TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, AND DIRECT SUPPORT MAINTENANCE MANUAL

HEATER, SPACE MULTIFUEL WITH BLOWER, 15,000 BTU/HR, 28 VDC (VBM MODEL VBM 15-IV) NSN 4520-01-032-7363

HEADQUARTERS, DEPARTMENT OF THE ARMY

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Operator's, Organizational, and Direct
Support Maintenance Manual

HEATER, SPACE MULTIFUEL WITH BLOWER,
15,000 BTU/HR, 28 VDC
(VBM MODEL VBM 15-IV)
NSN 4520-01-032-7363

TM 5-4520-242-13, 21 September 1979, is changed as follows:

1. **Remove** and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
2-5 and 2-6	2-5 and 2-6
4-13 through 4-16	4-13

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

DONALD J. DELANDRO
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-25C, Operator, Organizational, and Direct and General Support Maintenance Requirements for Heaters, Space, 15,000 BTU.

WARNING

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 gases are piped to the outside. Do not locate the heater where expelled exhaust gases 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 prolonqed 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 100°F (38°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.

TECHNICAL MANUAL
TM 5-4520-242-13

HEADQUARTERS,
DEPARTMENT OF THE ARMY
Washington, D.C., 21 September 1979

OPERATOR'S, ORGANIZATIONAL, AND DIRECT SUPPORT MAINTENANCE MANUAL

HEATER, SPACE, MULTIFUEL, WITH BLOWER, 15,000 BTU/HR, 28VDC 28 VDC (VBM MODEL VBM 15-IV) NSN 4520-01-032-7363

REPORTING OF ERRORS

You can help improve this manual by calling attention to errors and by recommending improvements, using DA Form 2028 (Recommended Changes to Publications and Blank Forms) or DA Form 2028-2 (Test), located in back of manual, or by a letter, and mail directly to Commander, U.S. Army Troop Support Command, ATTN: DRSTS-MTPS, 4300 Goodfellow Blvd., St. Louis. MO 63120, A rely will be furnished directly to you.

LIST OF ILLUSTRATIONS

LIST OF TABLES

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. SCOPE. This manual is for your use in operating and maintaining the Heater, Space, Multifuel, with Blower, 15,000 Btu/hr (3780 kg-c), 28 vdc Model VBM 15-IV.

1-2. MAINTENANCE FORMS AND RECORDS.

a. Maintenance forms and records that you are required to use are as follows:

(1) DA Form 2402 (Exchange Tag).

(2) DA Form 2404 (Equipment Inspection and Worksheet).

(3) DA Form 2407 (Maintenance Request Used for Requesting Support Maintenance).

(4) DA Form 2407-1 (Continuation Sheet Used for Requesting Support Maintenance).

b. For additional forms and records pertaining to your particular equipment, refer to TM 38-750 (The Army Maintenance Manual System [TAMMS]).

1-3. ADMINISTRATIVE STORAGE.

a. General.

(1) Equipment that is placed in administrative storage should be capable of being readied to perform its mission within a 24-hour period or otherwise may be prescribed by the approving authority.

(2) Report equipment in administrative storage in Materiel Readiness and Unit Readiness reports as prescribed for all reportable equipment.

(3) Perform inspections, maintenance services, and lubrications in accordance with the instructions in this manual.

b. Storage Site.

(1) Select the best available site for storage. Separate stored equipment from equipment in use. Conspicuously mark the area “Administrative Storage”.

(2) Covered space is preferred. Open sites should be improved hardstand, if available. Unimproved sites should be firm, well-drained, and kept free of excessive vegetation.

c. Storage Plan.

(1) Store equipment so as to provide maximum protection from the elements and to provide access for inspection, maintenance, and exercising.

(2) Take into account environmental conditions, such as extreme heat or cold; high humidity; blowing sand, dust, or loose debris; soft ground; and take adequate precautions.

d. Maintenance Services and Inspection.

(1) Prior to storage, perform the next scheduled major preventive maintenance checks and services. Inspect and approve equipment.

(2) Correct all shortcomings and deficiencies. Clean the equipment of dirt, grease, and other contaminants.

(3) Remove rust and damaged paint by scraping, wire brushing, sanding, or buffing. Sand to a smooth finish and spot paint, as necessary.

(4) After cleaning and drying, immediately coat unpainted surfaces with an oil or grease as appropriate.

(5) Install all covers; close and secure all openings except those required for venting and draining. Seal openings to prevent entry of rain, snow, or dust. Place equipment and provide adequate blocking to allow for draining of water.

1-4. EQUIPMENT SERVICEABILITY CRITERIA. This equipment is not covered by an ESC.

1-5. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE.

a. Destruction by Misuse.

(1) Pour sand and gravel into the fuel supply.

(2) Block air inlet and outlet passages with oil-soaked rags or debris.

b. Mechanical Destruction. Using an axe, pick, mattock, sledge, or any other heavy implement, damage all vital elements such as controls, fuel pump, switches and valves, motor and any other major assemblies and components.

c. Destruction by Fire. Pour fuel over unit and pile quantities of flammable material around unit. Burn assemblies and components on a priority basis if possible. Proper concentration of equipment to be burned will produce a hotter, more destructive fire. Fires should be lit after mechanical destruction has been accomplished.

d. Destruction by Gunfire.

WARNING

Point blank firing at equipment should not be attempted unless the safety of all personnel in the area is assured.

Fire on the equipment with the heaviest weapons available, aiming at the major assemblies and controls.

e. Use of Natural Surroundings.

(1) Submergence of equipment and repair parts underwater (lakes, ponds, bogs, swamps, etc.), or by concealment by hiding material in caves or preferably by burial, can be used effectively.

(2) Widely dispersed scattering of material, preferably into heavy underbrush, can serve as a denial or delaying measure. In the event the area is recaptured, effort should be made to recoup concealed items.

1-6. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS.

EIRIs will be prepared on SF Form 368, Equipment Deficiency Report. Instructions for preparing EIR's are provided in TM 38-750, THE ARMY MAINTENANCE MANAGEMENT SYSTEM (TAMMS). EIR's should be mailed directly to Commander, U.S. Army Troop Support and Aviation Materiel Readiness Command, St, Louis, Missouri 63120. A reply will be furnished to you ,

Section II. DESCRIPTION AND DATA

1-7. DESCRIPTION.

NOTE

Dimensions and tolerances are given in U.S. Standard and metric units. Metric units are enclosed in parentheses.

a. The Model VBM 15-IV Multifuel Space Heater is designed for heating enclosures at which a source of 28-volt direct current power source is available. It has a maximum output of 15,000 Btu (3780 kg-c) per hour, and is designed for floor or wall installation. The heater is controlled by a remotely mounted thermostat to maintain a selected temperature in an enclosed space within the range of 35° to 95°F (1.7° to 35°C) up to the rated output of the heater.

b. The heater will operate satisfactorily on any gasoline conforming to Specification MIL-G-3056, VV-G-76, or any other gasoline (leaded or aromatic) of up to 100-octane grade. It will also burn diesel fuel which conforms to Specification VV-F-800, Class DF-1, DF-2, or DF-A, having a cloud point of not less than -55°F (-48°C) . Air craft turbine fuels JP-4 and JP-5, conforming to Specification MIL-T-5624, will also operate this heater.

c. The heater is equipped with a removable discharge louver (fig. 1-1) for directing the outlet air. A screened air inlet opening provides for entry of circulating air. Combustion air is provided by a separate impeller assembly and enters the heater through an opening at the rear of the heater.

d. The heater is equipped with a timed ignition control for safe starting without continuous operator supervision. A safety control will shut off the power if ignition does not occur within 5 seconds, minimizing risk of fire or explosion and protecting the unit from damage in the event of equipment malfunction or loss of fuel .

e. Once the heater is in full operation, an additional safety control will shut off the flow of fuel if the unit reaches an overheat temperature of 250° ±6°F (98.9° ±6.7°c).

f. The organizational maintenance paragraphs of this manual contain detailed descriptions of the heater components.

1-8. DIFFERENCES IN MODELS.

This publication covers only Heater, Space, VBM Corporation Model VBM 15-IV, serial numbers 001 through 632. No known differences exist for models in this serial number range.

1-9. TABULATED DATA.

a. Identification. The heater has four major identification plates, as follows:

(1) The U.S. Government data plate (fig. 1-2) lists the heater nomenclature, national stock number, part number, contract number, serial number, and weight.

(2) The wiring diagram plate is mounted on the inside of the top cover panel of the heater.

(3) The electrical schematic plate is mounted on the inside of the solid right side cover panel of the heater.

(4) The instruction plate (fig. 1-1) provides abbreviated operating instructions for the heater.

b. Tabulated Data. Tabulated data applicable to the space heater and its components is given in table 1-1.

c. Electrical Schematic and Wiring Diagram. Refer to figure 1-3 for the electrical schematic diagram. Refer to figure 1-4 for the wiring diagram.

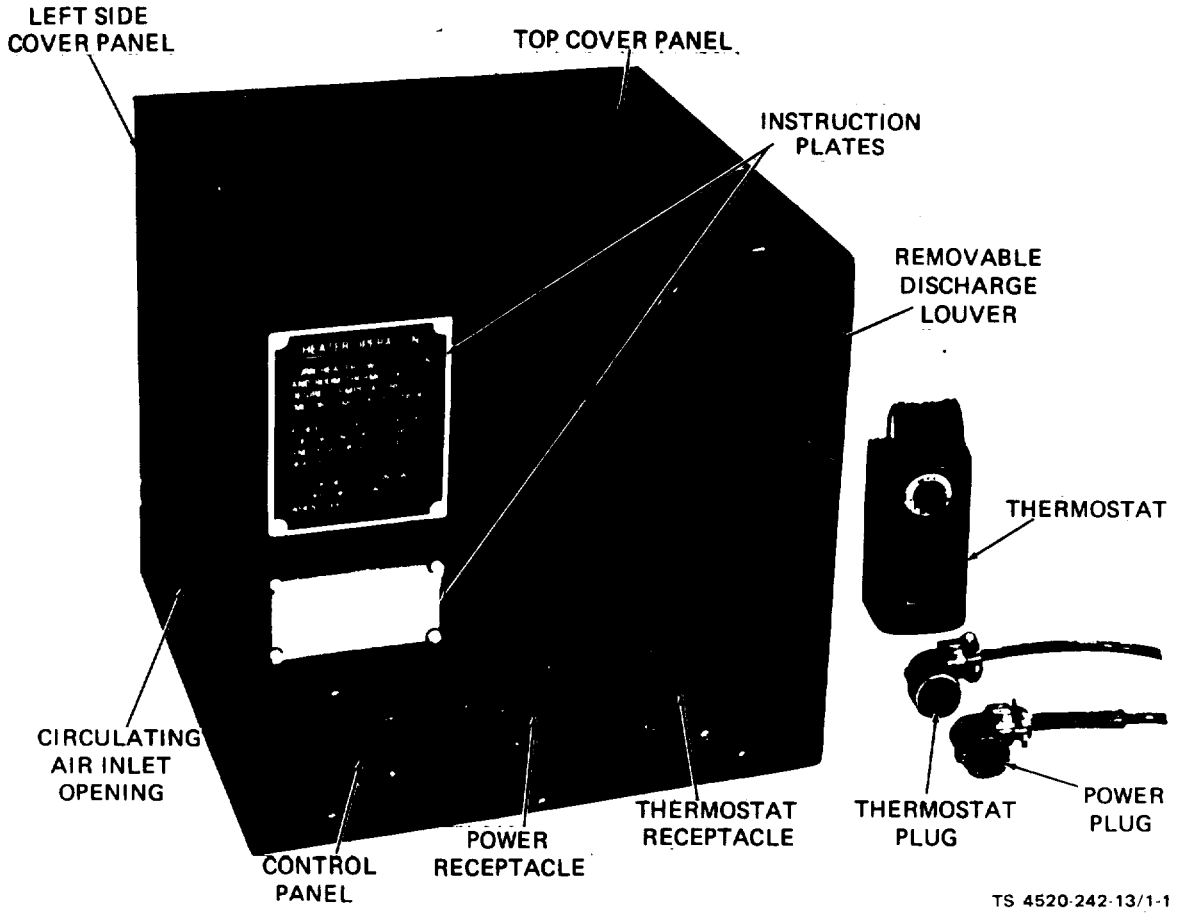


Figure 1-1. Multifuel space heater, left front three-quarter view.

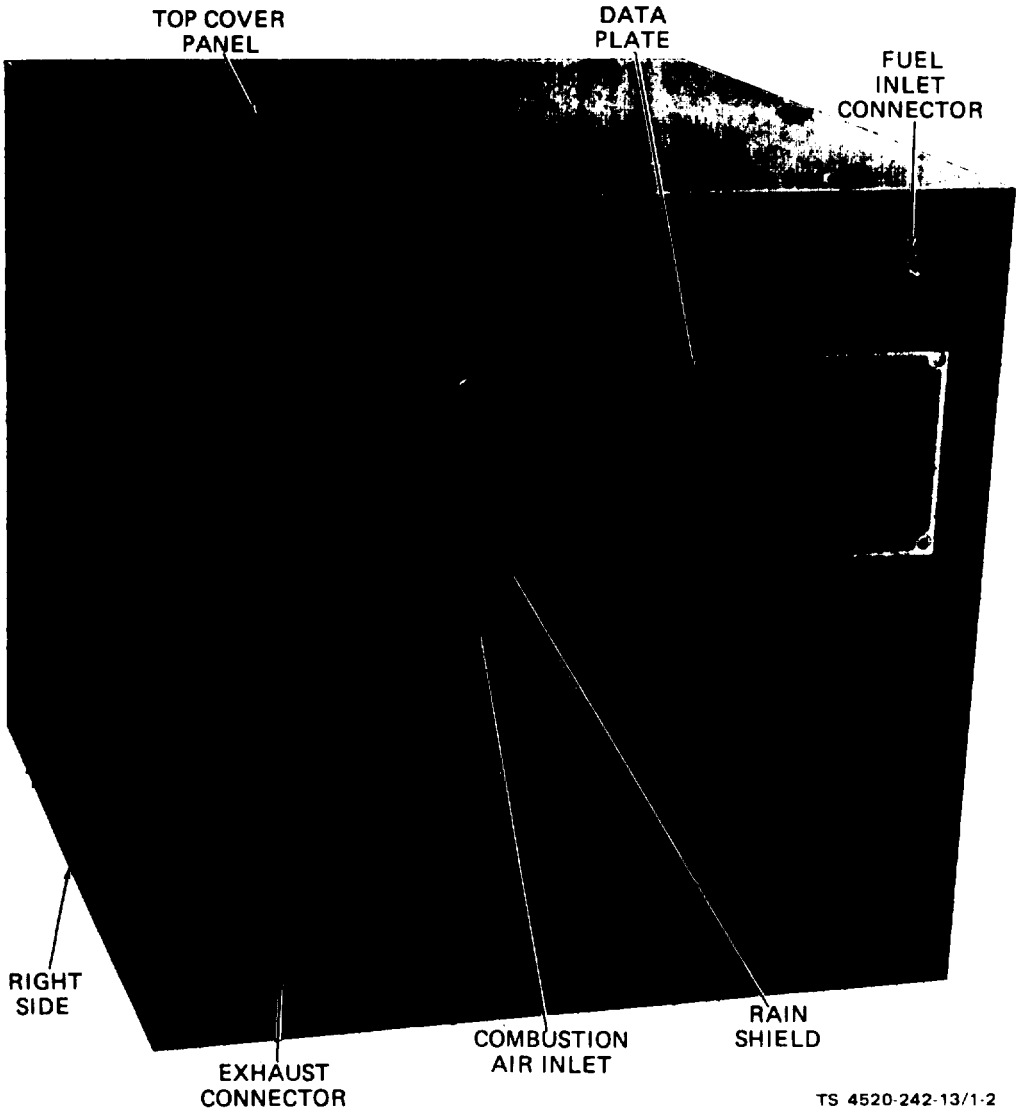
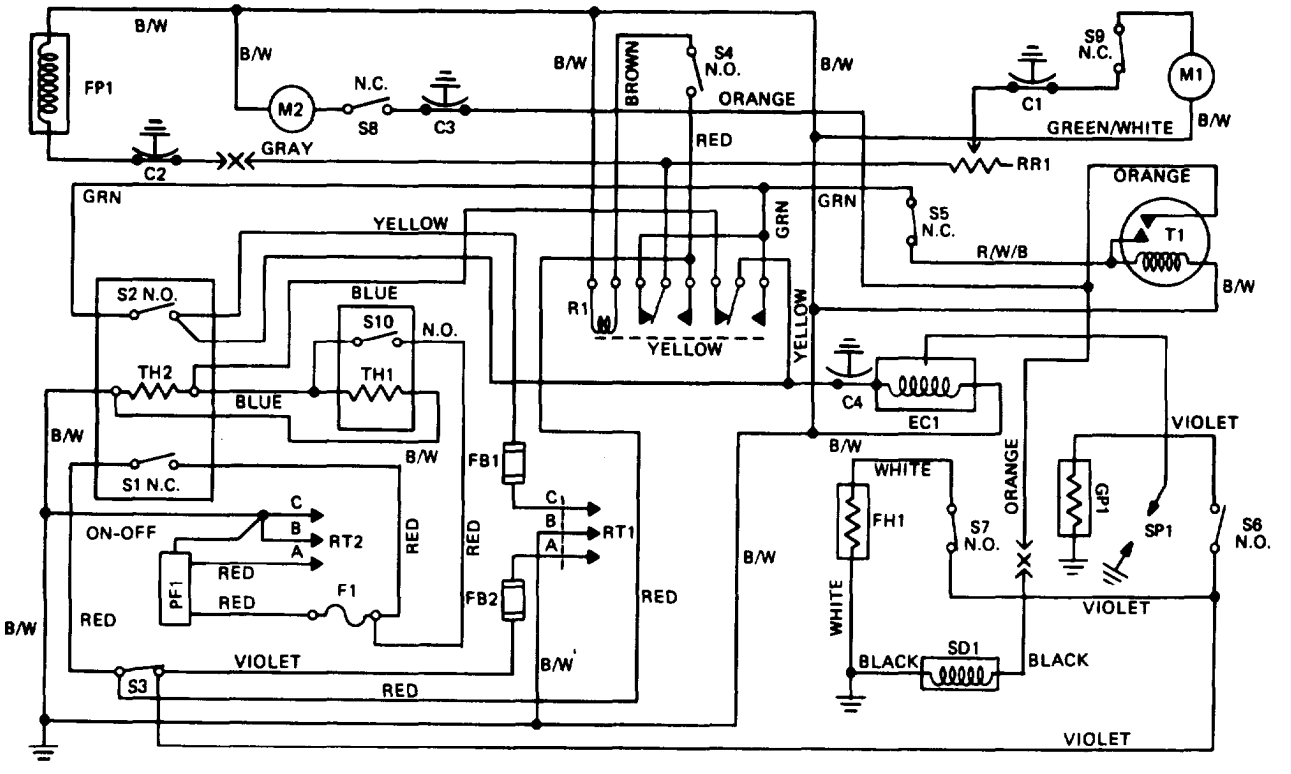


Figure 1-2. Multifuel space heater, right rear, three-quarter view.



KEY TO DIAGRAM			
C1	Capacitor-Vent. & Comb. Motor	S4	Sw. Safety Thermostat
C2	Capacitor-Fuel Pump	S5	Sw. Overheat Thermostat
C3	Capacitor-Compressor	S6	Sw. Glow Plug Thermostat
C4	Capacitor-Ignition Coil	S7	Sw. Fuel Heater Thermostat
F1	Fuse	S8 & S9	Sw. Overheat Protector
FH1	Fuel Heater	S10	Sw. Maintenance Thermostat
FP1	Fuel Pump	SD1	Solenoid
EC1	Ignition Coil	SP1	Spark Plug
GP1	Glow Plug	T1	Timer
M1	Vent. & Comb. Motor	TB1 & TB2	Terminal Block
M2	Compressor	TH1 & TH2	Timer Heater
R1	Relay-DPDT	R/W/B	Red, White, Blue
RR1	Resistor	B/W	Black, White
RT1	Receptacle-Thermostat	GRN	Green
RT2	Receptacle-Power 28 V.D.C.	YEL	Yellow
S1	Sw. Reset Thermostat	WHT	White
S2	Sw. Delay Thermostat	FB1 & FB2	Ferrite Beads
S3	Sw. On-Off	PF1	Power Filter

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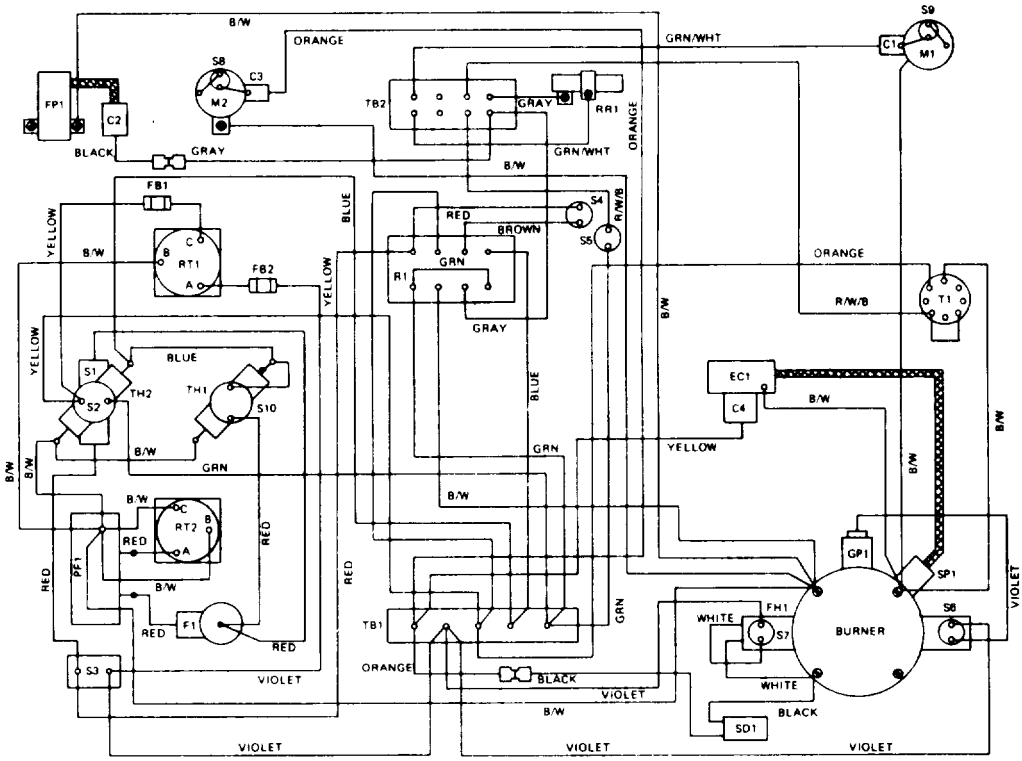
Figure 1-3. Electrical schematic diagram.



KEY TO DIAGRAM			
C1	Capacitor-Vent. & Comb. Motor	S4	Sw. Safety Thermostat
C2	Capacitor-Fuel Pump	S5	Sw. Overheat Thermostat
C3	Capacitor-Compressor	S6	Sw. Glow Plug Thermostat
C4	Capacitor-Ignition Coil	S7	Sw. Fuel Heater Thermostat
F1	Fuse	S8 & S9	Sw. Overheat Protector
FH1	Fuel Heater	S10	Sw. Maintenance Thermostat
FP1	Fuel Pump	SD1	Solenoid
EC1	Ignition Coil	SP1	Spark Plug
GP1	Glow Plug	T1	Timer
M1	Vent. & Comb. Motor	TB1 & TB2	Terminal Block
M2	Compressor	TH1 & TH2	Timer Heater
R1	Relay-DPDT	R/W/B	Red, White, Blue
RR1	Resistor	B/W	Black, White
RT1	Receptacle-Thermostat	GRN	Green
RT2	Receptacle-Power 28 V.D.C.	YEL	Yellow
S1	Sw.Reset Thermostat	WHT	White
S2	Sw. Delay Thermostat	FB1 & FB2	Ferrite Beads
S3	Sw. On-Off	PF1	Power Filter

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Figure 1-4. Electrical wiring diagram.

Table 1-1. Tabulated Data

OPERATOR/CREW

Manufacturer	VBM Corporation
Model number	VBM 15-IV
Volts	.28vdc
Watts	346 max
Btu output.	15,000 (3780 kg-c)
Description	Heater, space, multifuel, with blower

ORGANIZATIONAL

Overall dimensions and weight	
Height	12 in. (30.48 cm)
Width.	12 In. (30.48 cm)
Depth.	13-3/4 in. (34.93 cm)
Weight	40 lb. (18.14 kg)
Fuel filter	
Manufacturer	Motor Components Division Facet Enterprises, Inc.
Part number	MS51086-1
Type	Strainer element
Heater fuse	
Manufacturer	Littlefuse, Inc.
Part number	307020
Rating	20 amp
Room Thermostat	
Manufacturer	Penn Controls, Inc.
Part number	A19BAB-3
Pilot duty rating	125 volt-amperes
Range.	35° to 95° F (1.7° to 35° C)
Spark plug	
Manufacturer	VBM Corporation
Part number	154-216
Glow plug	
Manufacturer	Champion Spark Plug Company
Part number	AG-47
Power requirements	105 watts at 24 volts
ON-OFF switch	
Manufacturer	Cutler-Hammer
Part number	MS35058-22

DIRECT SUPPORT

Fuel float bowl	
Manufacturer	Marvel Schiebler-Tillotson Division Borg Warner Corporation

Table 1-1. Tabulated Data - Continued

DIRECT SUPPORT - Continued

Part number	013440
Fuel pump	
Manufacturer	Motor Components Division Facet Enterprises, Inc.
Part number	MS51321-1
Type	Electric
Voltage	24 vdc, negative ground
Solenoid valve	
Manufacturer	Acorn Products Corporation
Part number	M21B-1/8-1/8-24VDC
Voltage	24 vdc coil
Coils	
Manufacturer	Guaranteed Parts
Part number	GC-202
Overheat thermostat	
Manufacturer	VBM Corporation
Part number	3100-61-125
Open temperature	250° ±6°F (121.1° ±3.3°C)
Close temperature	210° ±°12°F (98.9° ±6.7°C)
Timer (delay relay)	
Manufacturer	Amperite Company
Part number	26N05T
Glow plug thermostat	
Manufacturer	VBM Corporation
Part number	3100-61-116
Open temperature	55° ±5°F (12.8° ±2.8°C)
Close temperature	40° ±5°F (4.4° ±2.8°C)
Fuel heater thermostat	
Manufacturer	VBM Corporation
Part number	3100-61-116
Open temperature	55° ±5°F (12.8° ±2.8°C)
Close temperature	40° ±5°F (4.4° ±2.8°c)
Compressor	
Manufacturer,	VBM Corporation
Part number	154-283
Voltage	18/28 vdc
Rating	1 cfm@5psig
Suppression capacitors (motor, compressor, and ignition)	
Manufacturer	Sprague Electric Company
Part number	103P608
Capacitance	0.470 mfd, 100 vdc, 10 amp
Delay thermostat	
Manufacturer	VBM Corporation
Part number	3100-45-114
Open temperature	38° ±5°F (3.3° ±2.8°C)
Close temperature	65° ±5°F (18.3° ±2.8°C)

Table 1-1. Tabulated Data - Continued

DIRECT SUPPORT - Continued	
Blower motor	
Manufacturer	Universal Electric Company
Part number	YZ1UO26K
volts.	28 vdc
Rated rpm, full load	4600 ±200 rpm
Flame safety thermostat	
Manufacturer	VBM Corporation
Part number	3100-61-114
Open temperature	90° ±5°F (32.2° ±2.8°C)
Close temperature	110° ±5°F (43.3° ±2.8°C)
Reset thermostat	
Manufacturer	VBM Corporation
Part number	3455RM-77
Open temperature	150° ±10°F (65° ±5.6°C)
Close temperature	Manual reset
Maintenance thermostat	
Manufacturer	VBM Corpo ion
Part number	3100-61-116
Open temperature	55° ±5°F (12.8° ±2.8°C)
Close temperature	40° ±5°F (4.4° ±2.8°C)
Power filter	
Manufacturer	VBM Corporation
Part number	7673-1F

CHAPTER 2

OPERATING INSTRUCTIONS

INDEX

WARNING

If equipment fails to operate, refer to troubleshooting procedures in Chapter 3.

Section I. DESCRIPTION AND USE OF OPERATOR's CONTROLS AND INDICATORS

2-1. GENERAL. This section contains information and instructions for the personnel responsible for operating this space heater. The information includes the description and function of all controls and indicators.

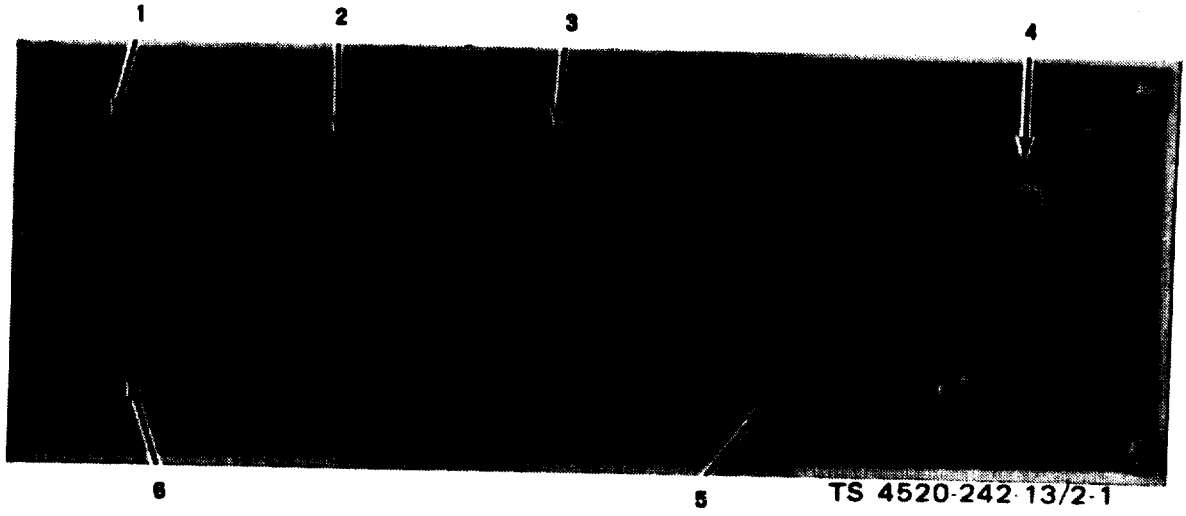
2-2. CONTROLS AND INDICATORS. Before operating the heater, you must become familiar with the controls and Indicators provided on the unit. Refer to table 2-1 and to figures 2-1 and 2-2.

Table 2-1. Controls and Indicators

Fig. and Item no.	Control or indicator	Function
2-1 1	SPARE FUSE holder	Houses a spare fuse which can be used if the in-circuit fuse blows out.
2-1 2	FUSE holder	Houses the in-circuit fuse to protect electrical circuits from overload.
2-1 3	POWER receptacle	Provides a connector for 28-volt direct current Input to the heater.
2-1 4	THERMO receptacle	Provides a connector for the room thermostat which controls heater operation.
2-1 5	RESET button	When button is pressed, a switch resets heater circuits after heater has stopped due to ignition failure or lack of fuel.
2-1 6	ON-OFF switch	Controls starting and stopping of heater. In ON position, heater will start and operate under control of room thermostat. When placed in OFF position, switch stops heater operation. If motor blower is running when switch is moved to OFF, heater will continue to run until cool, then shut off.
2-2	Thermostat knob	Provides a means of selecting the temperature which heater is to maintain in the enclosure. Rotate knob until desired temperature is aligned with index mark.

NOTE

The thermostat provides only an on-off control of the heater. Raising the thermostat setting does not Increase the heat output of the heater. It causes the heater to run longer to satisfy the heat demand. Setting the thermostat to the highest setting at startup does not Increase the rate at which the desired temperature will be reached. To prevent temperature overshoot, set the thermostat only to the temperature desired for the enclosure.



1. SPARE FUSE holder
2. FUSE holder
3. POWER receptacle
4. THERMO receptacle
5. RESET button
6. ON-OFF switch

Figure 2-1. Heater controls and connectors.

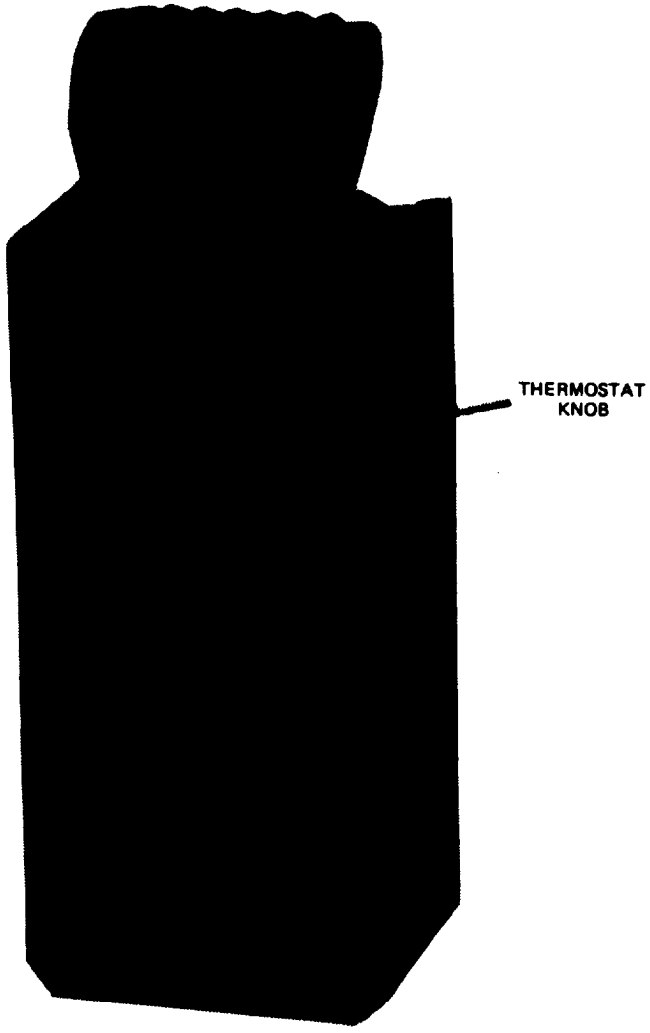


Figure 2-2. Room thermostat.

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

2-3. GENERAL. The preventive maintenance services to be performed are listed and described in table 2-2. Defects discovered during operation of the unit shall be noted for future correction, to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noticed which would damage the equipment if operation ware continued. To ensure that the space heater is ready for operation at all times, it must be inspected systematically in accordance with the procedural checks and services.

a. Before Your Operate. Always keep in mind the CAUTIONS and WARNINGS. Perform your before (B) preventive maintenance checks and services.

b. While Your Operate. Always keep in mind the CAUTIONS and WARNINGS. Perform your during (D) preventive maintenance checks and services.

c. After You Operate. Be sure to perform your after (A) preventive maintenance checks and services.

d. If Your Equipment Fails to Operate. Troubleshoot with proper equipment. Report any deficiencies using the following forms as necessary.

(1) DA Form 2402 (Exchange Tag).

(2) DA Form 2404 (Equipment Inspection and Worksheet).

(3) DA Form 2407 (Maintenance Request Used for Requesting Support Maintenance).

(4) DA Form 2407-1 (Continuation Sheet Used for Requesting Support Maintenance).

For additional forms and records pertaining to your particular equipment, refer to TM 38-750 (The Army Maintenance Manual System [TAMMS]).

e. Recording. The preventive maintenance checks and services in table 2-2 are listed in the item number column according to sequence of performance. Use this column as a source of item numbers for the TM Number column on DA Form 2404, when recording results of preventive maintenance checks and services.

Table 2-2. Operator/Crew Preventive Maintenance Checks and Services

NOTE

Within designated interval, these checks are to be performed in the order listed.

B - Before D - During

Item No.	Interval B	Interval D	Item to be Inspected	Procedures Check for and have repaired or adjusted as necessary	Equipment is Not Ready/ Available if:
				MAKE THE FOLLOWING WALK AROUND CHECKS:	
1	●		Heater Attachments	a. Check for evidence of leakage (fuel) on or under heater. Check fuel lines for breaks or damage. b. Check fuel tank for proper operating level. Refill as necessary. Open supply valve. c. Check that thermostat and power cable connector are properly connected and cable is not loose, frayed, or pinched.	Leakage is evident.
2		●	Heater Assembly	Check for unusual noises or vibration, improper cycling, or smoking exhaust.	Noisy or vibrating.

2-4. SERVICING STANDBY HEATER.

a. Heaters on standby which have fuel connections and power connections intact must be run periodically to prevent fuel in the lines from losing volatility. Fuel with low volatility will make heater starting difficult or impossible.

b. Every two weeks, run standby heaters long enough to replace residual fuel in the fuel system of each heater to ensure that the heaters will start when they are needed.

Section III. OPERATION UNDER USUAL Conditions

WARNING

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

2-5. Preparation for Use.

a. Check the fuel supply to see that it is adequate for the period of operation, and verify that the fuel supply valve is open.

b. Check the external fuel lines for leakage or damage. Notify organizational maintenance if any leakage or damage is detected.

c. Check that the power cable plug and room thermostat plug are fully inserted in mating receptacles with threaded swivels tightened.

d. Check the room thermostat setting. If necessary, adjust knob to the desired setting (fig. 2-2).

2-6. Starting.

a. Place the ON-OFF switch (6, fig. 2-1) in the ON position. The heater will operate under control of the room thernmstat, starting as the thermostat calls for heat, and stopping as the heat requirement is satisfied. While the heater runs, the blower circulates warm air in the enclosure.

b. If the heater stops after a short time, check for an inadequate fuel supply and replenish if necessary. Allow 3 to 5 minutes for the time delay mechanism to cool, then press the RESET button (5, fig. 2-1) and start the heater in the normal manner.

NOTE

The instruction plate (fig. 2-3) provides abbreviated Instructions for operating the heater.

2-7. OPERATION.

a. After starting, the heater will run without operator control, cycling on and off under control of the room thermostat.

b. If the temperature in the enclosure becomes too high or too low, adjust the thermostat knob (fig. 2-2) to compensate.

c. If the type of fuel being used is changed from one operating period to another, the heater may smoke or operate erratically. Report the condition to organizational maintenance for adjustment.

2-8. STOPPING.

a. To stop the heater, turn the ON-OFF switch (6. fig. 2-1) to OFF.

CAUTI0N

Do not disconnect the power cable connector or interrupt the electrical supply to the heater until it shuts down after the purge cycle is completed.

b. If the heater is operating at the time of shutoff, the blower motor will continue to run until all fuel has been purged from the heater. When the fuel is purged and the heater has cooled sufficiently, the heater will shut down.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

2-9. OPERATION IN EXTREME COLD (BELOW 10°F) (-12.2°C). A thermostatically controlled fuel heater automatically heats the fuel when the temperature drops below 40° ±6°F (1.1° to 7.8°C). This preheating of the fuel aids combustion and ignition during extremely cold conditions. No operating procedures are required for this fuel heater. You should take the following precautions during extremely cold conditions:

a. Keep the fuel tank full to prevent condensation of moisture in the tank.

b. Clean snow and ice from fuel tank filler to prevent them from entering fuel tank, causing freezing in fuel lines.

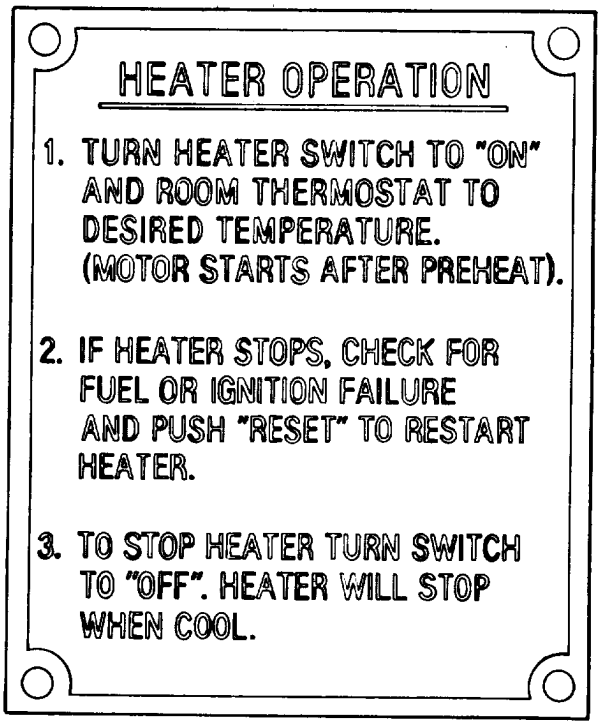


Figure 2-3. Instruction plate.

