TECHNICAL MANUAL

Operator's, Unit, Direct Support and General Support Maintenance Manual

AIR CONDITIONER, VERTICAL, COMPACT 9,000 BTU/HR 115 VOLT, 1-PHASE, 50/60 HERTZ (NSN 4120-01-193-4999)

* This manual supersedes TM 5-4120-385-14, dated 31 July 1986, including all changes.

HEADQUARTERS, DEPARTMENT OF THE ARMY
24 JUNE 1992

CHANGE NO. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 31 March 1993

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

AIR CONDITIONER, VERTICAL, COMPACT
9,000 BTU/HR 115 VOLT,
1-PHASE, 50/60 HERTZ
(NSN 4120-01-193-4999)

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TM 9-4120-385-14, 24 June 1992, is changed as follows:

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Remove pages	Insert pages
4-17 and 4-18	4-17 and 4-18
4-53 and 4-54	4-53 and 4-54
4-63 and 4-64	4-63 and 4-64
- - - -	4-64.1/(4-64.2 blank)
5-3 and 5-4	5-3 and 5-4
B-7 and B-8	B-7 and B-8

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

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DISTRIBUTION:
To be distributed in accordance with DA Form 12-25-E, block no. 5792, requirements for TM 9-4120-385-14.

WARNING

Notices in this manual must be obeyed by all personnel. Failure to do so can result in serious injury, or death.

WARNING

Do not use steam, open flame, heat gun, or any other high temperature source to thaw an iced coil. Thaw an iced coil by operating unit in high heat mode, or by leaving unit shut down until ice melts.

WARNING

Compressed air used for cleaning purposes will not exceed 30 psi (2.1 kg/ cm^2). Do not direct compressed air against skin. Use goggles or full face shield.

WARNING

Avoid inhaling ties from acid formed by bum out of oil and refrigerant. Wear gas mask if area is not thoroughly ventilated. Wear protective goggles or glasses to protect eyes. Wear rubber gloves to protect hands. Use care to avoid spilling compressor bum out sludge. If sludge is spilled, clean area thoroughly.

WARNING

Clean parts in well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38 °C to 59 °C).

WARNING

DEATH ON CONTACT or severe injury may result if personnel fail to observe safety precautions. Always disconnect the air conditioner from power source before performing maintenance on this equipment. If power must remain on for troubleshooting, exercise extreme care to avoid contact with any electrical component, fan, fan motor, etc.

WARNING

Whenever possible, input power supply to the equipment must be shut off before beginning work. Take particular care to ground every capacitor likely to hold a dangerous potential charge. When working inside after power has been turned off, always ground every part before touching it.

WARNING

Do not operate equipment without all grilles, guards, louvers, and covers in place and tightly secured.

WARNING

The burning of polyurethane foam is dangerous. Due to the chemical composition of a polyurethane foam, toxic fumes are released when it is burned or heated. If it is burned or heated indoors, such as during a welding operation in its proximity, precautions should be taken to adequately ventilate the area. An exhaust system equivalent to that of a paint spray booth should be used. Air supply respirators, approved by the National Institute for Occupational Safety and Health or U.S. Bureau of Mines should be used for all welding in confined spaces and when ventilation is inadequate.

WARNING

DEATH or severe injury may result if personnel fail to observe safety precautions. Never use a heating torch on any part that contains Refigerant-22. Avoid bodily contact with liquid refrigerant and avoid inhaling refrigerant gas.

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NO. 4120-385-14

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 24 JUNE 1992

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AIR CONDITIONER, VERTICAL COMPACT
9,000 BTU/HR
115 VOLT,
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REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistake or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual directly to: Commander, U.S. Army Troop Support Command, ATTN: AMSTR-MMTS, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798. A reply will be furnished directly to you.

Approved for public release; distribution is unlimited.

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CHAPTER 1

INTRODUCTION

Section I. GENERAL INFORMATION

1-1. SCOPE

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

b. Model Number and Equipment Name: Air Conditioner, 9,000 BTU/HR, Vertical, Compact, 115 Volt, 1-Phase, 50/60 Hertz, Model Number ECU-9VC116.

c. Purpose of Equipment: Cools and heats enclosed space (shelter or van). The unit covered by this manual is designed for cooling and heating air to a desired predetermined range and circulating the conditioned air to provide heating and cooling of equipment or personnel within the sheltered area.

1-2. MAINTENANCE FORMS, RECORDS, AND REPORTS

Department of the Army forms and procedures used equipment maintenance will be those prescribed by DA PAM 738-750, The Army Maintenance Management System (TAMMS).

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

Command decisions, according to the tactical situation, will determine when destruction of the air conditioner will be accomplished. A destruction plan will be prepared by the using organization, unless one has been prepared by higher authority. For general destruction procedures for this equipment, refer to TM 750-244-3, Procedures for Destruction of Equipment to Prevent Enemy Use.

1-4. PREPARATION FOR STORAGE OR SHIPMENT

Administrative storage of the air conditioner shall conform generally with the provisions of TM 740-90-1, Administrative Storage of Equipment.

1-5. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIRs)

If your air conditioner needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Tell us why a procedure is hard to perform. Put it on an SF-368 (Quality Deficiency Report). Mail it to us at Commander, Headquarters, U.S. Army Troop Support Command, ATTN: AMSTR-MOF, 4300 Goodfellow Boulevard, St Louis, MO 63120-1798. We'll send you a reply.

Section II. EQUIPMENT DESCRIPTION AND DATA

1-6. PURPOSE OF AIR CONDITIONER

Cools and heats enclosed space (shelter or van). The unit covered by this manual is designed for cooling and heating air to a desired predetermined range and circulating the conditioned air to provide heating and cooling of equipment or personnel within the sheltered area.

1-7. CHARACTERISTICS

- Heats or cools air into a shelter or van as required.
- Ventilates or circulates air in a shelter or van

1-8. CAPABILITIES AND FEATURES

- Cooling capacity on COOL, BTU/HR 9,000
- Heating capacity on HI HEAT, BTU/HR 6,000
- Heating capacity on LO HEAT, BTU/HR 3,000
- Power requirement

Voltage	115
Phases	1
Frequency, Hertz	50/60
Amperes (maximum)	
Cooling	33.0
Heating	33.0
Watts, running (maximum)	
Cooling	3.6 KW
Heating	3.6 KW
Refrigerant type	R-22
Amount of charge	3lb 5 oz (kg)

1-9. OPERATING TEMPERATURES

The air conditioner is capable of functioning as follows:

- Start, operate, and cycle on COOL mode up to 120° (49°C) ambient temperature with air up to 120° (49 °C) entering the evaporator and condenser.
- Operate on COOL mode without forming frost or ice on the evaporator at 55°F (13°C) ambient temperature with air at 67°F (19 °C) dry bulb and 57 °F (14 °C) wet bulb entering the evaporator.
- Operate on the HI-HEAT mode in ambient temperatures as low as -50°F (-10°C) and as high as 80 °F (27 °C).
- Start and operate on cooling mode at 0 °F (-18 °C) ambient temperature with air at 70 °F (21 °C) entering the evaporator.

1-10. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

a. CONDENSER AREA. See Figures 1-1 and 1-2.

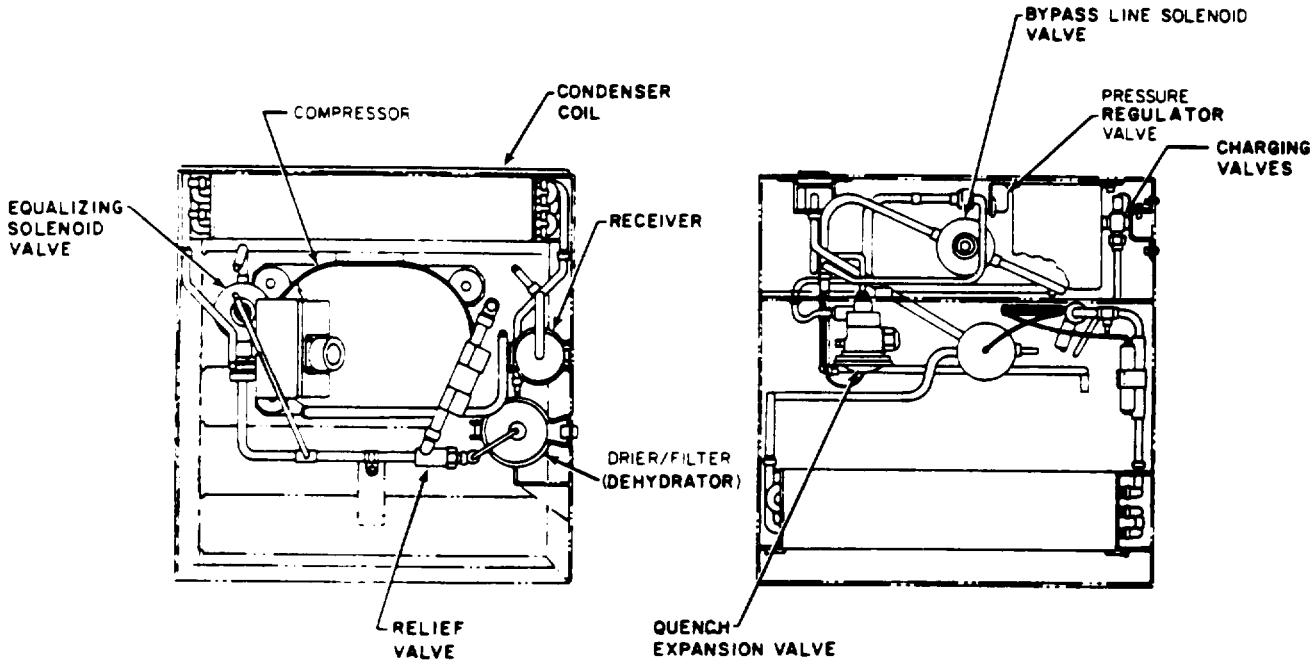


Figure 1–1. Air Conditioner, Condenser Section.

• EQUALIZING SOLENOID VALVE: This solenoid valve causes discharge and suction pressures to equalize whenever compressor is not operating.

• BYPASS LINE SOLENOID VALVE: This solenoid valve controls flow of liquid refrigerant to the evaporator coil.

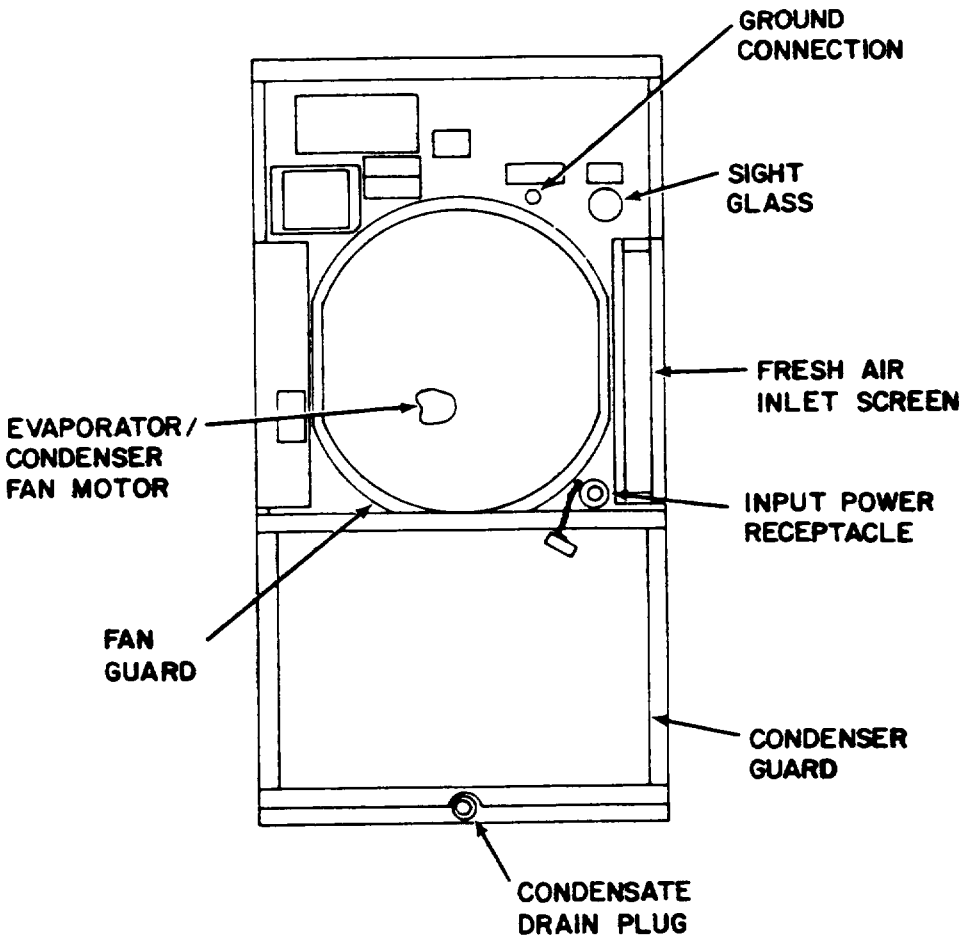


Figure 1–2. Air Conditioner, Condenser Section.

• QUENCH EXPANSION VALVE: This valve controls expansion of liquid refrigerant to gas in the suction line when the suction line superheat rises above 30 °F to 31 °F (-1 °C to 0 °C).

• DRIER/FILTER (DEHYDRATOR): A dehydrator is a device used to remove water or water vapor from the refrigerant.

• CONDENSER COIL: It is constructed of interconnected parallel tubes which are retained in a series of multiple, closely spaced fins. Hot compressed gas is air-cooled to a liquid in this coil.

• COMPRESSOR: It consists of a reciprocating compressor driven by an electric motor, hermetically sealed into a steel container with a lifetime charge of oil. A crankcase heater tube is located on the side of the container. The heater is thermostatically controlled to prevent migration of liquid refrigerant into the crankcase where it would become mixed with the oil.

• PRESSURE REGULATOR VALVE: The pressure regulator valve is part of the hot gas bypass circuit and opens when the compressor suction pressure drops below a preset level of 58 psig (4.07 kg/ cm^2).

• RELIEF VALVE: The relief valve opens when the discharge line pressure rises above 555 psig (39.02 kg/ cm^2).

Ž CHARGING VALVES: The charging valves provide connection ports so that refiigerant can be put into system. They also provide ports for checking system operating pressures.

Ž EVAPORATOR/CONDENSER FAN MOTOR: This motor drives the condenser impeller which draws outside air over and through the condenser coil in order to remove the heat from the hot gas entering the condenser coil. This motor also drives the evaporator impeller which draws air through the air filter, over the evaporator coil and exhausts it into the conditioned area.

• CONDENSER GUARD: The guard protects the condenser coil from damage.

• RECEIVER: The receiver is a storage tank for liquid refrigerant.

• INPUT POWER RECEPTACLE: Connection for power supply.

• GROUND CONNECTION: The ground connection is an external point where shelter or van electrical ground is connected to the air conditioner.

Ž SIGHT GLASS, LIQUID INDICATOR: The condition of liquid refrigerant flowing through the system can be observed through this window when the compressor is operating in the cooling mode. A milky or bubbly appearance of the refrigerant indicates that the system contains insufficient refrigerant, and that more must be added. The center of the sight glass has an area which indicates moisture content of the refrigerant. This area will change colors: green, yellow/green, and yellow.

COLOR	MOISTURE CONTENT
Green	None
Yellow/green	Slight
Yellow	Replace drier/filter and refrigerant

• CONDENSATE DRAIN PLUG: Drain connection for water collected below evaporator coil.

• FRESH AIR INLET SCREEN: This screen cleans outside air drawn into the shelter.

• FAN GUARD: The guard protects individuals from fan and protects fan from damage.

NOTE

The air conditioner can be equipped for operation in chemical-biological-radiological (CBR) environment by connecting filtering equipment to the fresh air filter.

b. EVAPORATOR AREA: See Figures 1-3 and 1-4.

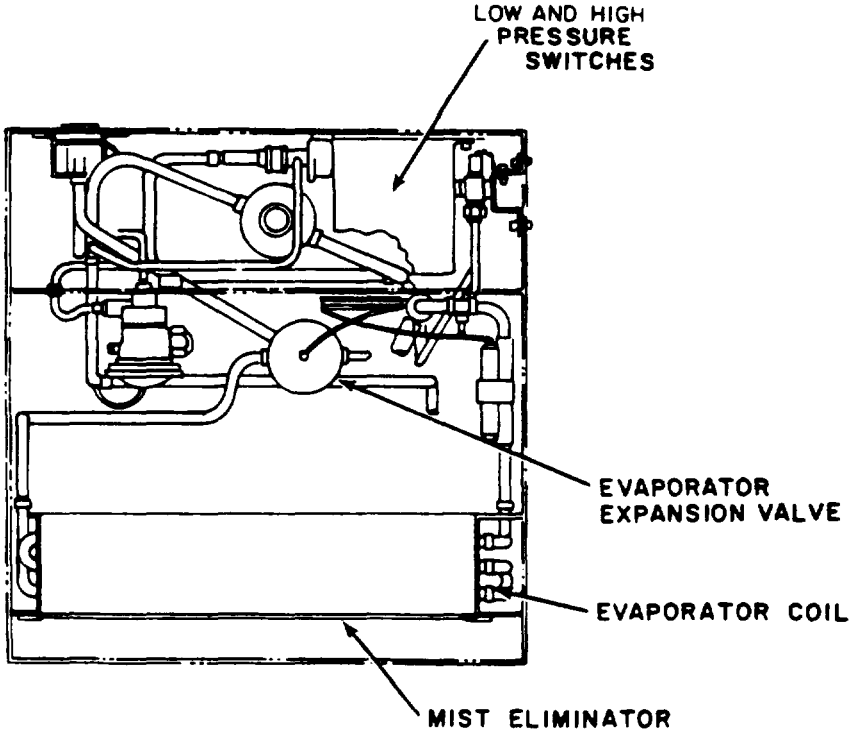


Figure 1-3. Air Conditioner, Evaporator Section.

• EVAPORATOR EXPANSION VALVE: This valve controls the amount of liquid refrigerant to the evaporator.

• EVAPORATOR COIL: The evaporator coil converts the liquid refrigerant into gas to cool the air.

• MIST ELIMINATOR: The purpose of the mist eliminator is to trap droplets of condensed water which have formed on the evaporator coil, so that they will not be blown into the air conditioned space.

• LOW PRESSURE SWITCH: This switch opens when suction line pressure drops to 20 to 30 psig (1.406 to 2.109 kg/ cm^2). This switch must be manually reset after the line pressure rises above 40 psig (2.812 kg/ cm^2).

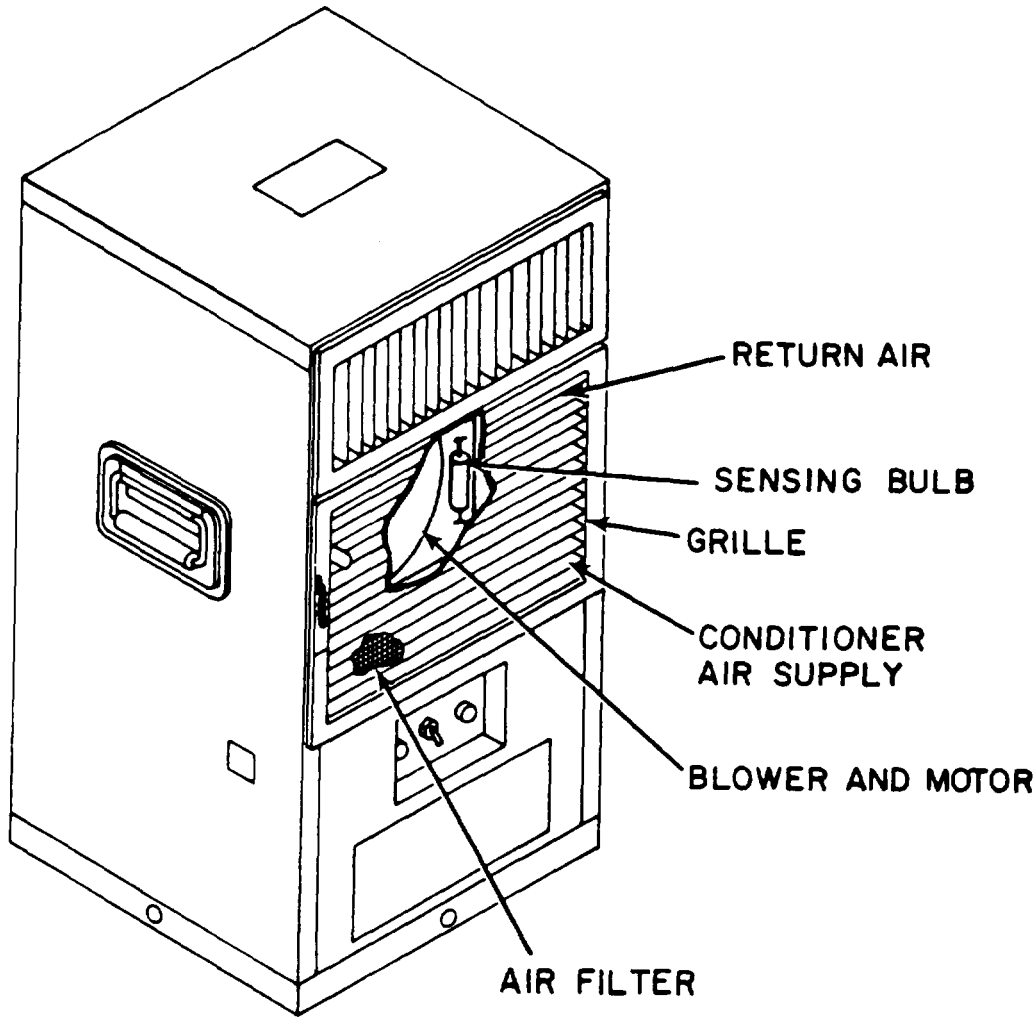


Figure 1-4. Air Conditioner, Evaporator Section.

• HIGH PRESSURE SWITCH: The high pressure switch opens when the discharge line pressure rises to 470 to 490 psig (33.041 to 34.447 kg/ cm^2) to stop the compressor. This switch must be manually reset after the line pressure drops to 320 psig (22.50 kg/ cm^2).

• AIR FILTER AND GRILLE: The air filter removes dirt and dust from the air that is to be conditioned. The air falter is located behind the grille.

• SENSING BULB: The sensing bulb senses the air temperature in the evaporator section to maintain an even temperature of cooling air into the conditioned area.

c. HEATING AREA. See Figure 1-5.

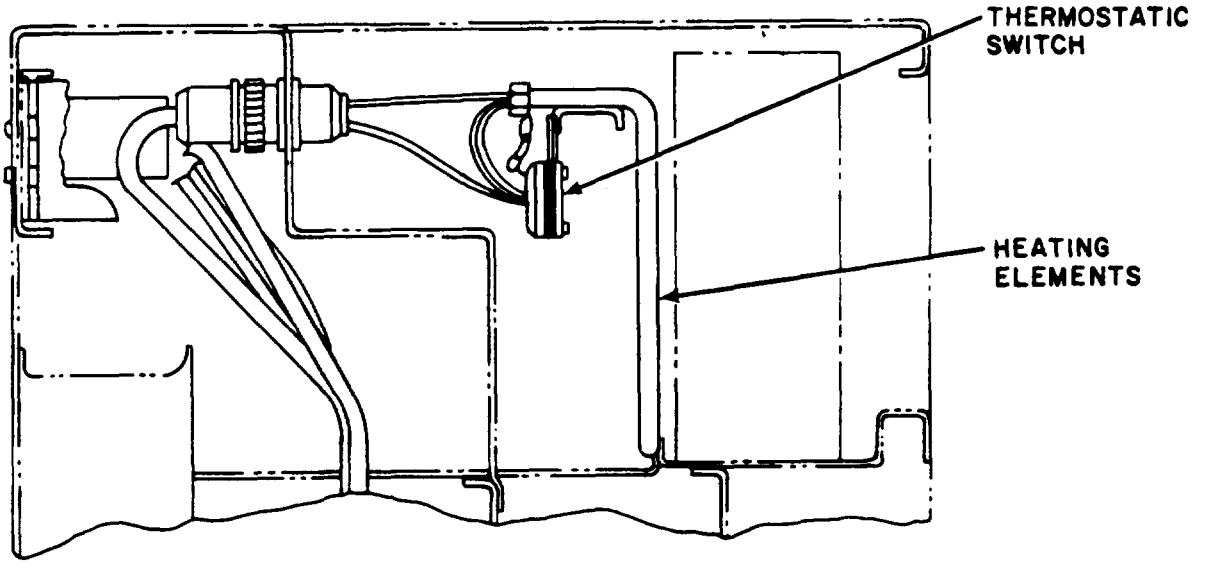


Figure 1–5. Air Conditioner, Heating Section.

• HEATING ELEMENTS: The heating elements heat the air before it passes through the evaporator coil while operating in the heat mode.

• THERMOSTATIC SWITCH (OVERHEAT SAFETY): The thermostatic switch opens the heating circuit at 205 °F (90 °C) and closes at 139 °F (61 °C).

1-11. EQUIPMENT DATA

a. TYPES OF CONDITIONING AVAILABLE.

VENTILATE MODE	Air ventilation and filtering.
COOL MODE	Cooling, filtering, and dehumidification.
HI-HEAT MODE	High velocity heating.
LO-HEAT MODE	Low velocity heating.
HI-SPEED Fan	Maximum velocity for cooling, ventilating, or heating.
LO-SPEED Fan	Minimum velocity for cooling, ventilating, or heating.

b. COOLING CAPACITY. 9,000 BTU/HR at 90 °F (32.2 °C) dry bulb 75 °F (23.9 °C) wet bulb air to evaporator and 120 °F (49 °C) ambient air conditions.

HEATING CAPACITY (HI-HEAT MODE). 6,000 BTU/HR in ambient of -75 °F to 80°F (-59.4 °C to 26.7 °C).

d. CONDITIONED AIRFLOW (MAXIMUM) is 335 SCFM (9.4 m^3/m).

e. ELECTRICAL POWER REQUIREMENTS. 115 volts ac, 1 phase, 50/60 Hz

f. REFRIGERANT (R22). 3 pounds 5 oz.

g. PHYSICAL CONDITIONS.

Dimensions:
17 inches (43.18 cm wide)
17 inches (43.18 cm deep)
32 inches (81.28 cm high)

Weight: 200 pounds (90.8 kg)

h. EVAPORATOR/CONDENSER MOTOR RATING.

Voltage	115
Frequency	50/60
Phase	Single
RPM	3464
Amperes	8.4
Horsepower	1.09
Duty cycle	Continuous
Thermal Protector	440°F (180°C)
Rotation (Facing Condenser end)	Clockwise

i. COMPRESSOR MOTOR RATING.

Voltage	115
Frequency	50/60 Hz
Phase	Single
Thermal Protector	Internal

j. SWITCH SETTING.

Low Pressure Cutout: Open at 20 to 30 psig (1.406 to 2.109 kg/ cm^2). Hand reset when pressure rises to 40 psig (2.812 kg/ cm^2).

High Pressure Cutout: Open at 470 to 490 psig (33.04 to 34.45 kg/ cm^2). Hand reset when pressure decreases to 320 psig (22.50 kg/ cm^2).

Section III. TECHNICAL PRINCIPLES OF OPERATION

1–12. REFRIGERATION CYCLE

a. THE REFRIGERATION CYCLE. The refrigeration system removes heat from a given area. See Figure 1-6 for a schematic of the refrigeration cycle.

COMPONENT REFERENCE LIST		
DESIGNATION	PART NO	DESCRIPTION
B1	13208E4182-5	COMPRESSOR
B2	13214E3728-11	FAN MOTOR
C	13214E3708	COIL, CONDENSER
D	13214E3557	FILTER-DRIER, REFRIGERANT
E	13220E0607	COIL, EVAPORATOR
G	13211E8218	GLASS, SIGHT
L1	13214E3524	VALVE, SOLENOID
L2	13214E3524	VALVE, SOLENOID
R	13214E3708-2	RECEIVER
S5	13211E8404	SWITCH, HIGH PRESSURE CUTOUT
S6	13214E3794	SWITCH, LOW PRESSURE CUTOUT
S8	13221E9273-2	SWITCH, PRESSURE
V1	13219E9499-1	VALVE, CHARGING WITH CAP
V2	13214E3742	REGULATOR, FLUID PRESSURE
V3	13211E8369	VALVE, PRESSURE RELIEF
V4	13214E3705-2	VALVE, QUENCH
V5	13214E3568-2	VALVE, EXPANSION
V6	13219E9499-1	VALVE, CHARGING WITH CAP

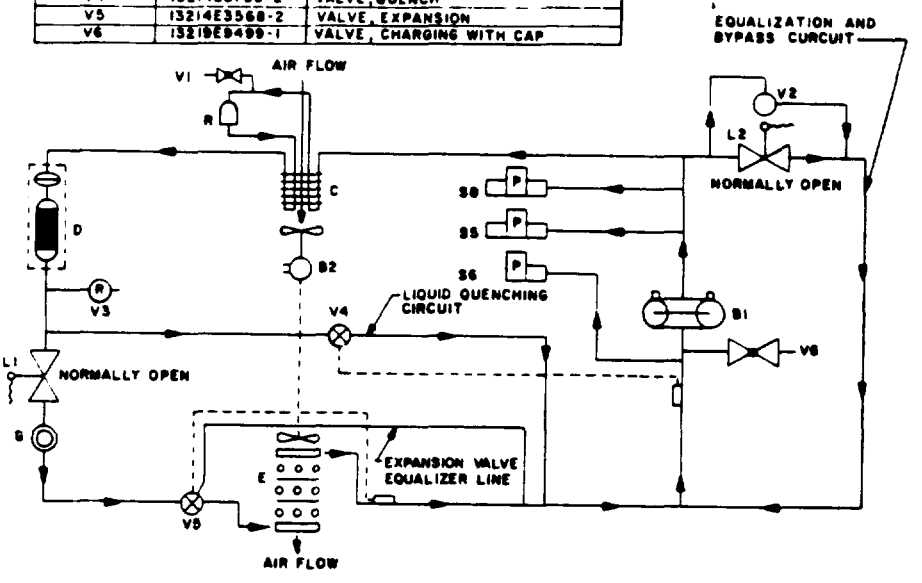


Figure 1-6. Schematic of Refrigeration Cycle.

(1) The compressor (B1) takes cold, low pressure refrigerant gas and compresses it to a high temperature, high pressure gas. This gas flows through the copper tubing to the condenser coil (C) and receiver (R).

(2) The condenser fan draws outside ambient air over and through the condenser coil (C). The high temperature, high pressure gas from the compressor (B1) is cooled by the flow of air and is changed into a high pressure liquid.

(3) The liquid sight glass (G) indicates the presence of moisture and quantity of refrigerant in the system.

(4) The drier/filter dehydrator (D) removes any moisture (water vapor) or dirt that may be carried by the liquid refrigerant.

(5) The solenoid valve (L1) is controlled by the temperature control knob on the control panel. This valve will shut off the flow of refrigerant to the evaporator section when the temperature in the conditioned area reaches the set point.

(6) The expansion valve (V5) controls the amount and pressure of liquid refrigerant to the evaporator coil (E). The expansion valve (V5) senses the temperature and pressure of the refrigerant as it leaves the evaporator coil. Because of the sensing bulb and "external equalizer line" the valve constantly adjusts the flow of liquid refrigerant to the evaporator coil (E).

(7) As the high pressure liquid refrigerant leaves the expansion valve (V5), it enters the evaporator coil (E). As the liquid enters the coil, due to the size difference between the coil and the tubing, the pressure is suddenly decreased. As the pressure decreases, the liquid refrigerant "flashes" to a gas. The evaporator impeller circulates the return air from the conditioned space over and through the evaporator coil. Liquid absorbs heat when it changes from a liquid to a gas. As the air from the conditioned space comes in contact with the evaporator coil (E), the air is cooled.

(8) To prevent compressor damage during startup, the solenoid valve (L2) is normally open to equalize pressure on both sides of the compressor.

b. BYPASS SYSTEM. This unit has a bypass system which allows cooling operation at low cooling loads without cycling the compressor on and off. In bypass, the refrigerant is piped from the discharge to the suction side of the compressor, bypassing the evaporator coil (E).

(1) When the temperature selector on the control panel senses that cooling conditions have reached the set point, it closes the solenoid valve (L2) to shut off refrigerant flow to the evaporator coil (E).

(2) As the compressor suction pressure starts to drop, the pressure regulator (V2) opens to allow flow of hot gas from the compressor.

(3) The quench valve (V4) senses the temperature of the gas at the suction side of the compressor. To prevent excessively hot gas from reaching the compressor, the quench valve (V4) opens to allow liquid refrigerant to mix with the hot gas.

1–13. HEATING

When the mode selector is set for HI-HEAT, six heating elements, located behind the evaporator coil, are energized. These elements are protected from overheating by a thermal cutout switch. Three of the elements are controlled by the temperature selector, and the remaining three are on all of the time. When set for LO–HEAT, only the three thermostatically controlled elements are energized.

CHAPTER 2

OPERATING INSTRUCTIONS

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

CAUTION

Before turning on any of the air conditioner's operating controls, make sure that the fabric cover is rolled up and secured, and that evaporator intake and discharge grilles are fully open.

2–1. CONTROLS AND INDICATORS

CAUTION

To start unit on COOL mode at 0°F (–18°C) ambient, contact unit maintenance.

NOTE

The control range of the temperature control knob is approximately 40°F to 90°F (4.44° to 32.2°C).

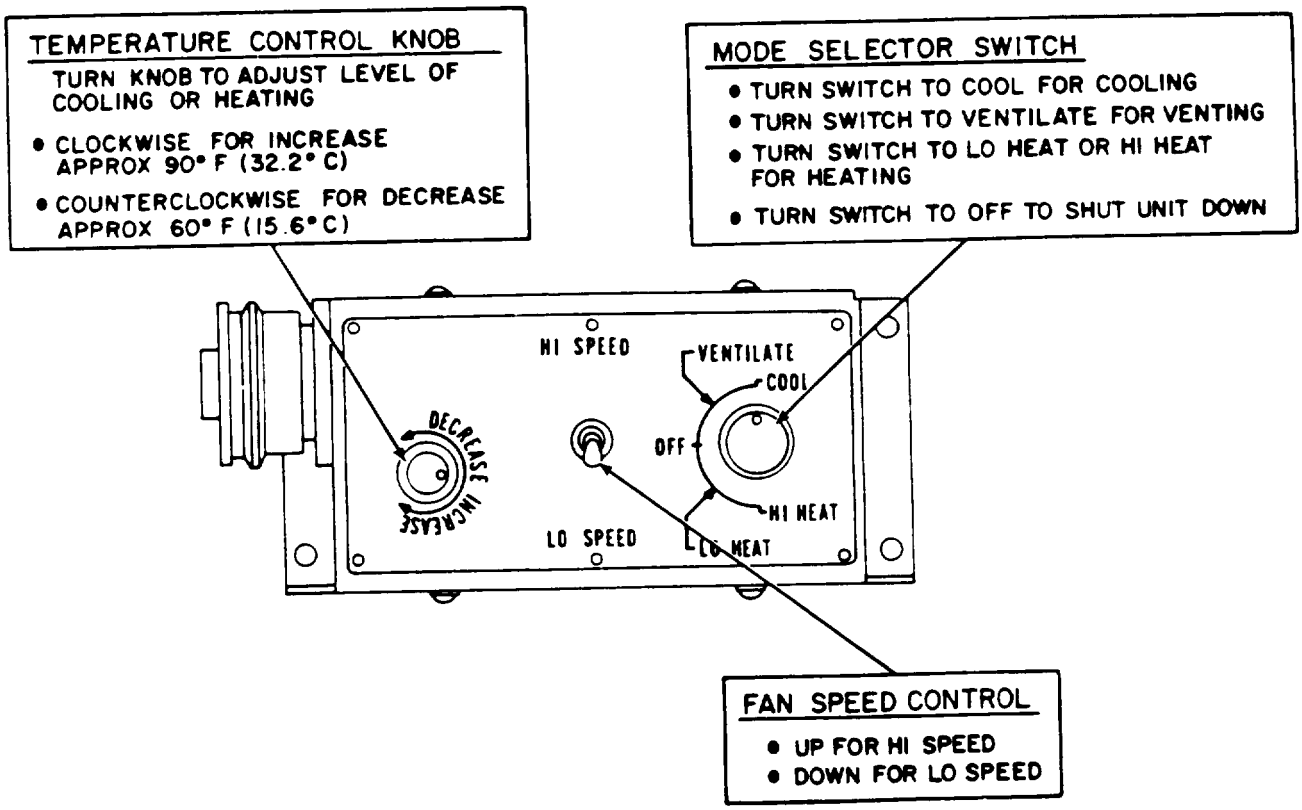


Figure 2–1. Front Controls and Indicators.

NOTE

Cool air is denser than warm air, so it tends to sink downward; therefore, it is desirable to direct cool air slightly upward and warm air slightly downward for maximum comfort and coverage.

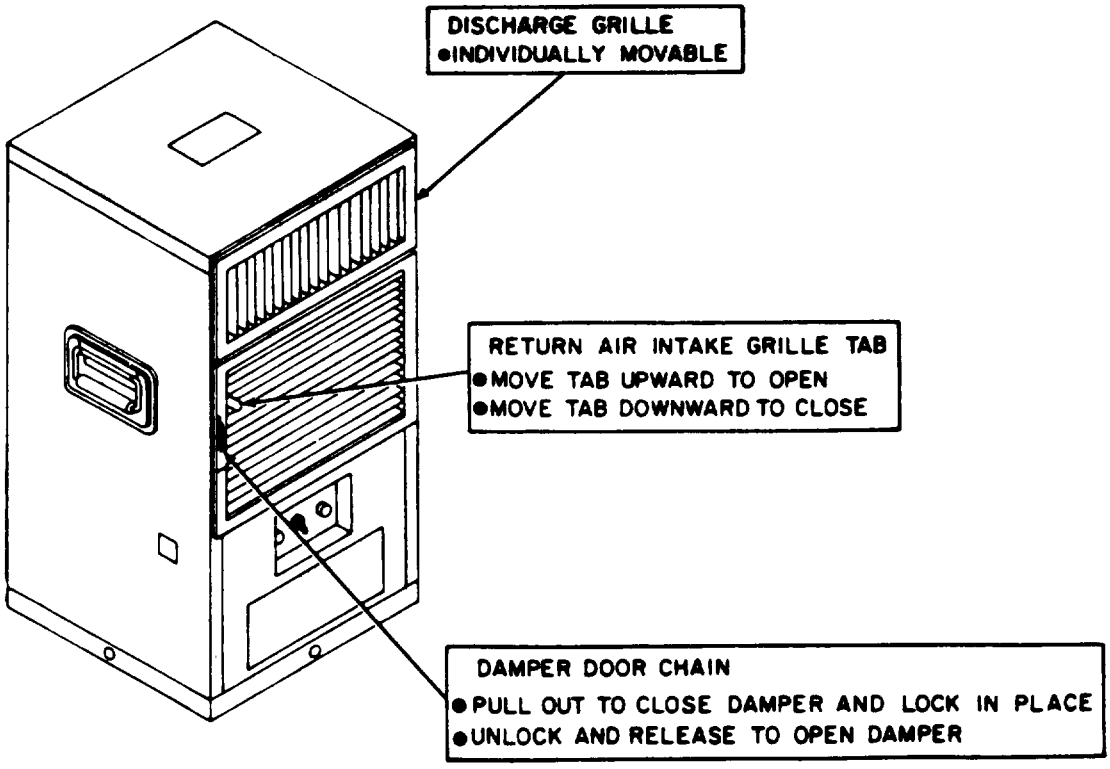


Figure 2-2. Airflow Controls.

