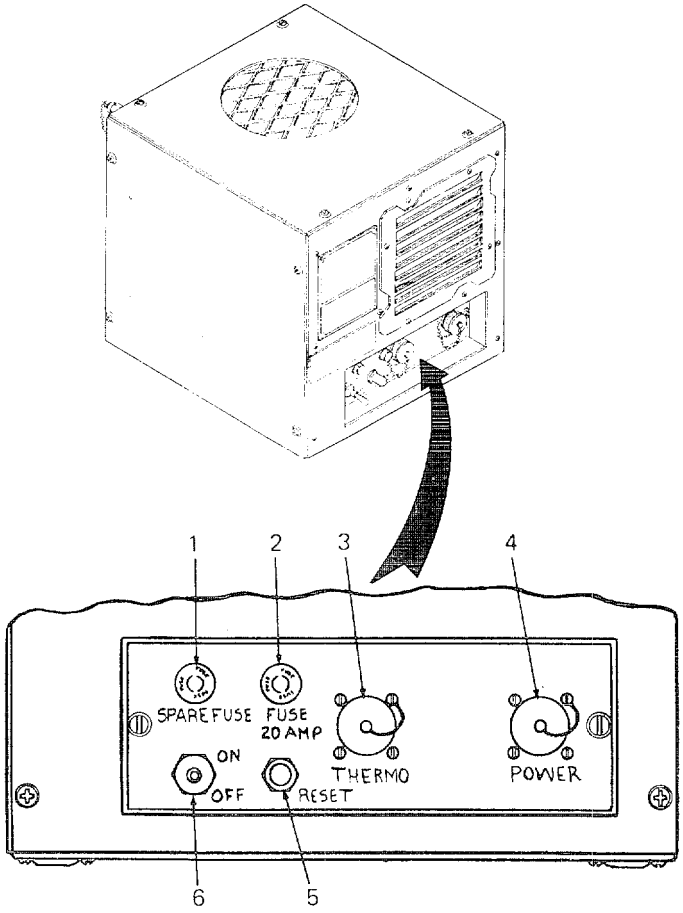


Figure 2-1. Heater Control Panel Controls and Indicators.

2-2. HEATER CONTROLS AND INDICATORS (Figure 2-1).

a. Control Panel. Description and functions of heater control panel controls and indicators are contained in Table 2-1.

Table 2-1. Heater Control Panel Controls and Indicators

Key	Control or Indicator	Function
1	Spare fuse holder	Houses a spare fuse.
2	Fuse	In-circuit fuse to protect electrical circuits from overload.
3	THERMO receptacle	Provides a connection for the room thermostat which controls heater operation.
4	POWER receptacle	Provides a connection for 28 VDC into the heater.
5	RESET switch	When pressed, switch resets heater and timing circuits after heater has stopped due to ignition failure.
6	ON-OFF switch	Controls starting and stopping of heater. In ON position the heater will start and operate under control of the room thermostat. In OFF position heater stops operating. If blower is running when switch is moved to OFF, heater will continue to run until heater cools, then motor will stop.

b. Room Thermostat (Figure 2-2). Description and function of room thermostat are contained in Table 2-2.

Table 2-2. Room Thermostat Control

Key	Control or Indicator	Function
1	Thermostat knob	Provides a means of selecting the temperature which heater is to maintain. Rotate knob to the desired temperature.

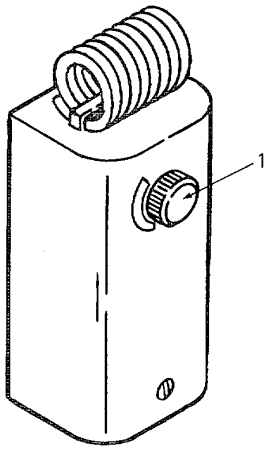


Figure 2-2. Room Thermostat.

NOTE

The thermostat provides the heated air output regulation. Raising the thermostat setting does not increase the heat output. It only causes the heater to run until desired heat is reached. Setting the thermostat to its highest position at startup does not increase the rate of heat. Set the thermostat only to the desired temperature in the enclosure.

SECTION II. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-3. GENERAL.

Preventive Maintenance Checks and Services (PMCS) means systematic caring, inspecting, and servicing of equipment to keep it in good condition and to prevent breakdowns.

a. Be sure to perform your PMCS each time you use the heater. Always do your PMCS in the same order, so it gets to be a habit. Once you've had some practice, you'll quickly spot anything wrong.

b. Do your BEFORE (B) PMCS just before you use the heater. Pay attention to WARNINGs, CAUTIONs, and NOTEs.

c. Do your DURING (D) PMCS while you operate the heater. Monitor the heater an(d its related components while it is being operated. Pay attention to WARNINGs, CAUTIONs, and NOTEs.

d. Do your AFTER (A) PMCS right after operating the heater. Pay attention to WARNINGs, CAUTIONs, and NOTEs.

e. Do your WEEKLY (W) PMCS once a week.

f. Do your MONTHLY (M) PMCS once a month.

g. Use DA Form 2404 (Equipment Inspection and Maintenance Worksheet) to record any faults that you discover before, during, or after operation, unless you can fix them. You DO NOT need to record faults that you fix.

h. Be prepared to assist unit maintenance when necessary. Perform any other services when required by unit maintenance.

2-4. PMCS PROCEDURES.

a. Your Preventive Maintenance Checks and Services, Table 2-3, lists inspections and care required to keep the heater in good operating condition.

b. The Interval column of Table 2-3 tells you when to do a certain check or service.

c. The Procedure column of Table 2-3 tells you how to do the required checks and services. Carefully follow these instructions. It you do not have tools, or if the procedure tells you to, notify your supervisor.

NOTE

The terms "ready/available" and "mission capable" refer to same status: Equipment is on hand and ready to perform its combat missions. (See DA Pam 738-750.)

d. The Not Fully Mission Capable If: column in Table 2-3 tells you when your heater is nonmission capable and why it cannot be used.

e. If the heater does not perform as required, refer to Chapter 3, Section II, Troubleshooting.

f: If anything looks wrong and you can't fix it, write it on your DA Form 2404. IMMEDIATELY, report it to your supervisor.

g. When you do your PMCS, you may need a rag or two. Following are checks that are common to the heater:

(1) Keep it Clean. Dirt, grease, oil, and debris only get in the way and may cover up a serious problem. Clean as you work and as needed. Use dry cleaning solvent (Item 6, Appendix E) on all metal surfaces. Use soap (Item 11, Appendix E) and water when you clean rubber or plastic material.

(2) Rust and Corrosion. Check panels for rust and corrosion. If any bare metal or corrosion exists, clean, and apply a thin coat of corrosion preventive compound (Item 5, Appendix E). Report it to your supervisor.

(3) Bolts, Nuts, and Screws. Check them all for obvious looseness, missing, bent, or broken condition. You can't try them all with a tool, but look for chipped paint, bare metal, or rust around bolt heads. If you find a bolt, nut, or screw you think is loose, tighten it or report it to your supervisor.

(4) Welds. Look for loose or chipped paint, rust, or gaps where parts are welded together. If you find a bad weld, report it to your supervisor.

(5) Electric Wires and Connectors. Look for cracked, frayed, or broken insulation, bare wires, and loose or broken connectors. Tighten loose connectors. Report any damaged wires to your supervisor.

(6) Hoses and Fluid Lines. Look for wear, damage, and leaks, and make sure clamps and fittings are tight. Wet spots show leaks, but a strain around a fitting or connector can also mean a leak. If a leak comes from a loose fitting or connector, tighten it. If something is broken or worn out, report it to your supervisor.

h. Check operating condition. Listen for unusual noise, and watch for unusual shaking or vibrations.

2-5. CLEANING AGENTS.

WARNING

- DO NOT use diesel fuel, gasoline, or benzene (benzol) for cleaning.
- DO NOT SMOKE when using cleaning solvent. NEVER USE IT NEAR AN OPEN FLAME. Be sure there is a fire extinguisher nearby and use cleaning solvent only in well-ventilated places. Flash point of solvent is 140°F (60°C).
- USE CAUTION when using cleaning solvents. Cleaning solvents evaporate quickly and can irritate exposed skin if solvents contact skin. In cold weather, contact of exposed skin with cleaning solvents can cause frostbite.

a. Only use those authorized cleaning solvents or agents listed in Appendix E.

b. Keep cleaning solvents, gasoline, and lubricants away from rubber or soft plastic parts. They will deteriorate material.

c. When cleaning grease buildup or rusty places, use a cleaning solvent (Item 6, Appendix E). Then apply a thin coat of corrosion preventive compound (Item 5, Appendix E) to affected area.

2-6. LEAKAGE DEFINITIONS FOR OPERATOR PMCS.

It is necessary for you to know how fuel leaks affect the status of the heater. Following are classes of leaks an operator needs to know to determine the operational status of the heater. Learn these leakage class definitions. Remember-when in doubt, notify your supervisor.

WARNING

Leakage may present a fire and/or health hazard. No leakage of any type is permitted within the heater. No leakage of any type is permitted within the area or compartment being heated.

NOTE

Heater operation is allowed if:

- Class I or Class II leaks occur in fuel supply lines external to the heater and the area or compartment being heated.
- And, such leakage does not present a fire or health hazard.
- Class III leaks shall be reported immediately to your supervisor.

a. CLASS I-Slight seepage of fuel, but not great enough to form a drop. Indicated by slight wetness or discoloration.

b. CLASS II-Seepage of fuel great enough to form drops but not great enough to cause drops to drip from the item being checked.

c. CLASS III-Leakage of fuel great enough to form drops that fall from the item being checked.

2-7. PMCS TABLE.

Table 2-3. Operator Preventive Maintenance Checks and Services for Heater Model UH48-E

NOTE

If the equipment must be kept in continuous operation, do only the procedures that can be done without disturbing operation. Make complete checks and services when the equipment is shut down.

Item No.	Interval	Location: Item to Check/ Service	Procedure	Not Fully Mission Capable if:
1	Before	Fuel Supply	Check fuel supply and that fuel supply valve is open.	Fuel is not available.
2	Before	External Electrical Connections	Check that power cable and thermostat connector are fully mated to receptacles on heater.	Not properly connected. Connect properly or notify Unit Maintenance.

Table 2-3. Operator Preventive Maintenance Checks and Services for Heater Model UH48-E - Continued

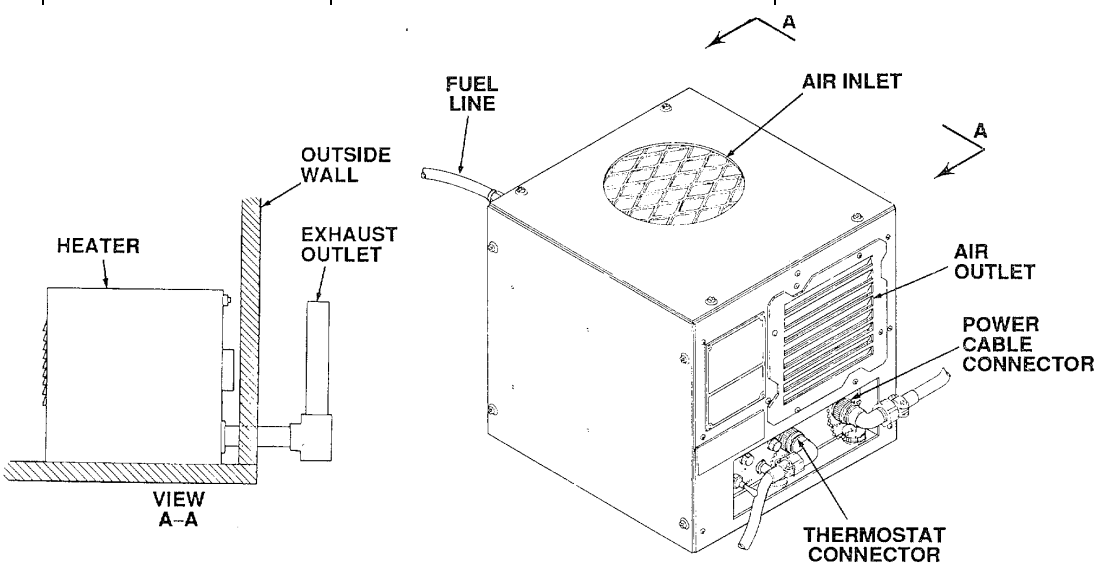
Item No.	Interval	Location: Item to Check/ Service	Procedure	Not Fully Mission Capable if:
				
3	Before	Air Inlet/Outlet	Check that air inlet/outlet is free of obstructions.	There are obstructions. Remove obstructions.
4	Before	Exhaust Piping and Outlet	Check that exhaust outlet is free of obstructions, no combustible materials have been placed in contact with piping, and all connections are tight and leak free.	There are obstructions. Remove obstructions.
5	During	External Fuel Lines	Check for kinks, leakage, or damage. Heater can be operated with Class I or Class II leaks, if: • Leaks occur in fuel supply lines external to the heater and the area or compartment being heated. • And, such leakage does not present a fire or health hazard. • Class III leaks shall be reported immediately to your supervisor.	Fuel lines inside the heater or the area being heated leak or are damaged. Notify Unit Maintenance for correction.

Table 2-3. Operator Preventive Maintenance Checks and Services for Heater Model UH48-E - Continued

Item No.	Interval	Location: Item to Check/ Service	Procedure	Not Fully Mission Capable if:
6	During	Heater	Check for unusual noises, vibration, excessive Faults appear. cycling, improper combustion, or smoking exhaust.	Faults appear. Notify Unit Maintenance.
7	During	Heater	Check for unusual odors coming from the heater itself, especially the smell of fuel, smoke, or exhaust	The smell of fuel or smoke is present. Notify Unit Maintenance.-
8	Quarterly	Housing Cover Panels and Louver	Check exterior of heater housing, cover panels, and louver for proper installation and secured fasteners. Check for warping or dents.	Cover panels and louver are not secure, or are damaged.
9	Quarterly	Data Plates	Check data plates for illegibility and loose fasteners.	

SECTION III. OPERATION UNDER USUAL CONDITIONS

2-8. ASSEMBLY AND PREPARATION FOR USE .

Installation of the heater and its preparation for use are accomplished by unit maintenance personnel. See following paragraph for initial adjustments, checks, and services.

2-9. INITIAL AD JUSTBMENTS, CHECKS, AND SERVICES.

Perform Before procedures required in Table 2-3.

2-10. OPERATING PROCEDURES.

WARNING

Do not operate this heater in an enclosure unless exhaust fumes are piped outside the enclosure. The fumes contain carbon monoxide, a colorless, odorless, deadly poisonous gas. Failure to provide proper elimination of exhaust fumes will cause severe illness or death.

a. Preparation for Starting.

(1) Perform the preventive maintenance checks an(i services given in Table 2-3.
(2) Adjust the thermostat knob (1, Figure 2-3) to the desired setting.

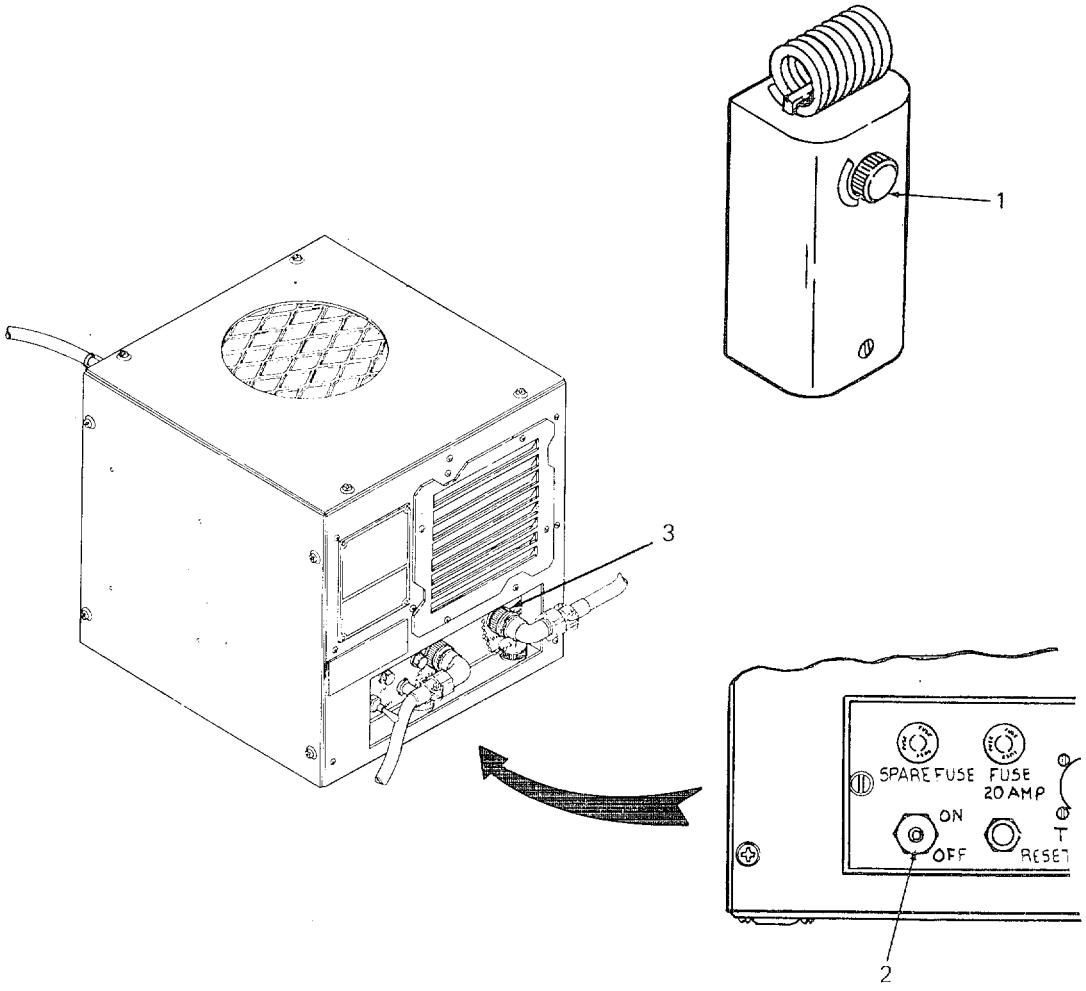


Figure 2-3. Starting and Stopping.

b. Starting Procedure.

(1) Place the ON-OFF switch (2) to the ON position. After an approximate 30 second delay, the heater will start and operate under control from the room thermostat setting, starting and stopping as correct temperature is reached.

(2) While the heater runs, the blower circulates warm air out the louver to the enclosure.

c. Stopping.

(1) To stop the heater, place the ON-OFF switch (2) to OFF position.

CAUTION

Do not disconnect the power cable connector or interrupt the electrical supply to the heater until it shuts down completely.

(2) If the heater is operating at the time of shutdown, the blower motor will continue to run until heater cools down, then motor will shut off. Disconnect power cable connector (3), if required. Heater will not restart until motor shuts off.

2-11. DECAL AND INSTRUCTION PLATES.

Decal and instruction plates are shown on Figure 2-4.

a. ID Plate (1). Identifies nomenclature, NSN, part number, serial number, manufacturer, contract data, serial number, and weight.

b. Instruction Plate (HEATER OPERATION) (2). Describes basic heater operation and heater manufacturer.

c. Caution Label (3). Requires that external electrical power be disconnected prior to servicing the heater.

d. Control Panel (4). Identifies heater controls, fuse locations, external electrical power connector, and external thermostat connector.

e. Fuel Inlet Tag (5). Identifies fuel inlet connector.

f. Wiring Diagram (6). Schematically illustrates the electrical/electronic components and their interconnections.

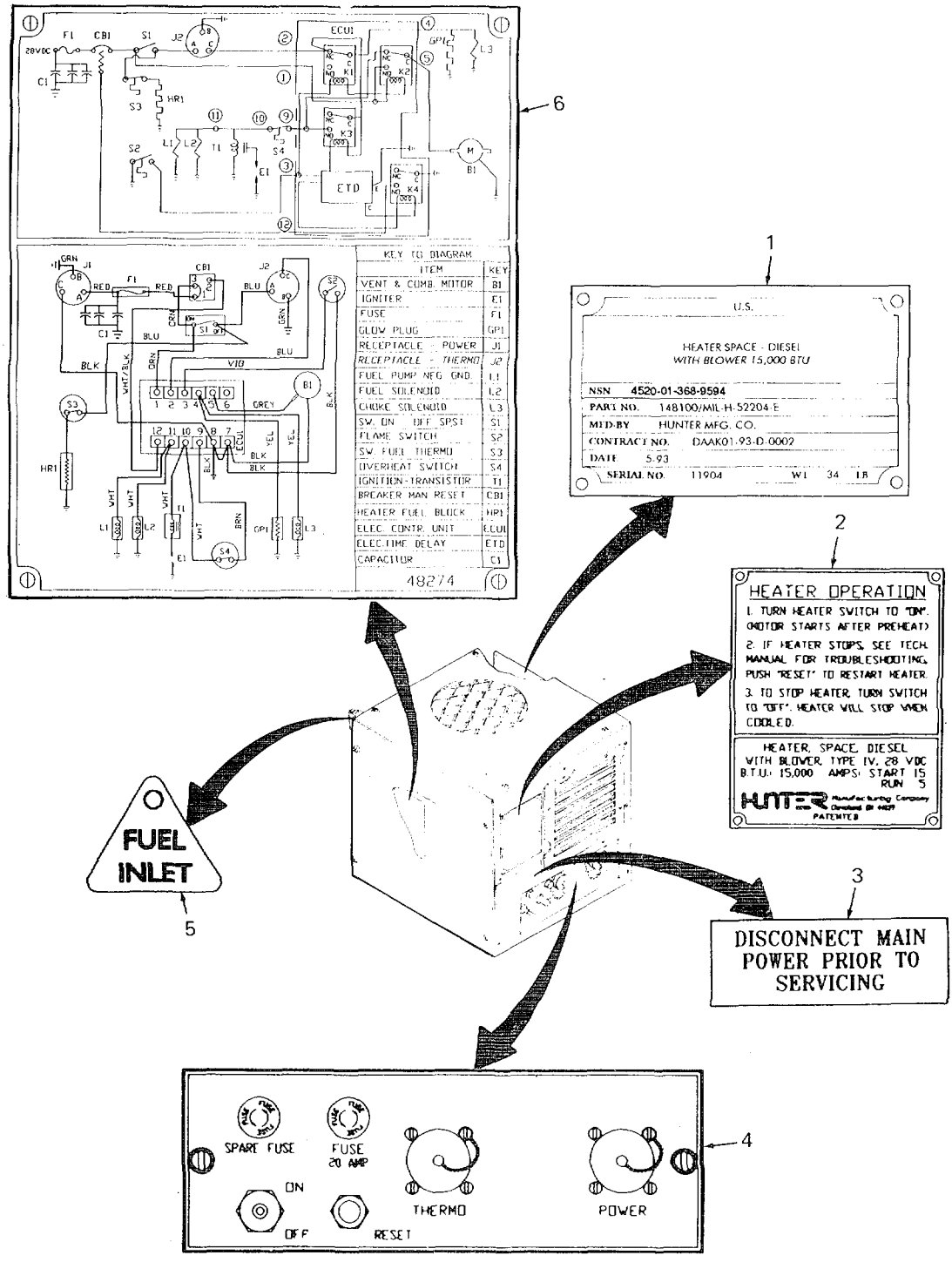


Figure 2-4. Decal and Instruction Plates.

SECTION IV. OPERATION UNDER UNUSUAL CONDITIONS

2-12. OPERATION IN EXTREME COLD (BELOW 10°F [-12.2 ℃]).

a. A thermostatically controlled fuel heater mounted in the carburetor heats the fuel when the temperature drops below 40 ± 60F (4.4 + 3.30C). This preheating of fuel aids combustion and ignition during extremely cold weather.

b. Refer to Table 1-2 for fuel requirements.

c. Take the following steps during extremely cold conditions:

(1) Keep the fuel tank full to prevent condensation of moisture in the tank.

(2) Clean snow and ice from fuel tank filter to keep fuel lines from freezing.

2-13. OPERATION AT HIGH ALTITUDES.

a. The heater will operate at elevations up to 10,000) feet above sea level without special service or adjustment.

b. At 10,000-foot altitude, heat output may be reduced by approximately 15 percent.

2-14. OPERATION UNDER RAINY/HUMID CONDITIONS.

a. Wipe all accessible exposed areas frequently.

b. Paint all chipped or scratched surfaces to prevent rust.

c. Cover the heater when not in use.

2-15. INTERIM NUCLIEAR, BIOLOGICAL, AND CHEMICAL (NBC) DECONTAMINATION PROCEDURES.

NOTE
Detailed decontamination procedures can be found in: FM 3-3, FM 3-4, and FM 3-5.

a. General. The following emergency procedures can be performed until field NBC decontamination facilities are available.

b. Emergency Procedures. If NBC attack is known or suspected, mask at once and continue mission. Do not unmask until told to do so.

(1) Nuclear decontamination. Brush fallout from skin, clothing, and equipment with available brushes, rags, and tree branches. Wash skin and have radiation check made as soon as tactical situation permits.

(2) Biological decontamination. Remain masked and continue mission until told to unmask.

(3) Chemical detection and decontamination.

WARNING

Do not use decontamination spray on personnel. It could cause personal injury.

(a) Determine if liquid agent is present on the surface of the equipment.

(b) If exposure to liquid agent is known or suspected, clean exposed skin, clothing, and personal gear, in that order. Use the buddy system. Wash exposed skin and thoroughly decontaminate as soon as tactical situation permits.

(c) Decontamination procedures take time. Do as much as you can based on the tactical situation.

CHAPTER 3
OPERATOR MAINTENANCE INSTRUCTIONS

SECTION I. LUBRICATION INSTRUCTIONS

Lubrication of the heater is not required.

SECTION II. OPERATOR TROUBLESHOOTING PROCEDURES

3-1. TROUBLESHOOTING.

a. Table 3-1 lists common malfunctions that you may find with your equipment. Perform the tests, inspections, and corrective actions in the order they appear in the table.

b. This table cannot list all the malfunctions that may occur, all the tests and inspections needed to find the fault, or all the corrective actions needed to correct the fault. If the equipment malfunction is not listed or actions listed do not correct the fault, notify your supervisor.