2-10. OPERATION AT HIGH ALTITUDES.

a. The heater is designed to 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 approximately 15 percent. This is a normal condition which cannot be prevented, but optimum performance can be obtained by followlng all service InstructIons carefully.

2-11. OPERATION UNDER RAINY OR 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.

CHAPTER 3

OPERATOR/CREW MAINTENANCE INSTRUCTIONS

Section I. LUBRICATION INSTRUCTIONS

No lubrication is required.

Section II. TROUBLESHOOTING PROCEDURES

3-1. GENERAL. This section contains troubleshooting information for locating and correcting most of the operating problems which may develop in the space heater.

3-2. OPERATOR/CREW MAINTENANCE TROUBLESHOOTING CHART. Refer to table 3-1 for troubleshooting which is allocated to operator/crew maintenance levels.

a. The table lists the common malfunctions which you may find during the operation or maintenance of the space heater or its components. You should perform the tests/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed, or is not corrected by the listed corrective actions, notify your supervisor.

NOTE

Before you use this table, be sure you have performed all applicable operating checks.

Table 3-1. Operator/Crew Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. HEATER FAILS TO START (NO FLAME, NO BLOWER).
Step 1. Check that power is applied to heater. Connect heater to a source of 28-vdc power. Ensure that power is connected to the POWER receptacle.
Step 2. Check that ON-OFF switch is ON. Turn switch on.
Step 3. Check room thermostat setting. Thermostat setting must be higher than ambient temperature of enclosure to start heater operation.
Step 4. Check RESET button. Press RESET button to reset heater circuit. Start heater by placing the ON-OFF switch in the ON position.
2. HEATER FAILS TO START (NO HEAT; BLOWER RUNS FOR A SHORT TIME, THEN STOPS).
Step 1. Check that fuel tank contains fuel. Replenish fuel supply.
Step 2. Check that fuel supply has recently been replenished and that it contains no visible contaminants. Replace fuel in lines and tank if it has become old or contaminated.
3. HEATER OVERHEATS.
Check for airflow restrictions. Clear area of obstructions to permit free passage of air into and out of heater.

CHAPTER 4

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIEL

4-1. INSPECTING AND SERVICING THE EQUIPMENT.

a. Prepare the heater for inspection and operation as outlined on DA Form 2258, Depreservation Guide for Vehicles and Equipment.

b. Inspect the entire heater for lost parts or for damage which may have occurred during shipment.

c. Check the controls for free operation.

d. Inspect for loose or missing hardware.

e. Inspect the thermostat for a broken or loose element.

f. Inspect ail tubing, lines and fittings to see that they are secure and free of breaks, kinks, and other damage.

g. Correct all deficiencies or report them to direct support maintenance.

4-2. INSTALLATION OF SEPARATELY PACKED COMPONENTS. The room thermostat and the power and thermostat connectors are separately packed. For installation of these components, refer to paragraph 4-3.

4-3. INSTALLATION OR SETTING UP INSTRUCTIONS.

WARNING

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

a. Location.

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

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

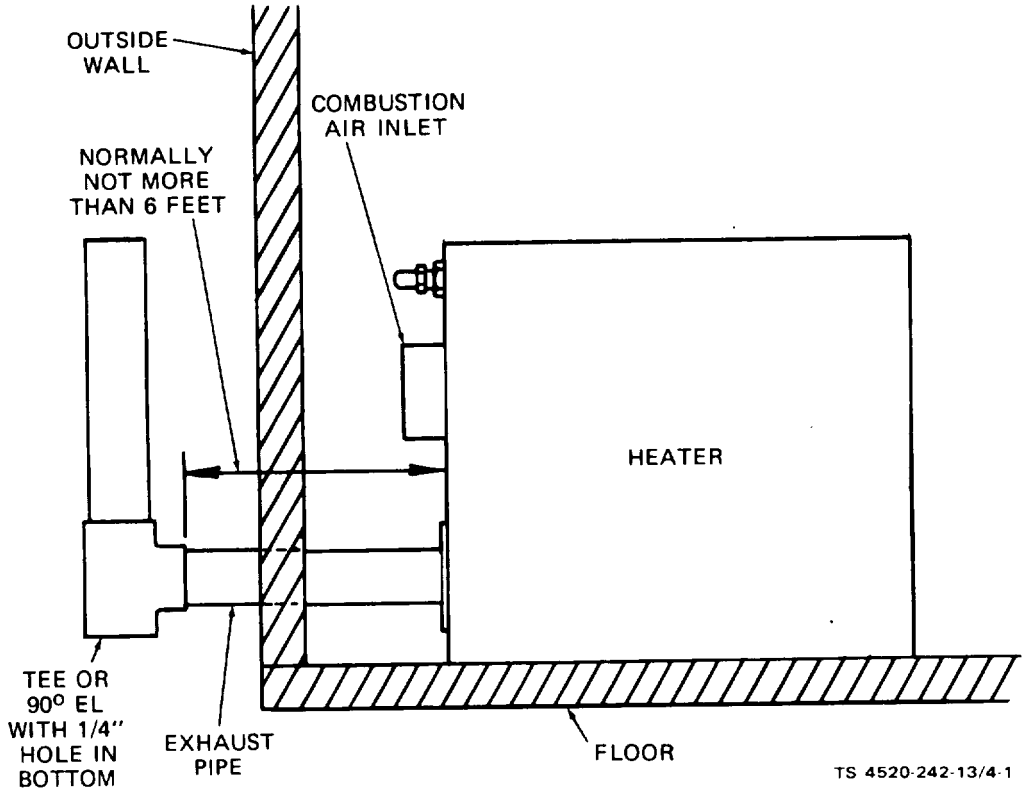


Figure 4-1. Typical exhaust connection.

(3) Refer to figure 4-2 and provide clearances as indicated to permit proper air circulation. Allow adequate room at the front and left side for control access and servicing.

(4) The left side cover panel and the top cover panel are interchangeable to provide alternate air intake installation.

b. Installation.

(1) Secure heater to base or floor using 1/2-20 bolts of suitable length (bolts not furnished with equipment).

NOTE

The space heater should be positioned at approximately the same level as the fuel source and should never be positioned more than 7 feet above the fuel source.

(2) Connect the fuel inlet connector (fig. 4-3) on the heater to the fuel source, using suitable lines and fittings. Make sure that the fuel supply is clean and free of moisture. Check that connections do not leak.

WARNING

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

CAUTION

During operation, the 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,

(3) Connect a 1-1/4-inch exhaust pipe from the exhaust connection on the heater to the outside (fig. 4-1). The exhaust line should be less than 6 feet long and contain as few bends as possible. Seal all exhaust pipe joints using anti-seize compound meeting specification JAN-A-669.

(4) When the heater is operated in a tightly constructed compartment which restricts intake of combustion air, it is recommended that combustion air be connected to the combustion air inlet (fig. 4-3) from an external source. Combustion air piping is necessary to prevent depletion of oxygen in an extremely tight enclosure.

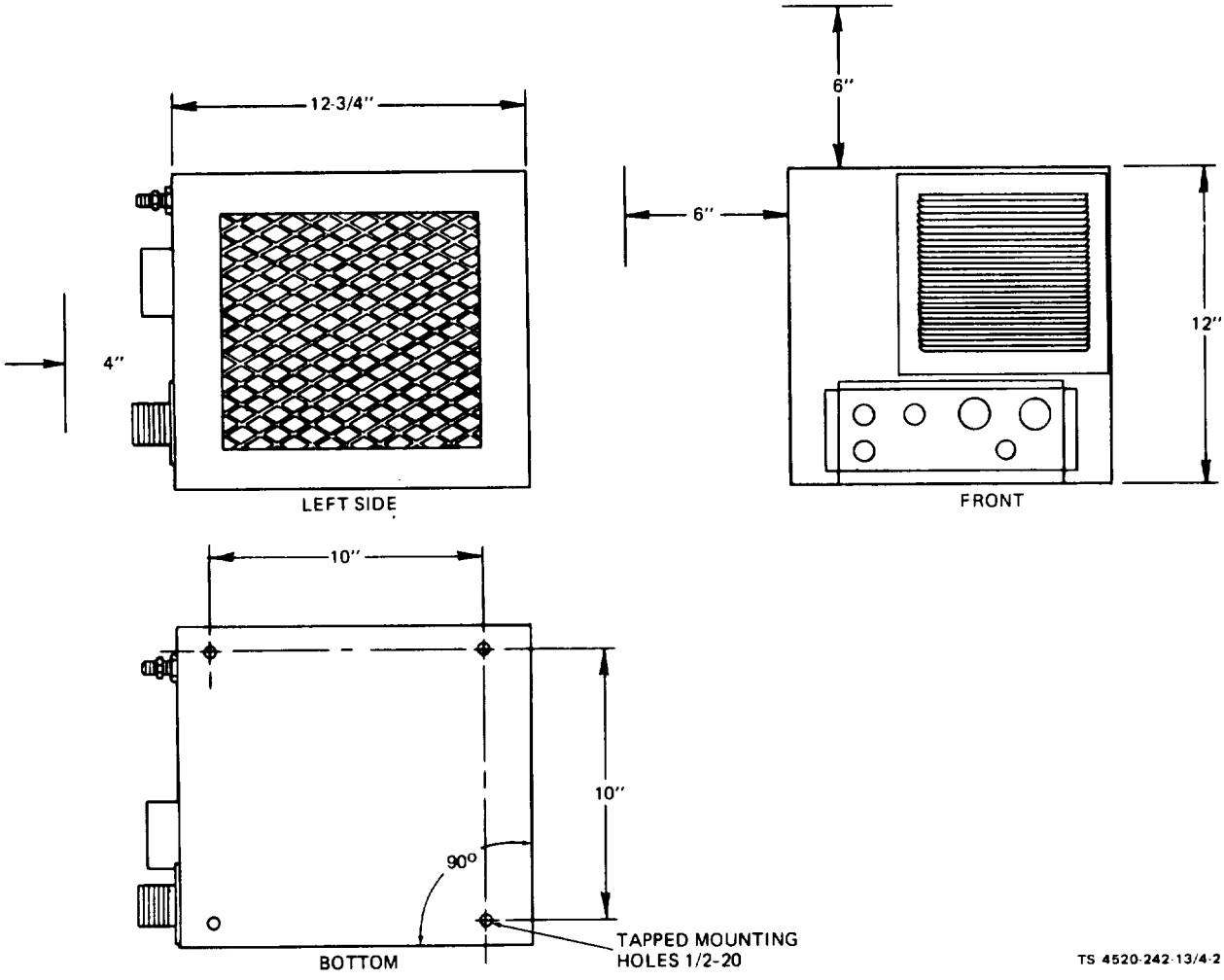


Figure 4-2. Base plan.

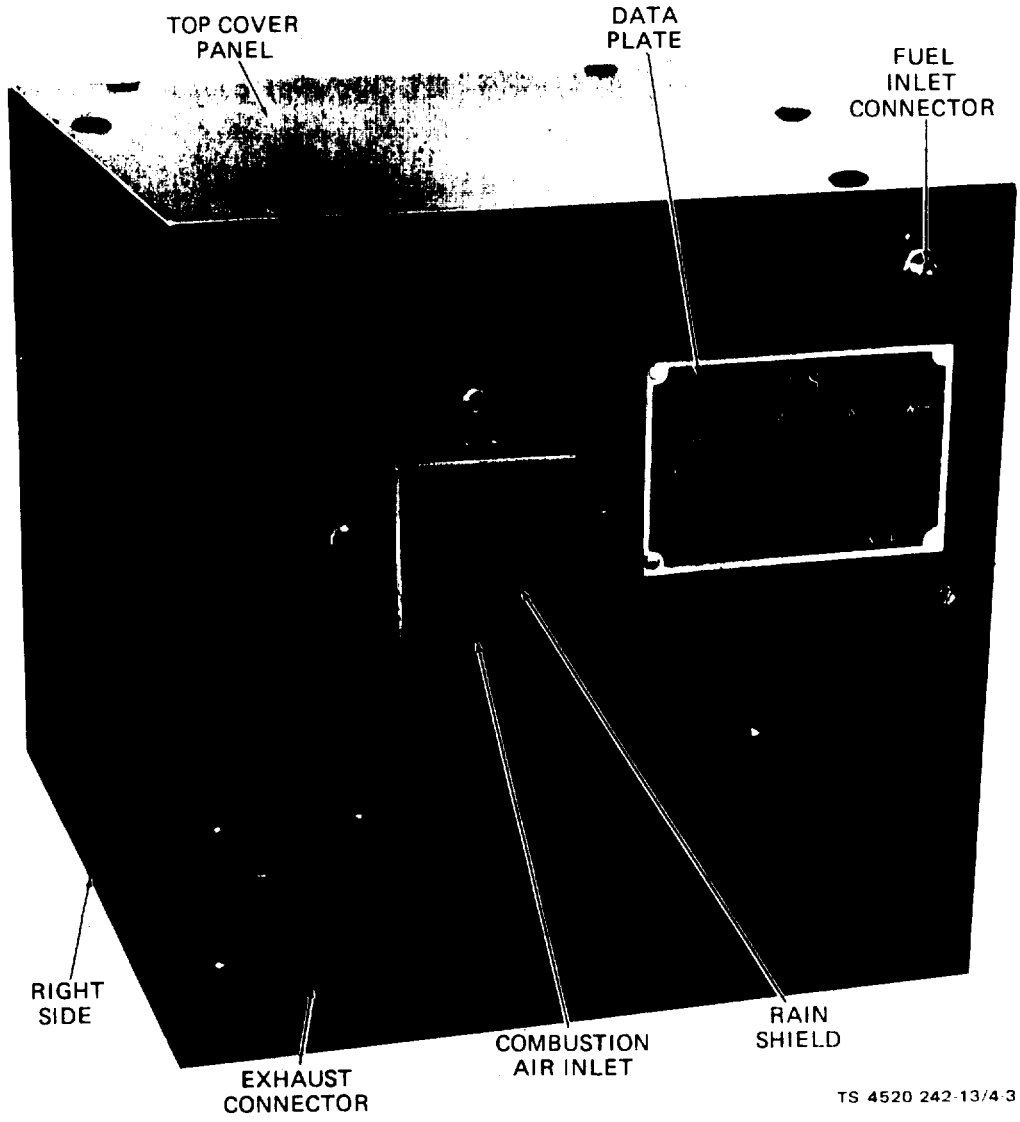


Figure 4-3. Multifuel space heater, right rear, three-quarter view.

(5) Mount the room thermostat (fig. 4-4) in an upright position on an inside or insulated wall in the area to be heated. Do not install the thermostat in line with the heater alr inlet or discharge air flow, in a drafty position, or on an outside wall.

(6) Remove the thermostat cover and attach a shield 3-wire cable, long enough to reach between heater and thermostat, secure the cable ground (green) wire to one of the thermostat mounting screws and connect the other two wires (red and black) to the two terminals on the thermostat switch. Attach the other end of the cable to the three-pin room thermostat plug (which is packaged separately). Make sure the ground wire of the cable is connected to the ground lug of the connector (pin B). Connect the connector to the room THERMO receptacle (4, fig. 4-5) on the heater control panel.

NOTE

If the combined length of power cable and thermostat cable does not exceed 20 feet, use 14-gage cable for both applications. If the combined length exceeds 20 feet, use 12-gaqe cable.

(7) Prepare a dc power cord using a 3-wire cable and the dc connector provided with the heater. The B terminal must be negative (-) and the A terminal must be positive (+). Connect the ground to the C terminal. Connect the cable between the 28-volt dc power source and the POWER receptacle (3, fig. 4-5).

c. Initial Checkout and Adjustment. After installation, check heater operation as follows:

(1) With the thermostat knob (fig. 4-4) set to less than ambient temperature, set the ON-OFF switch (6, fig. 4-5) to the ON position. The heater must not start.

(2) Start heater operation by setting the thermostat knob to a temperature above ambient to cause heater ignition.

(3) Check that the blower motor starts and that the unit circulates air.

(4) After warmup, check the exhaust for smoke and check for erratic operation. If either condition exists, adjust the fuel adjustment needle.

NOTE

You must remove the left side cover panel (fig. 4-6) to gain access to the fuel adjustment needle. Loosen the fuel adjustment lock nut before you turn the adjustment needle.

(5) if the heater smokes, turn the fuel adjustment needle 1/8 turn clockwise to reduce the fuel flow. Observe heater operation for 1 minute. If smoking persists, turn the needle an additional 1/8 turn and observe the operation. Continue until operation is satisfactory.

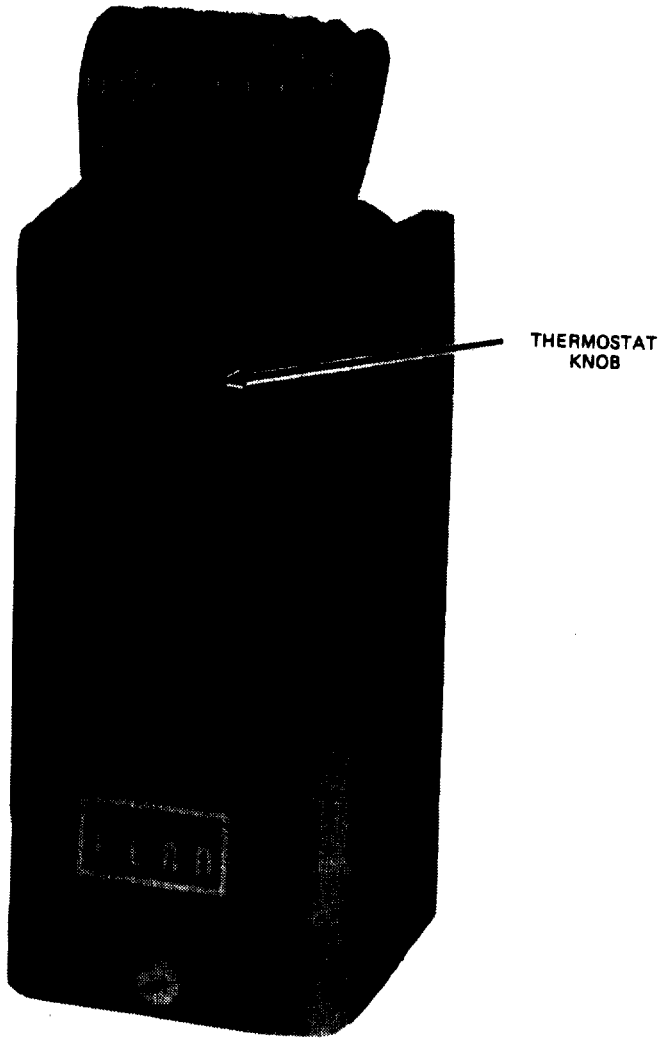
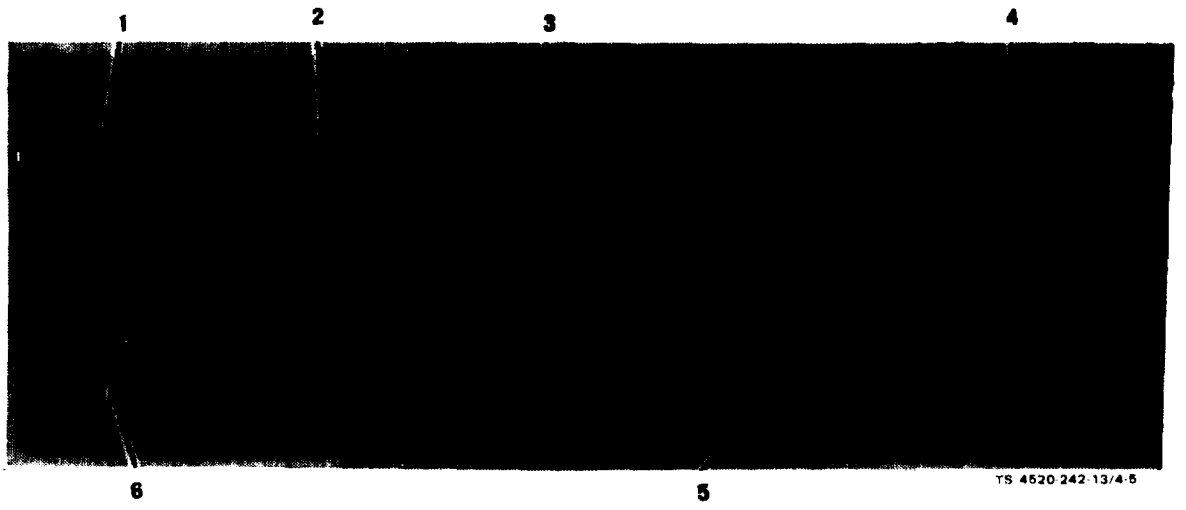


Figure 4-4. Room thermostat.



1. SPARE FUSE holder
2. FUSE holder
3. POWER receptacle
4. THERMO receptacle
5. RESET button
6. ON-OFF switch

Figure 4-5. Heater controls and connectors.

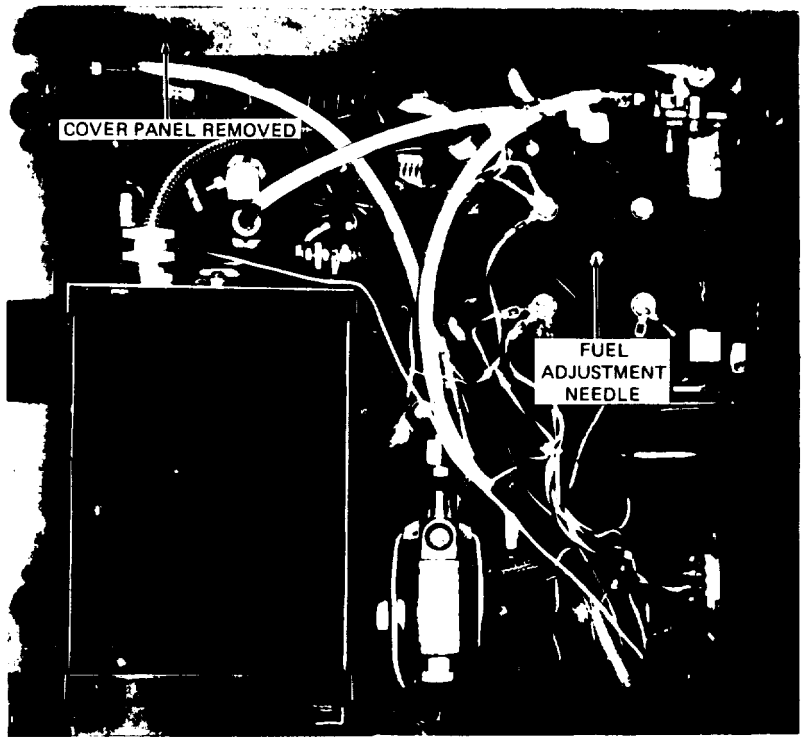


Figure 4-6. Fuel adjustment.

(6) If heater operation is erratic, or if heater fails to operate properly in extremely low ambient temperatures turn the fuel adjustment needle 1/8 turn counterclockwise to increase fuel flow. Observe operation for 1 minute. Continue to turn the needle counterclockwise in 1/8-turn increments until heater operation is satisfactory. When heater is burning smoothly, there should be little or no smoke from the exhaust outlet, and the heat exchanger tubes should not be red in color.

(7) check that the heater shuts off when the thermostat set temperature is reached in the enclosure. If conditions permit, check that the unit cycles under control of the room thermostat.

(8) Stop the heater by operating the ON-OFF switch (6, fig. 4-5) to OFF. If the heater is burning when the switch is operated to OFF, the flame will go out immediately, but the blower motor will continue to run until the heat is purged from the burner, after which it will stop.

(9) Refer to table 4-2, Troubleshooting, if the unit fails to operate in the required manner.

Section II. MOVEMENT TO NEW WORKSITE

4-4. DISMANTLING FOR MOVEMENT.

a. Disconnect the fuel line from the fuel inlet connector.

b. Operate the heater until residual fuel Is expended, then cap the heater fuel connection.

WARNING

Do not disconnect exhaust pipe until heat has dissipated.

c. Disconnect the exhaust pipe from the exhaust connection.

d. Remove the thermostat; disconnect the thermostat and power cable connectors from mating receptacles on the control panel.

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

WARNING

Do not drain fuel in an enclosed area or near an open flame or spark. The fuel is flammable and must be drained in an open area.

f. Drain the fuel pump. Remove the fuel bowl of the fuel filter and tip the heater sideways. After draining, reinstall the fuel bowl of the fuel filter.

g. Remove the slotted plug from the fuel float bowl and tip the heater sideways to drain the fuel.

4-5. REINSTALLATION AFTER MOVEMENT. There are no differences between reinstallation procedures after movement and installation performed to set up the equipment.

Section III. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

4-6. SPECIAL TOOLS AND EQUIPMENT. No special tools or equipment is required.

4-7. MAINTENANCE REPAIR PARTS. Repair parts are listed and illustrated in TM 5-4520-242-23P, Repair Parts and Special Tools List.

Section IV. LUBRICATION INSTRUCTIONS

No lubrication is required.

Section V. Preventive MAINTENANCE CHECKS AND SERVICES

4-8. GENERAL. The preventive maintenance services to be performed are listed and described in table 4-1. It includes and expands upon the preventive maintenance services performed by operator/crew maintenance and includes additional services which are allocated to organizational maintenance. The space heater must be checked and serviced systematically in accordance with the required procedures.

a. Before You Service. Always keep in mind the CAUTIONS and WARNINGS.

b. While You Test. Always keep in mind the CAUTIONS and WARNINGS.

c. When You Replace. Always keep in mind the CAUTIONS and WARNINGS.

d. If Your Equipment Fails To Operate. Troubleshoot with proper equipment. Report any deficiencies using the following forms, as required.

(1) DA Form 2402 (Exchange Tag).

(2) DA Form 2404 (Equipment Inspection and Worksheet).

(3) DA Form 2407 (Maintenance Request used for Requesting Support Maintenance)"

(4) DA Form 2407-1 (Continuation Sheet Used for Requesting Support Maintenance).

For additional forms and records pertaining to your particular equipment, refer to TM 38-750 (The Army Maintenance Manual System [TAMMS]).

e. Recording. The preventive maintenance checks and services in table 4-1 are listed in the item number column according to sequence of performance. Use this column as a source of item numbers for the TM Number column on DA Form 2404 when recording results of preventive maintenance checks and services.

Table 4-1. Organizational Preventive Maintenance Checks and Services

S-Semiannually

Item No.	Interval S	Item to be Inspected	Procedures
			NOTE Perform operator/crew PMCS prior to or in conjunction with organizational PMCS.
1	●	Exterior of heater	a. Check case, panels, and louver for damage and missing or broken parts. b. Check data and instruction plates for damage and legibility.
2	●	Electrical panel	Check panel for missing or damaged fuses. Replace if damaged or missing.
3	●	Fuel Pump	Check fuel pump for loose or missing screws. Tighten loose screws, replace broken or missing screws. WARNING Drycleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat.
4	●	Fuel Filter	Clean fuel filter with cleaning solvent.
5	●	Burner	Check burner for tears, holes, loose or missing parts, and damage. Refer to direct support for repair.

All data on pages 4-14 through 4-16 deleted.

Table 4-1. Organizational Peventive Maintenance Checks and Servicess, Quarterly Schedule - Continued

Item no.	Item to be Inspected	Procedures	For readiness reporting, equipment is not ready/ available if:
	Burner-Continued		
8	Glow Plug-Continued	damage. Apply 28 vdc across the glow plug leads and check that the glow plug heats. Replace a damaged or defective glow plug. Replace the power plug.	
9	Air Combustion Tube	Inspect for tears, holes, collapsed walls, and for loose or missing hose clamps. Tighten or replace hose clamps. Replace defective air tube.	
10	Ignition Cable	Inspect for damaged shielding and broken connections. Report any defects to direct support maintenance.	Damage is visible.
	Fuel System		
11	Fuel Tubing and Fittings	Remove the left side cover panel of the heater. Inspect for leakage, damage, and tightness of fittings and tubing. Tighten fittings to stop leaks, and replace damaged tubing.	Fittings are damaged or leakage persists after fittings are tightened.
12	Fuel Float	Inspect for leaks, fitting thread damage, and loose screws. Tighten loose screws.	Cover or body is cracked, threads are damaged, or screws are missing.
13	Solenoid Valve	Inspect for damaged electrical leads and fuel leakage.	Leads are damaged, or there is evidence of fuel leakage.
14	Fuel Filter	Inspect for dents, cracks and leaks. Check filter and bowl for contamination. Loosen the nut on the fuel filter bail. Swing the bail aside and remove the fuel bowl, gasket, and filter element. Replace damaged parts.	
15	Fuel Pump	Inspect for secure mounting and fuel leakage. Check for proper operation. Tighten loose mounting screws. Service fuel pump filter as follows: Disconnect the power plug and remove the left side cover panel. Shut off the fuel supply line and disconnect the fuel supply line at the bulkhead	Damage or leakage is visible, or if fuel pump is inoperative.

Table 4-1. Organizational Preventive Maintenance Checks and Services, Quarterly Schedule - Continued

Item no.	Item to be inspected	Procedures	For readiness reporting, equipment is not ready/ available if:
	Fuel System-Continued		
15	Fuel Pump-Continued	fitting. Remove the control panel as far as the wires will permit. Remove the two screws, nuts, and washers securing the fuel pump to the heater case. Pull the fuel pump toward the control panel opening. Use a small container to catch the fuel, and remove the fuel pump cover and filter. Clean the filter using dry cleaning solvent. Reassemble all parts in the order of removal.	

Section VI. TROUBLESHOOTING

4-9. GENERAL.

a. This section contains troubleshooting information for Iocating and correcting most of the operating troubles which may develop in the space heater. The table lists the common malfunctions which you may find during the operation or maintenance of the space heater or Its components. Each malfunction for an individual component, unit, or system Is followed by a list of tests or inspections which will help you to determine corrective actions to take. You should perform the tests/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

c. Only those functions which are solely within the scope of organizational maintenance are listed.

4-10. ORGANIZATIONAL MAINTENANCE TROUBLESHOOTING CHART

Refer to table 4-2 for troubleshooting which is allocated to organizational maintenance levels.

NOTE

Before you use this table, be sure you have performed all applicable operating checks.

Table 4-2. Organizational Maintenance Troubleshooting

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

WARNING

The ignition system of this space 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 cable connector before making any continuity tests.

1. HEATER FAILS TO START (NO FLAME, NO BLOWER).

Step 1. Check that fuse is not blown.
Replace blown fuse. Push in the cap on the fuse holder and rotate the fuse. Insert new fuse.

Step 2. Inspect room thermostat wiring for loose connections.
Tighten loose connections or repair broken leads.

Step 3. Turn on the ON-OFF switch. Set thermostat to its highest setting, remove cover, and jump thermostat terminals with an insulated screw driver.
If heater starts when terminals are jumped, replace thermostat as follows:
Remove the thermostat cover and attach a shielded 3-wire cable, long enough to reach between heater and thermostat. Secure the cable ground (green) wire to one of the thermostat mounting screws, and connect the other two wires (red and black) to the two terminals on the thermostat switch. Attach the other end of the cable to the three-pin room thermostat plug. Make sure the ground wire of the cable is connected to the ground lug of the connector (pin B). Connect the connector to the room THERMO receptacle (4, fig. 4-5) on the heater control panel.

NOTE

If the combined length of power cable and thermostat cable does not exceed 20 feet, use 14-gage cable for both applications. If the combined length exceeds 20 feet, use 12-gage cable.

Table 4-2. Organizational Maintenance Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

2. HEATER FAILS TO START (NO HEAT; BLOWER RUNS UNTIL RESET SWITCH TRIPS).

Step 1. Remove filter element (fig. 4-7) by loosening the nut on the fuel filter bail. Swing the bail aside and remove the filter.
Check filter element for contamination. Replace parts in reverse order of removal.

Step 2. Check that power is available to fuel pump (11, fig. 4-8) and solenoid valve (10).
if no power is available, check electrical connections.

Step 3. Disconnect fuel tube at float bowl (8, fig. 4-8) inlet and turn on power. Fuel should flow from fuel tube.
Check power input to fuel pump. Report to direct support maintenance if power is available but no fuel flows from fuel tube.

Step 4. Remove the spark plug (4, fig. 4-8) and check for damage.
Replace a damaged spark plug.

Step 5. Remove glow plug (5, fig. 4-8). Apply 28 vdc across the glow plug leads.
Replace glow plug if it fails to heat.

Step 6. Remove main fire tube inspection plug from burner (6, fig. 4-8). Turn on power, and check that fuel flows into main fire tube.
If no fuel flows, report to direct support maintenance.

3. HEATER OVERHEATS, CYCLING UNDER CONTROL OF OVERHEAT THERMOSTAT.

Step 1. Check for restricted air flow.
Remove any obstacles restricting air flow.

Step 2. Check for high fuel flow rate (indicated by heat exchanger tubes being red in color).
Reduce fuel rate.

4. HEATER BACKFIRES.

Step 1. Check that fuel adjustment is correct.
Adjust fuel adjustment needle as follows:

NOTE

You must remove the left side cover panel (fig. 4-9) to gain access to the fuel adjustment needle. Loosen the fuel adjustment lock nut before you turn the adjustment needle.

If the heater smokes, turn the fuel adjustment needle 1/8 turn clockwise to reduce the fuel flow. Observe heater operation for 1 minute. If smoking persists, turn the needle an additional 1/8 turn and observe the operation. Continue until operation is satisfactory.

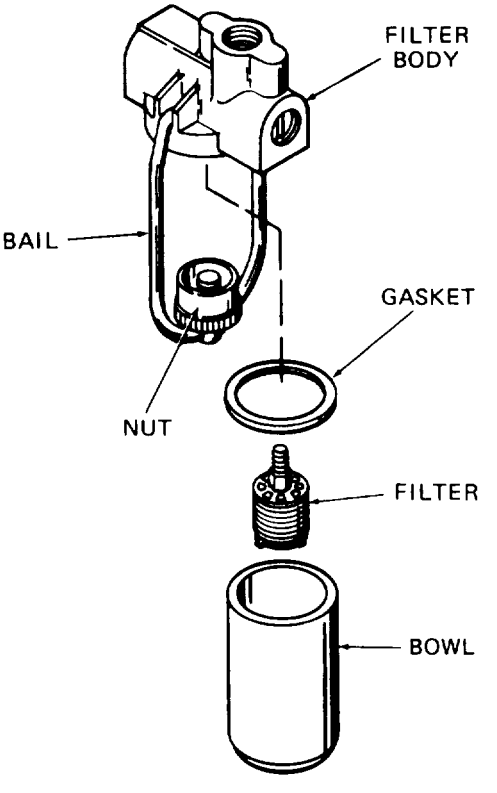
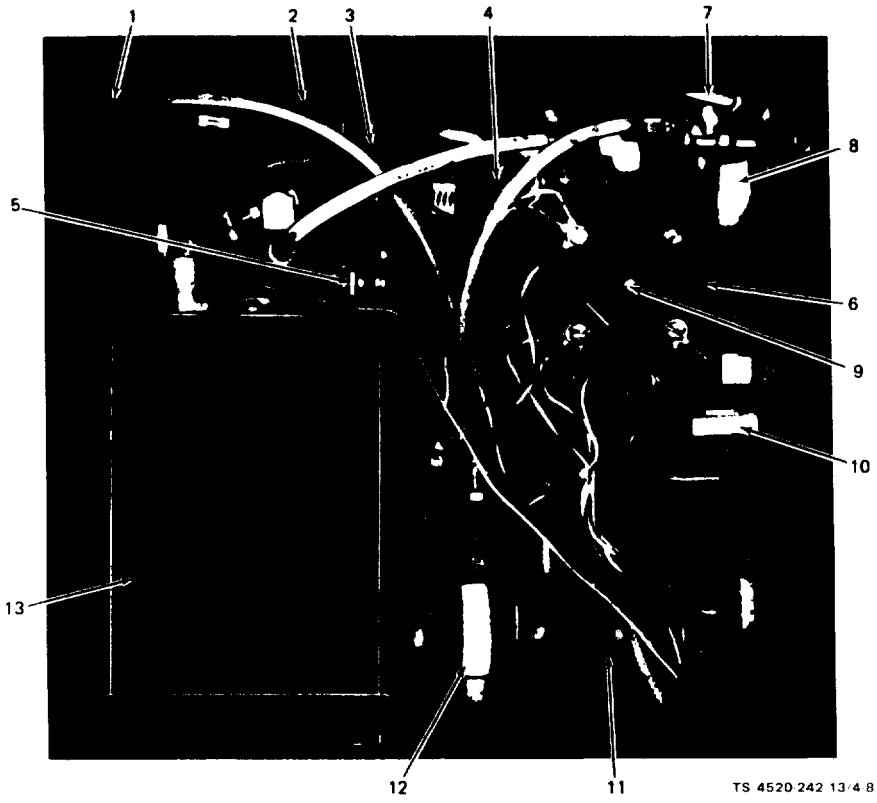


Figure 4-7. Fuel filter,



1. Fuel inlet bulkhead fitting
2. Combustion air tube
3. Ignition cable
4. Spark plug
5. Glow plug
6. Burner
7. Vent tube
8. Fuel float bowl
9. Fuel adjustment needle
10. Solenoid valve
11. Fuel pump
12. Fuel filter
13. Ignition case

Figure 4-8. Side view of heater showing internal components.

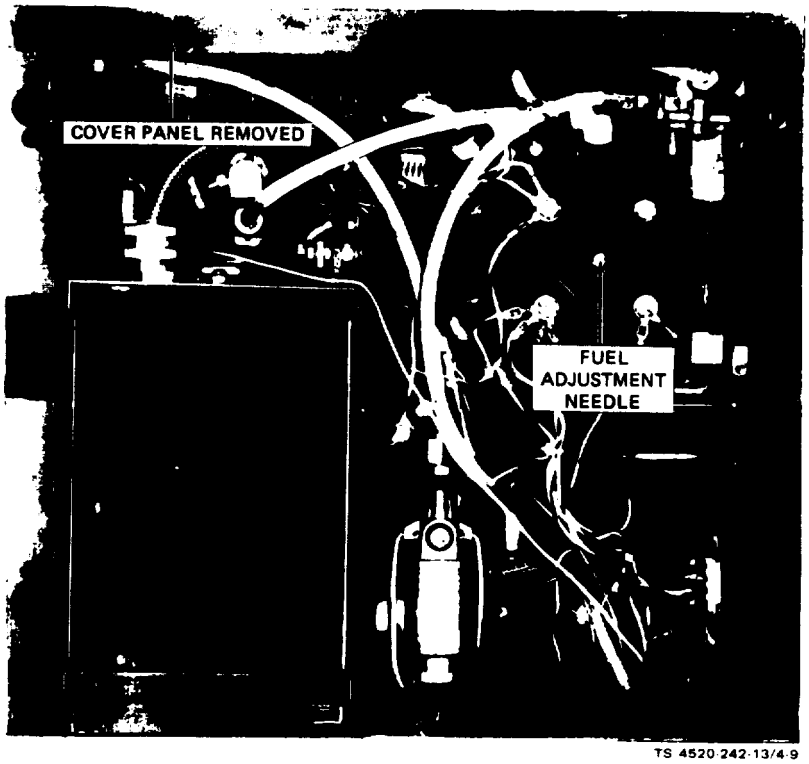


Figure 4-9. Fuel adjustment.

Table 4-2. Organizational Maintenance Troubleshooting -Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

4 - Continued

If heater operation Is erratic , or If heater fails to operate properly in extremel low ambient temperatures, turn the fuel adjustment needle 1/8 turn counterclockwise to increase fuel flow. Observe operation 1 minute. Continue to turn the needle counterclockwise in 1/8-turn increments until heater operation is satisfactory. When heater is burning smoothly, there should be little or no smoke from the exhaust outlet, and the heat exchanger tubes should not be red in color.

CAUTION

When checking spark, do not exceed the 1/8 inch (3 mm) distance from grounded surface. Any greater distance will cause excessively high potential buildup resulting in insulation breakdown either internally or in the Ignition cable. Make sure there are no fuel and fumes in the area of grounded surface that could ignite when checking spark.