WARNING

Do not operate without external ground connected. See unit maintenance.

NOTE

The air conditioner can be equipped for operation in chemical–biological-radiological (CBR) environment by connecting filtering equipment to the rectangular covered opening on the left side of the fan guard.

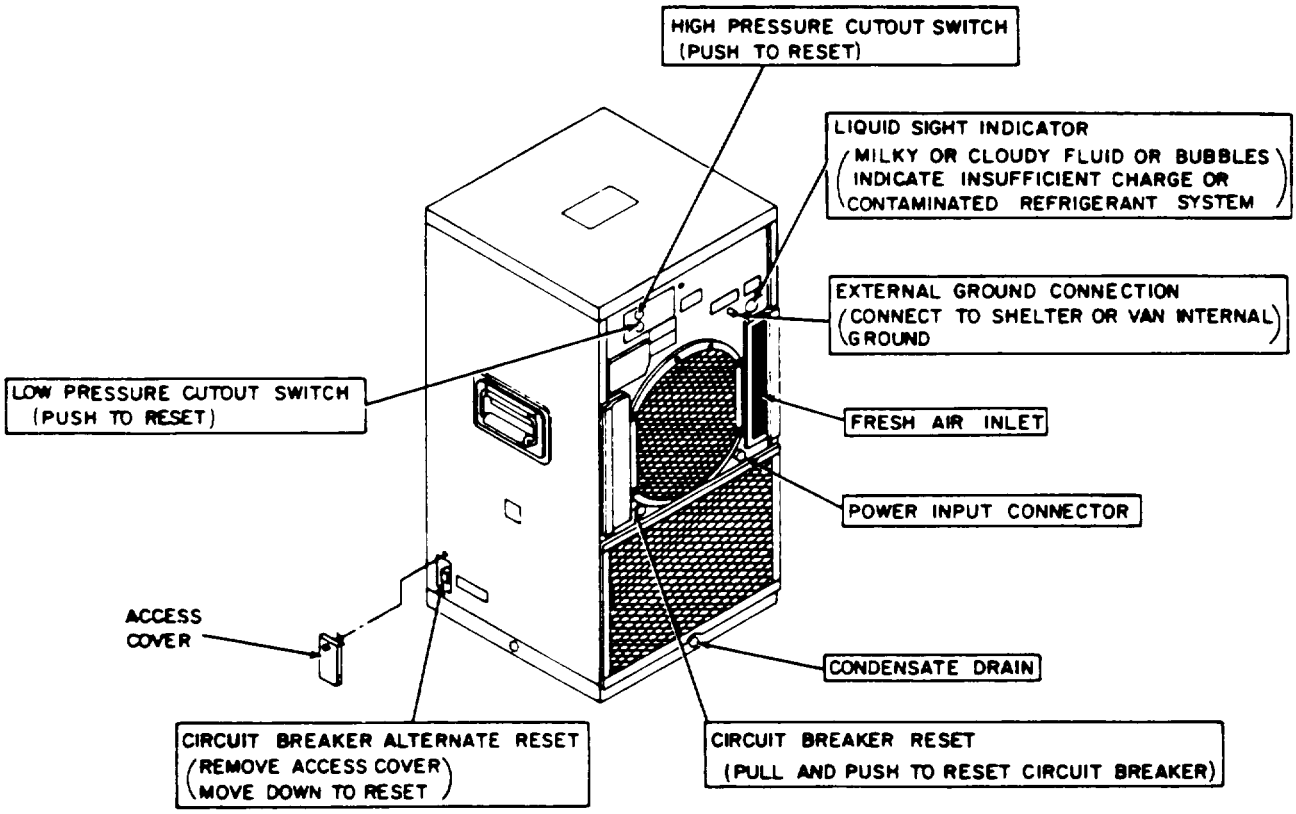


Figure 2-3. Rear Control and Indicators.

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-2. OPERATOR MAINTENANCE

The operator is required to perform preventive maintenance checks and services. Refer to Table 2-1. Maintenance by operator/crew is limited to operating the air conditioner in COOL, LO-HEAT, and VENTILATE modes. Refer any malfunction to unit maintenance.

NOTE

Perform weekly as well as before PMCS if:

- You are assigned operator and have not operated the item since the last weekly PMCS.
- You are operating the item for the first time.

Table 2–1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B – Before A –After M – Monthly
D – During W – Weekly

No.	INTERVAL B	D	A	W	M	ITEM TO BE INSPECTED	PROCEDURES (CHECK/AND HAVE REPAIRED AND ADJUSTED AS NECESSARY)	FOR READINESS REPORTING EQUIPMENT IS NOT READY/ AVAILABLE IF:
1	•		•		●	Cover	Missing, damaged, no mildew. All snaps in good condition. Cover must be rolled and stored on top of unit during operation.	
2					●	Panels	No major dents or cracks. No missing screws.	
3					●	Screens and Guards	No major dents or cracks. No missing screws.	
4					●	Grilles/Louvers:	No major dents, cracks, open and clear. No missing screws.	
5					●	Information Plates	Missing or damaged.	
6	•		•		●	Air Filter	Check that filter is clean.	
7		•				Condensate Drain	No water dripping anywhere except through drain.	
8				•		Control Panel	Check that knobs are not missing.	Missing
9		•				Sight Glass (liquid indicator)	Center should be clear, no bubbles. • Green, (Good) • Yellow/green (*) • Yellow (*)	Not Green in Color

* Indicates moisture in refrigerant system and possible problems. Report unit to Direct Support Maintenance.

Section III. OPERATION UNDER USUAL CONDITIONS

2-3. BEFORE OPERATION

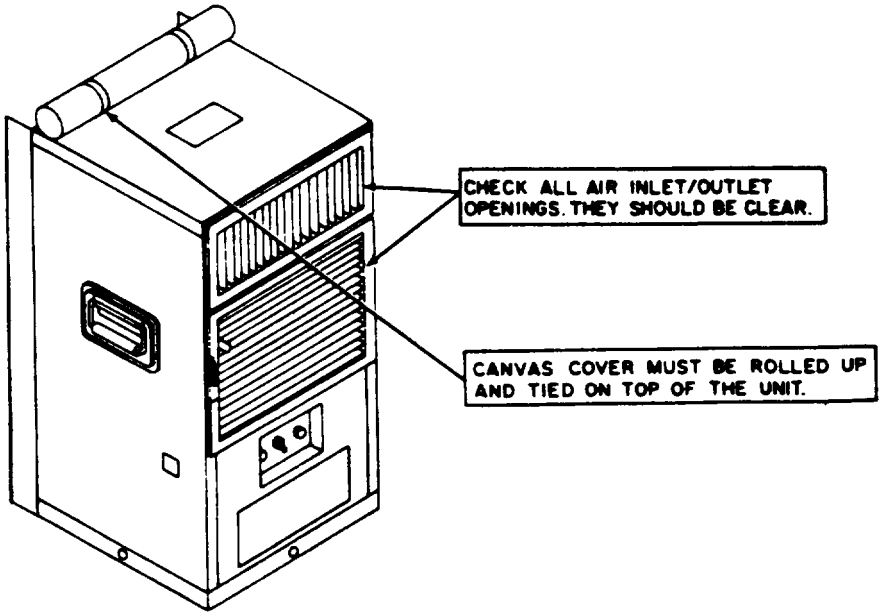


Figure 2-4. Operating Mode.

WARNING

Recirculation of stale air can use up existing shelter oxygen supplies resulting in dizziness, nausea, headache, and unconsciousness. Make sure to introduce about 10% fresh air into the system to allow for adequate ventilation.

CAUTION

The shelter or van circuit breaker and CB (providing power to the air conditioner) should be ON at least 6 hours before operating the unit in the COOL mode. This allows the crankcase heater to raise the compressor oil temperature to normal operating range.

NOTE

Cool air is denser than warm air, and it tends to sink downward, therefore, it is usually desirable to direct cool air slightly upward and warm air slightly downward for maximum comfort and coverage.

2-4. OPERATING PROCEDURES

a. Control Indicators

(1) DISCHARGE AIR OUTLET LOUVERS. Individually adjust.

(2) FRESH AIR DAMPER CONTROL. Release pullchain to open; secure to close.

(3) RETURN AIR INTAKE GRILLE. Move up to open.

(4) CIRCUIT BREAKER. On reset.

(5) MODE SELECTOR.

(6) TEMPERATURE CONTROL KNOB.

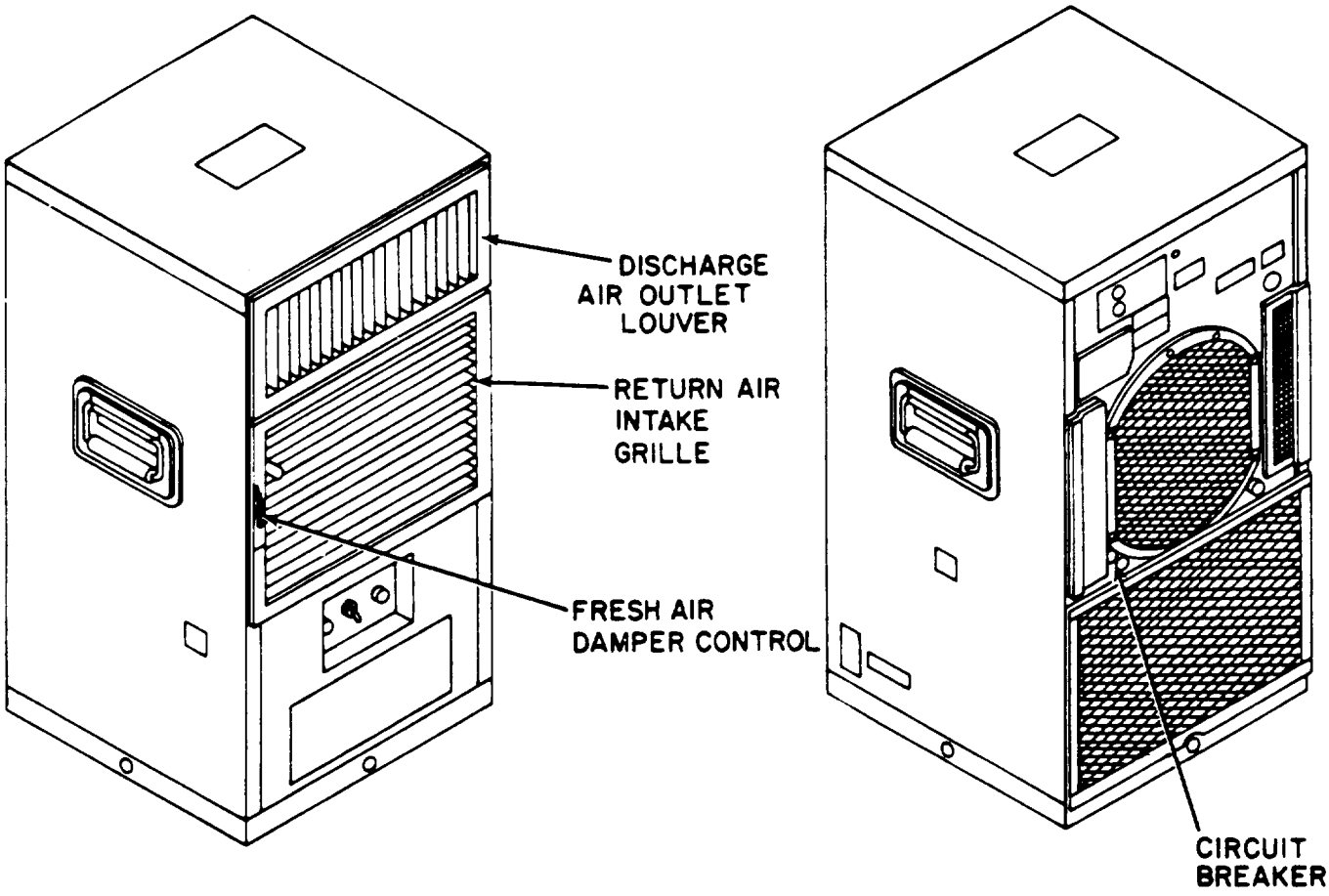


Figure 2-5. Operating Procedures.

b. Cooling Operation

(1) Turn Mode Selector to COOL.

(2) Turn temperature control knob to decrease. Within 2 minutes, discharge air will feel cooler than ambient air. When shelter temperature drops to the desired level, turn temperature control knob slowly toward INCREASE. Cooling will stop when temperature control senses cooling is longer required.

(3) To stop cooling, turn mode selector to OFF.

NOTE

The time delay relay prevents the compressor from starting for about 30 seconds after the mode selector has been turned to COOL.

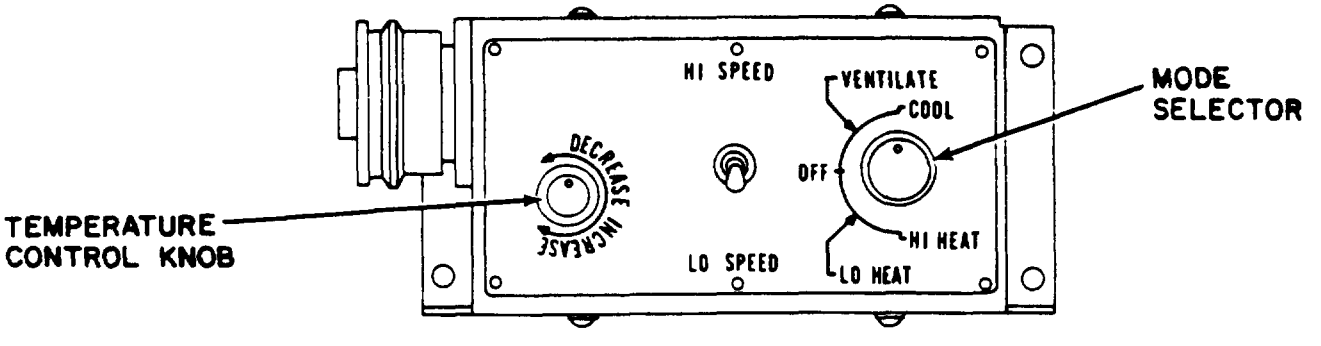


Figure 2-6. Cooling Operation.

c. Low Heat Operation

(1) Turn mode selector to LO-HEAT. After 5 seconds, airflow can be felt.

(2) Turn temperature control knob to increase. After 2 minutes, discharge air will feel warmer than ambient air. When shelter temperature rises to the desired level, turn temperature control knob slowly toward DECREASE. Heating will stop when temperature control senses heating is no longer required.

CAUTION

Move mode selector to VENTILATE to remove heat from electric heaters. Heaters could be damaged by heat buildup.

(3) To stop heating, move mode selector to VENTILATE for 5 minutes. After a 5 minute vent operation, move switch to off.

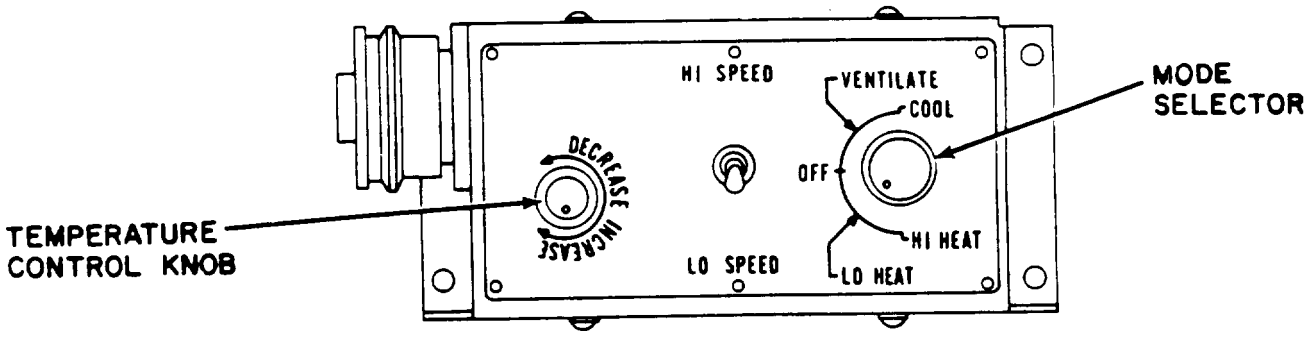


Figure 2-7. Low-Heat Operation.

d. High Heat Operation

NOTE

The temperature control knob operates one bank of heating elements. In HI-HEAT, a second bank of elements is continuously ON.

(1) Turn mode selector to HI-HEAT. After 5 seconds, airflow can be felt

(2) Turn temperature control knob to increase. After 2 minutes, discharge air will feel warmer than ambient air. When shelter temperature rises to the desired level, turn temperature control knob slowly toward DECREASE. Heating will stop when temperature control senses heating is no longer required.

NOTE

Use HI-HEAT when LO-HEAT fails to raise the shelter temperature.

CAUTION

Move to VENTILATE to remove heat from electric heaters. Heaters could be damaged by heat buildup.

(3) To stop heating, move mode selector (5) to VENTILATE for 5 minutes. After a 5 minute vent operation, move switch to off.

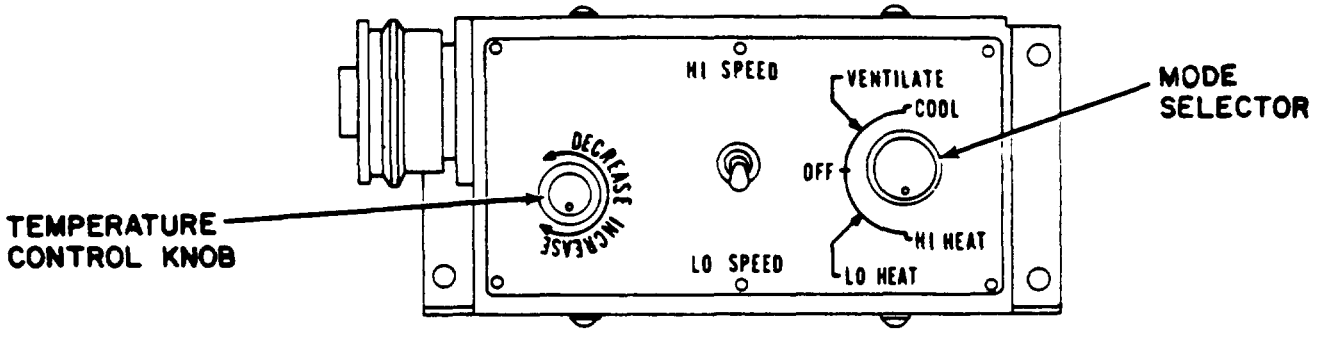


Figure 2-8. High Heat Operation.

e. Ventilating Operation

(1) Turn mode selector to VENTILATE.

(2) Turn temperature control knob to any setting,

(3) To stop, turn mode selector to OFF

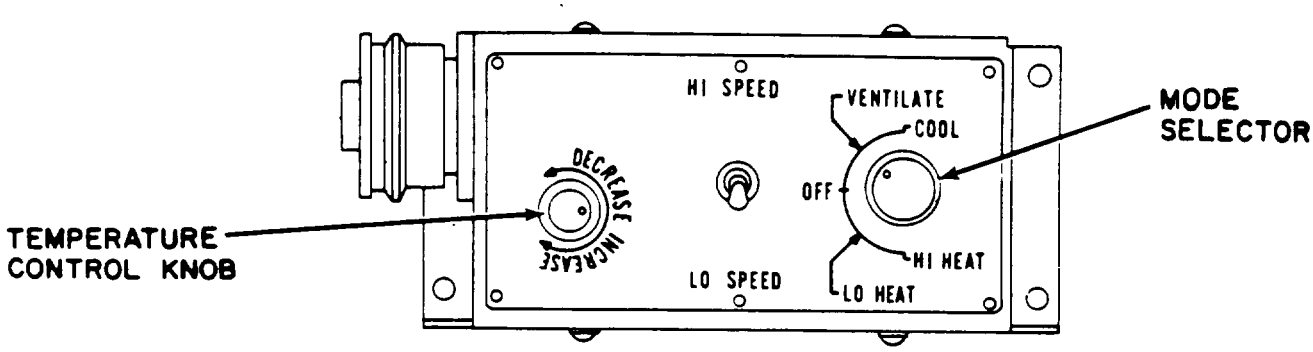


Figure 2-9. Ventilating Operation.

Table 2-2. OPERATING SETTINGS

MODE	MODE SELECTOR SWITCH	TEMPERATURE CONTROL KNOB	FRESH AIR INLET VENT	RETURN AIR INLET GRILLE	CANVAS COVER
Cooling-100% recirculated air	COOL	Desired temperature	Closed	Open	Rolled
Cooling-with fresh makeup air	COOL	Desired temperature	Partially or fully open	Partially or fully closed*	Rolled
Cooling-with fresh makeup air through CBR filter	COOL	Desired temperature	Fully open	Partially or fully open*	Rolled
Heating-100% recirculated air	LO HEAT or HI HEAT	Desired temperature	Closed	Open	Optional
Heating-with fresh makup air	LO HEAT or HI HEAT	Desired temperature	Partially or fully open	Partially or fully closed*	Rolled
Heating-with fresh makup air through CBR filter	LO HEAT or HI HEAT	Desired temperature	Fully open	Partially or fully open*	Rolled
Ventilation - Rolled maximum outdoor air	VENTILATE		Any setting	Open	Closed

* Partial closing of the return air inlet grille causes a greater portion of the total airflow to be drawn from the outside.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

NOTE

The air conditioner can be equipped for operation in chemical–biological-radiological (CBR) environment by connecting filtering equipment to the rectangular covered opening to the left of the fan guard.

2-5. OPERATION IN EXTREME COLD

a. GENERAL. The air conditioner is designed to operate on the heating cycle in ambient temperatures as low as –50 °F (-45.5 °C) and on cooling cycle with 0 °F (–18 °C) air entering the condenser and 70 °F (21 °C) air entering the evaporator.

CAUTION

Do not disturb wiring during cold weather unless absolutely necessary. Cold temperatures make wiring and insulation brittle and easily broken.

b. BEFORE OPERATION.

(1) Before starting on cooling cycle, be sure cover is rolled from condenser air intake and discharge.

(2) Clear all ice and snow from openings.

(3) To start unit on COOL mode below 0°F (–18°C) ambient (minimum operating temperature), contact organizational maintenance.

c. AFTER OPERATION. Install cover over condenser air intake and discharge openings.

2-6. OPERATION IN EXTREME HEAT

NOTE

Unit Preventive Maintenance Checks and Services (PMCS) should be performed at daily intervals.

a. GENERAL. The air conditioner is designed to operate in temperatures up to 120 °F (49 °C). Extra care should be taken to minimize the cooling load when operating in extreme high temperatures.

b. PROTECTION.

(1) Check all openings in the enclosure, especially doors and windows, to be sure they are tightly closed. Limit in and out traffic if possible.

(2) When appropriate, use shades or awnings to shut out direct rays of the sun.

(3) When possible, limit the use of electric lights and other heat producing equipment.

(4) Limit the amount of hot outside air introduced through the fresh air damper to that essential for ventilation.

NOTE

Weatherstripping, the installation of storm doors, and windows, if appropriate, and insulation of surfaces exposed to the outside is recommended when operating in extremely high temperatures for extended periods.

c. CLEANING. Clean outside grilles, coils, filters, and mist eliminator more frequently.

2-7. OPERATION IN DUSTY OR SANDY AREAS

NOTE

Unit Preventive Maintenance Checks and Services (PMCS) should be performed at daily intervals.

a. GENERAL. Dusty and sandy conditions can seriously reduce the efficiency of the air conditioner by clogging the air filter, mist eliminator, and coils, This will cause a restriction in the volume of airflow. Accumulation of dust or sand in the condenser coil and/or in the compressor compartment may cause overheating of the refrigeration system. Dust or sand may also clog the condensate trap and water drain lines.

CAUTION

Never operate the air conditioner without having the air filters in place.

b. PROTECTION.

(1) Shield the air conditioner from dust as much as possible.

(2) Take advantage of any natural barriers which offer protection.

(3) Limit the amount of dusty or sandy outside air introduced through the fresh air damper.

(4) Roll down and secure the fabric cover on the back of the cabinet durimg periods of shutdown

c. CLEANING.

(1) Keep the air conditioner as clean as possible.

(2) Pay particular attention to the outside grilles, condenser, filters, mist eliminator, louvers, and electrical components.

(3) In extreme conditions, daily cleaning of condenser, filters, and outside grilles may be necessary.

2-8. OPERATION UNDER RAINY OR HUMID CONDITIONS

WARNING

High voltage can kill. Make sure power supply is disconnected from air conditioner before touching any wiring or other electrical parts.

a. Take special precautions to keep equipment dry. If installed outdoors, cover the equipment with a waterproof cover when it is not in use.

b. Remove cover during dry periods. Take all necessary precautions to keep electric components free from moisture.

2-9. OPERATION NEAR SALT WATER AREAS

WARNING

High voltage can kill. Disconnect power supply prior to washing the air conditioner.

a. Wash the exterior and condenser section of the unit.

b. Be careful not to damage electrical system with water.

c. Special attention must be given to prevent rust and corrosion.

d. Paint all exposed areas where paint has cracked, peeled or blistered.

e. Coat all exposed areas of polished metal with a light coat of grease.

CHAPTER 3

OPERATOR'S MAINTENANCE INSTRUCTIONS

Section I. LUBRICATION INSTRUCTIONS

3-1. LUBRICATION

a. There are no lubrication requirements at the operator's level.

b. For operator's Preventive Maintenance Checks and Services, refer to Paragraph 2–2.

Section II. TROUBLESHOOTING

3-2. TROUBLESHOOTING

a. The troubleshooting table (Table 3–1) lists the most common malfunctions which you may find during the operation of the air conditioner or its components. You should perform the test/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions which may occur. However, all tests or inspections and corrective actions are listed for most common malfunctions. If a malfunction is not listed or is not corrected by listed corrective action, notify your supervisor or organizational maintenance.

Table 3-1. OPERATOR'S TROUBLESHOOTING

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. AIR CONDITIONER FAILS TO START
Step 1. Controls not properly set. Set controls for starting. Refer to Paragraph 2-1.
Step 2. Power supply leads loose or not connected. Check power supply leads and tighten, or connect leads as required.
Step 3. Circuit breaker tripped. RESET. Refer to Paragraph 2-1.

Table 3-1. OPERATOR'S TROUBLESHOOTING – Continued

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
2. AIR CONDITIONER NOISY DURING OPERATION	
Step 1. Panels loose.	Tighten fasteners. For replacement of defective fasteners, refer to unit maintenance.
Step 2. Loose components.	Refer to unit maintenance.
3. INSUFFICIENT COOLING	
Step 1. Temperature control knob improperly set.	Set temperature control knob for cooler operation. Refer to Paragraph 2-4.
Step 2. Refrigerant low or contaminated.	Check sight glass. If refrigerant appears yellow rather than green, or if bubbles appear in the refrigerant, report the condition to Direct Support Maintenance.
Step 3. Fan switch set to LO SPEED rather than HI SPEED.	Set fan switch to HI SPEED.
4. NO COOL AIR DISCHARGE	
Step 1. Temperature control knob in wrong position.	Set temperature control knob for cooling. Refer to Paragraph 2-4.
Step 2. Air filter is dirty or clogged.	Remove and clean air filter. Refer to unit maintenance.
Step 3. HIGH PRESSURE CUT-OUT switch tripped.	RESET HIGH PRESSURE CUT-OUT switch.

Table 3-1. OPERATOR'S TROUBLESHOOTING – Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
Step 4. LOW PRESSURE CUT-OUT switch tripped. RESET LOW PRESSURE CUT-OUT switch.
5. EXCESSIVE COOLING
Step 1. Temperature control knob set for too cool operation. Increase temperature control knob for temperature desired. Refer to Paragraph 2-4.
Step 2. Mode selector switch set to COOL rather than VENTILATE. Set mode selector switch to VENTILATE.
Step 3. Fan switch set to HI SPEED rather than LO SPEED. Set fan switch to LO SPEED.
6. INSUFFICIENT HEATING
Step 1. Temperature control knob improperly set. Set temperature control knob for desired temperature. Refer to Paragraph 2-4c.
Step 2. Mode selector switch set to LO HEAT instead of HI HEAT. Set mode selector switch to HI HEAT. Refer to Paragraph 2-4d.

Table 3-1. OPERATOR'S TROUBLESHOOTING - Continued

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
7. NO HOT AIR DISCHARGE	
Step 1. Mode selector switch in wrong position.	Set selector switch to LO HEAT or HI HEAT as desired. Refer to Paragraph 2-4c.
Step 2. Temperature control knob improperly set.	Set temperature control knob for desired temperature. Refer to Paragraph 2-1.
Step 3. Air filter dirty or clogged.	Remove and clean air filter. Refer to unit maintenance.
8. EXCESSIVE HEATING	
Step 1. Temperature control knob improperly set.	Set temperature control knob for desired temperature. Refer to Paragraph 2-1.
Step 2. Mode selector switch set to HI-HEAT instead of LO-HEAT.	Set mode selector switch to LO HEAT. Refer to Paragraph 2-4c.

CHAPTER 4

UNIT MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

4-1. COMMON TOOLS AND EQUIPMENT

a. For authorized common tools and equipment refer to the Modified Table of Organization and Equipment, (MTOE) applicable to your unit.

b. Tool Kit, Service, Refrigeration Unit, contains hand tools and equipment used for air conditioner maintenance. The following items not contained in the refrigeration unit tool kit are also required for air conditioner maintenance.

DESCRIPTION

Brush, Bristle
Brush, Wire
Bucket
Heat Gun
Multimeter
Nitrogen Regulator
Pliers, Long Round Nose
Rubber Gloves
Safety Goggles
Screwdriver, Cross Tip
  No. 2, 1 Inch Long Blade
Screwdriver, Offset,
  Cross Tip No. 1

4-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

No special tools, TMDE, or support equipment are required.

4-3. REPAIR PARTS

Repair parts are listed and illustrated in Repair Parts and Special Tools List (RPSTL) TM9-4120–385-24P.

Section II. SERVICE UPON RECEIPT OF EQUIPMENT

4-4. UNPACKING AND INSPECTION

a. UNPACKING.

(1) Cut steel strapping.

(2) Remove plastic wrap.

(3) Lay unit on side with help of assistant.

(4) Remove four mounting bolts. Keep bolts for permanent mounting.

b. INSPECTION.

(1) Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on DD Form 6, Packaging Improvement Plan.

(2) Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with the instructions of TM 38-750.

(3) Check to see whether the equipment has been modified.

(4) Report any modifications.

4-5. INSTALLATION OR REMOVAL

a. SHELTER OR VAN, AIR CONDITIONER LOCATION.

(1) See Figures 4-1 and 4-2 for dimensions and location of mounting hardware.

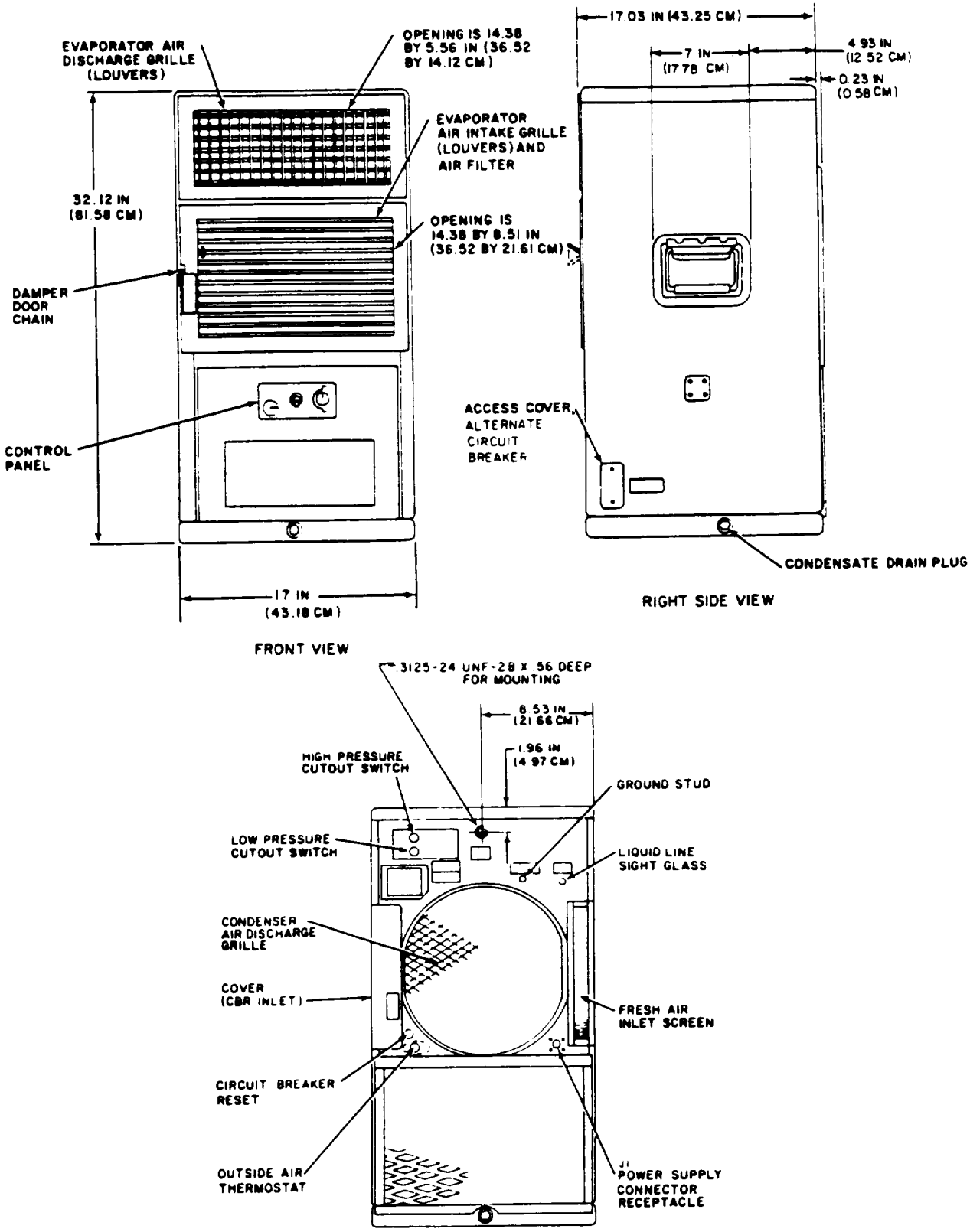


Figure 4-1. Installation Dimensions.

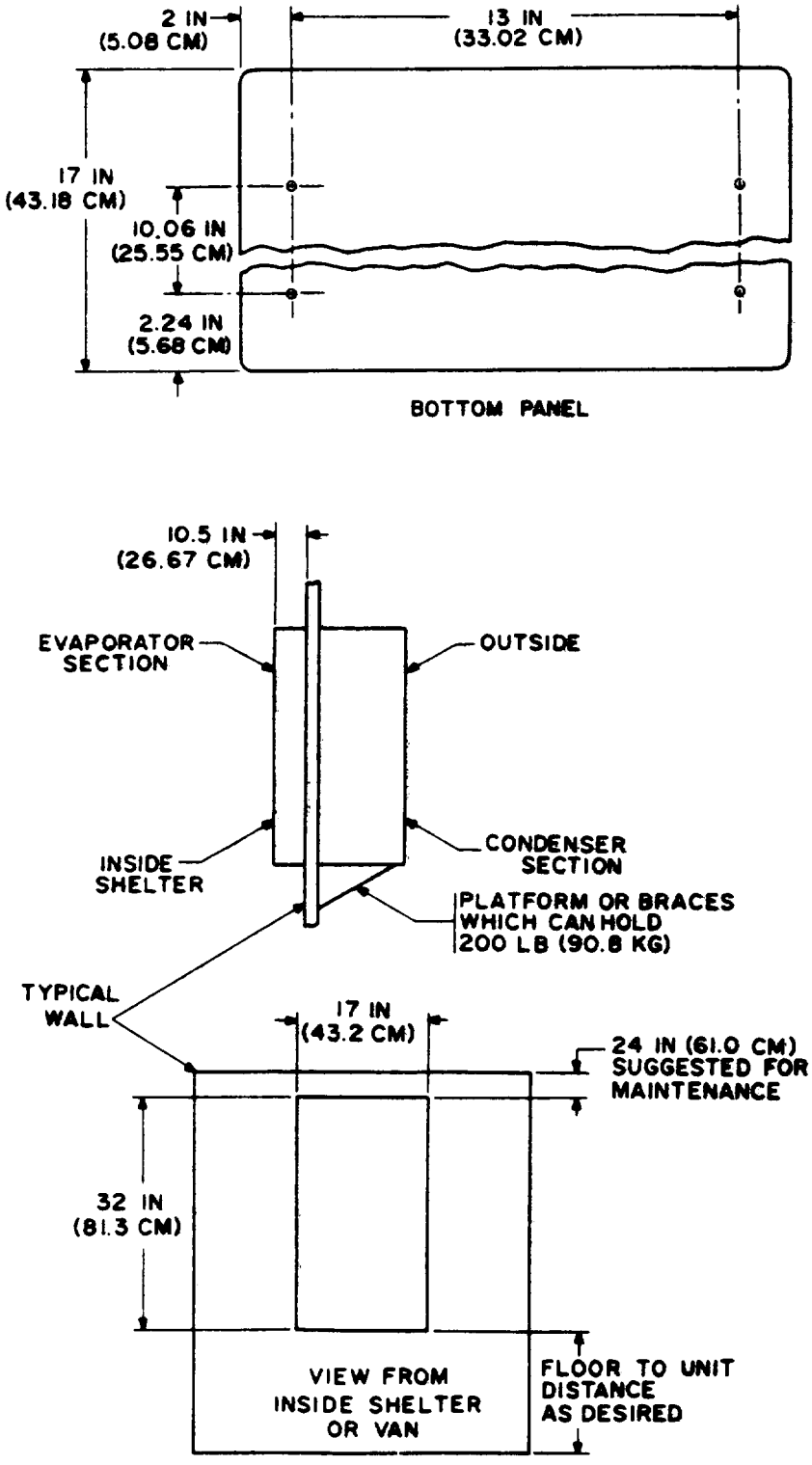


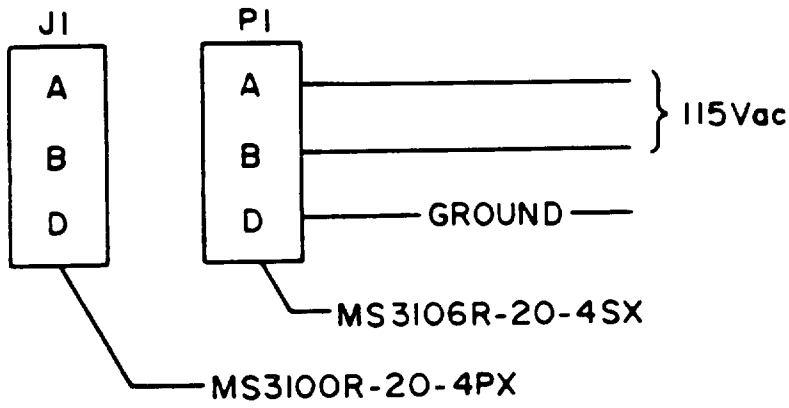
Figure 4-2. Dimensions And Mounting Hardware Location.