MALFUNCTION INDEX

Table 3-1. Operator Troubleshooting

HEATER FAILS TO START

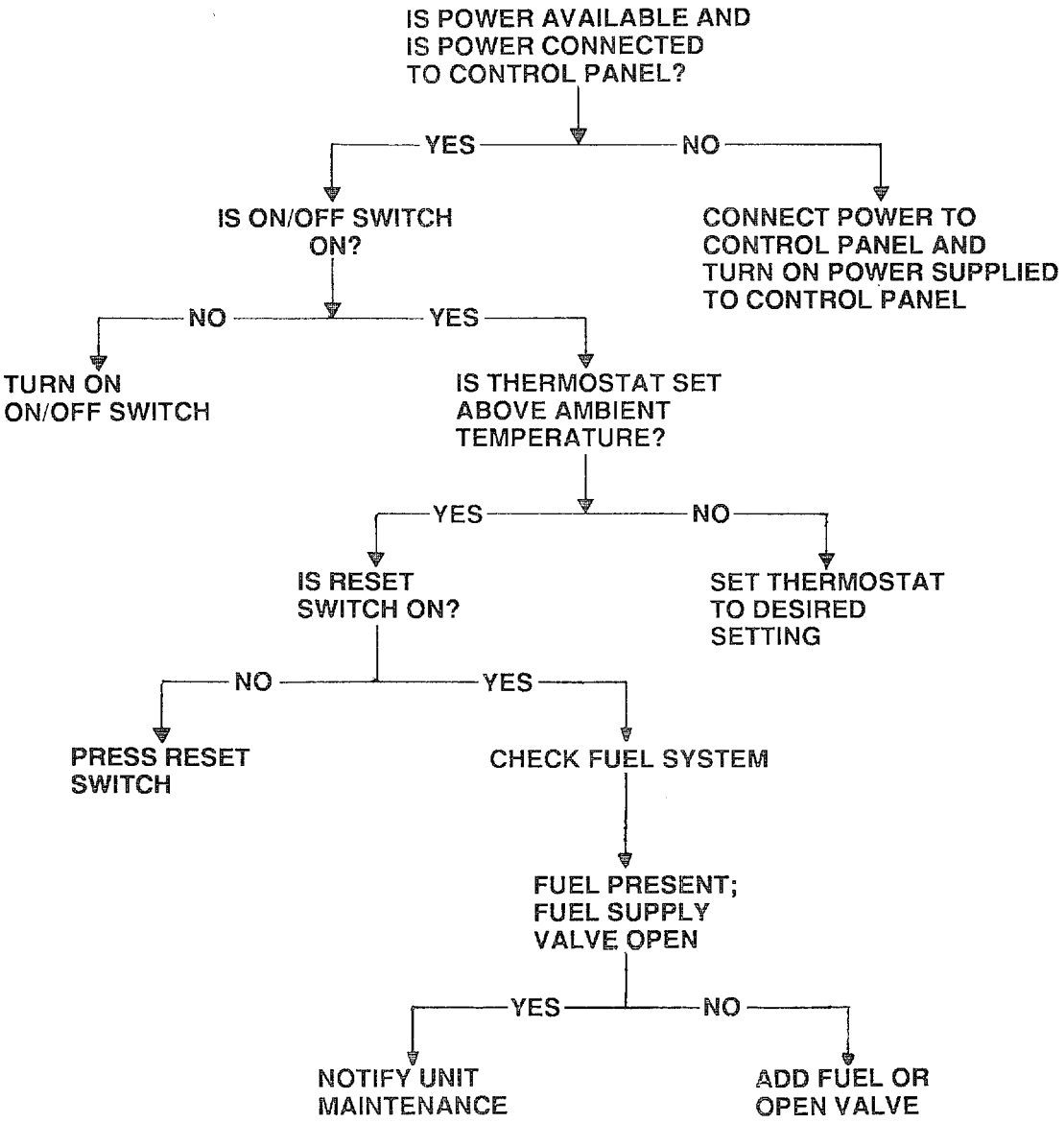
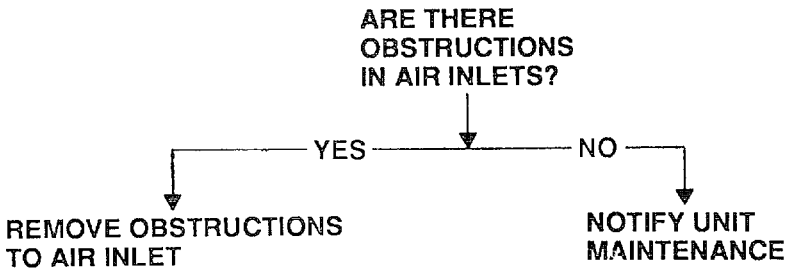


Table 3-1. Operator Troubleshooting - Continued

ERRATIC OPERATION OR HEATER SMOKES	**NO OPERATOR ADJUSTMENT. NOTIFY UNIT MAINTENANCE.**
HEATER OVERHEATS AND SHUTS OFF	

SECTION III. OPERATOR MAINTENANCE PROCEDURES

3-2. GENERAL.

Operator maintenance is limited to inspections and services identified in Table 2-3.

CHAPTER 4
UNIT MAINTENANCE INSTRUCTIONS

SECTION I. SERVICE UPON RECEIPT

4-1. UNPACKING.

There are no special unpacking procedures for this heater. Be careful when unpacking to prevent damage. Verify contents of the package to ensure all items are accounted for. Save packing container for reuse.

4-2. PROCESSING UNPACKED EQUIPMENT.

Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on SF 368, Product Quality Deficiency Report.

4-3. INSPECTION OF INSTALLED COMPONENTS.

Remove the top and side covers (para 4-10) for access to the heater components. Inspect the heater components to determine if any components are damaged, deteriorated, or incomplete to the extent that the components should be replaced or repaired.

4-4. INSTALLATION INSTRUCTIONS.

WARNING

Do not locate heater where expelled exhaust fumes can be recirculated into inlet air openings of the heater space. Inhalation of exhaust fumes can cause serious illness or death.

NOTE

No special tools are required for installation.

a. Location.

(1) Locate the heater near an outside wall so the exhaust can be piped to the outside with a short direct run (Figure 4-1). The total length of the horizontal run of the exhaust pipe should not exceed 6 feet.

(2) Position the heater at approximately the same level as the fuel source. It should never be positioned more than 7 feet above the fuel source.

(3) Provide clearances indicated in Figure 4-2 to permit proper air circulation.

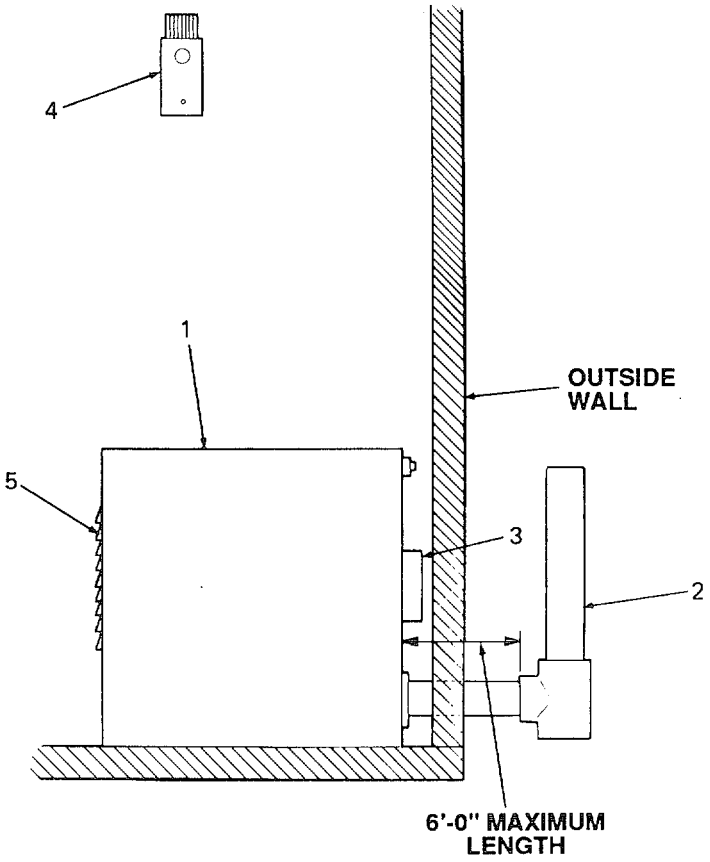


Figure 4-1. Typical Exhaust Connection.

b. Installation.

(1) See Figure 4-1. Secure heater (1) to base of floor (or wall) using 1/2-20 bolts of suitable length.

WARNING

Do not operate your space heater in an enclosed area unless exhaust gases are piped to the outside. Inhalation of exhaust fumes will result in serious illness or death.

CAUTION

During operation, exhaust pipe becomes hot enough to cause combustion of wood or other flammable building materials. Provide adequate fireproofing insulation between the exhaust pipe and wall to prevent fire.

(2) Connect an exhaust pipe (2) from the heater to the outside of the enclosure. Seal exhaust pipe with anti-seize compound (Item 1, Appendix E).

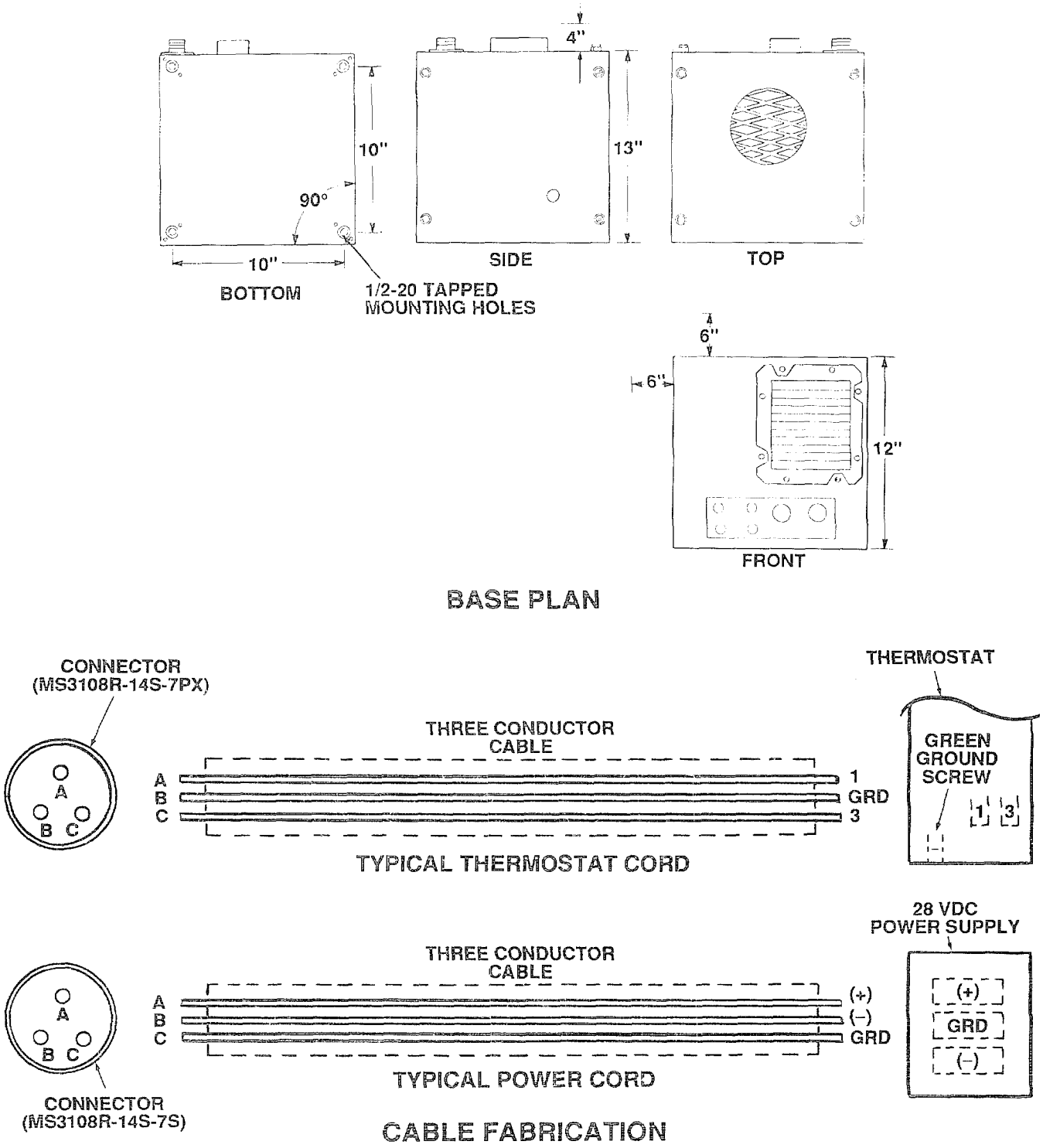


Figure 4-2. Base Plan and Typical Cable Fabrication.

WARNING

Oxygen depletion within a tightly sealed compartment could cause dizziness and headaches and may lead to flame loss within heater.

(3) When the heater is operated in a tightly constructed enclosure, which restricts air flow, it is recommended that combustion air be connected from an external source to the rain-shield inlet (3). Combustion air piping is necessary to prevent depletion of oxygen in a tight enclosure.

NOTE

An L-shaped cover is attached to the rain shield assembly with six screws. Depending on its installed position, it can be used to block off either the bottom of the rain shield or the hole for the attachment of combustion air piping. Rotate the cover as needed for this particular installation.

(4) Mount and connect the room thermostat (4) to the heater as follows:

(a) Select a thermostat mounting site. Use the following rules when selecting a site:

- Select a well-insulated inside wall.
- Select a site that will allow for easy access and good visibility.
- Select a site that is out of direct sunlight.
- Select a site that is free from drafts and that will not be in line with combustion air inlet (3) or heated air discharge flow (5).

(b) Remove thermostat cover and mount them thermostat (4) vertically as shown in Figure 4-1.

(c) Measure the distance from heater control panel.

- If required cable length is 20 feet or less, select three wire cable (MIL-C-27072, or equivalent) having 14-gage conductors.
- If required cable length is more than 20 feet, select three wire cable (MIL-C-27072, or equivalent) having 12-gage conductors.

(d) See Figure 4-2. Wire connector and thermostat as shown.

(e) Thread connector onto control panel THERMO connector.

(5) Prepare a DC power cord using three-wire cable and a DC connector. The B terminal must be negative (-) and the A terminal must be positive (-). Connect the ground to C terminal. See Figure 4-2.

(6) Connect the power cord to the power source and to the control panel POWER receptacle.

c. Preliminary Servicing and Adjustment of Heater.

(1) Make sure the fuel supply is adequate for checks and adjustments.

(2) Set the room thermostat knob to less than the enclosure ambient temperature.

(3) Set the ON-OFF switch on control panel to ON. The heater must not. start. Place ON-OFF switch to OFF.

(4) Set the thermostat to a temperature above enclosure room temperature.

(5) Set the ON-OFF switch to ON. After an approximate 30 second delay the heater will start. Check that the blower operates and the heater circulates warm air.

(6) Check that the exhaust does not smoke and check heater for erratic operation. If heater smokes or operates erratically, adjust the carburetor.

(a) See Figure 4-3. For smoke, adjust the fuel needle (1) on carburetor 1/8 turn clockwise to reduce fuel flow.

(b) If smoking persists, turn fuel needle an additional 1/8 turn clockwise. Allow to run for one minute and observe heater operation.

(c) Continue to turn fuel needle 1/8 turn clockwise until heater performs satisfactorily. When heater is burning smoothly, there should be little or no smoke from the exhaust.

(d) If heater operates erratically or improperly, turn fuel needle (1) 1/8 turn counterclockwise to increase fuel flow. Allow to run for one minute and observe heater operation. If necessary, continue to turn fuel needle 1/8 turn counterclockwise until heater operates satisfactorily.

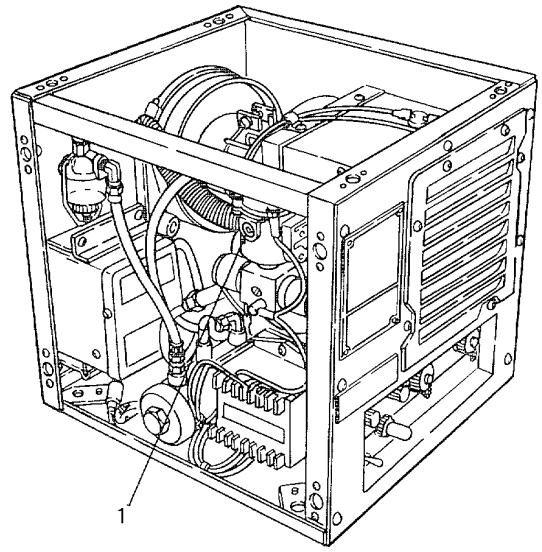


Figure 4-3. Adjusting Carburetor.

SECTION II. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

4-5. GENERAL.

This section lists the preventive checks and services to be performed quarterly by Unit Maintenance personnel. Refer to Operator PMCS paragraphs 2-3 through 2-5 for an explanation of PMCS procedures.

4-6. PMCS TABLE.

Table 4-1 provides a listing of PMCS to be performed by Unit personnel. It includes the following:

a. Item Number Column. This column is a list of every check and service task in the PMCS. They are numbered in logical order of performance regardless of the interval. This column is to be used as a source of item numbers for the TM Number Column on DA Form 2404, Equipment Inspection and Maintenance Worksheet, in recording results of PMCS.

b. Interval Column. This column indicates the interval at which a specific item needs to be checked or serviced.

c. Item To Be Checked or Serviced Column. This column provides the name of the item to be checked or serviced.

d. Procedure Column. This column describes the procedures used to check or service an item. It includes all the information required to perform the checks or services.

e. Not Fully Mission Capable If: Column. This column indicates conditions under which the heater is not capable of performing its intended mission.

4-7. LEAKAGE DEFINITIONS FOR UNIT PMCS.

It is necessary for you to know how fuel leaks affect the status of the heater. Following are classes of leaks you need to know to determine the operational status of the heater. Learn these leakage class definitions. Remember-when in doubt, notify your supervisor.

WARNING

Leakage may present a fire and/or health hazard. No leakage of any type is permitted within the heater. No leakage of any type is permitted within the area or compartment being heated.

NOTE

Heater operation is allowed if:

- Class I or Class II leaks occur in fuel supply lines external to the heater and the area or compartment being heated.
- And, such leakage does not present a fire or health hazard.
- Class III leaks shall be reported immediately to your supervisor.

a. CLASS I-Slight seepage of fuel, but not great enough to form a drop. Indicated by slight wetness or discoloration.

b. CLASS II-Seepage of fuel great enough to form drops but not great enough to cause drops to drip from the item being checked.

c. CLASS III-Leakage of fuel great enough to form drops that fall from the item being checked.

Table 4-1. Unit Preventive Maintenance Checks and Services

NOTE

If the equipment must be kept in continuous operation, do only the procedures that can be done without disturbing operation. Make complete checks and services when the equipment is shut down.

Item No.	Interval	Item To Be Checked or Serviced	Procedure	Not Fully Mission capable If:
1	Quarterly	Control Panel	Check that the ON-OFF switch and RESET switch are operational. Check if fuse is good. Inspect POWER and THERMO connectors for serviceability and proper connections.	Components on control panel are not operational.
2	Quarterly	Rain Shield	Check that rain shield is properly mounted and has no obstructions to air inlet.	Air inlet is obstructed.
3	Quarterly	Fuel Strainer	Check for dents, cracks, or leaks. Service fuel strainer (para 4-15). Replace fuel strainer (para 4-15).	Strainer leaks.
4	Quarterly	Fuel Pump	Check for loose mounting leaks, and faulty operation. Check for cracks or damaged wires or connector. Service fuel pump (para 4-16). Replace fuel pump (para 4-16).	Fuel pump leaks, is damaged, or does not operate properly.
5	Quarterly	Carburetor	Check carburetor for leaks. Tighten loose connections and fittings. Adjust per para 4-4. c. (6). If carburetor requires replacement, refer heater to Direct Support Maintenance.	Carburetor leaks or cannot be adjusted.
6	Quarterly	Igniter	Check igniter cable for serviceability. Remove and clean igniter (para 4-18). Check for burned electrode or stripped threads. Replace if defective (para 4-18).	Igniter cable is damaged or igniter is unserviceable.
7	Quarterly	Glow Plug	Remove glow plug and check for broken heater element, cracked insulator, or damaged threads. Replace a defective glow plug (para 4-19).	Glow plug is unserviceable.

Table 4-1. Unit Preventive Maintenance Checks and Services - Continued

Item No.	Interval	Item To Be Checked or Serviced	Procedure	Not Fully Mission capable If:
8	Quarterly	Air Duct Hose	Check for cracks or holes. Replace a defective hose (para 4-20). Inspect clamp. Replace if damaged (para 4-20).	Hose or clamp is damaged.
9	Quarterly	Room Thermostat	Check for loose terminals or restricted movement of knob. Replace per (para 4-25)	Room thermostat is defective.
10	Annually	Motor Brushes	Remove brushes and inspect for cracks, broken rings, distorted springs, and wear. Replace if defective (para 4-21).	Brushes are defective.

SECTION III. UNIT TROUBLESHOOTING

4-8. INTRODUCTION TO TROUBLESHOOTING.

This troubleshooting procedure allows Unit Maintenance personnel to isolate and remedy equipment faults and return the equipment to operational status. See Table 4-2.

WARNING

The heater ignition system contains dangerous voltages which can cause severe electrical shock. Be extremely careful when troubleshooting while heater is connected to power source. Always disconnect power when making continuity checks.