Step 2. Remove ignition cable from the spark plug and position cable so that cable end is 1/8 inch (3 mm) from a grounded surface. Turn on power.
If spark is weak or intermittent, report to direct support maintenance.

Step 3. Remove spark plug and check for damage,
Replace a damaged spark plug.

Step 4. Check exhaust system for obstructions.
Remove exhaust obstructions.

Step 5. Check that exhaust piping is installed correctly.
Revise exhaust piping to conform to figure 4-10.

Step 6. Check that combustion air damper Is opened sufficiently to provide adequate combustion air,
Adjust the air damper nut so that air damper will have 5/16-inch (8 mm) clearance from the side of the intake housing when the damper is in the open position.

5. HEATER CYCLES ON AND OFF EXCESSIVELY.

Step 1. Check that room thermostat is Installed correctly.
Relocate improperly Installed thermostat. Mount the room thermostat In an upright position on an inside or Insulated wall in the area to be heated. Do not install the thermostat in line with the heater air inlet or discharge air flow, in a drafty position, or on an outside wall.

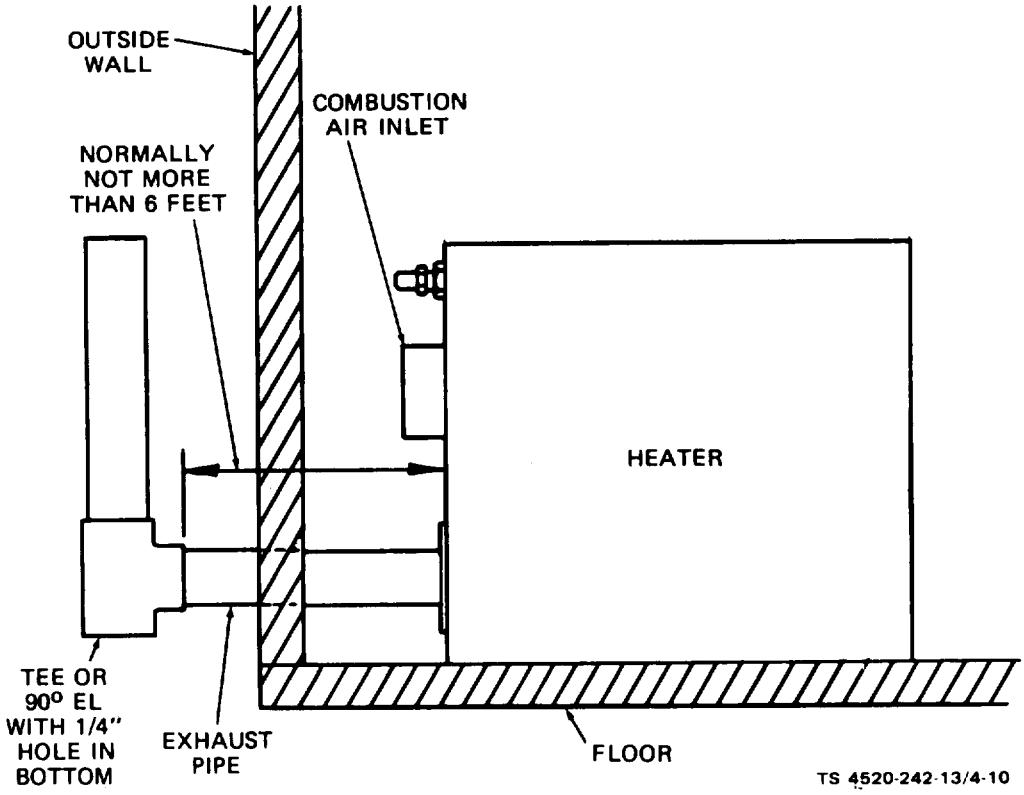
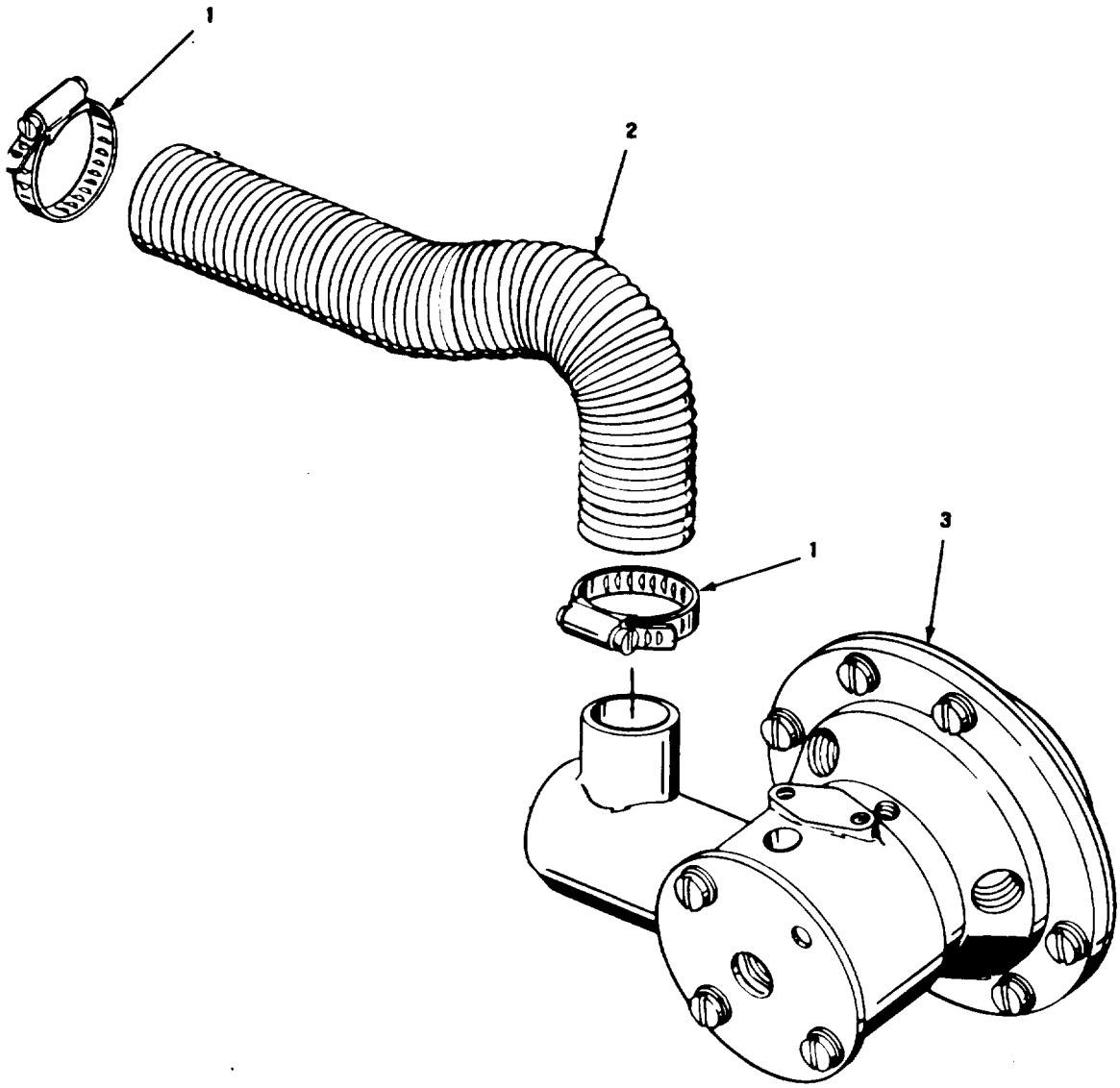


Figure 4-10. Exhaust installation.

Table 4-2. Organizational Miantenance Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
5 - Continued
Step 2. Disconnect thermostat power cable from thermostat. Use a multimeter set to read 1X resistance and check continuity across thermostat contacts while operating thermostat temperature control. Continuity must be made sharply as temperature control is moved up to and past ambient temperature. Continuity must be broken sharply as temperature control is moved down to and past ambient temperature. Replace thermostat if contact operation is Intermittent or erratic.
6. HEATER SMOKES.
Step 1. Check that fuel adjustment is correct. Adjust fuel adjustment needle.
Step 2. Check that combustion air inlet is not blocked or dirty. Clean or repair combustion air inlet or replace damaged parts. Adjust damper to provide adequate combustion air.
Step 3. Check that combustion' air damper is opened sufficiently to provide adequate combustion air. Adjust the air damper nut so the air damper will have 5/16-inch (8 mm) clearance from the side of the intake housing when the damper is in the open position.
Step 4. Remove left side cover panel and check that combustion air tube (2, fig. 4-11) is not torn or restricted. Replace a damaged combustion air tube. Disconnect the power plug and remove the top and side cover panels to provide access to the burner assembly. Loosen the two hose clamps (1, fig. 4-11) securing the combustion air tube (2) to the combustion air blower outlet and the burner (3). Remove the combustion air tube, and remove the clamps from the tube. Slide the clamps over the ends of a new combustion air tube, and fit the tube over the combustion air blower outlet and the burner air inlet. Tighten the clamps. Reinstall the top and side cover panels. Connect the power plug.
Step 5. Check that fuel float bowl controls fuel flow. With the heater energized and the fuel pump running, remove the vent tube (7, fig. 4-8) from the top side of the fuel bowl. No fuel should flow through opening. If fuel flows through opening, report to direct support maintenance.



1. Hose clamp
2. Combustion air tube
3. Burner assembly

Figure 4-11. Combustion air tube installation.

Section VII. RADIO INTERFERENCE SUPPRESSION

4-11. GENERAL METHODS USED TO ATTAIN PROPER Suppression, Essentially, suppression is attained by providing a low resistance path to ground for stray currents. The methods used include shielding the ignition wires; installing capacitors on the ignition power supply, blower motor, and air compressor; and installing a power filter in the control panel.

4-12. PRIMARY INTERFERENCE SUPPRESSION COMPONENTS.

a. Three 0.47 microfarad, 200 vdc capacitors are used for primary Interference suppression. One is installed on the ignition power supply. This capacitor suppresses the radio frequency interference of the ignition system, The other two capacitors suppress the radio frequency generated by the arcing of brushes at the motor commutators. One is installed on the blower motor and the other is installed on the air compressor motor.

b. A power filter is installed in the control panel. This device passes direct current but filters out the rf component of the input power.

4-13. REPLACEMENT OF PRIMARY INTERFERENCE SUPPRESSION COMPONENTS. Refer replacement of ignition power supply, blower motor, air compressor suppression capacitors, and control panel power filter to direct support maintenance.

4-14. SECONDARY INTERFERENCE SUPPRESSION COMPONENTS.

a. Component Identification. The secondary suppression components on the space heater are the shielded high tension ignition cable from the power supply to the spark plug and the shielded spark plug,

b. Component Replacement.

(1) The ignition cable is part of the ignition power supply. Refer replacement of the ignition cable to direct support maintenance.

(2) Replace the spark plug if defective.

4-15. TESTING OF RADIO INTERFERENCE SUPPRESSION COMPONENTS. Refer testing of suppression capacitors and power filter to direct support maintenance.

Section VIII. MAINTENANCE OF HEATER CASE

4-16. DESCRIPTION.

a. Cover Panels and Case. The heater case contains and mounts the heater components. The warm air louver, secured with wing head studs, can be rotated to any one of four positions to direct the flow of heated air up, down, or to either side. The

top and side cover panels are Interchangeable so the circulating air inlet screen can be positi oned either on the top or left side, as the heater location requires.

b. Control Panel Assembly. The control panel mounts all of the operator controls and the inlet connectors, It is installed at the lower front of the heater case. Its components are connected into the heater electrical system by solder-type and screw-type connectors.

4-17. COVER PANELS AND CASE,

WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock, Be sure to disconnect the power plug before servicing or repairing the heater.

a. Disassembly.

(1) Disconnect the power plug before removing the cover panels, unless you are going to perform operating tests or adjustment.

(2) The cover panels (1, 6, and 11, fig. 4-12) are secured to the heater case (27) with twist-lock type studs (3, 5, 8, 10, 13, and 15). Give each stud a quarter turn counterclockwise to release the cover panels.

(3) The louver (16) is secured to the heater case (27) with wing head studs (18). Give each wing head stud a quarter twist counterclockwise to release the louver.

(4) if the combustion chamber cover (20) is damaged, remove the screws (19) that secure it to the case; remove the combustion chamber cover.

(5) If the nut plates (22, 24, and 26) are damaged, remove the screws (21, 23, and 25) that secure them to the case; remove the nut plates.

b. Cleaning and Inspection.

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 (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 100°F (38°C).

(1) Using a dry cloth, wipe dust and lint from the top and side cover panels, warm air louver, and combustion air inlet. Remove greasy or gummy deposits with a cloth dampened with dry cleaning solvent (fed. spec. P-D-680).

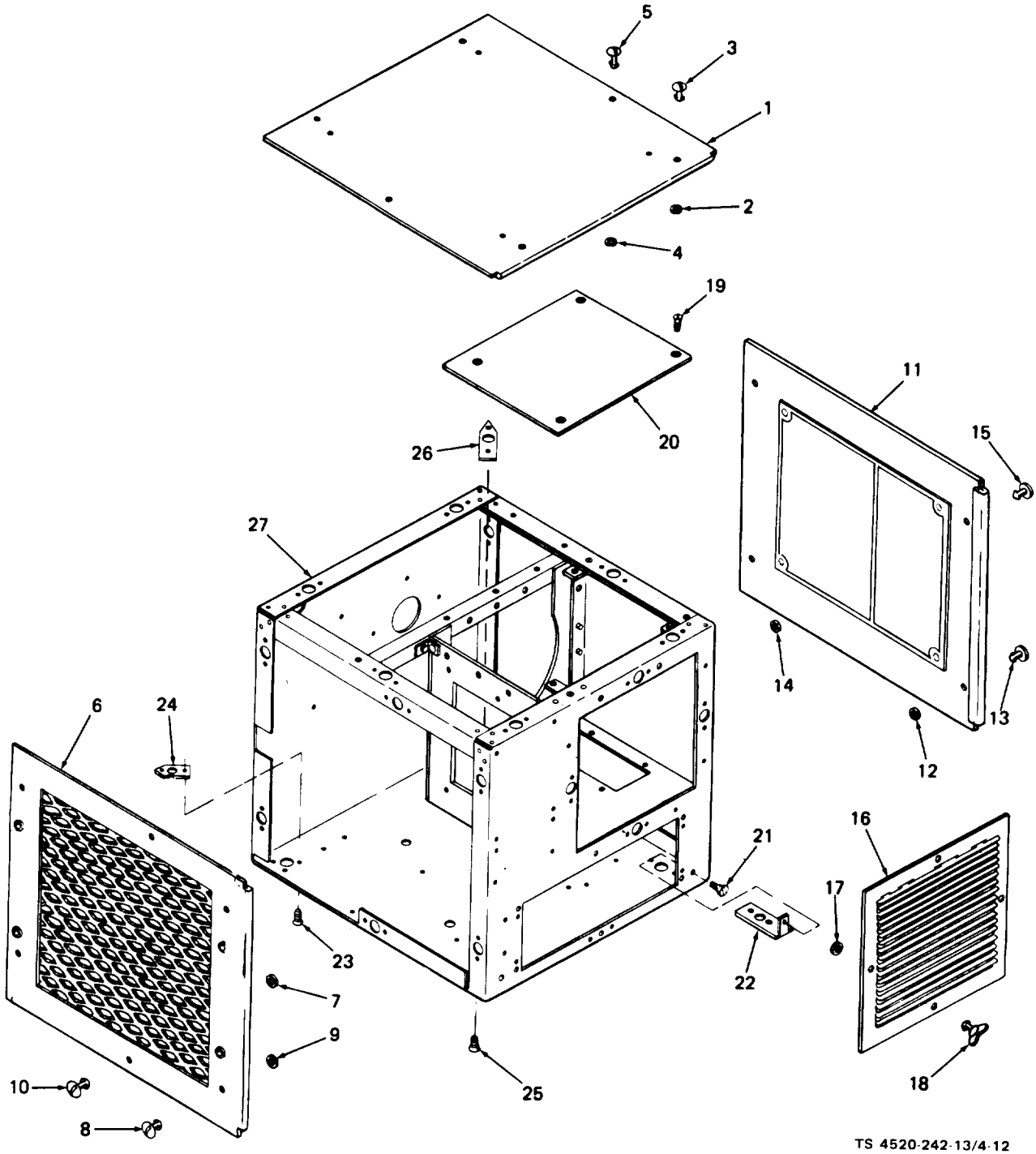


Figure 4-12. Heater case assembly, exploded view.

Legend for fig. 4-12:

1. Top cover panel
2. Split ring
3. Stud
4. Split ring
5. Stud
6. Side cover panel
7. Split ring
8. Stud
9. Split ring
10. Stud
11. Side cover panel
12. Spilt ring
13. Stud
14. Split ring
15. Stud
16. Louver
17. Split ring
18. Wing head stud
19. Screw
20. Combustion chamber cove r
21. Screw
22. Front nut plate
23. Screw
24. Left rear nut plate
25. Screw
26. Right rear nut plate
27, Case

(2) Check the inside of the heater case for accumulations of dust and lint. If vacuum cleaning equipment is available, use it to clean the inside of the heater case, taking care not to disturb the wiring or damage components. If vacuum cleaning equipment is not available, use a clean, dry cloth to remove accumulations of dust and lint.

(3) if any of the data plates are defaced or Illegible, report the condition to direct support maintenance.

(4) Before reinstalling covers and warm air louver, inspect heater components for fuel leaks, signs of burning or overheating, or other damage or malfunction. Refer to the appropriate repair sections of this publication for repair and replacement procedures.

c. Reassembly. Reassemble the covers and the louver to the heater case in the reverse order of the index numbers in figure 4-12.

4-18. ON-OFF SWITCH AND FUSE HOLDERS.

WARNING

The ignition system of this heater contains dangerous voltages which can cause severe electrical shock, Be sure to disconnect the power plug before servicing or repairing the heater.

a. Removal and Disassembly.

(1) Disconnect the power plug, and remove the left side cover panel to provide access to the back of the control panel.

(2) Remove the five screws (1, fig. 4-13) and-lock washers (2) securing the control panel assembly (7) to the heater case. Pull out gently on the control panel to provide access to the wiring on the back of the panel.

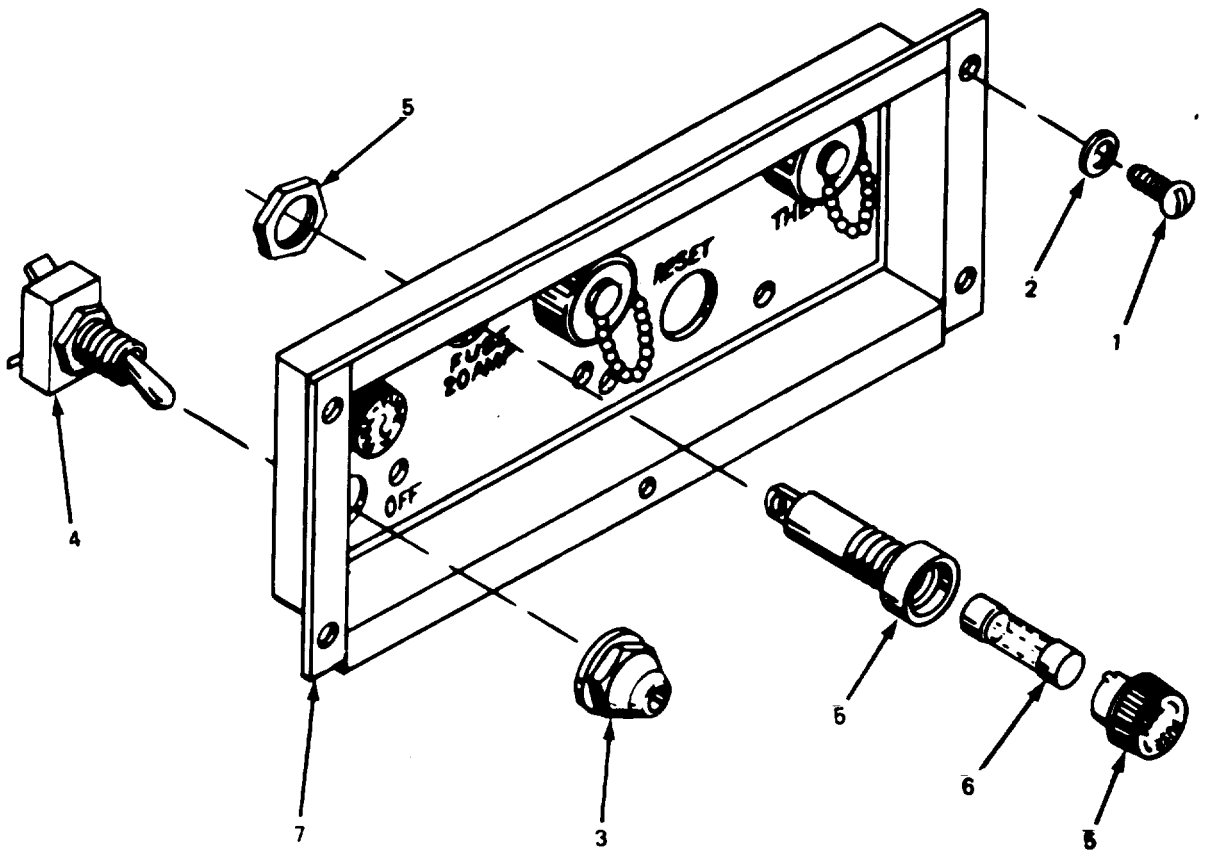
(3) If the ON-OFF switch (4) is defective, tag and remove the two red and two violet leads from the switch. Unscrew the boot (3) and remove the ON-OFF switch from the back of the control panel.

(4) Push in the cap on the fuse holder (5), and rotate the cap counterclockwise to remove it from the fuse holder. Remove the fuse (6) from the fuse holder. Tag and unsolder the three red wires from the fuse holder, Remove the fuse holder nut and pull the fuse holder from the front of the control panel. Remove the spare fuse holder the same way, except the spare fuse holder has no connected wires.

b. Cleaning and Inspection.

(1) Clean the switch and fuse holders with a clean, dry cloth or a soft-bristle brush.

(2) Do not repair the ON-OFF switch or fuse holders. Replace these parts if they are damaged or defective.



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1. Screw
2. Lock washer
3. Boot
4. ON-OFF switch
5. Fuse holder (including nut)
6. Fuse
7. Control panel assembly

Figure 4-13. Control panel, exploded view.

(3) Inspect the THERMO and POWER receptacles in the control panel for cracks, damaged terminals, and signs of overheating, Report defective receptacles to direct support maintenance,

c. Reassembly and Installation,

(1) Reassembly of the ON-OFF switch and the fuse holders is the reverse of disassembly. Refer to figure 4-13.

(2) Use only rosin-core solder for soldered connections.

(3) Reinstall the assembled control panel in the heater case and secure with the five screws (1, fig. 4-13) and lock washers (2). Reinstall the side cover panels, connect the power plug, and check heater operation.

Section IX. MAINTENANCE OF ELECTRICAL COMPONENTS

4-19. DESCRIPTION.

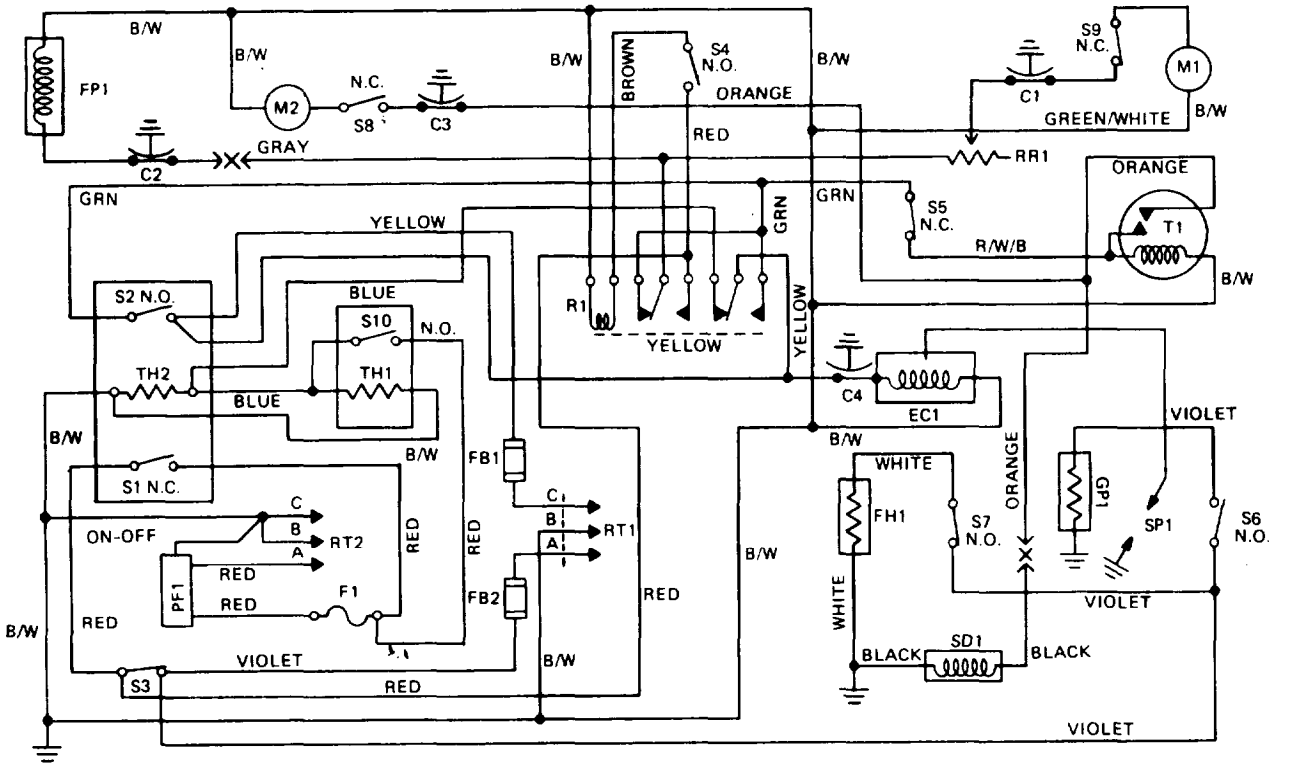
a. Room Thermostat. The room thermostat mounts on a wall in the heated enclosure. It is connected to the heater by a 3-wire cable which plugs into the front of the heater. The thermostat senses the temperature of the air in the enclosure and turns the heater on and off, as long as the ON-OFF switch is on and the heater is supplied with fuel.

b. ON-OFF Switch. The ON-OFF switch is mounted on the control panel and provides the electrical power to operate the thermostat in the automatic mode. When the ON-OFF switch is turned ON, the thermostat will operate the heater automatically to control room temperature.

4-20. ROOM THERMOSTAT.

a. Check the thermostat operation by operating the knob from one extreme to the other, checking that electrical continuity is made as the knob position indicates room temperature and below, and that continuity is broken above room temperature.

b. No repair is authorized for the room thermostat. Replace a defective thermostat as follows:



KEY TO DIAGRAM			
C1	Capacitor-Vent. & Comb. Motor	S4	Sw. Safety Thermostat
C2	Capacitor-Fuel Pump	S5	Sw. Overheat Thermostat
C3	Capacitor-Compressor	S6	Sw. Glow Plug Thermostat
C4	Capacitor-Ignition Coil	S7	Sw. Fuel Heater Thermostat
F1	Fuse	S8 & S9	Sw. Overheat Protector
FH1	Fuel Heater	S10	Sw. Maintenance Thermostat
FP1	Fuel Pump	SD1	Solenoid
EC1	Ignition Coil	SP1	Spark Plug
GP1	Glow Plug	T1	Timer
M1	Vent. & Comb. Motor	TB1 & TB2	Terminal Block
M2	Compressor	TH1 & TH2	Timer Heater
R1	Relay-DPDT	R/W/B	Red, White, Blue
RR1	Resistor	B/W	Black, White
RT1	Receptacle-Thermostat	GRN	Green
RT2	Receptacle-Power 28 V.D.C.	YEL	Yellow
S1	Sw. Reset Thermostat	WHT	White
S2	Sw. Delay Thermostat	FB1 & FB2	Ferrite Beads
S3	Sw. On-Off	PF1	Power Filter

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Figure 4-14. Electrical system operation.

WARNING

The ignition system of this heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before servicing or repairing the heater.

(1) Mount the room thermostat in an upright position on an inside or insulated wall in the area to be heated. Do not install the thermostat in line with the heater air inlet or discharge air flow, in a drafty position, or on an outside wall.

(2) Remove the thermostat cover and attach a shielded 3-wire cable, long enough to reach between heater and thermostat. Secure the cable ground (green) wire to one of the thermostat mounting screws and connect the other two wires (red and black) to the two terminals on the thermostat switch. Attach the other end of the cable to the three-pin room thermostat plug (which is packaged separately). Make sure the ground wire of the cable is connected to the ground lug of the connector (pin B). Connect the connector to the room THERMO receptacle on the heater control panel. Check heater operation.

NOTE

If the combined length of power cable and thermostat cable does not exceed 20 feet, use 14-gage cable for both applications. If the combined length exceeds 20 feet, use 12-gage cable.

4-21. ON-OFF SWITCH.

a. Check the operation of the ON-OFF switch by operating it from the ON to the OFF position, checking that electrical continuity is made as the switch is placed in the ON position.

b. No repair is authorized for the ON-OFF switch. Replace a defective switch as follows:

WARNING

The ignition system of this heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before servicing or repairing the heater.

(1) Disconnect the power plug, and remove the left side cover panel to provide access to the back of the control panel.

(2) Remove the five screws and lock washers securing the control panel to the heater case. Gently pull out the control panel as far as the wires will permit.

(3) Tag and unsolder two red and two violet leads from the switch.

(4) Unscrew the boot and remove the ON-OFF switch from the back of the control panel.

(5) Replace the switch and reassemble in the reverse order of disassembly.

(6) Replace the power plug and check the operation of the ON-OFF switch.

4-22. DESCRIPTION OF ELECTRICAL SYSTEM OPERATION.

a. Startup.

(1) When the operator turns the ON-OFF switch S3 (fig. 4-14) to ON, current flows to the glow plug thermostat S6 which closes at 40°F (4°C) and passes current to the glow plug GP1 to heat the combustion chamber. Current also flows to the fuel heater thermostat switch S7 which closes at 40°F (4°C) and passes current to the fuel heater FH1.

(2) If the room thermostat contacts are closed, current flows to the delay thermostat S2, ignition coil EC1, spark plug SP1, control relay R1, and timer heaters TH1 and TH2. Maintenance thermostat S1O is constantly supplied current through fuse F1 when the power plug is connected to a source of 28 vdc. Maintenance thermostat S1O closes at 40°F (4°C) to supply a secondary current flow to the two timer heaters TH1 and TH2, which are connected in parallel. With current flow to delay thermostat S2, the time delay cycle begins.

b. Transition.

(1) The delay thermostat S2 is open at room temperature. Heat from timer heater TH2 causes thermostat S2 to close on rising to 65°F (18°C).

(2) When the delay thermostat S2 closes, it passes current to timer T1 and control relay R1. Timer T1, after a slight delay, energizes the fuel solenoid valve SD1, and air compressor motor M2. Relay R1 energizes blower motor Ml and fuel pump FP1, and also opens relay contacts to eliminate the primary current flow to timer heater TH2.

(3) Timer heaters TH1 and TH2 remain energized by the secondary current flow through maintenance thermostat S10 until heater TH1 raises maintenance thermostat S10 temperature to 55°F (13°C).

(4) The combination of heat from the glow plug and spark from the spark plug make possible fuel ignition.

c. Run (Burner Lighted).

(1) if ignition proceeds normally in the transition stage, the heater lights, and heat from the burner is detected by flame safety thermostat S4 which closes on rising to 11O°F (43°C).

(2) When flame safety thermostat S4 closes, it energizes relay R1. When relay R1 is energized, it bypasses maintenance thermostat S10 and-delay thermostat S2.

(3) When energized, relay R1 also sends power to ignition coil EC1, fuel pump FP1, blower motor Ml, air compressor M2 , and fuel solenoid valve SD1, With the time delay circuit disconnected, the timer heaters shut off and cool, but the flame in the burner is sustained as long as fuel is supplied.

d. Ignition Failure.

(1) If the burner fails to light for any reason, the flame safety thermostat will not actuate the relay, and the contacts will not close. Therefore, relay R1 will not energize to operate the heater in the run stage described in subparagraph c, above.

(2) In this situation, the timer heater will temporarily remain energized. After a total of 60 to 70 seconds, heat from the timer heater will trip RESET switch S1, shutting off all power to the heater and preventing damage to the glow plug or the time delay mechanism,

(3) if the heater runs out of fuel, or if the fuel flow stops for any reason, thermostat S4 and relay will also act to shutoff the heater when the heat exchanger Cools.

e. Thermostatic Control.

(1) When ON-OFF switch S3 is turned on, the thermostat will operate the heater automatically to control room temperature. When the room temperature reaches the thermostat setting, the thermostat contacts open, starting the shutdown stage of the heater cycle.

(2) When the room temperature fails below the thermostat setting, the thermostat contacts close, causing the heater to enter the startup stage of its cycle.

(3) The thermostat will continue to turn the heater on and off to control room temperature as long as fuel and power are available to the heater.

f. Shutdown.

(1) When the operator turns ON-OFF switch S3 to OFF. or when the thermostat contacts open, the ignition , air compressor, and fuel solenoid valve circuits are broken, stopping ignition and fuel flow.

(2) Power is still available to flame safety thermostat S4 to keep relay R1 energized. Power is thus available to the relay to run blower motor M1 until all fuel in the burner is consumed. When the flame extinguishes, the blower circulates air to cool the heater.

(3) Air from the blower motor fan cools the heat exchanger until thermostat S4 reaches its cutout setting, The thermostat S4 relay contacts open, deenergizing relay R1, This shuts off power to the motor and prepares the heater for the next startup.

g. Overheat.

(1) if the heater overheats because of reduced ventilation ai r flow, excessive fuel flow, or other causes, overheat thermostat S5 opens, This breaks the flow 01' current to the air compressor and the fuel solenoid valve, shutting off the flow of fuel,

(2) Current still flows through relay RI to operate blower motor Ml, cooling down the heat exchanger. When the heat exchanger temperature reaches a safe level, the overheat swich closes to restart fuel flow and ignition, Because the heat exchanger and burner head are still quite warm, ignition is rapid and the time delay assembly is not utilized.

Section X. MAINTENANCE OF BURNER ASSEMBLY

4-23. DESCRIPTION.

a. Combustion Air Tube. The combustion air tube is a spring-wound, neoprene-coated tube which conducts the combustion air from the combustion air blower outlet to the combustion air Inlet on the burner.

b. Spark Plug. The spark plug is similar to an automotive spark plug, and it performs a similar function. High voltage from the ignition power supply creates a spark between the spark plug electrode and the grounded burner assembly. it is this spark which ignites the fuel and air mixture in the burner head.

c. Glow Plug. The glow plug is energized when burner casing temperature drops below 40°F (4°C). The glow plug is a wire-wound electrical heater that preheats the burner head to ensure vaporization of the fuel for rapid ignition.

d. Fuel Adjustment Needle. The fuel adjustment needle is located on the burner. It is used to adjust the fuel flow during heater operation or when the type of fuel being burned in the heater is changed.

4-24. COMBUSTION AIR TUBE, SPARK PLUG, GLOW PLUG, AND FUEL ADJUSTMENT NEEDLE.

a. Removal.

WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before servicing or repairing the heater.

(1) Disconnect the power plug and remove the top and side cover panels to provide access to the burner assembly.

(2) Loosen the two hose clamps (1, fig. 4-15) securing the combustion air tube (2) to the combustion air blower outlet and the burner, Remove the combustion air tube, and remove the clamps from the tube.

(3) Unscrew the nut on the ignition cable and separate the cable from the spark plug (3). Unscrew the sparkplug from the burner (15).

(4) Remove the nut (4) and lock washer (5), and disconnect the urple lead from the glow plug (6). Unscrew and remove the glow plug and gasket (7) from the burner.

(5) Remove screw (8) and lock washer (9) securing the needle retainer (10) to the burner. Remove the fuel adjustment needle assembly by unscrewing pipe plug (11) from the burner. Disassemble fuel adjustment needle assembly by loosening nut (12) and unscrewing needle (13). Remove seal (14).

b. Cleaning and Inspection.

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 (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 100°F (38°C).

(1) Clean the combustion air tube by shaking it or blowing through it with compressed air. Replace the tube if it is torn, deteriorated, restricted, or damaged.

(2) Clean the spark plug, glow plug, and fuel adjustment needle assembly metal parts with dry cleaning solvent (fed. spec. P-D-680). Do not immerse the glow plug in solvent. Allow all parts to dry thoroughly before installation.

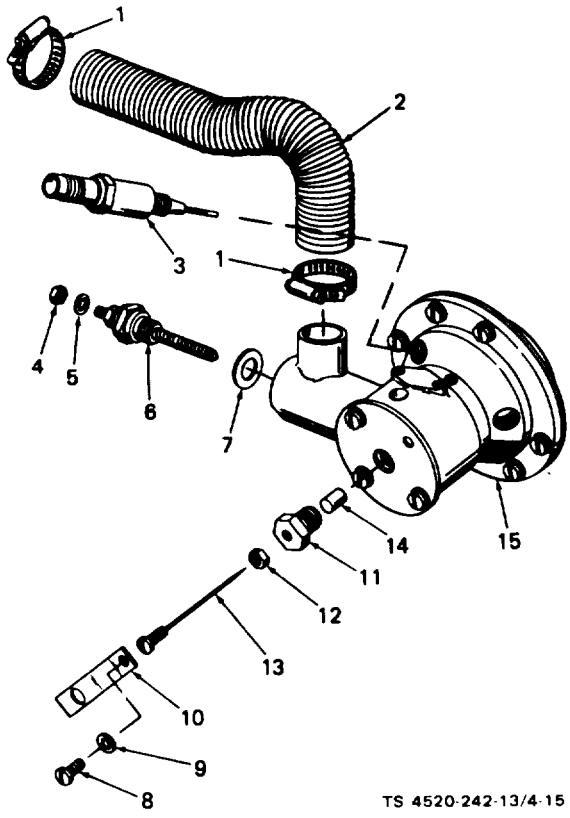
(3) Inspect the electrode and outer shell of the spark plug for burning or pitting. Inspect ceramic parts for cracks or breaks. Inspect threads for damage. Replace a damaged spark plug.

(4) Inspect the glow plug for cracks, frayed insulation, loose or broken leads, defective element winding and other damage. Apply 28 vdc across the glow plug leads and check that the glow plug heats. Replace a damaged or defective glow plug.

(5) Inspect the fuel adjustment needle tip for wear, scoring, or other damage. Replace the fuel adjustment needle if the needle is bent or damaged.

c. Installation.

(1) Reassemble fuel adjustment needle assembly by positioning nut (12) on adjustment needle (13). Install this assembly into pipe plug (11). Carefully slide needle seal (14) over the needle. Turn the fuel adjustment needle into pipe plug (11)



1. Hose clamp
2. Combustion air tube
3. Spark plug
4. Nut
5. Lock washer
6. Glow plug
7. Gasket
8. Screw
9. Lock washer
10. Needle retainer
11. Pipe plug
12. Nut
13. Adjustment needle
14. Seal
15. Burner

Figure 4-15. Burner assembly, exploded view.

until the top of the needle head is 7/16 inch (11 mm) from the face of the pipe plug, Maintain this dimension and tighten nut (12), Coat the male NPT threads of pipe plug (11) with Permatex No, 1, or equivalent, and install the fuel adjustment needle assembly on the burner. Tighten pipe plug until its head is flush to the burner cover plate of burner (15). Position needle retainer (10) over the slotted end of the adjustment needle (13). Secure with lock washer (9) and screw (8).

(2) Use a new gasket (7) and Install the glow plug (6) in the burner. Connect the purple lead using lock washer (5) and nut (4).

(3) Install the sparkplug (3) in the burner. Position the ignition cable and tighten the ignition cable nut.

(4) Slide the clamps (1) over the ends of the combustion air tube (2), and fit the tube over the combustion air blower outlet and the burner air Inlet. Tighten the clamps. Reinstall fuel lines.