(2) Check that there will be an unobstructed flow of outside air to and from condenser coil. Keep all sources of heat at least 10 feet (3. 05 m) from condenser coil.

(3) Check that no source of dangerous or objectionable fumes will be within 10 feet (3. 05 m) of the fresh air intake.

(4) Electric power supply requirements are 115 VAC, single phase, 50/60 Hz.

(5) Fabricate the input power cable using connector P1 (MS3106R–20-4SX) supplied with the air conditioner. Cable length and other end termination to suit the installation.



NOTES:

1. CABLE LENGTH AND PLUG TO BE SELECTED ACCORDING TO LOCAL INSTALLATION.
2. CABLE ASSEMBLY NOT SUPPLIED WITH AIR CONDITIONER– TO BE FABRICATED BY INSTALLER.
3. WIRE SIZE 10 AWG.
4. MAKE SURE GROUND CONNECTIONS ARE USED WHEN ASSEMBLING CABLE AND AT POWER SOURCE.

Figure 4-3. Input Power Cable Wiring.

WARNING

Use care in lifting. Air conditioner weighs 200 lb (90. 7 kg).

b. AIR CONDITIONER INSTALLATION IN SHELTER.

(1) Lift air conditioner to top of the mounting brackets. Each side has one lifting handle.

(2) Use lifting sling if possible. See Figure 4-4.

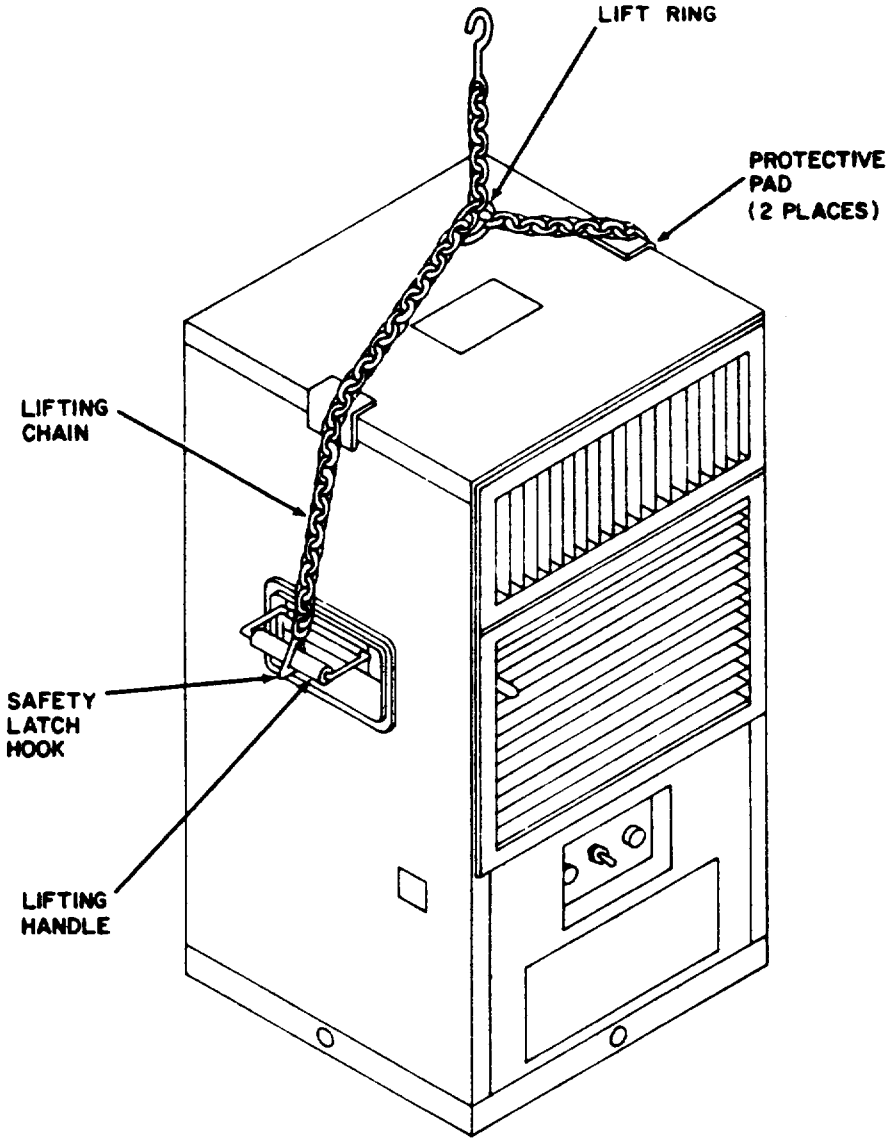


Figure 4-4. Lifting Using Slings.

(3) Level unit on bracket, side to side. Shim as necessary.

(4) Level unit on bracket, front to back. Shim as necessary.

(5) Bolt unit to brackets, four places. Hardware supplied with unit.

(6) Fill in and seal around air conditioner to prevent loss of conditioned air. Flexible plastic foam and pressure sensitive tape may be used.

WARNING

For safe operation, user must connect # 10 AWG ground wire to the external ground connection. Make certain that shelter is properly grounded.

(7) Connect #10 AWG ground wire from the shelter ground to air conditioner ground stud. The ground connection is located above and to the right of the condenser fan guard. Refer to Figure 4-1.

(8) Drain line. Remove one of four condensate drain plugs located at the lower edge of the unit-one per side. See Figure 4-1.

(9) Connect mating power supply connector to J1.

WARNING

Power supply circuit breaker must be OFF. Installation must be checked prior to turning ON power.

c. INSTALLATION CHECK

(1) Check installation. Unit ready for operation checkout (Paragraph 4-6).

(2) Perform steps in Paragraph 4-6 before placing unit in operation.

d. REMOVAL.

WARNING

High voltage can kill.

(1) Disconnect power cable at J1.

(2) Remove insulating material from area around air conditioner.

(3) Position hoist next to shelter or van in order to lift air conditioner.

WARNING

Air conditioner weighs 200 lb (90.7 kg).

(4) Connect shng to handles (one either side).

CAUTION

The maintenance personnel MUST be visible to hoist or wrecker operator and in a position to guide air conditioner away from shelter.

(5) Connect sling to hoist.

(6) Remove mounting bolts.

(7) Push air conditioner out of the conditioned area using the sling and hoist to hold and steady the unit.

(8) Lift air conditioner from mounting bracket and place on truck, transport trailer, or on the ground.

(9) Remove sling.

4-6. PRELIMINARY CHECKS OF EQUIPMENT

a. Check that canvas cover is rolled up and secure.

b. Check that airflow to and from condenser is free of obstructions.

c. Keep ALL sources of heat at least 10 feet (3.05 m) from condenser coil.

d. Keep ALL sources of dangerous or objectionable fumes at least 10 feet (3. 05 m) from fresh air intake, e.g., automobile or truck exhaust, refuse containers, fuel containers, etc.

e. Check electrical connections.

NOTE

At outside air temperatures below 0°F (–18 °C) the Low Pressure Cutout (LPCO) will have to be jumped to operate in COOL mode. Refer to Paragraph 5-18.

f. Operate unit:

1. COOL
2. HEAT, HI and LO
3. VENTILATE
4. FAN SPEED, HI and LO
5. Fresh air open
6. Fresh air closed

g. Check if air conditioner electrically interferes with other shelter electrical equipment.

Section III. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

4-7. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

a. The preventive maintenance checks and services are listed in Table 4-1.

b. For reliable equipment operation and performance, these checks should be performed regularly as indicated in Table 4-1.

Table 4-1. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES

W – Weekly M – Monthly Q - Quarterly

No.	NTERVAL W	M	Q	ITEM TO BE INSPECTED	PROCEDURES (CHECK/AND HAVE REPAIRED AND ADJUSTED AS NECESSARY)	FOR READINESS REPORTING EQUIPMENT' IS NOT READY/ AVAILABLE IF:
					WARNING High voltage can kill. Disconnect power supply.	
1			•	Panels	Remove canvas cover, top cover, and lower panel. Inspect for loose or damaged rubber gaskets and insulating foam. Check hardware. Repair or replace as necessary.	Missing
2		•		Screens and Guards	Remove flesh air inlet screen. Inspect for damage and clean. Repair or replace as necessary.	Missing

Table 4-1. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES – Continued

No.	INTERVAL W	INTERVAL M	INTERVAL Q	ITEM TO BE INSPECTED	PROCEDURES (CHECK/AND HAVE REPAIRED AND ADJUSTED AS NECESSARY)	FOR READINESS REPORTING EQUIPMENT IS NOT READY/ AVAILABLE IF:
3		•		Grilles /Louvers	Remove return air inlet grille. Check louvers for smooth operation and damage. Thoroughly clean grille. Repair or replace as necessary.	Missing
4			•	Information and Identification Plates	Inspect for legibility, dents, cracks missing hardware, and other damage. Replace if damaged or unreadable.	
5		•		Air Filter	Remove air filter and inspect for damage. Clean or replace as necessary.	Missing
6		•		Mist Eliminator	Remove air outlet louver and inspect front of mist eliminator. Check for excessive water buildup and broken or damaged material that could obstruct airflow. Clean or replace as necessary.	Missing
7			•	Fresh Air Damper	Inspect for damage and poor air sealing or malfunction. Check for proper opening and closing. Repair or replace as necessary.	Broken chain or missing
8			•	Condensate Drain Lines	Inspect drain lines for leaks and proper drainage of condensate. Clean or repair as necessary.	Disconnected, clogged, broken, cracked

Table 4-1. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES – Continued

No.	INTERVAL W	M	Q	ITEM TO BE INSPECTED	PROCEDURES (CHECK/AND HAVE REPAIRED AND ADJUSTED AS NECESSARY)	FOR READINESS EQUIPMENT IS NOT READY/ AVAILABLE IF:
9			•	Control Panel	Inspect for missing hardware and knobs, and other damage. Replace any missing hardware or knobs. Repair damage.	Broken switches Missing knobs
10			Ž	Temperature Control Thermostat	Inspect, test for continuity and replace as necessary.	No Continuity
11			•	Fan Speed	Inspect, test, and replace as necessary.	Broken, no continuity
12			•	Mode Selector Switch	Inspect, test, and replace as necessary.	Broken, no continuity
13			•	Connector	Inspect, test, and replace as necessary.	Broken pins, missing, broken shell
14			•	Junction Box	Inspect for missing hardware and for other damage. Replace any missing hardware. Repair damage.	Mounting brackets, broken
15			•	Relays/Control Circuit Breakers Capacitors/ Rectifier/ Transformer	Inspect for Corrosion. Replace as necessary.	Missing, no continuity
16			Ž	wiring Harnesses	Inspect for broken leads, missing terminals, broken solder joints, damaged insulation, or other damage. Repair as necessary.	Broken wires, missing terminals

Table 4-1. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES – Continued

No.	INTERVAL W	INTERVAL M	INTERVAL Q	ITEM TO BE INSPECTED	PROCEDURES (CHECK/AND HAVE REPAIRED AND ADJUSTED AS NECESSARY)	FOR READINESS EQUIPMENT IS AVAILABLE IF:
17			•	Fans and Housing	**WARNING** High voltage can kill. Disconnect power supply. Check freedom of movement of impellers. Thoroughly clean impellers.	Bound, bent or cracked
18			•	Evaporator/ Condenser Motor	Check that motor is clean. Turn shaft and check for binding, rough movement, and/or noise indicative of defective bearings. Check for and repair damaged wiring or insulation. Check for and replace missing hardware. Repair as necessary.	No continuity, excessive noise, missing or broken mounting brackets
19			Ž	Heater Thermostat (Switch S3)	**WARNING** High voltage can kill. Make sure that power supply to unit is disconnected. Check heater thermostatic switch for cleanliness, lack of obstruction between switch and heaters, security of terminals and proper location of wiring.' Check for damage to wiring and insulation. Check for and replace missing hardware.	No continuity, missing

Table 4-1. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Continued

No.	INTERVAL W	INTERVAL M	INTERVAL Q	ITEM TO BE INSPECTED	PROCEDURES (CHECK/AND HAVE REPAIRED AND ADJUSTED AS NECESSARY)	FOR READINESS REPORTING EQUIPMENT IS NOT READY/ AVAILABLE IF:
20			•	Heater Elements	**WARNING** If unit has been used to provide heat, allow heater elements to cool to room temperature before touching to avoid severe burns. Check heater elements for cleanliness, security of electrical connections, and for free airflow over elements. Inspect bracket for loose, damaged, or missing floating nuts or rivets and for other damage. Inspect support and heater clamps for bends, cracks, breaks, hole damage, or other damage. Repair as necessary.	Missing, cracked, no continuity
21			•	Evaporator Coil	Inspect coil for leaks, bent fins, and tube for damage. Clean as required.	Cracked mounting brackets, leaks, bent fins and/or tube damage
22		•		Condenser Coil	Remove condenser guard. Inspect coil for damage. Clean as required.	Cracked mounting brackets, leaks, bent fins and/or tube damage
23		•		Sight Glass Liquid Indicator	Check moisture indicator after air conditioner has been running for 15 minutes. Center should be clear with no bubbles. Green indicates no moisture present. If color is yellow/green or yellow, moisture is present in system. Notify Direct Support Maintenance. Inspect sight glass for cracks or leakage. If damaged, notify Direct Support Maintenance	Cracked, broken, missing

Table 4-1. UNIT PREVENTIVE MAINTENENCE CHECKS AND SERVICES - Continued

No.	INTERVAL W	INTERVAL M	INTERVAL Q	ITEM TO BE INSPECTED	PROCEDURES (CHECK/AND HAVE REPAIRED AND ADJUSTED AS NECESSARY)	FOR READINESS REPORTING EQUIPMENT IS NOT READY/ AVAILABLE IF:
24		•		Casing	Inspect for loose, damaged, or missing rivet nuts, rivet nut plates, rubber insulating foam, and insulating sheet. Inspect for other damage. Refer repairs to Direct Support Maintenance.	Cracked, extensive damage
25			●	Power Input Cable	Check for broken solder joints, damage to connector, wires, and other damage. Use a multimeter to check continuity between terminals. Repair or replace as necessary.	Missing, frayed, broken pins, broken shell

Section IV. TROUBLESHOOTING

4-8. TROUBLESHOOTING

a. This section contains troubleshooting information for locating and correcting most of the operating troubles which may develop in the air conditioner. You should perform 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 corrected by listed corrective actions, notify your supervisor.

WARNING

Disconnect power from the air conditioner before doing any maintenance work to the electrical system. High voltage in air conditioner can kill.

Never work on this equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid.

Be careful not to contact high voltage connections. Keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body. Do not be misled by the term “low voltage.” Potentials as low as 24 volts may cause death under certain conditions.

NOTE

At outside temperatures below 0 °F (–18 °C) LPCO will have to be jumped to operate in cool mode.

Table 4-2. TROUBLESHOOTING FOR UNIT MAINTENANCE

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
WARNING High voltage in air conditioner can kill.	
1. AIR CONDITIONER FAILS TO START IN ANY MODE	
Step 1. Check power supply. Is proper power supply connected to unit? 115 volt, 1–phase, 50/60 hertz.	Connect proper operating power supply to unit.
Step 2. Check external power supply circuit breakers. Are all circuit breakers in ON position?	Reset all circuit breakers.
Step 3. Check that CIRCUIT BREAKER (CB) is set to RESET position.	PULL AND PUSH the circuit breaker control in order to reset. If circuit breaker will not reset, check and/or replace. Refer to Paragraph 4-21.
Step 4. Check position of mode selector switch. Is switch turned to an operating mode: (LO HEAT, COOL, VENTILATE) ?	Try all switch positions.
Step 5. Check that the LOW and HIGH PRESSURE CUT-OUT switches resets are in.	Press the LOW and HIGH PRESSURE switch resets. (start compressor only).
Step 6. Refer to wiring diagram (FO-1).	Check that all connections are secure.
WARNING High voltage in air conditioner can kill.	

Table 4-2. TROUBLESHOOTING FOR UNIT MAINTENANCE

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 7. Test electrical components.

Replace components as required.

Step 8. If air conditioner fails to start, refer to Paragraph 5-1.

2. EVAPORATOR/CONDENSER BLOWERS FAIL TO START

Step 1. Check that power supply is connected.

Connect power supply.

Step 2. Check that CIRCUIT BREAKER (CB) has been RESET.

RESET CIRCUIT BREAKER.

Step 3. Check motor bearings and fans by:

- Disconnect power supply from air conditioner.
- Rotate the blower wheels by hand to see if the bearings are frozen or if shaft is bent, or if fans are loose or broken.

Replace defective motor.

Step 4. Move mode selector switch to each of the four positions: COOL, VENTILATE, LO HEAT, and HI HEAT. *Move* mode selector switch to VENTILATE.

Test switch S. Replace switch if defective. Refer to Paragraph 4–18.

Step 4.1. Test K9 time delay relay. Refer to paragraph 4-20 Test.

Replace if defective. Refer to Figure 4-25.

Step 5. Test motor. Refer to Paragraph 5-10.

Repair or replace defective motor. Refer to Paragraphs 4-24 and 5-10.

WARNING

High voltage in air conditioner can kill.

Table 4–2. TROUBLESHOOTING FOR UNIT MAINTENANCE

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 6. Refer to wiring diagram (FO-1). Check for broken and loose connections.

Repair or replace as necessary. Refer to Paragraph 4–23.

3. LITTLE OR NO HEATING IN LOW HEAT MODE

Step 1. Check that controls are properly positioned for LO HEAT operation

Position controls for LO heat operation.

Step 2. Check for air movement out of air outlet louver and into return air inlet.

NOTE

This unit can operate in temperatures as low as –50°F (10 °C). However, depending on shelter or van size, heat loss, and amount of heat generated by equipment, heat output in the LO HEAT mode may or may not heat shelter or van to a comfortable level.

- Remove obstructions from air inlets/outlets.
- Clean return air filter. Refer to Paragraph 4-15.
- Clean mist eliminator. Refer to Paragraph 4-16.

Step 3. Compare discharge air temperature to return air temperature by:

- Turn mode selector switch to LO HEAT and temperature selector to maximum INCREASE.
- After operating for 5 minutes, measure return air temperature and discharge air temperature.

NOTE

Discharge air temperature should be at least 10°F (–12.2°C) above return air temperature.

4-8. TROUBLESHOOTING – Continued

Table 4-2. TROUBLESHOOTING FOR UNIT MAINTENANCE

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
• Check heater thermostatic switch S3. Replace S3 if defective. Refer to Paragraph 4-25.
Step 4. Check mode selector switch S. Replace if defective. Refer to Paragraph 4-18.
WARNING Allow heater elements to COOL before handling. Severe bums can result from touching heater elements.
Step 5. Check heater elements. Replace if defective. Refer to Paragraph 4-26.
WARNING High voltage in air conditioner can kill.
Step 6. Check wiring for loose or broken connections. Refer to wiring diagram (FO-1). Repair or replace as necessary. Refer to Paragraph 4-23.
4. LITTLE OR NO ADDITIONAL HEATING IN HI HEAT MODE
Step 1. Check that mode selector switch S is positioned for HI HEAT operation. Set controls for HI HEAT operation.
Step 2. Check that temperature selector switch S1 is set to extreme INCREASE position. Set temperature selector switch to maximum INCREASE setting by rotating clockwise.

Table 4-2. TROUBLESHOOTING FOR UNIT MAINTENANCE

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
Step 3. Inspect shelter or van for openings that allow cold air to move inside. Seal all openings.
Step 4. Check for air movement out of discharge air outlet louver and into return air inlet. • Remove obstructions from air inlet/outlets. • Clean return air filer. Refer to Paragraph 4-14. • Clean mist eliminator.Refer to Paragraph 4-15.
NOTE This unit can operate in temperatures as low as -50° F (10 °C). However, depending on shelter or van size, heat loss, and amount of heat generated by equipment, heat output in the LO HEAT mode may or may not heat shelter or van to a comfortable level.
Step 5. Check thermostatic switch S3. Replace if defective. Refer to Paragraph 4-25
Step 6. Check mode selector switch S. Replace if defective. Refer to Paragraph 4-18.
Step 7. Check relay K2. Replace if defective. Refer to Paragraph 4-20.
WARNING Allow heater elements to cool before handling. Severe burns can result from touching heater elements.

4-8. TROUBLESHOOTING - Continued

Table 4-2. TROUBLESHOOTING FOR UNIT MAINTENANCE

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
Step 8. Test heater elements.
Replace if defective. Refer to Paragraph 4-26.
WARNING
High voltage in air conditioner can kill.
Step 9. Trace out wiring and check for loose or broken connections. Refer to wiring diagram (FO–1).
Repair or replace as necessary. Refer to Paragraph 4-23.
5. TEMPERATURE SELECTOR SWITCH NOT EFFECTIVE
Step 1. Check return air filter and sensing bulb for dirt.
Clean return air filter and sensing bulb. Operate unit in HI HEAT mode for 5 minutes and check air temperature.
Step 2. Check the temperature selector switch S1.
Replace if defective. Refer to Paragraph 4-18.
WARNING
High voltage in air conditioner can kill.
Step 3. Trace out wiring and check for loose or broken connections. Refer to wiring diagram (FO-1).
Repair or replace as necessary. Refer to Paragraph 4-23.

Table 4-2. TROUBLESHOOTING FOR UNIT MAINTENANCE

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
6. UNUSUAL NOISE OR VIBRATION	
Step 1. Check air conditioner installation and mounting brackets.	Replace or tighten loose hardware.
Step 2. Check air conditioner housing covers and attaching hardware.	Tighten loose screws. Replace missing hardware. Refer to Paragraph 4-10.
Step 3. Remove top cover and check evaporator section components and attaching hardware for security.	Tighten loose hardware. Replace missing hardware and clamps.
Step 4. Check evaporator-condenser blowers for interference and out of round.	Adjust position of blowers. Replace if damaged. Refer to Paragraph 4-24.
Step 5. Check evaporator-condenser motor shaft for bearing noise.	Notify Direct Support Maintenance.
Step 6. Check condenser guard for loose or missing hardware.	Tighten loose hardware. Replace missing hardware.
Step 7. Check compressor mounting by grasping compressor and attempting to rock it.	Tighten mounting hardware if loose.

Section V. MAINTENANCE PROCEDURES

4-9. GENERAL MAINTENANCE PROCEDURES

a. REMOVAL OF WIRES.

WARNING

High voltage can kill. Disconnect air conditioner power supply before performing maintenance work on electrical system.

(1) The electrical circuits in the air conditioner are completed by individual wire leads or by wire leads laced or enclosed in tiedown straps to form a wiring harness or wiring bundle.

(2) At the factory, all of the wiring is marked with the appropriate terminal designations. However, wires that have been replaced in the field will not carry these designations.

(3) When repairing or replacing the wiring harness or individual wires, refer to the wiring diagram FO–1.

(4) Preferred repair methods consist of replacing wires, terminals, connectors, etc. , rather than splicing wires, bending ends to form terminals, and other make-shift procedures.

(5) Detirmine the proper size and length of wire, terminal, or connector to be used for replacement.

b. TESTING OF WIRES.

(1) Use a multimeter set on low ohms range to test for continuity.

(2) Use multimeter set on high ohms range to test for shorts between the circuit in a component and the outside case of the component.

(3) When testing electrical component, also look for visual damage and inspect all wiring in the area for damage or loose connections.

(4) Test for continuity in leads or wiring harnesses by disconnecting both ends.

(5) Where wires terminate in an electrical connector, disconnect connector from corresponding receptacle connector or plug connector.

(6) Touch the test probes of a multimeter (set on low ohms range) to ends of wire or to corresponding pin of connector.

(7) If continuity is not indicated, replace wire.

c. INSPECTION OF WIRING.

1. Inspect all wiring installations for cracked or frayed insulation material.

2. Pay particular attention to wires passing through holes in the casing or around sharp edges.

3. Repair or replace defective wiring.

4. Inspect electrical connectors and fittings for damage or broken conditions.

5. Replace defective connectors and fittings.

d. SPLICING OF WIRING.

1. To repair broken or cut wires that are otherwise sound, the mating ends can be stripped and spliced.

2. A commercial butt splice can be crimped onto the ends to join them, or a wire splice can be made.

3. A wire splice is made by stripping 1–1/4 inch of insulation from wire ends, holding the ends parallel and facing opposite directions, then twisting each end around the other wire at least three turns.

4. solder and apply insulation.

e. CRIMPING TERMINALS.

1. To install a terminal on end of a wire, strip 1/4 - 1/2 inch of insulation from the end of the wire.

2. Apply a l–inch piece of heak shrink tubing (if the terminals are of the uninsulated type), and insert the wire end into the shank of the terminal.

3. Crimp the shank.

4. Install heat-shrink tubing if necessary.

f. INSULATING ELECTRICAL CONNECTIONS (HEAT SHRINK TUBING).

1. The preferred method of insulating electrical connections is by the use of heat-shrink tubing.

2. To apply, cut a piece of heat-shrink tubing of suitable diameter to a 1–inch length for covering joints at terminals or connectors or to a length about 1/2 longer than the joint to be insulated.

3. Slide the tubing over the wire before making the joint.

4. After the joint is made, slide the tubing over the joint. Using a heat gun, shrink in place with moderate heat.

g. SOLDERING CONNECTIONS.

1. Wire connections must be made mechanically sound before they are soldered.

2. Solder alone does not provide sufficient strength to prevent breakage.

3. Joining surfaces of connections to be soldered must be clean and bright.

4. If a separate flux is used, it should conform to Military Specification MIL-F-4995, Type I, rosin–alcohol flux, and should be brushed onto the joint before soldering.

5. If a flux-core solder is used, it should always be rosin–core electrical solder.

6. If an uncored solder is used, it should be a lead–tin solder conforming to Federal Specification QQ-S-571.

7. Wires should always be heated to the point at which the solder will melt completely and flow into all parts of the joint.

8. Excessive build-up of solder ‘gobs” on the joint should be avoided or removed.

h. REMOVAL AND REPLACEMENT OF RIVETS.

1. From the –24P Repair Parts and Special Tools List, identify the size of the rivet used.

2. Select drill bit one size smaller in diameter than the rivet to be removed.

3. Position the drill bit on the center of the rivet head and drill down slightly below the riveted surface.

4. Using a center punch, snap the rivet head off and punch the remaining rivet material through the hole.

5. Select the proper replacement rivet and insert in the rivet clinching tool.

6. Place the rivet in the hole and maintain the rivet shaft perpendicular to the material being riveted.

7. Apply a slow, even pressure on the clinching tool until the rivet is set.

8. Make sure rivet nuts or rivet is snug and not free to rotate.

4-10. CANVAS COVER and PANELS

This task covers:

a. Removal b. Inspection c. Repair d. Installation

INITIAL SETUP

Equipment Description	Materials/Parts
Power OFF	Solvent P–D-680 (Appendix D,17)
	Adhesive MMM–A-132 (Appendix D, 13)

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a. REMOVAL.

1. Canvas Cover. (See Figure 4-5).

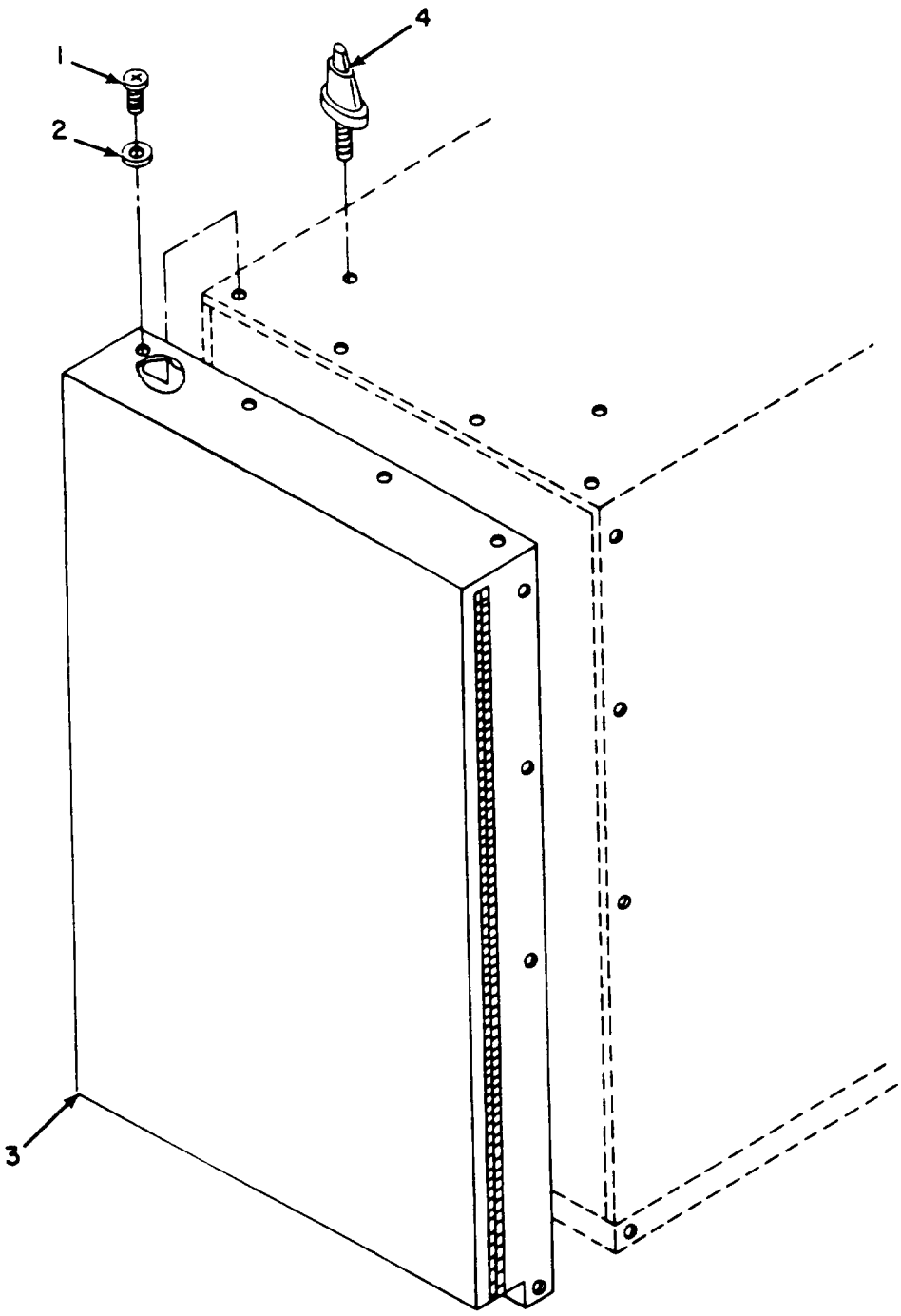


Fig. 4-5. Canvas Cover.

(a) Loosen tie strap on the canvas cover (if rolled) and unroll cover.

(b) Remove 16 screws (1) and rain seal washers (2) and 2 panel fasteners (4) and remove canvas cover (3).

2. Top Panel (See Figure 4-6).

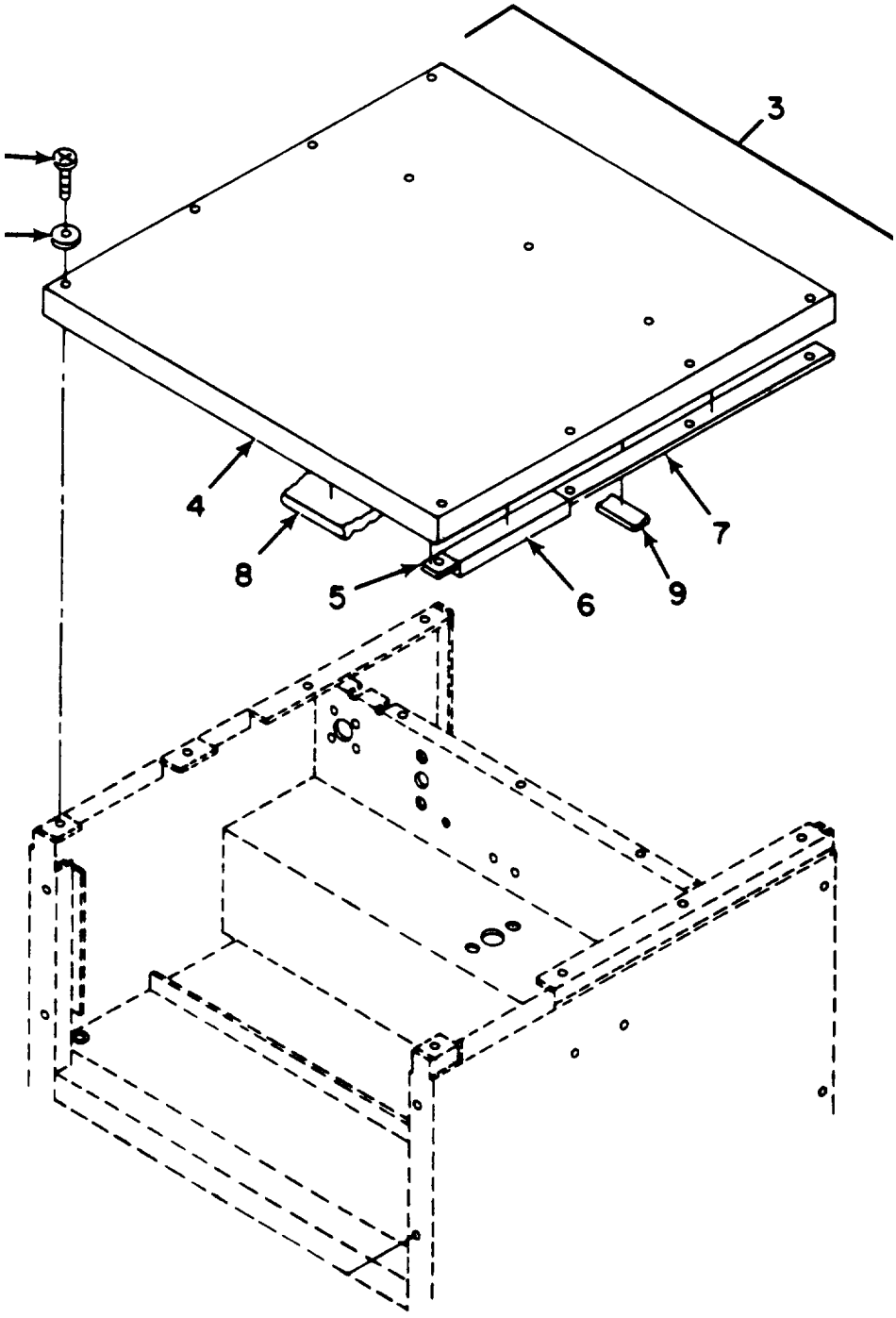


Fig. 4-6. Top Panel.

(a) Remove 11 screws (1) and rain seal washers (2).

(b) Remove top panel (3).

3. Lower Panel. (See Figure 4-7).

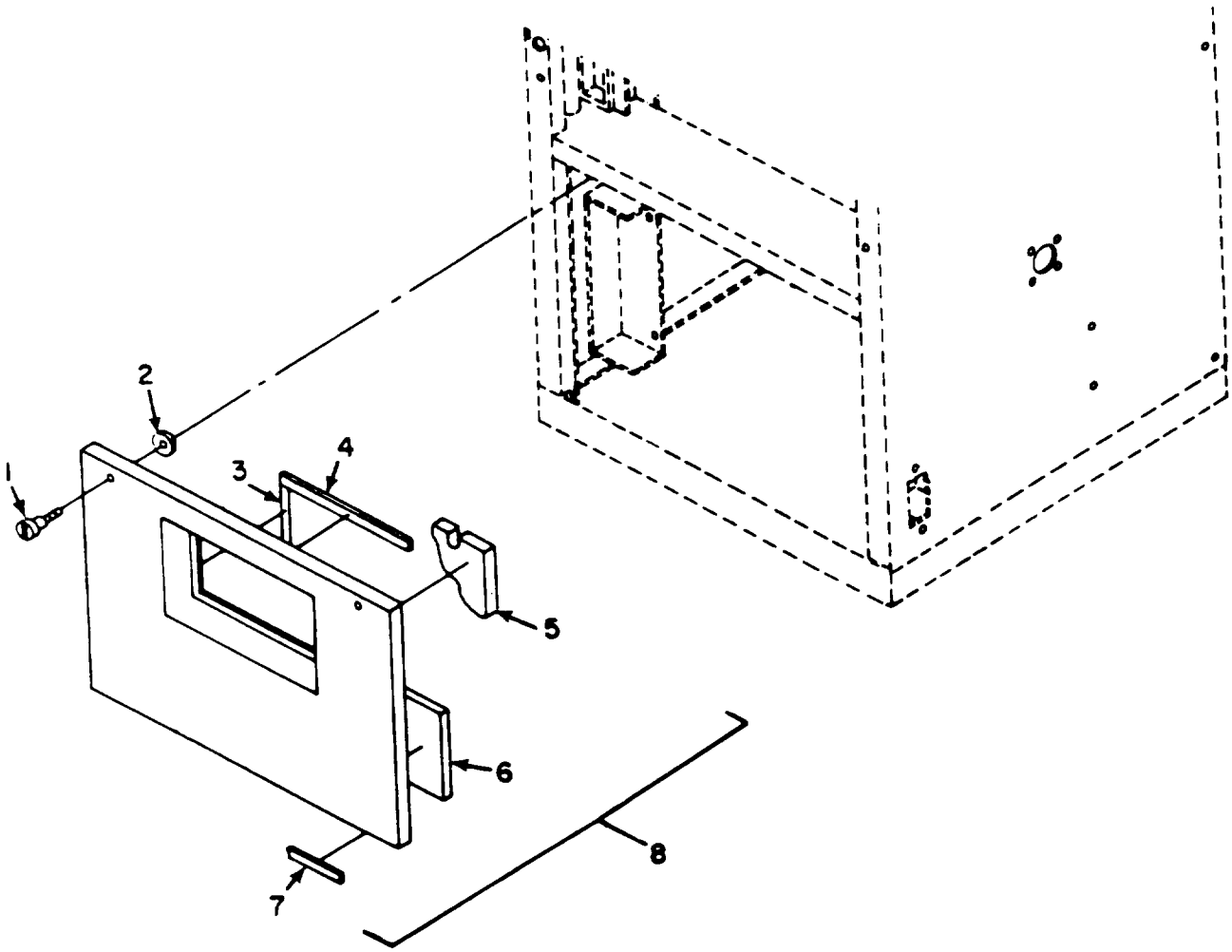


Fig. 4-7. Lower Panel.