MALFUNCTION INDEX

Table 4-2. Unit Troubleshooting

HEATER FAILS TO START - NO FLAME, NO BLOWER

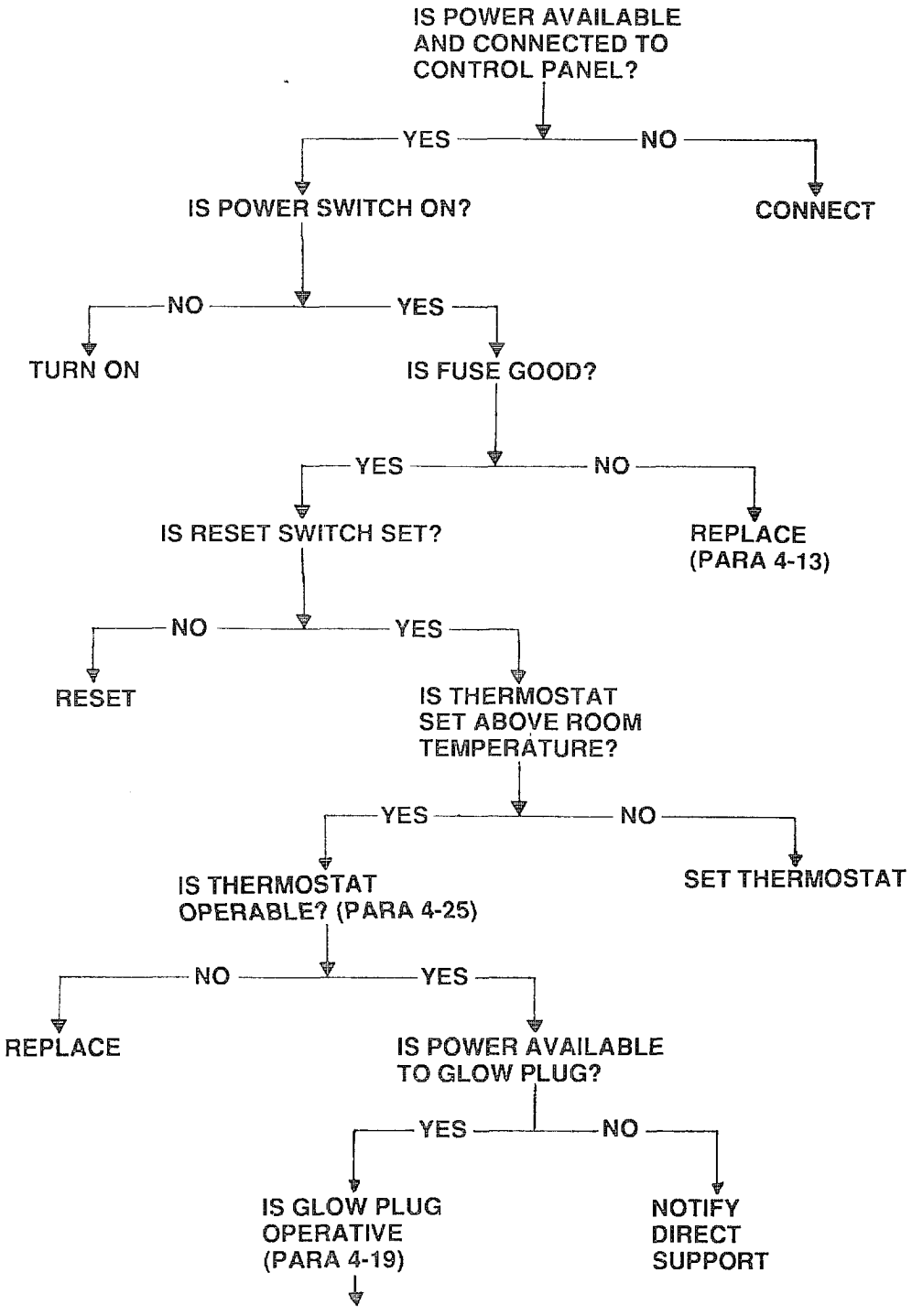


Table 4-2. Unit Troubleshooting - Continued

HEATER FAILS TO START - NO FLAME, NO BLOWER - CONTINUED

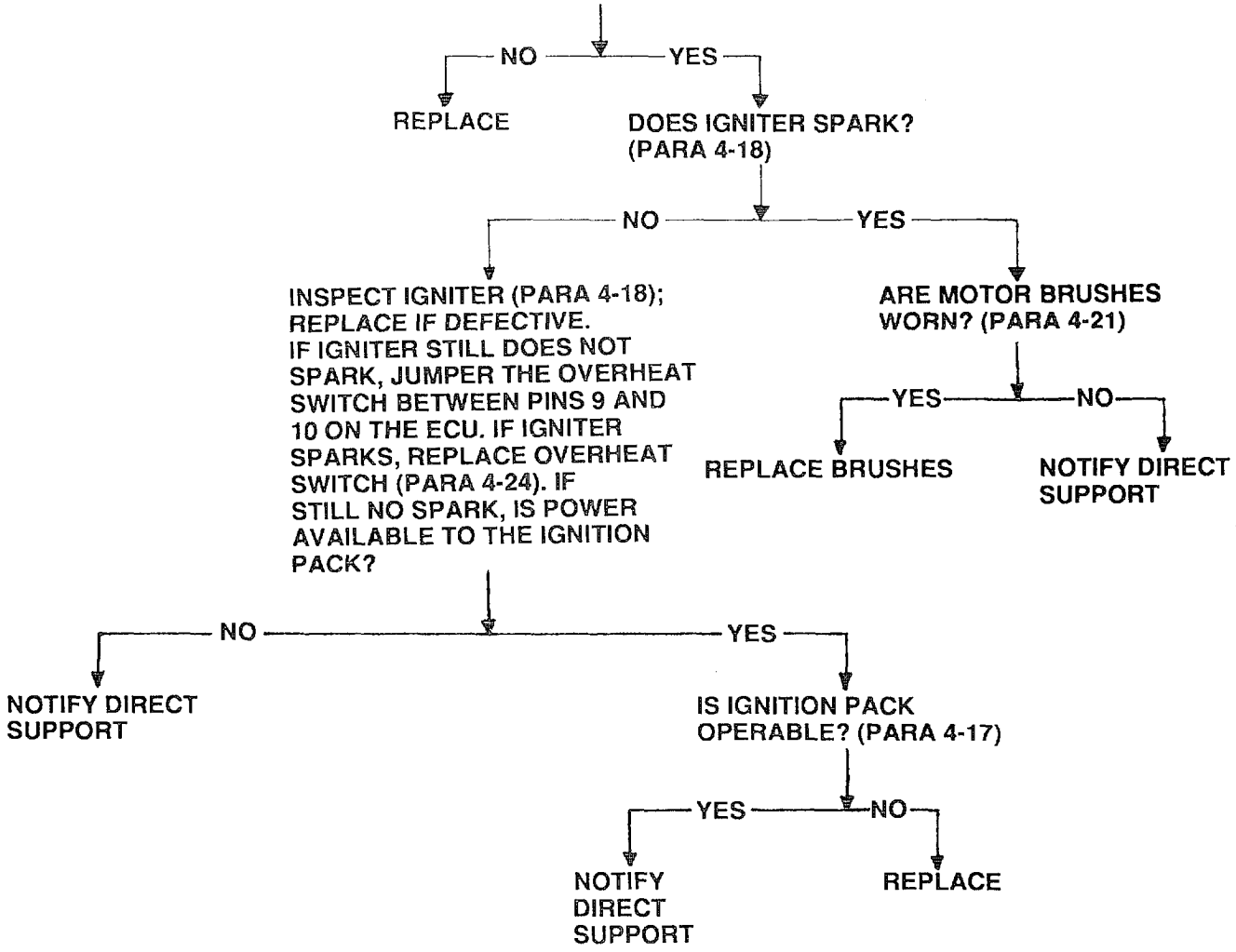


Table 4-2. Unit Troubleshooting - Continued

**HEATER FAILS TO STAR-
BLOWER RUNS FOR A SHORT
TIME THEN STOPS**

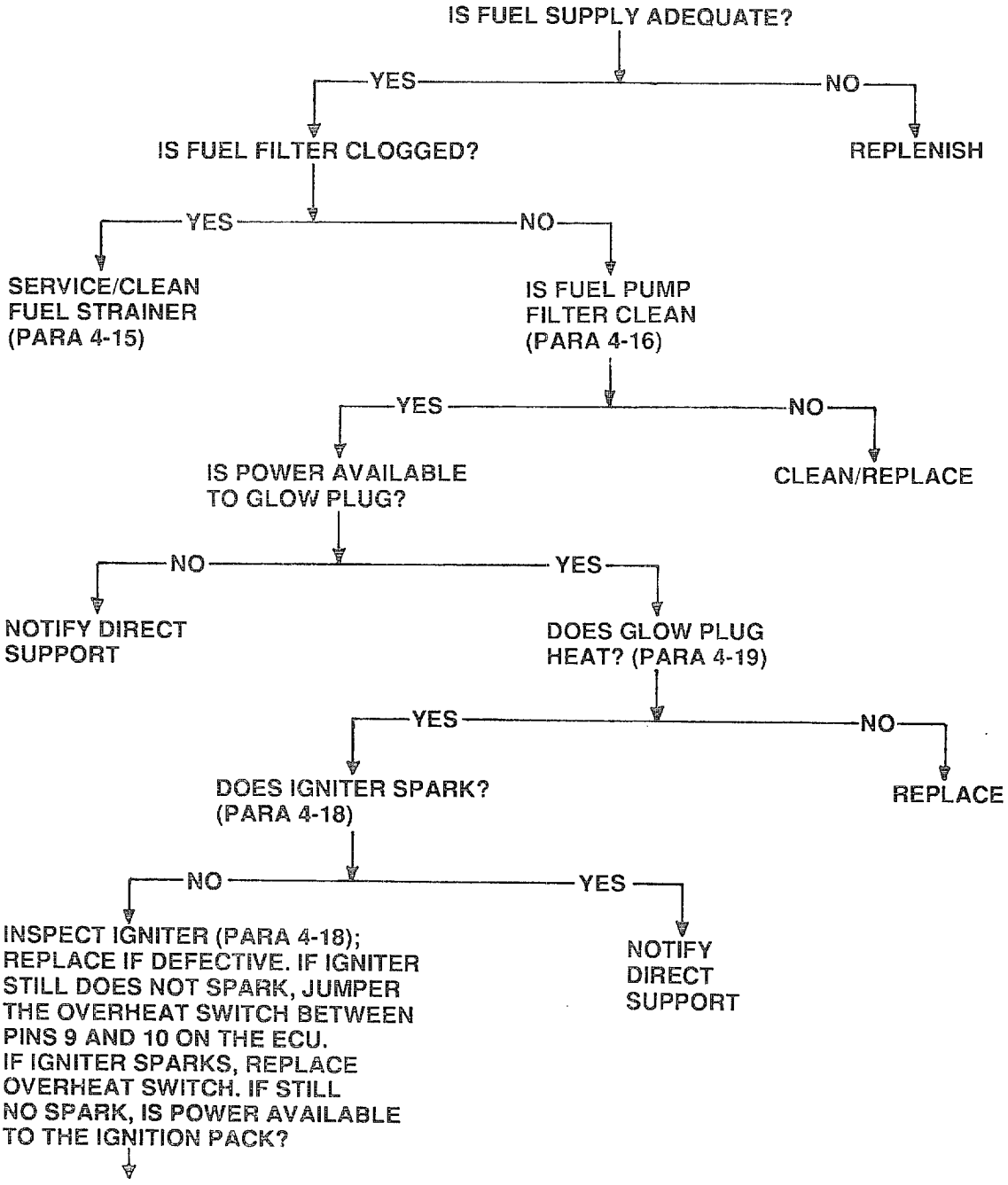
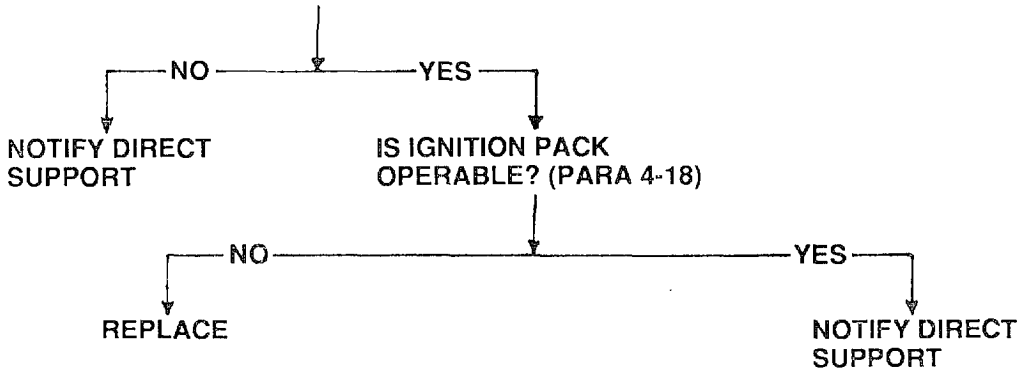


Table 4-2. Unit Troubleshooting - Continued

HEATER FAILS TO START-BLOWER RUNS FOR A SHORT TIME THEN STOPS - CONTINUED



HEATER SMOKES OR BACKFIRES

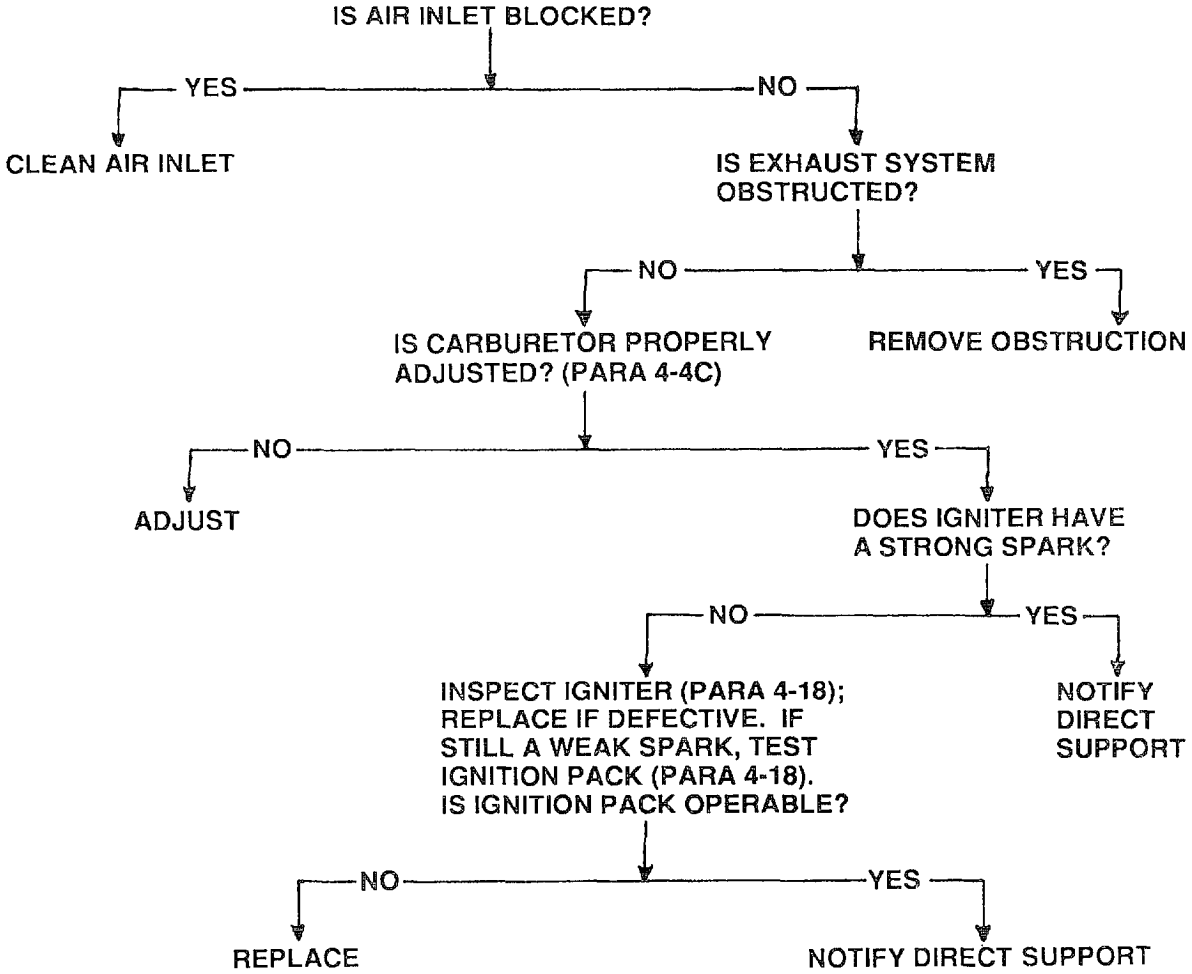
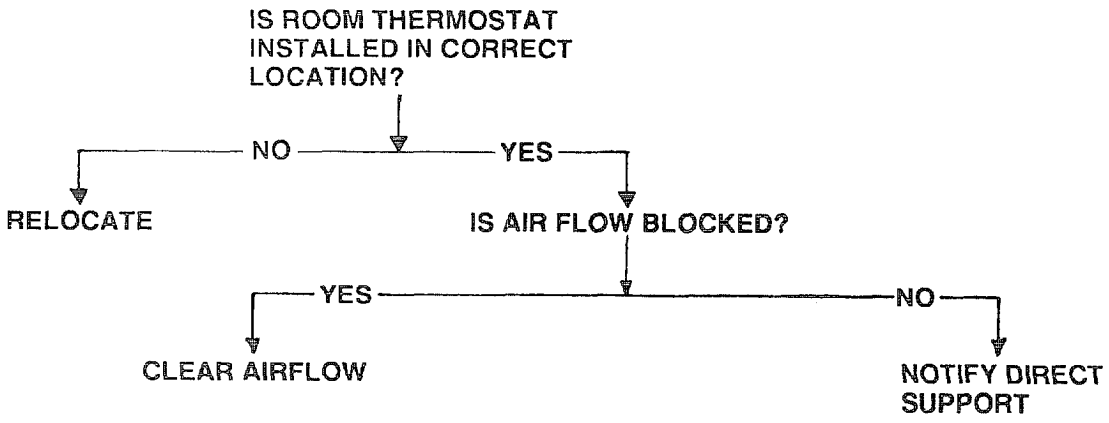


Table 4-2. Unit Troubleshooting - Continued

HEATER CYCLES ON-OFF EXCESSIVELY



SECTION IV. UNIT MAINTENANCE PROCEDURES

4-9. INTRODUCTION.

Instructions for removal and replacement of installed components are listed in a logical removal sequence as prescribed by the Maintenance Allocation Chart (MAC). Procedures will include (as applicable) disassembly, cleaning, inspection, reassembly, installation, and testing to return the heater to an operational condition.

NOTE

Because this heater is used in many different installation configurations, power, fuel, exhaust, and ductwork connections vary. Disconnect as required.

4-10. COVER PANELS

This task covers: a. Removal b. Installation

INITIAL SETUP

Tools

Tool Kit, Service Refrigeration Unit
(Item 1, Appendix B, Section III)

Equipment Condition

Power disconnected and fuel supply turned off.

General Safety Instructions

WARNING

The ignition system of this heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect power before any maintenance actions.

REMOVAL (Figure 4-4)

1. Turn four camloc studs (1) on each cover 1/4 turn counterclockwise to release top cover (2) and side cover (3).
2. Remove covers from heater.
3. Remove camloc studs.

INSTALLATION

1. Install camloc studs.
2. Position top cover (2) and side cover (3) on the heater.
3. Secure by turning the four studs (1) 1/4 turn clockwise.

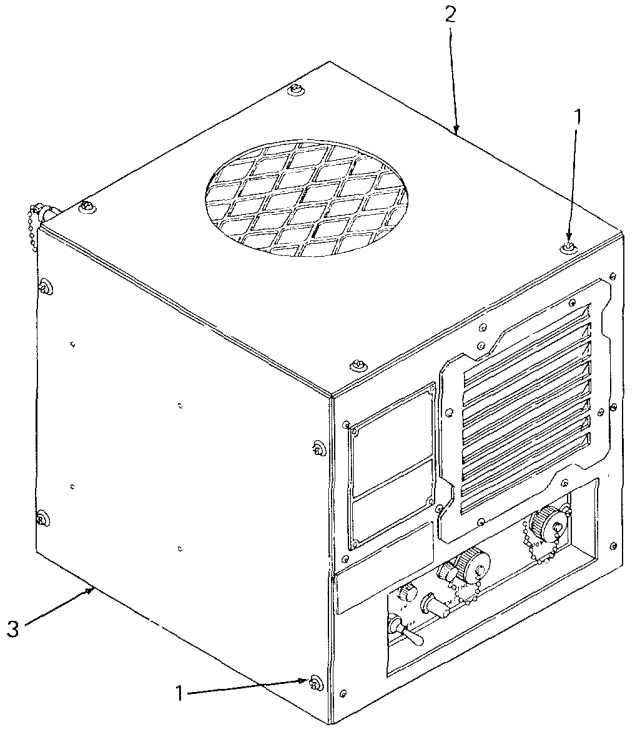


Figure 4-4. Replacing Cover Panels.

4-11. LOUVER

This task covers: a. Removal b. Installation

INITIAL SETUP

Tools

Tool Kit, Service Refrigeration Unit
(Item 1, Appendix B, Section III)

Equipment Condition

Power disconnected and fuel supply turned off.

General Safety Instructions

WARNING

The ignition system of this heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect power before any maintenance actions.

REMOVAL

Remove four screws (1) securing louver (2) to front plate (3). Remove louver from heater.

INSTALLATION

NOTE

The louver can be rotated to any of four positions to direct the air flow.

Position louver (2) on front plate (3) in the desired position for air flow. Secure with four screws (1).

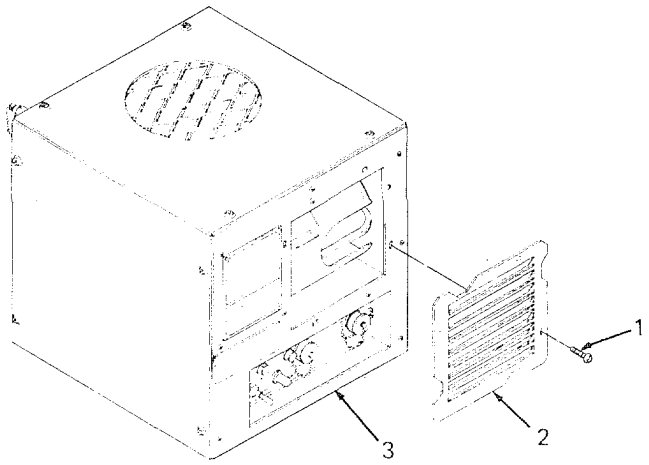


Figure 4-5. Replacing Louver.

4-12. DATA PLATES

This task covers: a. Removal b. Installation

INITIAL SETUP

Tools

Tool Kit, Service Refrigeration Unit
(Item 1, Appendix B, Section III)
Shop Set, Automotive Vehicle
(Item 3, Appendix B, Section III)
Riveter, Blind, Hand
(Item 4, Appendix B, Section III)

Material/Parts

Rivets
(Items 10, 11, and 12, Appendix H)

Equipment Condition

Power disconnected and fuel supply turned off.

Side covers removed (para 4-10).

General Safety Instructions

WARNING

The ignition system of this heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect power before any maintenance actions.

REMOVAL (Figure 4-6)

1. WIRING DIAGRAM.
Using a .125-inch diameter drill bit, drill out the four old rivets (2) and remove the wiring diagram (1).

2. INSTRUCTION PLATE.

a. Remove 11 screws (3) securing front plate (4) to the heater case and turn two camloc studs (10) 1/4 turn counterclockwise to release control panel (11).

b. Using a . 125-inch diameter drill bit, drill out the four old rivets (5) and remove instruction plate (6).

3. CAUTION LABEL.

Remove label (7) from front plate (4) by peeling it off.

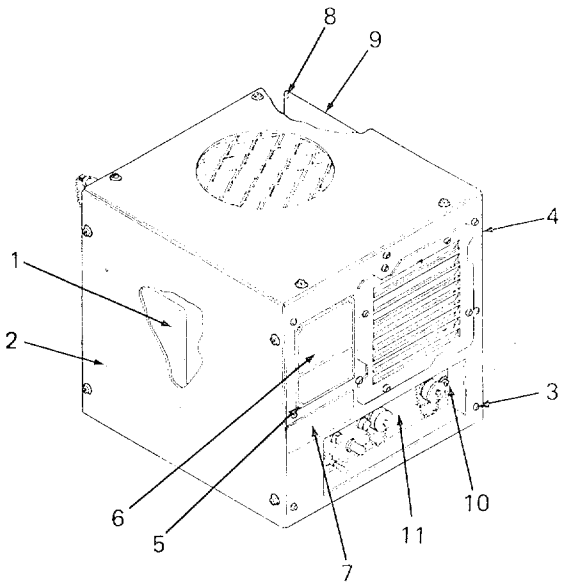


Figure 4-6. Replacing Data Plates.

4-12. DATA PLATES - CONTINUED

4. IDENTIFICATION PLATE.

CAUTION

Take care not to drill into parts inside heater.

NOTE

You may have to remove heater from its installation for access to this data plate.

Using a .125-inch diameter drill bit, drill out the four old rivets (8) and remove identification plate (9).

INSTALLATION

1. IDENTIFICATION PLATE.

   Install identification plate (9) using four rivets (8).

2. CAUTION LABEL.

   Install caution label (7) to front plate (4).

3. INSTRUCTION PLATE.

   a. Install instruction plate (6) and secure with four rivets (5).

   b. Install control panel (11) on front plate (4) using two camloc studs (10).

   c. Install front plate (4) to heater case with 11 screws (3).

4. WIRING DIAGRAM.

   Install wiring diagram (1) to side cover. Secure with four rivets (2).

5. Install side covers (para 4-10).

4-13. FUSE

This task covers: a. Removal b. Installation c. Testing

INITIAL SETUP

Tools

Tool Kit, Service Refrigeration Unit
(Item 1, Appendix B, Section III)

Equipment Condition

Power disconnected and fuel supply turned off.

General Safety Instructions

WARNING

The ignition system of this heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect power before any maintenance actions.

REMOVAL (Figure 4-7)

1. Push in on the cap (1) of fuse holder (3) and rotate cap counter-clockwise to remove.
2. Remove fuse (2) from fuse holder (3) and check for continuity using multimeter.
3. Replace defective fuse.

INSTALLATION

Install good 20 amp fuse (2) in fuse holder (3). Install cap (1) and secure by turning clockwise.

TESTING

1. Connect the power plug and turn on the fuel supply.
2. Start the heater (para 2-10) and check for correct heater operation.

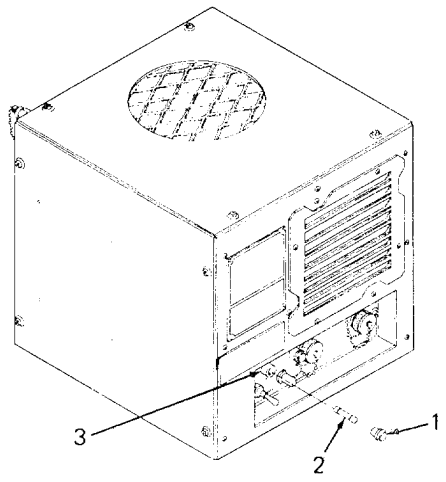


Figure 4-7. Replacing Fuse.

4-14. RAIN SHIELD

This task covers: a. Removal b. Inspection c. Installation

INITIAL SETUP

Tools

Tool Kit, Service Refrigeration Unit
(Item 1, Appendix B, Section III)

Equipment Condition

Power disconnected and fuel supply turned off.

General Safety Instructions

WARNING

The ignition system of this heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect power before any maintenance actions.

REMOVAL (Figure 4-8)

1. Remove six screws (1) securing rain shield cover (2) to rain shield (3). Remove cover.
2. Remove four nuts (4) from studs securing rain shield (3) to back heater case. Remove rain shield from heater.

INSPECTION

Inspect rain shield and cover for damage, make sure rain shield can be secured, and the cover can be installed upside down.

INSTALLATION

1. Install rain shield (3) to studs on heater case and secure with four nuts (4).
2. Install rain shield cover (2) and secure with six screws (1).

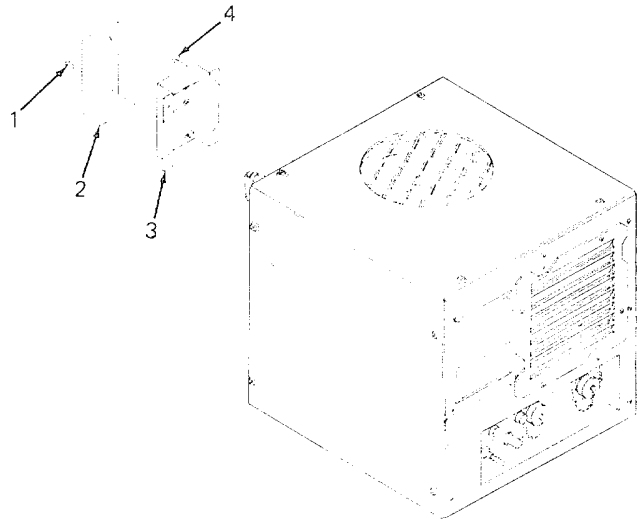


Figure 4-8. Replacing Rain Shield.

4-15. FUEL STRAINER

This task covers: a. Service b. Removal c. Cleaning d. Installation e. Testing

INITIAL SETUP

Tools

Tool Kit, Service Refrigeration Unit
(Item 1, Appendix B, Section III)

Material/Parts

Gasket
(Item 6, Appendix H)
Dry cleaning solvent
(Item 6, Appendix E)
Sealing compound
(Item 10, Appendix E)
Rags
(Item 9, Appendix E)

Equipment Condition

Power disconnected and fuel supply turned off.
Top and side covers removed (para 4-10).

General Safety Instructions

WARNING

The ignition system of this heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect power before any maintenance actions.

WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent is potentially dangerous to personnel. Do not use near open flame or excessive heat. Flash point is 140°F (60°C).

SERVICE (Figure 4-9)

1. While holding the fuel bowl (3) in place, loosen nut (l) until bowl holder (2) can be swung aside.
2. Remove fuel bowl (3). Safely (dispose of any fuel remaining in bowl.
3. Remove gasket (4) and screen (5).
4. Clean bowl (3) and screen (5) with dry cleaning solvent (Item 6, Appendix E) and allow to dry thoroughly.
5. Install screen (5), a new gasket (4), and bowl (3). Swing bowl holder (2) and nut (1) in place under bowl.
6. Engage nut (1) in the bowl notch and tighten hand tight.

4-15. FUEL STRAINER- CONTINUED

TESTING

1. Connect power plug and turn on the fuel supply.
2. Start the heater (para 2-10) and check for fuel leaks. If there are no leaks and heater operation is satisfactory, shut off heater.

REMOVING STRAINER

1. See Figure 4-10. Remove 7-inch hose (1) from elbow (2). Remove elbow from strainer (3).
2. Remove two screws (6) that attach bulkhead fitting (5), data plate (7), and cap chain (8) to heater case.
3. Remove assembled bulkhead fitting (5) and strainer (3).
4. Unthread strainer from nipple (4). If nipple comes off with the strainer, remove the nipple. If necessary, remove nipple (4) from bulkhead fitting (5).

CLEANING

Clean all metal parts in dry cleaning solvent (Item 6, Appendix E) and allow to dry thoroughly before assembly.

INSPECTION

Inspect all parts for cracks, worn spots, restrictions of fuel through metal strainer, and damaged threads. Replace damaged parts.

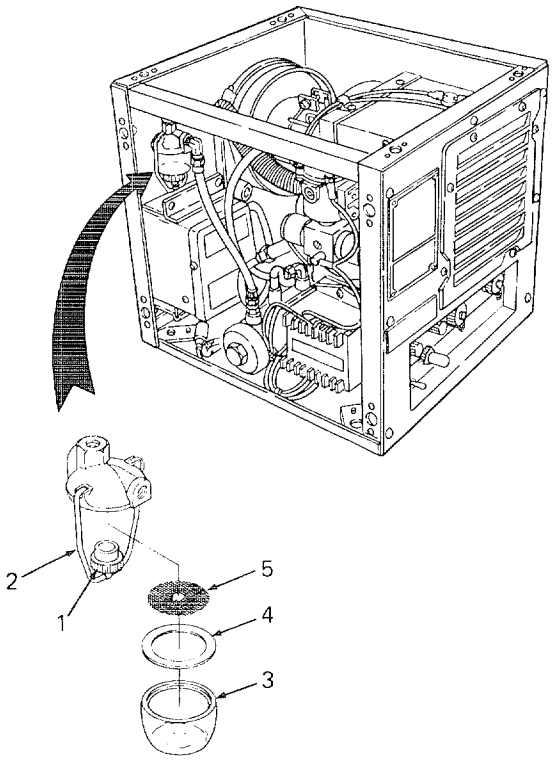


Figure 4-9. Servicing Fuel Strainer.

4-15. FUEL STRAINER- CONTINUED

INSTALLATION

1. See Figure 4-10. If necessary, install nipple (4) into bulkhead fitting (5). Tighten securely.
2. Thread strainer (3) onto installed nipple (4). Tighten securely, noting desired installed position shown in Figure 4-10.
3. Attach assembled bulkhead fitting (5) and strainer (3), along with data plate (7) and cap chain (8), to the heater case with screws (6). Tighten screws securely. Make sure strainer is positioned as shown in Figure 4-10. Adjust as needed.
4. Install elbow (2) into strainer (3). Tighten elbow securely and position as shown in Figure 4-10.
5. Install 7-inch hose (1) onto elbow (2) and tighten securely.