(5) Reinstall the top and side cover panels. Connect the power plug and test the heater operation. Adjust the fuel adjustment needle.

d. Fuel Adjustment. When the type of fuel being burned in the heater is changed, or when the heater is subjected to extremely low ambient temperatures, it will normally be necessary to readjust the fuel adjustment needle on the burner assembly for proper combustion.

NOTE

You must remove the left side cover panel to gain access to the fuel adjustment needle. Loosen the fuel adjustment lock nut before you turn the adjustment needle.

(1) If heater smokes, turn the fuel adjustment needle 1/8 turn clockwise to reduce the fuel flow. Observe heater operation for 1 minute. If smoking persists, turn the needle an additional 1/8 turn and observe operation. Continue until operation is satisfactory.

(2) If heater operation is erratic, or heater fails to operate properly in extremely low ambient temperatures, turn the fuel adjustment needle 1/8 turn counterclockwise to increase fuel flow. Observe operation for 1 minute. Continue to turn the needle counterclockwise 1/8 turn until heater operation is satisfactory. When heater is burning smoothly, there should be little or no smoke from the exhaust outlet and the heat exchanger tubes should not be red in color.

Section XI. MAINTENANCE OF FUEL SYSTEM

4-25. DESCRIPTION, The space heater fuel system consists of a fuel float bowl, solenoid valve, fuel filter, fuel pump, and the interconnecting lines and fittings. Refer to figure 4-16,

a. Fuel Float Bowl. The fuel float bowl (8, fig, 4-17) meters the flow of the fuel to the burner head to achieve efficient combustion.

b. Solenoid Valve. The solenoid valve (10) controls the flow of fuel from the fuel float bowl (8) to the fuel nozzle. This electrically controlled device opens the fuel valve when the room thermostat calls for heat and closes the valve when the heat requirement is satisfied.

c. Fuel Filter. The fuel filter (12) traps and holds dirt, moisture, and other contaminants before they enter the heater fuel system. The fuel filter has a metal disc-type element contained in a removable sediment bowl.

d. Fuel Pump. A 28-volt, pulsating-type electric fuel pump (11) draws fuel from the fuel supply and pumps it to the fuel float bowl (8). The pump also contain a filter to remove any contaminants which may have passed through the fuel filter.

e. Fuel Lines. Fixed fuel lines carry the fuel from the fuel filter to the fuel pump. A flexible fuel tube carries the fuel from the fuel pump to the fuel float bowl . A vent tube (3, fig. 4-18) vents excess fuel from the fuel float bowl (4) to the burner (5) in the event of fuel float bowl malfunction. A flexible line carries pressurized air from the compressor to the burner head to atomize fuel.

4-26. FUEL FLOAT BOWL. Inspect the fuel float bowl as follows:

WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before servicing or repairing the heater.

a. Remove the top and left side panels from the heater.

b. Check that fuel tube fittings and float bowl cover mounting screws are secure. Tighten loose fittings and screws.

c. Inspect the fuel float bowl for cracks, missing screws, and other visible damage. Report any visible damage to direct support maintenance.

d. Connect the power plug. With the cover panels still removed, start the heater and check for any leaks around the fuel float bowl. If any leakage is detected, shut off the heater, disconnect the power plug, and correct leak. Recheck heater operation and, when it is satisfactory, reinstall cover panels. if leakage cannot be corrected by tightening tube fittings and float bowl cover mounting screws, report condition to direct support maintenance.

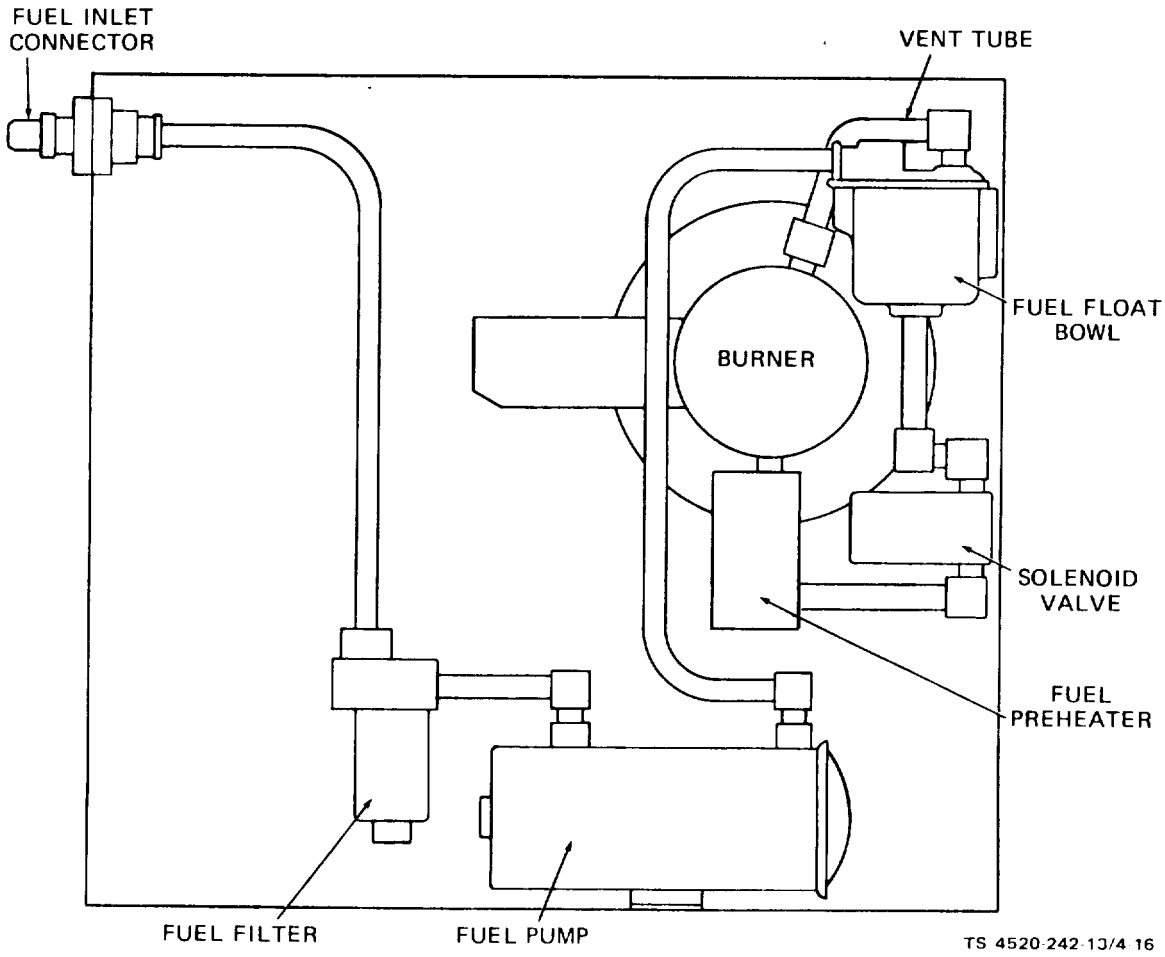
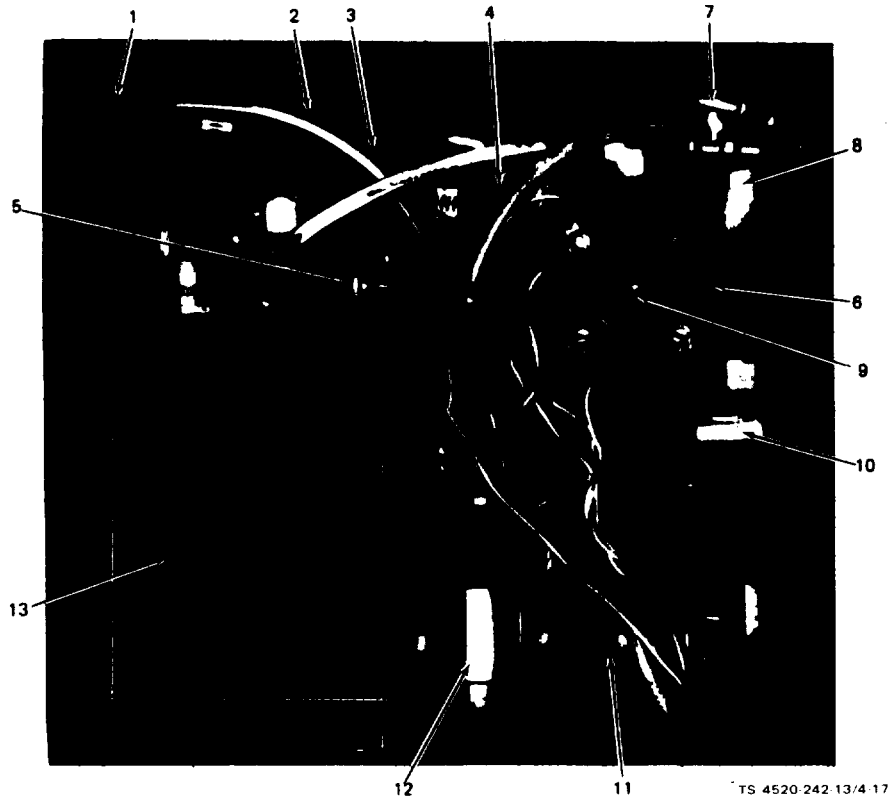
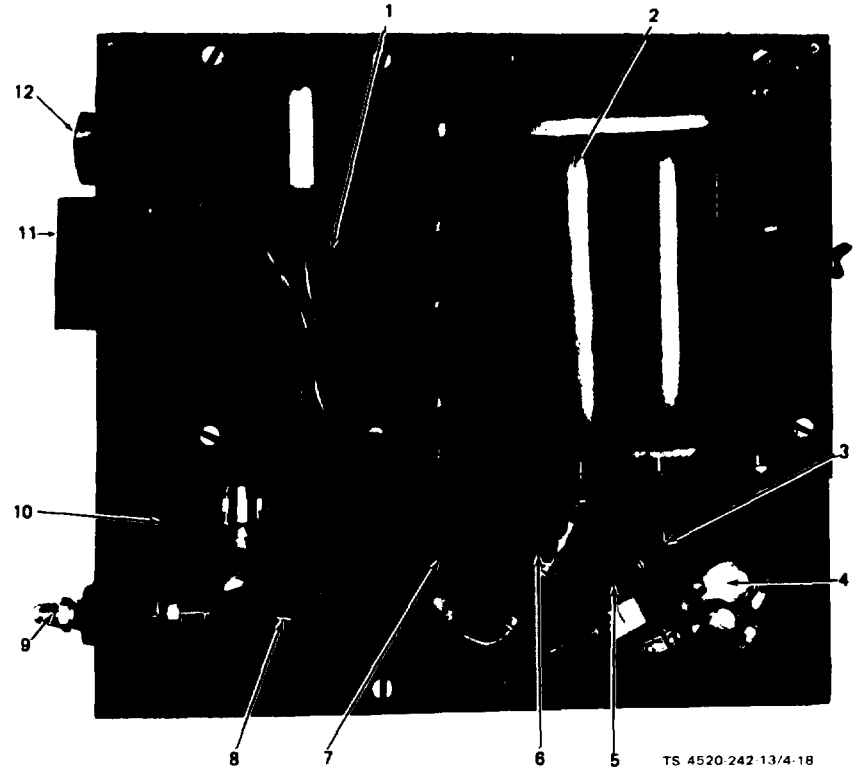


Figure 4-16. Fuel flow diagram.



1. Fuel inlet bulkhead fitting
2. Combustion air tube
3. Ignition cable
4. Spark plug
5. Glow plug
6. Burner
7. Vent tube
8. Fuel float bowl
9. Fuel adjustment needle
10. Solenoid valve
11. Fuel pump
12. Fuel filter
13. Ignition case

Figure 4-17. Side view of heater showing interal components,



1. Blower
2. Heat exchanger
3. Vent tube
4. Fuel float bowl
5. Burner
6. Spark plug
7. Combustion air tube
8. Fuel inlet tube
9. Bulkhead fitting
10. Air dampener
11. Combustion air inlet
12. Exhaust pipe connector

Figure 4-18. Top view of heater showing internal components.

4-27. SOLENOID VALVE. Inspect the solenoid Valve as follows:

WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock, Be sure to disconnect the power plug before servicing or repairing the heater.

a. Remove the left side cover panel from the heater.

b. Check that solenoid body nut is secure. Tighten nut if it is loose.

c. Inspect solenoid wires for frays and cracks. Check that wires are securely fastned In solenoid body. Report any visible damage to direct support maintenance.

d. Connect the power plug. With the cover panel still removed, start the heater and check for any leaks around the solenoid valve. If heater operation is satisfactory, reinstall cover panel. If heater operation is unsatisfactory, report condition to direct support maintenance.

4-28. FUEL FILTER, FUEL TUBES, AND FITTINGS.

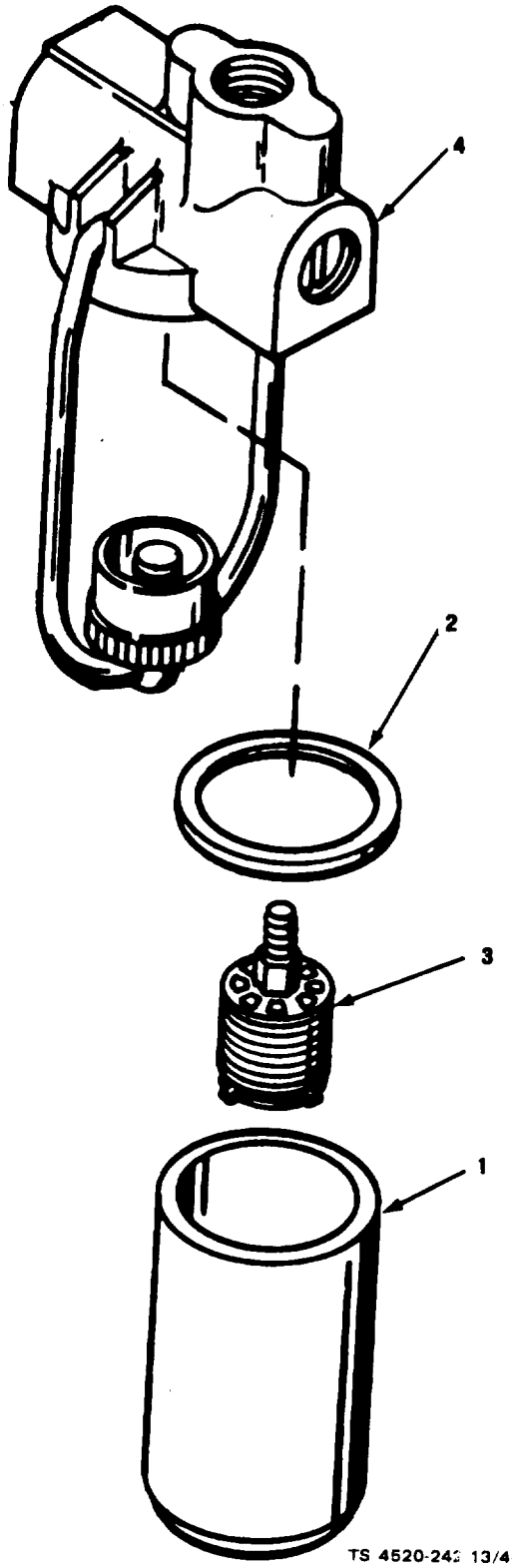
WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before servicing or repairing the heater.

a. Fuel Filter Service.

(1) Disconnect, the power plug and shut off the fuel supply. Remove the left side cover panel to provide access to the fuel filter.

(2) Loosen the nut on the fuel filter bail. Swing the ball aside and remove the fuel bowl (1, fig. 4-19), gasket (2), and filter element (3) from the fuel filter body (4).



1. Bowl
2. Gasket
3. Filter element
4. Fuel filter body

Figure 4-19. Fuel filter, exploded view.

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 (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 1OO°F (38°C).

(3) Clean the parts with dry cleaning solvent (fed. spec. P-D-680) and allow all parts to dry thoroughly before reassembly.

(4) Install the filter element (3) in the fuel filter body (4). Install the bowl (l), using a new gasket (2), and swing the bail in place. Engage the screw in the notch in the bottom of the bowl and tighten the nut hand tight.

(5) Turn on the fuel supply and connect the power plug. With the cover panel still removed, start the heater and check for leaks around the fuel filter bowl. If any leakage is detected, shut off the heater, disconnect the power plug, and correct the leak. Recheck heater operation and, when it is satisfactory, reinstall the cover panel.

b. Removal.

(1) Disconnect the power plug. Shut off the fuel supply and disconnect the fuel supply line at the bulkhead fitting. Remove the left side cover panel for access to the fuel filter, fuel lines, and fittings.

(2) Disconnect the assembled fuel tube (1 through 3, fig. 4-20), from the fuel filter inlet.

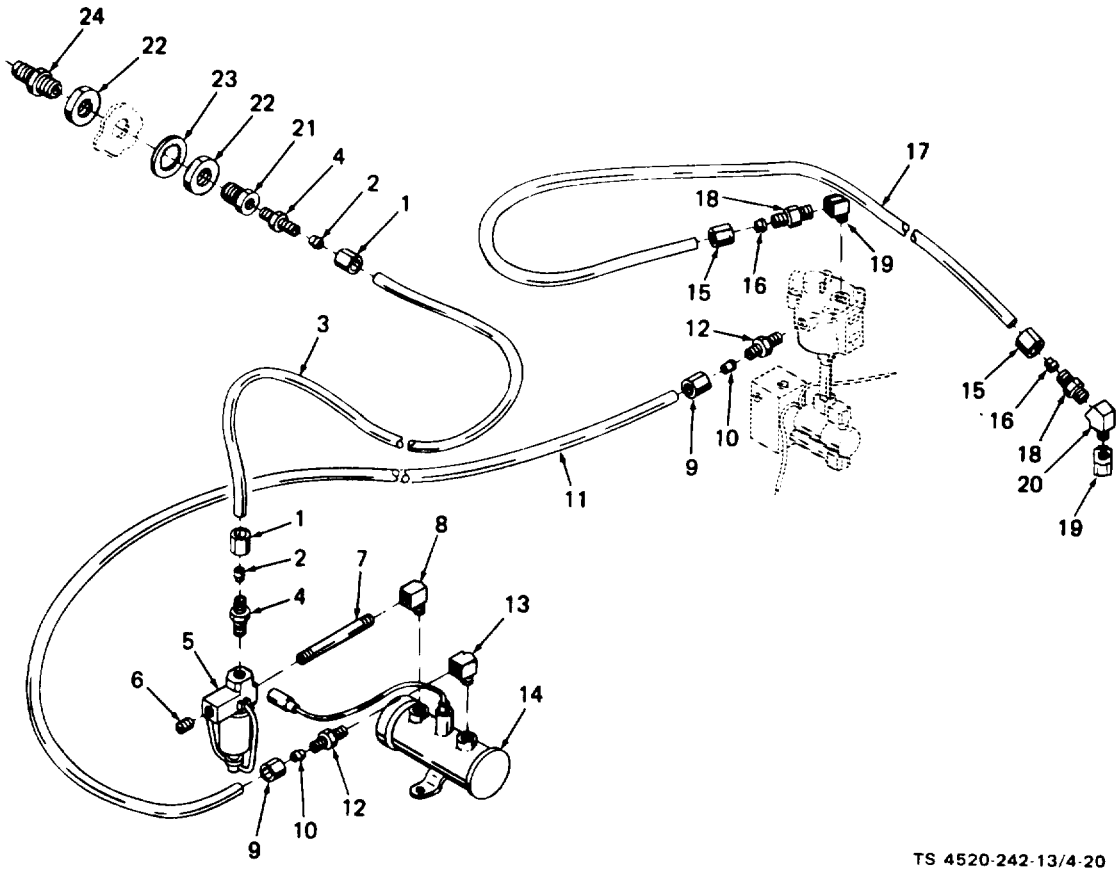
(3) Loosen the nut on the bail of fuel filter (5). Swing the bail aside and remove the fuel bowl (1, fig. 4-19), gasket (2), and filter element (3) from the fuel filter body (4). Unscrew fuel filter body by turning counterclockwise and remove from pipe nipple (7, fig. 4-20).

(4) Remove the assembled fuel tube (9 through 11) from the fuel pump (14) and fuel float bowl. Remove the assembled fuel tube (15 through 17).

NOTE

it is not necessary to disassemble the compression sleeves and compression nuts from the fuel tubes unless the fuel tubes must be replaced.

(5) Unscrew and remove pipe nipple (7), fittings (8, 13, 19, and 20), and connectors (4, 12, and 18).



1. Compression nut
2. Compression sleeve
3. Fuel tube
4. Connector
5. Fuel filter
6. Plug
7. Pipe nipple
8. Elbow
9. Compression nut
10. Compression sleeve
11. Fuel tube
12. Connector
13. Elbow
14. Fuel pump
15. Compression nut
16. Compression sleeve
17. Vent tube
18. Connector
19. Elbow
20. Elbow
21. Bushing
22. Nut
23. Lock washer
24. Connector

Figure 4-20. Fuel system, exploded view.

c. Cleaning and Inspection.

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 (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 100°F (38°C).

(1) Clean metal parts in dry cleaning solvent (fed. spec. P-D-680) and allow all parts to dry thoroughly before assembly.

(2) Inspect the fuel tubes for cracks, worn spots, restrictions, and other damage. Replace damaged tubes. The compression sleeves (2, 10, and 16, fig. 4-20) and compression nuts (1, 9, and 15) must be replaced when the fuel tubes are replaced.

(3) Replace any fittings that are cracked or have damaged threads.

d. Installation.

(1) Install the fuel tubes, fitt rigs, and fuel filter in the reverse order of the index numbers in figure 4-19.

(2) Use Permatex No. 1, or equivalent, to coat the male NPT threads of the pipe nipple (7) and connectors (4, 12, 18, and 24) before installing them. Do not apply sealing compound to the threads of the compression fittings.

(3) Connect the fuel supply line to the bulkhead fitting and reconnect the power plug. Start the heater with the cover panel still removed and check for leaks. If any leakage is detected, shut off the heater, disconnect the power plug, and correct the leak. Recheck heater operation and, when operation is satisfactory, reinstall the cover panel.

4-29. FUEL PUMP. Service the fuel pump filter as follows:

WARNING

The ignition system of this heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before servicing or repairing the heater,

NOTE

You can service the fuel pump filter without removing the fuel pump from the heater case.

a. Disconnect the power plug. Remove the left side cover panel for access to the fuel pump. Shut off the fuel supply and disconnect the fuel supply line at the bulkhead fitting. Disconnect exhaust pipe. Remove the control panel from the heater case. Pull gently on the control panel to prevent damaging the wires.

CAUTION

Have container available to catch fuel when fuel pump cover is removed,

b. Remove the two screws (1, fig. 4-21), nuts (2), and lock washers (3) securing the fuel, pump, fuel pump cable, and wire (4) to the heater case.

c. Pull the fuel pump towards the control panel opening to gain access to the Cover (5). Remove the cover, gasket (6), and filter element (7) from the fuel pump (8).

WARNING

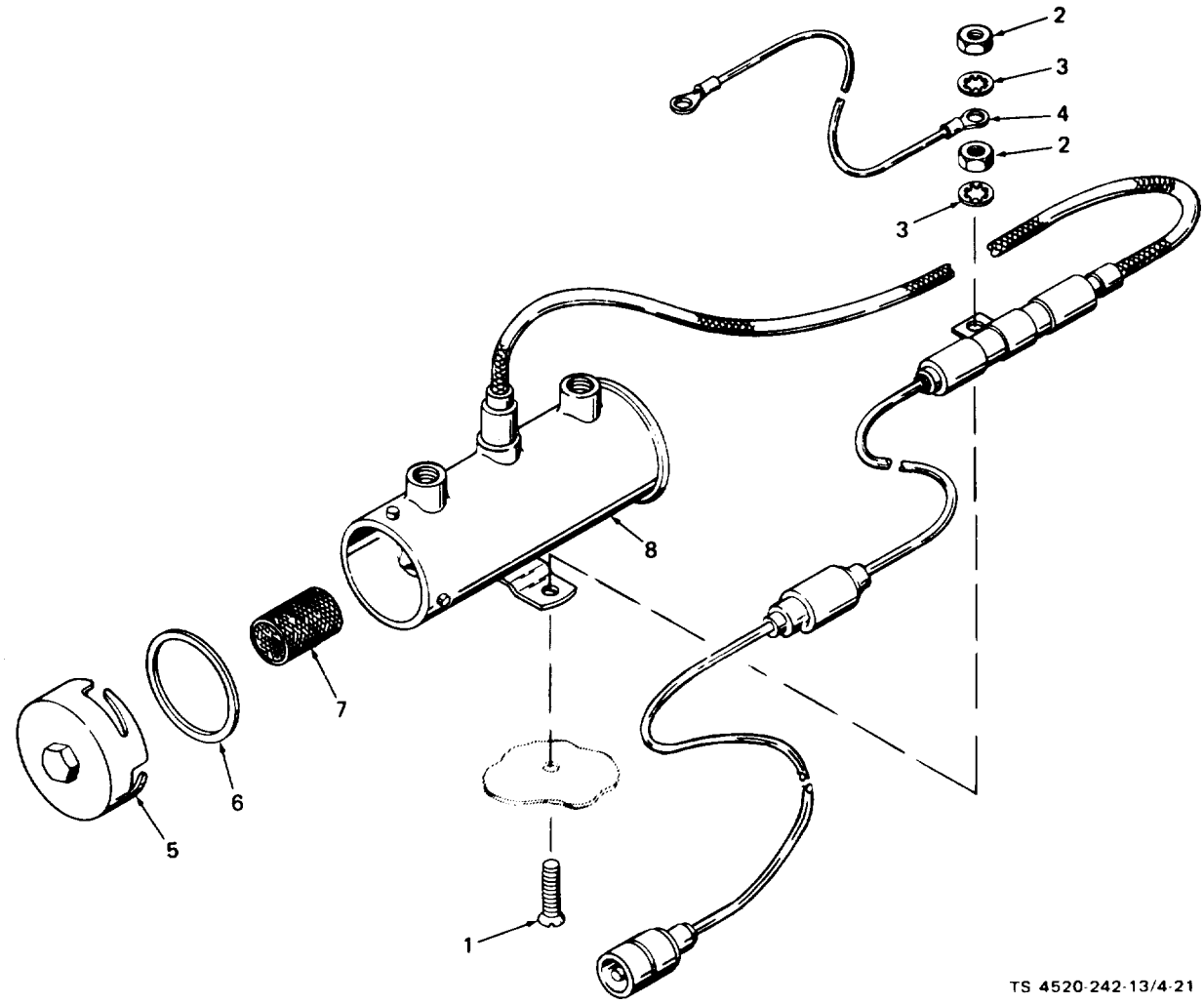
Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thorough y. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F (38°C).

d. Clean the parts with dry cleaning solvent (fed. spec. P-D-680) and allow all parts to dry thoroughly before reassembly. Replace the fuel pump filter element if it cannot be cleaned with cleaning solvent, or if it is cracked or damaged. Check the magnet in the cover to make sure all metal chips are removed.

e. Install the filter element (7, fig. 4-21) into the fuel pump (8). Make sure the filter element is fully seated, and install the cover (5) using a new gasket (6). Secure the cover to the fuel pump.

f. Position fuel pump over mounting holes in heater case. Install screws (l), nuts (2), lock washers (3), wire (4), and fuel pump cable. Install the control panel and connect the fuel supply line to the bulkhead fitting.

g. Open the fuel supply valve, and connect the power plug and exhaust pipe. With the cover panel still removed, start the heater and check for leaks around the fuel pump filter cover. If any leakage is detected, shut off the heater, disconnect the power plug, and correct the leak. Retest heater operation and, when it is satisfactory, reinstall the cover panel.



1. Screw
2. Nut
3. Lock washer
4. Wire
5. Cover
6. Gasket
7. Filter element
8. Fuel pump

Figure 4-21. Fuel pump filter, exploded view.

CHAPTER 5

DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

5-1. TOOLS AND EQUIPMENT. The equipment issues with the heater assembly is illustrated in figure 1-1.

5-2. SPECIAL TOOLS AND EQUIPMENT. No special tools or equipment is required for direct support maintenance of the heater assembly.

5-3. MAINTENANCE REPAIR PARTS. Repair parts and equipment are listed and illustrated in the repair parts and special tools list covering direct support maintenance for this equipment. Refer to TM-5-4520-242-23P.

Section II. TROUBLESHOOTING

5-4. GENERAL.

a. This section contains troubleshooting information for ocating and correcting most of the operating troubles which may develop in the space heater. Each malfunction is followed by a list of tests or inspections which will help you determine probable causes and corrective actions to take. Perform the tests/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor. Only those functions which are solely within the scope of direct support maintenance are listed.

5-5. DIRECT SUPPORT MAINTENANCE TROUBLESHOOTING CHART. Refer to table 5-1 for troubleshooting which is allocated to direct support maintenance levels.

WARNING

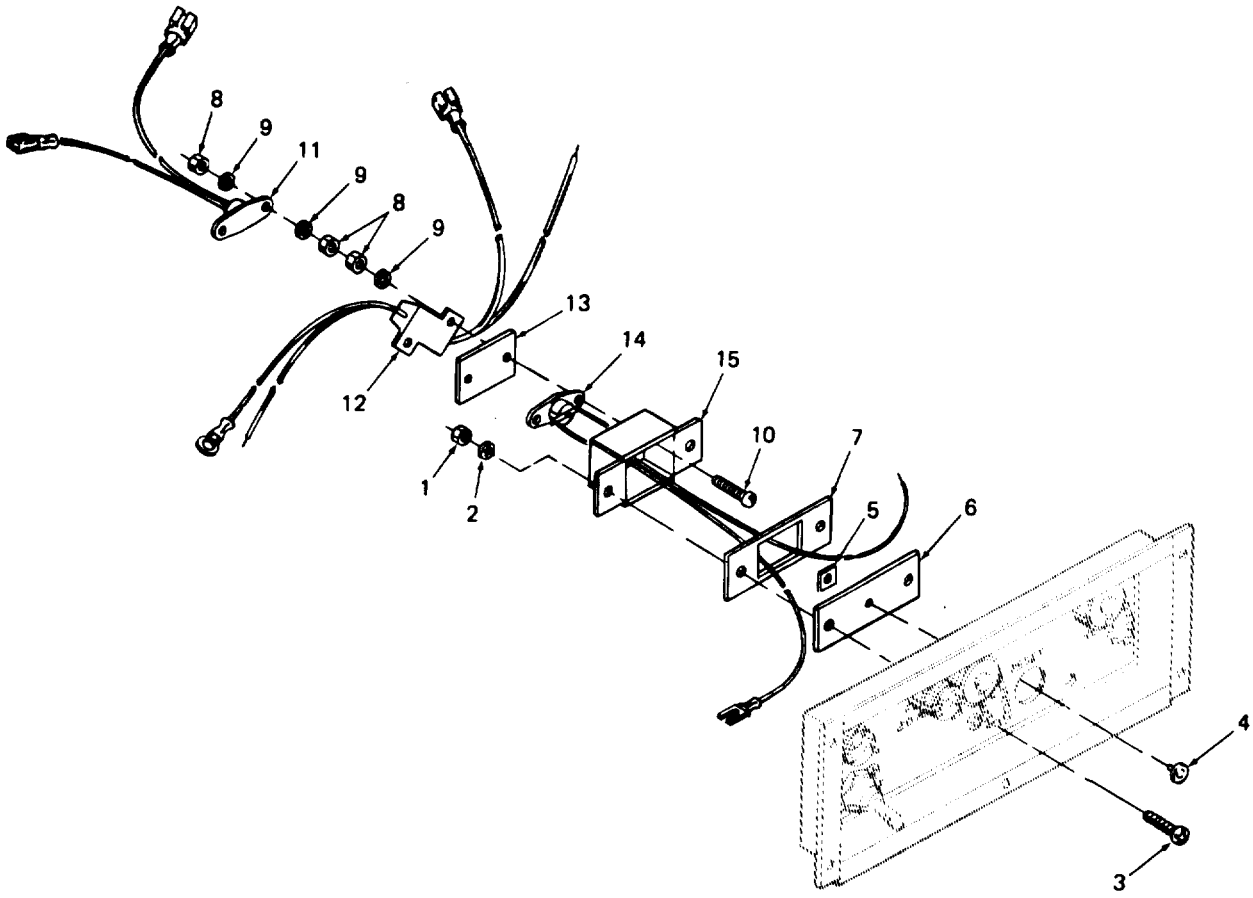
The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be extremely careful when making voltage measurements or other checks with the heater connected to the power source during troubleshooting. Always remove the power plug before making any continuity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

NOTE

Before you use this table, be sure you have performed all applicable operating checks.

Table 5-1. Direct Support Troubleshooting

MALFUNCTION TEST OR INSPECTION Corrective ACTION
1. HEATER FAILS TO START (NO FLAME, NO BLOWER).
Step 1. Remove top and side cover panels, and pull out control panel. With power connected, turn on the heater and check that the timer assembly heats. Replace the timer assembly if it fails to become noticeably warm within 45 to 70 seconds, To remove timer assembly, tag and unsolder all leads. Remove two nuts (1, fig. 5-1), lock washers (2), and screws (3), and separate the timer assembly from the control panel. NOTE If replacement of timer assembly components is necessary, only disassemble to the level of replacement. Remove reset button (4), and retainer (5) from outer seal (6), and remove inner seal (7). Remove two nuts (8) and lock washers (9), and remove delay thermostat (11). Remove four lock washers (9), and four nuts (8), and remove resistor (12) and shim (13). Reset thermostat (14) and screws (10) are potted inside the timer box (15) with Dow-Corning 732 RTV Silastic, Scrape the potting compound from the timer box to gain access to the thermostat and screws. Remove the thermostat by bending the terminal tabs and pulling the thermostat through the hole in the timer box. install the components of the timer assembly in the reverse order of the Index numbers in figure 5-1. Install the reset thermostat (14) into the tinier box (15) by bending the thermostat terminal



TS 4520-242-13/5-1

1. Nut
2. Lock washer
3. Screw
4. Reset button
5. Retainer
6. Outer seal
7. Inner seal
8. Nut
9. Lock washer
10. Screw
11. Delay thermostat
12. Resistor
13. Shim
14. Reset thermostat
15. Timer box

Figure 5-1. Timer components, exploded view.

Table 5-1. Direct Support Troubleshooting -Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1 - Continued
tabs out and placing the thermostat through the hole in the timer box. After positioning the thermostat, bend the terminal tabs back to their normal position, After assembly, fill the inside of the timer box up to the level of the thermostat terminals with Dow-Corning 732 RTV Silastic, or equivalent.
Step 2. With power on, briefly jumper yellow and green leads on main terminal block. If blower begins to run, replace the timer assembly.
Step 3. Disconnect power plug and allow timer assembly to cool. Press RESET button and check continuity between two red leads using an ohmmeter. Replace the timer assembly if the switch is open after reset.
Step 4. Check control relay continuity using an ohmmeter. Test the resistance of the relay coil. The resistance across terminals X1 and X2 (shown in fig. 5-2) must be 300 ±3O ohms. There must be continuity only between terminals B2 and B3, and between A2 and A3, but no continuity across B1 and B2, or across A1 and A2. Replace the control relay if it does not operate as specified. Tag and unsolder the electrical leads to the relay. Remove the two nuts, lock washers, and screws that secure the control relay to the heater case; remove the relay. Install a new control relay by reversing the removal procedure.
Step 5. Check motor resistor for continuity between green/white and grey leads using an ohmmeter. Continuity must be established across these leads. Replace a defective motor resistor. Tag and unsolder the electrical leads to the resistor. Remove the two nuts, lock washers, and screws that secure the resistor to the heater case; remove the resistor. Install a new resistor by reversing the removal procedure.

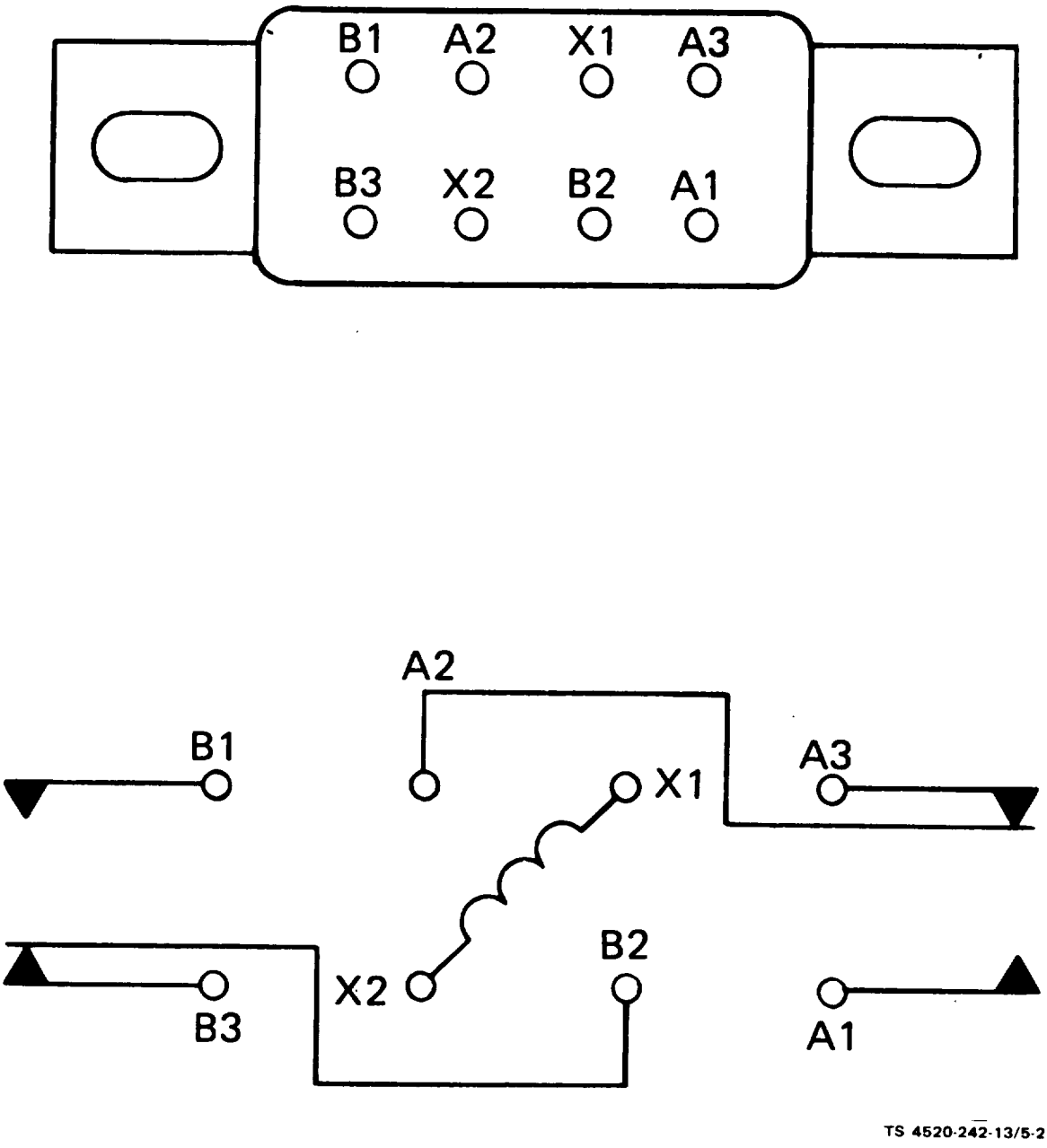


Figure 5-2. Control relay terminal identification.

Table 5-1. Direct Support Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1 - Continued

Step 6. Check Ignition power supply for high voltage output.

WARNING

The output of the ignition power supply is high enough to cause severe electrical shock. When testing, take care to prevent physical contact with bare end of the ignition cable.

CAUTION

When checking spark, do not allow the spark gap to exceed 1/8 inch (3 mm). Greater gap will cause excessively high potential resulting in insulation breakdown either internally or in the ignition cable. Make sure there are no fuel and fumes in the area of grounded surface that could ignite when checking spark.

NOTE

When checking. the ignition power supply, make sure that the input power is applied in the proper polarity. The unit will not operate when polarity is reversed.

Remove the top and left side panels to gain access to the ignition power supply. Connect the ignition power supply to a 28 vdc source of power. Connect the negative to an unpainted ground and connect the positive to the yellow primary lead. Hold the end of the ignition cable near an unpainted portion of the power supply case and check for a hot spark when power is applied to the primary circuit. If a hot spark does not jump across an 1/8-inch (3 mm) gap, the power supply is defective.