(a) Loosen two panel fasteners (1).

(b) Remove lower panel (8) by lifting up from bottom panel

b. Inspection.

1. Canvas Cover.

(a) Check for cuts, tears, missing or damaged attaching hardware.

(b) Replace as necessary.

2. Panels.

(a) Check for bent, cracked, or deformed panels,

(b) Assure all insulation is firmly attached and has not deteriorated.

(c) Repair or replace as necessary.

c. REPAIR.

1. Canvas Cover. Minor rips, cuts, tears, or punctures maybe repaired by applying a patch to the inside surface.

2. Panels.

(a) Sheet Metal. Repair the sheet metal panels as necessary to remove bends, cracks, deformations, and gouges.

WARNING

Dry cleaning solvent 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 to 138 °F (38 °C to 59 °C).

(b) Insulation and Sealing Strips (Fig 4-6, items 3-7; Fig 4-7, items 3-7).

- Remove insulation and sealing strips by scraping and peeling. Solvent can be used to assist in this task.
- Thoroughly clean all adhesive from panel surface using solvent.
- Apply a coat of adhesive to both surfaces. Allow adhesive to dry until tacky.
- Apply insulation to panels and press firmly in place. Allow to dry.

d. INSTALLATION.

1. Top Panel.

(a) Install top panel (8) as shown in Figure 4-6.

(b) Align panel with corresponding holes and secure with eleven screws (1) and rain seal washers (2).

2. Lower Panel.

(a) Install lower panel (8) as shown in Figure 4-7.

(b) Align panel with corresponding holes and secure with two panel fasteners (1).

3. Canvas Cover.

(a) Install canvas cover (3) on top panel as shown in Figure 4-5.

(b) Align cover with corresponding holes and secure with sixteen screws (1) and rain seal washers (2) and two panel fasteners (4).

(c) Zip cover shut or roll up and tie with straps.

4-11. FRESH AIR INLET SCREEN AND GUARDS

This task covers:

a. Removal. b. Cleaning c. Inspection
d. Repair e. Installation

INITIAL SETUP

Equipment Condition

Canvas cover removed (Para 4-10)

Materials/Parts
Solvent P–D-680 (Appendix D,17)
Detergent solution
Cleaning Cloths
Container to hold solvent and screen

NOTE

The flesh air inlet screen mounted on the rear wall of the housing covers the fresh air inlet opening to prevent airborne matter from entering the air conditioner. This unit was designed for use with CBR.

a. REMOVAL.

1. Remove five screws (1), lockwashers (2), and flat washers (3), and fresh air inlet screen (5). See Figure 4-8.

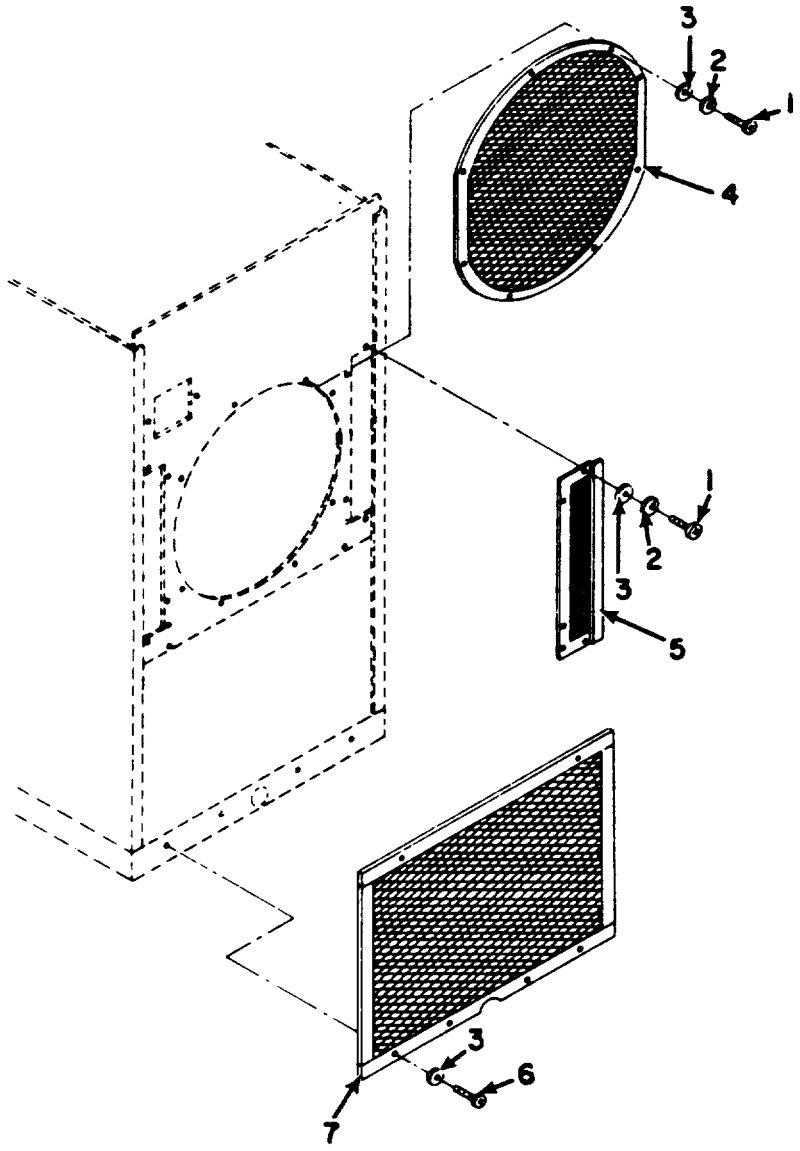


Figure 4-8. Fresh Air Inlet Screen and Condenser Guard.

2. Remove six screws (6) and flat washers (3) and condenser guard (7).

3. Remove eight screws (1), lockwashers (2), and flat washers (3) and fan guard (4).

WARNING

Dry cleaning solvent 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 to 138 °F (38 °C to 59 °C).

b. CLEANING.

1. Immerse the screen and guards in detergent solution or dry cleaning solvent.

2. Agitate until dirt is removed. Use a soft brush to loosen caked–on dirt.

3. Rinse in clear water or clean dry cleaning solvent.

4. Drain, then hold horizontal and tap each edge on bench or floor to dislodge droplets.

c. INSPECTION.

1. Inspect screen for damage such as perforations or punctures.

2. Inspect screen for areas of packed or crushed material that would obstruct airflow.

3. Replace screen if crushed, punctured, badly deformed, or broken.

4. Check guards for frame deformation and straighten. Replace if badly deformed.

d. REPAIR. Flatten and straighten screen or guard.

e. REPLACEMENT.

1. Secure fresh air inlet screen (5) to casing with five screws (1), lockwashers (2), and flat washers (3).

2. Secure fan guard (4) with eight screws (1), lockwashers (2), and flat washers (3).

3. Secure condenser guard (7) to casing with six screws (6) and flat washers (3).

4-12. GRILLES/LOUVERS

This task covers:

a. Removal b. Inspection c. Repair d. Installation

INITIAL SETUP

Equipment Condition
Power OFF

Materialals/Parts Solvent P–D-680 (Appendix D,17) Grease (GAA) (Appendix D,8) Cleaning Cloths Adhesive MMM–A-121 (Appendix D,12)

a. REMOVAL.

Return Air Intake Grille/Discharge Grille. Remove four screws (1), lockwashers (2), and flat washers (3) and grilles (4 and 5). See Figure 4-9.

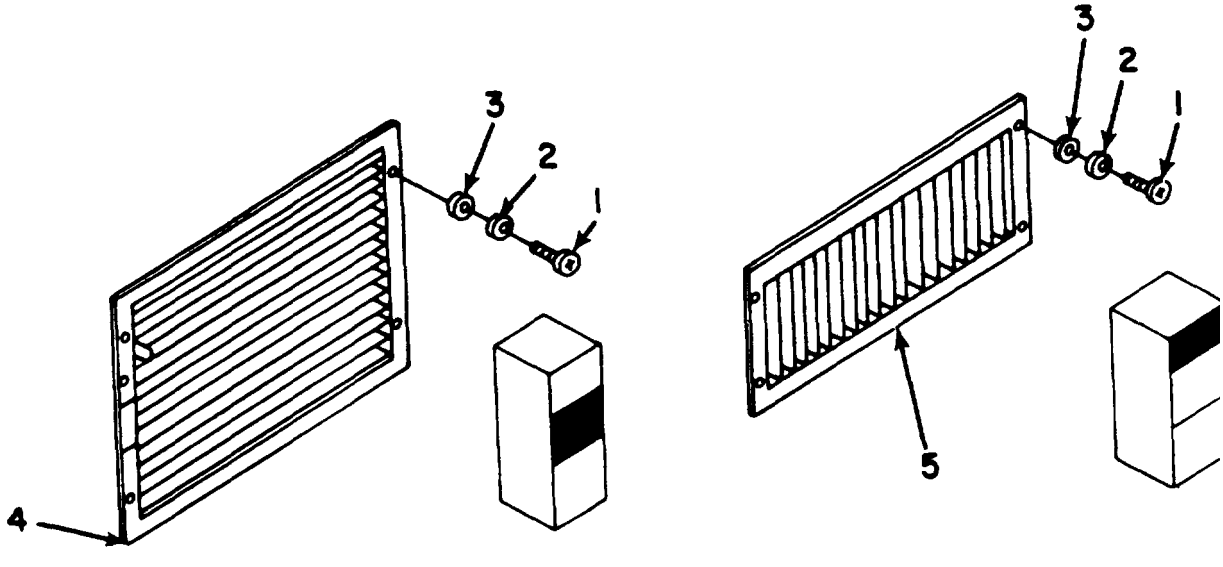


Figure 4-9. Intake and Discharge Grilles.

b. INSPECTION.

Return Air Intake Grille/Discharge Grille. Check for bent, broken, missing, or frozen blades. Repair blades as necessary.

WARNING

Dry cleaning solvent 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 to 138 °F (38 °C to 59 °C).

c. REPAIR.

Return Air Intake Grille/Discharge Grille.

1. Straighten bent blades. If a blade is beyond repair, replace the grille.

WARNING

Use compressed air to 30 psi (1.36 kg) or less. Never use compressed air to clean clothing or parts of the body. Do not point compressed air at yourself or others. Serious injury or death could result.

2. Frozen blades maybe freed by using a solvent to break down any dirt accumulation. The affected blade(s) should then be operated several times. Using low pressure air, remove remaining solvent.

d. REPLACEMENT.

Return Air Intake Grille/Discharge Grille.

1. Align grilles (4 and 5) to corresponding holes in casing.
2. Secure grilles (4 and 5) with four screws (1), lockwashers (2), and flat washers (3).

4-13. INFORMATION PLATES

This task covers:

a. Inspect b. Remove c. Replace

INITIAL SETUP

Equipment Condition
Canvas cover and top panel removode (Para 4-10)

a. INSPECT.

1. Visually inspect information plates for damage, legibility, or loose mounting. See Figure 4-10

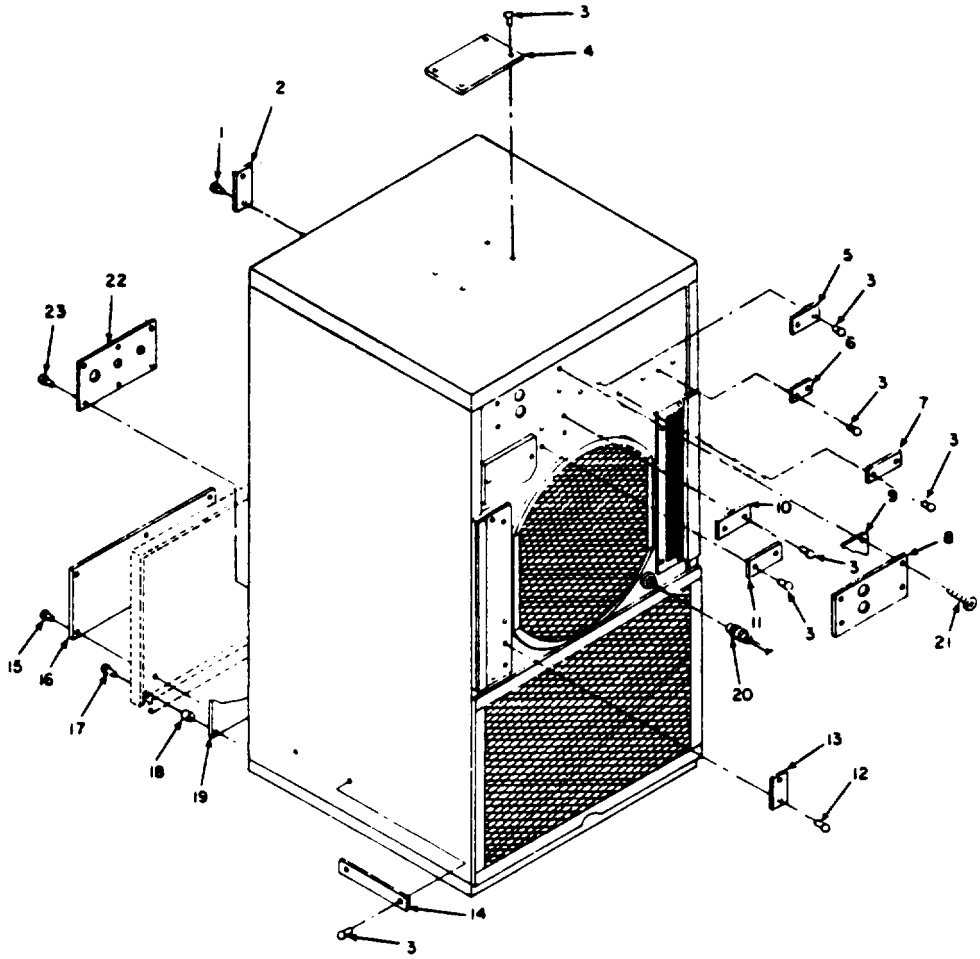


Figure 4-10. Information Plate.

2. Replace loose or damaged information plates.

b. REMOVAL. For removal of riveted information plates, refer to Paragraph 4-9.

c. REPLACEMENT. For replacement of riveted information plates, refer to Paragraph 4-9.

4-14. AIR FILTER

This task covers:

a. Removal b. Inspection c. Cleaning (service) d. Installation

INITIAL SETUP

Equipment Condition

Return air intake grille removed (Para 4-12)

Materials/Parts
- Solvent P–D-880 (Appendix D, 17)
- SAE 30 oil (Appendix D,23)
- Cleaning Cloths
- Detergent solution
- Container to hold solvent and air filter

NOTE

The air filter consists of a shredded aluminum foil mesh held between screens in an aluminum channel frame. The filter can be cleaned and reused repeatedly. Airflow markings (arrows) printed on the frame make it easy to replace the filter in the correct position every time.

a. REMOVAL. Remove air filter (5) from clip inside casing. See Figure 4-11.

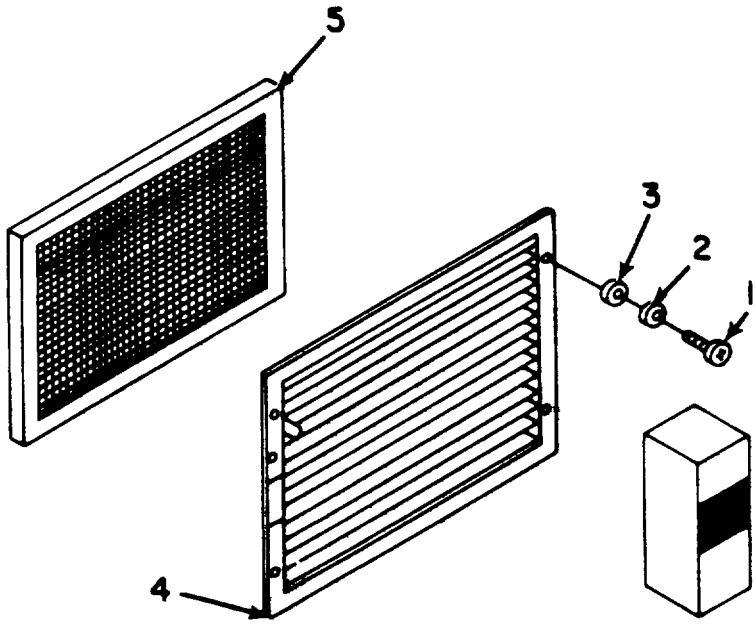


Figure 4-11. Return Air Filter.

b. INSPECTION.

1. Inspect the air filter for damage such as perforations or punctures in the screen and aluminum foil mesh that could permit passage of unfiltered air.

2. Inspect for areas of packed or crushed mesh material that would obstruct airflow through the filter.

3. Check air filter for bent frame. Straighten impossible without crushing mesh material.

4. Replace air filter if crushed, punctured, or badly bent.

c. CLEANING.

WARNING

Dry cleaning solvent 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 to 138 °F (38 °C to 59 °C).

1. Immerse the air filter in detergent solution or dry cleaning solvent.

2. Agitate until dirt is removed. Use a soft brush to loosen caked-on dirt.

3. Rinse in clear water or clean dry cleaning solvent.

4. Drain by holding filter horizontal and gently tap each edge on bench or floor to dislodge droplets.

d. REPLACEMENT.

1. Spray a very light coat of SAE 30 oil on air intake side of air filter (5).

2. Allow excess oil to drain.

3. Wipe off excess oil.

NOTE

Airflow arrows on filter frame point inward toward fan intake.

4. Place filter into left-hand bracket inside casing and press filter into right-hand bracket.

4-15. MIST ELIMINATOR

This task covers:

a. Removal b. Inspection c. Cleaning d. Installation

INITIAL SETUP

Equipment Condition

Top panel and canvas cover removed (Para 4-10)

Materials/Parts

Solvent P–D-680 (Appendix D,17)
Detergent solution
Cleaning Cloths
Adhesive MMM-A-121 (Appendix D,12)
Pan to hold solvent and mist eliminator

a. REMOVAL (See Figure 4-12). Carefully lift out mist eliminator (4).

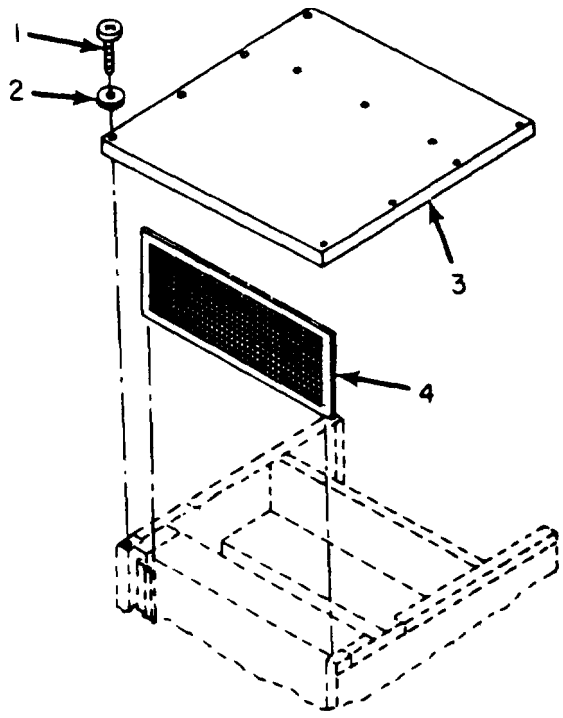


Figure 4-12. Mist Eliminator.

b. INSPECTION.

1. Inspect for damage such as perforations or punctures in the screen.

2. Inspect for areas of packed or crushed material that would obstruct airflow.

3. Check for deformation of the frame, and straighten if possible without crushing aluminum.

4. Replace if crushed, punctured, badly deformed, or broken.

5. Straighten minor bends and dents. Replace if damaged beyond repair.

c. CLEANING.

1. Immerse in detergent solution or dry cleaning solvent.

2. Agitate until dirt is removed using a soft brush if necessary to loosen caked-on dirt.

3. Rinse in clear water or clean dry cleaning solvent.

4. Drain, then hold horizontal and gently tap each edge on bench or floor to dislodge droplets.

d. REPLACEMENT.

Slide mist eliminator (4) between brackets.

4-16. FRESH AIR DAMPER.

This task covers:

a. Inspection b. Removal c. Repair d. Installation

INITIAL SETUP

Equipment Condition

Discharge grille removed (Para 4-12)
Air filter removed (Para 4-14)

Materials/Parts

Cleaning Cloths
Adhesive MMM–A-1617 (Appendix D,15)
Solvent P–D-680 (Appendix D,17)
Sealing Strip SB-E42CF2

NOTE

The damper opens and closes the fresh air inlet passage of the air conditioner casing. It is not designed for easy removal and replacement and should not require maintenance under normal conditions.

a. INSPECTION. See Figure 4-13. Inspect damper for poor air sealing or malfunction. Repair only if operation of damper is impaired. Wipe off all loose or caked dirt with a dry cloth.

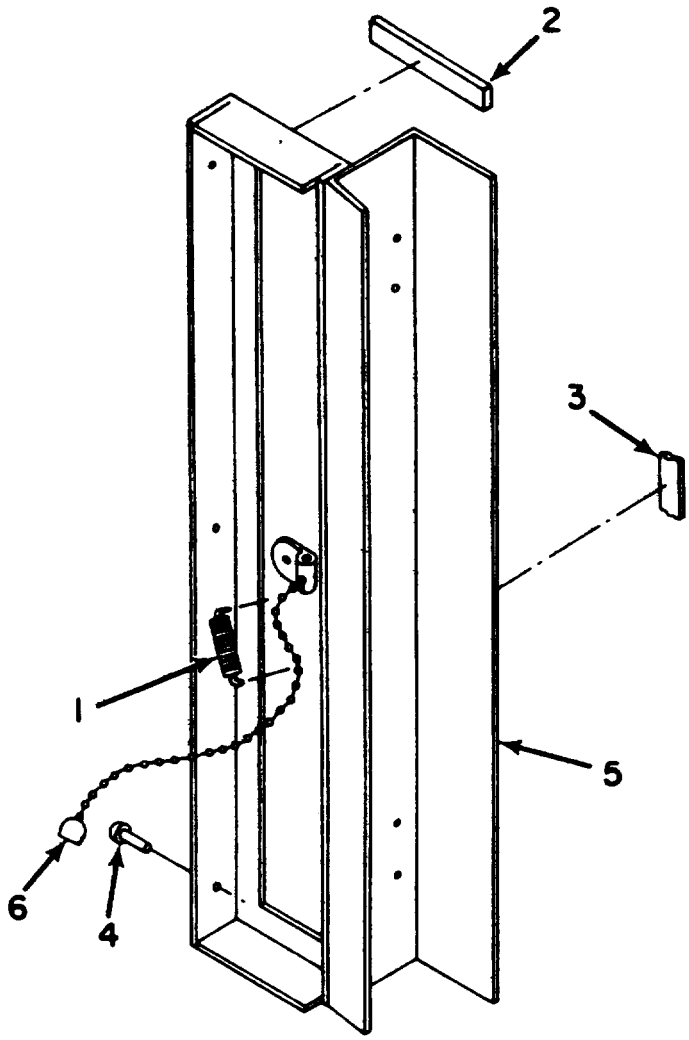


Figure 4-13. Damper Assembly.

b. REMOVAL.

1. Remove eleven rivets (4) holding damper assembly (5) to casing and remove damper assembly.

2. Disassemble the knob (6) from the chain.

c. REPAIR.

1. Replace spring (1) by unhooking it from chain assembly and reattaching new spring.

WARNING

Dry cleaning solvent 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 to 138 °F (38 °C to 59 °C).

2. Replace sealing strips (2 and 3) on panel by scraping old material off until panel is clean and clean with solvent. Apply adhesive on both panel and replacement sealing strips. Allow to dry until tacky. Apply strips to prepared surface.

3. Replace door, hinge, channel, as necessary.

d. INSTALLATION. Rivet damper assembly (5) back in place.

4-17. CONDENSATE DRAIN LINES

This task covers:

a. Inspection b. Cleaning c. Repair
d. Removal e. Replacement

INITIAL SETUP

Equipment Condition

Condition Description (Para 4-12)
Discharge grille removed (Para 4-12)
Mist eliminator removed (Para 4-15)
Junction box removed (Para 4-20)

Materials/Parts
One pint container
Fresh water
Small diameter brush
or soft wire

---

a. Inspection and Flow Test. See Figure 4-14.

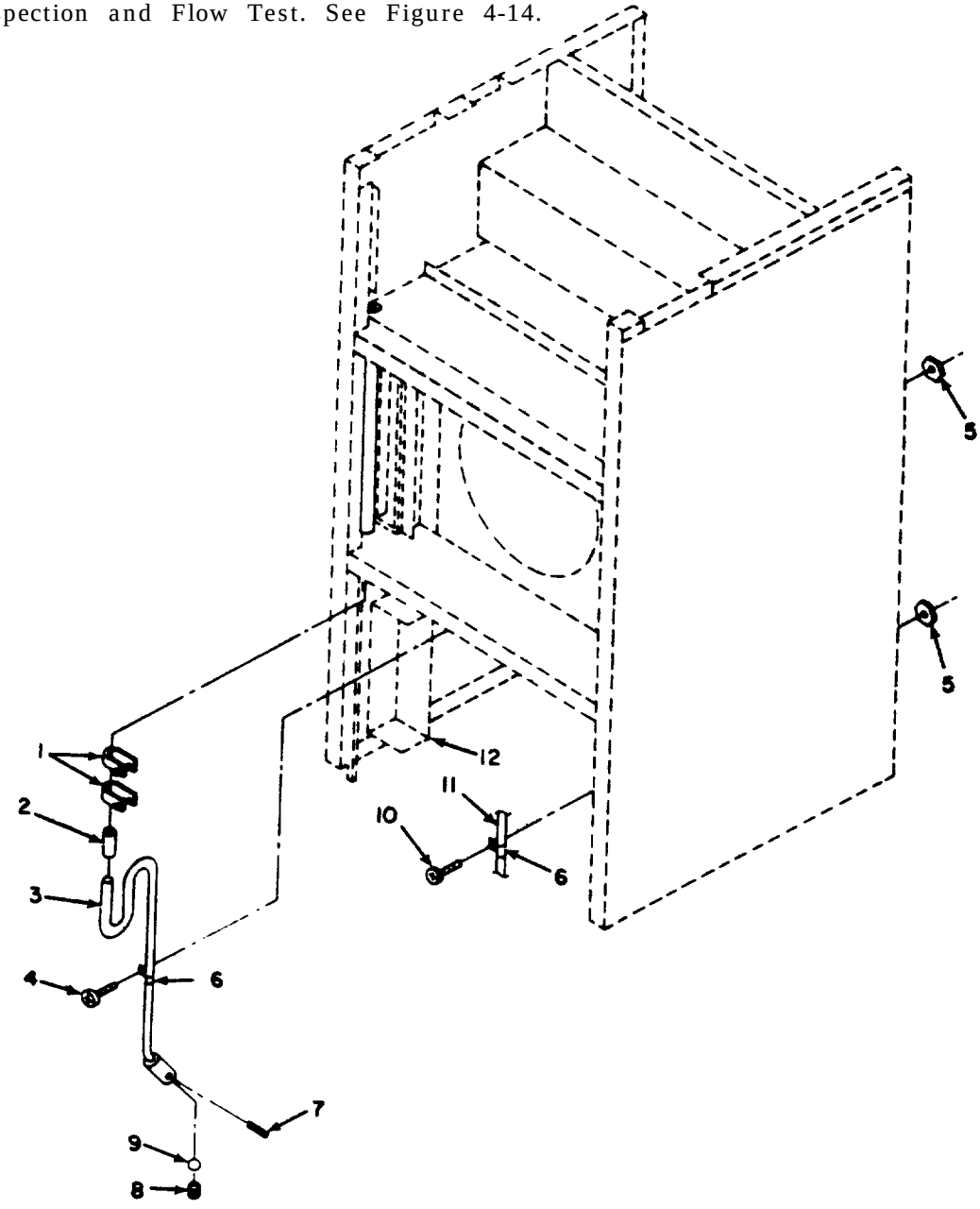


Figure 4-14. Condensate Lines.

1. Remove cotter pin (7), spring (8), and ball (9) from end of each drain tube.

2. Loosen air conditioner mounting bolts.

3. Place a 3/4-inch board under one side of the air conditioner to tilt slightly.

4. Pour about 1 pint (1/2 liter) of water into the lower end of the drip pan below the evaporator coil.

5. Verify that the water flows out of the drip pan through the drain tube.

6. Tilt the air conditioner the opposite direction and repeat the flow test on the other side.

7. Water should drain freely through both tubes. If it does not, remove, clean, and/or replace.

8. Tighten mounting bolts.

9. Inspect tubing for splits, cracks, breaks, and deterioration. Replace as necessary.

b. CLEANING.

1. Flush out tubing with fresh clean water.

2. Disconnect tubing.

3. Use a small diameter brush or soft wire to clean tubing.

c. REPAIR. Repair by replacing tubing.

d. REMOVAL.

1. Remove hose clamps (1) and clamp loops (6).

2. Remove left mounting bracket for junction box (12).

3. Remove drain hose (2) and drain tubing (3 and 11).

e. REPLACEMENT.

1. Cut replacement drain hose (2) to desired size.

2. Slide drain hose (2) over fixed tube section inside casing and secure with one hose clamp (1).

3. Replace ball (9), spring (8), and cotter pin (7).

4. Insert drain tube (3 and 11) into drain hose (2) and secure with other hose clamp (1).

5. Install left mounting bracket for junction box (12).

6. Secure drain tube (3 and 11) with screw (4) and clamp loop (6).

4-18. CONTROL PANEL

This task covers:

a. Removal b. Inspection c. Repair d. Installation

INITIAL SETUP

Equipment Condition

Lower panel removed (Para 4-10)
Return air intake grille removed (Para 4-12)
Air filter removed (Para 4-14)

Materials/Parts

Cleaning cloths
Seals

a. REMOVAL. See Figure 4-15.

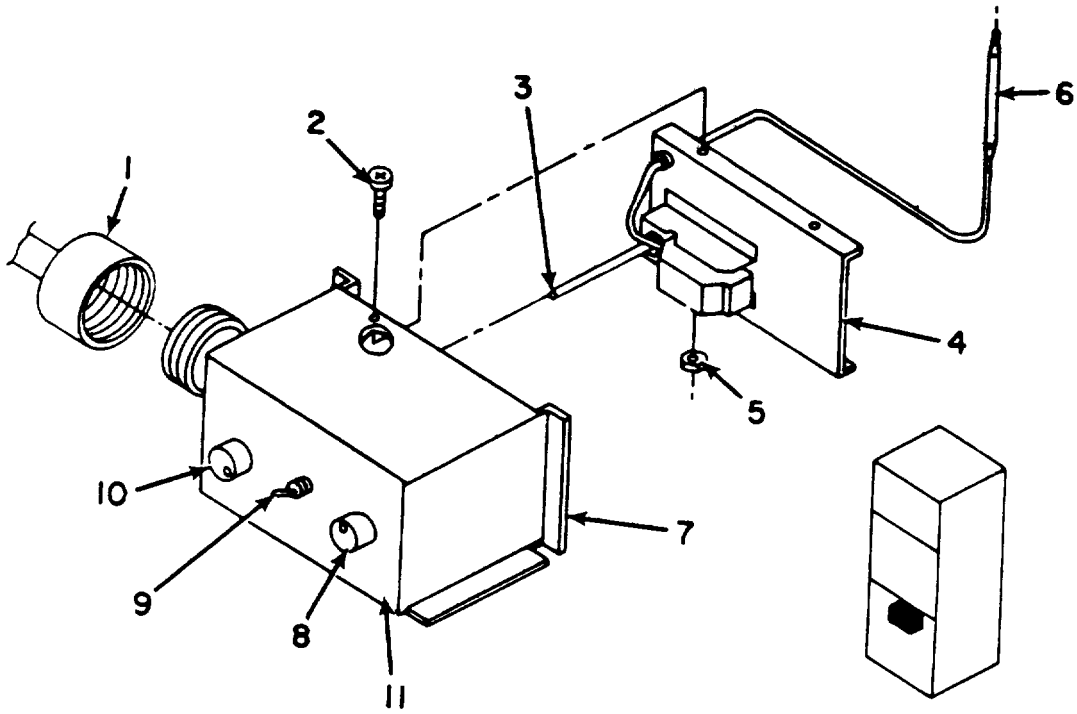


Figure 4-15. Control Panel.

WARNING

High voltage can kill.

1. Disconnect power supply.

2. Remove electrical connector (1) from control panel (7).

3. Loosen clamp loop securing sensing bulb (6) to well inlet.

4. Remove four bolts and flat washers and control panel (7). Carefully pull sensing bulb (6) through clamp loop.

5. Remove panel (4) from control panel (7) by removing knob from temperature control switch (10) and removing four screws (2) and nuts (5)-

6. Remove knob from **INCREASE/DECREASE** switch (S1) (10).

7. Tag and remove all electrical leads.

8. Remove nut (Figure 4-16, item 2), lockwasher (3), and switch (S).

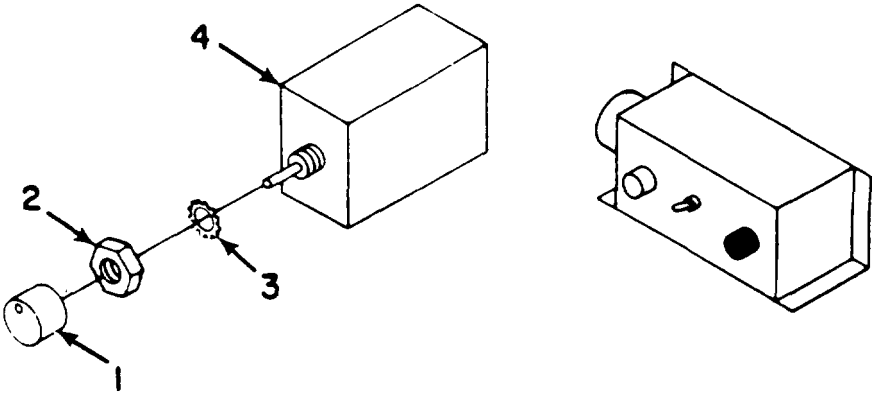


Figure 4-16. Mode Selector Switch(s).

9. Remove grommet (Figure 4-17, item 6) and carefully slide sensing line (6) away from panel (4).

10. Tag and remove electrical wires from (S1) (Figure 4-17, item 9).

11. Remove four screws (Figure 17, Item 7) and nuts (8) and (S1) (9) with sensing bulb line (4).

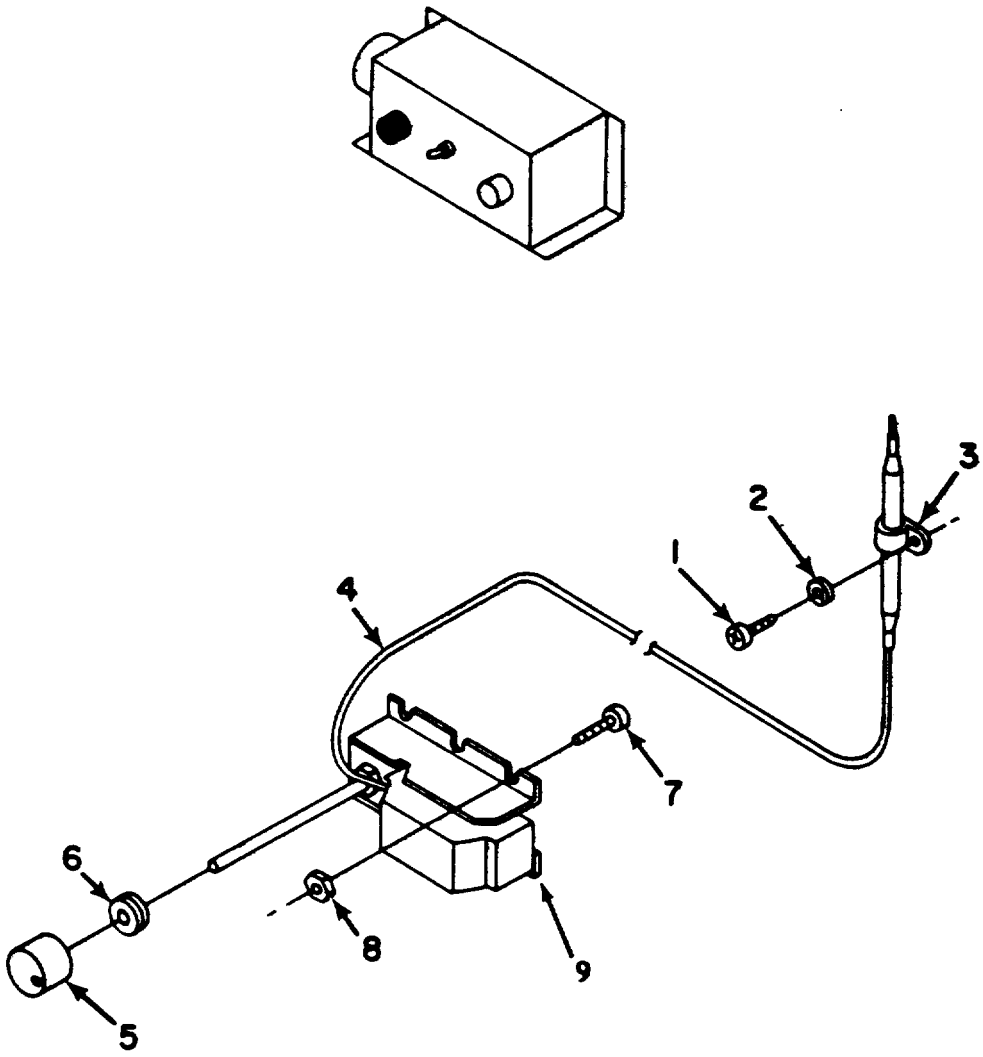


Figure 4-17. Temperature Control Switch (S1) .