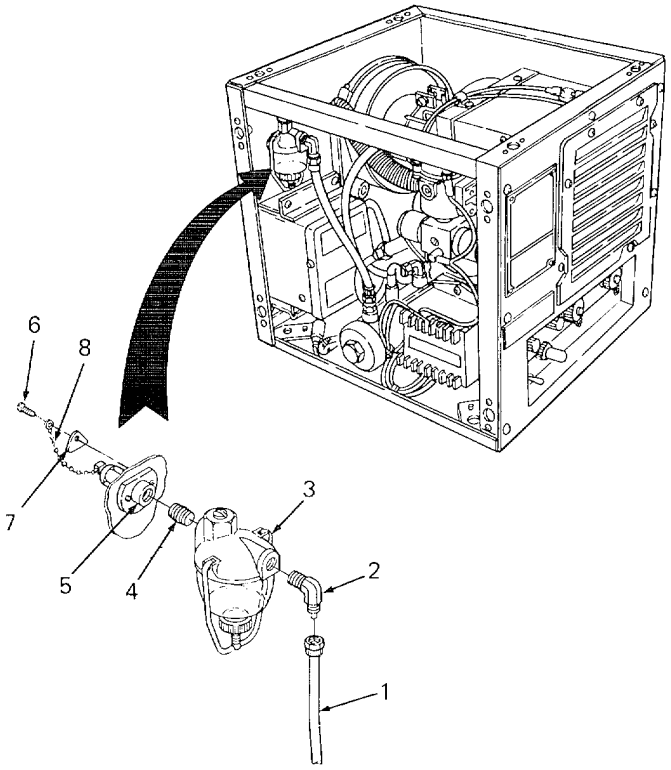


Figure 4-10. Replacing Fuel Strainer.

TESTING

1. Reconnect the power plug.
2. Start the heater (para 2-10) and check for fuel leaks. If leaks occur, stop the heater and correct the leaks. Restart heater; when operation is satisfactory, stop heater.

4-16. FUEL PUMP

This task covers: a. Removal b. Cleaning c. Installation d. Testing

INITIAL SETUP

Tools

Tool Kit, Service Refrigeration Unit
(Item 1, Appendix B, Section III)

Material/Parts

Gasket
(Item 6, Appendix H)
Soft-bristle brush
(item 2, Appendix E)
Dry cleaning solvent
(Item 6, Appendix E)
Sealing compound
(Item 10, Appendix E)
Rags
(Item 9, Appendix E)

Equipment Condition

Power disconnected and fuel supply turned off.
Top and side covers removed (para 4-10).

General Safety Instructions

WARNING

The ignition system of this heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect power before any maintenance actions.

WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent is potentially dangerous to personnel. Do not use near open flame or excessive heat. Flash point is 140°F (60°C).

CAUTION

Have rags available to catch fuel when fuel pump cover is removed.

REMOVAL OF FUEL PUMP FILTER (Figure 4-11)

Turn fuel pump cover (1) counterclockwise and remove cover, gasket (2), magnet (3), and filter (4) from fuel pump body (5).

CLEANING FILTER

Clean filter (4) with dry cleaning solvent (Item 6, Appendix E) and a soft-bristle brush (Item 2, Appendix E). Allow to dry thoroughly. Replace filter if it cannot be cleaned.

4-16. FUEL PUMP - CONTINUED

INSTALLATION

CAUTION

Install filter into pump body with larger opening toward cover. Reverse installation can cause damage to equipment.

Install filter (4), magnet (3), new gasket (2), and cover (1) to fuel pump body (5). Secure by turning cover (1) clockwise.

TESTING

1. Connect the power plug and turn on the fuel supply.
2. Start the heater (para 2-10) and check for fuel leaks. If there are no leaks and heater operation is satisfactory, shut off heater.

REPLACING FUEL PUMP (Figure 4-12)

1. Disconnect power plug and shut off fuel supply.
2. Disconnect 7-inch hose (1) from elbow (2) on strainer (3), and from male connector (4) on fuel pump (5). Disconnect 11. 5-inch hose (6) from elbow (7) on fuel pump (5), and from carburetor (8). Replace damaged hoses (1 and 6), if necessary. Fabricate hoses as needed (Figure 1, Appendix F).

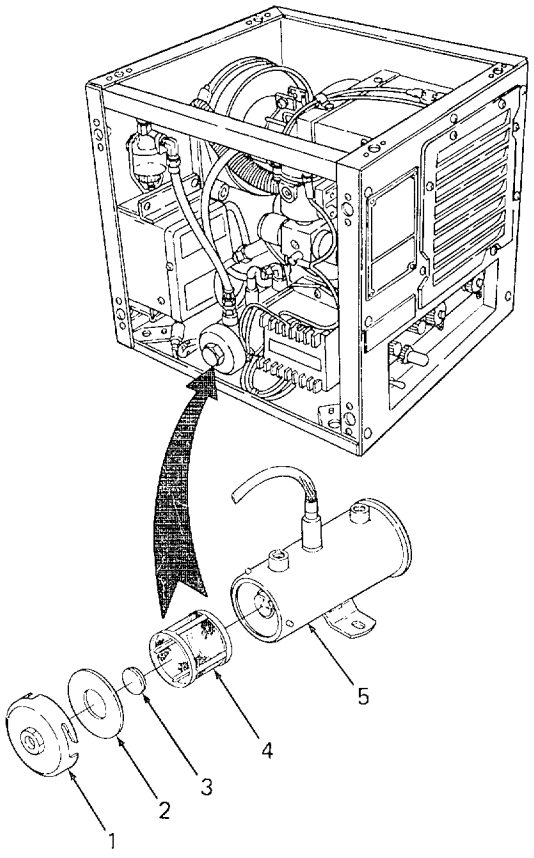


Figure 4-11. Servicing the Fuel Pump.

NOTE

Tubing ferrule and caps come with connectors and elbows. If connectors and elbows presently installed are in good condition, new connectors and elbows need not be used.

NOTE

If fuel pump is replaced, remove elbow and connector from the old pump and install on new pump. If old pump is reused, replace filter and gasket.

4-16. FUEL PUMP - CONTINUED

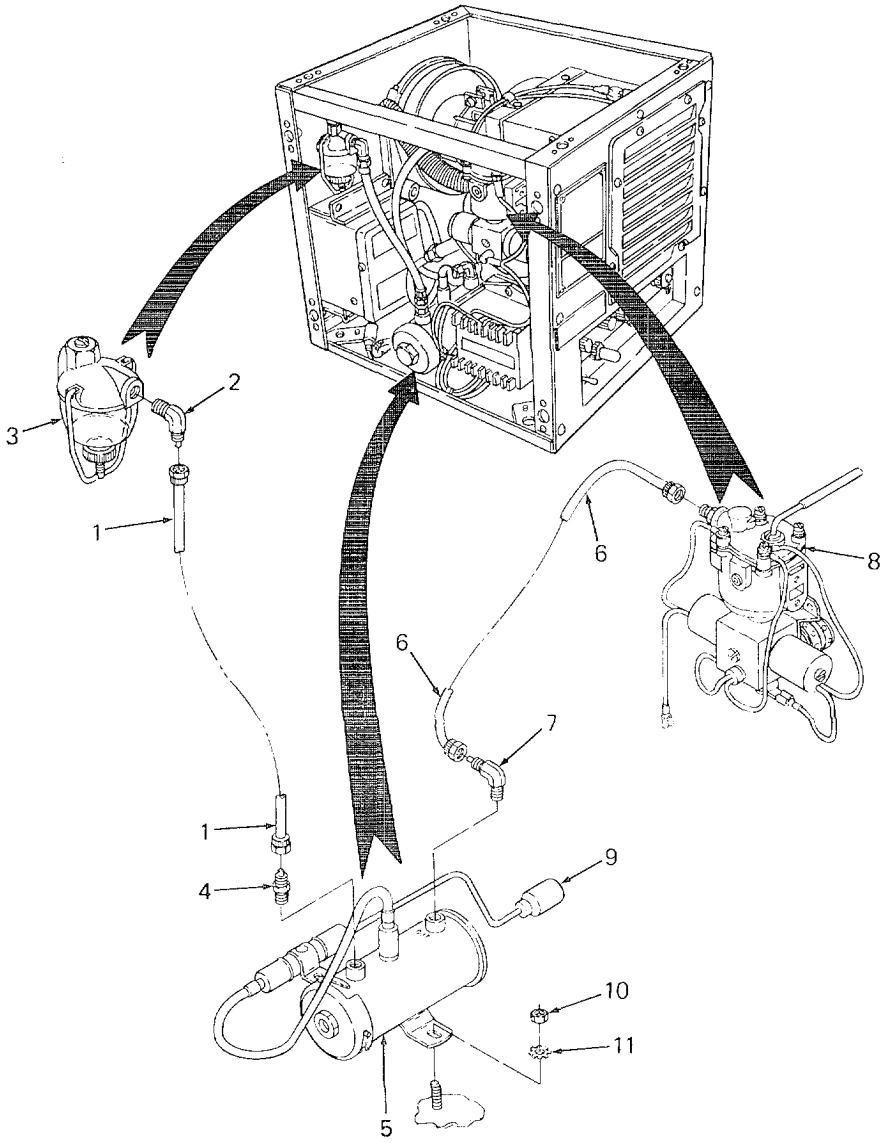


Figure 4-12. Replacing Fuel Pump.

3. Disconnect electrical lead connector (9).
4. Remove two nuts (10) and lock washers (11) that secure fuel pump and EMI filter assembly (5) to the heater case.
5. Remove pump and EMI filter assembly (5).
6. If required, remove fittings (4 and 7) from pump (5).

4-16. FUEL PUMP - CONTINUED

CLEANING

Clean the fuel pump with a rag (Item 9, Appendix E) dampened with dry cleaning solvent (Item 6, Appendix E).

INSTALLATION (Figure 4-12)

1. If required, install fittings (4 and 7). Tighten securely. Position elbow (7), as shown.
2. Secure fuel pump and EMI filter assembly (5) to the heater case with lock washers (11) and nuts (10).
3. Connect electrical lead connector (9).
4. Connect 11. 5-inch hose (6) to elbow (7) on fuel pump, and to carburetor (8).
5. Connect 7-inch hose (1) to elbow (2) on strainer (3), and to male connector (4) on fuel pump (5).

TESTING

1. Connect the power plug and turn on the fuel supply.
2. Start the heater (para 2-10) and check for leaks and proper operation.

4-17. IGNITION PACK

This task covers: a. Testing b. Removal c. Installation

INITIAL SETUP

Tools

Tool Kit, Service Refrigeration Unit
(Item 1, Appendix B, Section III)

Equipment Condition

Power disconnected and fuel supply turned off.

Top and side covers removed (para 4-10).

General Safety Instructions

WARNING

The heater ignition system of this heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect power before any maintenance actions.

TESTING (Figure 4-13)

WARNING

Do not hold or touch ignition pack cable during test. The heater ignition system contains dangerous voltages which can cause severe electrical shock.

1. Disconnect ignition pack cable (1) from igniter.

CAUTION

When checking spark, do not allow the spark gap to exceed 1/8 inch. Greater gap will result in insulation breakdown either internally or in the ignition cable.

2. Lay the cable end on heat exchanger making sure there is 1/8-inch maximum gap between cable end and heat exchanger.

3. Connect power plug to heater and turn on the ON-OFF switch. Verify that a spark comes from the ignition pack cable to the heat exchanger. If spark is missing, replace the ignition pack (2).

4. Turn off the heater and disconnect power plug.

4-17. IGNITION PACK - CONTINUED

REMOVAL

NOTE

When removing ignition pack electrical wire from ECU, a second wire from the overheat switch will also be disconnected.

1. Remove 28 VDC electrical wire from terminal 10 on ECU.
2. Remove two screws (3) securing ignition pack (2) to heater, and remove ignition pack.

INSTALLATION

1. Install ignition pack (2) in heater and secure with two screws (3).
2. Connect ignition pack cable (1) to the igniter.
3. Connect two 28 VDC electrical wires (4) previously removed to terminal 10 on ECU (5).

TESTING HEATER

1. Connect power plug and open fuel supply to heater.
2. Start the heater (para 2-10) and check for correct heater operation.

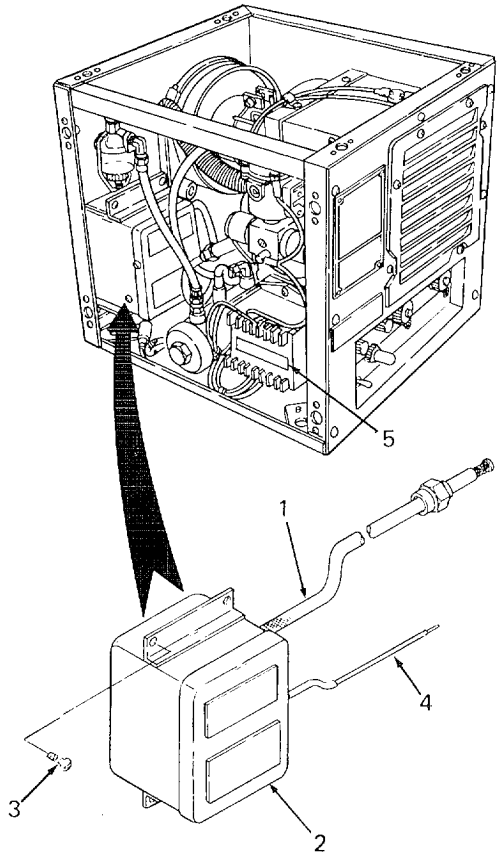


Figure 4-13. Testing/Replacing Ignition Pack.

4-18. IGNITER

This task covers: a. Removal b. Testing c. Cleaning d. Inspection e. Installation f. Testing

INITIAL SETUP

Tools

Tool Kit, Service Refrigeration Unit
(Item 1, Appendix B, Section III)

Material/Parts

Dry cleaning solvent
(Item 6, Appendix E)
Rags
(Item 9, Appendix E)

Equipment Condition

Power disconnected and fuel supply turned off.

Top and side covers removed (para 4-10).

General Safety Instructions

WARNING

The ignition system of this heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect power before any maintenance actions.

WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent is potentially dangerous to personnel. Do not use near open flame or excessive heat. Flash point is 140°F (60°C).

REMOVAL (Figure 4-14)

1. Disconnect ignition cable (1) from igniter (2).
2. Unscrew igniter (2) and gasket (3) from burner head (4).

4-18. IGNITER- CONTINUED

TESTING

WARNING

Do not hold or touch ignition pack cable during test. The heater ignition system contains dangerous voltages which can cause severe electrical shock.

1. Reconnect ignition cable (1) to igniter (2).
2. Lay igniter on heat exchanger.
3. Connect power and turn on switch.
4. Verify spark between electrode and sleeve. If no spark, replace.
5. Disconnect power.

CLEANING

Clean the igniter with dry cleaning solvent (Item 6, Appendix E) and a rag (Item 9, Appendix E). Allow to dry thoroughly.

INSPECTION

Inspect the electrode and outer shell of the igniter for burning, pitting, cracks, or breaks. Replace a damaged igniter.

INSTALLATION

1. Install igniter (2) and gasket (3) on burner head (4).
2. Connect ignition cable (1) to the igniter.

TESTING

1. Connect the power plug and open fuel supply to heater.
2. Start the heater (para 2-10) and check for correct heater operation.

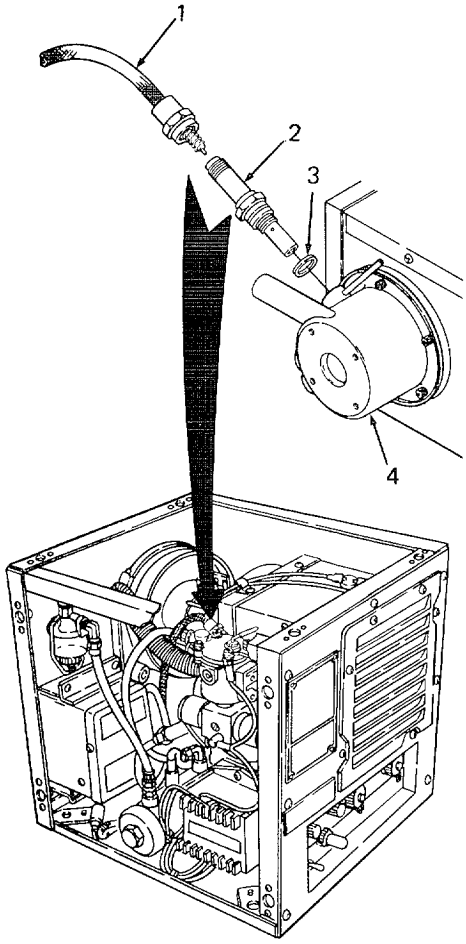


Figure 4-14. Replacing Igniter.

4-19. GLOW PLUG

This task covers: a. Removal b. Inspection e. Installation
b. Cleaning d. Testing

INITIAL SETUP

Tools

Tool Kit, Service Refrigeration Unit
(Item 1, Appendix B, Section III)

Material/Parts

Dry cleaning solvent
(Item 6, Appendix E)
Rags
(Item 9, Appendix E)

Equipment Condition

Power disconnected and fuel supply turned off.

Top and side covers removed (para 4-10).

General Safety Instructions

WARNING

The ignition system of this heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect power before any maintenance actions.

WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent is potentially dangerous to personnel. Do not use near open flame or excessive heat. Flash point is 140°F (60°C).

REMOVAL (Figure 4-15)

1. Remove nut (1) securing wire (2) to glow plug (4) and remove wire (2). Nut (3) remains on the glow plug.
2. Remove glow plug (4) and gasket (5) from burner head (6).

CLEANING

Clean glow plug using a rag (Item 9, Appendix E) dampened with dry cleaning solvent (Item 6, Appendix E). Do not immerse glow plug in solvent.

INSPECTION

Inspect glow plug for cracks, frayed insulation, or a defective element.

4-19. GLOW PLUG - CONTINUED

TESTING GLOW PLUG

1. Connect wire (2) to glow plug (4) and secure with nut (1).
2. Connect power plug to control panel. Hold the glow plug against side of heat exchanger (7).

WARNING

The glow plug element can get hot enough to cause burns.

WARNING

Keep hands away from blower fan blade.
Blower will energize in 15 seconds after switch is turned on and could injure personnel.

3. Turn on heater and verify that glow plug heats. Turn off heater and disconnect power plug.
4. Remove nut (1) and wire (2) from glow plug (4).
5. Replace glow plug if it does not heat.

INSTALLATION

Install glow plug (4) with gasket (5) in burner head (6). Connect wire (2) to glow plug and secure with nut (1).

TESTING INSTALLED GLOW PLUG

1. Connect the power plug and open fuel supply to heater.
2. Start the heater (para 2-10) and check for correct heater operation.

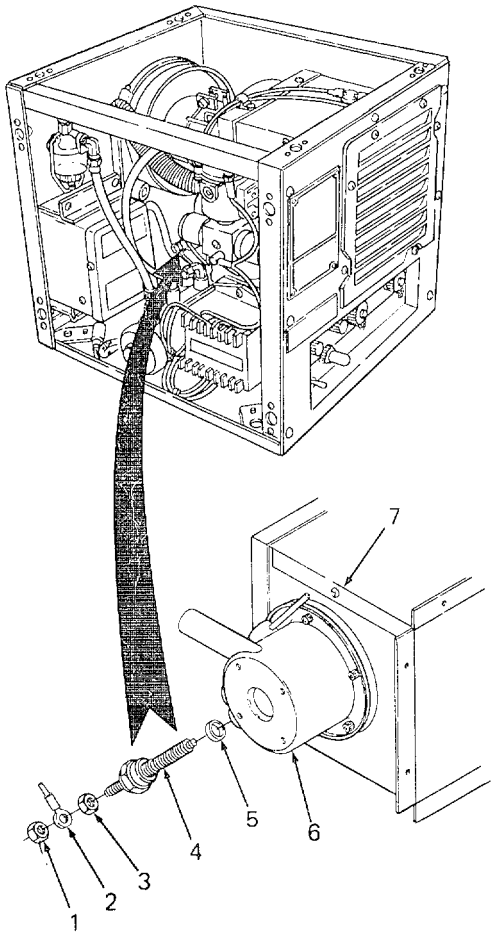


Figure 4-15. Replacing Glow Plug.

4-20. AIR DUCT HOSE

This task covers: a. Removal b. Installation c. Testing

INITIAL SETUP

Tools

Tool Kit, Service Refrigeration Unit
(Item 1, Appendix B, Section III)

Equipment Condition

Power disconnected and fuel supply turned off.

Top and side covers removed (para 4-10).

General Safety Instructions

WARNING

The ignition system of this heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect power before any maintenance actions.

REMOVAL (Figure 4-16)

1. Loosen clamp (1) securing air duct hose (2) to motor /fan subassembly (3).
2. Loosen clamp (4) securing air duct hose (2) to burner head (5).
3. Remove hose and two clamps.

INSTALLATION

1. Install clamps (1 and 4) over air duct hose (2).
2. Connect hose (2) to burner head (5) and to motor/fan subassembly (3).
3. Secure hose (2) with clamps (1 and 4).

TESTING

1. Connect the power plug and open fuel supply to heater.
2. Start the heater (para 2-10) and check for correct heater operation.

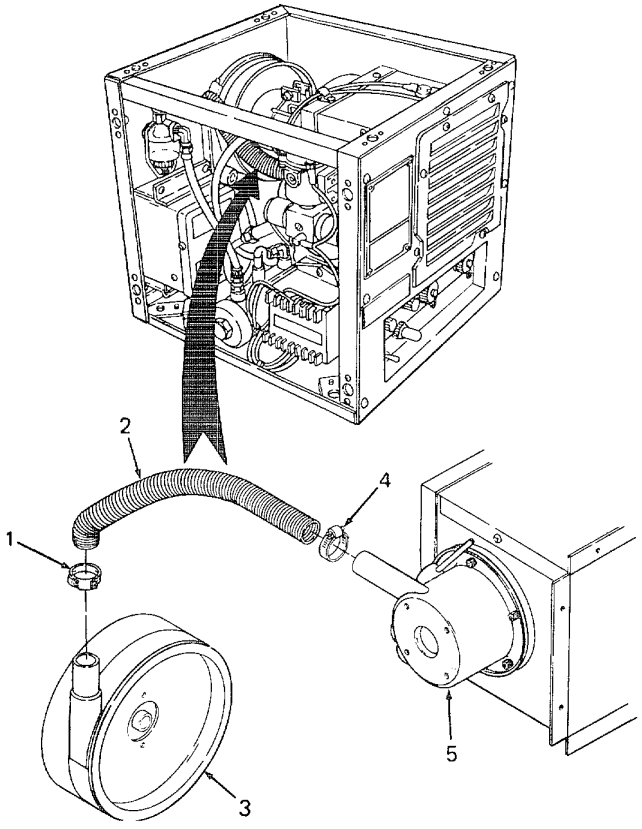


Figure 4-16. Replacing Air Duct Hose.

4-21. MOTOR BRUSHES

This task covers: a. Removal b. Inspection c. Cleaning d. Installation e. Testing

INITIAL SETUP

Tools

Tool Kit, Service Refrigeration Unit
(Item 1, Appendix B, Section III)

Material/Parts
Lint-free cloth

(Item 4, Appendix E)

Equipment Condition
Power disconnected and fuel supply turned off

Top and side covers removed (para 4-10).

General Safety Instructions

WARNING

The ignition system of this heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect power before any maintenance actions.

WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent is potentially dangerous to personnel. Do not use near open flames or excessive heat. Flash point is 140°F (60°C).

REMOVAL (Figure 4-17)

Remove cap (1) securing brushes (top and bottom) (2) in motor (3). Remove brushes from motor.

INSPECTION

NOTE

A new brush is about 1/2 inch long.

Inspect the spring and brush assembly for uneven wear, scoring, pitting, or other damage. Replace the brush if worn to less than 5/16 inch.

4-21. MOTOR BRUSHES - CONTINUED

CLEANING

Wipe the spring and brush with a clean, dry, lint-free cloth (Item 4, Appendix E).

INSTALLATION

Install brushes (top and bottom) (2) in motor (3), making sure to align the curve of the brush wear face with the curvature of motor armature commutator. Secure the brushes with caps (1).

TESTING

1. Connect the power plug and turn on fuel supply to heater.
2. Start the heater (para 2-10) and check for correct heater operation.

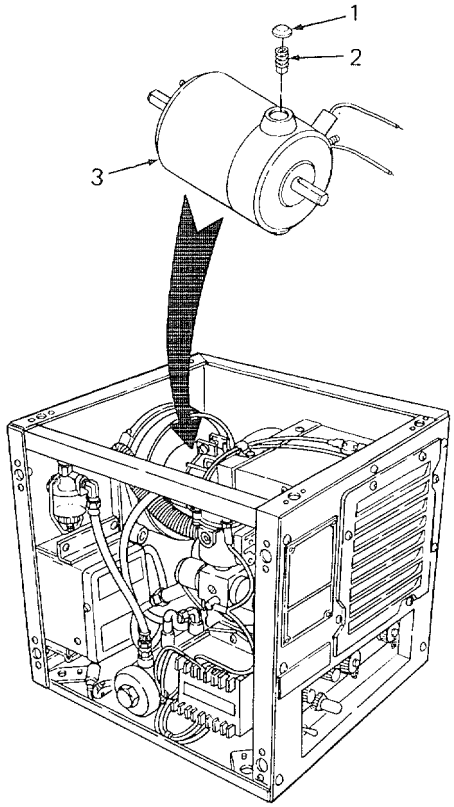


Figure 4-17. Replacing Motor Brushes.

4-22. CONTROL PANEL

This task covers: a. Removal b. Testing c. Cleaning d. Inspection e. Repair

INITIAL SETUP

Tools

Tool Kit, Service Refrigeration Unit
(Item 1, Appendix B, Section III)

Soldering Gun Kit
(Item 2, Appendix B, Section III)

Shop Set, Automotive Vehicle
(Item 3, Appendix B, Section III)

Material/Parts

Lint-free cloth
(Item 4, Appendix E)

Soft-bristle brush
(Item 2, Appendix E)

Material/Parts - Continued

Solder
(Item 12, Appendix E)

Tags
(Item 13, Appendix E)

Equipment Condition

Power disconnected and fuel supply turned off.

General Safety Instructions

WARNING

The heater ignition system contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect power before any maintenance action.

REMOVAL (Figure 4-18)

NOTE

Disassemble only to level required to make repairs.

1. Turn the two camloc studs (1) 1/4 turn counterclockwise to release control panel (2) from the heater.
2. Pull the control panel out of the heater for access to component wiring on back of control panel.

TESTING/INSPECTION

1. Visually check all electrical components including wiring for any obvious signs of damage that would prevent the component from being reused.

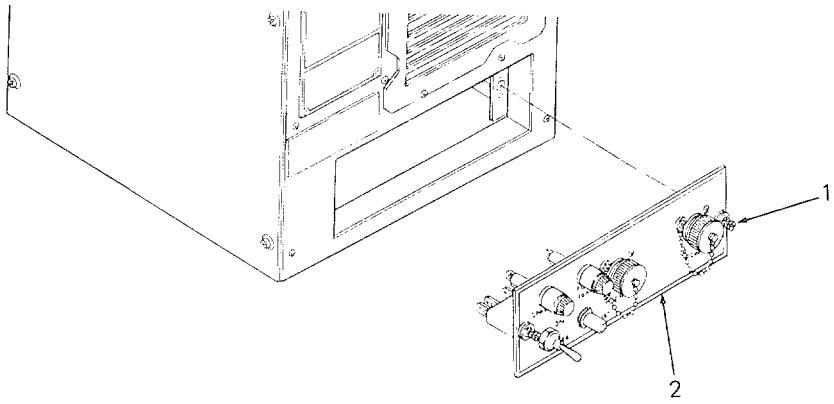


Figure 4-18. Replacing or Repairing Control Panel.