Replace a defective power supply.

Table 5-1. Direct Support Troubleshooting -Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1 - Continued

WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

Disconnect the power plug and remove the exhaust pipe connection. Disconnect the fuel line at the bulkhead fitting. Disconnect the ignition cable from the spark plug. Disconnect the yellow primary lead from the tab on the main terminal block, and the white/black lead from the burner head.

Remove the four screws (1, fig. 5-3) that secure the ignition case (61) to the bottom-of the heater housing. Remove-two screws (2) and lock washers (3) that secure the ignition case to the back of the heater case. Remove the ignition power supply from the heater case.

Separate the case top assembly from the case and coil assembly as follows: Remove two nuts (4), lock washers (5), and screws (6), and remove brace (7). Rermove nut (8), lock washer (9), and screw (10), and separate the two white/black wires.

CAUTION

Do not separate case top from ignition case until interior wires are disconnected.

Pull the case top (44) away from the ignition case (61) to expose the interior wire connections. Remove two nuts (11), washers (12), and screws (13), and disconnect white/black wires (19) from power straps (54). Separate the case top (44) from the ignition case (61).

If transistors (21) must be replaced, remove screws (20), and remove the transistor, insulator (22), and socket (23) from case top (44).

Suppression capacitor (28), nut (26), lock washer (27), ferrite beads (29), connector (30), and choke (31) are potted inside case top (44) with Dow-Corning 732 RTV Silastic. Scrape the potting compound from the case top to gain access to the potted components.

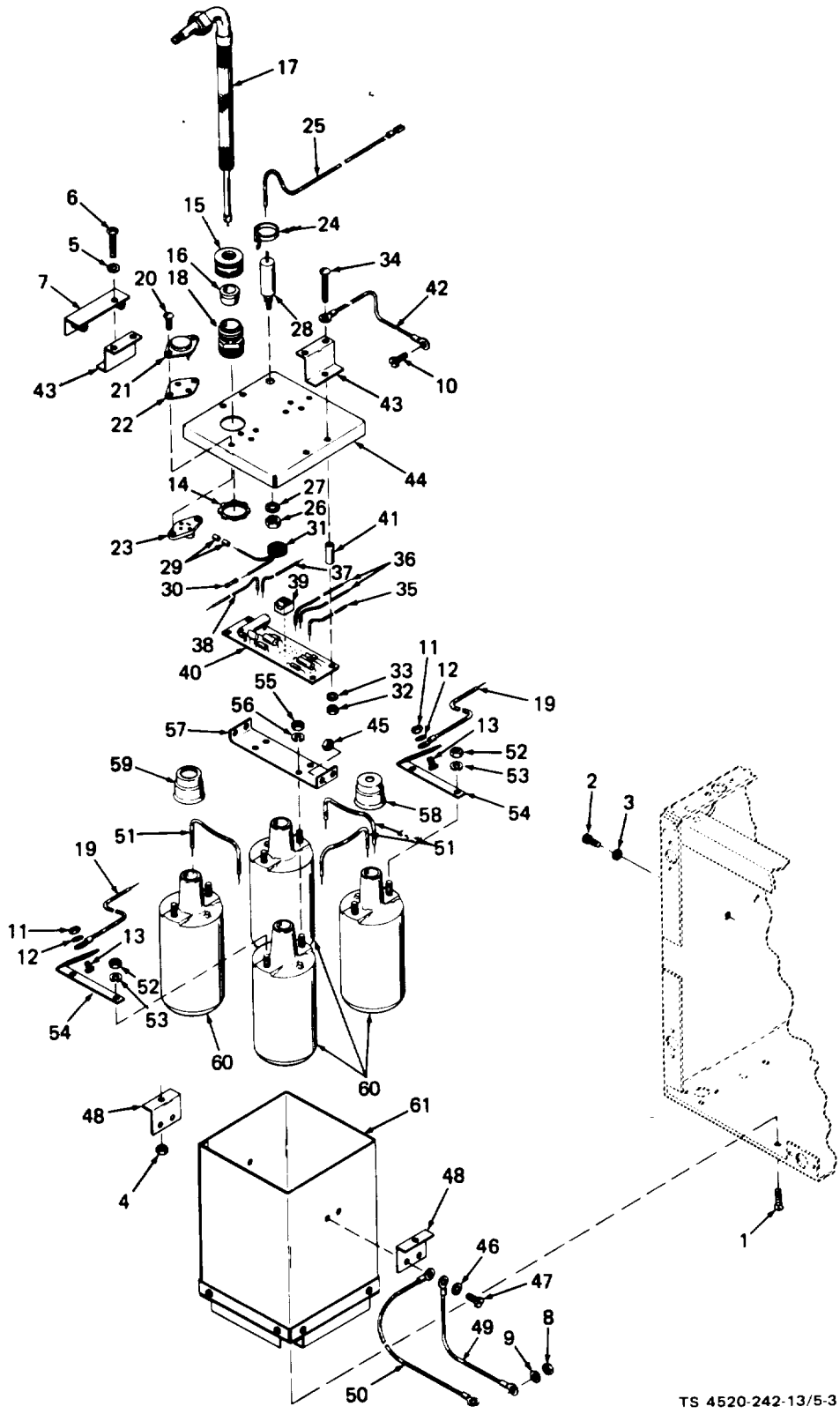


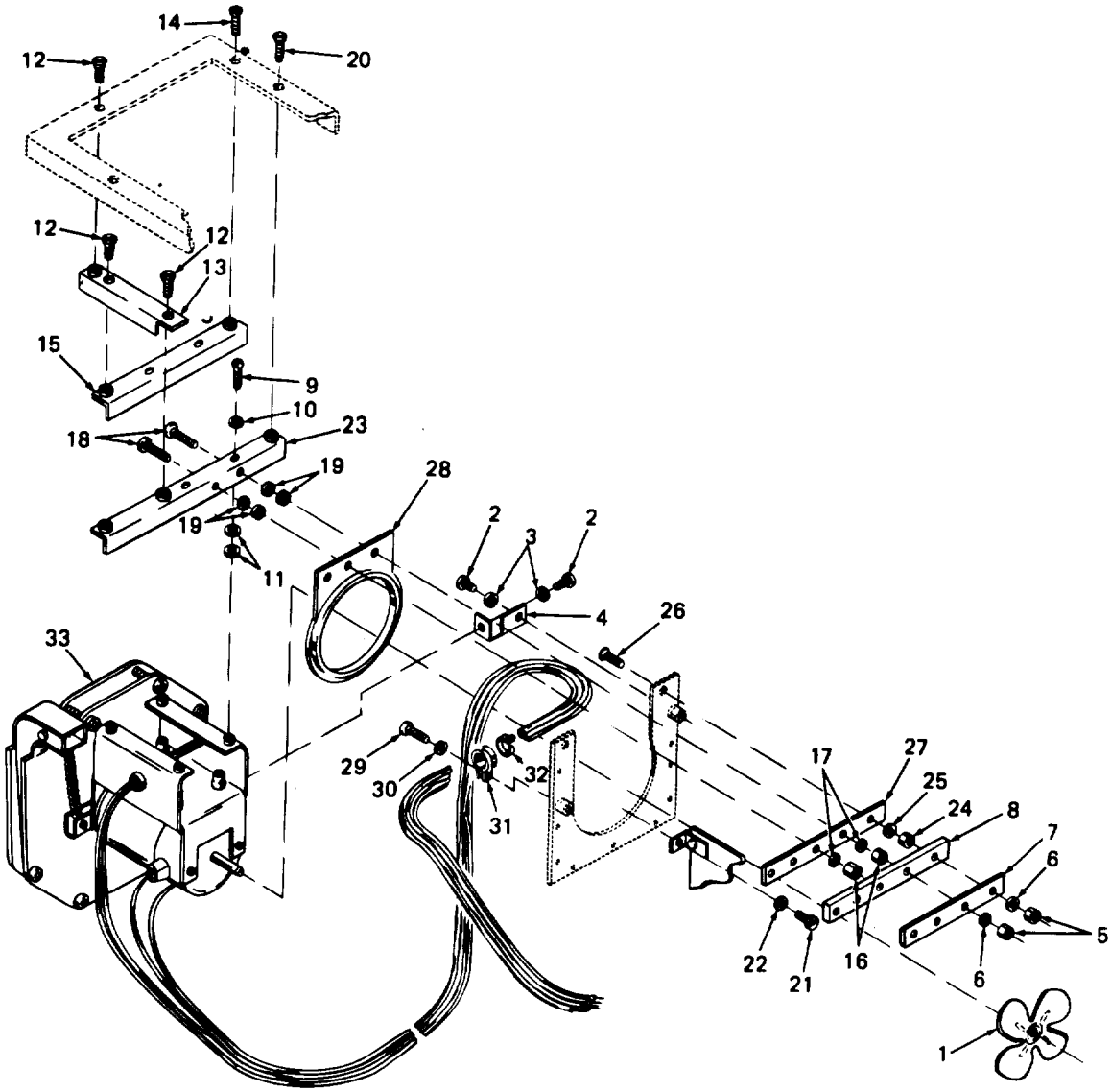
Figure 5-3. Ignition power supply, exploded view.

Legend for figure 5-3:

1. Screw
2. Screw
3. Lock washer
4. Nut
5. Lock washer
6. Screw
7. Ignition brace
8. Nut
9. Lock washer
10. Screw
11. Nut
12. Lock washer
13. Screw
14. Nut
15. Compression nut
16. Compression sleeve
17. Ignition cable
18. Adapter
19. Wire
20. Screw
21. Transistor
22. Insulator
23. Socket
24. Cable tie
25. Wire
26. Nut
27. Lock washer
28. Suppression capacitor
29. Ferrite beads
30. Connector
31. Choke
32. Nut
33. Lock washer
34. Screw
35. Wire
36. Wire
37. Wire
38. Wire
39. Timer
40. PC board
41. Spacer
42. Wire
43. Upper bracket
44. Case top
45. Nut
46. Lock washer
47. Screw
48. Lower bracket
49. Wire
50. Wire
51. Wire
52. Nut
53. Lock washer
54. Power strap
55. Nut
56. Lock washer
57. Ground strap
58. Nipple
59. Ignition wire nipple
60. Ignition coil
61. Ignition case

Table 5-1. Direct Support Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
1 - Continued	Unsolder lead wires from suppression capacitor (28), choke (31), and connector (30). Remove nut (26), and lock washer (27), and remove suppression capacitor (28). If PC board (40) requires removal, tag and unsolder all leads. Remove four nuts (32), and lock washers (33), and remove the PC board. If timer (39) must be replaced, remove the timer from its socket. The timer has an eight-pin connection to the socket. Unsolder socket connections from PC board and remove socket. If the case and coil assembly requires disassembly, remove power straps (54) by removing nuts (52) and lock washers (53). Remove ground strap (57) from Ignition case (61) by removing four nuts (45), lock washers (46), and screws (47). Remove the ground strap from the coils (60) by removing four nuts (55) and lock washers (56). Reassemble ignition power supply in the reverse order of the disassembly procedure, and recheck the high voltage output. Install the ignition power supply in the heater case. Install two screws (2) and lock washers (3) through the back of the heater case and into the ignition power supply. Install four screws (1) through the bottom of the heater case and into the bottom of the ignition power supply. Connect the high voltage ignition cable to the spark plug on the burner head. Connect the yellow lead to the tab on the terminal board to which the other yellow leads are connected. Install the top and left side covers and insert the power plug into the POWER receptacle. Connect fuel line and exhaust. Start the heater and check for proper operation.
2. HEATER IGNITES BUT BLOWER FAILS TO RUN.	
Step 1. Remove the top, both side cover panels, and heat exchanger cover panel. Turn power on, wait for time delay, and check for 28 vdc across motor terminals using a multimeter set to read dc voltage.	Replace control relay If there is no power for motor terminals. Tag and unsolder the electrical leads to the control relay. Remove the two nuts, lock washers, and screws that secure the control relay to the heater case; remove the control relay.
Step 2. Disconnect motor leads and connect to external source of 28 vdc.	If motor fails to run, replace it as follows: Remove the power plug. Shut off fuel supply and remove the combustion air tube from the blower housing. Loosen the setscrew and remove axial fan (1, fig. 5-4). Remove two screws (2), lock washers (3), and remove stabilizer (4).



1. Axial fan
2. Screw
3. Lock washer
4. Stabilizer
5. Nut
6. Lock washer
7. Retainer seal
8. Seal
9. Screw
10. Lock washer
11. Flat washer
12. Screw
13. Support bridge
14. Screw
15. Back support bracket
16. Nut
17. Lock washer
18. Screw
19. Flat washer
20. Screw
21. Screw
22. Lock washer
23. Center support stiffener
24. Nut
25. Lock washer
26. Screw
27. Tie bar
28. Fan shroud
29. Screw
30. Lock washer
31. Cable clamp
32. Cable tie
33. Blower and motor

Figure 5-4. Blower motor support, exploded view.

Table 5-1. Direct Support Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

2 - Continued

Remove five nuts (5), lock washers (6), and remove retainer seal (7) and seal (8). Remove four screws (9), lock washers (10), flat washers (11), three screws (12), and support bridge (13). Remove screw (14) and remove back support bracket (15). Remove two nuts (16), lock washers (17), screws (18), four flat washers (19), screw (20), screw (21), lock washer (22), and center support stiffener (23). Remove three nuts (24), lock washers (25), screws (26), tie bar (27), and fan shroud (28). Remove screw (29), lock washer (30), cable clamp (31), and cable tie (32). Remove blower and motor (33) from heater case.

Remove two screws (1, fig. 5-5) and lock washers (2) from motor (24) . Remove two nuts (3), lock washers (4), and washers (5) from the motor studs. Separate motor and blower housing (25). Remove two nuts (6), lock washers (7), screws (8), and remove tube socket (13).

Replace blower motor (24) and reassemble the motor and motor support in the reverse order of disassembly.

3. HEATER OVERHEATS.

WARNING

The ignition system of this heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

Step 1. Disconnect the power plug and remove top cover panel. Check that the axial fan is tight on the motor shaft , and not damaged or restricted.

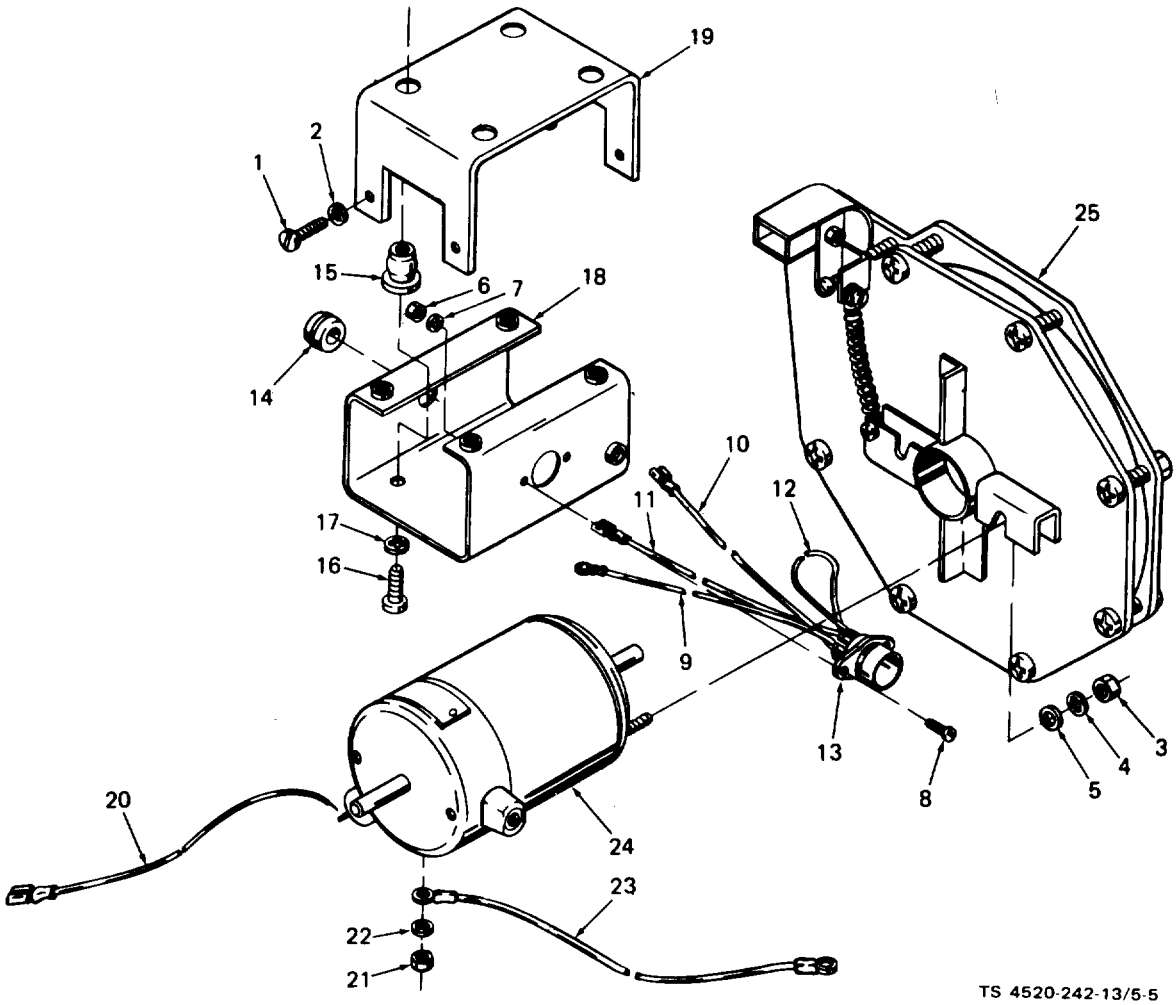
Check for restricted fan. Tighten the fan by turning the setscrew on the hub of the fan.

Step 2. Connect power plug, start heater , and observe motor operation with cover panels removed,

Repair motor if motor runs slowly or vibrates due to defective bearings, or if the motor protector thermostat S9 trips out.

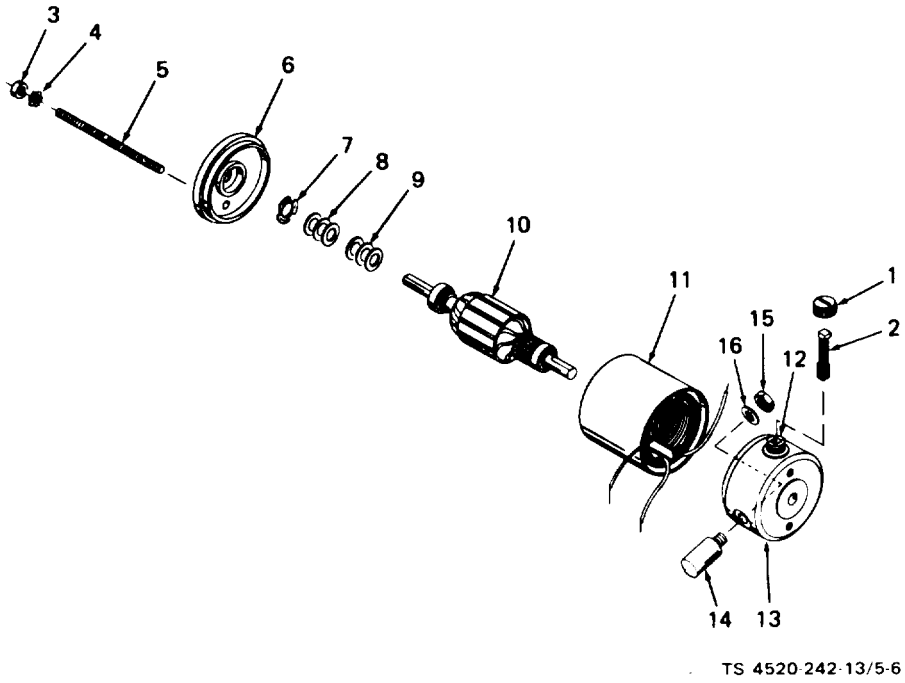
if the suppression capacitor (14, fig. 5-6) or motor is faulty, disassemble the motor and replace defective parts as follows:

Remove brush caps (1) and brushes (2). Remove nuts (3) and lock washers (4) that secure end bell (6) to the motor assembly; remove the end bell. Remove spring washer (7) and washers (8 and 9); retain washers for reassembly. Pull armature (10) from stator (11).



1. Screw
2. Lock washer
3. Nut
4. Lock washer
5. Flat washer
6. Nut
7. Lock washer
8. Screw
9. Wire
10. Wire
11. Wire
12. Wire
13. Tube socket
14. Grommet
15. Well nut
16. Screw
17. Lock washer
18. Upper support
19. Lower support
20. Wire
21. Nut
22. Lock washer
23. Wire
24. Motor
25. Blower housing

Figure 5-5. Blower and motor, exploded view.



1. Brush cap
2. Brush and spring
3. Nut
4. Lock washer
5. Stud
6. End bell
7. Spring washer
8. Washer
9. Washer
10. Armature
11. Stator
12. Brush tube
13. Commutator end bell
14. Suppression capacitor
15. Nut
16. Lock washer

Figure 5-6. Blower motor, exploded view.

Table 5-1. Direct Support Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION	
3 - Continued	
	Separate the stator from commutator end bell (13) to provide access to the capacitor mounting hardware. Unsolder the electrical lead from the capacitor terminal inside the motor. Remove nut (15) and lock washer (16), and remove capacitor (14) from the end bell. Replace defective parts and reassemble the motor by reversing the disassembly procedure. Test motor for proper operation.

Section III. GENERAL MAINTENANCE

5-6. ELECTRICAL COMPONENTS.

WARNING

This space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

a. Disconnect the power plug. Remove the side and top cover panels.

b. Clean all electrical components by wiping with a clean, dry cloth.

c. Inspect all wires for cracks or broken Insulation.

d. Inspect all receptacles and cables for bent or damaged pins and for defective or corroded sockets.

e. Inspect all wires and electrical components for continuity.

f. Inspect all terminals for damage or corrosion and replace any defective terminals.

g. Check all grounding leads and grounding straps.

5-7. MECHANICAL COMPONENTS

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 (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 100°F (38°C).

a. Clean all mechanical components with a cloth dampened with dry cleaning solvent (fed. spec. P-D-680). Wipe thoroughly and allow to dry.

b. Inspect all painted surfaces and touch up where necessary.

5-8. HARDWARE.

a. Clean all hardware by immersing in dry cleaning solvent (fed. spec. P-D-680). Wipe thoroughly and allow to dry.

b. Inspect all threaded parts for broken or damaged threads and replace as needed.

c. Inspect bright metal hardware for integrity of plating, and replace any corroded parts.

d. The data plates are riveted to the heater case, The rivets must be drilled out and replaced to Install new data plates.

5-9. WIRING.

WARNING

This space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

a. Removal.

(1) Remove the hardware which mounts the power and thermostat receptacles to the control panel.

(2) Remove all wires from their connection points at the terminal boards, flame switch, and other components. Tag the wires to aid in replacement.

b. Installation. Install in reverse order of removal. Consult wiring diagram.

Section IV. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS AND ASSEMBLIES

5-10. CONTROL PANEL.

a. Removal.

(1) Detach the control panel from the heater case by removing five screws and removing the control panel to the extent of the attached wires.

(2) The individual components of the control panel can be readily removed at this point.

b. Installation. Install in reverse order of removal.

5-11. HEATER CASE ASSEMBLY. The top and left side cover panels can be removed from the heater case by unlocking the stud turnlock fasteners which secure them to the case.

CHAPTER 6

REPAIR OF CONTROL PANEL

6-1. DESCRIPTION. The following control panel components help control heater operation:

a. Time Delay Assembly. The time delay assembly consists of the timer heater TH2 (fig. 6-1), RESET thermostat S1, and the time delay thermostat S2.

(1) The timer heater is energized when the ON-OFF switch S3 is turned on, and it heats both the time delay thermostat and the RESET thermostat.

(2) The time delay thermostat S2 is normally open, until heat from the timer heater TH2 closes it. The time required for the timer heater to trip the time delay thermostat is longer than the time required by the glow plug to preheat the burner head to ensure rapid fuel ignition.

(3) When the time delay thermostat finally closes from the heat of the timer heater TH2, it energizes the fuel pump FP1, air compressor M2, fuel flow to the burner head, and the blower motor.

(4) If ignition proceeds normally, the contacts of the safety thermostat S4 close, energizing relay R1. This disconnects the timer heater, allowing it to cool down, and bypasses the time delay switch.

(5) The RESET switch S1 is normally closed. If the burner does not ignite, the timer heater will continue to heat the RESET switch to its opening point, When the RESET switch opens, it shuts off all power to the heater. The RESET switch requires manual reset.

b. Receptacles. The THERMO and POWER receptacles are mounted on the control panel to provide connections to the room thermostat and to the 28 vdc power source to operate the heater.

6-2. REMOVAL AND DISASSEMBLY.

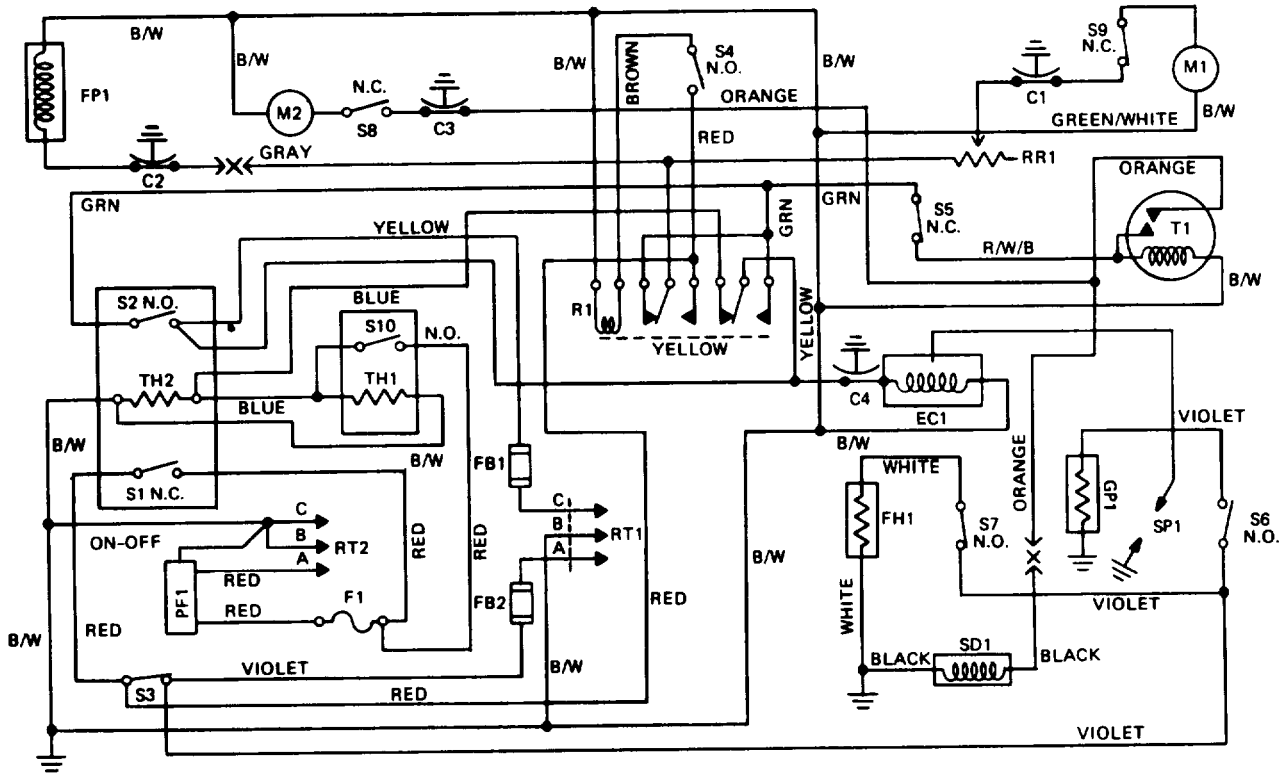
WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconect the power plug before repairing the heater.

a. Disconnect the power and thermostat plugs and remove the left side cover panel for access to the main terminal block strip.

b. Remove the five screws (1, fig. 6-3) and lock washers (2) securing the control panel to the heater case. Gently pull out the control panel as far as wires will permit.

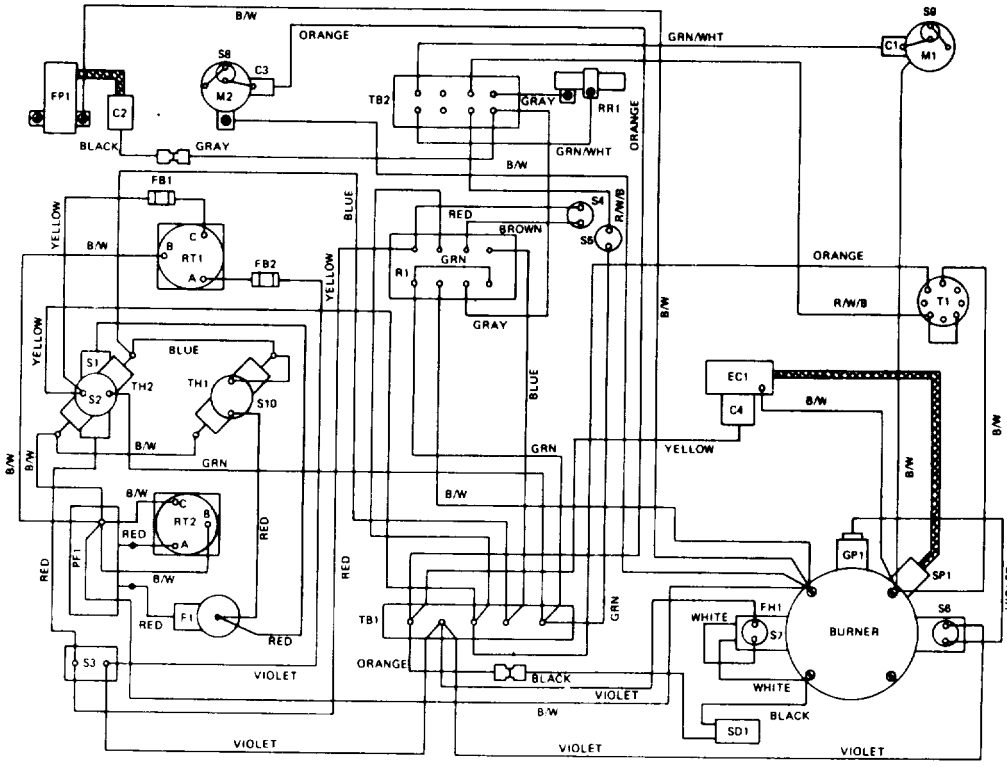
c. If ON-OFF switch (4) is defective, tag and unsolder the two red and two violet leads from the switch. Refer to the wiring diagram (fig, 6-2). Unscrew boot (3, fig. 6-3) and remove the ON-OFF switch from the back of the control panel.



KEY TO DIAGRAM			
C1	Capacitor-Vent. & Comb. Motor	S4	Sw. Safety Thermostat
C2	Capacitor-Fuel Pump	S5	Sw. Overheat Thermostat
C3	Capacitor-Compressor	S6	Sw. Glow Plug Thermostat
C4	Capacitor-Ignition Coil	S7	Sw. Fuel Heater Thermostat
F1	Fuse	S8 & S9	Sw. Overheat Protector
FH1	Fuel Heater	S10	Sw. Maintenance Thermostat
FP1	Fuel Pump	SD1	Solenoid
EC1	Ignition Coil	SP1	Spark Plug
GP1	Glow Plug	T1	Timer
M1	Vent. & Comb. Motor	TB1 & TB2	Terminal Block
M2	Compressor	TH1 & TH2	Timer Heater
R1	Relay-DPDT	R/W/B	Red, White, Blue
RR1	Resistor	B/W	Black, White
RT1	Receptacle-Thermostat	GRN	Green
RT2	Receptacle-Power 28 V.D.C.	YEL	Yellow
S1	Sw. Reset Thermostat	WHT	White
S2	Sw. Delay Thermostat	FB1 & FB2	Ferrite Beads
S3	Sw. On-Off	PF1	Power Filter

TS 4520-242-13/6-1

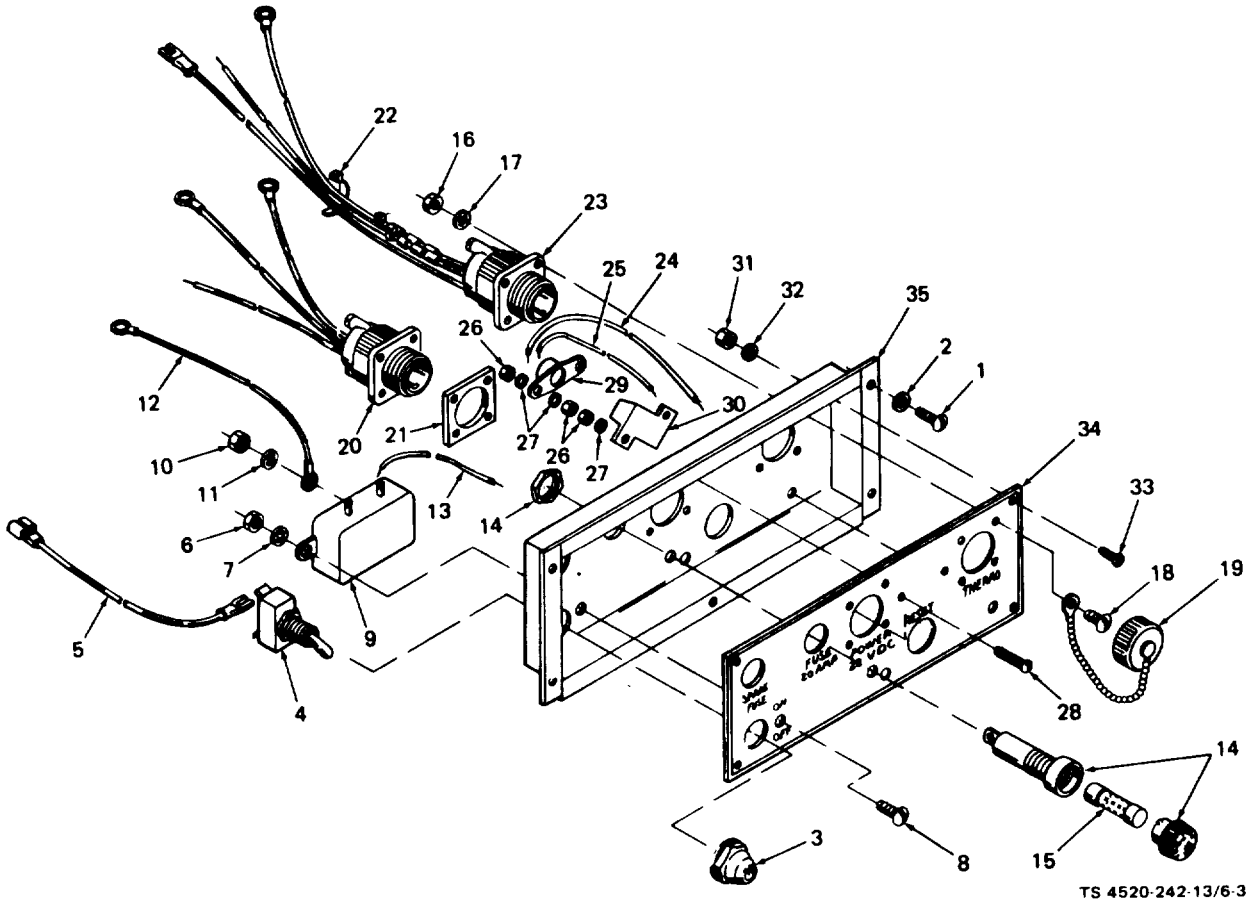
Figure 6-1. Electrical schematic diagram.



KEY TO DIAGRAM			
C1	Capacitor-Vent. & Comb. Motor	S4	Sw. Safety Thermostat
C2	Capacitor-Fuel Pump	S5	Sw. Overheat Thermostat
C3	Capacitor-Compressor	S6	Sw. Glow Plug Thermostat
C4	Capacitor-Ignition Coil	S7	Sw. Fuel Heater Thermostat
F1	Fuse	S8 & S9	Sw. Overheat Protector
FH1	Fuel Heater	S10	Sw. Maintenance Thermostat
FP1	Fuel Pump	SD1	Solenoid
EC1	Ignition Coil	SP1	Spark Plug
GP1	Glow Plug	T1	Timer
M1	Vent. & Comb. Motor	TB1 & TB2	Terminal Block
M2	Compressor	TH1 & TH2	Timer Heater
R1	Relay-DPDT	R/W/B	Red, White, Blue
RR1	Resistor	B/W	Black, White
RT1	Receptacle-Thermostat	GRN	Green
RT2	Receptacle-Power 28 V.D.C.	YEL	Yellow
S1	Sw.Reset Thermostat	WHT	White
S2	Sw. Delay Thermostat	FB1 & FB2	Ferrite Beads
S3	Sw. On-Off	PF1	Power Filter

TS 4520-242-13/6-2

Figure 6-2. Electrical wiring diagram.



1.	Screw	13.	Wire	25.	Wire
2.	Lock washer	14.	Fuse holder	26.	Nut
3.	Boot	15.	Fuse	27.	Washer
4.	Switch	16.	Nut	28.	Screw
5.	Wire	17.	Lock washer	29.	Maintenance thermostat
6.	Nut	18.	Screw		
7.	Lock washer	19.	Cap	30.	Resistor
8.	Screw	20.	Receptacle	31.	Nut
9.	Filter	21.	Insulator	32.	Washer
10.	Nut	22.	Cable tie	33.	Screw
11.	Lock washer	23,	Receptacle	34.	Panel plate
12.	Wire	24.	Wire	35.	Control panel

Figure 6-3. Control panel components, exploded view.

d. If filter (9, fig. 6-3) must be replaced, tag and unsolder two red leads from the filter. Remove the five black and white wires by removing nut (10), and lock washer (11). Remove nut (6), lock washer (7), and screw (8) securing the filter to the control panel, and remove the filter.

e. Push in the cap on fuse holder (14) and rotate the cap counterclockwise to remove it from the fuse holder. Remove fuse (15) from the fuse holder. Tag and unsolder the three red wires from the fuse holder. Remove the fuse holder nut and pull the fuse holder from the front of the control panel. Remove the spare fuse holder the same way, except the spare fuse holder has no connected wires.

f. To remove receptacles (20 and 23), remove nuts (16), lock washers (17), and screws (18), and remove the receptacles and insulators (21) from control panel (35). Unscrew the retainer from the rear of the receptacle and pull out the plug to provide access to the lead-to-pin connections. Unsolder the pins from the leads and remove the receptacles.

g. If maintenance thermostat (29) or resistor (30) must be replaced, tag and unsolder all leads. Remove two nuts (26), and lock washers (27), and remove thermostat (29). Remove four lock washers (27), four nuts (26), and two screws (28), and remove resistor (30) from control panel.

h. To remove timer assembly, tag and unsolder all leads. Remove two nuts (1, fig. 6-4), lock washers (2), and screws (3), and separate the timer assembly from the control panel.

NOTE

If replacement of timer assembly components is necessary, only disassemble to the level of replacement.