12. Remove nut (Figure 4-18, item 1), lockwasher (2) and locking ring (3) and remove switch (S7) (4).

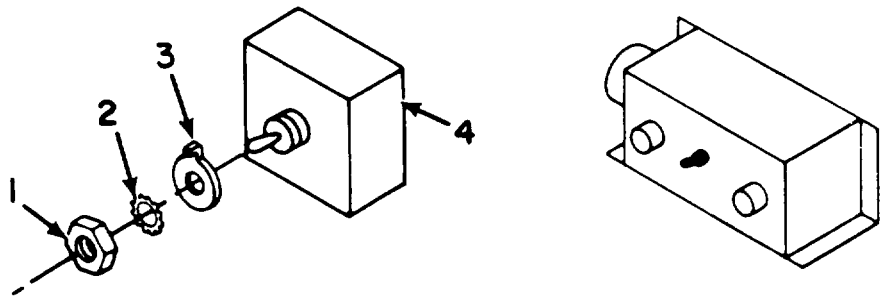


Figure 4-18. Fan Switch (S7).

13. Remove four screws, lockwashers, and flat washers and harness (See Figure 4-19).

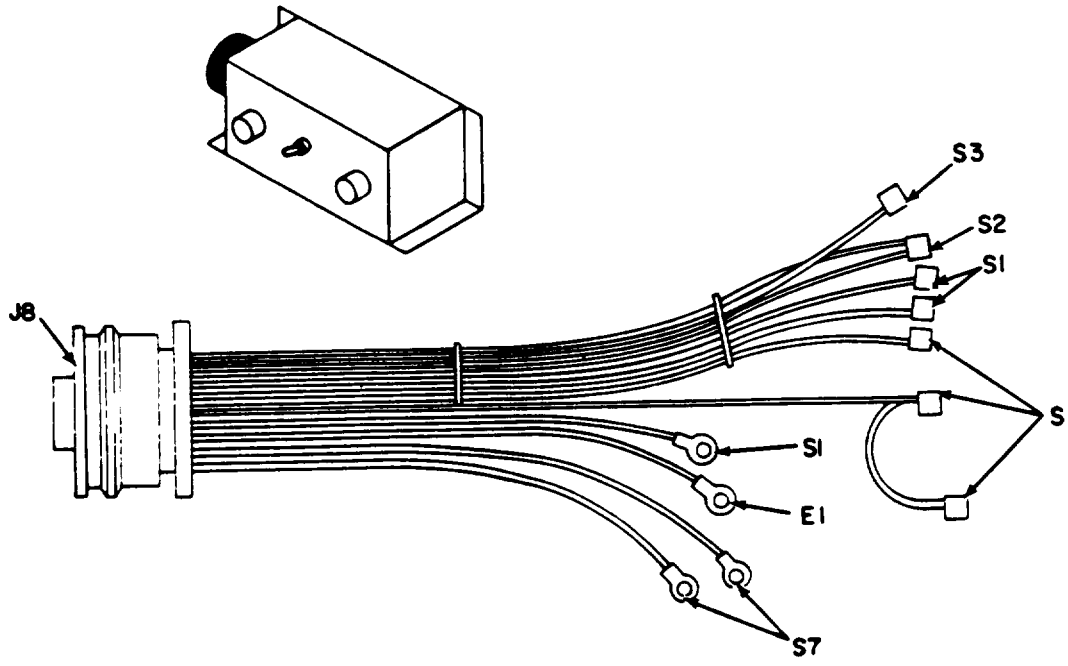


Figure 4-19. Wiring Harness (Control Panel).

14. Remove grommets from control panel and information plate (Figure 4-15, item 11).

15. Remove six rivets to separate information plate (11) from control panel (7).

b. INSPECTION.

1. Inspect information plate for legibility, damage, and security.

2. Inspect grommets for cracking or deterioration.

3. Check all wires and leads for fraying, missing terminals, and broken solder joints.

4. Check rotary shafts on switches (S) and (S1) for looseness.

5. Check sensing line for breaks, kinks, and damage.

6. Refer to Tables 4-3 and 4-4 for continuity checks.

Table 4-3. CONTROL PANEL WIRING HARNESS CONTINUITY CHECK

FROM	TO
J8–C	S7–1
J8–D	S7–8
J8–E	S2–B
J8–H	S–32
J8–J	S–3A
J8–K	S–2B
J8–L	S–1A
J8–M	S–1B
J8–N	S–1D
J8–P	S1–R
J8–R	E1
S–32	S–22

Table 4-4. CONTROL PANEL ELECTRICAL LEADS CONTINUITY CHECK

FROM	TO
S1–R	S/WA–11
S1–R	S7–3
S1–BL	S/WA–12

c. REPAIR.

1. Repair electrical components, rivets, grommets, and panel by replacement.

2. Replace or repair broken leads or terminals, resolder broken solder joints. Refer to paragraph 4-9.

3. Replace defective wiring. Refer to Paragraph 4-9.

d. INSTALLATION.

1. Secure information plate (Fig 4-15, item 11) to control panel (7) with six rivets.

2. Install switch grommets.

3. Install temperature selector switch (S1) (Fig 4-17, item 9) to panel and secure with six screws (7) and nuts (8).

4. Install switch (S) (Fig 4-16, item 4) with lockwasher (3) to control panel and secure with nut (2) furnished with switch.

5. Replace knob (1) on switch (S) (4).

6. Install switch (S7) (Fig 4-18, item 4) to control panel and secure with nut (1), lockwasher (2), and locking ring (3).

7. Connect all electrical leads and wiring harness. Refer to wiring diagram FO-1 for correct connection.

NOTE

Use tie straps to tie wires clear of control operation. Electrical leads should not interfere with control operation.

8. Attach panel (Fig 4-15, item 4) to control panel (7) and secure with four screws (2) and nuts (5).

NOTE

Carefully feed the sensing line (6) with grommet (3) through the slot located on the side of the panel (4) and snap grommet in place.

9. Mount control panel (7) to junction box using four bolts and flat washers.

10. Carefully feed sensing bulb through clamp loop on well inlet and tighten in place.

4-19. CONNECTOR, EXTERNAL POWER

This task covers:

a. Removal b. Inspection c. Installation

INITIAL SETUP

Equipment Condition

Canvas cover removed (Para 4-10)
Fan and condenser guards removed (Para 4-11)
Condenser impeller and baffle removed (Para 4-24)

a. REMOVAL. See Figure 4-20.

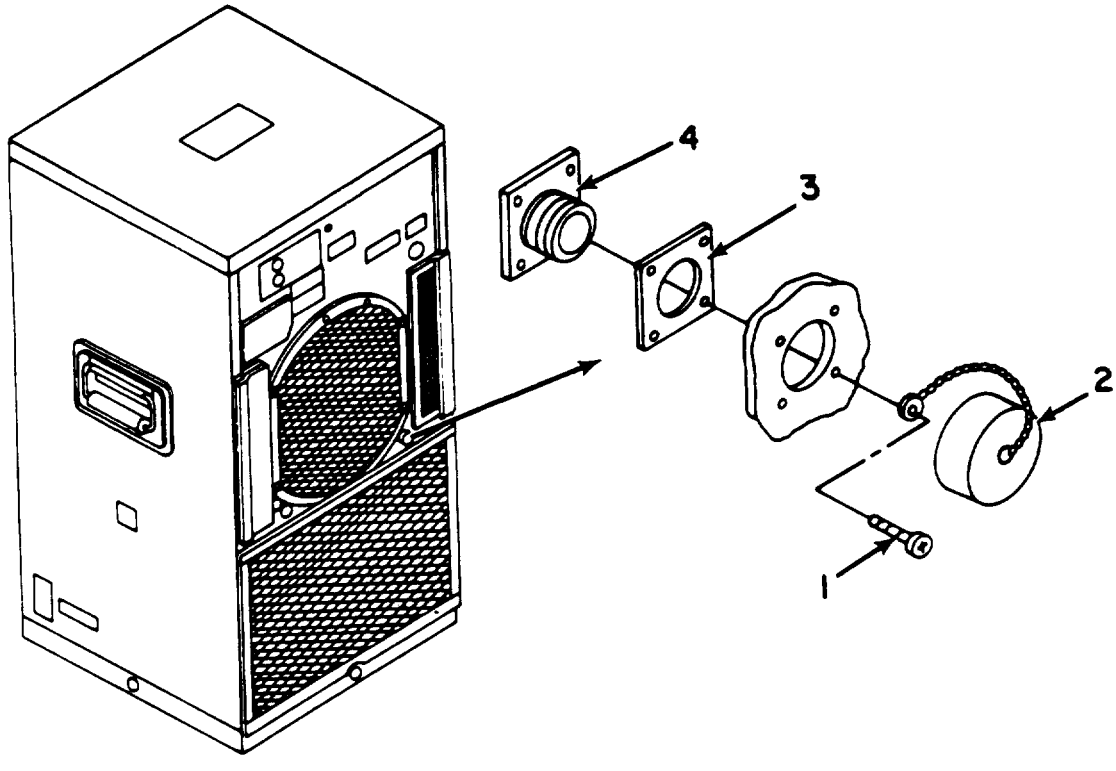


Figure 4-20. Connector Cover.

4-19. CONNECTOR COVER – Continued

WARNING

High voltage can kill.

1. Unscrew cover (2) from connector (4).
2. Remove one screw (1) to release cover (2).
3. Remove remaining three screws (1) to release gasket (3) and connector (4).
4. Reach inside casing to remove connector (4) and gasket (3).

b. INSPECTION.

1. Check cover for cracks and thread damage.
2. Inspect gasket for deterioration and cracks.
3. Replace cover if defective.
4. Replace connector if damaged.

c. INSTALLATION.

1. Reattach connector (4) and gasket (3) with three screws (1).
2. Screw cover (2) onto connector (4) and hand tighten.
3. Install cover chain to back plate with one screw (1).

4-20. JUNCTION BOX

This task covers:

a. Removal b. Inspection c. Test d. Repair
e. Installation

INITIAL SETUP

Equipment Condition
Control panel removed (Para 4-18)

Test Equipment
Multimeter

WARNING

High voltage can kill.

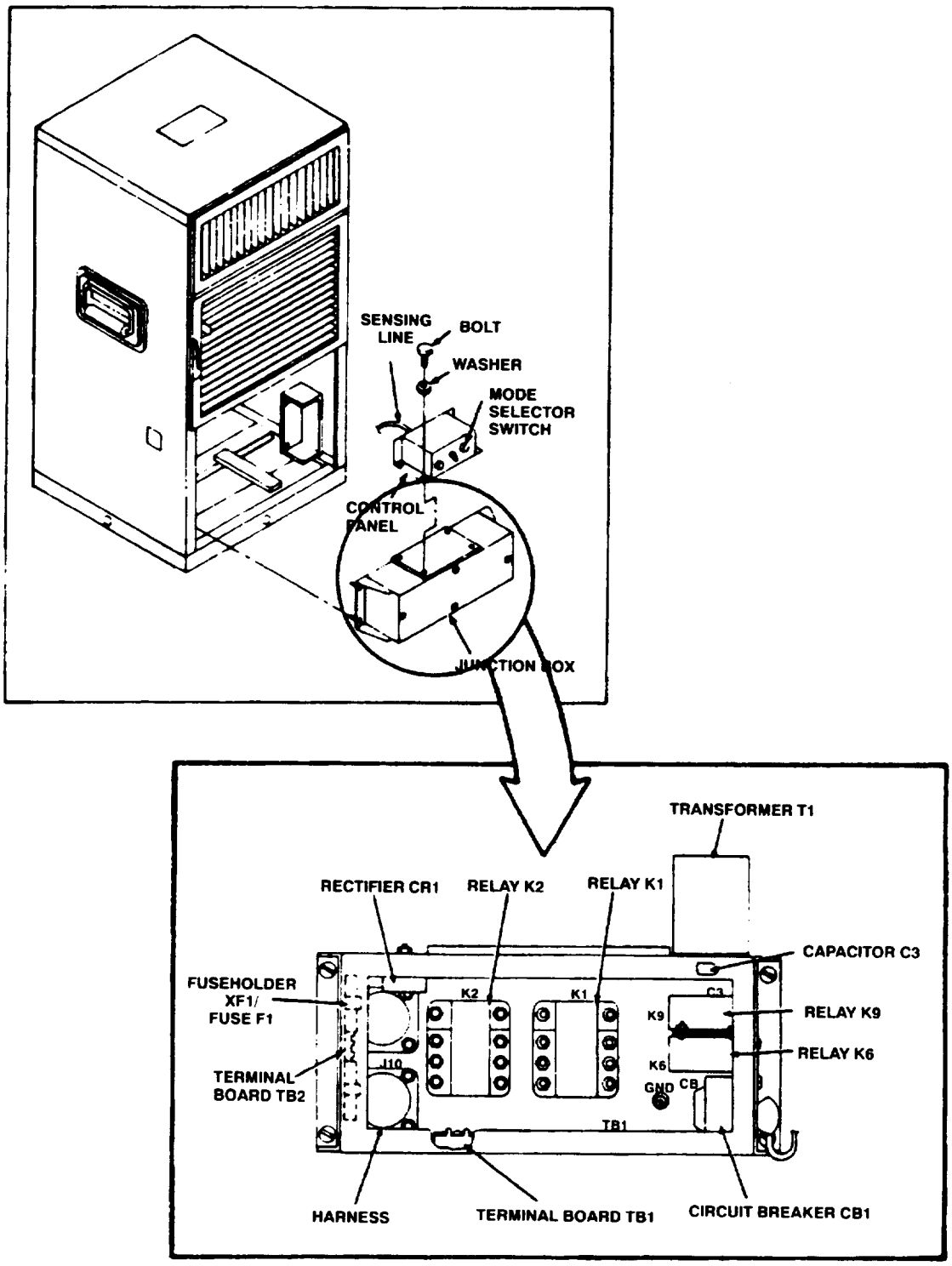


Figure 4–21. Junction Box.

4-20. JUNCTION BOX–Continued

a. REMOVAL.

1. Disconnect power supply.

2. Loosen four captive screws retaining junction box cover. Remove cover to gain access to electrical components.

3. Remove and tag all leads from circuit breaker (Fig 4-22, item 5).

4. Remove four screws (1) and lockwashers (2) and circuit breaker (5).

5. Remove two screws (3) and lockwashers (2) and cover (6).

6. Remove guard (4) by compressing outside and pulling in through hole.

7. Using a center punch, drive out circuit breaker handle shaft and remove arm.

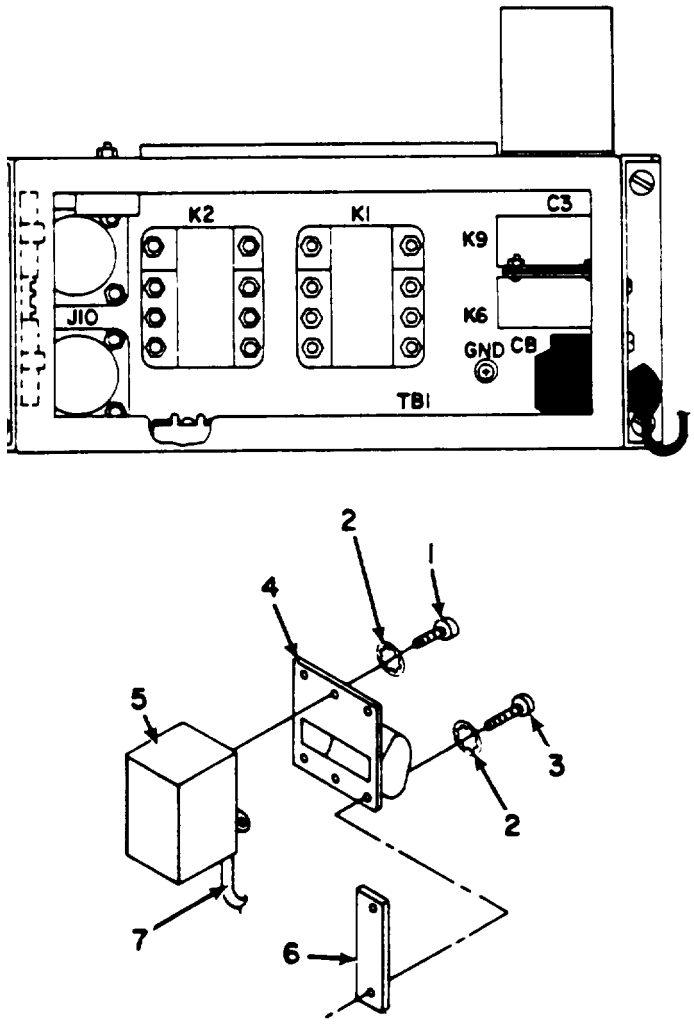


Figure 4-22. Circuit Breaker (CB).

8. Remove and tag all leads from rectifier (Fig 4-23, item 4).
9. Remove nut (1), lockwasher (2), and flat washer (3), and rectifier (4).

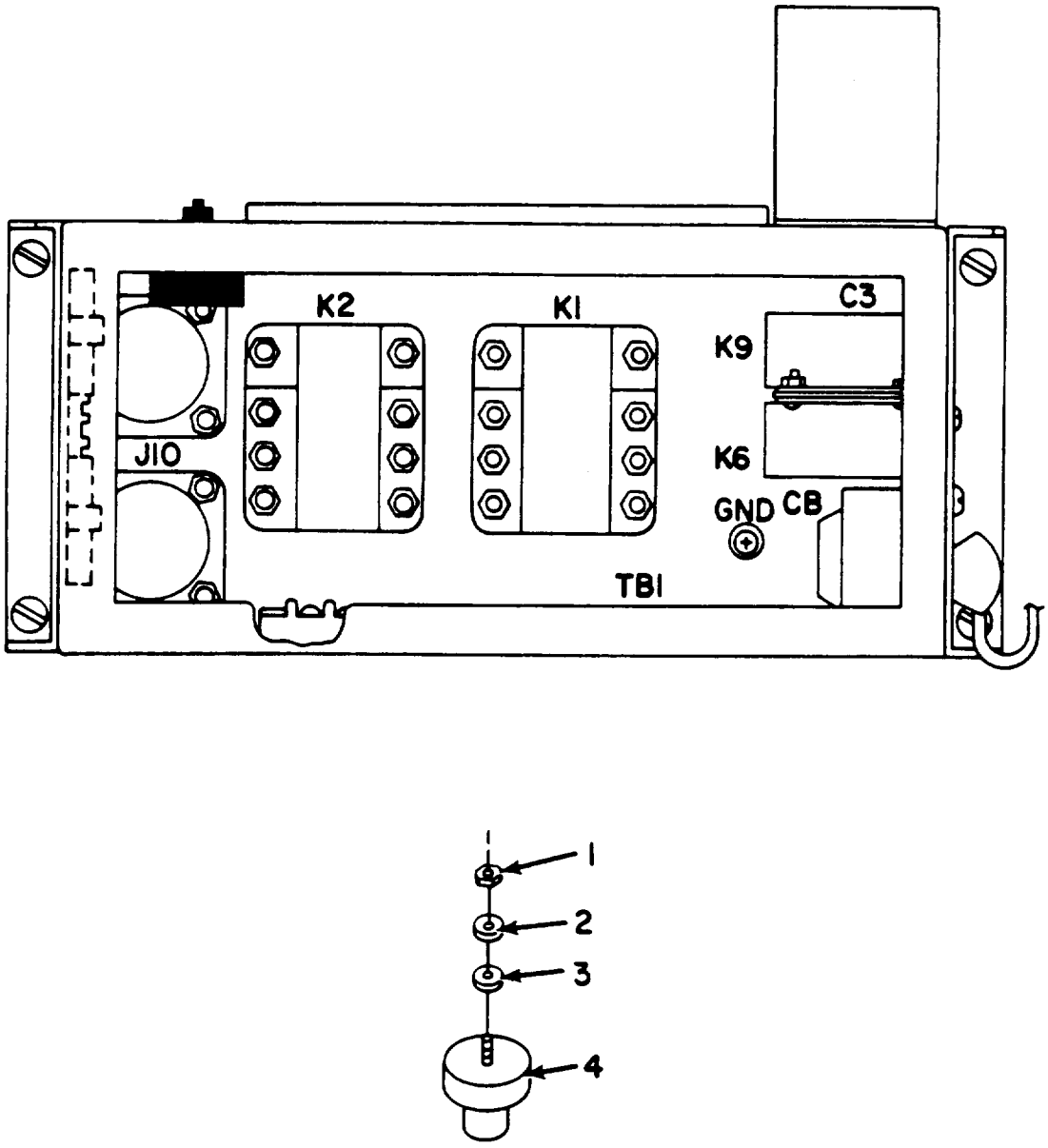


Figure 4-23. Rectifier (CR).

NOTE

Relays (K1) and (K2) (fig 4-24, item 3) are identical in configuration so all instructions apply to both.

10. Remove and tag all leads from relay (3).
11. Remove four screws (1) and nuts (2) and relay (3).

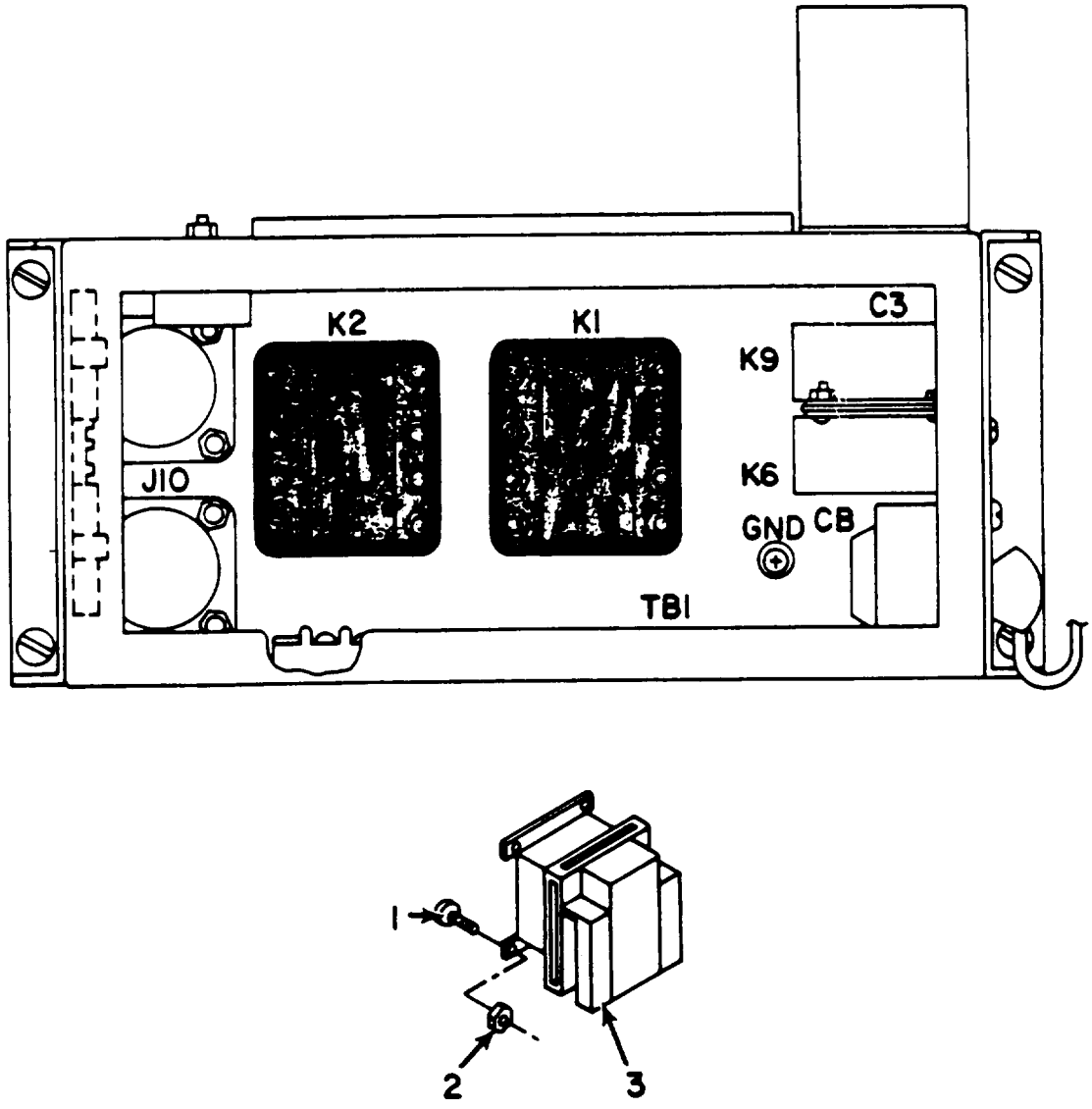


Figure 4-24. Relays (K1 and K2).

12. Remove and tag all leads from relays (K6 and K9) (Fig 4-25, items 3 and 4).
13. Remove four screws (1) and nuts (2) and remove relays (3 and 4).
14. Remove three screws (5) to remove mounting bracket (6).

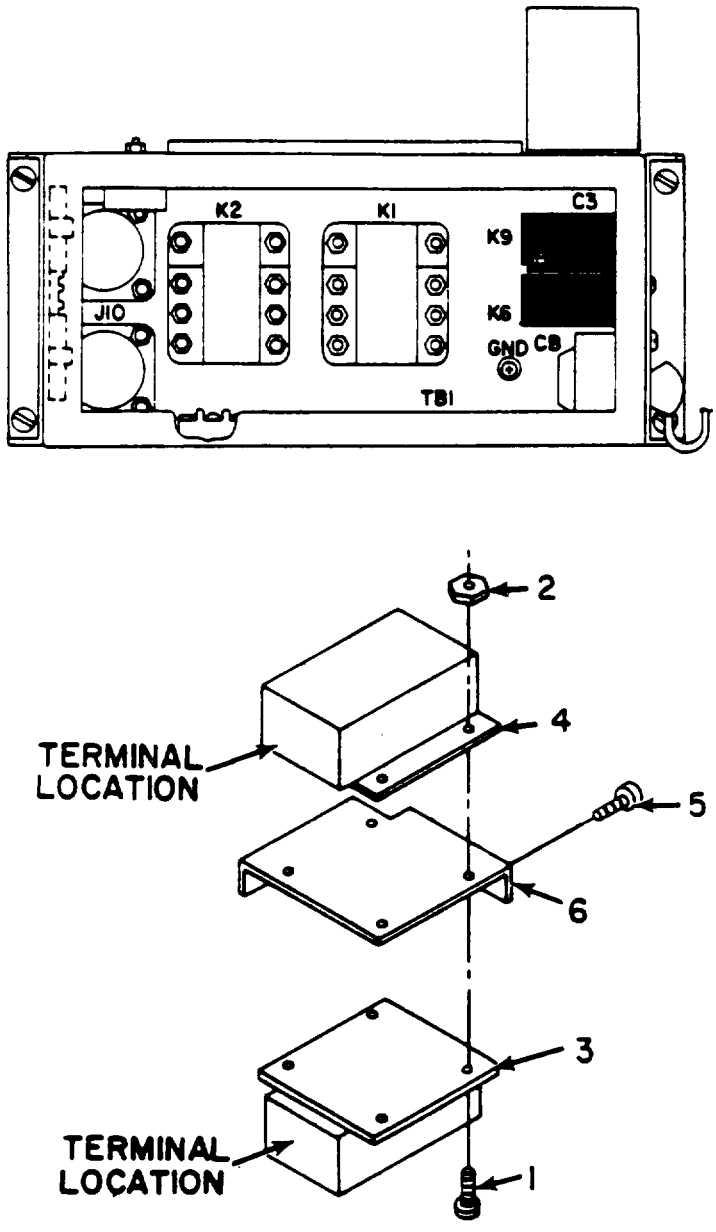
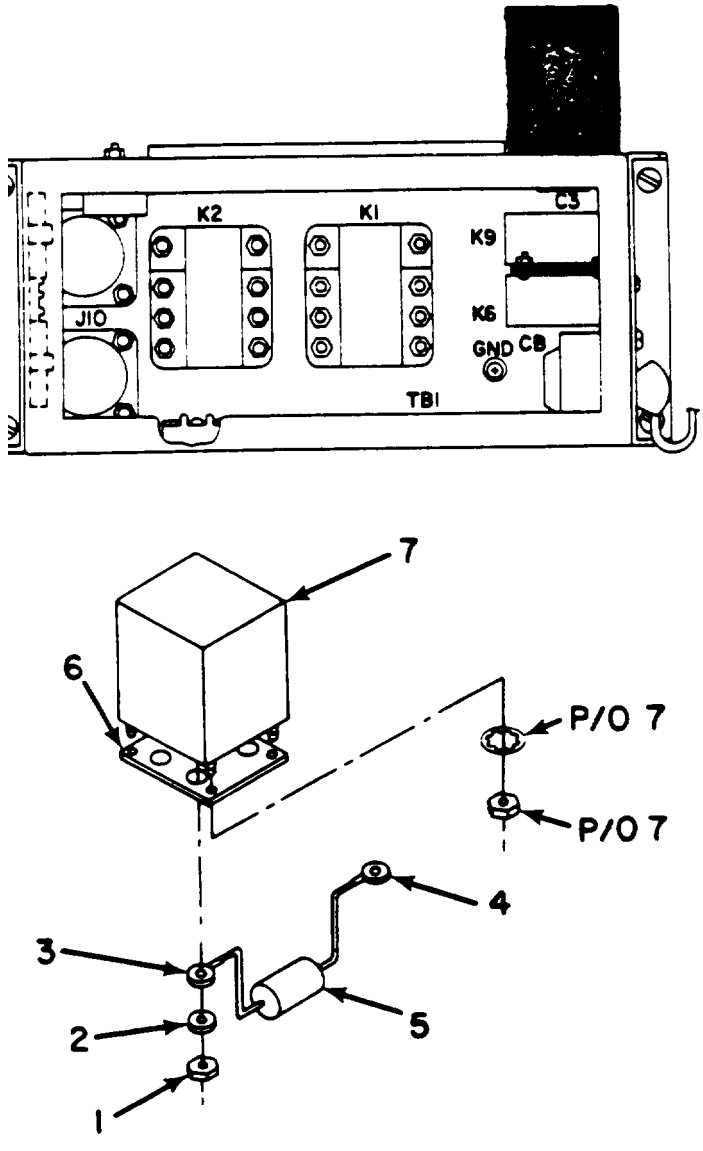


Figure 4-25. Time Delay Relays (K6 and K9).

15. Remove and tag all leads from transformer (Fig 4-26, item 7) and capacitor (5).
16. Remove two nuts (1) and flat washers (2) to remove capacitor assembly (5).
17. Remove four nuts and lockwashers and transformer (7).
18. Remove insulation (6) from transformer (7).



Items 3 and 4 deleted.

Figure 4-26. Transformer (T) and Capacitor Assembly.

19. Remove and tag all leads from (TB1) (Fig 4-27, item 6) and (TB2) (3).
20. Remove four screws (4) and nuts (5) to remove (TB1) (6).
21. Remove two screws (1) and nuts (2) to remove (TB2) (3).

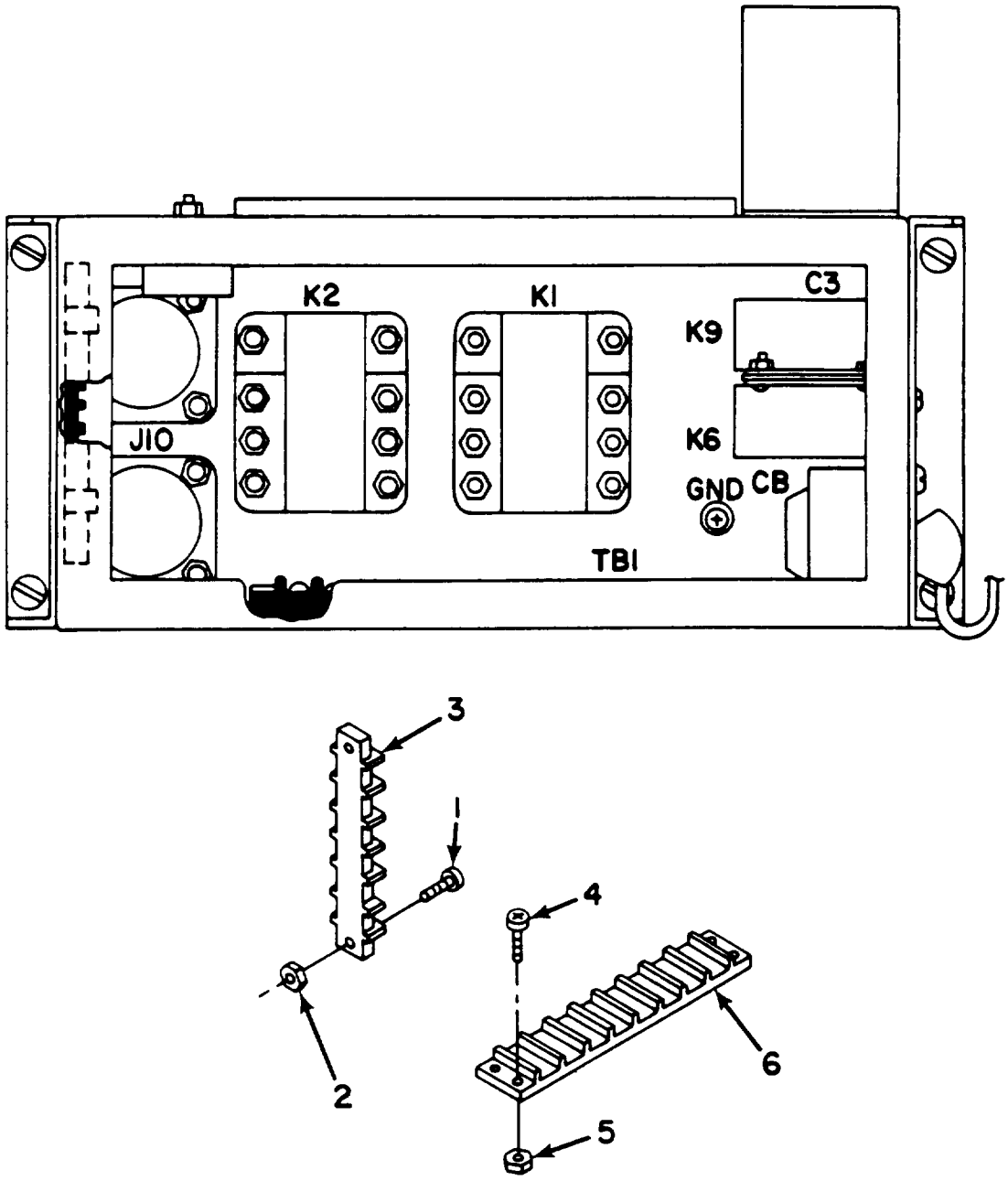


Figure 4-27. Terminal Boards (TB1 and TB2).

22. Tag and disconnect leads from (K1 and K2) (See Figure 4-28).

23. Tag and disconnect leads from E2 by removing screw, two flat washers, lockwasher, and nut.

24. Remove connectors P4 and P10.

25. Remove connectors J4 and J10 by removing four screws and nuts each.

26. Tag and disconnect leads to TB1 by removing 16 screws and lockwashers.

27. Tag and disconnect leads to TB2 by removing six screws and lockwashers.

28. Tag and disconnect lead to CB terminal C by removing quick disconnects.

29. Remove wiring harness from unit.

30. Cut tie straps as required.

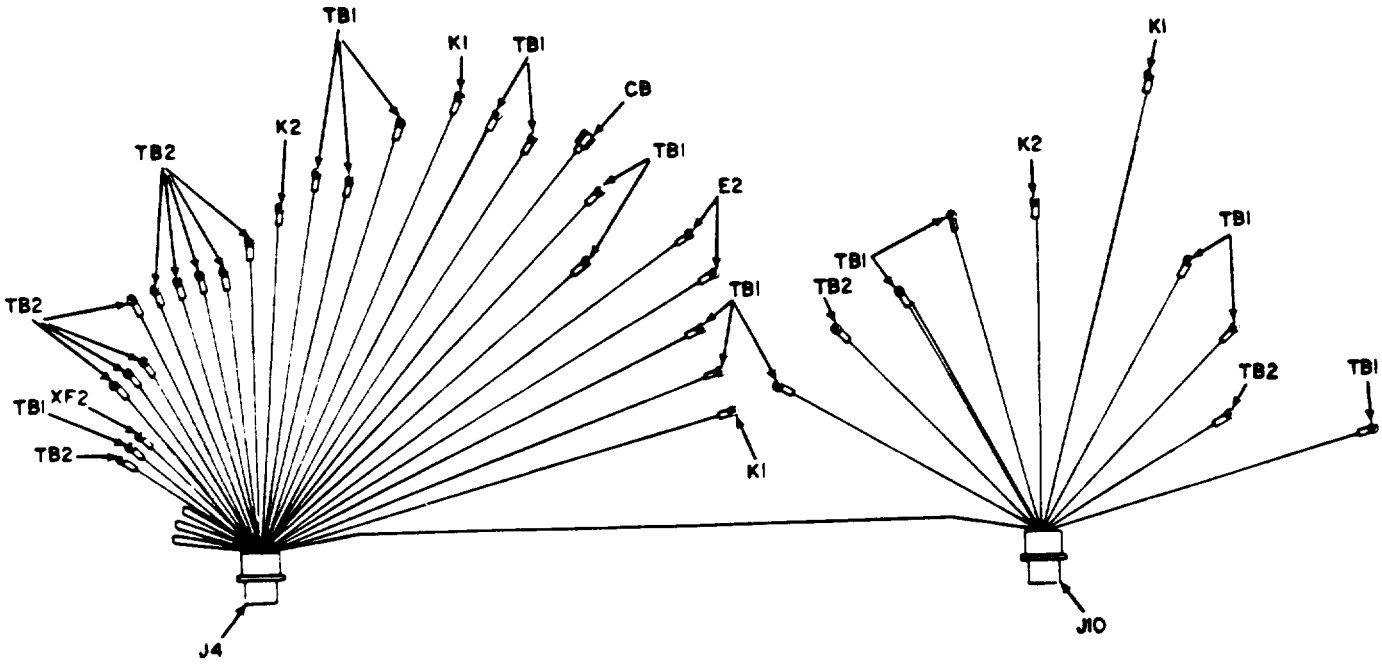


Figure 4-28. Wiring Harness (Junction Box).