2. Visually check for any indication of: arcing, cracked plastic housings, damaged insulation, loose or damaged terminals, overheating, and shorting. Replace any component found to have this type of damage.

3. ON-OFF SWITCH (See Figure 4-19):

   Place switch (1) in OFF position. Using a multimeter set on the OHMS scale, check for continuity between the two terminals (2 and 3). There shall be no continuity between the two terminals. Place switch in ON position and check for continuity between terminals as described above. There shall be continuity between the two terminals. Replace a defective switch.

4. RESET CIRCUIT BREAKER (4, Figure 4-19).

   a. Using a multimeter set on the OHMS scale, check for continuity between terminal numbers I and 3. There shall be continuity between these terminals.

   b. If there is no continuity, reset the circuit breaker and recheck. If there is still no continuity, replace a defective breaker.

   c. If the breaker tests good, then do the following. Using a multimeter set on the OHMS scale, measure the resistance between terminal numbers 2 and 3. Resistance shall be 14.4 OHMS. Replace a defective breaker.

4-22. CONTROL PANEL - CONTINUED

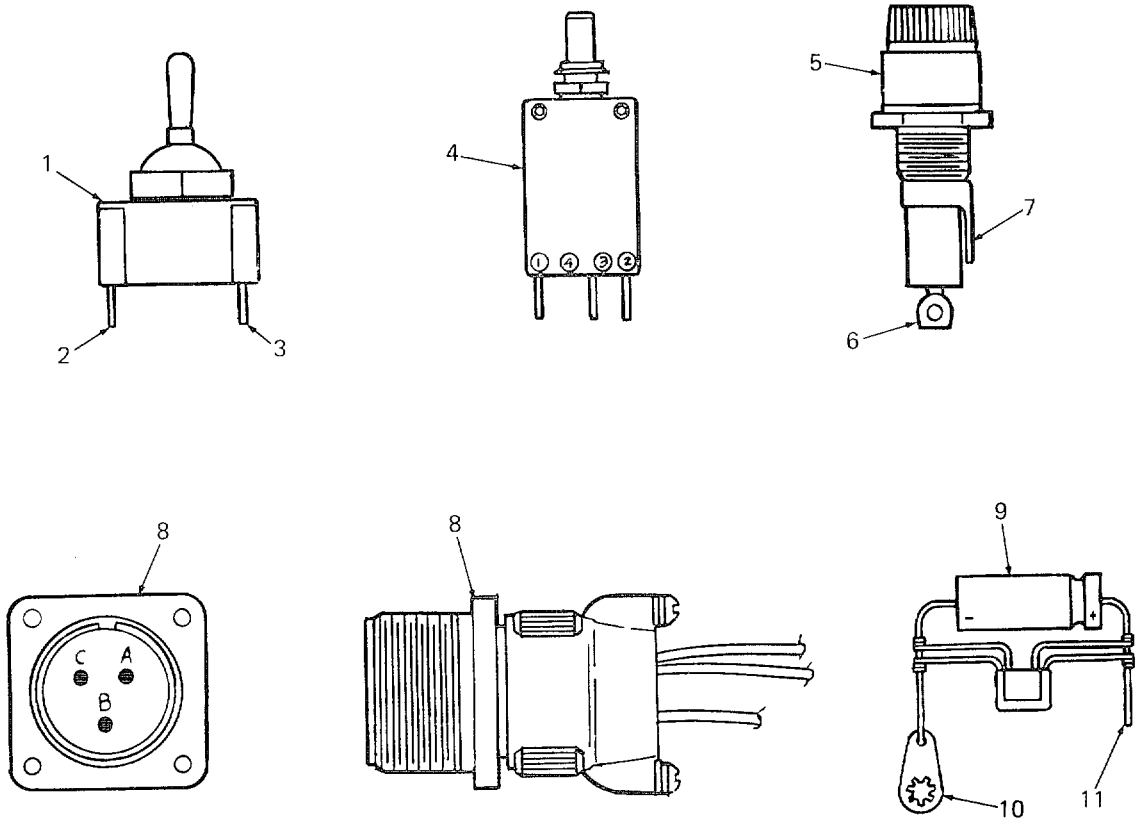


Figure 4-19. Control Panel Assembly component Test Points.

5. FUSE HOLDER.

NOTE

The fuse holder on the control panel assembly that is marked SPARE FUSE does not need to be tested. It is not connected electrically to any other components. It is only used to hold the spare fuse.

a. Push in the cap on the fuse holder (5, Figure 4-19), rotate the cap counterclockwise, and remove it.

b. Remove fuse from fuse holder.

c. Check fuse for continuity using a multimeter set on the OHMS scale. There shall be continuity. Replace a defective fuse.

4-22. CONTROL PANEL - CONTINUED

d. Install a known good fuse into the cap and insert into the fuse holder (5). Press in and turn clockwise.

e. Check continuity, as described above, between the two terminals (6 and 7) on the fuse holder. There shall be continuity. Replace a defective fuse holder.

f. Remove fuse and install cap into fuse holder. As described above, check continuity between the two terminals (6 and 7). There shall be no continuity. Replace a defective fuse holder.

6. THERMOSTAT RECEPTACLE (Typical thermostat and power receptacle shown as item 8 on Figure 4-19).

a. Tag (Item 13, Appendix E) and remove wire from the receptacle to terminal 2 of ECU. Do not allow this wire to contact other wires leading from the receptacle.

b. Using a multimeter set on the OHMS scale, check for continuity between sockets A, B, and C of the receptacle. There shall be no continuity. Replace defective receptacle.

7. POWER RECEPTACLE (Typical thermostat and power receptacle shown as item 8 on Figure 4-19).

a. Tag (Item 13, Appendix E) and remove wire from the receptacle to terminal 7 of ECU. Do not allow this wire to contact other wires leading from the receptacle.

b. Using a multimeter set on the OHMS scale, check for continuity between sockets A, B, and C of the receptacle. There shall be no continuity. Replace defective receptacle.

8. CAPACITOR ASSEMBLY (9, Figure 4-19).

a. Using a multimeter set on the OHMS scale, place a probe on terminals (10 and 11) of the capacitor assembly. The small amount of electrical power supplied by the multimeter will induce a slight charge into the capacitor.

b. There shall be some resistance registered on the multimeter. The exact amount of resistance is not important. If meter reads 0 OHMS, the capacitor assembly is shorted internally and shall be replaced.

c. Reverse the probes (i.e., probe that was on terminal 11 goes to terminal 12, and probe that was on terminal 12 goes to terminal 11). The resistance indicated on the multimeter shall quickly increase (i.e., pulse higher) and then return to a lower resistance indication.

NOTE

This pulse of higher resistance indicates the proper discharge of the capacitor assembly and that the capacitor assembly may be reused. The exact amount of resistance is not important.

d. If needed, repeat above steps, as required, to verify condition of capacitor assembly.

e. If no pulse in resistance reading can be verified, replace capacitor assembly (9).

CLEANING

Clean components with a dry lint-free cloth (Item 4, Appendix E) or soft-bristle brush (Item 2, Appendix E).

4-22. CONTROL PANEL - CONTINUED

INSPECTION

Inspect components for damage, cracks, damaged terminals, and signs of overheating.

REPAIR (See Figure 4-20)

1. POWER RECEPTACLE.
   a. Remove four screws (9), lockwashers (11), and nuts (10) from panel (8).
   b. Remove power receptacle (15), cap and chain (13), and gasket (14) from panel (8).
   c. Unthread endbell (1) from connector body (2).
   d. Slide the exposed ferrule (3) and grommet (4) out of the connector body and down the wires.

WARNING

Solder and flux contain materials which are hazardous to health. Avoid breathing vapors or fumes from soldering operations. Perform operations only in well-ventilated areas. Wash hands with soap and water after handling solder and flux.

   e. Tag and unsolder wires from connector pins. Discard connector body (2), grommet (4), ferrule (3), and endbell (1).

   f. Place new endbell (1) and ferrule (3) over wires with the key (5) on the end of the ferrule toward the connector ends of the wires.

   g. Thread wires through marked grommet (RED through A, GREEN through B, and BLACK through C.

   h. Solder wires to pins as follows: RED wire to pin A, GREEN wire to pin B, and BLACK wire to pin C.

   i. Slide ferrule (3) down over grommet (4). Align key (5) on felrule with keyway in connector body (2). Press grommet and ferrule down firmly into connector body.

   j. Slide the endbell (1) down along the wires and over the installed ferrule and grommet. Thread the endbell onto the connector body. Tighten endbell securely.

   k. Install gasket (14) on power receptacle (15).

   l. Position power receptacle (15) on the control panel (8), and secure with four screws (9), nuts (10), and washers (11). Make sure ground wire is attached to one screw (9).

   m. Install cap and chain assembly (] 3) to one of the screws on front of panel.

4-22. CONTROL PANEL - CONTINUED

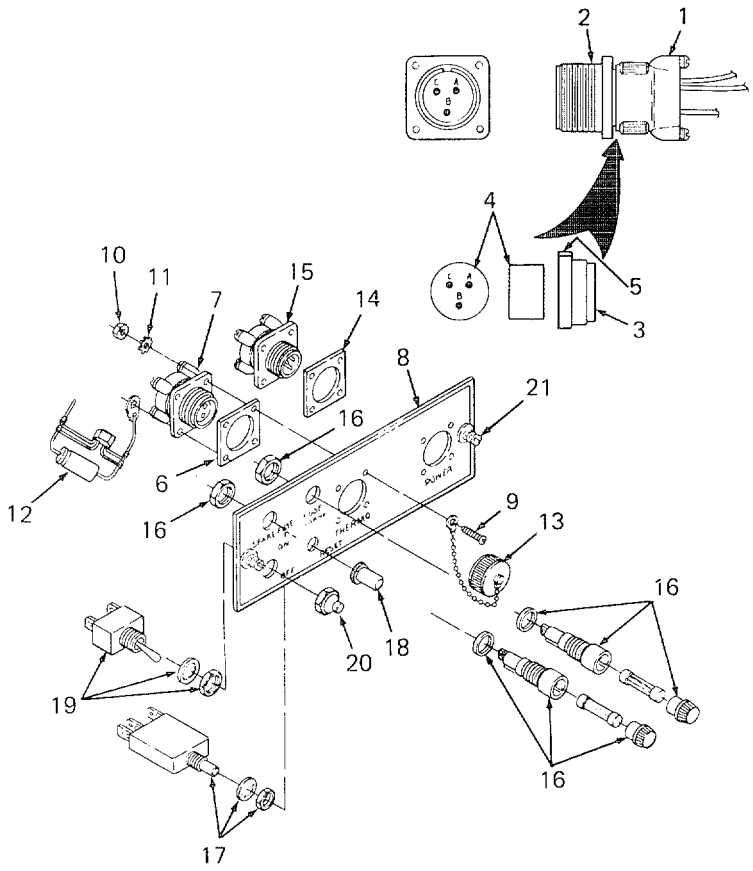


Figure 4-20. Repair of Control Panel and Components.

2. THERMOSTAT RECEPTACLE.

NOTE

One attaching screw also attaches capacitor wire but capacitor will remain attached to control panel when removing thermostat receptacle.

a. Remove four screws (9), lockwashers (11), and nuts (10) from panel (8).

b. Remove thermostat receptacle (7), cap and chain (13), and gasket (14) from panel (8).

c. Unthread endbell (1) from connector body (2).

d. Slide the exposed ferrule (3) and grommet (4) out of the connector body and down the wires.

4-22. CONTROL PANEL - CONTINUED

WARNING

Solder and flux contain materials which are hazardous to health. Avoid breathing vapors or fumes from soldering operations. Perform operations only in well-ventilated areas. Wash hands with soap and water after handling solder and flux.

e. Tag and unsolder wires from connector pins. Discard connector body (2), grommet (4), ferrule (3), and endbell (1).
f. Place new endbell (1) and ferrule (3) over wires with the key (5) on the end of the ferrule toward the connector ends of the wires.
g. Thread wires through marked grommet (short BLUE through A, GREEN through B, and BLACK through C.
h. Solder wires to pins as follows: short BLUE wire to pin A, GREEN wire to pin B, and BLACK wire to pin C.
i. Slide ferrule (3) down over grommet (4). Align key (5) on ferrule with keyway in connector body (2). Press grommet and ferrule down firmly into connector body.
j. Slide the endbell (1) down along the wires and over the installed ferrule and grommet. Thread the endbell onto the connector body. Tighten endbell securely.
k. Install gasket (6) on thermostat receptacle (7).
l. Position thermostat receptacle (7) on the control panel (8), and secure with four screws (9), nuts (10), and washers (11). Make sure ground wire is attached to one screw (9).
m. Install capacitor assembly (12) to one of the screws (9), nuts (10), and washers (11).
n. Install cap and chain assembly (13) to one of the screws on front of panel.

3. FUSE HOLDER

WARNING

Solder and flux contain materials which are hazardous to health. Avoid breathing vapors or fumes from soldering operations. Perform operations only in well-ventilated areas. Wash hands with soap and water after handling solder and flux.

a. Tag and unsolder wires.

b. Remove nut and slide out fuse holder (16).

c. Position new fuse holder (16) and attach with nut.

d. Resolder wires.

4-22. CONTROL PANEL - CONTINUED

4. RESET SWITCH.

   a. Tag and remove wires.

   b. Remove boot (18) and slide switch (17) out of panel (8).

   c. Position new switch (17) in panel.

   d. Secure with new boot (18).

   e. Reconnect wires.

5. ON-OFF SWITCH.

WARNING

Solder and flux contain materials which are hazardous to health. Avoid breathing vapors or fumes from soldering operations. Perform operations only in well-ventilated areas. Wash hands with soap and water after handling solder and flux.

   a. Tag and unsolder wires.

   b. Remove boot (20) and slide switch (19) out of panel (8).

   c. Position new switch (19) in panel.

   d. Secure with boot (20).

   e. Solder wires.

6. CAMLOC STUDS.

   Remove and replace camloc studs (21) if required.

7. INSTALL CONTROL PANEL.

   Position the assembled control panel in place on heater and secure with two camloc studs (21).

TEST HEATER

1. Connect the thermostat and power plugs to the control panel.

2. Start the heater (para 2-10) and check for correct heater operation.

4-23. WIRING

This task covers: a. Removal b. Installation c. Testing d. Installation

INITIAL SETUP

Tools

Tool Kit, Service Refrigeration Unit
(Item 1, Appendix B, Section III)

Soldering Gun Kit
(Item 2, Appendix B, Section III)

Material/Parts

Rosin core solder
(Item 12, Appendix E)

Tie wraps
(Item 14, Appendix E)

Tags
(Item 13, Appendix E)

Equipment Condition
Power disconnected and fuel supply turned off

Top and side covers removed (para 4-10).

General Safety Instructions

WARNING

The heater ignition system contains dangerous voltages which can cause severe electrical shock.
Be sure to disconnect power before any maintenance actions.

INSPECTION

Inspect heater wiring for fraying or overheating; inspect insulation, connectors, and terminal lugs for damage.

REMOVAL/REPAIR

WARNING

Solder and flux contain materials which are hazardous to health. Avoid breathing vapors or fumes from soldering operations. Perform operations only in well-ventilated areas. Wash hands with soap and water after handling solder and flux.

1. Tag (Item 13, Appendix E) and remove a damaged wire, connector, or terminal lug. Remove tie wraps as necessary. Use soldering iron as required to remove wires.

4-23. WIRING -- CONTINUED

2. Fabricate new wire assemblies, as needed, in accordance with instructions provided in Appendix F, Manufactured Items. Also see Figure FO-1.

NOTE

For cross-reference purposes, both Figure FO-1 and Appendix F list wire part numbers.

INSTALLATION

Install new wire, connectors, or terminal lug. Use tie wraps (Item 14, Appendix E) as required. Use only rosin core solder (Item 12, Appendix E) when soldering wire to components.

4-24. OVERHEAT SWITCH AND FLAME SWITCH

This task covers: a. Inspection b. Testing c. Removal d. Installation

INITIAL SETUP

Tools
Tool Kit, Service Refrigeration Unit

Material/Parts
Tags
(Item 13, Appendix E)

Equipment Condition
Power disconnected.

Covers removed (para 4-10).

Louver removed (para 4-11).

General Safety Instructions

WARNING

The ignition system of this heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect power before any maintenance actions.

INSPECTION (Figure 4-21)

NOTE

Both the overheat switch and the flame switch may be visually inspected as described below. Both switches may be confidence tested at ambient temperatures as described in TESTING, below. Complete electrical testing, sufficient to ensure proper operation of the switches, requires a heat source and temperature measuring equipment not available to Unit Maintenance personnel. If the proper operation of the heater from which the switches were removed cannot be verified, then both switches must be discarded upon removal and new switches installed in INSTALLATION.

Visually check overheat switch (2) and flame switch (6) for the following conditions. Replace a switch that has any of the following problems:

a. Damaged terminals.

b. Broken or cracked insulation or insulators.

c. Cracks.

d. Evidence of overheating or arcing.

4-24. OVERHEAT SWITCH AND FLAME SWITCH - CONTINUED

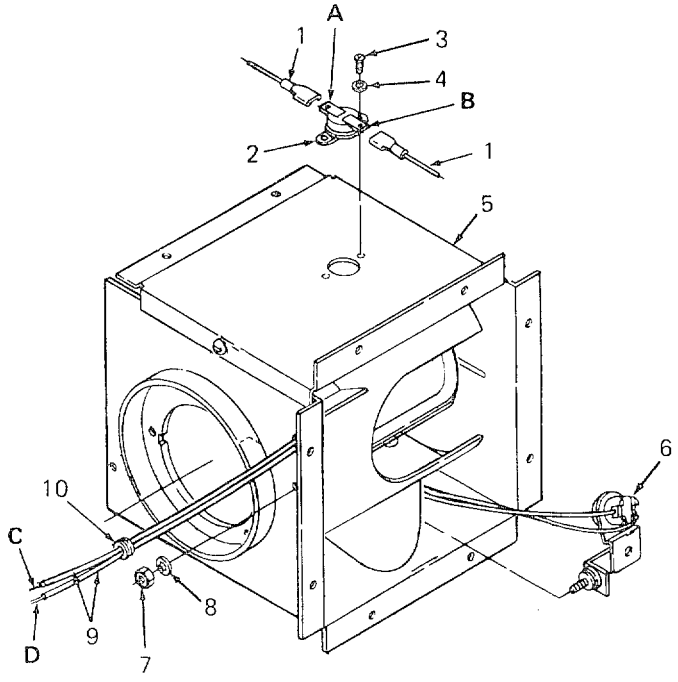


Figure 4-21. Removing Overheat Switch and Flame Switch.

4-24. OVERHEAT SWITCH AND FLAME SWITCH - CONTINUED

TESTING

NOTE

The overheat switch is a normally closed switch at normal ambient temperatures.

1. Using a multimeter set on the OHMS scale check for continuity between terminals A and B of the overheat switch (2). There shall be continuity between terminals A and B at normal ambient temperatures.

2. Replace an overheat switch that does not exhibit continuity between terminals A and B.

NOTE

Flame switch is a normally opened switch at normal ambient temperatures.

3. Using a multimeter set on the OHMS scale check for continuity between stripped wire ends C and D of flame switch (6). There shall not be continuity between wire ends C and D at normal ambient temperatures.

4. Replace a flame switch that exhibits continuity between stripped wire ends C and D.

REMOVAL (Figure 4-21)

1. Disconnect and tag (Item 13, Appendix E) two wires (1) from the overheat switch (2).
2. Remove two screws (3) and two washers (4) securing overheat switch (2) to heat exchanger (5) and remove switch (2).
3. Remove flame switch (6) by removing nut (7) and washer (8).
4. Disconnect and tag (Item 13, Appendix E) two wires (9) from ECU.
5. Remove wires (9) from grommet (10). Remove the grommet (10).

INSTALLATION

1. Install flame switch (6) and secure with nut (7) and washer (8).
2. Install grommet (10) and position flame switch wires (9) through the grommet (10). Connect wires to the ECU.
3. Remove tag and connect violet wire (C) to terminal 3 of the ECU.
4. Remove tag and connect black wire with (D) to terminal 7 of the ECU.
5. Install overheat switch (2) to heat exchanger (5), and secure with two washers (4) and screws (3). Connect wires (1) to overheat switch (2).

4-25. ROOM THERMOSTAT

This task covers: a. Removal b. Inspection c. Cleaning d. Testing e. Installation

INITIAL SETUP

Tools

Tool Kit, Service Refrigeration Unit
(Item 1, Appendix B, Section III)

Material/Parts

Soft-bristle brush
(Item 2, Appendix E)

Tags
(Item 13, Appendix E)

Equipment Condition

Power disconnected and fuel supply turned off.

General Safety Instructions

WARNING

The ignition system of this heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect power before any maintenance actions.

REMOVAL (Figure 4-22)

1. Loosen screw (1) and remove thermostat cover (2).
2. Tag (Item 13, Appendix E) and disconnect three-wire cable (3).
3. Remove screws (4) that secure thermostat (5) to wall and remove thermostat.

INSPECTION

Make sure knob turns freely.

CLEANING

Clean the thermostat with a soft-bristle brush (Item 2, Appendix E) to remove dust or lint.

4-25. ROOM THERMOSTAT- CONTINUED

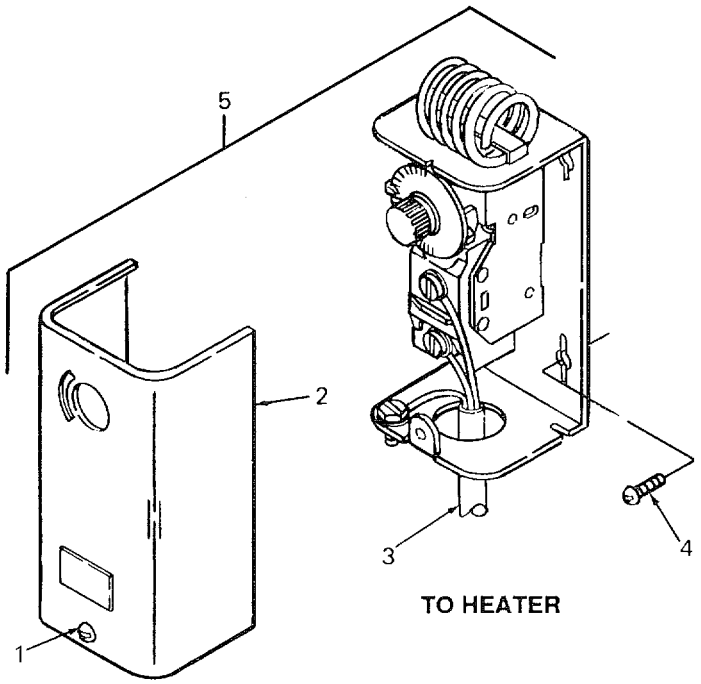


Figure 4-22. Replacing Room Thermostat.

TESTING

Using a multimeter, check electrical continuity at room temperature or below. Check that continuity is present when thermostat is set above room temperature.

INSTALLATION

1. Secure the thermostat (5) to wall with four screws (4). Connect the three-wire cable (3) to thermostat (5), and remove tags.
2. Install cover (2) and tighten screw (1).

TESTING

1. Set thermostat above ambient room temperature so heater will come on.
2. Start the heater (para 2-10) and check for correct heater operation. Place room thermostat below room temperature and verify that heater and fan shut off. The blower motor will continue to run until heater cools down.

SECTION V. PREPARATION FOR STORAGE OR SHIPMENT

4-26. REMOVAL FROM SERVICE.

a. Remove the thermostat, and disconnect the power and thermo connectors from the control panel receptacles.

b. Disconnect the fuel line from the fuel inlet connector at back of heater.

c. Operate the heater until residual fuel is expended, then shut off heater. Place the cap on the fuel inlet connector.

WARNING

Exhaust components get hot enough to cause severe bums. Allow parts to cool before handling.

d. Disconnect the exhaust pipe from the exhaust connector.

e. Remove the bolts securing the heater to the base or floor.

f. Remove top and side covers (para 4-10), and drain the fuel (para 4-15) from the strainer. Remove the fuel pump cover (para 4-16) and drain the fuel pump. Replace the fuel pump cover.

g. Remove the plug (Figure 4-23) from the carburetor float bowl. Tip the heater sideways and drain fuel from carburetor float bowl into a container.

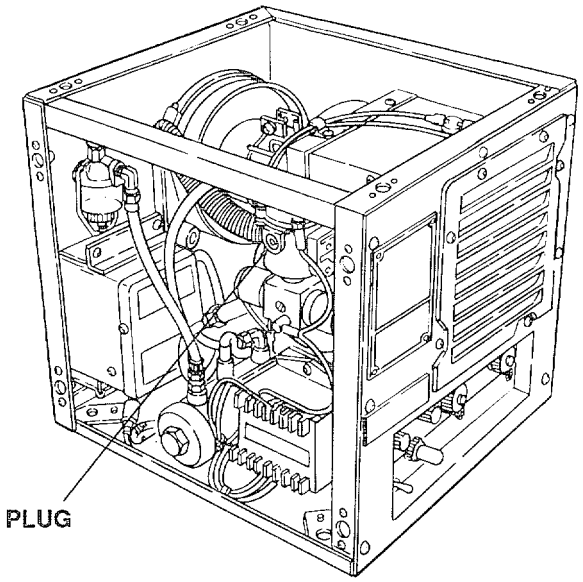


Figure 4-23. Carburetor Float Bowl.

4-27. PRESERVATION.

Make sure all fuel has been completely drained from the heater. Seal the fuel inlet fitting with attached cap.

4-28. PACKAGING.

a. Place the thermostat, thermostat and power supply receptacles, repair parts, maintenance tools, and the technical manual for the heater together in a close-fitting box conforming to PPP-B-636 domestic class. Place each heater and box of consolidated components in a close fitting box conforming to PPP-B-636. Strap the box.

b. Make sure the weight does not exceed the size limitations of the box specification.

4-29. ADMINISTRATIVE STORAGE.

a. Placement of equipment in administrative storage should be for short periods of time when a shortage of maintenance effort exists. Items should be in mission readiness within 24 hours or within the time factors as determined by the directing authority. During the storage period, appropriate maintenance records will be kept.

b. Before placing the equipment in administrative storage, current preventive maintenance checks and services should be completed shortcomings and deficiencies should be corrected, and all Modification Work Orders (MWO) shall be applied.

c. Storage site selection. Inside storage is preferred for items selected for administrative storage. If inside storage is not available, trucks, vans, conex containers, and other containers may be used.

CHAPTER 5

DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

SECTION I. DIRECT SUPPORT TROUBLESHOOTING

5-4. TROUBLESHOOTING.

This troubleshooting procedure allows Direct Support Maintenance personnel to isolate and remedy equipment faults and return the equipment to an operational status. See Table 5-1.