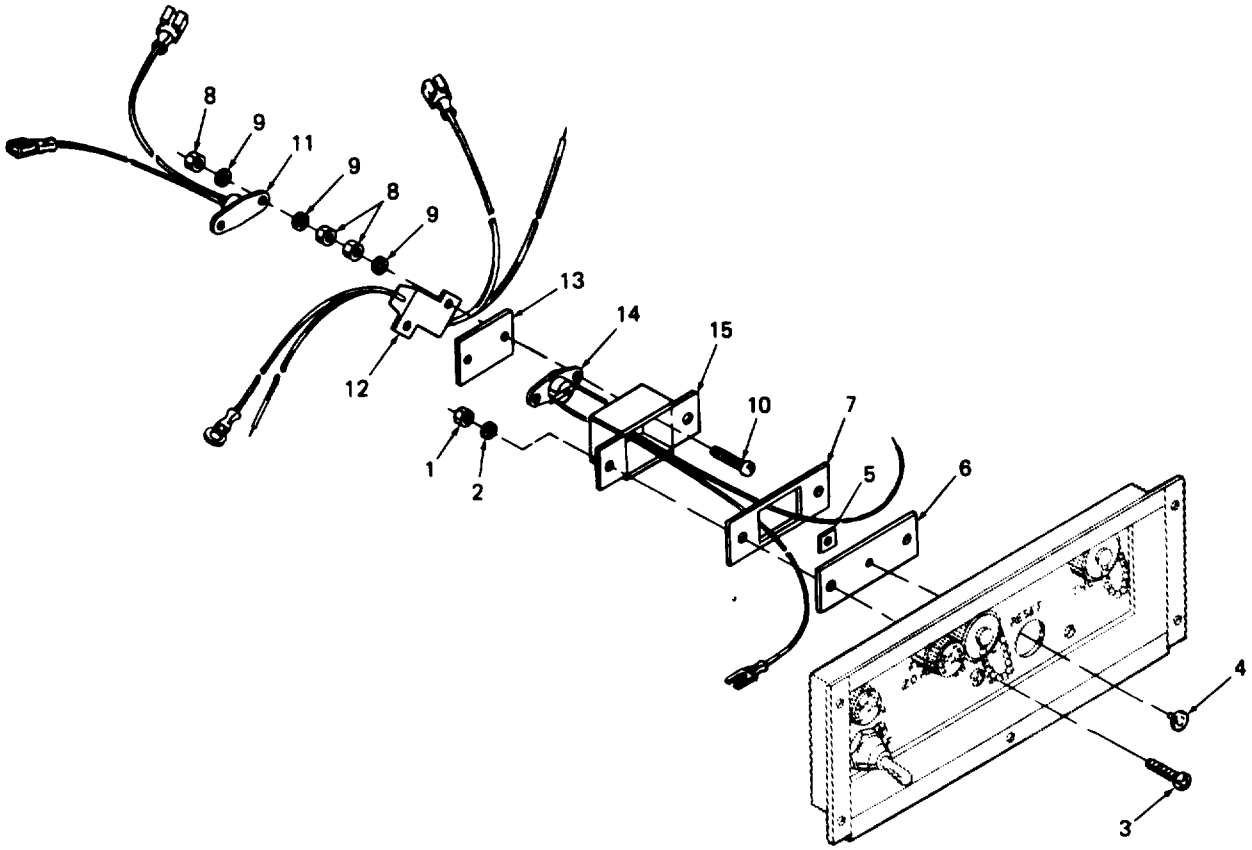
(1) Remove reset button (4) and retainer (5) from outer seal (6), and remove inner seal (7).

(2) Remove two nuts (8) and lock washers (9), and remove delay thermostat (11).

(3) Remove four lock washers (9) and four nuts (8), and remove resistor (12) and shim (13).

(4) Reset thermostat (14) and screws (10) are potted inside the timer box (15) with Dow-Corning 732 RTV Silastic. Scrape the potting compound from the timer box to gain access to the thermostat and screws. Remove the thermostat by bending the terminal tabs and pulling the thermostat through the hole in the timer box.

i. When control panel components have been removed, you can separate the panel plate (34, fig. 6-3) from the control panel (35) for cleaning and replacement.



TS 4520-242-13/6-4

1. Nut
2. Lock washer
3. Screw
4. Reset button
5. Retainer
6. Outer seal
7. Inner seal
8. Nut
9. Lock washer
10. Screw
11. Delay thermostat
12. Resistor
13. Shim
14. Reset thermostat
15. Timer box

Figure 6-4. Timer components, exploded view.

6-3. CLEANING AND INSPECTION.

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 (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heatc Flash point of solvent is 100°F (38°C).

a. Clean parts with a dry soft-bristle brush. Remove greasy or gummy deposits with a cloth dampened lightly in dry cleaning solvent (fed. spec. P-D-680).

b. Inspect leads and components for worn or broken Insulation, signs of overheating, and other defects. Replace defective parts,

c. Visually inspect the resistors, thermostats, and timer assembly. Replace components if any damage is evident> Use an ohmmeter to test the removed timer assembly. Press the reset button; there must be continuity between the two red leads of the reset thermostat. Check continuity between the blue lead and the white/black lead of the resistor (timer heater TH2); there must be continuity. The delay thermostat closes on rise to 65° ±5°F (18.3° ±2.8°c) and opens at 38° ±5°F (3.33° ±2.8°C). When checking continuity of the delay thermostat green and yellow leads, be certain the thermostat is at its closing temperature.

CAUTION

Do not immerse the thermostats in any liquid to make temperature rise or fall.

NOTE

If the timer assembly has not been removed from the control panel, the yellow, blue, and green leads must be disconnected from the main terminal block before the continuity test is performed. Also, disconnect the jumper wires from the resistor (timer heater TH2) to resistor (timer heater TH1).
The maintenance thermostat closes at 40° ±5°F (4.44° ±2.8°C) and opens at 55° ±5°F (12.8° ±2.8°C). When checking continuity between the red and blue leads be certain the thermostat is at its closing temperature.

NOTE

if the thermostat has not been removed from the control panel, remove the fuse from the fuse holder and disconnect the blue lead from the thermostat terminal.

d. Replace boot (3, fig. 6-2) if it will not form a tight seal around the ON-OFF switch (4).

6-4. REASSEMBLY AND INSTALLATION.

a. Install the components on the control panel in the reverse order of the index numbers in figure 6-3.

b. When installing the THERMO and POWER receptacles (20 and 23) on the control panel, slide the plug and retainer over the ends of the leads before soldering the leads to the pins in the other segment of the receptacle. Make sure the wire color will be correct when the key in the plug is inserted in the keyway on the receptacle housing. Slide the plug into the housing to cover the soldered connections and secure by installing the retainer.

c. Use the wiring diagram (fig. 6-2) as a guide when installing the leads On the components.

d. Install the components of the timer assembly in the reverse order of the index numbers in figure 6-4. Install the reset thermostat (14) into the timer box (15) by bending out the thermostat terminal tabs and placing the thermostat through the hole in the timer box. After positioning the thermostat, bend the terminal tabs back to their normal position. After assembly, pot the Inside of the timer box up to the level of the thermostat terminals with Dow-Corning 732 RTV Silastic, or equivalent. Install the control panel in the front of the heater case and secure with five screws (1, fig. 6-3) and lock washers (2). Reinstall the side cover panels, connect the power and thermostat plugs, and test heater for proper operation.

CHAPTER 7

REPAIR OF IGNITION POWER SUPPLY

7-1. DESCRIPTION.

a. The ignition power supply is mounted in the bottom of the heater housing. It converts 28 vdc input to the high voltage output necessary to provide a hot spark at the spark plug in the burner head. This spark is necessary to ignite fuel vapors to start combustion. A shielded high voltage cable connects the secondary of the power supply to the spark plug.

b. The ignition power supply employs a solid state oscillating circuit which rapidly makes and breaks the primary circuits to the four parallel coils. This induces high voltage in the secondary Which induces the spark plug to make a spark causing fuel ignition. All components of the power supply are mounted in the ignition case except the suppression capacitor. The capacitor is mounted on the ignition top cover,

7-2. REMOVAL..

WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

a. Disconnect the power plug and remove the top and left side panels to provide access to the ignition power supply. Remove the exhaust pipe.

b. Disconnect the fuel line at the bulkhead fitting.

c. Disconnect the ignition cable from the spark plug.

d. Disconnect the yellow primary lead from the tab on the main terminal block and the white/black lead from the burner head.

e. Remove the four screws (1, fig. 7-1) that secure the Ignition case (6) to the bottom of the heater housing. Remove two screws (2) and lock washers (3) that secure the ignition case to the back of the heater case. Remove the ignition power supply from the heater case.

f. Separate the case top assembly from the case and coil assembly.

(1) Remove two nuts (4), lock washers (5), and screws (6), and remove brace (7) .

(2) Remove nut (8), lock washer (9), and screw (10), and separate the two white/black wires.

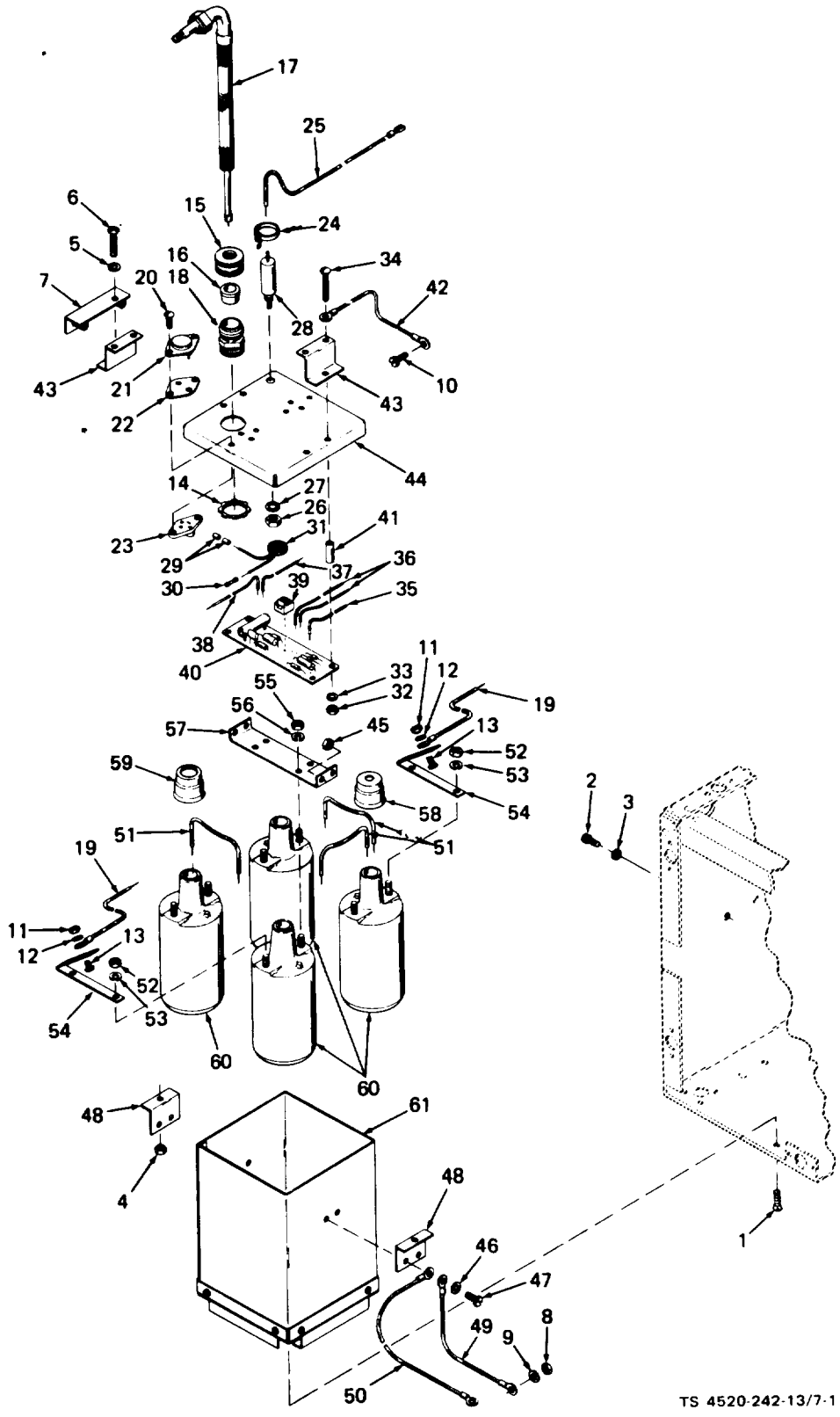


Figure 7-1. Ignition power supply, exploded view.

Legend for 7-1:

1. Screw
2. Screw
3. Lock washer
4. Nut
5. Lock washer
6. Screw
7. Ignition brace
8. Nut
9. Lock washer
10. Screw
11. Nut
12. Lock washer
13. Screw
14. Nut
15. Compression nut
16. Compression sleeve
17. Ignition cable
18. Adapter
19. Wire
20. Screw
21. Transistor
22. Insulator
23. Socket
24. Cable tie
25. Wire
26. Nut
27. Lock washer
28. Suppression capacitor
29. Ferrite beads
30. Connector
31. Choke
32. Nut
33. Lock washer
34. Screw
35. Wire
36. Wire
37. Wire
38. Wire
39. Timer
40. PC board
41. Spacer
42. Wire
43. Upper bracket
44. Case top
45. Nut
46. Lock washer
47. Screw
48. Lower bracket
49. Wire
50. Wire
51. Wire
52. Nut
53. Lock washer
54. Power strap
55. Nut
56. Lock washer
57. Ground strap
58. Nipple
59. Ignition wire nipple
60. Ignition coil
61. Ignition case

CAUTION

Do not separate case top from ignition case until interior wires are disconnected.

(3) Pull the case top (44) away from the ignition case (61) to expose the interior wire connections.

(4) Remove two nuts (11), washers (12), and screws (13), and disconnect white/ black wires (19) from power straps (54). Separate the case top (44) from the Ignition case (61).

NOTE

Do not replace the following parts unless they are found to be defective following the cleaning and inspection procedures described in paragraph 7-3.

g. If the transistors (21), must be replaced, remove screws (20), and remove the transistor. Insulator (22), and socket (23) from the case top (44).

h. Suppression capacitor (28), nut (26), lock washer (27), ferrite beads (29), connector (30), and choke (31) are potted inside the case top (44) with Dow-Corning 732 RTV Silastic. Scrape the potting compound from the top case to gain access to the potted components. Unsolder lead wires from suppression capacitor (28), choke (31), and connector (30). Remove nut (26), and lock washer (27), and remove suppression capacitor (28).

i. If the PC board (40) requires removal, tag and unsolder all leads. Remove four nuts (32), and lock washers (33), and remove the PC board.

j. If the timer (39) must be replaced, remove the timer from its socket. The timer has an eight-pin connection to the socket. Unsolder socket connections from PC board and remove socket.

k. If the case and coil assembly requires disassembly, remove the power straps (54) by removing nuts (52) and lock washers (53). Remove the ground strap (57) from the ignition case (61) by removing four nuts (45), lock washers (46), and screws (47). Remove the ground strap from the coils (60) by removing four nuts (55) and lock washers (56).

7-3. CLEANING AND INSPECTION.

WARNING

Clean all 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 100°F (38°C).

a. Wipe the exterior of the ignition power supply with a cloth dampened with dry cleaning solvent (fed. spec. P-D-680). Take care to prevent solvent from entering the interior of the unit.

WARNING

The output of the ignition power supply is high enough to cause severe electrical shock. When testing, take care to prevent physical contact with bare end of the ignition cable.

CAUTION

When checking spark, do not allow the spark gap to exceed 1/8 inch (3 mm). Greater gap will cause excessively high potential resulting in insulation breakdown either internally or in the ignition cable.

NOTE

When checking the ignition power supply, make sure that the input power is applied in the proper polarity. The unit will not operate when polarity is reversed.

b. To check the operation of the ignition power supply, connect it to a 28 vdc source of power. Connect the negative to an unpainted ground and connect the positive to the yellow primary lead. Hold the end of the ignition cable near an unpainted portion of the power supply case and check for a hot spark when power is applied to the primary circuit. If a hot spark does not jump across an 1/8-inch (3 mm) gap, the power supply is defective.

c. If the power supply fails to operate properly, disconnect it from the power source, remove two nuts (4, fig. 7-1), lock washers (5), and screws (6), and remove brace (7). Lift off the case top (44) as far as the interconnecting wires will permit. This will provide access to the interior components (fig. 7-2). Check interior components as follows:

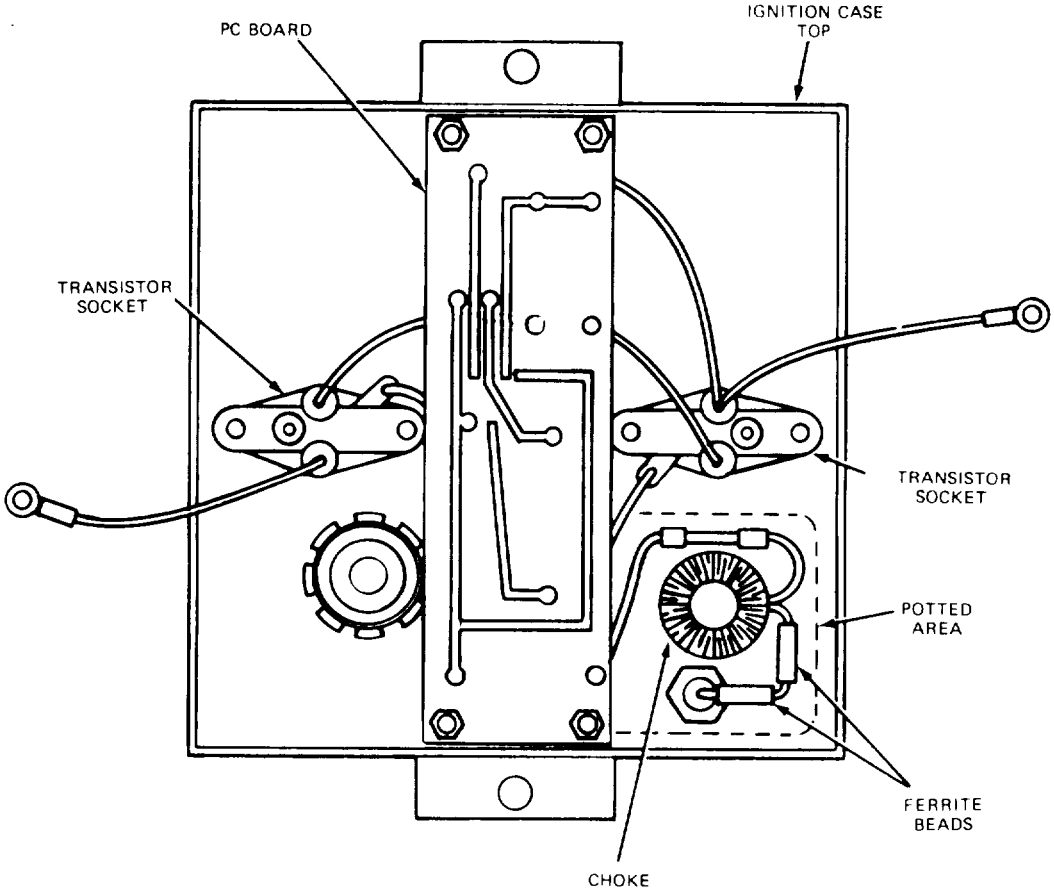


Figure 7-2. Ignition case top, interior view.

(1) Replace timer (39, fig. 7-1). Recheck per step b above.

(2) Replace transistors (21). Recheck per step b above.

(3) Check for continuity from yellow power lead to connection to PC board. If no continuity, replace PC board (40) and recheck per step b above.

(4) Replace coils (60). Recheck per step b above.

(5) Replace ignition power supply. Recheck per step b above,

(6) Secure the case top (44, fig. 7-1) to the ignition power supply with two nuts (4), lock washers (5), screws (6), and brace (7).

7-4. INSTALLATION.

a. Position the ignition power supply in the heater case. Install two screws (2) and lock washers (3) through the back of the heater case and into the ignition power supply. Install four screws (1) through the bottom of the heater case and into the bottom of the ignition power supply.

b. Connect the high voltage ignition cable to the spark plug on the burner head.

c. Connect the yellow lead to the tab on the terminal board to which the other yellow leads are connected.

d. Install the top and left side covers and insert the power plug into the POWER receptacle. Connect fuel line and exhaust. Start the heater and check for proper operation.

CHAPTER 8

REPAIR OF ELECTRICAL CONTROL COMPONENTS

8-1. DESCRIPTION.

a. The electrical components which control automatic heater operation, and which are not mounted on the control panel, include the control relay R1, flame safety thermostat S4, timer T1 (delay relay) and overheat thermostat S5. Two terminal blocks TB1 and TB2 are provided to facilitate making electrical connections. Other remote mounted components are, motor resistor RR1, fuel heater FH1, fuel heater thermostat S7, and glow plug thermostat S6.

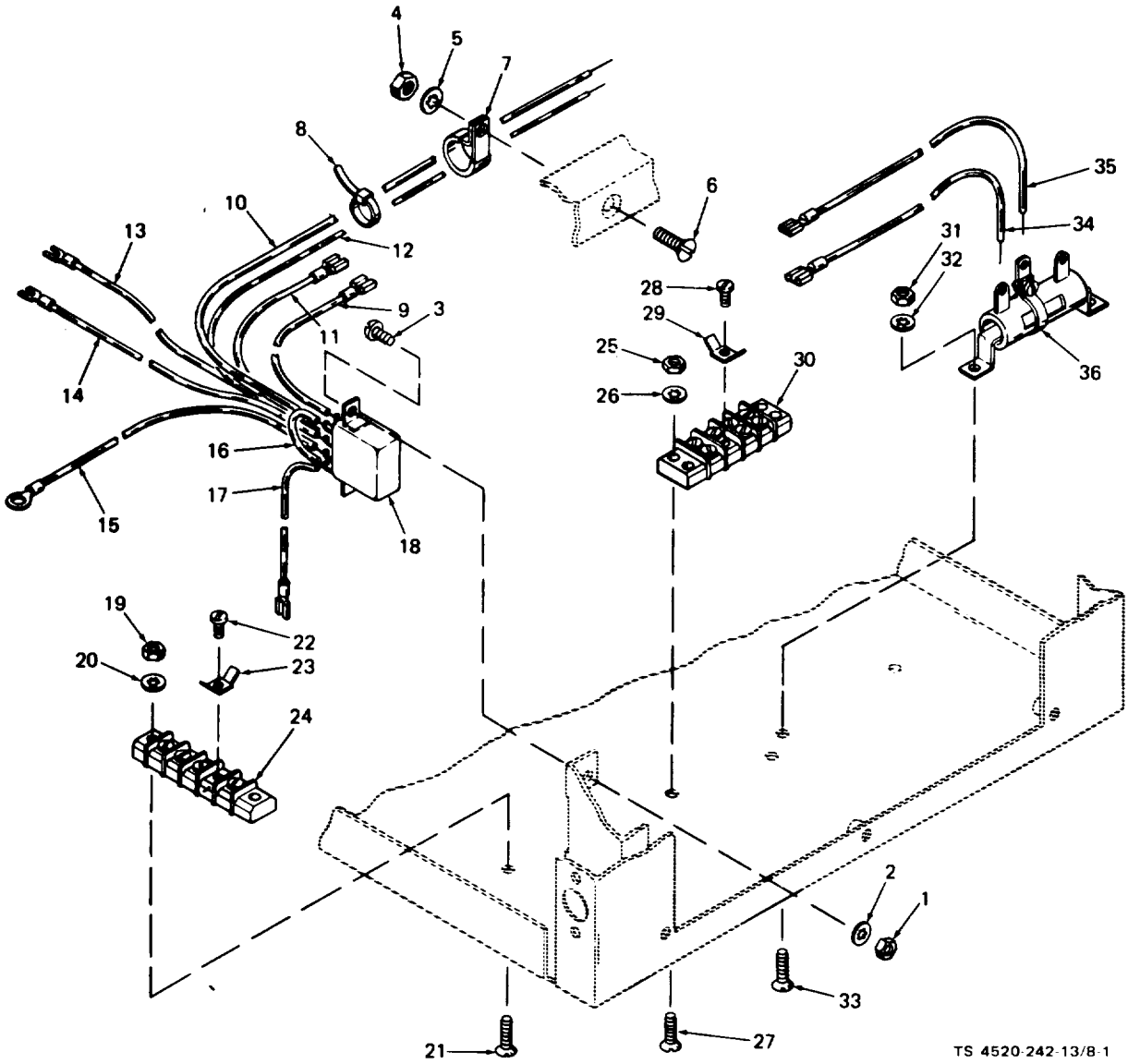
b. The control relay (18, fig. 8-1) is mounted on the heater case next to the control panel. This double-pole, double-throw relay is energized through the flame safety thermostat S4 to switch heater operation from the start mode to the run mode when the presence of heat is detected by the thermostat S4.

c. The flame safety thermostat (15, fig. 8-2) is mounted in the heater case near the heat exchanger. When the fuel is ignited, the flame heats the heat exchanger. The flame safety thermostat heated by the heat exchanger allows current to energize the control relay to change heater operation from the start mode to run mode.

d. The overheat thermostat is mounted on a bracket near the heat exchanger. The thermostat is normally closed. At a temperature of 250° ±6°F (118° to 124°C), the thermostat opens. The thermostat is connected into the fuel solenoid and air compressor circuit so that when an excessive temperature is reached, the fuel solenoid valve and air compressor will deenergize to stop combustion. As the thermostat cools to 210° ±12°F (92° to 105°C), the circuit will again be energized, the fuel solenoid will again open the fuel valve, and the air compressor will operate to reestablish combustion.

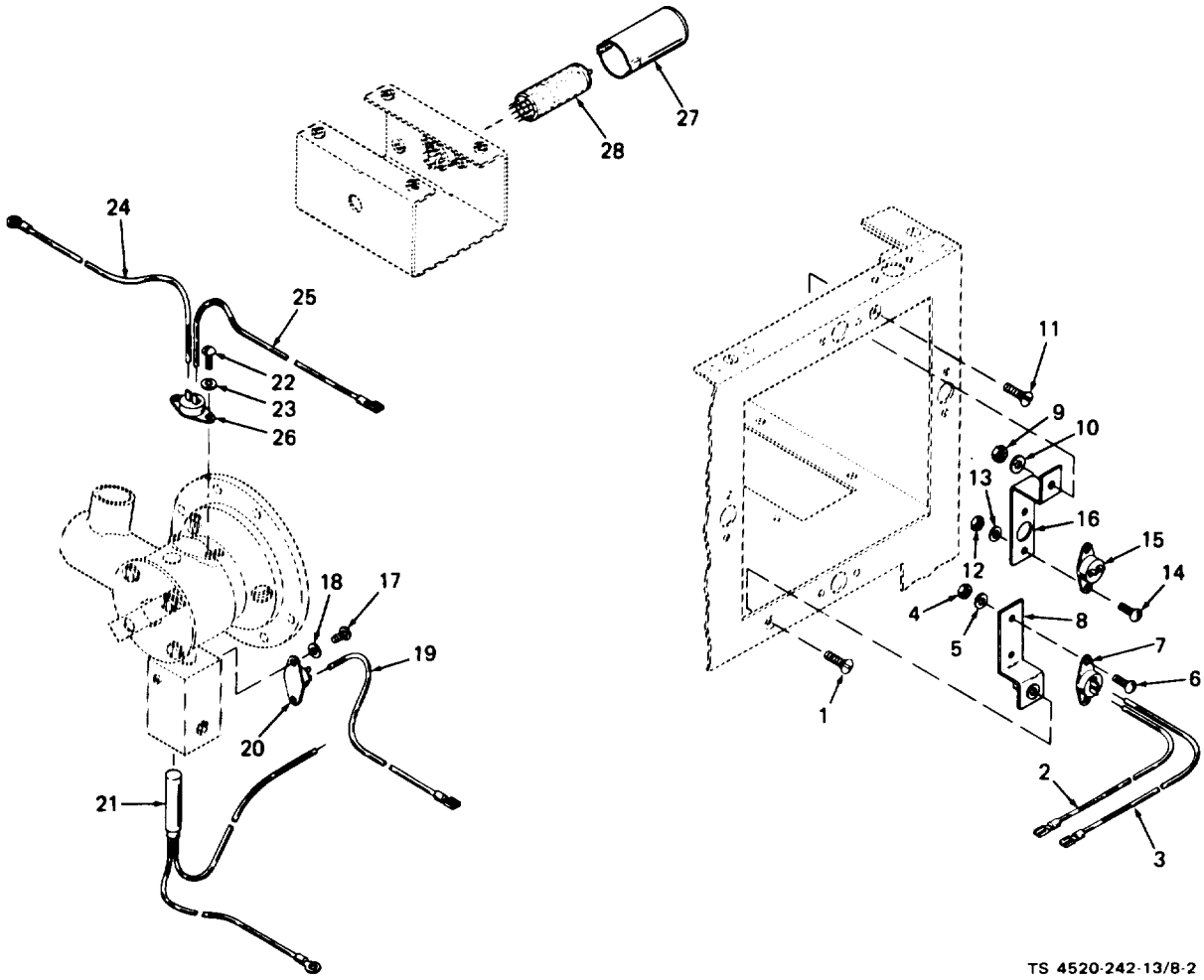
e. Two terminal blocks (24 and 30, fig. 8-1) are mounted on the bottom of the heater housing to help facilitate electrical connections to the various components of the heater. Connector tabs are installed on the terminal block to permit making multiple slip-on type connections to the terminals of the block.

f. The delay relay (28, fig. 8-2) is mounted on the blower and motor upper support bracket. The relay is connected into the fuel solenoid and air compressor circuit. When ignition does not occur within five seconds, the delay relay will reenergize the fuel solenoid valve and air compressor.



1.	Nut	13.	Wire	25.	Nut
2.	Lock washer	14.	Wire	26.	Lock washer
3.	Screw	15.	Wire	27.	Screw
4.	Nut	16.	Jumper wire	28.	Screw
5.	Lock washer	17.	Wire	29.	Terminal b lock tab
6.	Screw	18.	Control relay	30.	Terminal b lock
7.	Cable clamp	19.	Nut	31.	Nut
8.	Cable tie	20.	Lack washer	32.	Lock washer
9.	Wire	21.	Screw	33.	Screw
10.	Wire	22.	Screw	34.	Wire
11.	Wire	23.	Terminal block tab	35.	Wire
12.	Wire	24.	Terminal block	36.	Resistor

Figure 8-1. Control relay, terminal blocks, and resistor, exploded view.



1.	Screw	11.	Screw	20.	Fuel heater thermostat
2.	Wire	12.	Nut	21.	Fuel heater
3.	Wire	13.	Lock washer	22.	Screw
4.	Nut	14.	Screw	23.	Lock washer
5.	Lock washer	15.	Flame safety thermostat	24.	Wire
6.	Screw	16.	Bracket	25.	Wire
7.	Overheat thermostat	17.	Screw	26.	Glow plug thermostat
8.	Bracket	18.	Lock washer	27.	Tube shield
9.	Nut	19.	Wire	28.	Delay relay
10.	Lock washer				

Figure 8-2. Thermostats, delay relay, and fuel heater, exploded view.

8-2. REMOVAL.

WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before servicing or repairing the heater.

a. Disconnect the power plug and remove the top and side cover panels to provide access to the electrical control components. Remove the warm air louver.

b. Tag and unsolder the electrical leads to the control relay (18, fig. 8-1). Remove two nuts (1), lock washers (2), and screws (3) that secure the control relay to the heater case; remove the control relay.

c. Tag and unsolder the electrical lead to resistor (36). Remove two nuts (31), lock washers (32), and screws (33) that secure the resistor to the heater case; remove the resistor.

d. Tag and disconnect the electrical leads from the terminal blocks (24 and 30) and from tabs (23 and 29) on the terminal boards. Remove the nuts, lock washers, and screws, and remove the terminal blocks from the bottom of the heater case.

e. Disconnect the leads from the overheat thermostat (7, fig. 8-2). Remove the two nuts (4), lock washers (5), and screws (6), and remove the overheat thermostat from the bracket (8) on the heater case.

f. Disconnect the leads from the flame safety thermostat (15). Remove two nuts (12), lock washers (13), and screws (14), and remove the flame safety thermostat from the bracket (16) on the heater case.

g. Disconnect wire (19) and unsolder the fuel heater (21) lead from the fuel heater thermostat (20). Remove two screws (17) and lock washers (18), and remove fuel heater thermostat. Loosen the setscrew (20, fig. 10-1) in the fuel preheater and remove the fuel heater (21, fig. 8-2).

h. Disconnect the leads from glow plug thermostat (26). Remove two screws (22) and lock washers (23), and remove the glow plug thermostat.

i. Rotate the tube shield (27) counterclockwise and remove it from the socket. Remove the delay relay (28) from its socket. The relay has a nine-pin connection to the socket.

8-3. CLEANING AND INSPECTION.

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 (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 100°F (28°C).

a. Wipe the components with a clean, dry cloth, Dampen the cloth with dry cleaning solvent (fed. spec. P-D-680) if necessary to remove greasy or gummy deposits. Do not saturate the electrical components.

CAUTION

The control relay is designed for 28-volt operation only. Voltage in excess of 28 volts may destroy the relay coil (terminal X1 and X2).

NOTE

The control relay must be disconnected from the heater circuits before performing continuity tests. Alternate circuit paths within the heater will confuse the test results.

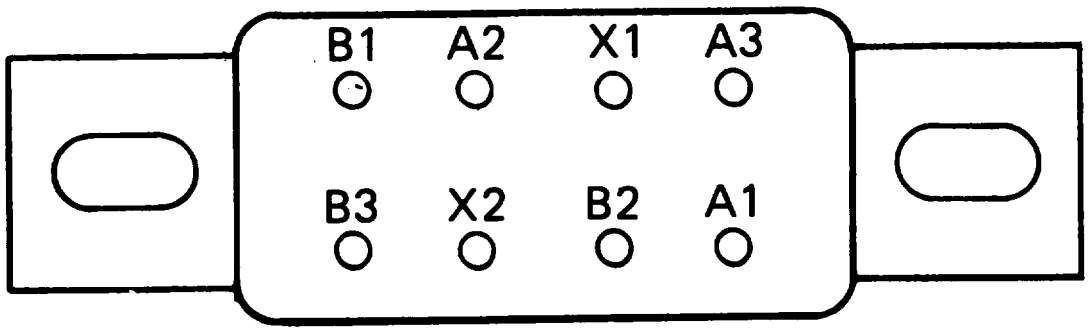
b. Replace the control relay (18, fig. 8-1) if the case is damaged, or if the relay shows signs of overheating or arcing. Test the resistance of the relay coil with an ohmmeter. The resistance across terminals X1 and X2 (shown in fig. 8-3) must be 300 ±30 ohms. There must be continuity only between terminals B2 and B3, and between A2 and A3, but no continuity across B1 and B2, or across A1 and A2. Replace the relay if it does not operate as specified.

c. To test the resistor, check for continuity between the green/white and grey leads using an ohmmeter. Continuity must be established across these leads. Replace a defective resistor.

d. Inspect the terminal blocks for cracks, burned or damaged terminals, and missing terminal screws. Replace a damaged terminal block.

e. Inspect all wiring for loose or broken terminals, frayed or damaged insulation, or burned wires. Replace any defective wires.

f. Inspect the overheat thermostat for damaged terminals, broken insulation, or other damage. There must be continuity across the overheat thermostat terminals at room temperature, and up to a temperature of 250° ±6°F (118° to 124°C). Replace the



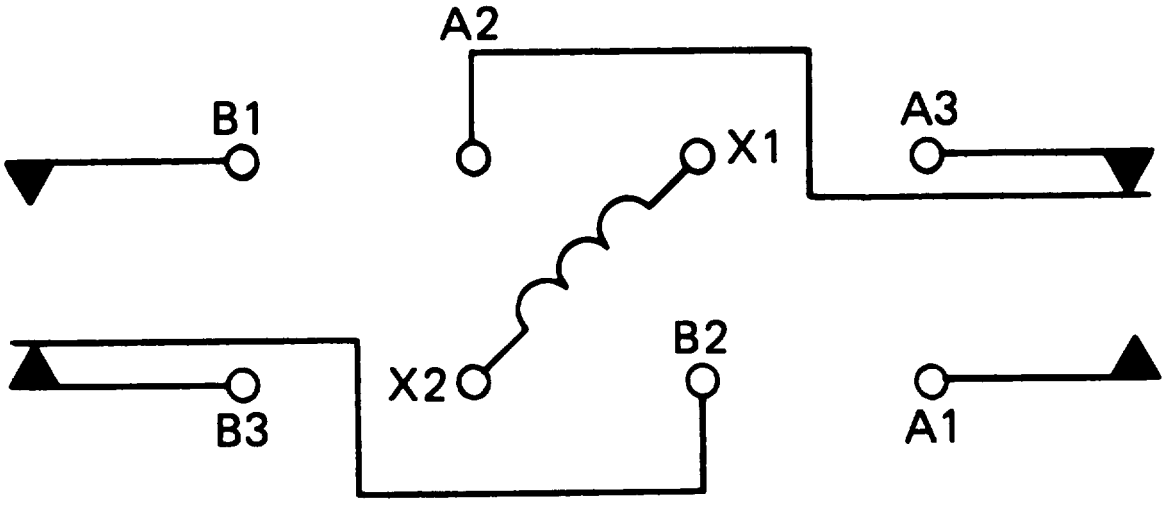


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Figure 8-3. Control relay terminal identification.

thermostat if it is open below this temperature range or if it is still closed above 256°F (124°C). When cooling, the thermostat must reopen at 210° ±12°F (92° to 105°C). Replace a defective thermostat.

g. Inspect the flame safety thermostat for damaged terminals, broken insulation, or other damage. There must be continuity across the flame safety thermostat terminals at a temperature of 110° ±5°F (41° to 45°C). Replace the thermostat if it is closed below this temperature range, or if it is still open above 115°F (45°C). When cooling, the thermostat must reopen at 90° ±5°F (30° to 34°C). Replace a defective thermostat.

h. Inspect the fuel heater thermostat for damaged terminal, broken insulation, or other damage. Test the fuel heater thermostat for continuity. The thermostat contacts must be open (no continuity) at a temperature of 55° ±6°F (9.4° to 16°C). The contacts must be closed (continuity) at a temperature of 40° ±6°F (1.1° to 7.8°C). Replace the thermostat if it does not perform as described.

i. Inspect the glow plug thermostat for damaged terminals, broken insulation, or other damage. Test the glow plug thermostat for continuity. The thermostat contacts must be open (no continuity) at a temperature of 55° ±6°F (9.4° to 16°C). The contacts must be closed (continuity at a temperature of 40° ±6°F [1.1° to 7.8°C]). Replace the thermostat if it does not perform as described.

j. Inspect the fuel heater for damaged terminal, broken insulation, or other damage. Test the fuel heater for proper operation. Connect the two heater leads to a source of 28-volt dc power. Replace the heater if it does not heat.

k. Inspect the timer (delay relay) for cracks, bent pins, or other damage.

8-4. INSTALLATION.

a. Install the control relay, thermostat, timer, resistor, fuel heater, and terminal blocks by reversing the removal and disassembly procedure. Refer to figures 8-1 and 8-2.

b. After installation, install the side and top cover panels and insert the power plug. Check the operation of the heater. Correct any defective operation.

CHAPTER 9

REPAIR OF BURNER

9-1. DESCRIPTION. The burner mounts on the end of the heat exchanger, and provides mounting for the spark plug, glow plug, fuel heater, solenoid valve, and fuel float bowl. Combustion air supplied by the combustion air blower enters the burner and passes into the burner head combustion chamber, where it mixes with the atomized fuel. This mixture is Ignited and burns within the burner head.

9-2. REMOVAL AND DISASSEMBLY.

WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

a. Disconnect the power and thermostat plugs. Disconnect the fuel supply. Remove the top and side cover panels.

b. Disconnect the glow plug thermostat leads, fuel heater thermostat leads, fuel heater leads, fuel solenoid leads, and all ground leads attached to the burner cover plate mounting screws. Disconnect the fuel supply tube from the fuel float bowl.

c. Disconnect the compression nut (3, fig. 9-1) of the compressor tubing (5) at the connector (6) in the compressor outlet.

d. Loosen the hose clamps (1) and remove combustion air tube (2) from the blower outlet and the burner head inlet.