31. Loosen four captive screws retaining junction box.

32. Disconnect P10 and P4 connectors.

33. Disconnect circuit breaker actuator. Refer to Paragraph 4-21.

34. Disconnect ground lead.

35. Disconnect leads to run capacitor (C1).

36. Remove junction box from casing.

b. INSPECTION.

1. Check wires and leads for fraying and proper connection.

2. Check circuit breaker handle and arm for damage.

3. Check condition of guard.

4. Check all electrical components inside junction box for external damage.

5. Check relay mounting bracket for damage.

6. Check for damaged insulation.

7. Inspect terminal boards for cracks, damaged or loose terminals, and corrosion.

WARNING

Dry cleaning solvent 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 to 138 °F (38 °C to 59 °C).

8. Remove corrosion with abrasive cloth. Clean terminal boards with solvent. Dry with a clean cloth.

9. Inspect wiring harness for broken leads, missing terminals, and broken solder joints.

10. Inspect junction box for cracks, bends, and breaks. Replace as necessary.

11. Continuity Checks.

(a) To test terminal board: Using 10 megohms megger, check continuity between each terminal pin and board. Continuity should not be indicated. Check continuity between three pins of neighboring terminal pins. Continuity should not be indicated. If continuity is indicated, terminal board must be replaced.

(b) Refer to Table 4-5 and perform continuity checks on wiring harness. Continuity should be indicated.

Table 4–5. JUNCTION BOX WIRING HARNESS CONTINUITY CHECK

FROM	TO
J4-A	TB2–2
J4–B	J4–a
J4-C	J4-X
J4-D	TB1-4
J4-E	TB2–1
J4-F	TB2-3
J4-G	TB2–2
J4-H	K1–X2
J4-I	TB1–7
J4-J	TB2-5
J4-K	J4–f
J4-L	CB-C
J4–M	TB2-4
J4–N	TB1-1
J4-P	TB1–1
J4-R	TB1-4
J4-T	E2
J4-W	TB1–5
J4-Y	K2-X2
J4–Z	TB2-4
J4-b	XF2–2
J4-c	E2
J4--d	TB2–5
J4-e	TB2-6
J4-g	TB1-8
J4-j	TB2–5
J4-k	TB1–7
J4-S	TB1–2
J4-U	TB1-1
J4-b	K1–A1
J10-C	J4–V
J10-M	TB1-4
J10-L	TB2–1
J10-E	TB1–3

Table 4–5. JUNCTION BOX WIRING HARNESS CONTINUITY CHECK – Continued

FROM	TO
J10–K	TB1-5
J10-J	K2-C2
J10-D	K1–A1
J10-B	TB1-3
J10-M	TB2-3
J10-A	TB1-6
TB1–2	J10-F

Table 4-6. RELAYS K1 AND K2 CONTINUITY CHECK

RELAY (K1)		RELAY (K2)	
WIRE NO.	TERMINAL NO.	WIRE NO.	TERMINAL NO.
K2-X1	X1	K1–X1	X1C
B-A2	A2	TB1-8	X1
J4–h	A1	TB1-1	C1
J10-D	A1	J10-J	C2
TB1-6	B1	J4-Y	X2
K1–B2	X2		
J4-H	X2		
K6-3	X2		
K1-X2	B2		

c. Test.

1. K6 time delay relay, compressor, testing procedures:

(a) Connect multimeter to terminals 2 and 3 of K6 relay.

(b) Apply +28 VDC to terminal 1 of K6 relay and -28 VDC to terminal 5 of K6 relay.

(c) Multimeter must show continuity across terminals 2 and 3 within 30 seconds ± 3 seconds after applying the 28 VDC.

(d) Remove the 28 VDC. The multimeter must show that contacts are open.

(e) Replace defective relay. Refer to Figure 4-25.

2. K9 time delay relay, fan motor, testing procedures:
   (a) Connect multimeter to terminals 2 and 3 of K9 relay.
   (b) Apply +28 VDC to terminal 1 of K9 relay and -28 VDC to terminal 5 of K9 relay.
   (c) Multimeter must show continuity across terminals 2 and 3 within 15 seconds ± 1.5 seconds after applying
   (d) Remove the 28 VDC. The multimeter must show that contacts are open.
   (e) Replace defective relay. Refer to Figure 4-25.

d. REPAIR.

1. Repair bent portions of junction box by straightening.
2. Replace or repair broken leads or terminals. Resolder broken solder joints. Refer to Paragraph 4-9.
3. Replace defective wiring. Refer to Paragraph 4-9.

e. REPLACEMENT.

1. Connect ground lead.
2. Install guard (Figure 4-22, item 4) by pressing from inside.
3. Secure arm (7) to circuit breaker handle by driving in shaft.
4. Replace cover (6) and secure with two screws (3) and lockwashers (2).
5. Connect all leads to circuit breaker (5). Refer to Table 4-7.

Table 4-7. CB, XF2, and E2 CONNECTIONS

CIRCUIT BREAKER CB	
WIRE NO.	TERMINAL NO.
J4-L	CB-C
FUSEHOLDER X.F2	
WIRE NO.	TERMINAL NO.
J4-b	XF2-2
GROUNDING STUD E2	
WIRE NO.	TERMINAL NO.
J4-T	E2
J4-c	E2

6. Replace circuit breaker (5) and secure with two screws (1) and lockwashers (2).
7. Attach leads to rectifier (Fig 4-23, item 4). Refer to wiring diagram FO–1.
8. Install rectifier (4) using supplied nut (1), lockwasher (2), and flat washer (3).
9. Attach leads to relays (K1 and K2) (Fig 4-24, item 3). Refer to Table 4-9.

Table 4-8. K1 AND K2 CONNECTIONS

RELAY K1	
WIRE NO.	TERMINAL NO.
J4–H	K1–X2
J4–h	K1–A1
J10–D	K1–A1
RELAY K2	
WIRE NO.	TERMINAL NO.
J4–Y	K2–X2
J10–j	K2–C2

10. Install relays (3) using four screws (1) and nuts (2) each.

11. Attach leads to relays (K6 and K9) (Fig 4-25, items 3 and 4). Refer to wiring diagram FO–1.

12. Attach relays (3 and 4) to mounting bracket (6) using four screws (1) and nuts (2).

13. Install mounting bracket (6) using three screws (5).

14. Attach transformer (Fig 4-26, item 7) and insulation (6) to junction box and secure with four nuts and lockwashers.

15. Install capacitor assembly to underside of transformer (7) using two nuts (1) and flat washers (2).

16. Connect an leads. Refer to wiring diagram FO–1.

17. Install (TB1) (Fig 4-27, item 6) and secure with four screws (4) and nuts (5).

18. Install (TB2) (3) and secure with two screws (1) and nuts (2).

19. Connect all leads to (TB1 and TB2). Refer to Tables 4-9 and 4-10.

Table 4-9. TB1 CONNECTIONS

WIRE NO.	TERMINAL NO.
J4-N, J4-P, J4-U	1
J4-S, J10-F	2
J10-E, J10-B	3
J4-D, J4-R, J10-M	4
J4-W, J10-K	5
J10-A	6
J4-1, J4-K	7
J4-B	8

Table 4-10. TB2 CONNECTIONS

WIRE NO.	TERMINAL NO.
J4-E, J10-L	1
J4-A, J4-G	2
J4-F, J10-M	3
J4-M, J4-Z	4
J4-i, J4-j, J4-d	5
J4-e	6

20. Replace tie straps as necessary.

21. Carefully place wiring harness in general location within the unit.

22. Connect electrical leads to TB1. Refer to Table 4-9 for correct connections.

23. Connect electrical leads to TB2. Refer to Table 4-10 for correct connections.

24. Connect leads to ground E2. Secure with screw, two flat washers, lockwasher, and nut.

25. Install J4 and J10 and secure with four screws and nuts each.

26. Connect harness connectors P4 and P10.

27. Connect electrical leads disconnected during repair procedures. Refer to Table 4-11 for correct connections.

Table 4-11. JUNCTION BOX ELECTRICAL LEADS CONTINUITY CHECK

FROM	TO
TB1–1	K2-C1
TB1–1	CB-A1
TB1–2	T–H2
TB1–2	TB1-3
CB-B1	TB1-4
CB-B2	TB1-2
K1–A2	CB-A2
XF1-2	T–H1
T–X1	CR-1
T–X2	CR-4
E2	E3
XF1–1	CB-NO
CR–3	XF2-1
TB1-6	K6-1
K6-1	K6-2
TB1-6	K1–B1
K1–B2	K1–X2
K6-3	K1–X2
K1–X1	K2-X1
K2-X1	TB1-8
TB1-8	TB1–7
TB1-7	CR-2
TB2-6	K9-2
TB1-8	K9-3
TB1-7	K9-5
K6-5	K9-5
XF2-2	K9-1

28. Install cover and fasten four captive screws.
29. Carefully slide junction box into casing.
30. Secure junction box with four captive screws.
31. Install circuit breaker actuator. Refer to Paragraph 4-21.
32. Install control panel. Refer to Paragraph 4-18.

4-21. CIRCUIT BREAKER RESET CONTROL

This task covers:

a. Removal b. Cleaning (service) c. Inspection d. Replacement

INITIAL SETUP

Equipment Condition

Canvas cover and lower panel removed (Para 4-10)

Materials/Parts

Cleaning Cloths

a. REMOVAL. See Figure 4-29.

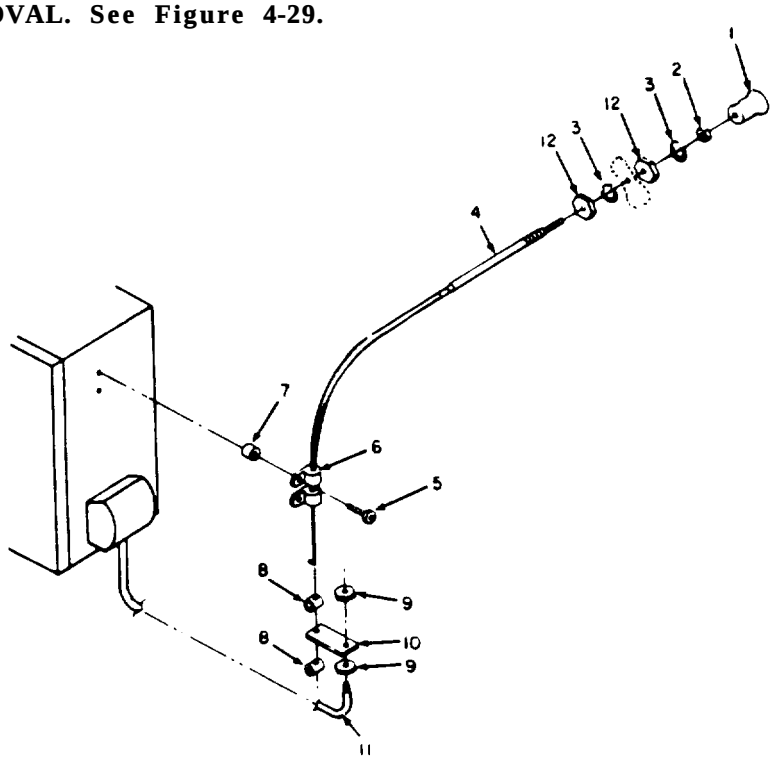


Figure 4-29. Circuit Breaker Reset Control.

1. Remove small access cover exposing circuit breaker reset mechanism.

2. Remove nut (9) securing plate (10) to circuit breaker arm (11).

3. Remove two screws (5) holding two clamps (6) to junction box and remove two spacers (7). This will free the front end of the control assembly (4).

4. Remove knob (1), two nuts (2 and 12) and lockwasher (3), from rear of unit.

5. Remove control assembly (4) from front.

6. Remaining nut (12) and lockwasher (3) may be removed from rear of control assembly (4).

7. Straighten 90 degree bend at front end of control assembly.

8. Release setscrews on each of two fittings (8) and slide fittings and plate (10) off the end.

9. Two clamps (6) may now be removed from end.

b. CLEANING. Wipe off any loose or caked dirt from exposed end of control assembly with a dry cloth.

c. INSPECTION.

1. Inspect all components for damage or excessive wear.

2. Replace any damaged components.

d. REPLACEMENT.

1. Attach nut (12) and lockwasher (3) to threaded end of control assembly (4).

2. Insert threaded end of control assembly (4) through the front of the unit and through the hole in the rear plate.

3. Secure rear end of control assembly (4) with two nuts (2 and 12) and lockwasher (3), and attach knob (1).

4. Slide two clamps (6) up exposed end of control assembly (4).

5. Slide wire through two fittings (8) and plate (10) and tighten setscrews on each fitting.

6. Bend end of wire 90° to secure.

7. Align clamps (6) with two holes injunction box, insert spacers (7), and secure each with a screw (5).

8. Attach one nut (9) to threaded end of circuit breaker arm (11) and twist to full extent of thread.

9. Slide plate (10) over circuit breaker arm (11) and secure with second nut (9). Tighten both nuts to secure plate.

4-22. RELAYS K7/K10 and CAPACITORS C2 AND C4

This task covers:

a. Removal b. Inspection c. Testing d. Installation

INITIAL SETUP

Equipment Condition

Canvas cover, top and lower panels removed (Para 4-10)
Condensate lines removed (Para 4-17)
Control panel removed (Para 4-18)
Junction box removed (Para 4-20)

Test Equipment
Multimeter
28 Vdc power supply

---

a. REMOVAL.

WARNING

High voltage can kill.

1. Disconnect power supply.

2. Disconnect and tag leads from relay (K7) (Fig 4-30, item 6).

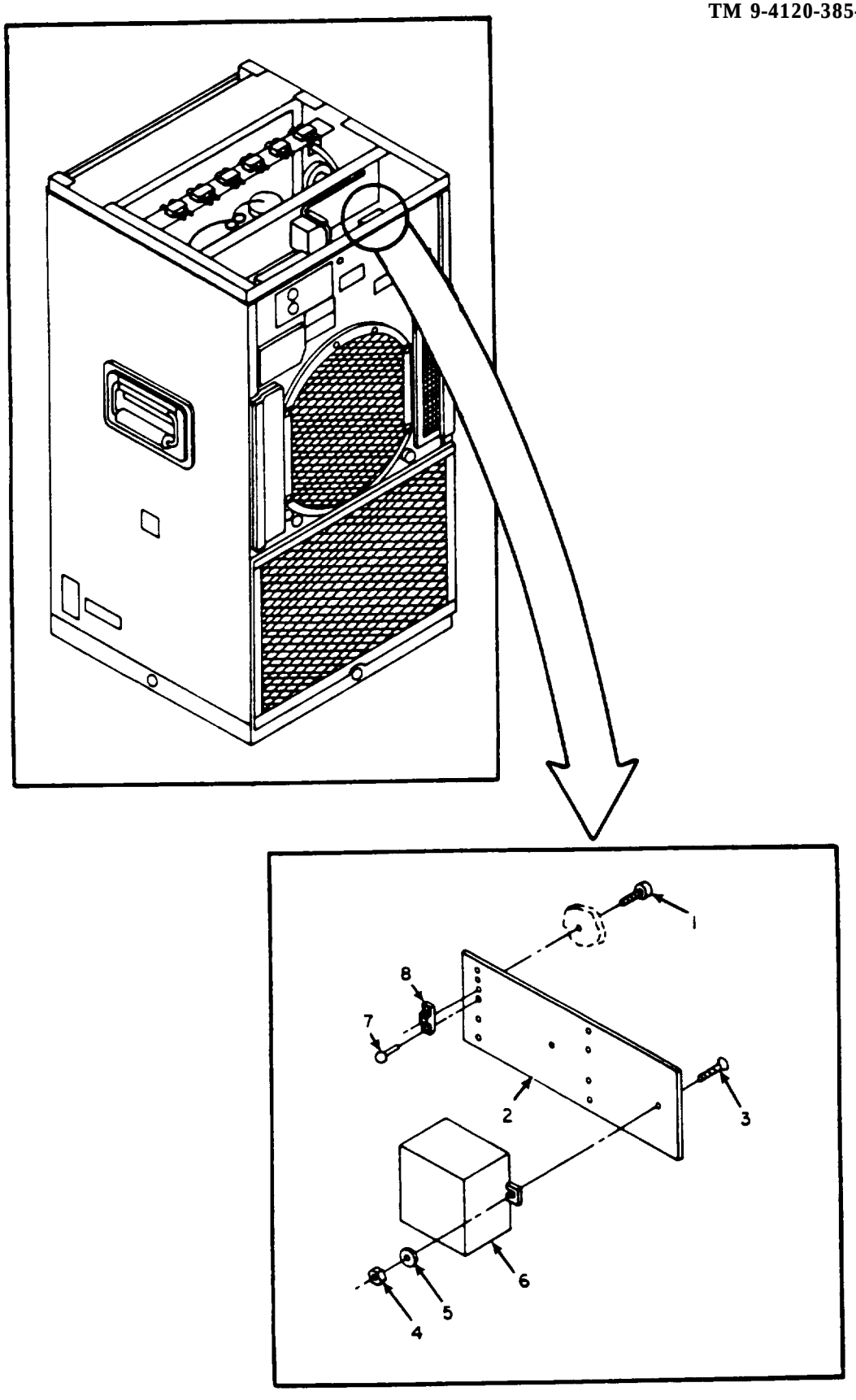


Figure 4-30. Relay (K7).

3. Hold relay (6) securely while removing four screws (1) that retain bracket (2).

4. Remove bracket (2).

5. Remove three screws (3), flat washers (5), and nuts (4) to remove relay (6).

6. Floating nuts (8) may be removed by removing two rivets (7).

7. Locate bracket (Fig 4-31, item 50) to the left of compressor and remove four screws (3) to release.

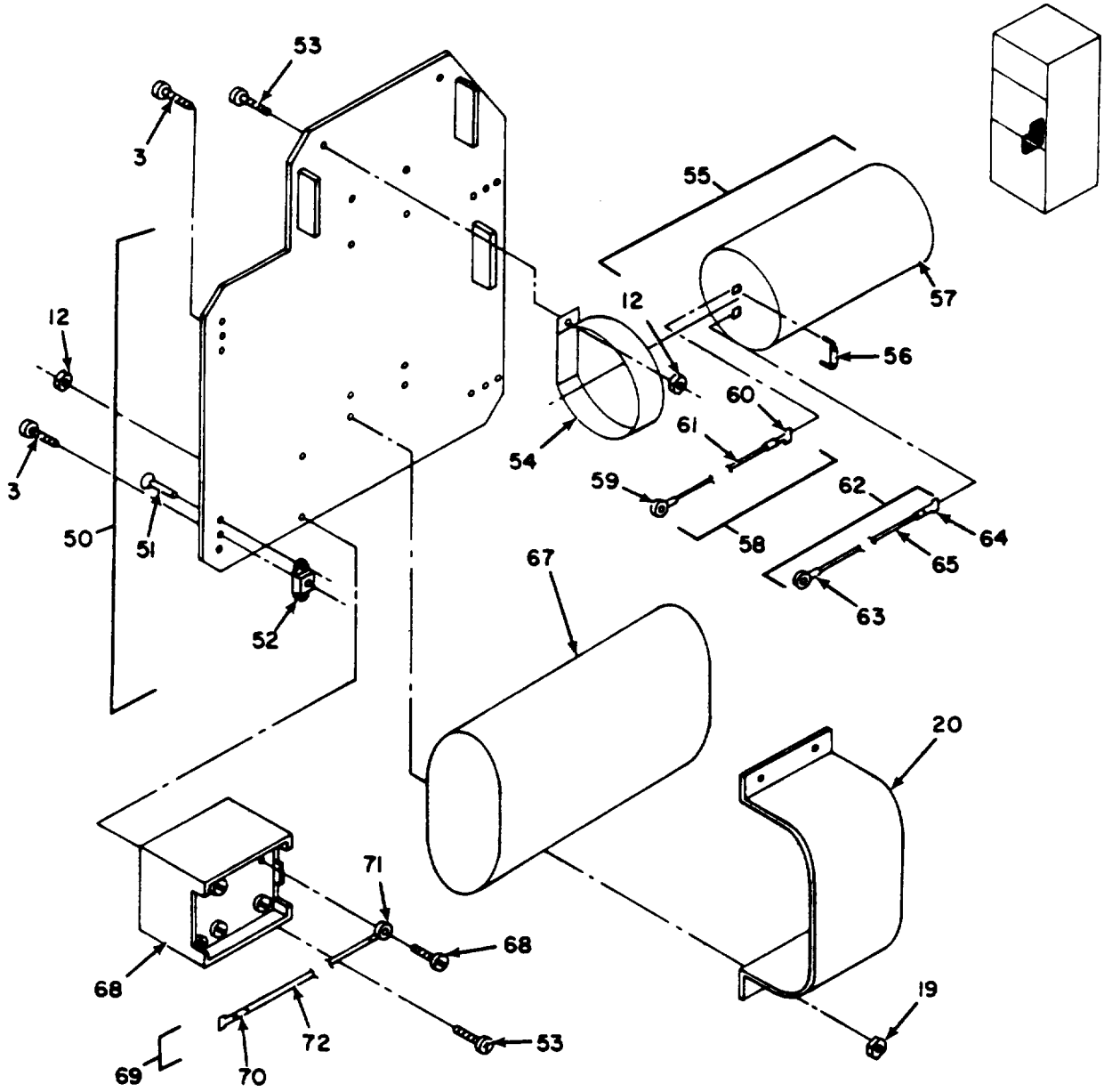


Figure 4-31. Relay (K10) and Capacitors (C2 and C4).

8. Disconnect all leads to capacitors (C2) (67) and (C4) (55) and relay (K10) (68) and remove bracket.

9. Remove screw (53) to remove relay (68).

10. Remove screw (53) and nut (12), each securing one of two clamps (54) and capacitor (C4) (55).

11. Remove resistor (56) from capacitor (55).

12. Remove four screws (3) and nuts (19) securing clamp (66) and capacitor (C2) (67).

13. Floating nuts (52) may be removed by removing two rivets (51).

b. INSPECTION.

1. Check leads for fraying, deterioration, and security.

2. Check relays for external damage.

3. Check brackets for damage.

4. Check capacitors, clamps, and resistor for external damage.

c. TESTING.

1. Apply 28 Vdc to terminals X1 and X2, positive to X1, negative to X2.

2. Check continuity of pairs A1–A2, B1–B2, and C1–C2. Continuity should be indicated.

3. Remove the 28 Vdc from terminals X1 and X2. Continuity should not be indicated.

4. Again, apply 28 Vdc to terminals X1 and X2.

5. Check continuity of pairs B2-B3 and C2-C3. Continuity should not be indicated.

6. Remove the 28 Vdc from terminals X1 and X2. Continuity should be indicated.

7. Replace defective relay. Refer to Figure 4-30.

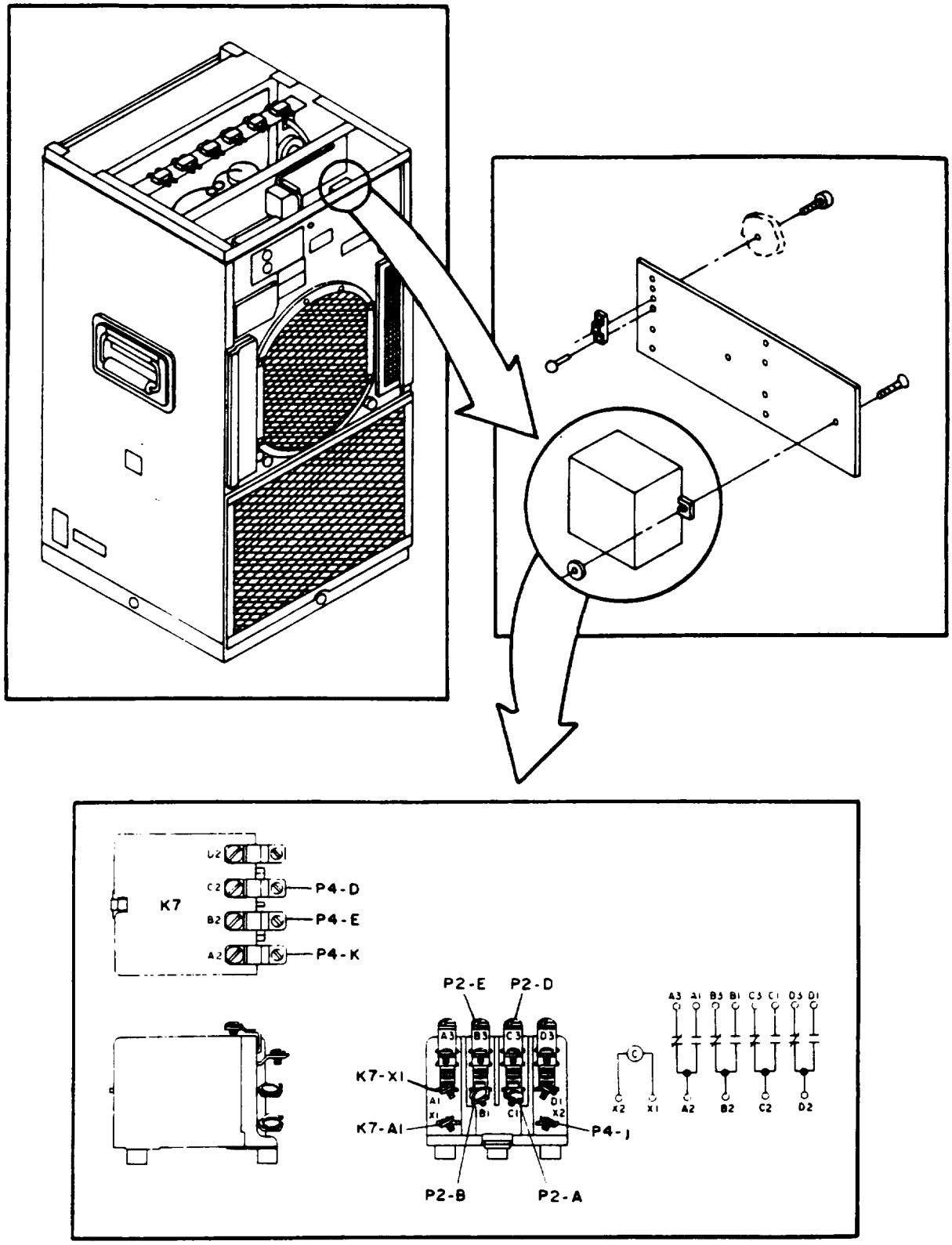


Figure 4-32. Terminal Location, Relay (K7).

8. Apply 115 Vac to terminals 1 and 5.

9. Check continuity between terminals 2 and 5. Continuity should be indicated.

10. Remove 115 Vac from terminals 1 and 5. Continuity should not be indicated between terminals 2 and 5.

11. Replace defective relay. Refer to Figure 4-31.

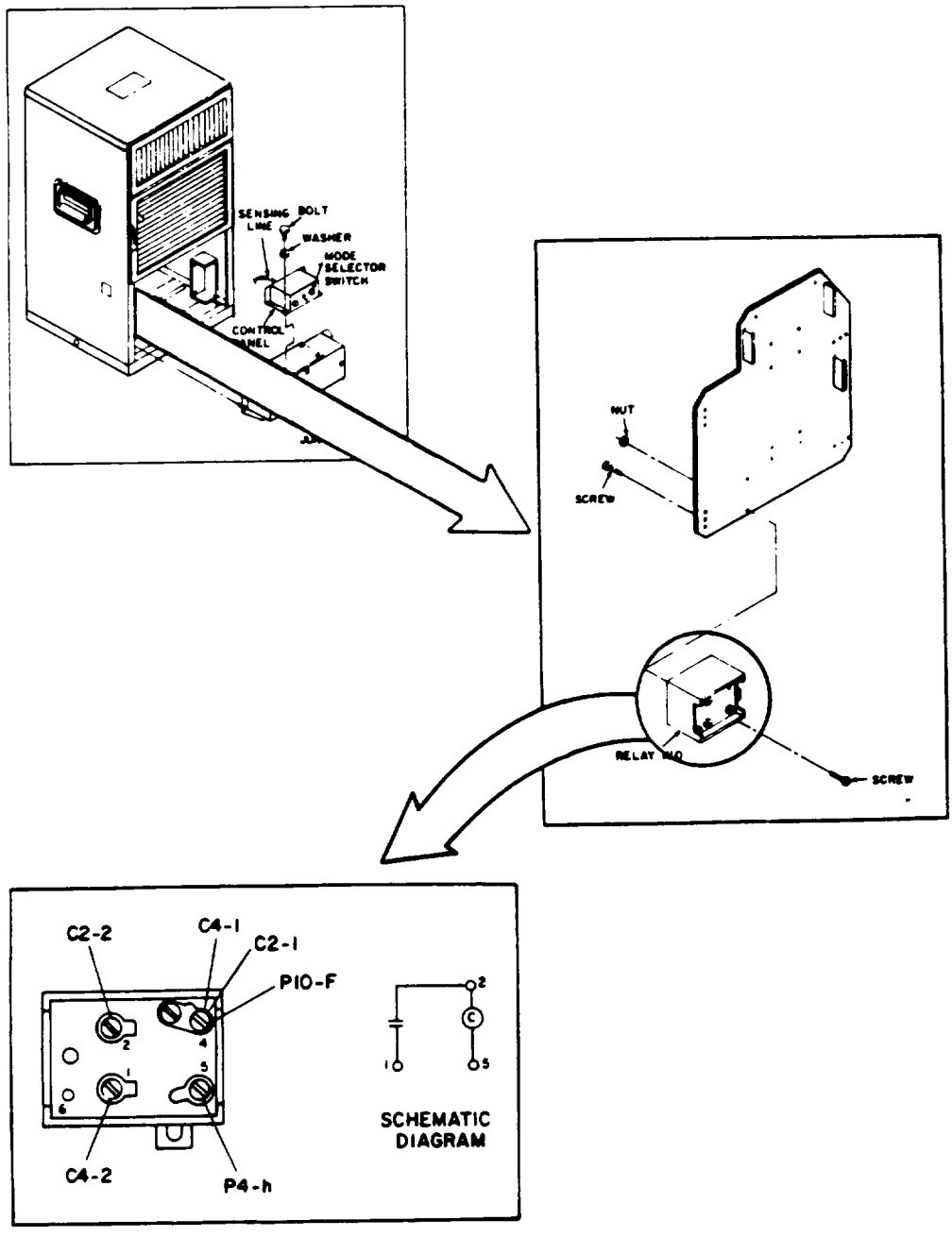


Figure 4-33. Terminal Location, Relay (K10).

d. INSTALLATION.

1. Mount relay (K7) (Fig 4-30, item 6) to bracket (2) with three screws (3), flat washers (5), and nuts (4).

2. Connect all leads to relay. Refer to wiring diagram FO–1.

3. Mount bracket (2) to rear panel using four screws (1).

4. Mount relay (K10) (Fig 4-31, item 68) to bracket (50) with screw (53).

5. Mount capacitor (C2) (67) with clamp (66) and four screws (13) and nuts (19).

6. Attach resistor (56) to capacitor (C4) (57).

7. Slide two clamps (54) onto capacitor (C4) (57) and secure with one screw (53) and nut (12) each.

8. Connect all leads to relay (68) and capacitors (55 and 67). Refer to wiring diagram FO-1.

9. Mount bracket (50) to inside left wall using four screws (3).

10. Install condensate drain line. Do not secure loop clamp.

11. Install left mounting bracket.

12. Secure loop clamp.

4-23. MAIN HARNESS AND ELECTRICAL LEADS

This task covers:

a. Removal
b. Inspection
c. Testing
d. Repair
e. Testing of Wires
f. Inspection of Wiring
g. Splicing of Wiring
h. Crimping Terminals
i. Insulating Electrical Connections
j. Soldering connections
k. Removal and Replacement of Rivets
l. Repair
m. Replacement

INITIAL SETUP

Equipment Condition

Canvas cover, top, and lower panels removed (Para 4-11)
Inlet screen and guards removed (Para 4-12)
Grilles and louvers removed (Para 4-13)
Condensate lines removed (Para 4-18)
Control panel removed (Para 4-19)
Junction box removed (Para 4-21)

Test Equipment
Multimeter

Materials/Parts
Heat shrink tubing
Solder
Cleaning cloths
Heat gun

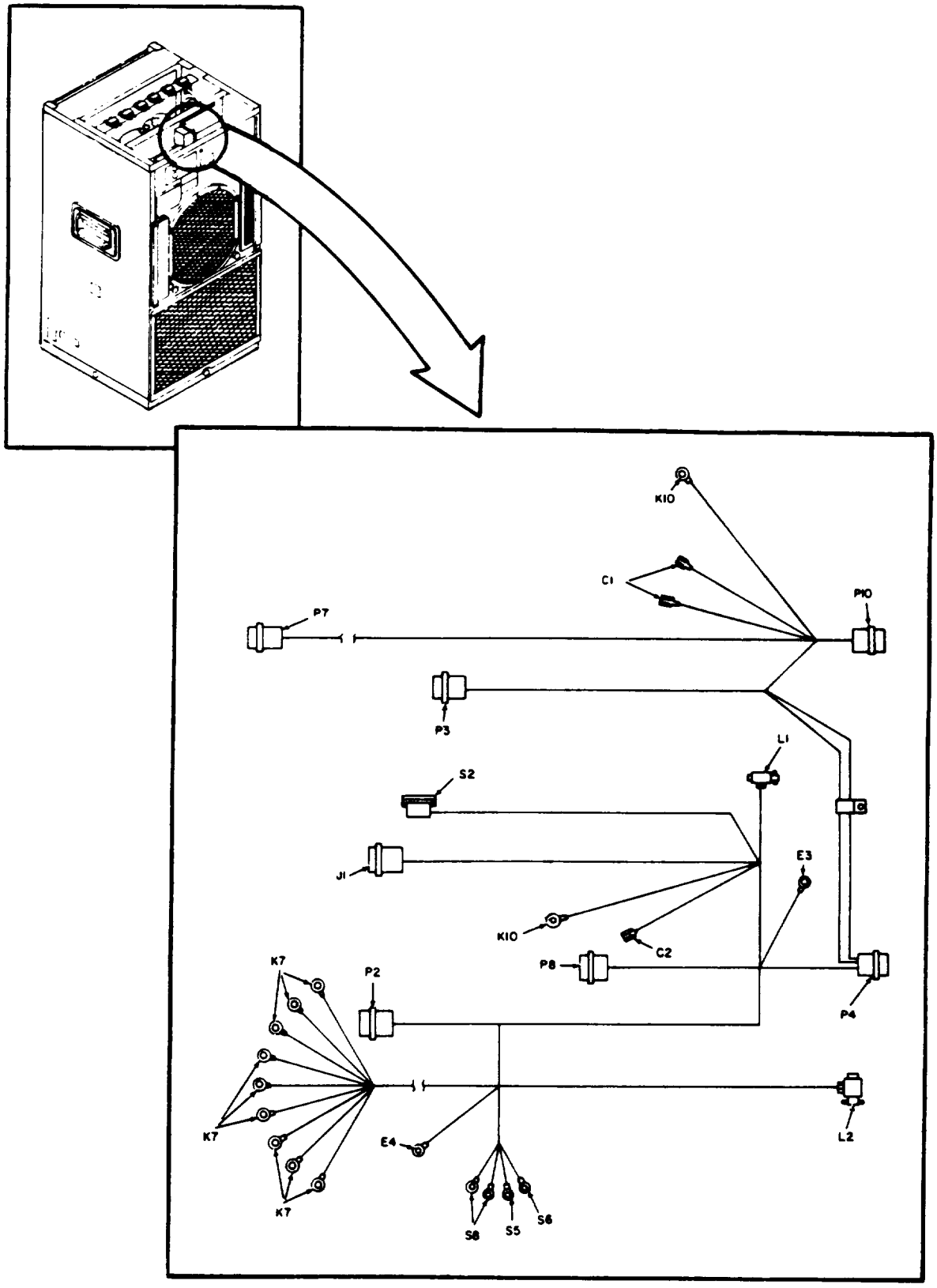


Figure 4-34. Wiring Harness (Main).

a. REMOVAL. See Figure 4-34.

WARNING

High voltage can kill.

1. Tag and disconnect electrical leads from C1, K10, C2, E3, E4, and K7.
2. Refer to Chapter 5 for removal of leads to pressure switches.
3. Refer to Chapter 5 for removal of solenoid valves L1 and L2.
4. Disconnect P7, P10, P3, J1, P8, P4, and P2.
5. Remove thermostat S2 using two screws.
6. Remove all cable clamps and attaching hardware and harness.
7. Cut tie straps as required.

b. INSPECTION.

1. Inspect for broken leads, missing terminals, and broken solder joints.
2. Check for frayed or broken wires, loose connector pins and damage.

c. TESTING. Refer to Tables 4-12 and 4-13 and perform continuity checks. Continuity shall be indicated.

Table 4-12. MAIN WIRING HARNESS CONTINUITY CHECK

FROM	TO
P4-A	S5-2
P4-B	S6-1
P4-C	P2-C
P4-C	K7-C2
P4-E	K7–B2
P4-F	S2-1
P4-G	S2-2
P4-H	L2-1
P4-I	L1–2
P4-J	P8-C
P4-K	P8-D
P4-I	P8-E
P4-M	L1–1
P4-N	P8-H

Table 4-12. MAIN WIRING HARNESS CONTINUITY CHECK - Continued

FROM	TO
P4-P	J1-A
P4-R	J1-B
P4-T	J1-D
P4-W	P8-J
P4-X	P8-K
P4-Y	P8-L
P4-Z	P8-M
P4-a	P8-N
P4-b	P8-P
P4-c	P8-R
P4-d	S8-3
P4-e	K7-X1
P4-f	S8-2
P4-g	L2-2
P4-j	K7-X2
P2-A	K7-C1
P2-B	K7-B1
P2-D	K7-C3
P2-E	K7-B3
P4-k	K7-A2
E3	E4
P10-A	P3-E
P10-B	P3-C
P10-C	P3-B
P10-D	P3-A
P10-E	P7-C
P10-F	K10-4
P10-H	P3-D
P10-J	P7-A
P10-K	P7-B
P10-L	C1-2
P10-M	C1-1
P3-G	P4-S
P3-F	P4-U
P4-h	K10-5
P4-V	C2-2
C2-2	K10-2

1. Check visually for damage.
2. Check continuity across leads. Continuity should be indicated.
3. Repair or replace defective components.
4. Refer to Paragraphs 4-18, 4-20, and 4-23.

d. REPAIR

WARNING

High voltage can kill. Disconnect air conditioner power supply before performing maintenance work on electrical system.