WARNING

The heater ignition system contains dangerous voltages which can cause severe electrical shock. Be extremely careful when troubleshooting while heater is connected to power source. Always disconnect power when making continuity checks.

MALFUNCTION INDEX

Table 5-1. Troubleshooting

HEATER FAILS TO START- NO FLAME, NO BLOWER

NO POWER AVAILABLE TO THE GLOW PLUG

↓

JUMPER TERMINALS 1 TO 4 ON ECU1. IF GLOW PLUG HEATS, REPLACE ECU1. IF STILL NO POWER TO GLOW PLUG, CHECK ELECTRICAL CIRCUIT BETWEEN J1 AND TERMINAL 1 OF ECU1.

NO POWER TO THE IGNITION PACK

↓

JUMPER TERMINALS 1 TO 10 ON ECU1. IF KNOWN GOOD IGNITION PACK AND IGNITER SPARK, REPLACE ECU1. IF NO SPARK, CHECK ELECTRICAL CIRCUIT BETWEEN J1 AND TERMINAL 1 OF ECU1.

IGNITION PACK IS OPERABLE AND MOTOR BRUSHES ARE NOT WORN, BUT HEATER FAILS TO START - NO FLAME, NO BLOWER

↓

JUMPER TERMINALS 1 TO 5 ON ECU1. IF FAN DOES NOT OPERATE, REPLACE MOTOR. IF FAN OPERATES, REMOVE GREY WIRE FROM TERMINAL 5 OF ECU1 AND CONNECT IT TO TERMINAL 10 OF ECU1. TURN POWER SWITCH S-1 AND ROOM THERMOSTAT TO ON; CHECK FOR HEATER OPERATION. IF HEATER STARTS AND RUNS, CHECK FOR POWER AT TERMINAL 5 ON ECU1 WHILE HEATER IS OPERATING. IF NO POWER, REPLACE ECU1.

Table 5-1. Troubleshooting - Continued

HEATER FAILS TO START - BLOWER RUNS FOR A SHORT TIME THEN STOPS

NO POWER AVAILABLE TO THE GLOW PLUG

↓

JUMPER TERMINALS 1 TO 4 ON ECU1. IF GLOW PLUG HEATS, REPLACE ECU1. IF STILL NO POWER TO GLOW PLUG, CHECK ELECTRICAL CIRCUIT BETWEEN J1 AND TERMINAL 1 OF ECU1.

NO POWER TO THE IGNITION PACK

↓

JUMPER TERMINALS 1 TO 10 ON ECU1. IF KNOWN GOOD IGNITION PACK AND IGNITER SPARK, REPLACE ECU1. IF NO SPARK, CHECK ELECTRICAL CIRCUIT BETWEEN J1 AND TERMINAL 1 OF ECU1.

IGNITION PACK IS OPERABLE AND IGNITER SPARKS, BUT HEATER FAILS TO START. BLOWER RUNS FOR A SHORT TIME THEN STOPS.

↓

REMOVE CARBURETOR (PARA 5-3) AND BURNER ASSEMBLY (PARA 5-5). PERFORM ALL CLEANING AND INSPECTION PROCEDURES. INSPECT HEAT EXCHANGER (PARA 5-7) WHILE BURNER ASSEMBLY IS REMOVED.

Table 5-1. Troubleshooting- Continued

HEATER SMOKES OR BACKFIRES

HEATER HAS STRONG SPARK; STILL SMOKES OR BACKFIRES

↓

REMOVE CARBURETOR (PARA 5-3) AND BURNER ASSEMBLY (PARA 5-5). PERFORM ALL CLEANING AND INSPECTION PROCEDURES. INSPECT HEAT EXCHANGER (PARA 5-7) WHILE BURNER ASSEMBLY IS REMOVED.

HEATER CYCLES ON-OFF EXCESSIVELY

AIR FLOW IS NOT BLOCKED

↓

INSPECT BLOWER/MOTOR/VENT ASSEMBLY (PARA 5-6). REPLACE ANY DEFECTIVE PARTS.

SECTION II. DIRECT SUPPORT MAINTENANCE PROCEDURES

5-2. INTRODUCTION.

Instructions for removal and replacement of installed components are listed in a logical removal sequence as prescribed by the Maintenance Allocation Chart (MAC). Procedures will include (as applicable) disassembly, cleaning, inspection, reassembly, installation, and testing to return the heater to an operational condition.

NOTE

Because this heater is used in many different installation configurations, power, fuel, exhaust, and ductwork connections vary. Disconnect as required.

5-3. CARBURETOR

This task covers:	a. Removal	c. Cleaning	e. Testing	g. Installation
	b. Disassembly	d. Inspection	f. Reassembly	

INITIAL SETUP

Tools

Tool Kit, Service Refrigeration Unit
(Item 1, Appendix B, Section III)

Material/Parts

Dry cleaning solvent
(Item 6, Appendix E)
Diesel fuel
(Item 7, Appendix E)

Lubricant
(Item 8, Appendix E)
Sealing compound
(Item 10, Appendix E)

Corrosion preventive compound
(Item 5, Appendix E)

Tags
(Item 13, Appendix E)
Preformed packing
(Item 7, Appendix H)
Preformed packing
(Item 8, Appendix H)
Jet gasket
(Item 5, Appendix H)

Equipment Condition

Power disconnected and fuel supply turned off.

Top and side covers removed (para 4-10).

General Safety Instructions

WARNING

The heater ignition system contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect power before any maintenance actions.

WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent is potentially dangerous to personnel Do not use near open flame or excessive heat. Flash point is 140°F (60°C).

REMOVAL (Figure 5-1)

1. Tag (Item 13, Appendix E) and disconnect the electrical lead (1) for the preheat thermostat (2) and solenoid leads (3 and 4) from electrical control unit (ECU) (5).

2. Disconnect compression nut (6) of fuel hose (7) at connector (8). Remove connector (8). Disconnect overflow hose (9) from overflow fitting (10) on carburetor (12).

3. Remove four screws (11) that secure carburetor (12) to burner head. Remove the carburetor carefully so any residual fuel in float bowl does not spill.

5-3. CARBURETOR - CONTINUED

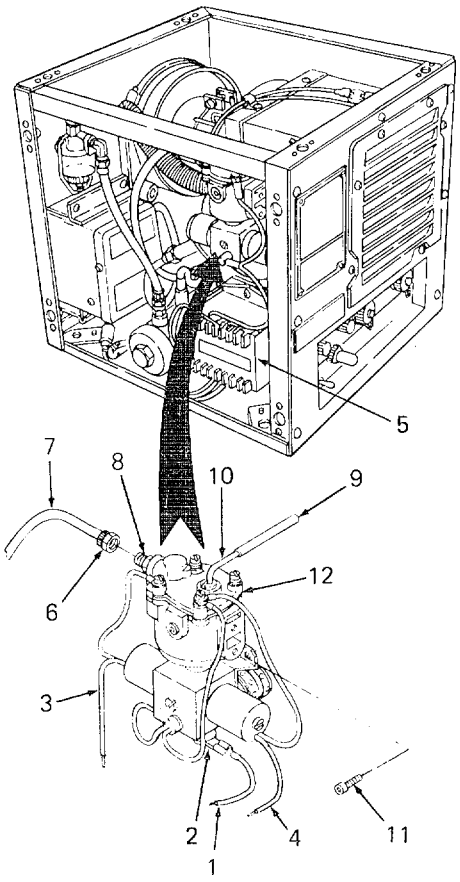


Figure 5-1. Removing Carburetor.

DISASSEMBLY (Figure 5-2)

NOTE

Disassemble only to point required to make necessary repairs.

1. Remove two screws (1) and two washers (2) securing wire assemblies (3 and 4) to top of float bowl (5). Tag (Item 13, Appendix E) wires for reinstallation.

2. Remove fuel heater (6) from carburetor body (7). Tag (Item 13, Appendix E) and remove white/black lead (8) wire from thermostat (9).

3. Remove two screws (10), two lockwashers (11), and thermostat (9).

5-3. CARBURETOR - CONTINUED

4. Remove solenoid valves (13 and 14) from carburetor body (7) by unscrewing.

5. Remove fuel adjustment needle (15) from carburetor body (7). Remove and discard preformed packing (16).

6. Remove mixer (17) from fuel jet (18), unscrewing by hand. Remove fuel jet (18) from carburetor body (7). Remove and discard preformed packing (19) from mixer (17) and gasket (20) from fuel jet (18).

7. Remove four screws (21), four lockwashers (22), and bracket (23). Unscrew float bowl (5) and remove orifice (24).

8. Unscrew overflow fitting (25) from float bowl (5).

CLEANING

CAUTION

Do not immerse the thermostat, solenoids, or float bowl in solvent. Equipment damage could result.

Clean all metal parts in dry cleaning solvent (Item 6, Appendix E) and allow all parts to dry thoroughly.

INSPECTION

1. Inspect tip of fuel adjustment needle (15) for wear, scoring, or other damage. Replace if bent, damaged, or worn.

2. Inspect mixer (17) for cracks, burrs, and thread damage. Inspect fuel jet (18) for wear or damage. Replace defective parts.

3. Inspect fuel solenoid (13) and choke solenoid Figure 5-2. Repairing or Replacing Carburetor. (14) for damage. Replace if defective.

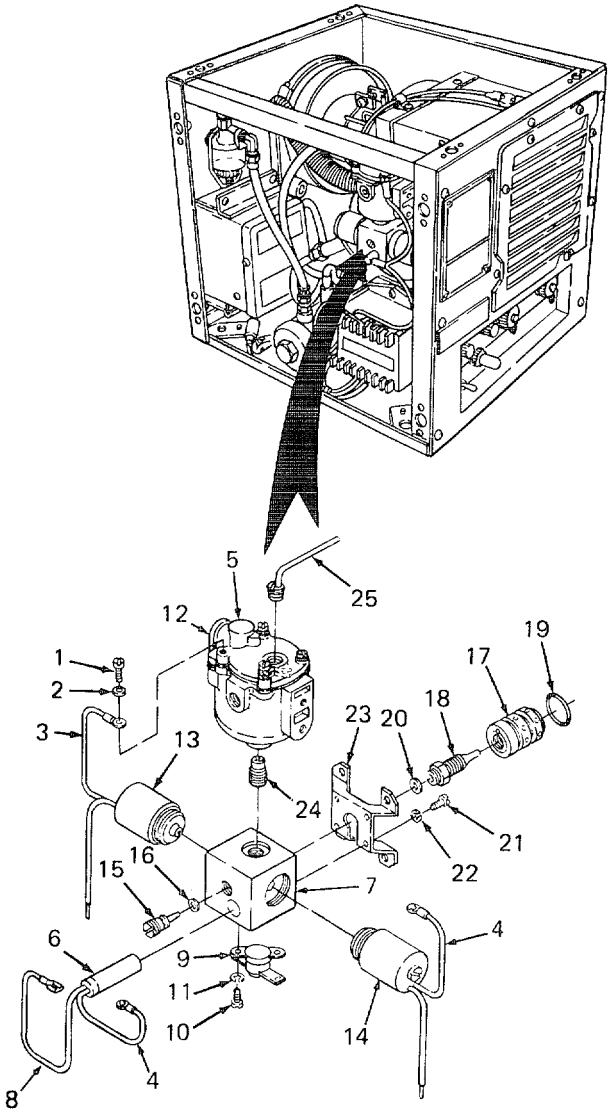


Figure 5-2. Repairing or Replacing Carburetor.

TESTING

1. Test the preheat thermostat (9) for continuity. It opens at 110°F (43°C), closes at 95°F (35°C).

2. Test the fuel solenoid (13) and choke solenoid (14) for continuity between the two leads. Replace if coil is open.

5-3. CARBURETOR - CONTINUED

REASSEMBLY

1. Install overflow fitting (25) to bowl (5).
2. Install fuel jet (18) and gasket (20) in carburetor body (7).
3. Install bracket (23) to the carburetor body (7) and secure with four screws (21) and four lockwashers (22).
4. Install new preformed packing (19) on mixer.
5. Install mixer (17) on fuel jet (18) and hand tighten.
6. Apply corrosion preventive compound (Item 5, Appendix E) to threads of fuel adjustment needle (15).
7. Install new preformed packing (16) on fuel adjustment needle (15) and install in carburetor body (7).
8. Install orifice (24) in carburetor body (7).
9. Install float bowl (5) on orifice (24). Make sure fuel inlet (12) faces in direction shown in Figure 5-2.
10. Install heater (6) in carburetor body (7). Connect one white/black lead (4) to screw at top of float bowl (5).
11. Install thermostat (9) to carburetor body (7) and secure with two screws (10) and two lockwashers (11).
12. Connect one white/black lead (8) from heater (6) to thermostat (9).
13. Install solenoid valves (13 and 14) in carburetor body (7).
14. Secure black wire (3) from fuel solenoid valve (13) to top of float bowl (5) with screw (1) and washer (2).
15. Secure black wire (4) from choke solenoid valve (14) to top of float bowl (5) with screw (1) and washer (2).

INSTALLATION (Figure 5-1)

1. Install carburetor assembly (12) to burner head using four screws (11).
2. Install overflow fitting hose (9) to carburetor assembly (12). Coat connector threads with sealing compound (Item 10, Appendix E) and install connector (8) to fuel inlet on carburetor assembly.
3. Connect the fuel hose (7) and compression nut (6) to connector (8) on carburetor bowl.

NOTE

If fuel hose is replaced, then replace compression nut also.

4. Connect electrical leads (1, 3, and 4) to ECU (5).
5. Connect power plug and open fuel supply to heater.
6. Start the heater (para 2-10) and check for correct heater operation. If required, adjust the carburetor [para 4-4.c(6)].

5-4. ELECTRONIC CONTROL UNIT (ECU)

This task covers: a. Removal b. Inspection c. Installation d. Testing

INITIAL SETUP

Tools

Tool Kit, Service Refrigeration Unit
(Item 1, Appendix B, Section III)

Material/Parts

Diesel fuel
(Item 7, Appendix E)

Tags
(Item 13, Appendix E)

Equipment Condition

Power disconnected and fuel supply turned off.

Top and side covers removed (para 4-10).

General Safety Instructions

WARNING

The heater ignition system contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect power before any maintenance actions.

REMOVAL (Figure 5-3)

1. Tag (Item 13, Appendix E) and remove wires (1) from ECU (2).
2. Remove two screws (3) securing ECU (2) to heater, and remove ECU (2).

INSPECTION

Inspect the ECU (2) for overheating (burning), corrosion, or for terminal lug damage. Replace a defective ECU.

INSTALLATION

1. Position the ECU (2) in place in heater and secure with two screws (3).
2. Install wires (1) to terminals on ECU (2).

5-4. ELECTRONIC CONTROL UNIT (ECU) - CONTINUED

TESTING HEATER

1. Connect power plug and turn on fuel (Item 7, Appendix E) supply.
2. Start the heater (para 2-10) and check for correct heater operation.

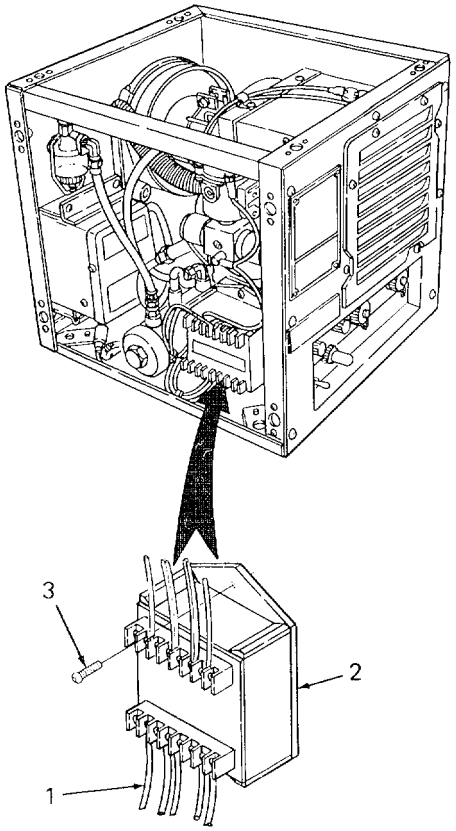


Figure 5-3. Replacing Electronic Control Unit.

5-5. BURNER ASSEMBLY

This task covers: a. Removal b. Cleaning c. Inspection d. Installation

INITIAL SETUP

Tools

Tool Kit, Service Refrigeration Unit
(Item 1, Appendix B, Section III)

Material/Parts

Dry cleaning solvent
(Item 6, Appendix E)

Wire brush
(Item 3, Appendix E)
Gasket
(Item 2, Appendix H)

Equipment Condition

Power disconnected and fuel supply turned off.
Top and side covers removed (para 4-10).
Igniter removed (para 4-18).
low plug removed (para 419).fame or excessive heat.
Glow plug removed (para 4-19).
Air duct hose removed (para 4-20).
Carburetor removed (para 5-3).

General Safety Instructions

WARNING

The heater ignition system contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect power before any maintenance actions.

WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent is potentially dangerous to personnelDo not use near open Flash point is 140°(60°C).

REMOVAL (Figure 5-4)

Remove five screws (1) and pressure pads (2) that secure burner head (3) to heat exchanger (4). Remove burner head (3) and gasket (5) from heat exchanger.

CLEANING

Clean the burner head (3) using dry cleaning solvent (Item 6, Appendix E) and a wire brush (Item, 3, Appendix E) to remove deposits. Allow to dry.

5-5. BURNER ASSEMBLY - CONTINUED

INSPECTION

1. Inspect burner head (3) for cracks, breaks, holes, or distortion. Check the threads in igniter boss (6) and glow plug boss (7) for damage.

2. Replace burner head if defective.

INSTALLATION

1. Position the burner head (3) with new gasket (5) on the heat exchanger (4).
2. Secure with five screws (1) and pressure pads (2).

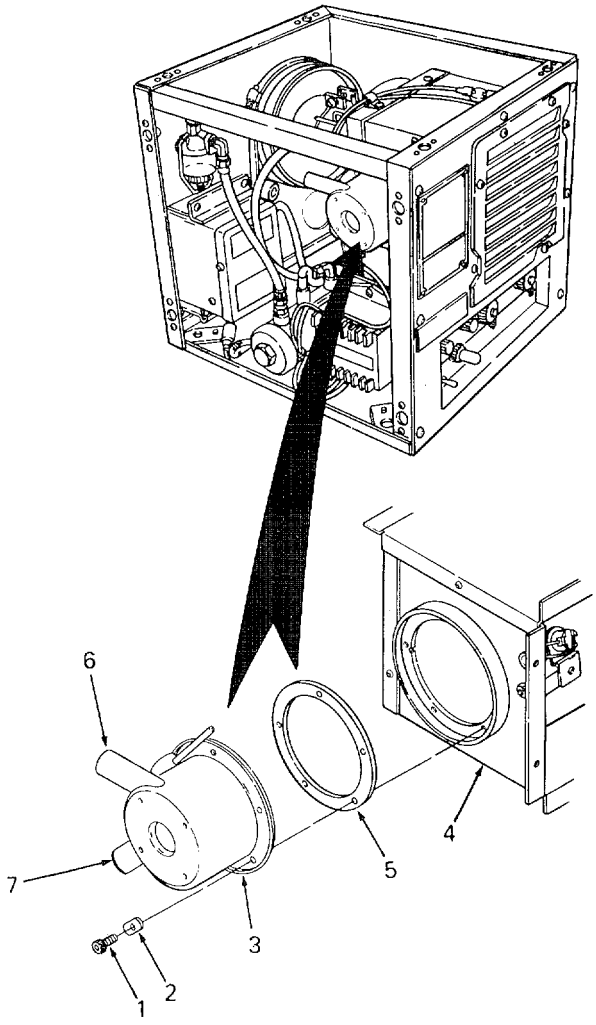


Figure 5-4. Replacing Burner assembly.

5-6. BLOWER/MOTOR/VENT ASSEMBLY

This task covers:
a. Removal
b. Disassembly
c. Cleaning
d. Inspection
e. Assembly
f. Installation
g. Testing

INITIAL SETUP

Tools

Tool Kit, Service Refrigeration Unit
(Item 1, Appendix B, Section III)

Equipment Condition

Heater removed from its installation.
Louver removed (para 4-11).
Burner head removed (para 5-5).

Material/Parts

Gasket
(Item 1, Appendix H)
Soft-bristle brush
(Item 2, Appendix E)
Lint-free cloth
(Item 4, Appendix E)
Tags
(Item 13, Appendix E)
Tape
(Figure 11, Appendix F)

REMOVAL (Figure 5-5)

NOTE

Disassemble only to level required to make repairs.

1. Remove 11 screws (1) securing front plate assembly (2) to heater case (3) and heat exchanger (4). Remove front plate assembly (2).
2. Tag (Item 13, Appendix E) and disconnect motor wires (5) from ECU (8).
3. Tag (Item 13, Appendix E) and disconnect flame switch wires (23) from ECU (8).
4. Disconnect overheat switch wires (6) and remove two clamps (7).
5. Loosen clamp (9) securing blower/motor/vent assembly (10) to the back of the heater case (11).
6. Loosen two stud-camloc fasteners (12) securing control panel (13), and pull control panel out as far as wires (14) connected to control panel will allow.
7. Remove blower/motor/vent assembly (10), gasket (15), and heat exchanger (4) from the back of the heater case (11).

5-6. BLOWER/MOTOR/VENT ASSEMBLY - CONTINUED

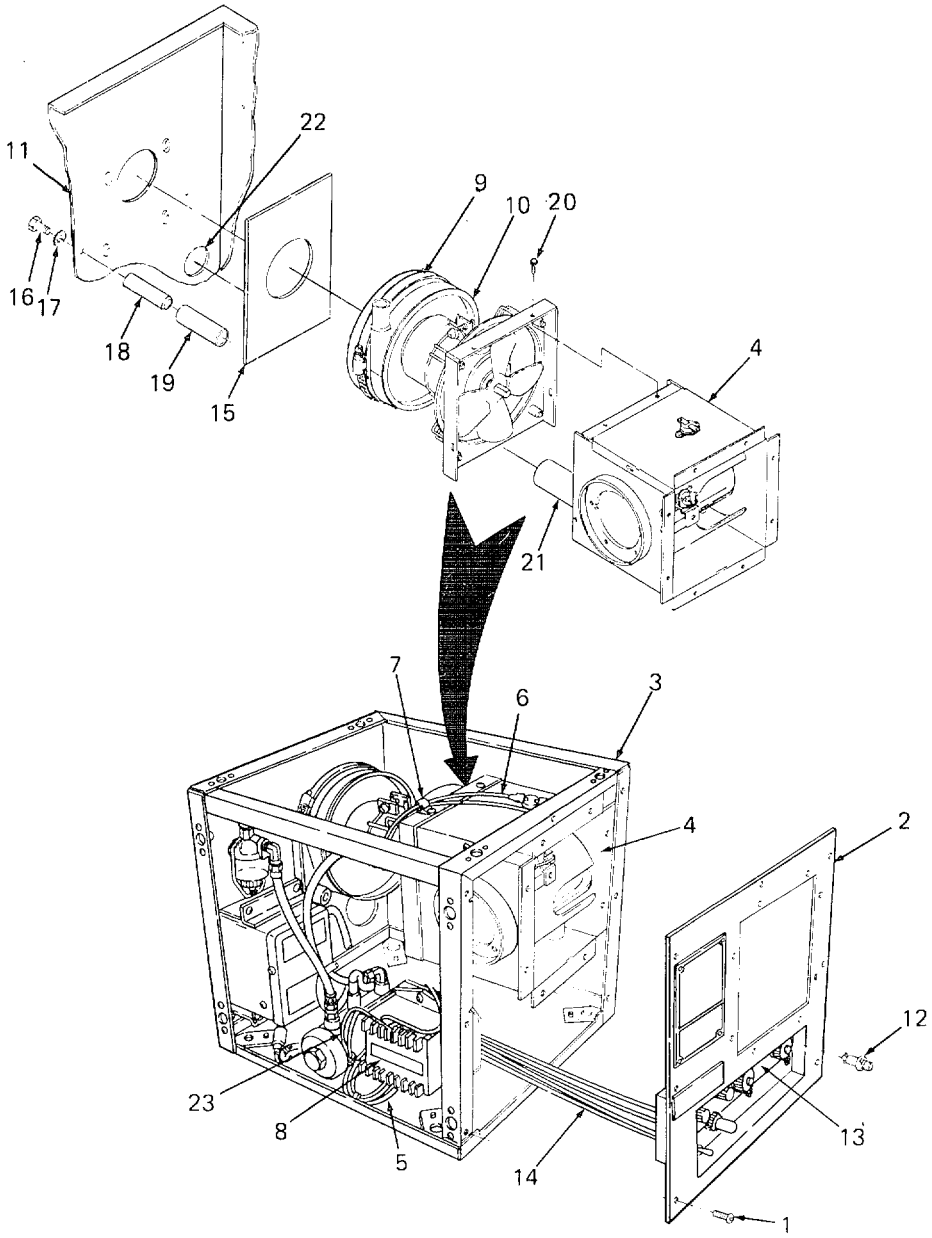


Figure 5-5. Replacing Blower/Motor/Vent Assembly.

5-6. BLOWER/MOTOR/VENT ASSEMBLY - CONTINUED

8. Remove two screws (16), two lockwashers (17), two mounting pins (18), and two rubber tubes (19) from heater case (11).
9. Remove four screws (20) securing blower/motor/vent assembly (10) to the heat exchanger (4). Separate heat exchanger and blower/motor/vent assembly.

DISASSEMBLY (Figure 5-6)

1. Remove four screws (1) and four washers (2) that secure motor mount (3) to fan mount plate (4) and remove fan mount plate.
2. Remove four wellnuts (5) from fan mount plate (4).
3. Loosen set screw (6) securing fan (7) to shaft of motor (8). Remove fan.
4. Remove tape (11).
5. Remove housing (12).
6. Loosen set screw (15) that secures blower wheel (13) to motor shaft and remove blower wheel (13).
7. Remove fan combustion air subassembly (14).
8. Loosen set screw (16) that secures blower wheel (17) to motor shaft and remove blower wheel (17).
9. Remove two nuts (18) and washers (19) securing motor (8) to blower back plate (20) and remove blower baci plate (20) from motor (8).
10. Loosen screw (9) with lockwasher (10) and remove motor mount (3) from motor (8).

CLEANING

Clean all parts using a clean lint-free cloth (Item 4, Appendix E) or soft-bristle brush (Item 2, Appendix E).

INSPECTION

Inspect all parts for wear, cracks, overheating, or damage. Replace any defective parts.

ASSEMBLY (Figure 5-6)

1. Install motor mount (3) on motor (8) and secure with screw (9) and lockwasher (10).
2. Position blower back plate (20) on motor (8) and secure with two nuts (18) and washers (19).