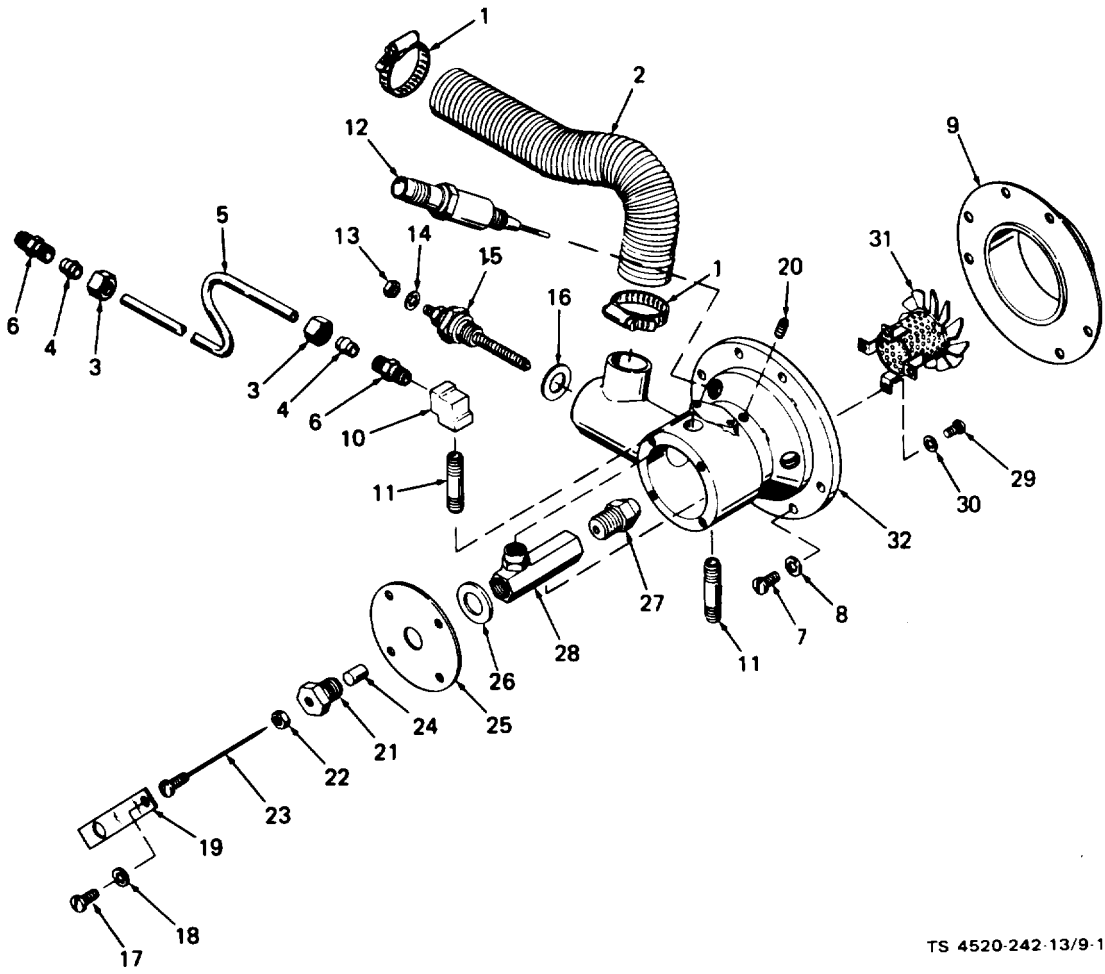
e. Unscrew the nut on the ignition cable and remove the cable. Unscrew the spark plug (12) and remove the spark plug from the burner.

f. Remove the nut (13) and lock washer (14), and disconnect the purple lead from glow plug (15). Unscrew-and remove the glow plug and the gasket (16) from the burner (32).

g. Remove the screws (7) and lock washers (8) securing the burner to the heat exchanger housing. Remove the burner and burner choke (9).

h. Remove the vent tube from the burner. Disconnect pipe nipple (11) from burner and fuel preheater.

i. Remove one screw (17) and lock washer (18) securing the needle retainer (19) to the burner. Remove the fuel adjustment needle assembly by unscrewing pipe plug (21) from the burner. Disassemble the fuel adjustment needle assembly by loosening nut (22) and unscrewing needle (23). Remove seal (24).



1.	Hose clamp	12.	Spark plug	23.	Fuel adjustment needle
2.	Air tube	13.	Nut	24.	Needle seal
3.	Compression nut	14.	Lock washer	25.	Burner cover plate
4.	Compression sleeve	15.	Glow plug	26.	Burner gasket
5.	Compressor tubing	16.	Glow plug gasket	27.	Nozzle
6.	Connector	17.	Screw	28.	Nozzle adapter
7.	Screw	18.	Lock washer	29.	Screw
8.	Lock washer	19.	Needle retainer	30.	Lock washer
9.	Burner choke	20.	Setscrew	31.	Burner head
10.	Elbow	21.	Pipe plug	32.	Burner
11.	Pipe nipple	22.	Nut		

Figure 9-1. Burner, exploded view.

j. Remove elbow (10) and pipe nipple (11). Remove three screws (17), lock washers (18), burner cover plate (25), and burner gasket (26). Remove nozzle (27) and adapter (28) by loosening two setscrews (20).

k. Remove four screws (29) and lock washers (30) securing burner head (31) to burner (32).

9-3. CLEANING AND INSPECTION.

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 (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 100°F (38°C).

a. Clean all metal parts in dry cleaning solvent (fed. spec. P-D-680), using a wire brush to remove deposits from the burner. Do not immerse the glow plug in solvent. If necessary, use compressed air to dry the inside of the burner before reinstalling it in the heater.

b. Inspect the electrode and outer shell of the spark plug for burning or pitting. Inspect ceramic parts for cracks or breaks. Inspect threads for damage. Replace a damaged spark plug.

c. Inspect the glow plug for cracks, frayed insulation, loose or broken leads, defective element winding, and other damage. Apply 28 vdc across the glow plug leads and check that the glow plug heats. Replace a damaged or defective glow plug.

d. Inspect the fuel adjusting needle tip for wear, scoring, or other damage. Replace the fuel adjusting needle if the needle is bent or damaged.

e. Inspect the nozzle (27) needle seat for wear, scoring, or other damage. Replace the nozzle if damaged.

f. Inspect the burner head (31) perforations and blades for cracks, breaks, and distortion. The burner head blades should be slightly bent away from the back side of the burner head. Replace the burner head if damaged.

g. Inspect the burner for cracks, breaks, and distortion. Check that the threads in the spark plug, glow plug, vent tube, and screw thread holes are not damaged. Replace a damaged burner.

9-4. INSTALLATION.

a. Install the burner head (31) to the burner (32), and secure with four screws (29) and lock washers (30). Install the spark plug (12) into the burner. Adjust the spark plug electrode to obtain 1/8 inch (3 mm) clearance between the spark plug electrode and the blade inner ring.

b. Assemble the nozzle (27) and nozzle adapter (28). Position this assembly in the burner, align the two threaded holes for pipe nipples (11), and secure the nozzle and nozzle adapter by tightening setscrews (20).

c. Reassemble fuel adjustment needle assembly by positioning nut (22) on adjustment needle (23). Install this assembly into pipe plug (21). Carefully slide the needle seal (24) over the needle. Turn the fuel adjustment needle into the pipe plug (21) until the top of the needle head is 7/16 inch (11 mm) from the face of the pipe plug. Maintain this dimension and tighten the nut (22). Coat the male NPT threads of the pipe plug (21) with Permatex No. 1, or equivalent, and install the fuel adjustment needle assembly through burner cover plate (25). Install burner gasket (26) on pipe pluq (21). Turn pipe plug (21) until the threads engage with adapter nozzle (28) threads. Use three screws (17) and lock washers (18) to secure burner cover plate (25) to the burner.

d. Tighten pipe plug (21) until pipe plug head is flush to burner cover plate (25). Position needle retainer (19) over the slotted end of adjustment needle (23), and secure screw (17) and lock washer (18).

e. Coat the threads of pipe nipples (11) with Permatex No. 1, or equivalent, and install into adapter nozzle (28) through the holes in burner (32).

f. Install the burner choke (9) and burner. Secure with screws (7) and lock washers (8).

g. Use a new gasket (16) and install glow lug (15) in the burner. Connect the purple lead using lock washer (14) and nut (13).

h. Position the Ignition cable and tighten the ignition cable nut.

i. Slide the clamps (1) over the ends of the combustion air tube (2), and fit the tube over the combustion air blower and the burner air inlet. Tighten the clamps.

j. Install compressor tube, fuel lines, and electrical leads.

k. Install the top and side cover panels. Connect the power plug and test the heater operation. Adjust the fuel adjustment needle if necessary to obtain smooth operation.

l. Fuel Adjustment. When the type of fuel being burned in the heater is changed, or when the heater is subjected to extremely low ambient temperatures, it will normally be necessary to readjust the fuel adjustment needle on the burner assembly for proper combustion.

NOTE

You must remove the left side cover panel to gain access to the fuel adjustment needle. Loosen the fuel adjustment lock nut before you turn the adjustment needle.

(1) If heater smokes, turn the fuel adjustment needle 1/8 turn clockwise to reduce the fuel flow. Observe heater operation for 1 minute. If smoking persists, turn the needle an additional 1/8 turn and observe operation. Continue until operation is satsifactory.

(2) If heater operation is erratic, or heater falls to operate properly in extremely low ambient temperatures, turn the fuel adjustment needle 1/8 turn counterclockwise to increase fuel flow, observe operation for 1 minute. Continue to turn the needle counterclockwise 1/8 turn until heater operation is satisfactory. When heater is burning smoothly, there should the little or no smoke from the exhaust outlet and the heat exchanger tubes should not be red in color.

CHAPTER 10

REPAIR OF FUEL SYSTEM

10-1. DESCRIPTION. The space heater fuel system consists of a fuel filter, fuel pump, fuel float bowl, solenoid valve, and the interconnecting lines and fittings.

a. Fuel Filter. The fuel filter traps and holds dirt, moisture, and other contaminants before they can enter the heater fuel system. The fuel filter has a metal disc-type element contained in a removable sediment bowl.

b. Fuel Pump. A 28-volt, pulsating-type electric fuel pump draws fuel from the fuel supply and pumps it to the fuel float bowl. The pump also contains a filter to remove any contaminants which may have passed through the fuel filter.

c. Fuel Float Bowl. The fuel float bowl meters the flow of fuel to the burner to achieve efficient combustion. Sensitive adjustment of this flow is provided by a fuel adjustment needle on the burner which enables you to manually adjust the flow rate according to the burning characteristics of the various fuels this heater will burn.

d. Solenoid Valve. The solenoid valve controls the flow of fuel from the fuel float bowl to the fuel nozzle. This electrically controlled device opens the fuel valve when the thermostat calls for heat and closes the valve when the heat requirement is satisfied.

e. Fuel Lines. Fixed fuel lines carry the fuel from the fuel filter to the fuel pump. A flexible fuel tube carries the fuel from the fuel pump to the fuel float bowl. A vent tube from the top of the fuel float bowl to the burner vents excess fuel to the burner head in the event of fuel float bowl malfunction. A flexible line carries pressurized air from the compressor to the burner to atomize fuel.

10-2. FUEL FLOAT BOWL.

a. Removal.

WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

(1) Disconnect the power plug and shut off the fuel supply. Remove the top and side cover panels for access to the fuel float bowl.

(2) Disconnect the glow plug thermostat leads, fuel heater thermostat leads, fuel heater leads, fuel solenoid leads, and all ground leads attached to the burner, Disconnect the fuel supply tube from the fuel flat bowl. Disconnect the compressor tube at the compressor. Remove the combustion air tube. Remove the ignition cable. Remove the burner from the heat exchanger housing.

(3) Remove the vent tube from the burner and float bowl. Disconnect the pipe nipple from the burner and fuel preheater. Remove the fuel float bowl, solenoid valve, and fuel preheater as an assembly.

(4) Remove pipe nipple (1, fig. 10-1) and remove fuel float bowl.

b. Disassembly.

(1) Remove four screws (4), lock washers (5), and float cover (6).

(2) Remove float pin (8), float (9), needle (10), needle seat (11), and seat gasket (12).

c. Cleaning and Inspection.

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 (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 100°F (38°C).

(1) Clean metal parts in dry cleaning solvent (fed. spec. P-D-680) and allow parts to dry thoroughly before reassembly.

(2) inspect the needle tip and needle seat for wear, scoring, or other damage. Replace damaged parts.

d. Reassembly and Installation.

(1) Install a new seat gasket (12) and assemble needle seat (11) to the float cover (6).

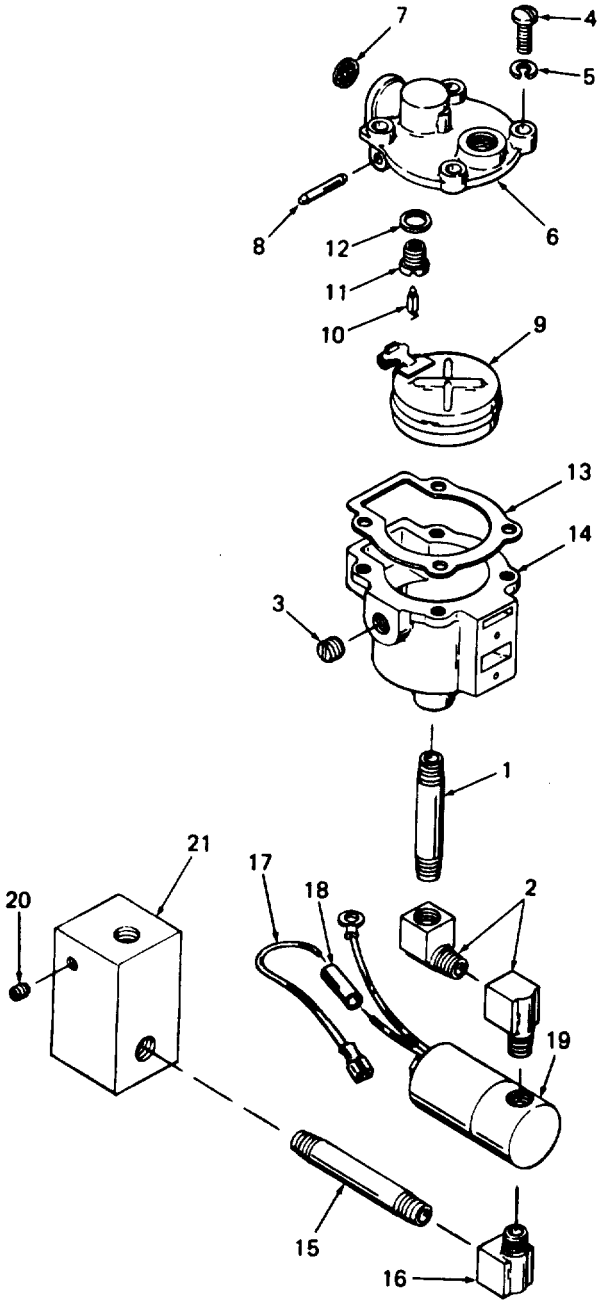
(2) Position needle (10) on float (9) and into needle seat (11). Lock in position on float cover (6) with float pin (8).

(3) Use a new cover gasket (13) and assemble float cover (6) to bowl (14) with four screws (4) and lock washers (5).

(4) Coat the threads of pipe nipple (1) with Permatex No. 1, or equivalent, and install Into fuel float bowl and elbow (2).

(5) Install the vent tube to the burner and fuel float bowl.

(6) Install the burner on the heat exchanger housing. Install the ignition cable. Install the combustion air tube. Connect the compressor tube to the compressor. Connect the fuel supply tube to the fuel float bowl. Connect the thermostat leads, fuel heater leads, fuel solenoid leads, and all ground leads to the burner.



1. Pipe nipple
2. Elbow
3. Pipe plug
4. Screw
5. Lock washer
6. Float cover
7. Inlet screen
8. Float pin
9. Float
10. Needle
11. Needle seat
12. Seat gasket
13. Cover gasket
14. Bowl
15. Pipe nipple
16. Elbow
17. Wire
18. Connector
19. Solenoid valve
20. Setscrew
21. Fuel preheater

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Figure 10-1. Fuel float bowl, solenoid valve, and fuel preheater, exploded view.

(7) Install the cover panels, power plug, and turn on fuel supply. Start the heater and check operation.

10-3. SOLENOID VALVE AND FUEL PREHEATER.

a. Removal.

WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

(1) Disconnect the power plug and shutoff the fuel supply. Remove the top and side cover panels for access to the solenoid valve.

(2) Disconnect the glow plug thermostat leads, fuel heater thermostat leads, fuel heater leads, fuel solenoid leads, and all ground leads attached to the burner. Disconnect the fuel supply tube from the fuel float bowl. Disconnect the compressor tube at the compressor. Remove the combustion air tube. Remove the ignition cable. Remove the burner from the heat exchanger housing.

(3) Remove the vent tube from the burner and float bowl. Disconnect the pipe nipple from the burner and fuel preheater. Remove the fuel float bowl, solenoid valve, and fuel preheater as an assembly.

(4) Remove pipe nipple (1), two elbows (2), pipe nipple (15), elbow (16), and solenoid valve (19). Loosen setscrew (20) and remove the heater cartridge from fuel preheater (21).

b. Cleaning and Inspection.

WARN ING

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 100°F (38°C).

(1) Clean metal parts in dry cleaning solvent (fed. spec. P-D-680) and allow parts to dry thoroughly before reassembly. Do not immerse the parts in solvent.

(2) Inpsect the needle tip and needle seat for wear, scoring, or other damage. Replace damaged parts.

(3) Test the solenoid for continuity between the two leads. Replace the solenoid if it is open. Inspect the solenoid for damage or signs of overheating. Replace the solenoid if damaged.

(4) Test the fuel heater for proper operation. Connect two heater leads to a source of 28-volt dc power. Replace the heater if it does not heat.

c. Reassembly and Installation.

(1) Install the heater cartridge in the fuel preheater (21) and secure with setscrew (20). Install pipe nipple (15), elbow (16), solenoid valve, (19), and two elbows (2). Install pipe nipple (1). Use Permatex No. 1, or equivalent, on pipe threads.

(2) Install the fuel float bowl, solenoid valve, and fuel preheater as an assembly on the burner using the pipe nipple to connect the assembly to the burner. Install the vent tube on the float bowl and burner.

(3) Install the burner on the heat exchanger housing. Install the ignition cable. Install the combustion air tube. Connect the compressor tube to the compressor. Connect the fuel supply tube to the fuel float bowl. Connect the glow plug thermostat leads, fuel heater thermostat leads, fuel heater leads, fuel solenoid leads, and all ground leads to the burner.

(4) Install the top and side cover panels. Connect the fuel supply and the power plug. Start the heater and check operation.

10-4. FUEL PUMP.

a. Removal.

WARNING

The Ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

(1) Disconnect the power plug and shut off the fuel supply. Remove the left side cover panel. Remove the screws from the control panel and remove the panel to the full extent of its wires. It is not necessary to totally remove the control panel to remove the fuel pump.

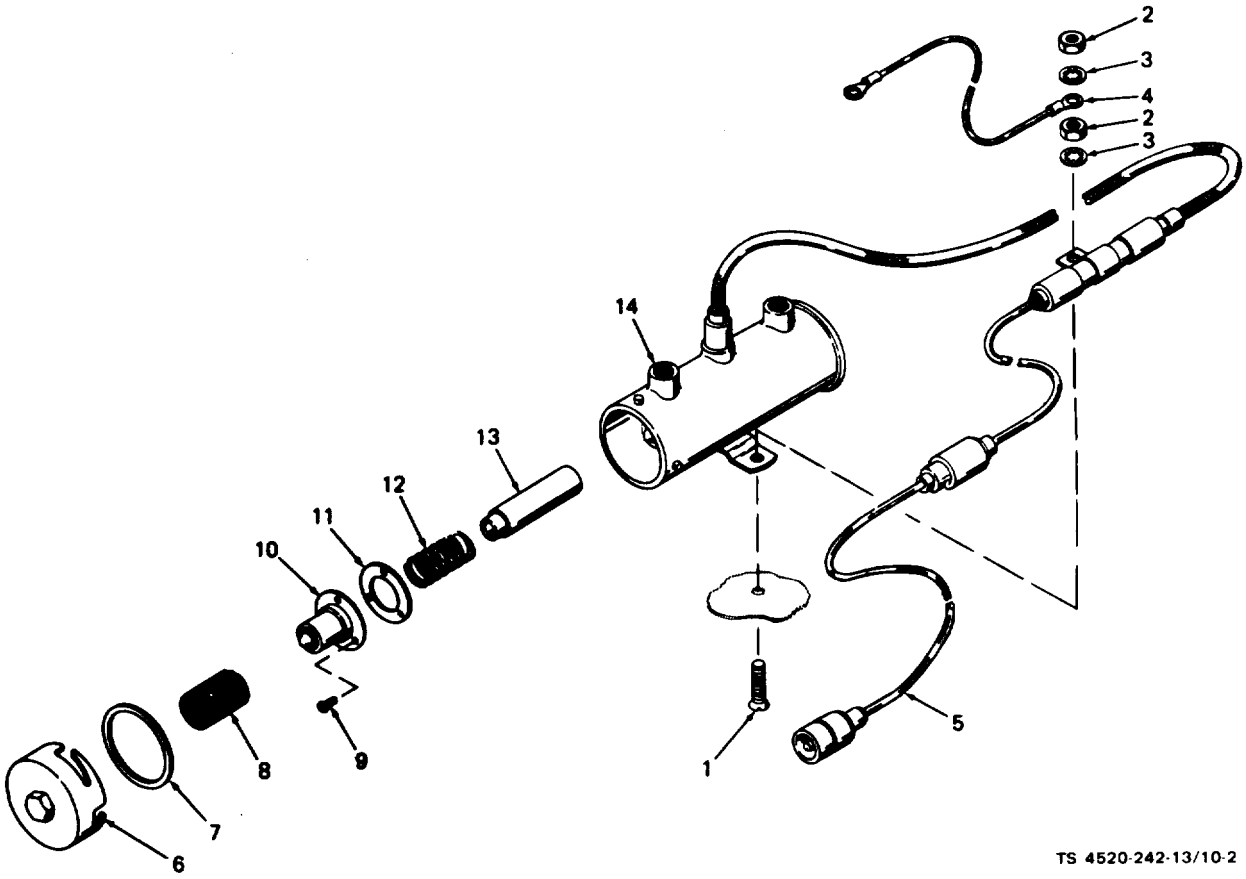
(2) Disconnect the fuel tube from the fuel pump to the fuel float bowl. Disconnect the fuel supply tube at the fuel filter. Remove the fuel filter, pipe nipple, and elbow.

(3) Disconnect cable (5, fig. 10-2). Remove nuts (2), lock washers (3), screws (1), and wire (4). Remove the fuel pump through the control panel opening.

b. Disassembly.

(1) Remove cover (6), gasket (7), and filter screen (8).

(2) Remove screws (9), spring cup (10), cup gasket (11), plunger spring (12), and plunger assembly (13).



1. Screw
2. Nut
3. Lock washer
4. Wire
5. Cable
6. Cover
7. Gasket
8. Filter screen
9. Screw
10. Spring cup
11. Cup gasket
12. Plunger spring
13. Plunger
14. Body

Figure 10-2. Fuel pump, exploded view.

c. Cleaning and Inspection.

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 (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 100°P (38°C).

(1) Clean the exterior of the fuel pump with a cloth dampened with dry cleaning solvent (fed. spec. P-D-680). Dry thoroughly.

(2) inspect the fuel pump for cracks, damaged threads, damaged electrical lead or connector, and other visible damage; replace a defective fuel pump.

d. Reassembly and Installation.

(1) Install plunger assembly (13), plunger spring (12), new cup gasket (11), spring cup (10), and screws (9).

(2) Install filter screen (8), new gasket (7), and cover (6).

(3) Insert the fuel pump in the heater case through the control panel opening. install wire (4), screws (1), lock washers (3), and nuts (2). Connect cable (5).

(4) Install the elbow, pipe nipple, and fuel filter. Connect the fuel supply tube to the fuel filter. Connect the fuel tube to the fuel pump and fuel float bowl.

(5) Install the control panel. Connect the fuel supply line and the power plug. Check for proper operation. Check for leaks around the fuel pump filter cover and fuel lines. If any leakage is detected, shut off the heater, disconnect the power plug, and correct the leak. Retest heater operation and, when it is satisfactory, reinstall the left side cover panel.

CHAPTER 11

REPAIR OF HEAT EXCHANGER, EXHAUST CQNNECTION, AND RAIN SHIELD

11-1. DESCRIPTION.

a. Heat Exchanger. The heat exchanger is a bundle of stainless steel tubes with a large surface area. It is open to the burner head at one end, and contains an outlet for gases near the other end. The burning fuel and air mixture heats the walls of the heat exchanger. The blower motor blows circulating air around the outside of the heat exchanger, where the air picks up heat from the heat exchanger before it passes through the warm air louver into the enclosure to be heated.

b. Exhaust Connection. The exhaust connection is an Insulated tubular assembly which carries the gases from the heat exchanger to the exhaust pipe outside the enclosure to be heated. It is located in the bottom of the heater case and is directly connected to the heat exchanger and the exhaust fitting.

c. Rain Shield. The rain shield Is located on the back of the heater case and is removable to allow connecting an air inlet tube which can draw air from outside the enclosure to be heated.

11-2. REMOVAL AND DISASSEMBLY.

WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

a. Disconnect the power plug and shut off the fuel supply. Remove the top, side, and heat exchanger cover panels. Remove the louver and pull out the control panel to the full extent of its wires.

b. Disconnect the glow plug thermostat leads, fuel heater thermostat leads, fuel heater leads, fuel solenoid leads, and all ground leads attached to the burner. Disconnect the fuel supply tube from the fuel float bowl. Disconnect the compressor tube at the compressor. Remove the combustion air tube, Remove the ignition cable, remove the burner from the heat exchanger housing.

c. Remove the bent clip (3, fig. 11-1), seal retainer (4), and seal (7).

d. Remove four screws (11) and lock waskers (12). Remove exhaust fitting (13) and exhaust insulation (14).

e. Loosen clamp (24). Loosen and remove clamps (15), exhaust pipe cover (16), exhaust pipe insulation (17), and exhaust tube (18).

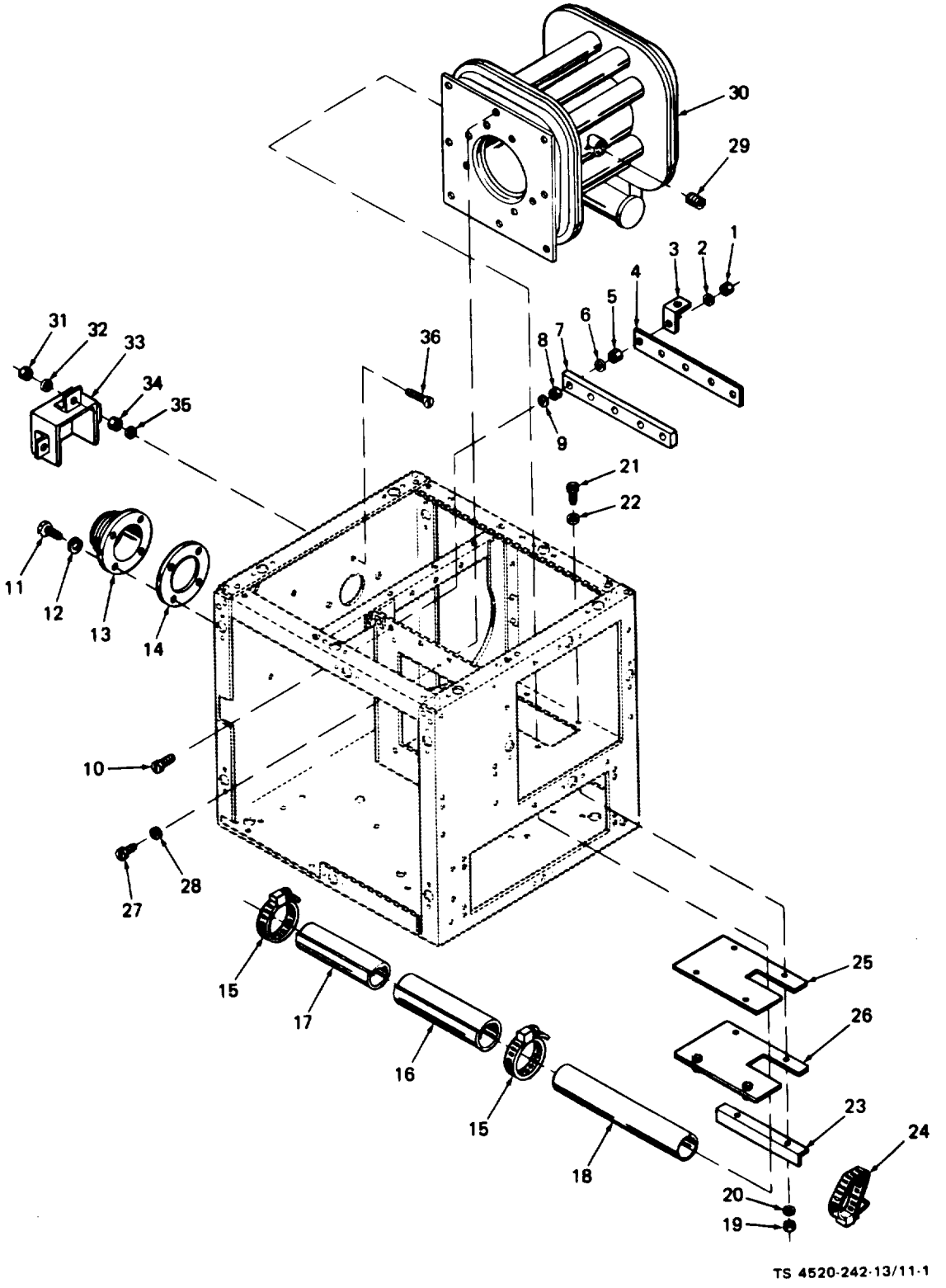


Figure 11-1. Heat exchanger, exhaust connection, and rain shield, exploded view.

Legend for fjg. 11-1

1. Nut
2. Lock washer
3. Bent clip
4. Seal retainer
5. Nut
6. Lock washer
7. Seal
8. Nut
9. Lock washer
10. Screw
11. Screw
12. Lock washer
13. Exhaust fitting
14. Exhaust Insulation
15. Clamp
16. Exhaust pipe cover
17. Exhaust pipe Insulation
18. Exhaust
19. Nut
20. Lock washer
21. Screw
22. Lock washer
23. Exchanger support
24. Clamp
25. Insulation
26. Exhaust seal
27. Screw
28. Lock washer
29. Pipe plug
30. Heat exchanger
31. Nut
32. Lock washer
33. Rain shield
34. Nut
35. Lock washer
36. Screw

f. Remove exchanger support (23), clamp (24), insulation (25), and exhaust seal (26) by removing nut (19), lock washer (20), screw (21), and lock washer (22).

Remove three nuts (31), lock washers (32), and remove rain shield (33). It is not necessary to remove nuts (34), lock washers (35), and screws (36) to remove the rain shield from the heater case.

h. Remove the heat exchanger from the heater case.

11-3. CLEANING AND INSPECTION.

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 (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 100°F (38°C).

a. Clean all metal parts in dry cleaning solvetn (fed. spec. P-D-680) using a wire brush to clean the heat exchanger. If necessary, use compressed air to dry out the inside of the heat exchanger before reinstalling it in the heater.

WARNING

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 heater enclosure. Any crack or hole through the exchanger walls requires exchanger replacement.

b. Inspect the heat exchanger and its exhaust tube for cracks, breaks, holes, excessive corrosion, and other damage. Replace a damaged heat exchanger or exhaust tube.

c. Inspect seals and insulation for damage. Replace damaged parts. The exhaust insulation (14) may be reused if it is not distorted, compressed, or damaged.

11-4. REASSEMBLY AND INSTALLATION.

a. Install the heat exchanger, rain shield, exhaust tube, and exhaust fitting in the reverse order of the index numbers in figure 11-1.

b. Install the burner on the heat exchanger housing. Install the ignition cable, combustion air tube, and connect the compressor tube to the compressor. Connect the fuel supply tube to the fuel float bowl. Connect the glow plug thermostat leads, fuel heater thermostat leads, fuel heater leads, fuel solenoid leads, and all ground leads to the burner.

c. Install the control panel and the louver. Install the heat exchanger cover panel, side cover panel, and top panel. Connect the fuel supply line and power plug. Test the heater for proper operation.

CHAPTER 12

REPAIR OF BLOWER ASSEMBLY

12-1. DESCRIPTION. The blower assembly consists of a blower wheel contained within a housing, blower motor support, 28-volt motor, and an axial fan. The blower wheel is located at the rear of the motor and provides air under slight pressure for combustion only. Combustion air is ducted through the combustion air tube to the burner. The amount of combustion air to the burner is controlled by the adjustable air damper located on the blower housing. Ventilation air is circulated around the outside of the heat exchanger by the axial fan. This heated air passes through the warm air louver to heat the enclosure.

12-2. REMOVAL OF BLOWER ASSEMBLY.

WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

a. Disconnect the power plug and shut off the fuel supply. Remove the top panel and both side cover panels. Remove the heat exchanger cover panel. Disconnect the orange lead at the primary terminal block. Disconnect the green/white, and red/white/blue leads at the secondary terminal block. Disconnect two white/black leads at the burner. Remove the combustion air tube from the blower housing.

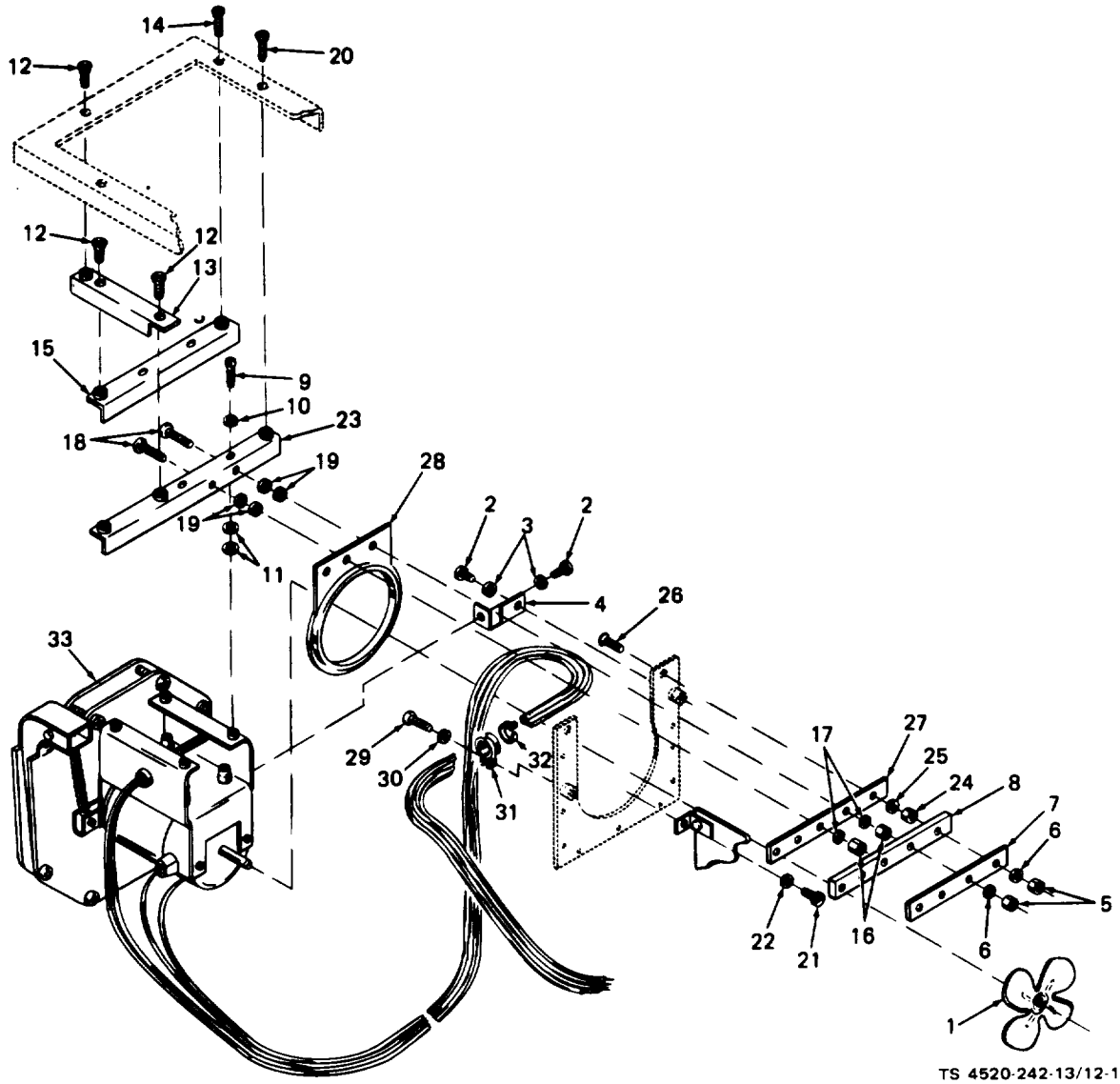
b. Loosen the setscrew and removal axial fan (1, fig. 12-1). Remove two screws (2), lock washers (3), and remove stabilizer (4). Remove five nuts (5), lock washers (6), and remove retainer seal (7) and seal (8). Remove four screws (9), lock washers (10), flat washers (11), three screws (12), and support bridge (13). Remove screw (14) and remove back support bracket (15). Remove two nuts (16), lock washers (17), screws (18), four flat washers (19), screw (20), screw (21), lock washer (22), and center support stiffener (23). Remove three nuts (24), lock washers (25), screws (26), tie bar (27), and fan shroud (28). Remove screw (29), lock washer (30), cable clamp (31), and cable tie (32). Remove blower and motor (33) from heater case.

12-3. DISASSEMBLY OF BLOWER MOTOR SUPPORT. Remove two screws, (1, fig. 12-2) and lock washers (2) from motor (24). Remove two nuts (3) lock washers (4), and washers (5) from the motor studs. Separate motor and blower housing (25). Remove two nuts (6), lock washers (7), screws (8), and remove tube socket (13).

12-4. MOTOR.

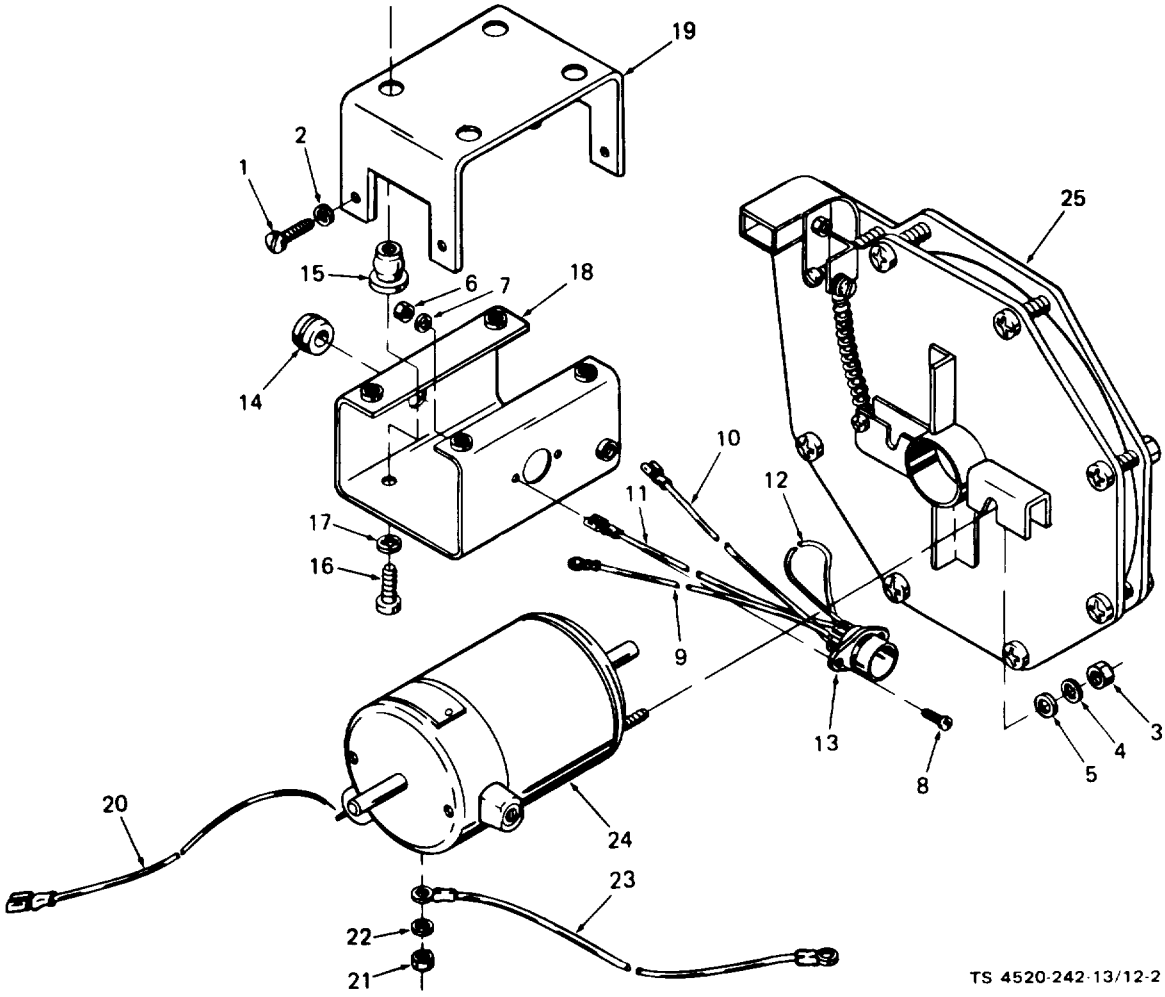
a. Disassembly. If the suppression capacitor (14, fig. 12-3) or motor is faulty, disassemble the motor as follows:

(1) Remove brush caps (1) and brushes (2).