1. The electrical circuits in the air conditioner are completed by individual wire leads or by wire leads laced or enclosed in tiedown straps to form a wiring harness or wiring bundle.

2. At the factory, all of the wiring is marked with the appropriate terminal designations. However, wires that have been replaced in the field will not carry these designations.

3. When repairing or replacing the wiring harness or individual wires, refer to the wiring diagram FO–1.

4. Preferred repair methods consist of replacing wires, terminals, connectors, etc., rather than splicing wires, bending ends to form terminals, and other make-shift procedures.

5. Determine the proper size and length of wire, terminal, or connector to be used for replacement.

e. TESTING OF WIRES.

1. Use a multimeter set on low ohms range to test for continuity.

2. Use multimeter set on high ohms range to test for shorts between the circuit in a component and the outside case of the component.

3. When testing electrical component, also look for visual damage and inspect all wiring in the area for damage or loose connections.

4. Test for continuity in leads or wiring harnesses by disconnecting both ends.

5. Where wires terminate in an electrical connector, disconnect connector from corresponding receptacle connector or plug connector.

6. Touch the test probes of a multimeter (set on low ohms range) to ends of wire or to corresponding pin of connector.

7. If continuity is not indicated, replace wire.

f. INSPECTION OF WIRING.

1. Inspect all wiring installations for cracked or frayed insulation material.

2. Pay particular attention to wires passing through holes in the casing or around sharp edges.

3. Repair or replace defective wiring.

4. Inspect electrical connectors and fittings for damage or broken conditions.

5. Replace defective connectors and fittings.

g. SPLICING OF WIRING.

1. To repair broken or cut wires that are otherwise sound, the mating ends can be stripped and spliced.

2. A commercial butt splice can be crimped onto the ends to join them, or a wire splice can be made.

3. A wire splice is made by stripping 1-1/4 inch of insulation from wire ends, holding the ends parallel and facing opposite directions, then twisting each end around the other wire at least three turns.

4. Solder and apply insulation.

h. CRIMPING TERMINALS.

1. To install a terminal on end of a wire, strip 1/4 – 1/2 inch of insulation from the end of the wire.

2. Apply a l–inch piece of heat-shrink tubing (if the terminals are of the uninsulated type), and insert the wire end into the shank of the terminal.

3. Crimp the shank.

4. Install heat-shrink tubing if necessary.

i. INSULATING ELECTRICAL CONNECTIONS (HEAT SHRINK TUBING).

1. The preferred method of insulating electrical connections is by the use of heat-shrink tubing.

2. To apply, cut a piece of heat-shrink tubing of suitable diameter to a l–inch length for covering joints at terminals or connectors or to a length about 1/2 longer than the joint to be insulated.

3. Slide the tubing over the wire before making the joint.

4. After the joint is made, slide the tubing over the joint. Using a heat gun, shrink in place with moderate heat.

j. SOLDERING CONNECTIONS.

1. Wire connections must be made mechanically sound before they are soldered.

2. Solder alone does not provide sufficient strength to prevent breakage.

3. Joining surfaces of connections to be soldered must be clean and bright.

4. If a separate flux is used, it should conform to Military Specification MIL-F4995, Type I, rosin-alcohol flux, and should be brushed onto the joint before soldering.

5. If a flux-core solder is used, it should always be rosin–core electrical solder.

6. If an uncored solder is used, it should be a lead–tin solder conforming to Federal Specification QQ–S–571.

7. Wires should always be heated to the point at which the solder will melt completely and flow into all parts of the joint.

8. Excessive build-up of solder “gobs” on the joint should be avoided or removed.

k. REMOVAL AND REPLACEMENT OF RIVETS.

1. From the –24P Repair Parts and Special Tools List, identify the size of the rivet used.

2. Select drill bit one size smaller in diameter than the rivet to be removed.

3. Position the drill bit on the center of the rivet head and drill down slightly below the riveted surface.

4. Using a center punch, snap the rivet head off and punch the remaining rivet material through the hole.

5. Select the proper replacement rivet and insert in the rivet clinching tool.

6. Place the rivet in the hole and maintain the rivet shaft perpendicular to the material being riveted.

7. Apply a slow, even pressure on the clinching tool until the rivet is set.

8. Make sure rivet nuts or rivet is snug and not free to rotate.

Table 4-13. ELECTRICAL LEADS CONTINUITY CHECK

FROM	TO
HR2-A	HR1-A
HR2-A	HR3-A
HR2-B	HR1-B
HR2-B	HR3-B
HR5-A	HR6-A
HR5-A	HR4-A
HR5-B	HR6-B
HR5-B	HR4-B
S5-1	S6-2
K7–X1	K7-A1
C2-1	K10-4
K10-1	C4-2
K10-4	C4-1

1. Repair.

1. Replace or repair broken leads or terminals, resolder broken solder joints. Refer to Paragraph 4-9.

2. Replace defective wiring. Refer to Paragraph 4-9.

m. Replacement.

1. Replace tie straps as necessary.

2. Attach all harness leads to their proper components.

3. Install harness and replace all clamp loops.

4. Connect P7, P10, P3, J1, P8, P4, and P2.

5. Replace thermostat S2 using two screws.

4-24. FANS (EVAPORATOR/CONDENSER)

This task covers:

a. Removal b. Inspection c. Repair d. Installation

INITIAL SETUP

Equipment Condition

Canvas cover removed (Para 4-10)
Condenser and fan guards removed (Para 4-11)
Return air intake grille removed (Para 4-12)
Air filter removed (Para 4-14)

Materials/Parts

Safety glasses
Detergent solution
Cleaning cloths
Gloves

---

a. REMOVAL. See Figure 4-35.

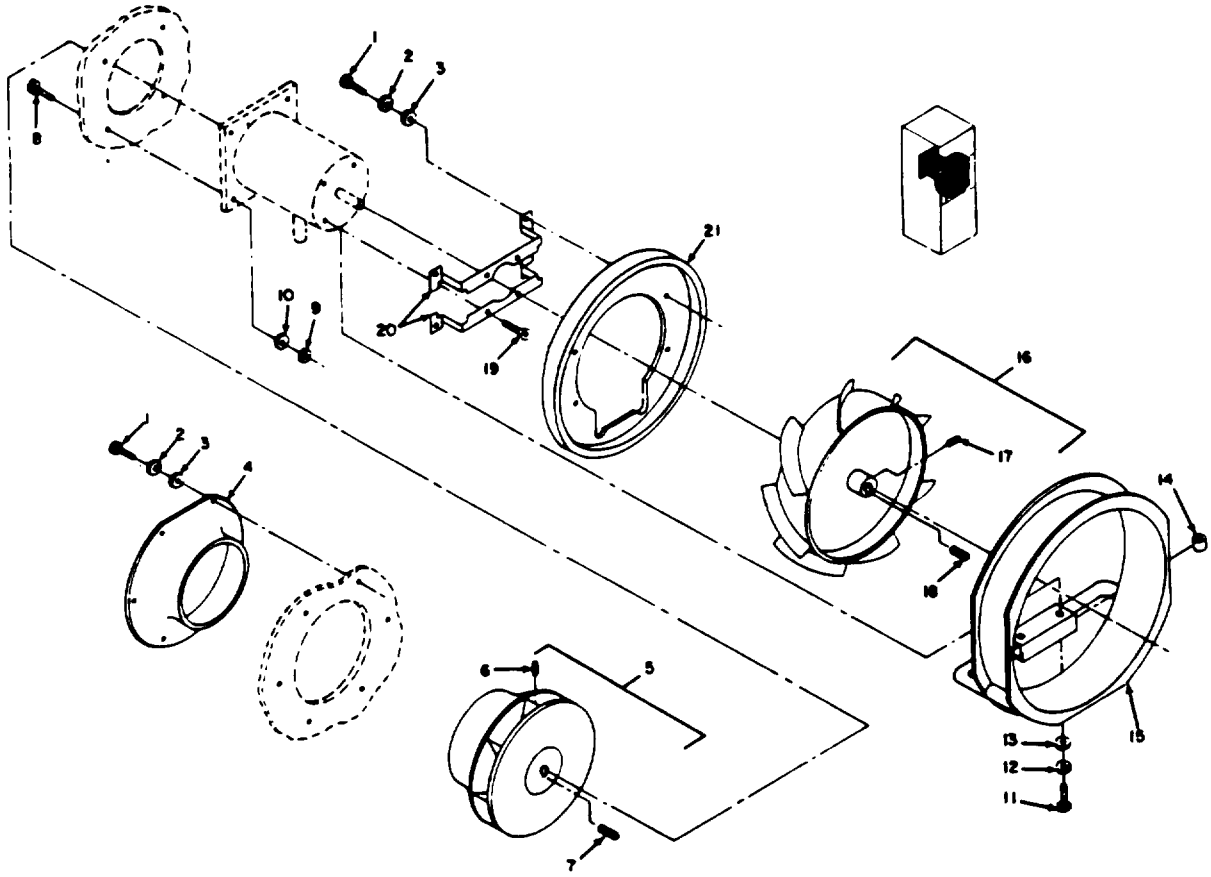


Figure 4-35. Impellers (Evaporator and Condenser).

WARNING

High voltage can kill.

1. From front of unit, remove six screws (1), lockwashers (2), and flat washers (3) and ring (4).

2. Loosen two setscrews (6) and carefully pull off evaporator impeller (5) and key (7).

3. Loosen two setscrews (17) and pull condenser impeller (16) and key (18) from motor.

4. Remove four screws (19) to release baffle mounting brackets (20) from motor.

5. Remove two bolts (11), lockwashers (12), flat washers (13), and sleeves (14) to remove motor bracket (15) from motor.

6. Disconnect harness from motor.

7. Remove four bolts (8), flat washers (10), and nuts (9) to release motor from casing.

b. INSPECTION.

1. Inspect impeller fans for broken, loose, or bent blades and other damage.

2. Inspect ring, brackets, and baffle for damage.

3. Replace any defective parts.

c. REPAIR.

1. Repair impeller fans by replacement.

2. Repair ring, brackets, and baffle by straightening and removing burrs.

d. INSTALLATION.

1. Insert motor into rear of unit and secure flange to casing wall using four bolts (8), flat washers (10), and nuts (9).

2. Connect motor to harness.

3. Attach motor to motor bracket (15) using two bolts (11), lockwashers (12), flat washers (13), and sleeves (14).

4. Attach baffle mounting brackets (20) to motor and secure with four screws (19).

5. Slide condenser impeller (16) onto motor shaft, drive in key (18) and secure by tightening two setscrews (17).

6. Slide evaporator impeller (5) onto motor shaft, drive in key (7) and secure by tightening two setscrews (6).

7. Mount ring (4) using six screws (1), lockwashers (2), and flat washers (3).

4–25 HEATER THERMOSTAT SWITCH (S3) (OVERHEAT SAFETY)

This task covers:

a. Removal b. Inspection c. Testing d. Installation

INITIAL SETUP

Equipment Condition

Canvas cover and top panel removed (Para 4-10)

Test Equipment
Multimeter

WARNING

Allow heaters to cool before attempting removal or test of heater thermostat.

---

a. REMOVAL. See Figure 4-36.

WARNING

High voltage can kill.

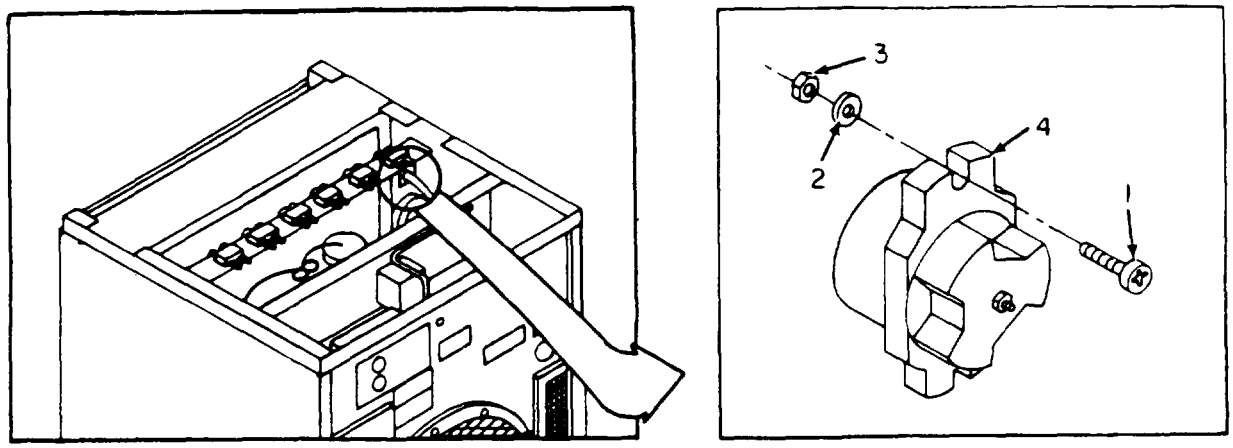


Figure 4-36. Heater Thermostatic Switch (S3)

1. Remove two screws (l), and flat washers (2), and nuts (3) and thermostatic switch (4) from heater support.

2. Tag and disconnect electrical leads from switch (4).

b. INSPECTION.

1. Check for external damage to heater switch.

2. Check electrical leads for frayed or broken wires.

3. Check terminals for security.

c. TESTING.

1. Visually inspect the heater thermostat for cracks in the housing, missing pieces, or other damage.

2. Replace if defective. Refer to Figure 4-36.

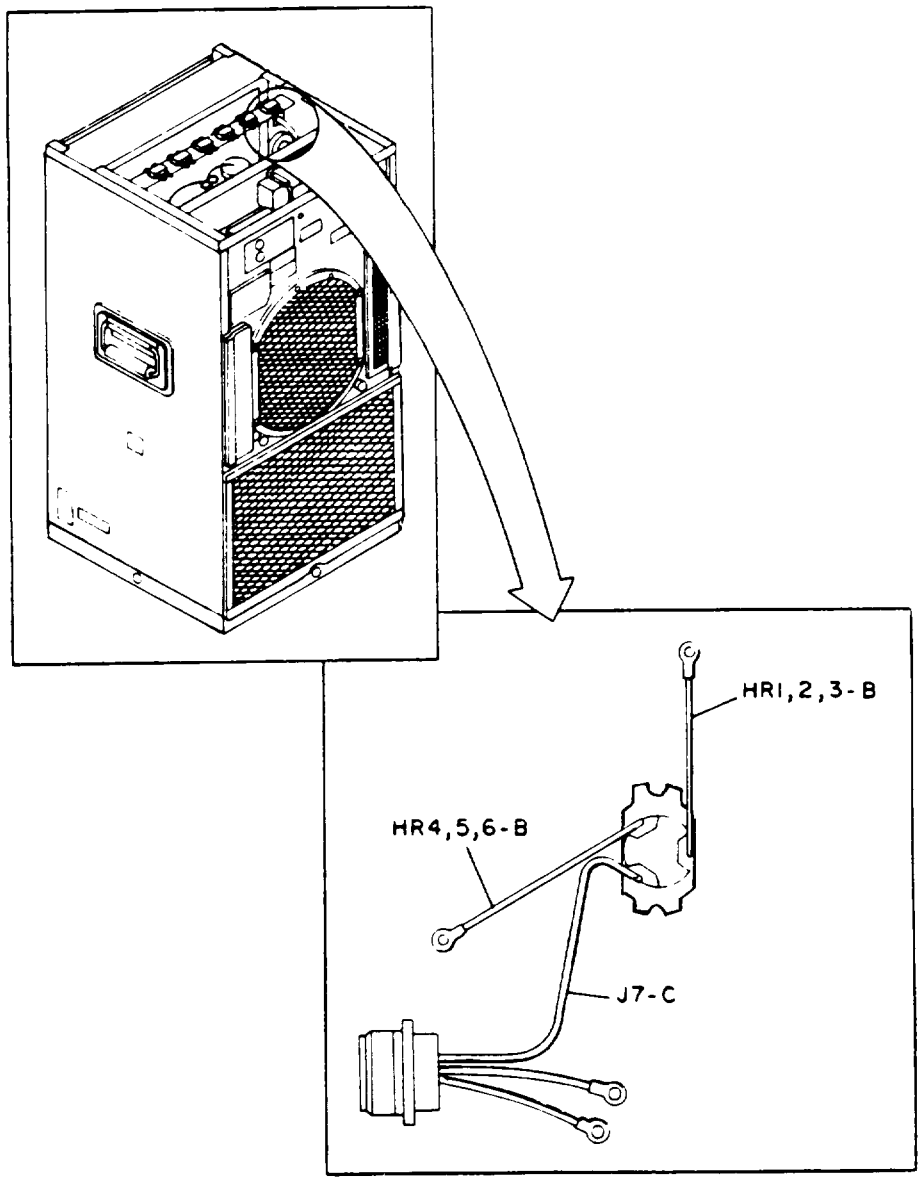


Figure 4-37. Terminal Location, Heater Thermostat (S3) (Overheat Safety).

3. Using a multimeter, check continuity between terminals 4 and 5,4 and 6.

4. Connect multimeter to terminals 4 and 5. Using a heat gun, direct heat to sensing area and hold 3 to 4 inches away. Continuity should be broken within 5 to 6 minutes.

5. Switch may also be tested by placing a thermometer bulb on the sensing element and applying heat source. Continuity should be broken at 205 °F ± 12 °F (90 °C ± 5 °C) and restored when switch cools to 139 °F ± 4 °F (61 °C ± 9 °C).

6. Connect multimeter to terminals 4 and 6 and repeat tests in step b above.

7. Replace switch if defective.

d. REPLACEMENT.

1. Connect electrical leads to switch (4). Refer to Table 4-14 for correct connections.

Table 4-14. THERMOSTATIC SWITCH (S3) TERMINAL CONNECTIONS

WIRE NO.	TERMINAL NO.
J3-C	4
HR5,6-B	5
HR2,3-B	6

2. Mount thermostatic switch (4) to bracket and secure with two screws (l), flat washers (2), and nuts (3).

4-26. HEATER ASSEMBLY–Inspect, Test, Replace

This task covers:

a. Removal b. Inspection c. Testing d. Installation

INITIAL SETUP

Equipment Condition

Canvas cover and top panel removed (Para 4-10)

Test Equipment
Multimeter

WARNING

Allow heaters to cool before attempting removal.

a. REMOVAL. See Figure 4-38.

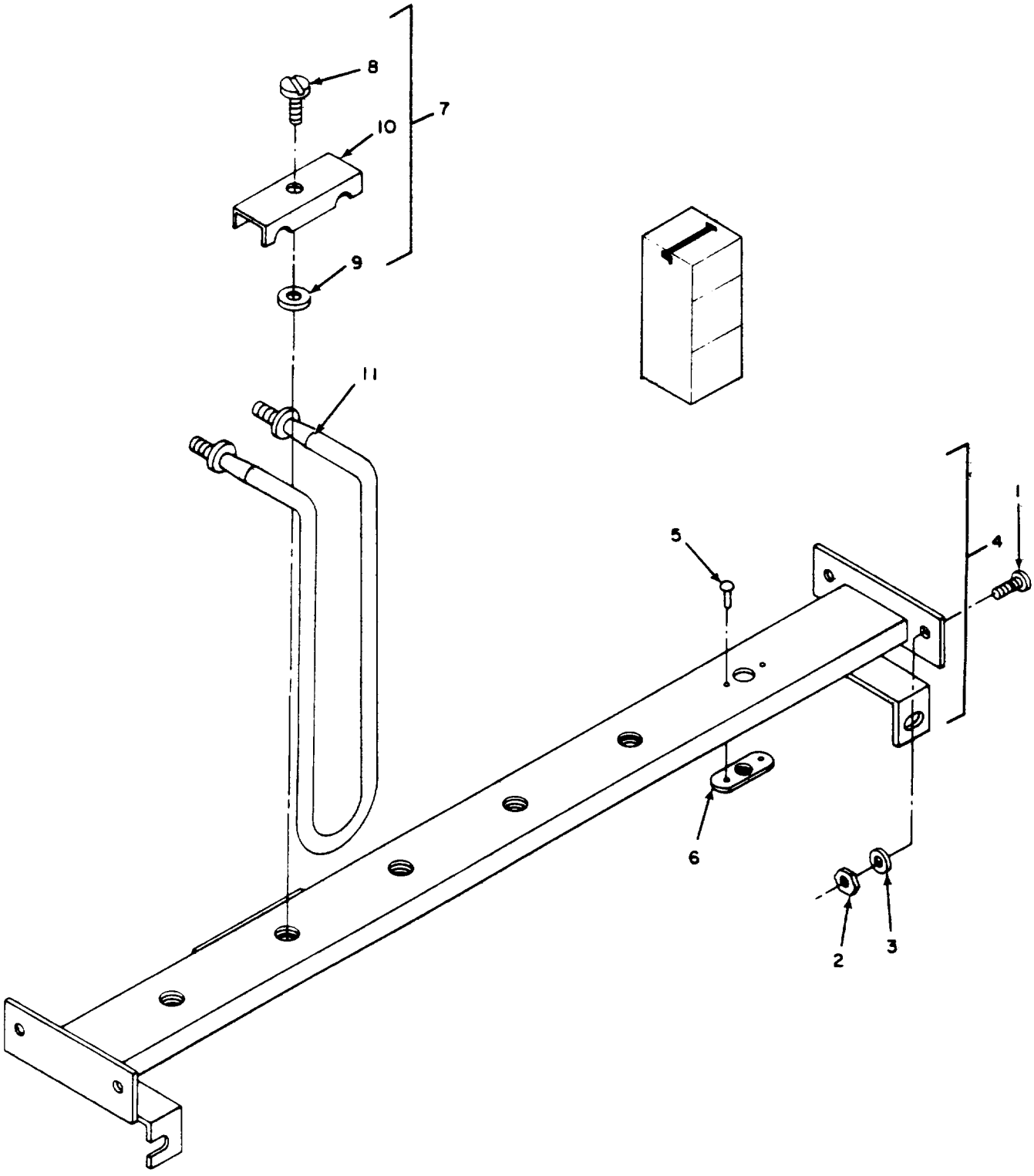


Figure 4-38. Heater Elements and Support.

WARNING

High voltage can kill.

1. Tag and disconnect electrical leads from heating elements (11).

2. Remove panel fastener (8) and clamp (10) to remove each heating element (11).

3. Remove four screws (l), flat washers (3), and nuts (2) to release support (4), if necessary.

4. Remove two rivets (5) to remove floating nut (6), if necessary.

b. INSPECTION.

WARNING

Allow heater to cool before handling. Severe burns can result from touching hot heater elements.

1. Visually inspect each heater element for damage, deformation, damaged terminal threads, cracked or broken sheath, and burn-out spots.

2. Inspect heater element electrical leads for frayed insulation, broken wires, and defective terminals.

WARNING

Allow heater to cool before handling.

CAUTION

Do not use solvent or detergent to clean heater. Damage to heater elements could result.

c. TESTING.

1. Check for continuity between terminal leads of each heater element (See Table 4-15). If continuity is not indicated, element is defective.

Table 4-15. HEATERS (HT1-HT6) TERMINAL CONNECTIONS

HEATER.	WIRE NO.
HR1	J7-A
HR1	S3-6
HR2	J7-A
HR2	S3-6
HR3	J7-A
HR3	S3-6
HR4	J7-B
HR4	S3-5
HR5	J7-B
HR5	S3-5
HR6	J7-B
HR6	S3-5

2. Check for continuity between each heater terminal and element. If continuity is indicated, element is defective and should be replaced.

d. INSTALLATION.

1. Secure each floating nut (6) to support (4) with two rivets (5), if necessary.

2. Attach support (4) to casing using four screws (l), flat washers, (3) and nuts (2), if necessary.

3. Mount heating elements (11) with clamps (10) and tighten panel fasteners (8).

4. Connect electrical leads to heating elements. Refer to Table 4-15 for correct connections.

4-27. EVAPORATOR and CONDENSER COILS

This task covers:

a. Inspection b. Cleaning

INITIAL SETUP

Equipment Condition

Para	Condition Description
4-10	Canvas cover, top and lower panels removed (Para 4-10)
4-11	Condenser guard removed (Para 4-11)
4-12	Discharge grille removed (Para 4-12)
4-15	Mist eliminator removed (Para 4-15)

Materials/Parts
Vacuum cleaner
Brush
Safety glasses
Compressed air and compressed air line

WARNING

Allow heaters to cool before attempting removal.

a. INSPECTION. See Figures 4-39 and 440.

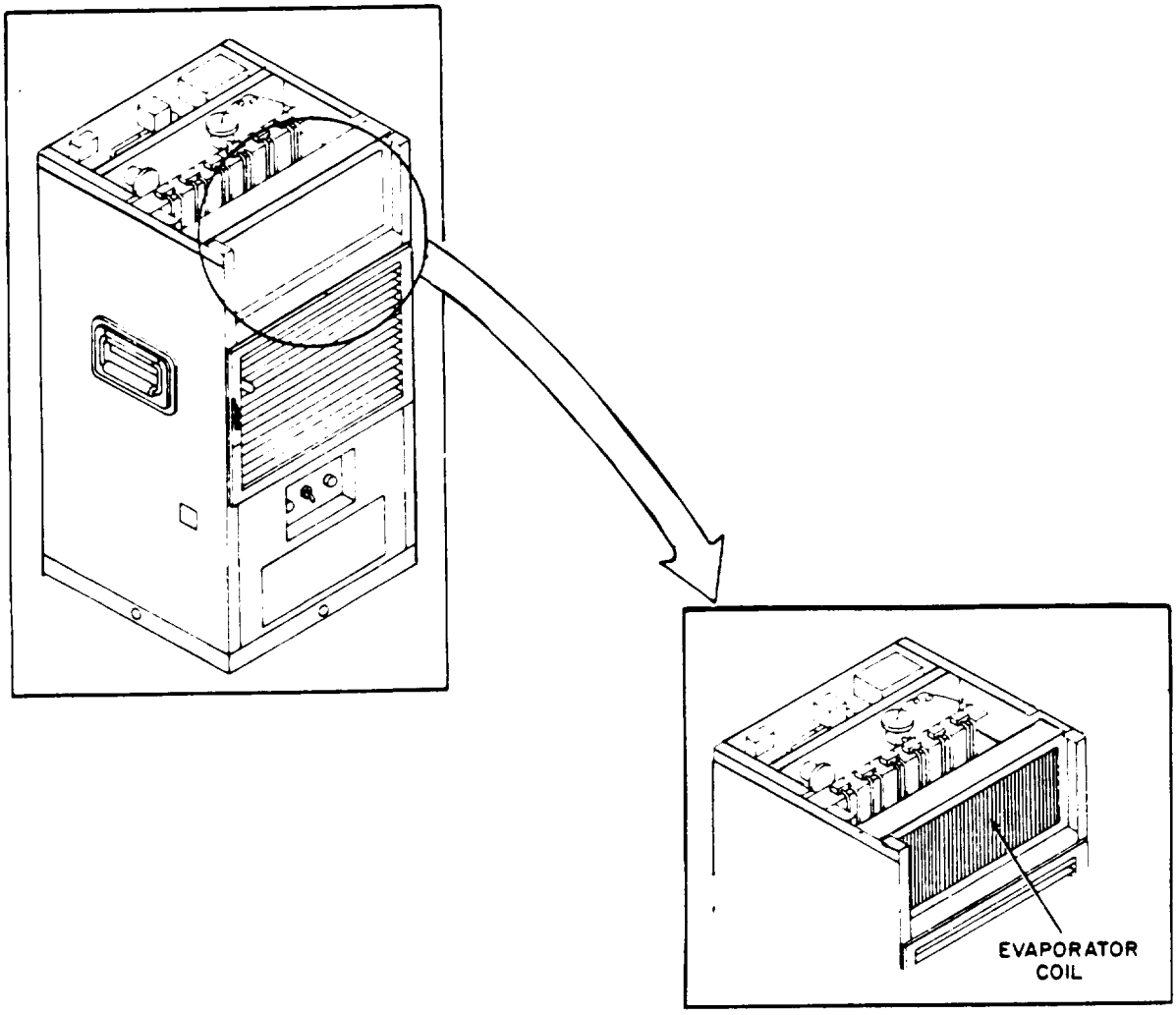


Figure 4-39. Evaporator Coil.

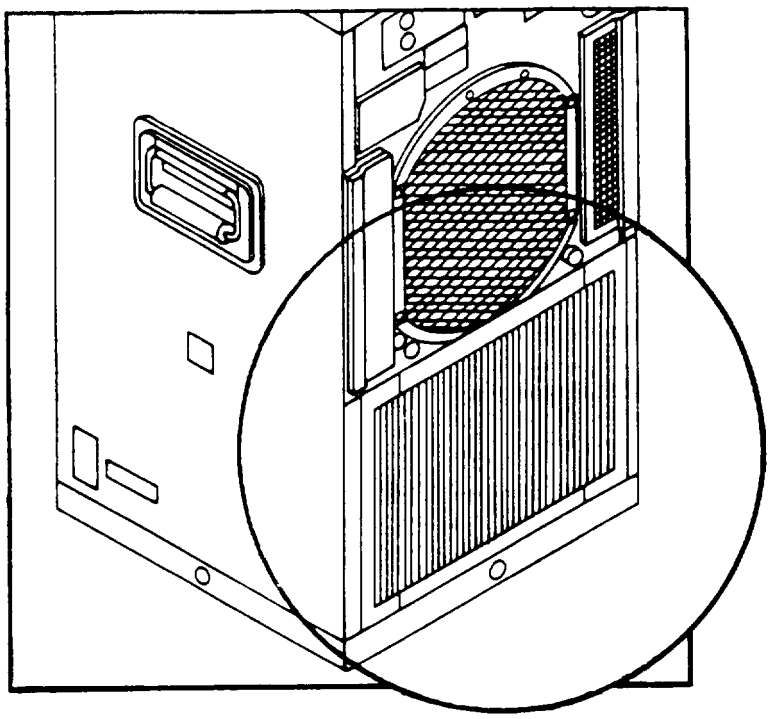


Figure 4-40. Condenser Coil.

WARNING

High voltage can kill.

1. Inspect evaporator and condenser coils for leaks, bent fins, and tubes.
2. Check connections for leaks.

b. CLEANING.

WARNING

Do not use steam to clean the coils. Live hot steam will splash and could cause serious burns. The high heat could cause high system pressure and could result in coil damage.

1. Cover the evaporator and condenser fan impeller to prevent dirt from entering the louvers and motor.

WARNING

Wear safety glasses or goggles when cleaning the coils. Dirt could be blown into your eyes resulting in injury.

2. Clean the front and back surfaces of the evaporator coil with a soft bristle brush.

3. Clean the front surface of the condenser coil with a soft bristle brush.

WARNING

Compressed air should never be used to clean clothing or parts of the body. Never point the air hose at yourself or anyone else. Serious injury or death could result from the misuse of compressed air.

CAUTION

Use compressed air at 30 psi (2.11 kg/cm²) or less. Hold compressed air nozzle at least 6 to 8 inches away from coil to keep the compressed air from damaging the coil or fins.

4. Use a vacuum cleaner and compressed air, if necessary. Clean the area between the evaporator coil and condenser coil fins.

5. Clean the evaporator and condenser impellers with a vacuum cleaner.

6. Using a fin comb, straighten the evaporator and condenser coil cooling fins.

7. Remove covers used to prevent dirt from entering the louvers and motor.

4-28. SOLENOID VALVES

This task covers:

a. Inspection b. Testing

INITIAL SETUP

Equipment Condition

Canvas cover, top and lower panels removed (Para 4-10)
Condensate lines removed (Para 4-17)
Control panel removed (Para 4-18)
Junction box removed (Para 4-20)

Test Equipment
Multimeter
24 Vdc power source

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a. **INSPECTION. See Figure 4-41.**

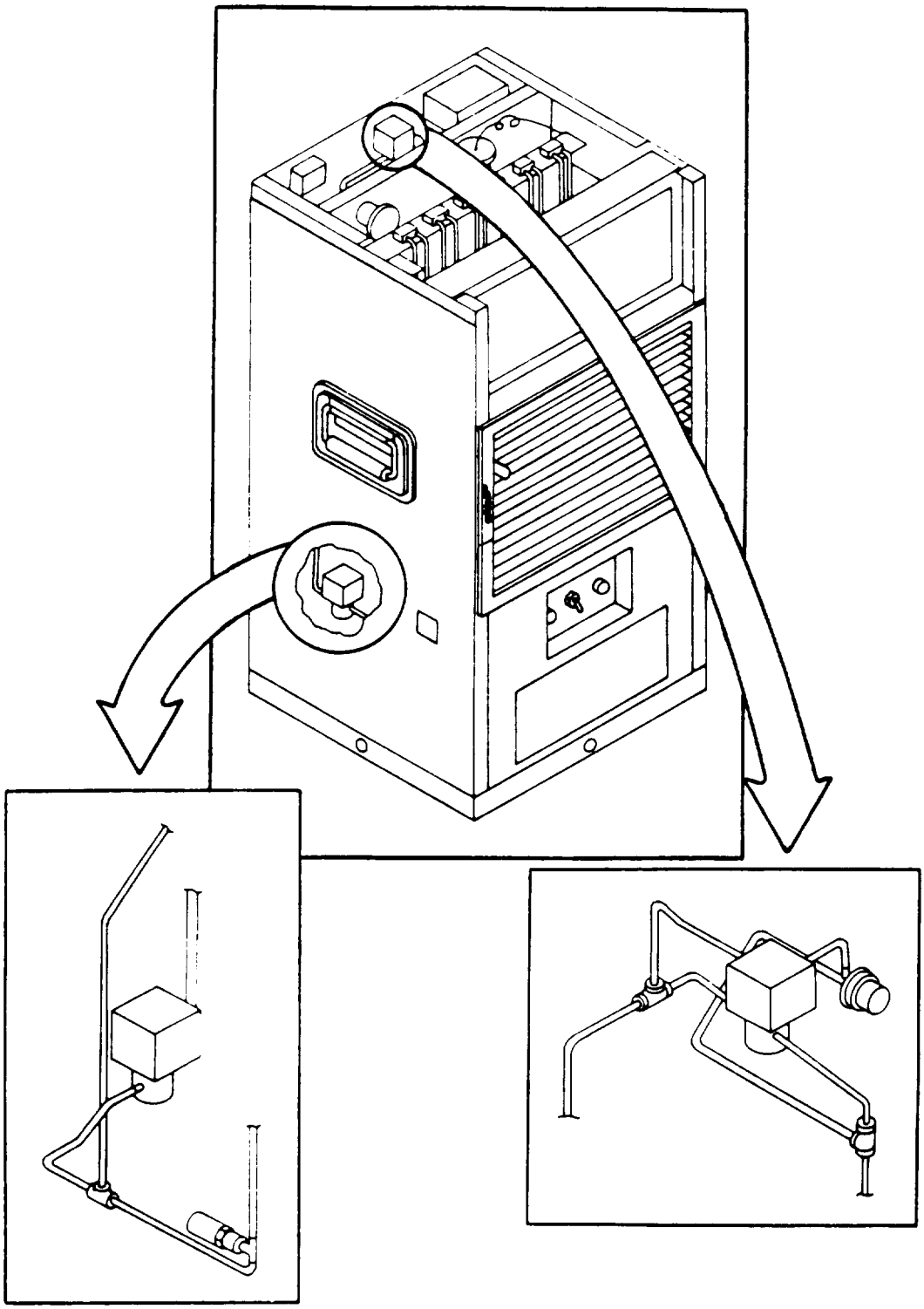


Figure 4-41. Solenoid Valves.

WARNING

High voltage can kill.

1. Check for loose mounting of solenoid valves. Tighten if loose.

2. Check for evidence of electrical arcing in solenoid area.

3. Check for leaks in and around the solenoid valves. If leaks are detected, refer to Direct Support Maintenance.

4. Check connector for loose or broken pins.

b. TESTING.

1. Disconnect connector P4.

2. Connect an external 24 Vdc power source to J4 pin J4-M or J4-1 for L1 and J4 pin J4-H or J4-g for L2. Refer to Table 4-16 for connection.

Table 4-16. SOLENOID VALVE CONNECTIONS

VALVE	WIRE NO.	TERMINATIONS
L1	L1-1	J4-M
	L1-2	J4-1
L2	L2-1	J4-H
	L2-2	J4-g

3. Switching the 24 Vdc power source ON should operate valve L1 or L2 depending on which pin the power source is applied.

4. If solenoid valve is defective, notify direct support maintenance.

5. Reconnect connector P4.

Section VI. PREPARATION FOR STORAGE OR SHIPMENT

4-29. STORAGE AND SHIPMENT

a. STORAGE.

1. Short Term.

(a) Disconnect power supply and remove from shelter. Refer to Paragraph 4-5.

(b) Make sure unit is clean and dry.

(c) Close all louvers and grilles.

(d) Unroll canvas cover and close zipper.

(e) Store in operating (upright) position.

2. Long Term.

(a) Disconnect power supply and remove from shelter. Refer to Paragraph 4-5.

(b) Make sure unit is clean and dry.

(c) Close all louvers and grilles.

(d) Unroll canvas cover and close zipper.

(e) Package all hardware, cable connectors, technical manuals, etc. in a cushioned protective sack. Staple shut and secure to unit.

NOTE

Wrap cable connectors in cushioning material before packaging.

(f) Seal all openings with polyethylene film and 1/2 inch pressure sensitive tape.

(g) Cover the entire unit with a polyethylene film shroud and secure with 1/2 inch pressure sensitive tape.

(h) Store air conditioner in a dry, dust-free space and in the operating (upright) position.

(i) Storage of the air conditioner will be in accordance with TM 740-90-1, Administrative Storage of Equipment.

b. SHIPMENT. See Figure 4-42.

1. Preparation. Prepare unit as prescribed for long term storage. Refer to Subparagraph a. 2. above.

2. Shipping Container.

(a) Fabricate a wood shipping container conforming to PPP-B-601, Domestic Type. A minimum of 1 inch clearance will exist between the air conditioner and walls of the box. The box will be modified with skids located so that the bolts securing the air conditioner pass through the skids. Bolt heads will be countersunk into the bottom of the skids. The bolts with washers, should protrude at least 3/8 inch above the skid and not more than 1/2 inch.

(b) The air conditioner will be packed in the shipping container and secured to the skids with four bolts (3/8-24) and washers.

(c) Wood spacers will be padded with water resistant cushioning material to prevent abrasion. Corner pads constructed of fiberboard will be used on all top and bottom edges of the air conditioner.

(d) The shipping container will be closed and secured with nails and steel strapping material.