5-6. BLOWER/MOTOR/VENT ASSEMBLY- CONTINUED

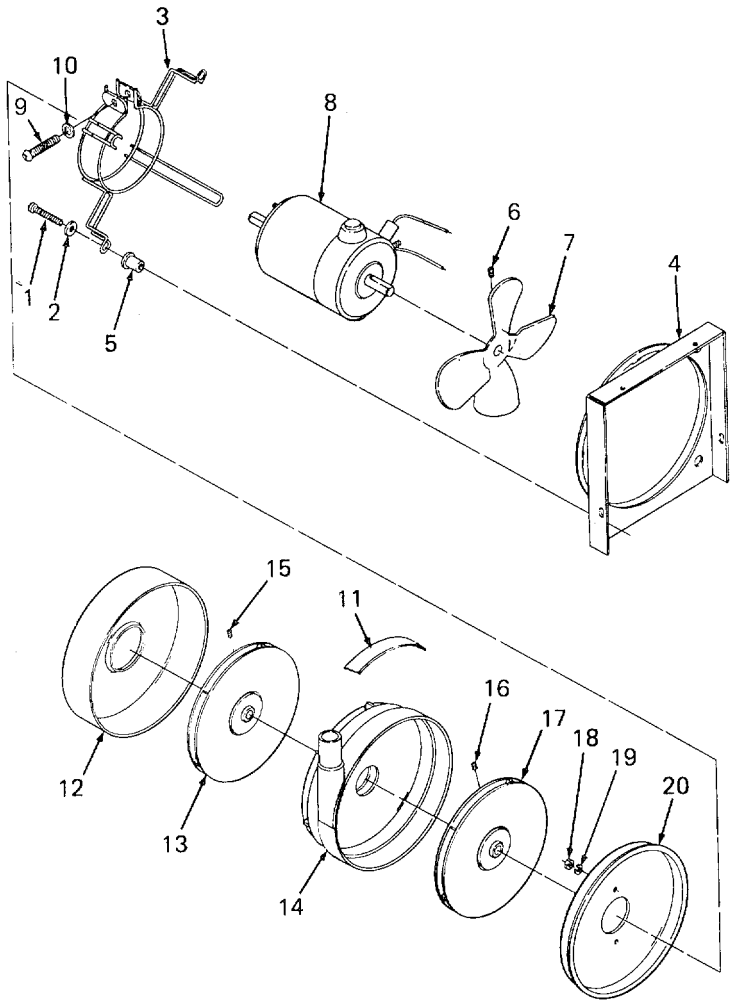


Figure 5-6. Repairing Blower/Motor/Vent Assembly.

CAUTION

Make sure clearance exists between back plate mounting studs and blower wheel. Equipment damage could occur.

3. Position blower wheel (17) on motor shaft, aligning set screw (16) with flat on motor shaft, and secure.
4. Position fan combustion air subassembly (14) over blower wheel (13), making sure it is aligned as shown in Figure 5-6.

5-6 BLOWER/MOTOR/VENT ASSEMBLY - CONTINUED

CAUTION

Make sure clearance exists between back of fan combustion subassembly and blower wheel. Equipment damage may occur.

5. Position blower wheel (13) on motor shaft, aligning set screw (15) with flat on motor shaft, and secure.
6. Position housing (12) over blower wheel (13).
7. Install tape(11) (Figure 11, Appendix F).
8. Install fan (7) to motor shaft, aligning set screw (6) with flat on motor shaft, and secure.
9. Install four wellnuts (5) in fan mount plate (4).
10. Align fan mount plate (4) to the motor mount (3). Secure with four screws (1) and four washers (2) to wellnuts (5) on fan mount plate (4). Torque to 5 lb-in.
11. Position the blower/motor/vent assembly to the heat exchanger (4, figure 5-5) and secure with four screws (20).

INSTALLATION (Figure 5-5)

1. Assemble two screws (16), two lockwashers (17), two mounting pins (18), and two rubber tubes (19) to heater case (11).
2. Position the blower/motor/vent assembly (10), gasket (15), and heat exchanger (4) to heater case (11). Align heat exchanger exhaust tube (21) in exhaust fitting opening (22) on back of the heater case (11).
3. Align the assembled parts to the back and front of heater case (3).
4. Position front plate assembly (2) to heater case and secure with 1 screws (1). Note that four screws are installed in the heat exchanger.
5. Tighten the clamp and sleeve (9) around the mounting pins (18).
6. Align the control panel (13) and secure with two stud-camloc fasteners (12).
7. Install two clamps (7) and connect overheat switch wires (6).
8. Connect flame switch wires (23) to ECU (8).
9. Connect motor wires (5) to ECU (8).

TEST

1. Connect the thermostat and power plugs to the control panel.
2. Start the heater (para 2-10) and check for correct heater operation.

5-7. HEAT EXCHANGER

This task covers: a. Disassembly b. Cleaning c. Inspection d. Reassembly

INITIAL SETUP

Tools

Tool Kit, Service Refrigeration Unit
(Item 1, Appendix B, Section III)

Material/Parts

Dry cleaning solvent
(Item 6, Appendix

Wire brush
(Item 3, Appendix E)WARNING

Equipment Condition

Heat exchanger removed from heater and blower/motor/vent assembly (para 5-6). Overheat switch and flame switch removed from heat exchanger (para 4-24).

General Safety Instructions

WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent is potentially dangerous to personnel. Do not use near open flame or excessive heat. Flash point is 140°F (60°C).

DISASSEMBLY (Figure 5-7)

1. Remove two screws (1) securing top subassembly (2) to bracket (3).
2. Remove four screws (4) securing exhaust cover (5) to bracket (3) and remove cover (5).
3. Remove heat exchanger (6) from bracket (3).

CLEANING

Clean the heat exchanger using dry cleaning solvent (Item 6, Appendix E) and a wire brush (Item 3, Appendix E) to remove deposits. Allow to dry.

INSPECTION

Inspect the heat exchanger and exhaust pipe for cracks, breaks, holes, corrosion, and other damage. Replace a defective heat exchanger.

5-7. HEAT EXCHANGER- CONTINUED

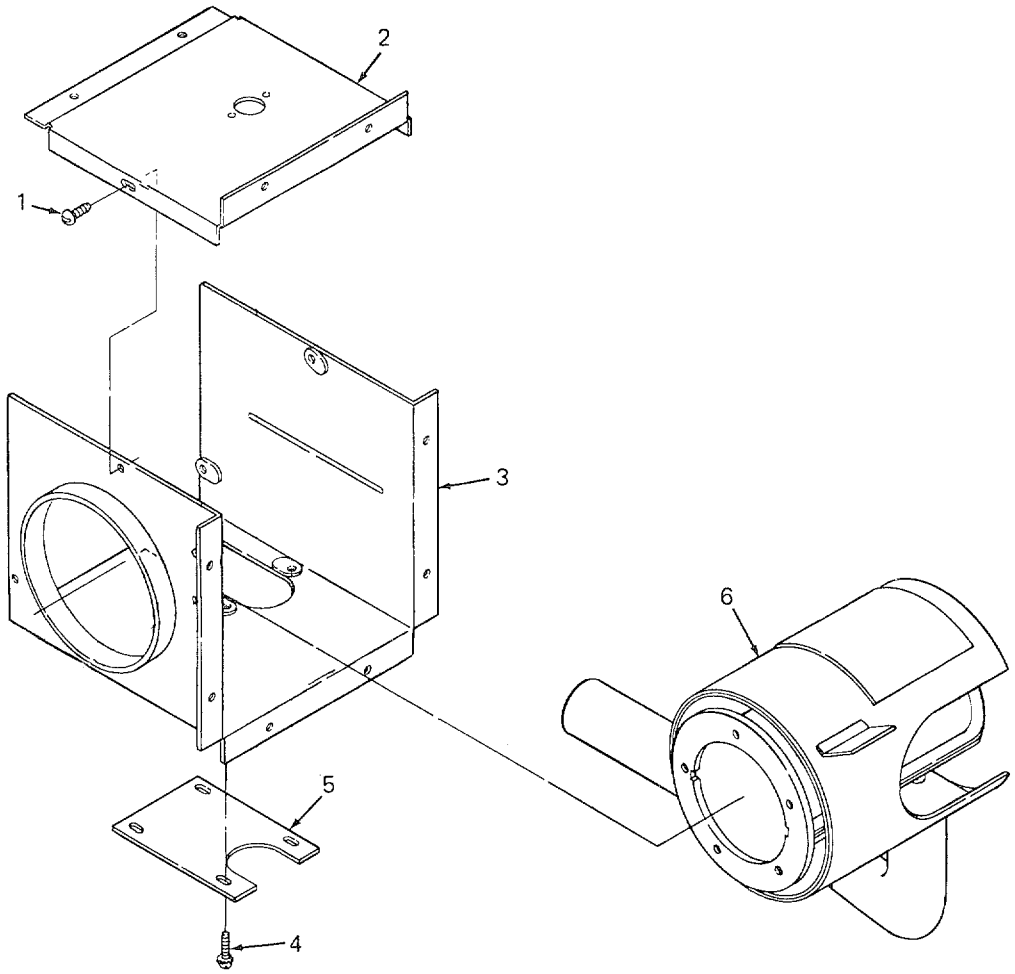


Figure 5-7. Replacing Heat Exchanger.

5-7. HEAT EXCHANGER - CONTINUED

REASSEMBLY

1. Install heat exchanger (6) in the bracket (3).
2. Install exhaust cover (5) and secure with four screws (4).
3. Install top subassembly (2) and secure with two screws (1).

5-8. HEATER CASE

This task covers: a. Inspection b. Repair

INITIAL SETUP

Tools

Tool Kit, Service Refrigeration Unit
(Item 1, Appendix B, Section III)

Shop Set, Automotive Vehicle
(Item 3, Appendix B, Section III)

Riveter, Blind, Hand
(Item 4, Appendix B, Section III)

Material/Parts

Gasket
(Item 3, Appendix H)

Rivet
(Item 9, Appendix H)

Equipment Condition

Heater removed from its installation.
Cover panels removed as required for access to all four threaded mounts (para 4-10).
Blower/motor/vent assembly removed (para 5-6).

INSPECTION (Figure 5-8)

Inspect threaded mounts (2), camloc receptacles (4), and exhaust connector (6) for any damage. Replace any defective parts.

REPAIR

1. Threaded Mounts.

   a. Remove two screws (1) securing each of the four threaded mounts (2) to heater case (3).

   b. Install four threaded mounts (2) and secure each with two screws (1).

2. Camloc Receptacle.

   a. Using a .125-inch diameter drill bit, drill out two rivets (5) that secure each of the eight camloc receptacles (4) to heater case (3).

   b. Install camloc receptacles (4) and secure with rivets (5) using a rivet gun.

5-8. HEATER CASE - CONTINUED

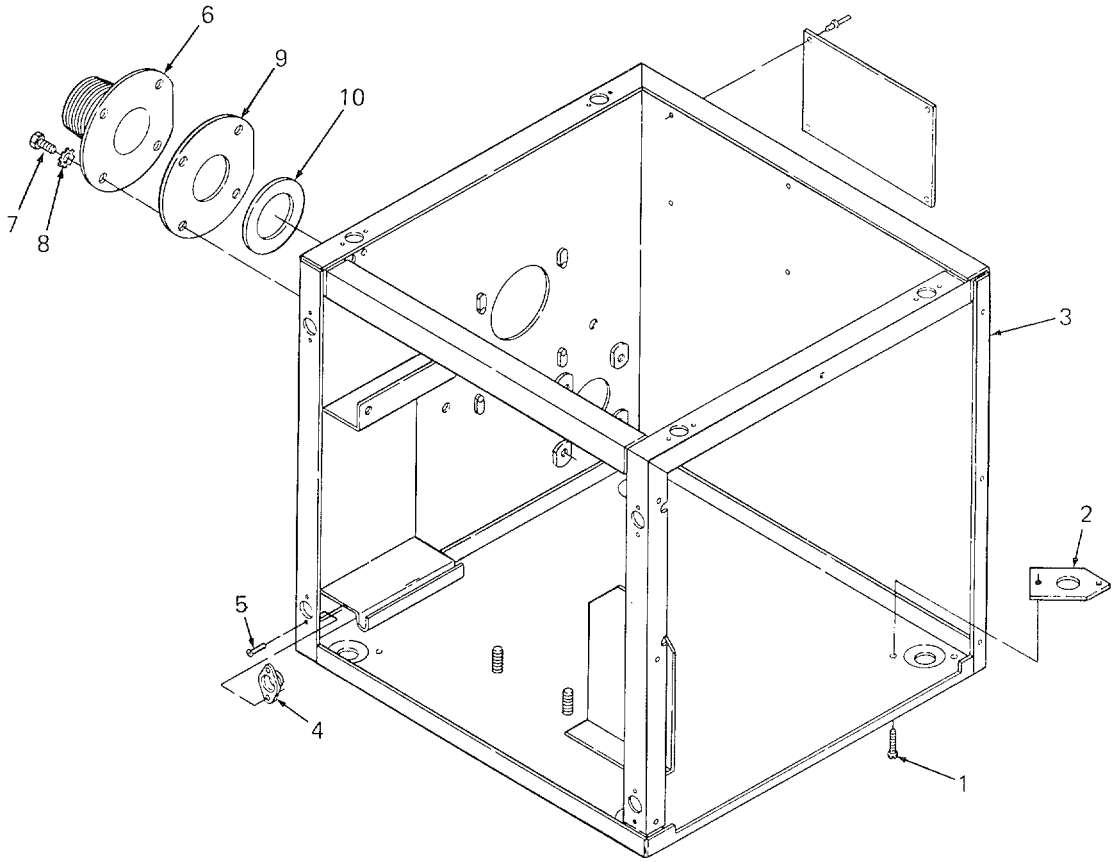


Figure 5-8. Repairing Heater Case.

3. Exhaust Connector.

   a. Remove four screws (7) and four washers (8) securing exhaust connector (6) to heater case (3).

   b. Remove exhaust connector (6), gasket (9), and washer (10) from the heater case (3).

   c. Install washer (10), gasket (9), and exhaust connector (6) to heater case (3). Secure with four screws (7) and four washers (8).

APPENDIX A

REFERENCES

SCOPE.
This appendix lists all forms, field manuals, and technical manuals referenced in this manual.

FORMS.

Recommended Changes to Publications and Blank Forms	DA Form 2028
Equipment Inspection and Maintenance Worksheet	DA Form 2404
Product Quality Deficiency Report	SF 368
Recommended Changes to Equipment Technical Manuals	DA Form 2028-2

FIELD MANUALS.

Chemical and Biological Contamination Avoidance	FM 3-3
NPC Protection	FM 3-4
NMC Decontamination	FM 3-5

TECHNICAL MANUALS.

Unit and Direct Support Maintenance Repair Parts and Special Tool List, Heater, Space, Diesel, With Blower, 15,000 BTU/HR, 28 VDC	TM 9-45200-260-3P
Destruction of Army Materiel to Prevent Enemy Use	TM 750-244-3

MISCELLANEOUS.

The Army Maintenance Management System (TAMMS)	DA Pam 738-750
Functional Users Manual for the Army Maintenance Management System	DA Pam 738-751
Expendable/Durable Items	CTA 50-790
Army Medical Dept. Expendable/Durable Items	CTA 8-100
Army Logistics Readiness and Sustainability	AR 700-138

APPENDIX B

MAINTENANCE ALLOCATION CHART (MAC)

SECTION I. INTRODUCTION

B-1. THE ARMY MAINTENANCE SYSTEM MAC.

a. This introduction (Section I) provides a general explanation of all maintenance and repair functions authorized at various maintenance levels under the standard Army Maintenance System concept.

b. The Maintenance Allocation Chart (MAC) in Section II designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance levels, which are shown on the MAC in column (4) as:

Unit - includes two subcolumns, C (operator/crew) and O (unit) maintenance.
Direct Support - includes an F subcolumn.
General Support - includes an H subcolumn.
Depot - includes a D subcolumn.

c. Section III lists the tools and test equipment (both special tools and common tool sets) requircd for each maintenance function as referenced from Section II.

d. Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

B-2. MAINTENANCE FUNCTIONS.

Maintenance functions are limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination; e.g., by sight, sound, or feel.

b. Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition; e.g., to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or gases.

d. Adjust. To maintain or regulate, within prescribed limits, by bringing into proper position, or by setting the operating characteristics to specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test, measuring, and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard o' known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Remove/Install. To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of equipment or system.

h. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and assigned maintenance level is shown as the 3rd position code of the SMR code.

i. Repair. The application of maintenance services[1] , including fault location/troubleshooting[2],removal/installation, and disassembly/assembly3 procedures, and maintenance actions4 to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications (i.e., DMWR). Overhaul is normally the highest degree of material maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (e.g., hours/miles) considered in classifying Army equipment/components.

B-3. EXPLANATION OF COLUMNS IN THE MAC, SECTION II.

a. Column 1, Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the item names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Functions. Column 3 lists the functions to be performed on the item listed in Column 2. (For detailed explanation of these functions, see paragraph B-2.)

d. Column 4., Maintenance Level. Column 4 specifies each level of maintenance authorized to perform each function listed in Column 3, by indicating work time required (expressed as man-hours in whole hours or decimals) in the appropriate subcolumn. This work-time figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance levels, appropriate work-time figures will be shown for each level. The work-time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. The symbol designations for the various maintenance levels are as follows:

C	Operator or Crew Maintenance
O	Unit Maintenance
F	Direct Support Maintenance
H	General Support Maintenance
D	Depot Maintenance

e. Column 5, Tools and Test Equipment Reference Code. Column 5 specifies, by code, those common tool sets (not individual tools), common TMDE, and special tools, special TMDE, and special support equipment required to perform the designated function. Codes are keyed to tools and test equipment in Section III.

1. Services- Inspect, test, service, adjust, align, calibrate, and/or replace.
2. Fault location/troubleshooting - The process of investigating and detecting the cause of equipment malfunctioning; the act of isolating a fault within a system or unit under test (UUT).
3. Disassembly/assembly - The step-by-step breakdown (taking apart) of a spare/functional group coded item to the level of its least component, that is assigned an SMR code for the level of maintenance under consideration (i.e., identified as maintenance significant).
4. Actions - Welding, grinding, riveting, straightening, facing, machining, and/or resurfacing.

f. Column 6, Remarks. When applicable, this column contains a letter code, in alphabetical order, which is keyed to the remarks contained in Section IV.

B-4. EXPLANATION OF COLUMNS IN TOOL AND TEST EQUIPMENT REQUIREMENTS, SECTION III.

a. Column 1, Reference Code. The tool and test equipment reference code correlates with a code used in the MAC, Section II, Column 5.
b. Column 2, Maintenance Level. The lowest level of maintenance authorized to use the tool or test equipment.
c. Column 3, Nomenclature. Name or identification of the tool or test equipment.
d. Column 4, National Stock Number. The National stock number of the tool or test equipment.
e. Column 5, Tool Number. The manufacturer's part number, model number, or type number.

B-5. EXPLANATION OF COLUMNS IN REMARKS, SECTION IV.

a. Column 1, Remarks Code. The code recorded in Column 6, Section II.
b. Column 2, Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

SECTION II. MAINTENANCE ALLOCATION CHART

GROUP NUMBER	COMPONENT ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE LEVEL					TOOLS AND EQUIP	REMARKS
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
00	Heater Assembly	Install		1.0				1	
	UH48-E	Service	0.2					1	
		Replace		1.0				1	
01	Heater Assembly	Inspect	0.1					1	
	Cover Panels	Replace		0.2				1	
	Louver	Inspect	0.1						
		Replace		0.2				1	
	Data Plates	Inspect	0.1						
	Replace			0.2				1,3,4	
0101	Control Panel	Inspect		0.1					
		Test		0.5					
		Replace		0.5				1,2,3	
		Repair		1.0				1,2,3	
	Fuse	Replace		0.1				1	
0102	Rain Shield	Inspect		0.1					
		Replace		0.3				1	
02	Fuel System								
0201	Fuel Strainer	Service		0.3				1	
		Replace		0.5				1	A
0202	Fuel Pump	Service		0.3					
		Replace		0.5				1	A
0203	Carburetor	Inspect		0.1					
		Adjust		0.3				1	
		Replace			0.5			1	A
		Repair			1.5			1	
	Solenoid Valve	Test			0.3				A
		Replace			0.3			1	

SECTION II. MAINTENANCE ALLOCATION CHART

GROUP NUMBER	COMPONENT ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE LEVEL					TOOLS AND EQUIP	REMARKS
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
03	Electrical								
0301	Ignition Pack	Test		0.3					
		Replace		0.5				1	
0302	Wiring	Inspect		0.3					
		Repair		0.5				1,2	
		Replace		0.5					
0303	Electronic Control Unit	Inspect			0.3				
		Replace			0.5			1	
0304	Overheat Thermostat/	Inspect		0.2					
	Flame Switch	Replace		1.3				1	
04	Burner Assembly								
0401	Burner Head	Inspect			0.1				
		Replace			0.5			1	A
0402	Igniter	Inspect		0.2					
		Replace		0.3				1	
0403	Glow Plug	Inspect		0.2					
		Replace		0.3				1	
	Air Duct Hose	Replace		0.3				1	
05	Blower/Motor/Vent	Inspect			0.2				
	Assembly	Replace			1.0			1	
		Repair			1.0			1	A
06	Heat Exchanger	Inspect			0.2				
		Replace			1.0			1	
07	Heater Case Assembly	Inspect			0.3				
		Repair			0.3			1,3,4	
08	Room Thermostat	Inspect		0.1					
		Adjust	0.1					1	
		Replace		0.3				1	

SECTION III. TOOLS AND TEST EQUIPMENT

(1) Tool or Test Equipment Ref Code	(2) Maintenance Level	(3) Nomenclature	(4) National Stock Number	(5) Tool Number
1 Unit	O,F	Tool Kit, Service Refrigeration	5180-00-596-1474	
2	O,F	Soldering Gun Kit	3439-00-930-1638	
3	O,F	Shop Set, Automotive Vehicle	4910-00-754-0654	
4	O,F	Riveter, Blind, Hand	5120-00-017-2849	

SECTION IV. REMARKS

Remarks Code	Remarks
A	Replace all mandatory replacement parts.

APPENDIX C
COMPONENTS OF END ITEM (COEI) AND BASIC ISSUE ITEMS (BII) LISTS

SECTION I. INTRODUCTION

C-1. SCOPE.
This appendix lists the components of end item and basic issue items for the Diesel Space Heater With Blower to help you inventory the items for safe and efficient operation of the equipment.

C-2. GENERAL.
The Components of End Item (COEI) and Basic Issue Items (BII) Lists are divided into the following sections:

a. Section II. Components of End Item. This listing is for information purposes only, and is not authority to requisition replacements. These items are part of the heater. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Items of COEI are removed and separately packaged for transportation or shipment only when necessary. Illustrations are furnished to help you find and identify the items.

b. Section III. Basic Issue Items. These essential items are required to place the Diesel Space Heater With Blower in operation, operate it, and do emergency repairs. Although shipped separately packaged, BII must be with the Diesel Space Heater With Blower during operation and when it is transferred between property accounts. This list is your authority to request/requisition them for replacement based on authorization of the end item by the TOE/MTOE. Illustrations are furnished to help you find and identify the items.

C-3. EXPLANATION OF COLUMNS.
The following provides an explanation of columns found in the tabular listings:

a. Column (1), Illus. Number, gives you the number of the item illustrated.

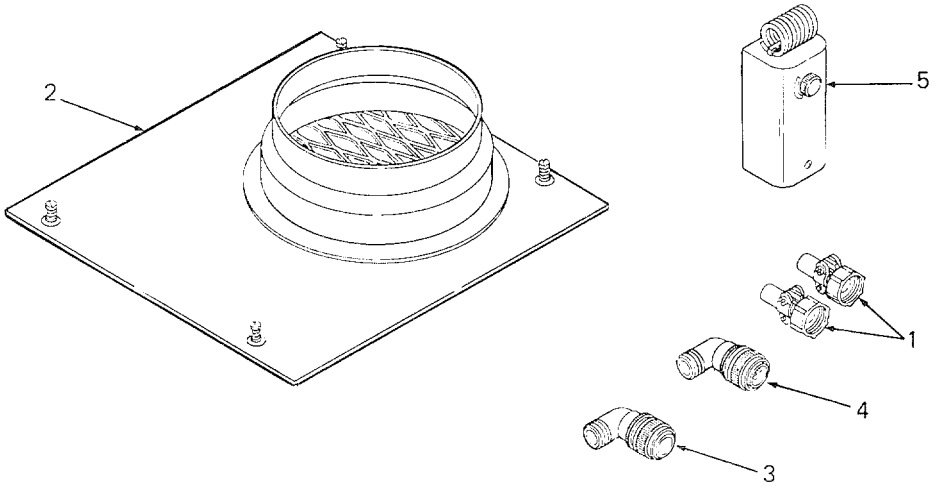
b. Column (2), National Stock Number, identifies the stock number of the item to be used for requisitioning purposes.

c. Column (3), Description and Usable on Code, identifies the Federal item name (in all capital letters) followed by a minimum description when needed. The last line below the description is the Commercial and Government Entity Code (CAGEC) (in parentheses) and the part number.

d. Column (4), U/I (unit of issue), indicates how the item is issued for the National Stock Number shown in column two.

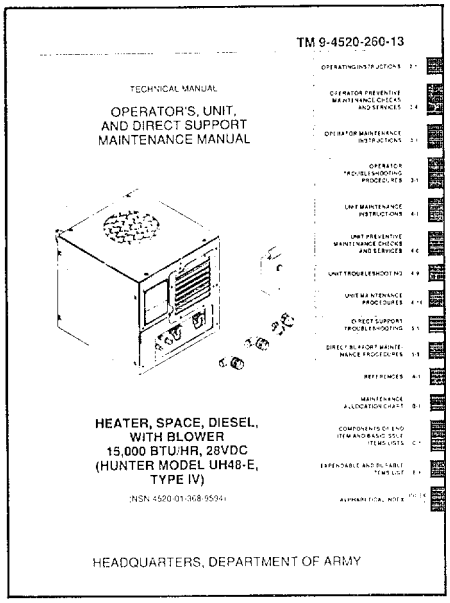
e. Column (5), Qty Rqd, indicates the quantity required.

SECTION II. COMPONENTS OF END ITEM



(1) Illus. Number	(2) National Stock Number	(3) Description CAGEC and Part Number	(4) U/I	(5) Qty Rqd
1		CLAMP, CABLE (96906) MS3057-6A	EA	2
2		COVER ASSEMBLY (92878) 48278	EA	1
3		PLUG, CONNECTOR (96906) MS3108R-14S-7S	EA	1
4		PLUG, THERMOSTAT (96906) MS3108R-14S-7PX	EA	1
5		THERMOSTAT, ROOM (92878) 68279	EA	1

SECTION III. BASIC ISSUE ITEMS



(1) Illus. Number	(2) National Stock Number	(3) Description CAGEC and Part Number	(4) U/I	(5) Qty Rqd
1		Technical Manual TM 9-4520-260-13, Operator's, Unit, and Direct Support Maintenance Manual for Heater, Space, Diesel, With Blower, 15,000 BTU/HR, 28 VDC.	EA	1

APPENDIX D
ADDITIONAL AUTHORIZATION LIST (AAL)

SECTION I. INTRODUCTION

D-1. SCOPE.
This appendix lists additional items that you are authorized for the support of the Heater, Space, Diesel, With Blower.

D-2. GENERAL.
This list identifies items that do not have to accompany the heater and that do not have to be turned in with it. These items are all authorized to you by CTA, MTOE, TDA, or JTA.

D-3. EXPLANATION OF LISTING.
National stock numbers, descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment. If the item required differs for different models of this equipment see the "Used on Code" column for the applicable model or models.

SECTION II. ADDITIONAL AUTHORIZED ITEMS LIST

D-4. An Additional Authorized Items List is not required for this heater.