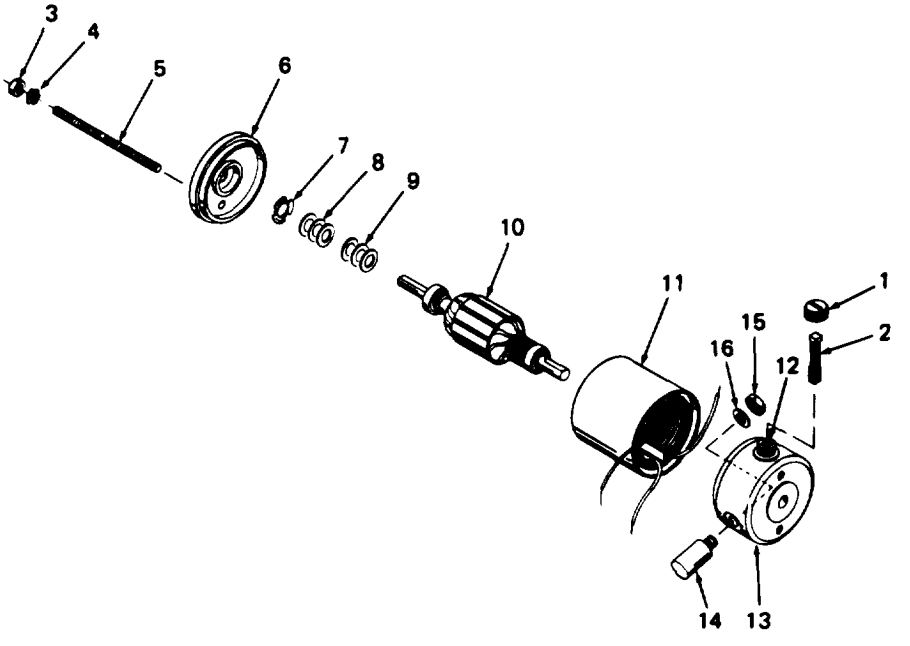
1.	Axial fan	12.	Screw	23.	Center support stiffener
2.	Screw	13.	Support bridge	24.	Nut
3.	Lock washer	14.	Screw	25.	Lock washer
4.	Stabilizer	15.	Back support bracket	26.	Screw
5.	Nut	16.	Nut	27.	Tie bar
6.	Lock washer	17.	Lock washer	28.	Fan shroud
7.	Retainer seal	18.	Screw	29.	Screw
8.	Seal	19.	Flat washer	30.	Lock washer
9.	Screw	20.	Screw	31.	Cable clamp
10.	Lock washer	21.	Screw	32.	Cable tie
11.	Flat washer	22.	Lock washer	33.	Blower and motor

Figure 12-1. Blower motor support, exploded view.



1. Screw
2. Lock washer
3. Nut
4. Lock washer
5. Flat washer
6. Nut
7. Lock washer
8. Screw
9. Wi re
10. WI re
11. Wire
12. Wi re
13. Tube socket
14. Grommet
15. Well nut
16. Screw
17. Lock washer
18. Upper support
19. Lower support
20. Wi re
21. Nut
22. Lock washer
23. Wi re
24. Motor
25. Blower housing

Figure 12-2. Blower and motor, exploded view.



1. Brush cap
2. Brush and spring
3. Nut
4. Lock washer
5. Stud
6. End bell
7. Spring washer
8. Washer
9. Washer
10. Armature
11. Stator
12. Brush tube
13. Commutator end bell
14. Suppression capacitor
15. Nut
16. Lock washer

Figure 12-3. Blower motor, exploded view.

(2) Remove nuts (3) and lock washers (4) that secure end bell (6) to the motor assembly; remove the end bell.

(3) Remove spring washer (7) and washers (8 and 9); retain washers for reassembly. Pull armature (10) from stator (11).

(4) Separate the stator from commutator end bell (13) to provide access to the capacitor mounting hardware.

(5) Unsolder the electrical lead from the capacitor terminal inside the motor. Remove nut (15) and lock washer (16), and remove capacitor (14) from the end bell.

b. Cleaning an Inspection.

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 (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 100°F (38°C).

(1) Wipe the exterior of the motor assembly with a cloth dampened with dry cleaning solvent (fed. spec. P-D-680). Prevent solvent from entering the motor. Clean the motor stator and armature using clean, dry low pressure (30 psi maximum) compressed air to blow out dust and dirt. Wipe off any grease with a cloth dampened with solvent.

(2) Clean metal parts in dry cleaning solvent and allow to dry thoroughly before reassembly.

(3) Remove and inspect the motor brushes for cracks, chips, wear, or scoring. Replace brushes if damaged or if they are worn to less than 5/16 inch (8 mm).

(4) Inspect the condition of the motor commutator. Replace the motor if the commutator is scored or badly burned. Light scoring of the commutator can be cleaned up using fine sandpaper.

(5) Visually inspect the motor armature and stator for signs of overheating or other damage. Inspect the bearings for wear and scoring. Replace defective motor parts.

(6) Inspect the suppression capacitor for burned or broken insulation or other damage. If a capacitance tester is available, test the capacitor Capacitance should be 0.47 microfarad. If a capacitance tester is not available, test the capacitor for continuity with an ohmmeter. Replace the suppression capacitor if the ohmmeter indicates that it is shorted, or if the capacitance tester indicates it is defective.

c. Reassembly.

(1) Reassemble the motor in the reverse order of the index numbers in figure 12-3.

(2) Use rosin-core solder when soldering the lead to the suppression capacitor (14).

12-5. BLOWER HOUSING.

a. Disassembly. If blower wheel (13, fig. 12-4) or air damper linkage (15) is damaged, disassemble the blower housing as follows:

(1) Remove two nuts (1), lock washers (2), screws (3), and spring (4).

(2) Remove nine nuts (8), lock washers (9), and screws (10) from blower housing (18). Separate the intake housing (12) from the blower housing. Remove blower wheel (13).

(3) Nut (14) is silver soldered to the linkage screw protruding through the blower housing combustion air outlet. Do not disturb this assembly.

b. Cleaning and Inspection.

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 (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 100°F (38°C).

(1) Wipe the exterior of the blower housing with a cloth dampened with dry cleaning solvent (fed. spec. P-D-680).

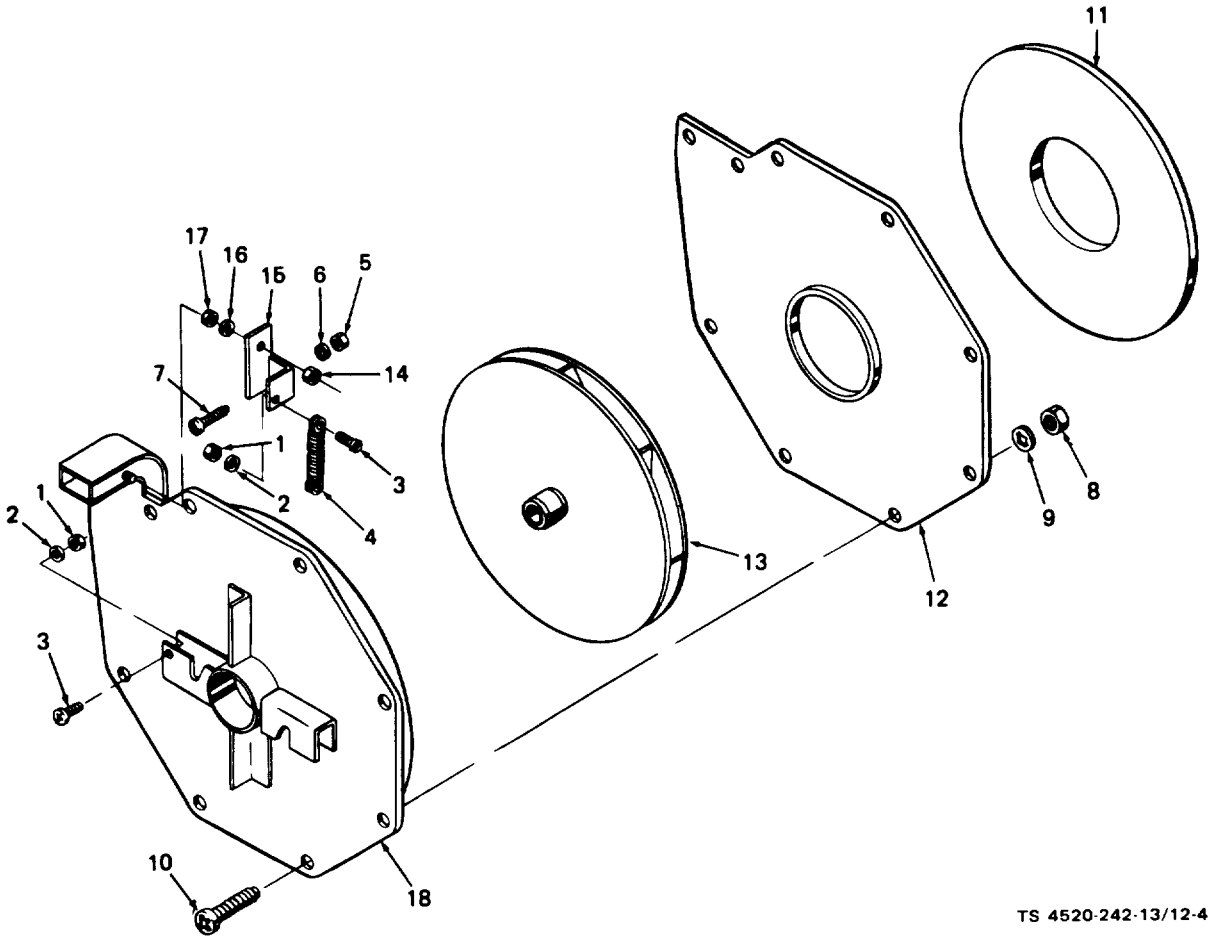
(2) Clean metal parts in dry cleaning solvent and allow to dry thoroughly before reassembly.

(3) Inspect the blower wheel for damaged or nicked vanes, loose collar, or cracks. Replace a defective blower wheel.

(4) Inspect the air damper and linkage for restrictions or damage to the combustion air outlet. The air damper and linkage should move freely without binding. Slight damage can be corrected by bending the sheet metal of the combustion air outlet. Replace the blower housing if damage cannot be repaired.

c. Reassembly.

(1) Reassemble the blower housing in the reverse order of the index numbers in figure 12-4.



1. Nut	10. Screw
2. Lock washer	11. Cushion
3. Screw	12. Intake housing
4. Spring	13. Blower wheel
5. Nut	14. Nut
6. Lock washer	15. Air damper linkage
7. Screw	16. Lock washer
8. Nut	17. Nut
9. Lock washer	18. Blower housing

Figure 12-4. Blower housing, exploded view.

(2) Seal the blower housing (18) and intake housing (12) using Dow-Corning 732 RTV Silastic, or equivalent.

(3) Adjust nut (5) so when it rests against the back of the intake housing (12) the air damper, in the blower housing, will have 5/16 inch (8 mm) clearance from the side of the intake housing when the damper is in the open position.

12-6. REASSEMBLY OF BLOWER MOTOR SUPPORT. Reassemble the blower motor support in the reverse order of the index numbers in figure 12-2.

12-7. INSTALLATION OF BLOWER ASSEMBLY.

a. Install the blower assembly in the heater case in the reverse order of the index numbers In figure 12-1.

b. Install the combustion air tube on the blower housing. Connect the two white/black leads to the burner. Connect the green/white, and red/white/blue leads to the secondary terminal block. Connect the orange lead to the primary terminal block. Install the heat exchanger cover panel. Install the top, and both side cover panels. Connect the fuel supply and the power plug. Check for proper operation.

CHAPTER 13

REPAIR OF AIR COMPRESSOR

13-1. DESCRIPTION. The compressor assembly consists of a diaphragm type air compresser, mounting straps, and needle valve. The air compressor has an integral motor which moves the diaphragm. The adjustable needle valve controls the amount of air going to the burner. The air, furnished by the compressor, atomizes the fuel in the burner.

13-2. REMOVAL OF COMPRESSOR ASSEMBLY.

WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

Disconnect the power plug and shut off the fuel supply. Disconnect the exhaust and fuel supply. Remove the top panel and both side cover panels. Disconnect the orange lead at the primary terminal block, and the white/black lead at the burner. Remove the ignition power supply. Remove the air tube at the compressor. Remove the four screws securing the compressor to the heater case. Remove the compressor from the heater case.

13-3. DISASSEMBLY OF COMPRESSOR ASSEMBLY.

a. Remove elbow (1, fig. 13-1), and needle valve (2 through 8) as an assembly.

b. If the needle valve is faulty, disassemble as follows:

(1) Loosen nut (3) and unscrew knob (2) from needle (6) .

(2) Remove washer (4), packing (5), needle (6), and housing (7) as an assembly. Remove needle (6) from housing (7).

(3) Do not remove well nuts (18) unless replacement is necessary.

13-4. AIR COMPRESSOR,

a. Disassembly. If the suppression capacitor (36, fig. 31-2) or motor is faulty, disassemble the motor as follows:

(1) Remove the front cover (3) by removing four screws (2).

(2) Remove screw (4). screen (5). and filter (6) from front cover.

(3) Remove four screws (7) and remove head (8).

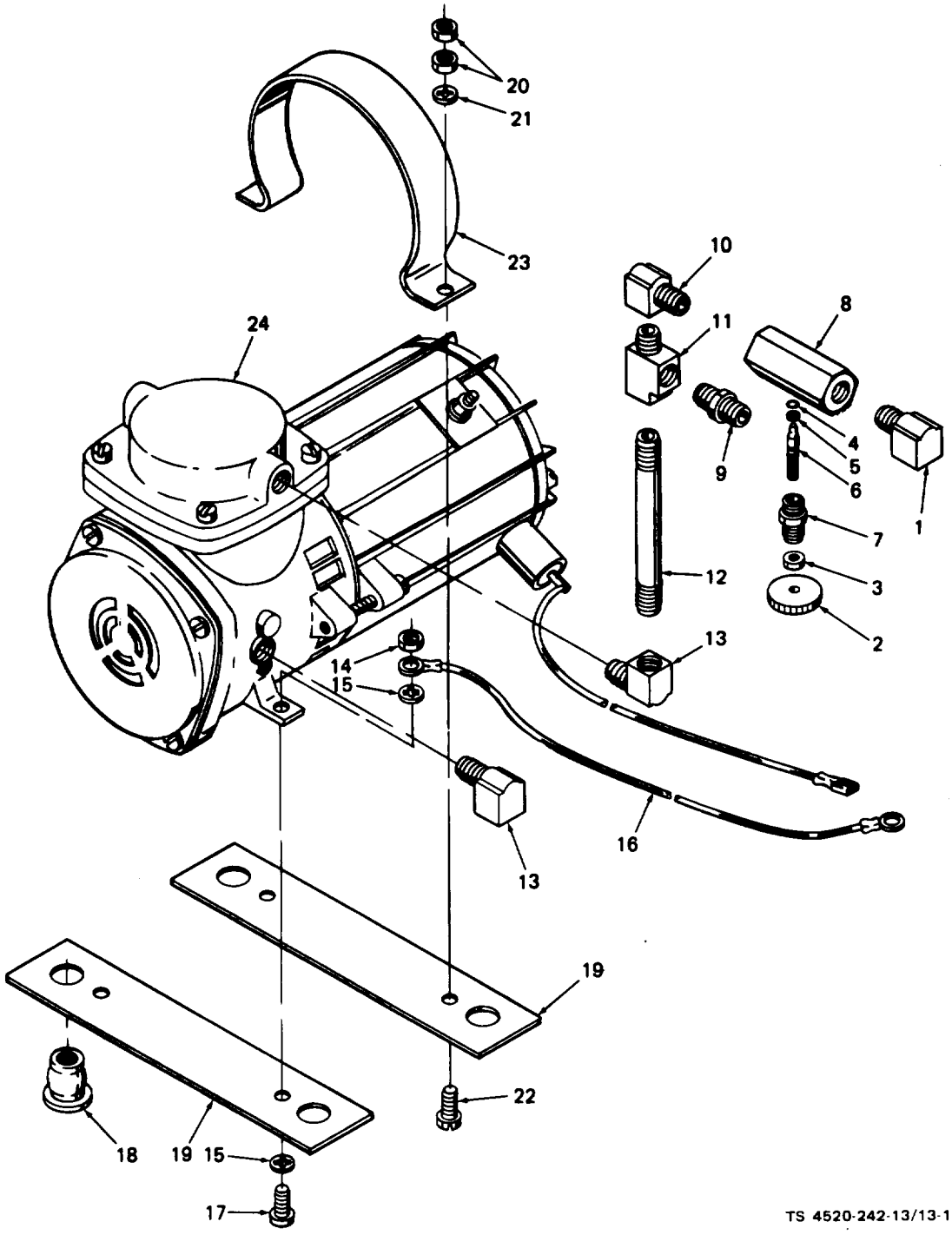
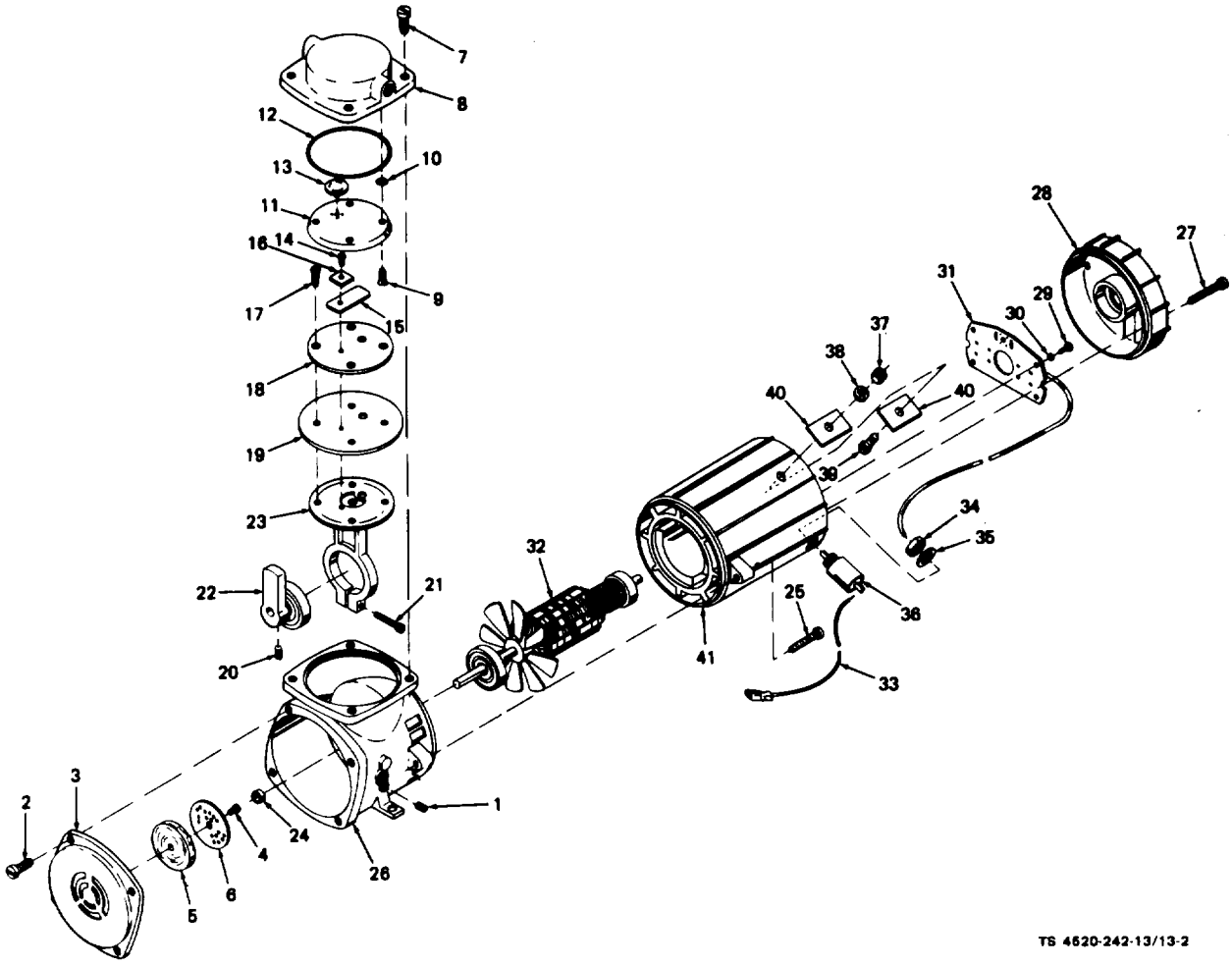


Figure 13-1. Compressor assembly, exploded view.

Legend for fig. 13-1:

1. Elbow
2. Knob
3. Nut
4. Washer
5. Packing
6. Needle
7. Housing
8. Body
9. Connector
10. Elbow
11. Tee
12. Nipple
13. Elbow
14. Nut
15. Lock washer
16. Wire
17. Screw
18. Well nut
19. Compressor mount
20. Nut
21. Lock washer
22. Screw
23. Retainer strap
24. Compressor



1. Pipe plug	15. Flapper valve	29. Screw
2. Screw	16. Valve keeper	30. Lock washer
3. Front cover	17. Screw	31. Brush and lead wire
4. Screw	18. Intake valve plate	32. Armature
5. Screen	19. Diaphragm	33. Wire
6. Filter	20. Setscrew	34. Nut
7. Screw	21. Screw	35. Lock washer
8. Head	22. Eccentric and bearing	36. Suppression capacitor
9. Screw	23. Connecting rod	37. Nut
10. Packing	24. Spacer	38. Lock washer
11. Exhaust valve plate	25. Screw	39. Screw
12. Packing	26. Housing	40. Cover
13. Umbrella valve	27. Screw	41. Housing
14. Screw	28. End cap	

Figure 13-2. Air compressor, exploded view.

(4) Remove screws (9), packing (10), exhaust valve plate (11), packing (12), and umbrella valve (13) from head (8).

(5) Remove screw (14), flapper valve (15), and valve keeper (16).

(6) Remove four screws (17) and remove intake valve plate (18), and diaphragm (19).

(7) Do not remove eccentric and bearing (22) from connecting rod (23) unless replacement is required.

(8) Separate housing (26) and housing (41) by removing two screws (25).

(9) Remove two screws (27) and remove end cap (28).

(10) Remove two screws (29), lock washers (30), unsolder the lead wire from capacitor (36), and remove brush and lead wire assembly (31). Remove armature (32).

(11) Unsolder lead wire (33), remove nut (34), lock washer (35), and capacitor (36).

b. Cleaning and Inspection.

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 (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 100°F (38°C).

(1) Wipe the exterior of the compressor with a cloth dampened with dry cleaning solvent (fed. spec. P-D-680). Prevent solvent from entering the compressor and motor. Clean the motor stator and armature using clean, dry, low pressure (30 psi maximum) compressed air to blow out dust and dirt. Wipe off any grease with a cloth dampened with solvent.

(2) Clean metal parts in dry cleaning solvent and allow to dry thoroughly before reassembly.

(3) Remove and inspect the motor brushes for cracks, chips, wear, or scoring. Replace brushes if damaged or if they show excessive wear.

(4) Inspect the condition of the motor commutator, Replace the motor section of the compressor if the commutator is scored or badly burned. Light scoring of the commutator can be cleaned up using fine sandpaper.

(5) Visually inspect the armature and stator for signs of overheating or other damage. Inspect all bearings for wear and scoring. Replace defective parts.

(6) Inspect the suppression capacitor for burned or broken insulation or other damage. If a capacitance tester is available, test the capacitor. Capacitance should be 0.47 microfarad. If a capacitance tester is not available, test the capacitor for continuity with an ohmmeter. Replace the suppression capacitor if the ohmmeter indicates that it is shorted, or if the capacitance tester indicates it is defective.

(7) Inspect the diaphragm for tears and lacerations. If the diaphragm is damaged or has lost its elasticity it must be replaced.

(8) Inspect the connecting rod for scoring, gall ing, or distortion. Replace a damaged connecting rod.

c. Reassembly. Reassemble the compressor in the reverse order of the Index numbers in figure 13-2. Use new packings (10 and 12) when reassembling the exhaust valve plate to the head.

13-5. REASSEMBLY OF COMPRESSOR ASSEMBLY. Reassemble the compressor assembly in the reverse order of the index numbers in figure 13-1.

13-6. INSTALLATION OF COMPRESSOR ASSEMBLY.

a. Position the compressor in the heater case and install four screws.

b. Install the air tube at the compressor outlet. Install the ignition power supply. Connect the orange lead to the primary terminal block, and the white/black lead to the burner. Install the top and both side panels. Connect the exhaust and fuel supply. Connect the power plug and turn on the fuel supply. Check for proper operation.

c. If the needle valve was disassembled it will require adjusting. Adjust the needle valve as follows:

(1) Loosen nut (3, fig. 13-1) until knob (2) can be turned.

(2) With the heater operating, turn the knob until smooth ignition is obtained. Visually inspect the heat exchanger; if the secondary or main tubes have a red glow, turn the needle valve knob counterclockwise 1/8 of a turn until even ignition or burning is obtained and the red glow is eliminated.

APPENDIX A

REFERENCES

TM 38-750	(The Army Maintenance Manual System (TAMMS)
TM 5-4520-242-23P	Organizational, DS and GS Repair Parts and Special Tools Lists

APPENDIX B

COMPONENTS OF END ITEMS LIST

Section I. INTRODUCTION

B-1. SCOPE. This appendix lists Basic Issue Items (BII) for the heater to help you inventory items required for safe and efficient operation.

B-2. GENERAL. The components of end item list are the following:

a. Section II. Integral Components of the End Item. (Not applicable.)

b. Section III. Basic Issue Items. These are minimum essential items required to place the heater in operation, to operate it, and to perform emergency repairs. Although shipped separately packed, they must accompany the heater during operation and whenever it is transferred between accountable officers. The illustrations will assist you with hard-to-identify items. This manual is your authority to requisition replace Bll based on Table(s) of Organization and Equipment (TOE)/Modification Table of Organization and Equipment (MTOE) authorization of the end item.

B-3. EXPLANATION OF COLUMNS.

a. Illustration. This column is divided as follows:

(1) Figure Number. Indicates the figure number of the illustration on which the item is shown (if applicable).

(2) Item Number. The number used to identify item called out in the illustration.

b. National Stock Number (NSN). Indicates the national stock number assigned to the end item which will be used for requisitioning.

c. Part Number (P/N). Indicates the primary number used by the manufacturer which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards and inspection requirements to identify an item or range of items.

d. Description. Indicates the federal item name and, if required, a minimum description to identify the item.

e. Location. The physical location of each item listed is given in this column. The lists are designed to inventory all items in one area of the major item before moving on to an adjacent area.

f. Usable on Code. "USABLE ON" codes are included to help you identify which component items are used on the different models. Identification of the codes used in this list are:

Code	Used On

g. Quantity Required (Qty Reqd). This column lists the quantity of each item required for a complete major item.

h. Quantity. This column is left blank for use during inventory. Under the received column, list the quantity you actually receive on your major item. The date columns are for use when you inventory the major item at a later date, such as for shipment to another site.

Section II.

INTEGRAL COMPONENTS OF END ITEM

Not Applicable

Section III.

BASIC ISSUE ITEMS

(1) ILLUSTRATION		(2)	(3)	(4)	(5)	(6)	(7)	(8) QUANTITY			
FIGURE NO.	ITEM NO.	NATIONAL STOCK NUMBER	PART NO. & FSCM	DESCRIPTION	LOCATION	USABLE ON CODE	QTY REQD	RCV'D	DATE	DATE	DATE
				Thermostat, Room			1				
				Connector, Electrical, Power			1				
				Connector, Electrical, Room Thermostat			1				
				Technical Manual Operator, Organizational and Direct Support Maintenance Manual (TM5-4520-242-13)			1				

APPENDIX C

EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

C-1. SCOPE. This appendix lists expendable supplies and materials you will need to operate and maintain the heater. These items are authorized to you by CTA50-970, Expendable Items (except Medical, Class V, Repair Parts, and Heraldic Items).

C-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 material (e.g., "Use cleaning compound, Item 5, App. D").

b. Column 2 - Level. This column identifies the lowest level of maintenance that requires the listed item.

(enter as applicable);

C - Operator/Crew
O - Organizational Maintenance
F - Direct Support Maintenance
H - General Support Maintenance

c. Column 3 - National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

d. Column 4 - Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parentheses, if applicable.

e. Column 5 - Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ca, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II.

EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
1	C	9130-00-160-1818	Gasoline, Combat, MIL-G-3056, Type 1 (2 gallons required for 8 hour operation)	Bulk
2	C	9140-00-286-5294	Fuel Oil, Regular, DF-2 (2 gallons required for 8 hour operation)	Bulk
3	C	9140-00-286-5286	Fuel Oil, Winter, DF-1 (2 gallons required for 8 hour operation)	Bulk
4	C	9140-00-286-5283	Fuel Oil, Arctic, DF-A (2 gallons required for 8 hour operation)	Bulk
5	O	6850-00-264-9038	Dry-Cleaning Solvent, P-D-680 Type 1, 5 gallon container (as required)	Gal
6	O	8040-00-828-7385	Sealing Compound, No. 732 RTV, Black, Dow-Corning (71984)	Tube

APPENDIX D

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

D-1. GENERAL.

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. The Maintenance Allocation Chart (MAC) in Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. Section III lists the special too s and test equipment required for each maintenance function as referenced from Section II.

d. Section IV contains supplemental nstructions on explanatory notes for a particular maintenance function.

D-2. MAINTENANCE FUNCTIONS.

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

b. Test. To verify serviceability and detect incipient failure by measuring the mechanical 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, i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. Adjust. To maintain, within prescribed limits, by bringing into proper or exact 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 equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install. The act of emplacing, seating, or fixing into position an item, part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Replace. The act of substituting a serviceable like type part, subassembly, or module component or assembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, or replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), and item, or system.

j. Overhaul. That maintenance effort (services/actions) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications, Overhaul is normally the highest degree of 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 materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipments/components.

D-3. COLUMN ENTRIES USED IN THE MAC.

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

b. Column 2, Component/Assembly. Column 2 contains the names of components, assembl ies, 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, by the listing of a work time figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform the 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 number of man-hours specified by 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, troubleshooting time, and quality assurance/quality control 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
O. . . . . Organization maintenance
F. . . . . Direct support maintenance
H. . . . . General support maintenance
D. . . . . Depot maintenance

e. Column 5, Tools and Equipment. Column 5 specifies, by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

f. Colunm 6, Remarks. This column shall contain a letter code in alphabetical order which shall be keyed to the remarks contained in Section IV.

D-4. COLUMN ENTRIES USED IN TOOL AND TEST EQUIPMENT REQUIREMENTS.

a. Column 1, Tool or Test Equipment Reference Code. The tool and test equipment reference code correlates with a maintenance function on the identified end item or component.

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/NATO Stock Number. The National or NATO stock number of the tool or test equipment.

e. Column 5, Tool Number. The manufacturer's part number.

D-5. EXPLANATION OF COLUMNS IN SECTION IV.

a. Reference Code. The code scheme recorded in column 6, Section II.

b. Remarks. This column lists information pertinent to the maintenance function being performed as indicated on the MAC, Section II.

Section II. MAINTENANCE ALLOCATION CHART

(1) Group number	(2) Component/Assembly	(3) Maintenance function	(4) Maintenance level C	O	F	H	D	(5) Tools and equipment	(6) Remarks
01	HEATER ASSEMBLY	Install		0.5					
		Service	0.2						
		Replace		0.5					
02	HOUSING PANELS AND LOUVERS								
0201	Cover Panels	Inspect		0.1					
		Service		0.1					
		Replace		0.1					
		Repair		0.3					
0202	Louver	Inspect		0.1					
		Service		0.1					
		Replace		0.1					
		Repair		0.3					
0203	Case	Inspect		0.1					
		Service		0.1					
		Replace			8.0				
0204	Data Plates	Inspect		0.1					
		Replace			0.5				
	Instruction								
	Identification								
	Schematic								
	Wiring								
03	ELECTRICAL								
0301	Control Panel Assembly	Inspect		0.1					
		Test			0.5				
		Replace			0.5				
		Repair			2.2				
	Switch, On-Off	Test		0.5					
		Replace		0.5					
	Reset, Time Delay	Test			0.5				
		Replace			1.O				
	Receptacle, Power	Inspect		0.5					
	and Thermo	Replace			1.0				
	Fuses	Inspect		0.1					
		Replace		0.1					
0302	Ignition Power Supply	Test			0.3				
	Assembly	Replace			0.3				
		Repair			2.3				
	Ignition Cable	Inspect		0.2					
	Capacitor, Suppres-	Test			0.5				
	sion	Replace			1.5				

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F - DIRECT SUPPORT; H - GENERAL SUPPORT; D - DEPOT
** INDICATES WT/MH REQUIRED

Section II. MAINTENANCE ALLOCATION CHART - Continued

(1) Group number	(2) Component/Assembly	(3) Maintenance function	(4) Maintenance level C	O	F	H	D	(5) Tools and equipment	(6) Remarks
03	ELECTRICAL - Continued								
0303	Wiring and Terminal Blocks	Inspect			0.1				
		Test			0 3				
		Replace			1.0				
		Repair			1.0				
0304	Motor Control Resistor	Inspect			0.1				
		Test			0.2				
		Adjust			0.5				
		Replace			0.3				
0305	Room Thermostat	Service		0.1					
		Inspect		0.1					
		Adjust	0.1						
		Replace		0.3					
0306	Overheat Thermostat	Test			0.5				
		Replace			0.6				
0307	Safety Thermostat	Test			0.5				
		Replace			0.6				
0308	Cartridge and Thermostat Assembly	Test			0,5				
		Replace			1.5				
0309	Glow Plug Thermostat	Test			0.5				
		Replace			0.6				
0310	Delay Relay	Test			0.2				
		Replace			0.1				
04	BURNER ASSEMBLY								
0401	Burner Head	Inspect			0.5				
		Service			0.5				
		Adjust			0.2				
		Replace			1.5				
0402	Spark Plug	Inspect		0.2					
		Service		0.2					
		Replace		0.2					
0403	Glow Plug	Inspect		0.2					
		Service		0.2					
		Test		0.2					
		Replace		0.2					
0404	Fuel Adjustment Needle	Inspect		0.2					
		Adjust		0.2					
		Replace		0.2					

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Section II. MAINTENANCE ALLOCATION CHART - Continued

(1) Group number	(2) Component/Assembly	(3) Maintenance function	(4) Maintenance level C	O	F	H	D	(5) Tools and equipment	(6) Remarks
05	FUEL SYSTEM								
0501	Fuel Tubing and Fittings	Inspect	0.1						
		Service		0.1					
		Replace		0.3					
0502	Fuel Float Bowl	Service		0.3					
		Replace			1.6				
		Repair			1.3				
0503	Solenoid Valve	Service		0.3					
		Test			0.3				
		Replace			1.6				
0504	Fuel Filter	Inspect		0.2					
		Service		0.2					
		Replace		0.2					
0505	Fuel Pump	Service		0.3					
		Test		0.3					
		Replace			1.0				
		Repair			1.0				
06	HEAT EXCHANGER								
0601	Exhaust Connection	Inspect			0.1				
		Replace			0.6				
0602	Housing	Inspect			0.1				
		Replace			2.4				
0603	Heat Exchanger	Inspect			0.2				
		Replace			3.0				
0604	Rain Shield	Inspect			0.1				
		Replace			0.2				
07	BLOWER ASSEMBLY								
0701	Axial Fan	Service			0.2				
		Replace			0.2				
0702	Blower Support Assembly	Inspect			0.2				
		Replace			0.6				
0703	Motor	Inspect			0.1				
		Test			0.3				
		Replace			0.8				
		Repair			1.3				
	Capacitor, Suppression	Test			0.5				
		Replace			0.8				
	Brushes	Inspect			0.3				
		Replace			0.3				
	Armature	Inspect			0.5				
		Service			0.5				
		Test			0.5				

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** INDICATES WT/MH REQUIRED

Section II. MAINTENANCE ALLOCATION CHART - Continued

(1)	(2)	(3)	(4)					(5)	(6)
Group number	Component/Assembly	Maintenance function	Maintenance level C	O	F	H	D	Tools and equipment	Remarks
07	BLOWER ASSEMBLY - Continued								
0704	Blower Housing	Inspect			0.1				
		Replace			1.4				
		Repair			1.0				
08	COMPRESSOR ASSEMBLY								
0801	Diaphragm	Inspect			0.2				
		Replace			0.7				
0802	Motor	Inspect			0.2				
		Test			0.3				
		Repair			1.2				
	Capacitor Suppression	Test			0.5				
		Replace			0.5				
	Brushes	Inspect			0.3				
		Replace			0.3				
	Armature	Inspect			0.5				
		Service			0.5				
		Test			0.5				

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** INDICATES WT/MH REQUIRED

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS

(1) Reference code	(2) Maintenance level	(3) Nomenclature	(4) National/NATO stock number	(5) Tool number
		No special tools and test equipment required. Standard tools and test equipment contained in following tool kits are adequate to accomplish maintenance functions listed in Section II;		
		Tool Kit, Service, Refrigeration Unit (SC 5180-90-CL-N18)	5180-00-597-1474	
		Soldering Gun Kit	3439-00-930-1638	

Section IV. REMARKS

MAINTENANCE ALLOCATION CHART

Reference code	Remarks
	No supplemental instructions or explanatory remarks are required for the maintenance functions listed Section II. All functions are sufficiently defined in Section I. Active time listed for maintenance task functions are with the heater in an off-equipment position.

INDEX

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*U.S.GOVERNMENT PRINTING OFFICE: 1979-665- 034 1324

By Order of the Secretary of the Army:

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General, United States A rmy
Chief of Staff

Official:

J. C. PENNINGTON
Major General, United States Army
The Adjutant General

DISTRIBUTION :
To be distributed in accordance with DA Form 12-25C Operator Maintenance Requirements for Heaters, Space, 15,000 BTU.

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

SOMETHING WRONG WITH THIS MANUAL?

THEN. . .JOT DOWN THE DOPE ABOUT IT ON THIS FORM, TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

FROM: (YOUR UNIT'S COMPLETE ADDRESS)
PFC JOHN DOE
COA, 3d ENGINEER BN
FT. LEONARD WOOD MO 63108

DATE

PUBLICATION NUMBER	DATE	TITLE
TM 5-4520-242-13	21 Sep 79	Heater, Space Multifuel with Blower 15,000 BTU/HR

BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO.	PARAGRAPH	FIGURE NO.	TABLE NO.
6	2-1 a		
81		4-3	
125	line 20		

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

In line 6 of paragraph 2-1a the manual states the engine has 6 cylinders. The engine on my set only has 4 cylinders. Change the manual to show 4 cylinders.

Callout 16 on figure 4-3 is pointing at a bolt. In the key to fig. 4-3, item 16 is called a shim. Please correct one or the other.

I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gasket but it doesn't fit. Supply says I got what I ordered so the NSN is wrong. Please give me a good NSN.

SAMPLE

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER
JOHN DOE, PFC (268) 317-7111

SIGN HERE:
John Doe

DA FORM 1 AUG 74 2028-2 (TEST)

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR MANUAL "FIND," MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

DRSTS-M Overprint 1, 1 Nov 78

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DATE

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TM 5-4520-242-13	21 Sep 79	Heater, Space Multifuel With Blower 15,000 BTU/HR, 28 VDC

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PAGE NO.	PARAGRAPH	FIGURE NO.	TABLE NO.

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

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REVERSE OF DA FORM 2028-2 (TEST)

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = . 39 inch
1 decimenter = 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 decigrams = . 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 milliliters = . 34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 38.82 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. decimenter = 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	0square 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	1.365	metric tons	short tons	1.102
pound-inches	newton-meters	.11375			

Temperature (Exact)

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

PIN: 042646-000