APPENDIX E
EXPENDABLE AND DURABLE ITEMS LIST

SECTION I. INTRODUCTION

E-1. SCOPE.

This appendix lists expendable and durable items that you will need to operate and maintain the Diesel Space Heater With Blower. This listing is for information only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-790, Expendable/Durable Items (except medical, Class V repair parts, and heraldic items), or CTA 8-100, Army Medical Department Expendable/Durable Items.

E-2. EXPLANATION OF COLUMNS.

a. Column (1), Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the item (e.g., "Use cleaning compound, Item 5, Appendix E").

b. Column (2), Level. This column identifies the lowest level of maintenance that requires the item.

c. Column (3), National Stock Number. This is the national stock number assigned to the item which you can use to requisition it.

d. Column (4), Item Name, Description, Commercial and Government Entity Code (CAGEC), and Part Number. This provides the other information you need to identify the item.

e. Column (5), Unit of Measure (U/M). This code shows the physical measurement or count of an item, such as gallon, dozen, gross, etc.

SECTION II. EXPENDABLE AND DURABLE ITEMS LIST

(1) Item. Number	(2) Level	(3) National Stock Number	(4) Item Name, Description, CAGEC, Part Number	(5) U/M
1	O	8030-00-251-3980	Anti-seize compound, MIL-A-907	lb
2	O,F		Brush, soft-bristle	ea
3	F		Brush, wire	ea
4	O,F		Cloth, lint-free	ea
5	C,F	8030-00-837-6557	Corrosion preventive compound (MIL-C-16173, Grade III or IV)	oz
6	C,O,F	6850-00-274-5421	Dry cleaning solvent, P-D-68(), Type II	gl
7	C,O,F,		Fuel, diesel VV-F-800, Class DF-I VV-F-800, Class DF-2 VV-F-800, Class DF-A	gl
8	F	9150-00-007-9289	Lubricant (10549) FS 1292	oz
9	C,O,F	7920-00-205-1711	Rags, wiping	lb
10	O	8030-0(0-247-2525	Sealing compound, gasket (MIIL-S-45180, ,Type 1) (Permatex No. 1 or equivalent)	oz
11	C	7930-00-068-1669	Soap	oz
12	O,F	3439-01-153-2077	Solder, rosin core, SN60, Form W, 99-S-571	oz
13	F	9905-00-537-8954	Tags, marking, MIL-T-12755	bx
14	O	5975-01-077-2222	Tie wraps	ea

APPENDIX F
ILLUSTRATED LIST OF MANUFACTURED ITEMS

SECTION I. INTRODUCTION

This appendix includes complete instructions for making items authorized to be manufactured or fabricated.

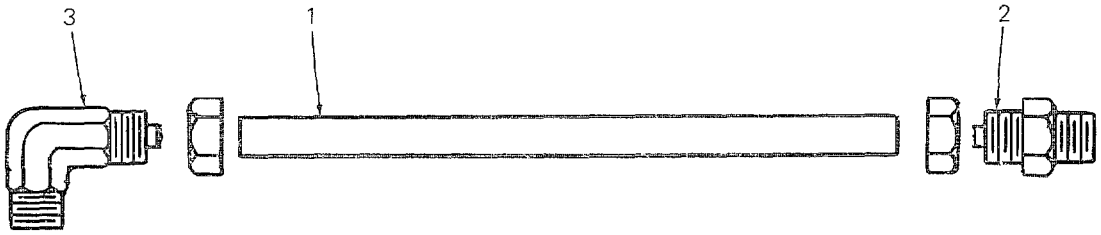
A part number index in alphanumeric order is provided for cross-referencing the part number of the item to be manufactured to the figure which covers fabrication criteria. Electrical wire part numbers are also cross-referenced to Figure FO-1.

All bulk materials needed for manufacture of an item are listed by part number or specification number in a tabular list on the illustration.

SECTION II. MANUFACTURED ITEMS PART NUMBER INDEX

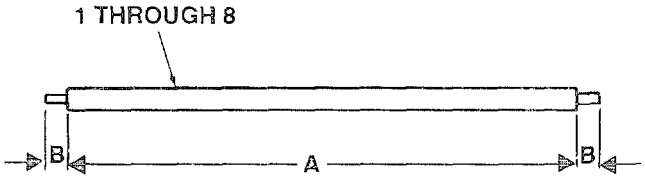
Part No.	Figure No.
10657	11
10664-7	1
10664-11.5	1
10766-9	3
10766-10.5	2
10767-23.5	5
10768-5	6
10769-8.5	2
10769-15	2
10769- 17	3
10770-5.5	7
10771-26	2
10772-6	8
10772-19	2
10772-24	9
10774-5	3
10774-9.5	2
10781-6	4
10781-8	10
10781-22	5
10818-10	3
10895-20.5	2
10898-19.5	2

SECTION lll. MANUFACTURED ITEMS



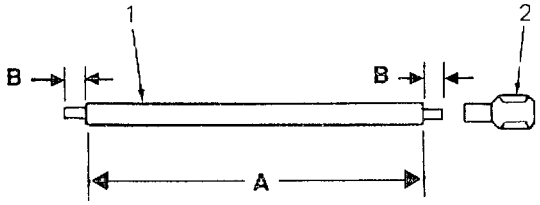
Item Part No.	CAGEC	Index No.	Material Part No.	Description	Length (inches)
10664-7	92878	1	10664	Fuel Hose	7
4374	14726	2	268P	Male Connector	
4373	14726	3	269P	Male Elbow	
10664-11.5	92878	1	10664	Fuel Hose	11.5
4374	14726	2	268P	Male Connector	
4373	14726	3	269P	Male Elbow	

Figure 1. Fuel Hoses.



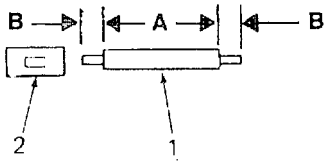
Item Part No.	CAGEC	Index No.	Material Part No.	Description	Length A (inches)	Length B (inches)
10772-19	92878	1	M16878/1BJEO	Electrical Wire	19	1/4
10895-20.5	92878	2	M16878/4BJEO	Electrical Wire	20.5	1/4
10771-26	92878	3	M16878/1BJE8	Electrical Wire	26	1/4
10898-19.5	92878	4	M16878/4BJE7	Electrical Wire	19.5	1/4
10766-10.5	92878	5	M16878/lBJE3	Electrical Wire	10.5	1/4
10769-15	92878	6	M16878/IBJE6	Electrical Wire	15	1/4
10769-8.5	92878	7	M16878/1BJE6	Electrical Wire	8.5	1/4
10774-9.5	92878	8	M16878/4BJE2	Electrical Wire	9.5	1/4

Figure 2. Heater Wires.



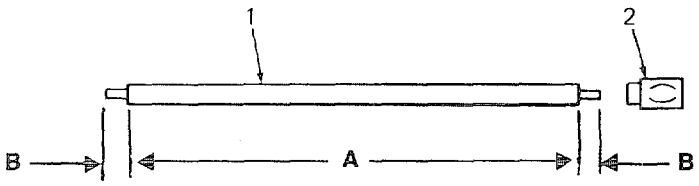
Item Part No.	CAGEC	Index No.	Material Part No.	Description	Length A (inches)	Length B (inches)
10774-5	92878	1	M16878/4BJE2	Electrical Wire	5	3/8
5865	14726	2	S09723 SNT	Lug Terminal		
10818-10	92878	1	M16878/1BGE9	Electrical Wire	10	3/8
5865	14726	2	S09723 SNT	Lug Terminal		
10766-9	92878	1	M16878/1BJE3	Electrical Wire	9	3/8
5865	14726	2	S09723 SNT	Lug Terminal		
10769-17	92878	1	M16878/lBJE6	Electrical Wire	17	3/8
5865	14726	2	S09723 SNT	Lug Terminal		

Figure 3. Heater Wires.



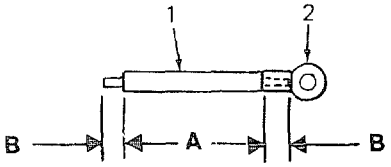
Item Part No.	CAGEC	Index No.	Material Part No.	Description	Length A (inches)	Length B (inches)
10781-6	92878	1	M16878/1BJE9	Electrical Wire	6	1/4
4109	14726	2	MIL-T-7928/3-2	Lug Terminal		

Figure 4. Heater Wire.



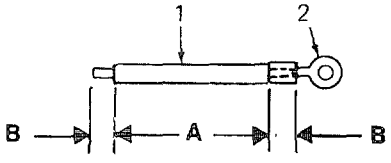
Item Part No.	CAGEC	Index No.	Material Part No.	Description	Length A (inches)	Length B (inches)
10781-22 168546	92878 14726	1 2	M16878/1BJE9 S05075	Electrical Wire Lug Terminal	22	1/4
10767-23.5 168546	92878 14726	1 2	M16878/1BJE1 S05075	Electrical Wire Lug Terminal	23.5	1/4

Figure 5. Heater Wires.



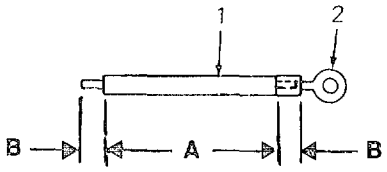
Item Part No.	CAGEC	Index No.	Material Part No.	Description	Length A (inches)	Length B (inches)
10768-5 3914	92878 14726	1 2	M16878/4BJE2 MIL-T-7928/1-39	Electrical Wire Lug Terminal	5	1/4

Figure 6. Heater Wire.



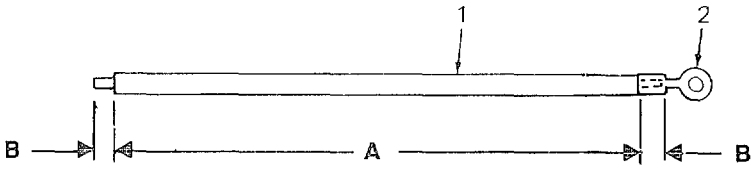
Item Part No.	CAGEC	Index No.	Material Part No.	Description	Length A (inches)	Length B (inches)
10770-5.5 5383	92878 14726	1 2	M16878/1BJE4 R4147F	Electrical Wire Lug Terminal	5.5	1/4

Figure 7. Heater Wire.



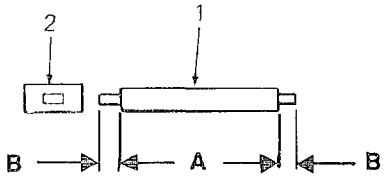
Item Part No.	CAGEC	Index No.	Material Part No.	Description	Length A (inches)	Length B (inches)
10772-6	92878	1	M16878/1BJE0	Electrical Wire	6	1/4
5674	14726	2	R4113T1	Lug Terminal		

Figure 8. Heater Wire.



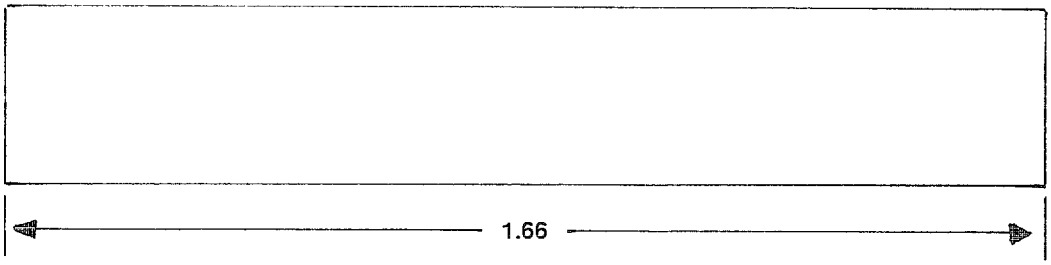
Item Part No.	CAGEC	Index No.	Material Part No.	Description	Length A (inches)	Length B (inches)
10772-24	92878	1	M16878/1BJE0	Electrical Wire	24	1/4
11275	14726	2	R4161FT	Lug Terminal		

Figure 9. Heater Wire.



Item Part No.	CAGEC	Index No.	Material Part No.	Description	Length A (inches)	Length B (inches)
10781-8	92878	1	M16878/1BJE9	Electrical Wire	8	1/4
4109	14726	2	MS27144-1	Lug Terminal		

Figure 10. Fuel Pump Wire/Terminal.



Item Part No.	CAGEC	Index No.	Material Part No.	Description	Length
10657	92878	1	PPP-T-60, Type 3, Class 1	Preservation Tape	1.66 feet

Figure 11. Preservation Tape.

APPENDIX G
TORQUE LIMITS

G-1. GENERAL.

This appendix provides general torque limits for fasteners. Special torque values are indicated in the maintenance procedures for applicable components. The general torque values given in this appendix shall be used when specific torque values are not indicated in the maintenance procedures.

G-2. TORQUE LIMITS.

Torque limits are listed in Table G-1 for fasteners. Dry fasteners are defined as fasteners on which no lubricants are applied to the threads. Wet fasteners are defined as fasteners on which graphite or moly-disulphide greases or other extreme pressure lubricants are applied to the threads. Table G-2 lists the minimum breakaway torque values for locknuts.

*Table G- 1. General Torque Requirements for Dry Fasteners**

	Torque Requirement in lb ft (N-m)			
Bolt/Screw Size	**SAE Grade 1 or 2**	**SAE Grade 5**	**SAE Grade 6 or 7**	**SAE Grade 8**
1/4-20 UNC	5 (7)	8 (11)	10 (14)	12 (16)
1/4-28 UNF	7 (8)	10 (14)	12 (16)	14 (19)
5/16-18 UNC	11 (15)	17 (23)	19 (26)	24 (33)
5/16-24 UNF	13 (18)	19 (26)	23 (31)	27 (37)
3/8-16 UNC	18 (24)	31 (42)	34 (46)	44 (60)
3/8-24 UNF	20 (27)	35 (47)	42 (57)	49 (66)
7/16-14 UNC	28 (38)	49 (66)	55 (75)	70 (95)
7/16-20 UNF	30 (41)	55 (75)	67 (91)	78 (106)
1/2-13 UNC	39 (53)	75 (102)	85 (115)	105 (142)
1/2-20 UNF	41 (56)	85 (115)	102 (138)	120 (163)
9/16-12 UNC	51 (69)	110(149)	120 (163)	155 (210)
9/16-18 UNF	55 (75)	120 (163)	145 (197)	170 (231)
5/8-11 UNC	63 (85)	150 (203)	167 (226)	210 (285)
5/8-18 UNF	95 (129)	170 (231)	205 (278)	240 (325)
3/4-10 UNC	105 (142)	270 (366)	280 (380)	375 (509)
3/4-16 UNF	115 (156)	295 (400)	357 (484)	420 (570)
7/8-9 UNC	160 (217)	395 (536)	440 (597)	605 (820)
7/8-14 UNF	175 (237)	435 (590)	555 (753)	675 (915)
1-8 UNC	235 (319)	590 (800)	660 (895)	910 (1234)
1-14 UNF	250 (339)	660 (865)	825 (1119)	999 (1342)

Table G- 1. General Torque Requirements for Dry Fasteners - Continued*

Bolt/Screw Size	Torque Requirement in lb ft (N.m)			
	SAE Grade 1 or 2	SAE Grade 5	SAE Grade 6 or 7	SAE Grade 8
1-1/8-7 UNC	350 (475)	800 (1085)	1000 (1356)	1280 (1736)
1-1/8-12 UNF	400 (542)	880 (1193)	1050 (1424)	1440 (1953)
1-1/4-7 UNC	500 (678)	1080 (1464)	1325 (1797)	1820 (2468)
1-1/4-12 UNF	550 (746)	1125 (1526)	1325 (1797)	1820 (2712)
1-3/8-6 UNC	660 (895)	1460 (1980)	1800 (2441)	2380 (3227)
1-3/8-12 UNF	740 (1003)	1680 (2278)	1960 (2658)	2720 (3688)
1-1/2-6 UNC	870() (118())	1940 (2631)	2913 (3950)	3160 (4285)
1-1/2-12 UNF	980 (1329)	22(00) (2983)	3000 (4068)	3560 (4827)

* Torque given is for clean, dry threads. .Reduce by 10% when engine oil is used as lubricant.

Table G-2. Locknut Breakaway Torque Values

NOTE

To determine breakaway torque, thread locknut onto screw or bolt until at least two threads stick out. Locknut shall not make contact with a mating part. Stop the locknut. Torque necessary to begin turning locknut again is the breakaway torque. Do not reuse locknuts that (do not meet minimum breakaway torque.

Thread Size	Minimum Breakaway Torque	
	lb-in.	(N.m)
10-32	2.0	(0.23)
1/4-28	3.5	(0.40)
5/16-24	6.5	(0.73)
3/8-24	9.5	(1.07)
7/16-20	14.0	(1.58)
1/2-20	18.0	(2.03)
9/16-18	24.0	(2.71)
5/8-18	32.0	(3.62)
3/4-16	50.0	(5.65)
7/8-14	70.0	(7.91)
1-12	90.0	(10.17)
1-1/8-12	117.0	(13.22)

APPENDIX H
MANDATORY REPLACEMENT PARTS

Item Number	Nomenclature	Part Number
1	Gasket, blower/motor/vent assembly	49385
2	Gasket, burner	49093
3	Gasket, exhaust	48077
4	Gasket, fuel pump	479136
5	Gasket, jet	49323
6	Gasket, strainer	MS51091-4
7	Preformed packing, carburetor	568-006
8	Preformed packing, carburetor	2-18
9	Rivet, heater case	5928
10	Rivet, identification plate	5548
11	Rivet, instruction plate	SD42BS
12	Rivet, wiring diagram	4011

GLOSSARY

SECTION I. ABBREVIATIONS

Btu/hr ..... British thermal units per hour
°C..... Degree Celsius
DC ..... Direct current
ECU ..... Electronic control unit
ETD ..... Electronic time delay
°F..... Degree Fahrenheit
Hz ..... Hertz
PMCS..... Preventive Maintenance Checks and Services
rpm ..... Revolutions per minute
U/M ..... Unit of Measure
VDC ..... Volts direct current

SECTION II. DEFINITION OF UNUSUAL TERMS

A

ALIGN - To arrange in a line vertically and/or horizontally.
ALLOCATION - Assignment of duties or materiels according to a plan.
AMBIENT - Surrounding. An engine cooled to ambient temperature has the same temperature as the air around it.
ASSEMBLY - A combination of parts that may be taken apart without destruction, which has no application or use of its own but is needed for the completeness of a more complex item with which it is combined, or to which it is attached.

C

CARBON MONOXIDE - A poisonous gas that is made while a fuel is burning, especially if there is not quite enough air. The gas is colorless, odorless, and tasteless, but it can cause illness or death. See the warnings on the Warning Page at front of manual.
COMBUSTION - A chemical change, especially oxidation, accompanied by the production of heat and light.
COMPONENT - A part or a combination of parts which together accomplish a function.
COMPRESSED AIR - Air that is under pressure. When the compressed air in a hose or pipe is allowed to escape (such as when you use an air gun), the air moves very fast and is used to blow away dirt and chips for cleaning.
CONDENSATION - A liquid formed from a vapor. Moisture carried in warm air will condense when it reaches a cold area, such as the surface of a fuel tank in subzero weather.
CONTAMINATION - To make impure by contact or mixture.
CORROSION - A gradual wearing away caused by chemical action. Metals exposed to salt water are likely to corrode.

E

EXHAUST - The gases that leave the motor while the motor is running.
EXPENDABLE - An item that is not repairable and is discarded if damaged.
EXPOSURE - Being in the presence of something, or in contact with something. Skin is exposed to cleaning solvent when the solvent contacts the skin during cleaning operations.

F

FILTER - A device which removes dirt from the air or a fluid.
FLASH POINT - The lowest temperature at which the vapors of a solvent will ignite and burn.
FRAYED - Something which has been worn away or unraveled, usually by rubbing.

G

GASKET - A seal or packing used between matched parts or around pipe joints to prevent the escape of gas or fluid.
GOGGLES - A device used to protect the eyes from dust, dirt, flying chips, etc.

INITIAL - The first or starting condition.
INTERMITTENT - Stopping and starting at intervals.

M

MALFUNCTION - Occurs when a unit fails to operate normally.

O

OBSTRUCTION - An obstacle.

P

PIVOT - A short rod or shaft about which a related part rotates; the act of turning on or as if on a pivot.

SCOPE - The extent of an activity or concept; the amount of information covered, as in a book.
SOLVENT - A liquid that can dissolve another substance.

T

TIEDOWN OR TIE WRAP - Strap or fastening device used to hold an object or wires in position.
TORQUE - Force around an axis. It produces a rotary or twisting motion.
TOXIC - Harmful; deadly; poisonous.

V

VALVE - A device used to control the flow of a fluid.
VAPOR - The gaseous form of any substance which is usually a liquid; vapors are present in the air around the substance.
VENTILATE - To provide with a source of fresh or uncontaminated air.

W

WELD - A union or joint (of metals) produced by applying heat, sometimes with pressure.

ALPHABETICAL INDEX

TM 9-4520-260-13

WIRE ASSEMBLY AND FABRICATION CHART

TERMINATION POINTS								TERMINALS	
PART NO.	FROM	TO	WIRE SPECIFICATION	COLOR	TYPE	LENGTH (inch)	GA.	PART NO.	QTY
10772-19	J1-"C"	ECU1-8	M16878/1BJE0	BLK	N	19	16		
10768-5	J1-"B"	GND SCR.	M16878/4BJE5	GRN	T	5	16	3914	1
10774-9.5	J1-"A"	F1 SIDE TERM.	M16878/4BJE2	RED	T	9.5	16		
10769-8.5	J2-"A"	S1 "OFF"	M16878/1BJE6	BLU	N	8.5	16		
10769-15	J2-"C"	ECU1-2	M16878/1BJE6	BLU	N	15	16		
10768-5	J2-"B"	GND SCR.	M16878/4BJE5	GRN	T	5	16	3914	1
10774-5	CB1-1	F1 REAR TERM.	M16878/4BJE2'	RED	T	5	16	5865	1
10818-10	CB1-2	ECU1-12	M16878/1BGE9	WH/BLK	N	10	20	5865	1
10766-9	CB1-3	S1 "ON" TERM.	M16878/1BJE3	ORN	N	9	16	5865	1
10766-10.5	S1 "ON" TERM.	ECU1-1	M16878/1BJE3	ORN	N	10.5	16		
10769-17	S3	S1 "OFF"	M16878/1BJE6	BLU	N	17	16	5865	1
10781-8	L1	ECU1-11	M16878/1BJE9	WHT	N	8	16	5981 5982 5983	1 EA
10781-6	T1	ECU1-10	M16878/1BJE9	WHT	N	6	16	4109	1
10781-22	S4	ECU1-10	M16878/1BJE9	WHT	N	22	16	168546	1
10767-23.5	S4	ECU1-9	M16878/1BJE1	BRN	N	23.5	16	168546	1
10770-5.5	GP1	ECU1-4	M16878/1BJE4	YEL	N	5.5	16	5383	1
10772-6	ECU1-8	CASE GND	M16878/1BJE0	BLK	N	6	16	5674	1
10895-20.5	S2	ECU1-7	M16878/4BJE0	BLK	T	20.5	16		
10772-24	B1	ECU1-7	M16878/1BJE0	BLK	N	24	16	11275	1
10771-26	B1	ECU1-5	M16878/1BJE8	GRY	N	26	16		
10898-19.5	S2	ECU1-3	M16878/4BJE7	VIO	T	19.5	16		

KEY TO ABBREVIATIONS

BLK	=	BLACK
BLU	=	BLUE
BRN	=	BROWN
GRN	=	GREEN
GRY	=	GRAY
N	=	NYLON
ORN	=	ORANGE
T	=	TEFLON
VIO	=	VIOLET
WH/BLK	=	WHITE W/BLACK STRIPE
WHT	=	WHITE
YEL	=	YELLOW

KEY TO DIAGRAM	
ITEM	KEY
VENT & COMB. MOTOR	B1
IGNITER	E1
FUSE	F1
GLOW PLUG	GP1
RECEPTACLE - POWER	J1
RECEPTACLE - THERMO	J2
FUEL PUMP NEG GND	L1
FUEL SOLENOID	L2
CHOKE SOLENOID	L3
ON-OFF SPST SWITCH	S1
FLAME SWITCH	S2
FUEL THERMO SWITCH	S3
OVERHEAT SWITCH	S4
IGNITION-TRANSISTOR	T1
BREAKER MAN. RESET	CB1
HEATER FUEL BLOCK	HR1
ELEC. CONTR. UNIT	ECU1
ELEC. TIME DELAY *	ETD
CAPACITOR	C1

*NOTE: ETD IS INTERNAL TO ECU1 AND IS SHOWN ONLY FOR REFERENCE.

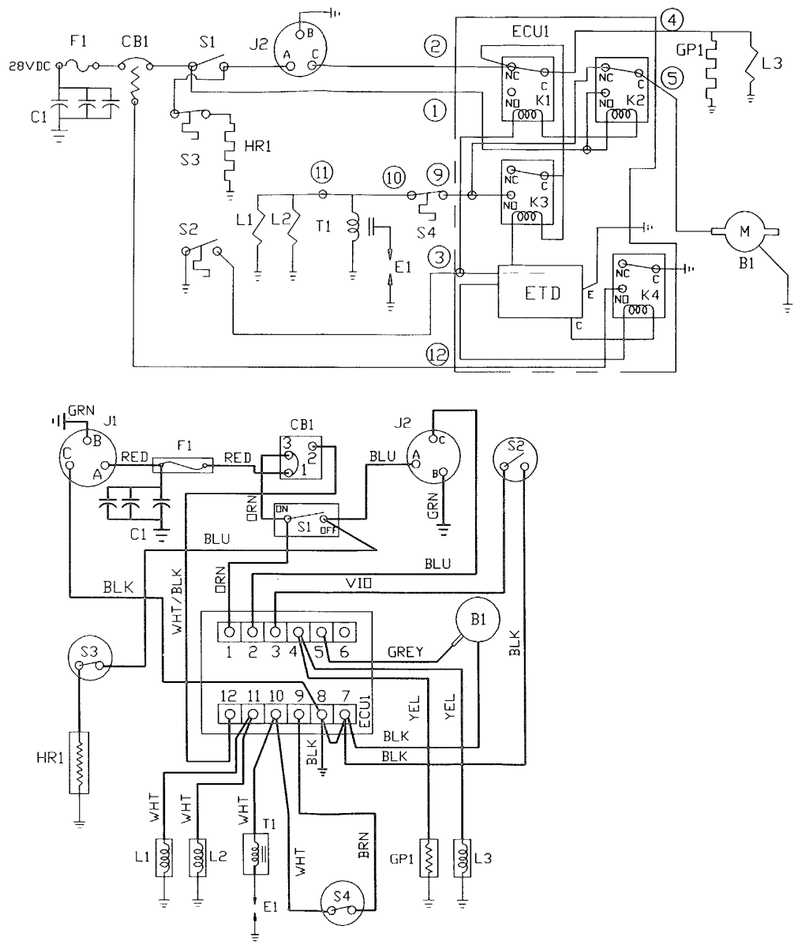


Figure FO-1. Schematic Diagram.

Figure FO-1. Schematic Diagram.
FP-1/(FP-2 blank)

By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official

MILTON H. HAMILTON
Administrative Assistant to the
Secretary of the Army
07894

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

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