(e) The air conditioner will be stored and shipped in the operating (upright) position. The words “THIS END UP” with arrows will be placed on each side of the shipping container. The letters will be black, at least 3 inches high, and located within the upper third of each side.

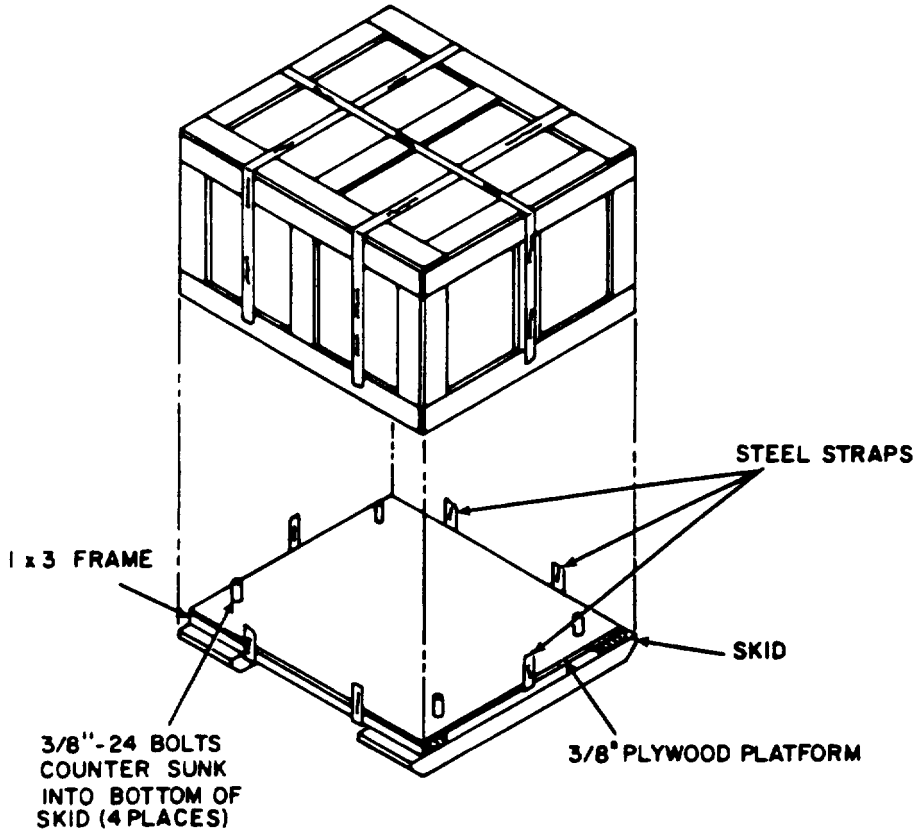


Figure 4-42. Shipping Container.

CHAPTER 5

DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

Section I. TROUBLESHOOTING

5–1. TROUBLESHOOTING TABLE

a. The troubleshooting table (Table 5-1) lists the most common malfunctions which you may find during the operation or maintenance of the air conditioner. You should perform the test/inspections and corrective actions in the order listed.

b. For specific malfunctions, perform the troubleshooting procedures listed in Table 4-2 before performing procedures listed in Table 5–1.

c. This manual cannot list all malfunctions which may occur. However, all tests or inspections and corrective action are listed for most common malfunctions.

d. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

WARNING

Disconnect power from the air conditioner before doing any maintenance work to the electrical system. High voltage in air conditioner can kill.

Never work on this equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid.

Be careful not to contact high voltage connections. Keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body. Do not be misled by the term “low voltage.” Potentials as low as 24 volts may cause death under adverse conditions.

REFRIGERANT UNDER PRESSURE is used in the operation of this equipment.

DEATH or severe injury may result if personnel fail to observe safety precautions.

WARNING

Never use a heating torch on any part that contains refrigerant 22.

Avoid bodily contact with liquid refrigerant and avoid inhaling refrigerant gas.

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing.

Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces.

Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas.

NOTE

At outside temperatures below O °F (–18 °C) LPCO will have to be jumped to operate in COOL mode. Refer to Paragraph 5-18.

Table 5-1. TROUBLESHOOTING FOR DIRECT SUPPORT MAINTENANCE

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
WARNING High voltage can kill.	
1. COMPRESSOR WILL NOT START	
NOTE Be sure and check Item 1, Steps 1 through 7, Table 4-2, Troubleshooting for Unit Maintenance before, proceeding with Step 1.	

Table 5-1. TROUBLESHOOTING FOR DIRECT SUPPORT MAINTENANCE – Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 1. Check that the LOW and HIGH PRESSURE cutoff switches RESETS are in.

Press the LOW and HIGH PRESSURE switches to RESET. If switches do not remain in, check and/or replace switches. Refer to Paragraph 5-18.

Step 2. Test K6 time delay relay. Refer to paragraph 4-20 Test.

Replace if defective. Refer to Figure 4-25.

Step 3. Check that the compressor motor thermo cutoff switch is operational. Refer to paragraph 5-11.

Replace compressor if therrno cutoff is defective. Refer to Paragraph 5-11.

Step 4. Inspect and check compressor for burnout. Refer to Paragraph 5-11.

Replace burned out mmpressor. Refer to Paragraph 5-11.

2. COMPRESSOR SHORT CYCLES

Step 1. Check for obstructions in front of condenser screen.

Remove obstructions and/or roll up and secure canvas cover.

Step 2. Check if HIGH PRESSURE cutoff switch RESET is out.

Push HIGH PRESSURE switch to RESET.

Table 5-1. TROUBLESHOOTING FOR DIRECT SUPPORT MAINTENANCE – Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

WARNING

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing.

Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces.

Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas.

Step 3. Check head pressure (high pressure side). Refer to Paragraph 5-4.

a. If pressure is too high, check HIGH PRESSURE cutout switch and replace if defective. Refer to Paragraph 5–18.

b. If pressure is excessive and sight glass is clear, release excess refrigerant. Refer to Paragraph 5-5.

Step 4. Check if LOW PRESSURE cutoff switch RESET is out.

Push LOW PRESSURE switch to RESET.

Step 5. Check head pressure (low pressure side). Refer to Paragraph 5-4.

Step 6. Check quench valve. Refer to Paragraph 5-14.

Step 7. Check compressor motor thermo cutoff switch. Refer to Paragraph 5-11.

Replace compressor if cutoff switch is defective. Refer to Paragraph 5-11.

Table 5-1. TROUBLESHOOTING FOR DIRECT SUPPORT MAINTENANCE – Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
3. INSUFFICIENT COOLING ACTION
NOTE At outside temperatures below 0°F(–18°C) the LPCO must be jumpered to operate in COOL mode. Refer to Paragraph 5-18.
Step 1. Check control settings. a. Move mode selector switch to COOL. b. Move temperature selector switch to INCREASE. If normal cooling does not resume in 15 minutes, go to Step 2.
NOTE Frost on the evaporator coil is usually caused by an obstruction to air flow or dirty evaporator coil, filter, or mist eliminator.
Step 2. Make sure louvers are open. Replace if defective. Refer to Paragraph 4-12.
Step 3. Check to make sure evaporator and condenser fans are tight on motor shaft. Refer to Paragraph 4-24. Tighten if loose. Refer to Paragraph 4-24.

Table 5-1. TROUBLESHOOTING FOR DIRECT SUPPORT MAINTENANCE – Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
Step 4. Check area near condenser guard and fresh air inlet for heat source over 120 °F (40 °C). Remove heat source.
Step 5. Check sight glass after operating unit for 15 minutes with temperature switch in maximum COOLER position. Center should be bubble free and green. Add refrigerant. Refer to Paragraph 5-8.
WARNING Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible. Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas.
Step 6. Check for refrigerant leaks. Refer to Paragraph 5-3. Repair or change defective part.
WARNING High voltage can kill.
Step 7. Check solenoid valves L1 and L2. Refer to Paragraph 4-28. Repair or replace if defective. Refer to Paragraph 5-16.

Table 5-1. TROUBLESHOOTING FOR DIRECT SUPPORT MAINTENANCE - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 8. Check pressure regulator valve. Refer to Paragraph 5-17.

Replace if defective. Refer to Paragraph 5-17.

Step 9. Check expansion valve for proper operation. Refer to Paragraph 5-15.

Replace if defective. Refer to Paragraph 5-15.

Step 10. Check quench valve for proper operation. Refer to Paragraph 5-14.

Replace if defective. Refer to Paragraph 5-14.

NOTE

To determine if unit is operating at proper capacity (output) in the COOLING mode, refer to Table 5-2.

4. REFRIGERANT SYSTEM CONTINUOUSLY LOSING REFRIGERANT

WARNING

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing.

Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces.

Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas.

Table 5-1. TROUBLESHOOTING FOR DIRECT SUPPORT MAINTENANCE – Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 1. Check refrigerant tubing and components for leaks using a leak detector. Refer to Paragraph 5-3.

Repair or replace as required.

Step 2. Check pressure relief valve. Refer to Paragraph 5–21.

Replace if defective. Refer to Paragraph 5-21.

5. UNIT OPERATES CONTINUOUSLY ON COOLING CYCLE

Step 1. Check position of temperature selector switch.

Move selector to WARMER.

WARNING

High voltage can kill.

Step 2. Check temperature selector switch S1 for continuity.

Replace if defective.

WARNING

High voltage can kill.

Step 3. Check solenoid valve L1. Refer to Paragraph 5-16.

Replace if defective. Refer to Paragraph 5-16.

6. SIGHT GLASS APPEARS YELLOW INSTEAD OF GREEN

WARNING

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing.

Table 5-1. TROUBLESHOOTING FOR DIRECT SUPPORT MAINTENANCE – Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

WARNING

Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces.

Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas.

Step 1. Yellow appearance of sight glass is caused by contamination in the refrigerant.

a. Release refrigerant. Refer to Paragraph 5-5.

b. Remove dehydrator. Refer to Paragraph 5-22.

c. Purge and dry system. Refer to Paragraph 5-6.

d. Install new dehydrator. Refer to Paragraph 5-22.

e. Evacuate system. Refer to Paragraph 5-7.

f. Recharge with refrigerant. Refer to Paragraph 5–8.

Step 2. Check for yellow in sight glass after allowing compressor to run for at least 1 hour.

Repeat corrective action in Step 1 above.

7. AIR CONDITIONER NOISY DURING OPERATION

Step 1. Check expansion valve. Refer to Paragraph 5–15.

Adjust or replace. Refer to Paragraph 5-15.

Step 2. Check quench valve. Refer to Paragraph 5-14.

Adjust or replace. Refer to Paragraph 5-14.

SECTION II. MAINTENANCE PROCEDURES

Table 5-2. CHECKING REFRIGERATION SYSTEM OUTPUT

STEP No.	PROCEDURE
1	Measure ambient outside temperature.
2	Operate air conditioner in COOL mode with maximum INCREASE temperature setting for at least 15 minutes.
3	Measure condenser discharge air temperature which should be 20 °F to 30 °F (–1 °C to –7 °C) above ambient.
4	Measure temperature of air going into (return) and out of (discharge) evaporator section.
5	Discharge should be 15 °F to 25 °F (-4 °C to –10 °C) lower than return air temperature.

5-2. GENERAL REPAIR PROCEDURES

NOTE

The following instructions are provided for use by refrigeration shops furnished with only the most basic equipment. If more complex equipment, such as two valve or four valve service manifolds are available, they should be used by making appropriate modifications to these instructions.

a. OPENING (BREAKING) THE SYSTEM.

1. When the refrigeration system must undergo maintenance that requires the system to be opened for removal and replacement of parts, the refrigerant must first be released. Refer to Paragraph 5-5.

2. After the repair is completed, a new dehydrator must be installed. The system must then be leak tested, evacuated, and charged. Refer to Paragraphs 5-22, 5-3, 5–7, and 5-8.

b. REMOVAL OF PARTS.

1. It may be necessary to remove some tubing and fittings with a part that is to be replaced.

2. The tubing and fittings can then be removed from the defective part and installed on the new part.

3. Care should be exercised when opening joints or rebrazing to prevent damage to other parts of the air conditioner.

WARNING

Prevent contact of refrigerant gas with flame or hot metal surfaces.

Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas.

CAUTION

To prevent damage to other parts of the unit, wrap the two solenoid valves (L1 and L2), the expansion valve, and the quench valve with wet rags to act as a heat sink.

NOTE

If brazing or debrazing is necessary on any part of the system, a constant purge of dry nitrogen must be fed through the system being soldered to prevent scale formation or oxidation within the tubing.

c. BRAZING.

1. Braze copper to copper and copper to brass joints with brazing alloy QQ-B-654, Grade III. Braze copper to steel with brazing alloy QQ–B-654, Grade I. Flux O-F-499 should be used during the brazing operation.

2. All joints inside and outside should be polished with abrasive cloth prior to brazing.

3. Tubing should be uniformly heated with a neutral or slightly reducing flame until the brazing alloy flows freely. Localized overheating is to avoided. The brazing alloy will be introduced at one edge of the joint and allowed to flow by capillary action to fill the joint.

WARNING

Prevent contact of refrigerant gas with flame or hot metal surfaces.

Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas.

CAUTION

To prevent damage to other parts of the unit, wrap the two solenoid valves (L1 and L2) the expansion valve, and the quench valve with wet rags to act as a heat sink.

NOTE

If brazing or debrazing is necessary on any part of the system, a constant purge of dry nitrogen must be fed through the system being soldered to prevent scale formation or oxidation within the tubing.

d. DEBRAZING.

1. Uniformly apply heat to the brazed joint until the liquid point of the brazing alloy is reached. While still at the liquid point, separate the parts.

2. Tubing and fittings attached to the damaged part can be used on the replacement part.

e. INSULATION AND GASKETS.

1. Replace damaged insulation and gaskets.

2. Cement loose insulation using MMM-A-121 Adhesive.

3. Adequate heat shielding should be provided to avoid heat damage to insulation and gaskets.

f. HARDWARE.

1. Replace damaged screws, flat washers, lockwashers, and nuts.

2. Use screws of correct length to hold parts securely.

3. In some application, screws that are too long may bottom before the head is snug causing damage to the threads or other parts.

g. REPAIRING DAMAGED THREADS.

1. Damaged threads should be repaired by use of a thread restorer.

2. Internal threads can be repaired with a tap of the correct size.

3. If threads cannot be satisfactorily repaired, replace the part.

H. REPAIR OF DAMAGED MACHINED AND POLISHED SURFACES.

1. Smooth rough spots, scores, burrs, galling, and gouges from damaged machined and polished surfaces.

2. The finish of the repaired part should approximate that of the original finish.

3. In performing any of these operations, critical dimensions must not be altered.

I. REMOVAL OF RUST OR CORROSION.

1. Completely remove corrosion from all surfaces of the part.

2. To remove rust or corrosion, use wire brush, abrasive cloth, sand blast, vapor blast equipment, or rust remover except on highly polished surfaces.

3. On highly polished surfaces, buffing or the use or crocus cloth is recommended.

J. TUBES AND FITTINGS.

1. Check tubes and fittings for cracks or splits.

2. Check tubing for kinks.

3. Replace damaged tubing with tubing of the same size.

4. Tubing should be bent accurately and to the correct radius using a bending tool.

5. Tubes should have a uniform bend without wrinkles or kinks.

6. The flattening effect in tube bends should not exceed 10 percent of the normal tube O. D.

7. Tubes should be bent to correct alignment with the fitting. Incorrect alignment places the tube under mechanical stress.

8. Use a flaring tool to flare tubing used with flare nuts.

9. All tubing and fittings must be completely clean on the inside prior to installation.

5-3. LEAK TESTING OF REFRIGERATION SYSTEM

WARNING

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. In case of refrigerant leaks, ventilate area immediately.

a. ELECTRONIC LEAK DETECTOR TEST.

WARNING

High voltage can kill.

1. Disconnect power supply.
2. Remove 16 screws, and rain seal washers, and canvas cover.
3. Remove 11 screws and rain seal washers and top panel.
4. Position refrigerant drum so that only refrigerant gas will be used. Connect the center hose of the charging manifold to refrigerant tank.
5. Remove caps from both service valves and loosely connect hose from charging manifold to service valves. Make sure the high pressure hose is connected to the high pressure service valve and the low pressure hose is connected to the low pressure (suction) service valve Purge air from lines and tighten hoses on valves. See Figure 5-1.

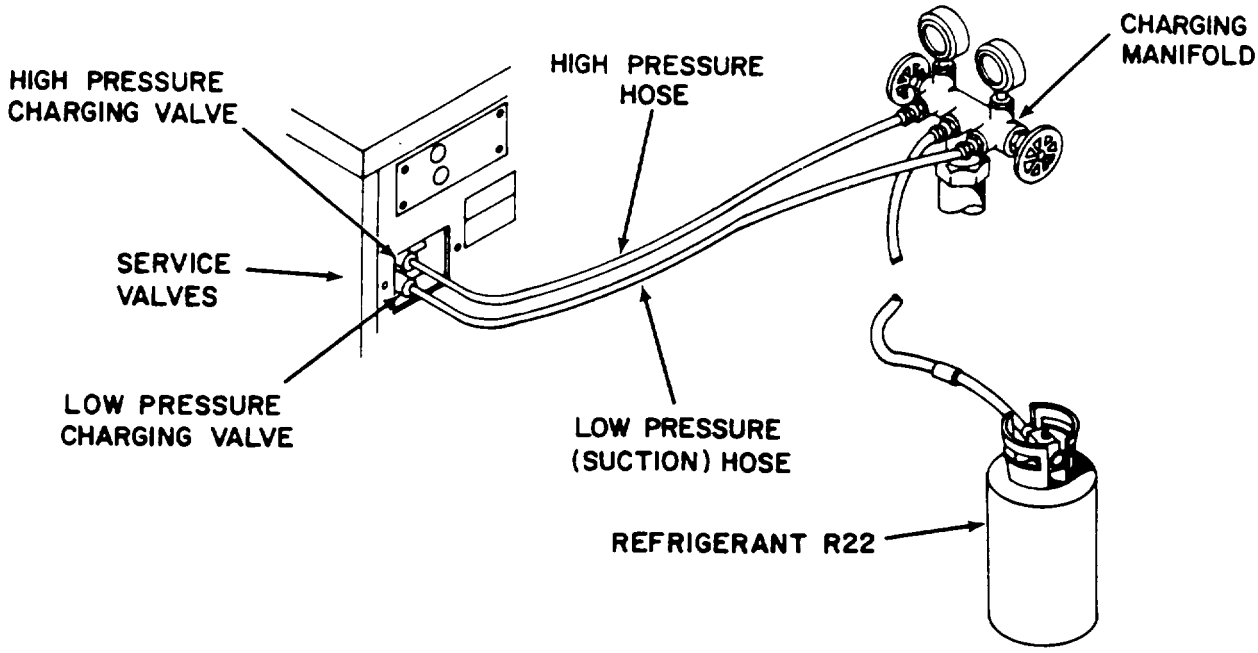


Figure 5-1. Leak Test Refrigerant Bottle Setup.

6. Slowly open both unit service valves and allow refrigerant to flow into system until guages indicate 50 psig (3.5 kgkmz).

7. Close both unit service valves, charging manifold valves, and refrigerant drum valve.

8. Disconnect refrigerant cylinder.

9. Connect nitrogen regulator to nitrogen cylinder.

10. Connect nitrogen regulator to center hose on charging manifold. See Figure 5-2.

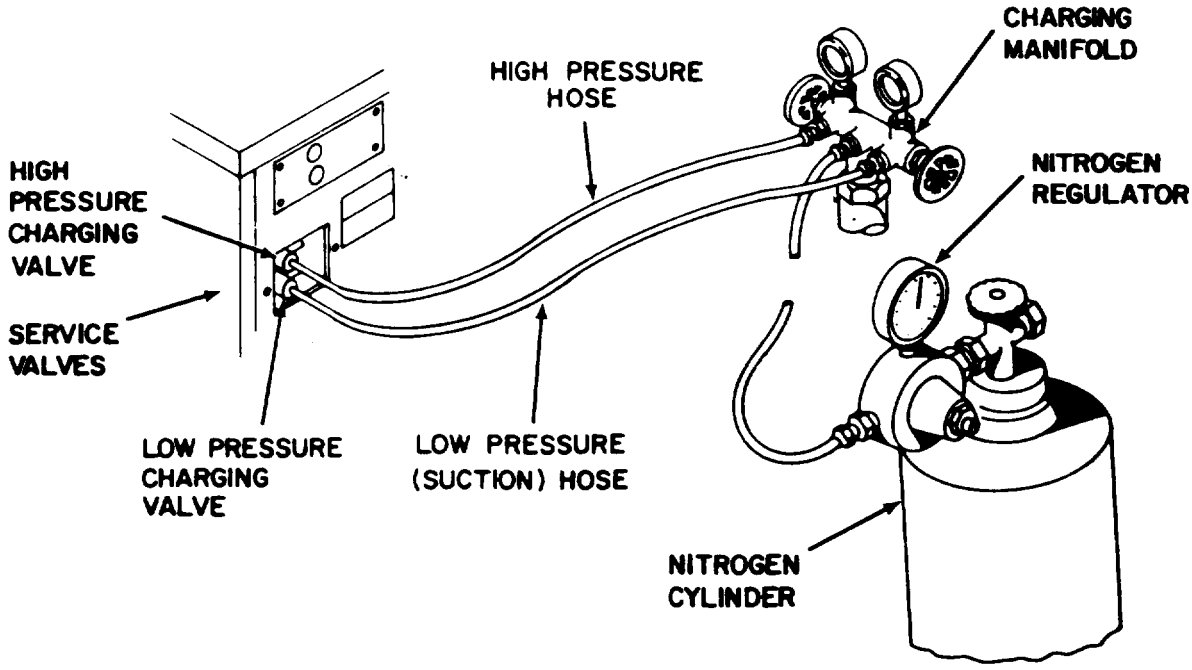


Figure 5-2. Leak Test, Nitrogen Bottle and Regulation Setup.

11. Open nitrogen regulator valve slowly.

12. Open high pressure service valve and low pressure service (suction) valve. **DO NOT TURN ON AIR CONDITIONER.**

13. Slowly open both valves on charging manifold and charge system to 350 paig (25 kg/cm²).

14. Close all valves.

CAUTION

The electronic leak detector is sensitive to the presence of refrigerant gas in the atmosphere. When refrigerant gas is present in the atmosphere of the work area, false indications can result. Use in a well ventilated but draft free area.

NOTE

Tester must be calibrated for a pure refrigerant leak rate of 0.1 ounce (2.83 g) per year.

15. Turn on electronic leak detector and slowly pass probe around all points in the refrigeration system.

16. Depending on the type of detector used, a leak will be indicated by an audible signal, a light, or by meter deflections.

17. When a leak is found, mark the leak point with a grease pencil.

18. Close nitrogen valve after checking entire refrigerant system. Disconnect hose between charging manifold and nitrogen insulator at the nitrogen regulator. Place center manifold hose in container.

19. Open manifold valves.

WARNING

Discharge refrigerant in an open area and NOT around an open flame.

CAUTION

Discharge the system SLOWLY to reduce oil loss from the compressor.

20. SLOWLY open low pressure valve to allow refrigerant gas to flow slowly through hose.

21. SLOWLY open high pressure valve to allow refrigerant gas to flow slowly through hose.

22. Close both service valves when gas stops flowing. If no leaks are detected, go directly to Step 26.

23. Repair or replace defective tubing, fittings, or parts. Refer to Paragraph 5-2. Nitrogen purge the system during brazing or debrazing. Refer to Paragraph 5-6.

24. Replace dehydrator. Refer to Paragraph 5-22.

25. Repeat leak test, steps 4 through 22.

26. Evacuate the system for eight hours. Refer to Paragraph 5-7.

27. Charge the system. Refer to Paragraph 5-8.

28. Install top panel and secure with eleven screws, and rain seal washers.

29. Install canvas cover and secure with sixteen screws and rain seal washers.

30. Connect power supply.

b. SOAP SOLUTION LEAK TEST.

NOTE

When using the soap solution test, the refrigerant system must be pressurized with nitrogen and a proper charge of R22. Refer to steps 1 through 4 and 18 through 22 above.

1. Using care to avoid touching blower or electrical components, brush soap or detergent solution on all joints or possible points of leakage.
2. Follow a definite sequence to avoid missing any points that should be tested.
3. Watch for bubbles and mark point where leak is found with grease pencil.
4. Wipe solution from all joints.
5. Repair leaks as required. Refer to steps 23 through 29 above. If no leaks are found, refer to steps 26 through 29 above.

5-4. PRESSURE TEST

a. SETUP. See Figure 5-3.

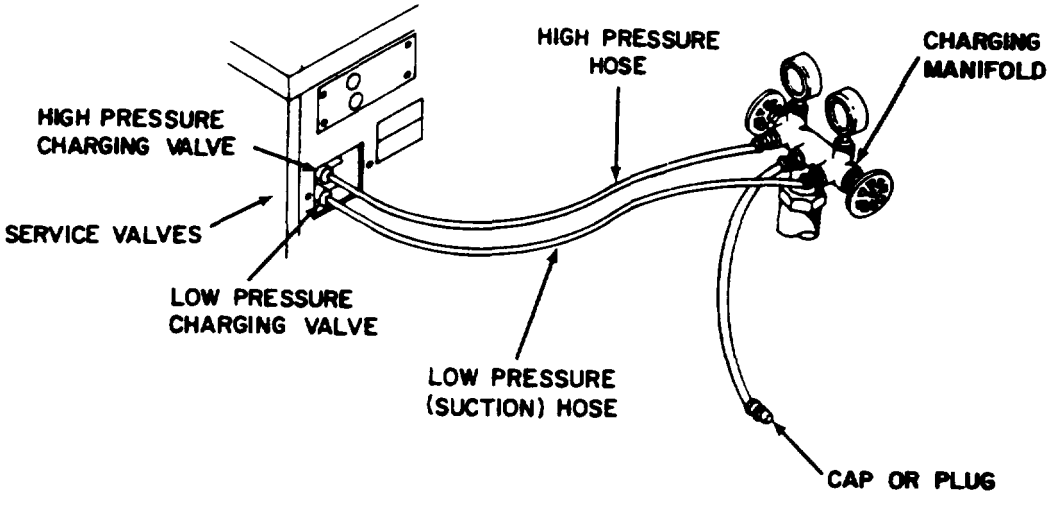


Figure 5-3. Pressure Test Setup.

1. Remove two screws and access cover.
2. Remove valve caps from the service valves.
3. Connect charging manifold hoses to service valves. Make sure the high pressure hose is connected to the high pressure service valve, and the low pressure hose to the low pressure (suction) service valve. See Figure 5–3.
4. Make sure the middle hose on the charging manifold is plugged or capped.

5. Make sure that the fresh air vent is completely closed and that the discharge grille and return air intake grille louvers are fully open.

6. Position an accurate thermometer directly in front of the return air intake grille to measure dry bulb return air temperature.

7. Position another thermometer in front of the condenser air inlet guard to record outside ambient air temperature. Make sure the thermometer is shaded fkom direct sunlight.

8. If indoor ambient temperature is too low, provide a space heater ta raise the dry bulb return air temperature to 80°(27°C).

b. PROCEDURE.

1. Turn the mode selector switch to COOL and the temperature selector switch to maximum INCREASE.

2. Slowly open the unit service valves.

3. Allow the air conditioner to operate for at least 15 minutes in the COOL mode so that all parts in the system are stabilized.

4. Record both inside and outside temperatures.

5. Record pressure readings.

6. Compare the pressure readings with the normal ranges shown in Table 5-3.

Table 5-3. NORMAL TEMPERATURE-PRESSURE RELATIONSHIPS

95 °F (35 °C) dry bulb return air to unit

Outdoor Ambient Temperature (degrees)	50F 10C	75F 24C	100F 38C	110F 43.5C	125F 52C
Gauge Pressures Suction(psig) (kg/cm²)	50–60 3.52–4.22	56–65 3.94–4.57	65–75 4.57–5.27	70–80 4.92–4.62	75–90 5.27–6.33
Discharge (psig) (kg/cm²) 10. 90	135–155 7.49– 14.41	185–205 13.01– 20.74	275–295 19.33– 26.72	375–380 26.37– 29.53	400–420 28.12–

Table 5–3. NORMAL TEMPERATURE–PRESSURE RELATIONSHIPS – cont

95 °F (35 °C) dry bulb return air to unit

Outdoor Ambient Temperature (degrees)	50F 10C	75F 24C	100F 38C	125F 52C
Gauge Pressures Suction(psig) (kg/cm 2)	56 min 3.94 min	56 min 3.94 min	56–65 3.94–4.57	65–75 4.57–5.27
Discharge (psig) kg/cm 2) 10. 55	130–150 9.14– 14.06	180–200 12.66– 20.39	270–290 19.98– 28.83	290–410 20.39–

NOTE

Dry bulb temperatures are measured with an ordinary thermometer.

c. ANALYSIS OF DISCREPANCIES.

1. If actual pressur~temperature relationships differ from those shown in Table 5-3, take appropriate action described below.

2. If pressures are too high, refer to Table 5-4.

Table 5–4. EXCESSIVE HEAD AND SUCTION PRESSURE

POSSIBLE CAUSE	REMEDY
Unit overcharged	Purge excess refrigerant
Restricted condenser air	Check for free airflow a. Check condenser louver adjustment b. Check for any restrictions to airflow c. Check operation of actuating cylinder d. Condenser fan or motor needs repair or replacement
Air in system	Check for leaks on suction side, release refrigerant, check operation.

3. If pressures are too low, refer to Tables 5-5 and 5-6.

NOTE

It maybe necessary to release entire charge and then recharge system.

Table 5-5. LOW HEAD PRESSURE

POSSIBLE CAUSE	REMEDY
Low refrigerant charge	Completely charge then leak test, repair and recharge to 4.25 lb (1.93 kg)
Restriction in liquid line	Locate and repair
Charging valve leaking	Replace

Table 5-6. LOW SUCTION PRESSURE

POSSIBLE CAUSE	REMEDY
Low refrigerant charge	Completely charge then leak test, repair and recharge to 4.25 lb (1.93 kg)
Restriction in liquid line	Repair or replace
Low evaporator airflow	Restriction, dirty filter, dirty mist eliminator, dirty motor or blower
Outdoor ambient at or near 0 °F (–18 °C)	It will be necessary to jumper LPCO to operate at this outdoor temperature. (refer to Paragraph 5–18).

d. COMPLETION.

1. After the pressure testing is completed, close the service valves on the air conditioner.
2. SLOWLY drain the pressure from the charging manifold by loosening the hose fittings at the service valves.
3. After the pressure from the charging manifold is completely released, disconnect the service hoses from the air conditioner.
4. Replace the valve caps on the service valves.
5. Reinstall the access cover and secure with two screws.

5–5. RELEASING REFRIGERANT

WARNING

Use great care to avoid contact with liquid refrigerant or refrigerant gas being dischargedfim anycontainer under pressure. Sudden and irreversible tissue damage can result fiwm fiwezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

NOTE

In accordance with Environmental Protection Agency regulations, refrigerant cannot be discharged into the atmosphere. A refrigerant recovery and recycling unit must be used whenever discharging the refrigerant system.

Operation of the recovery/recycling unit must be by AUTHORIZED PERSONNEL ONLY.

PREPARATION-SETUP. See Figure 5-4.

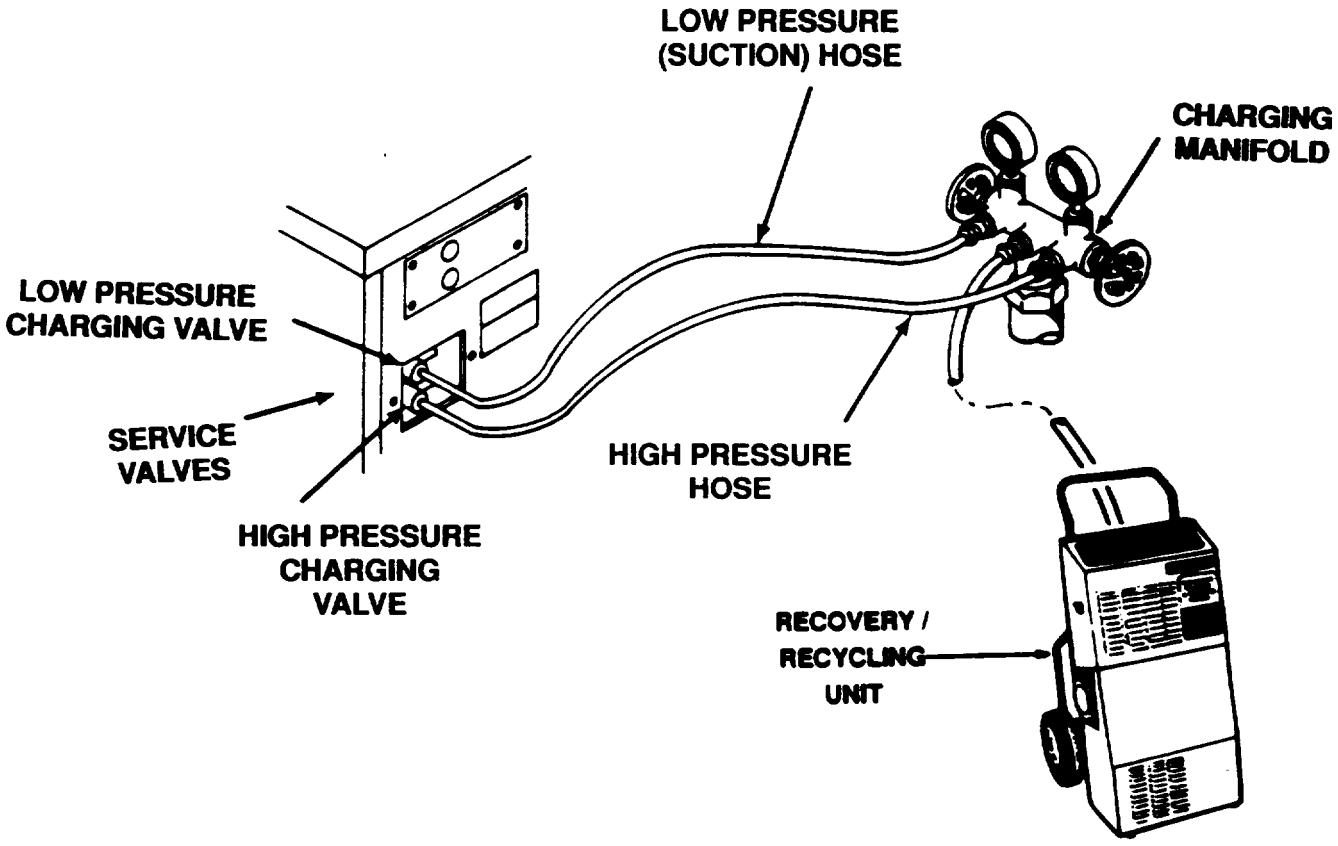


Figure 5-4. Releasing Refrigerant.

1. Remove two screws and access cover.
2. Remove service valve caps.
3. CONNECT charging manifold service hoses to unit service valves.
4. Connect and operate a recovery/recycling unit in accordance with manufacturer's instructions.

5-6. NITROGEN PURGE

NOTE

Nitrogen purge is used during brazing or debrazing operations and to remove moisture from refrigerant system.

a. PREPARATION-SETUP. See Figure 5-5.

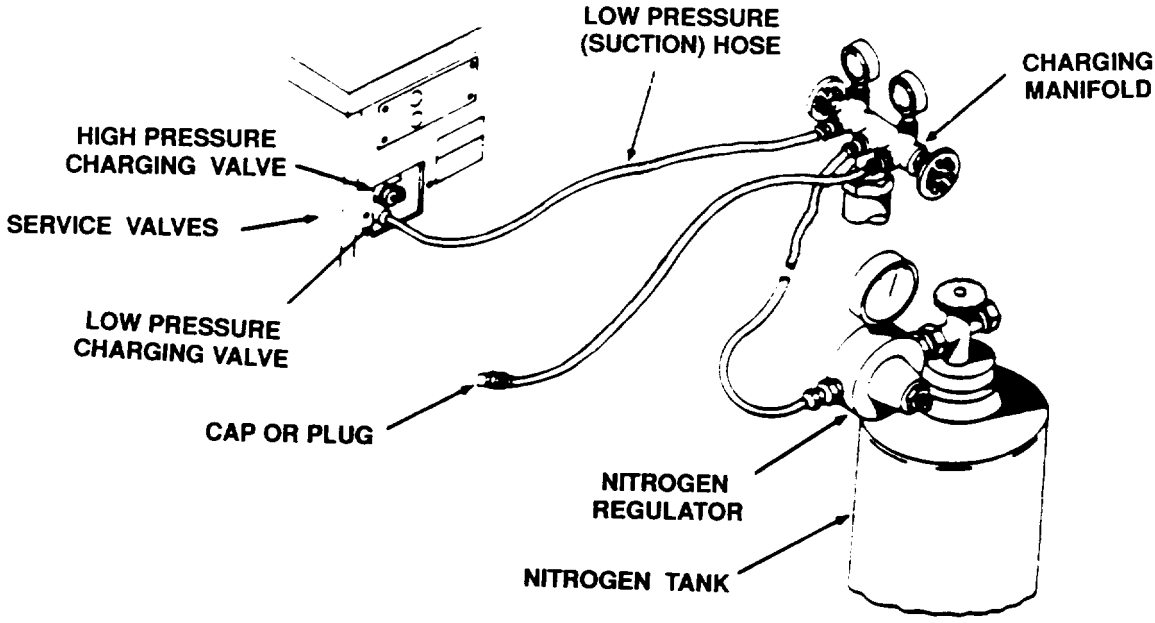


Figure 5-5. Nitrogen Tank Connection.

1. Remove two screws and access cover.
2. Release refrigerant charge. Refer to Paragraph 5-5.

CAUTION

Nitrogen pressure in the system should not exceed 10 psig (0.70 kg/cm2).

3. Attach center hose on charging manifold to dry nitrogen cylinder valve.
4. Connect low pressure (suction) hose from charging manifold to low pressure (suction) service valve on unit. Refer to Paragraph 5-5.

b. PURGING PROCEDURE.

1. Open both service valves on the unit.

2. Open nitrogen cylinder valve and allow dry nitrogen to flow through the system until brazing/debrazing operation is complete or moisture is removed from the system.

NOTE

A minimum of 5 minutes of nitrogen purge is required for moisture removal.

3. Close nitrogen cylinder valve.

4. Close both unit service valves.

5. Loosen service hoses to drain pressure in hoses.

6. Disconnect hoses and reinstall service valve caps.

5-7. EVACUATION

NOTE

Parts replacement (including dehydrator) should be accomplished prior to evacuating the refrigerant system. Refer to applicable paragraphs.

a. PREPARATION-SETUP. See Figure 5-6.

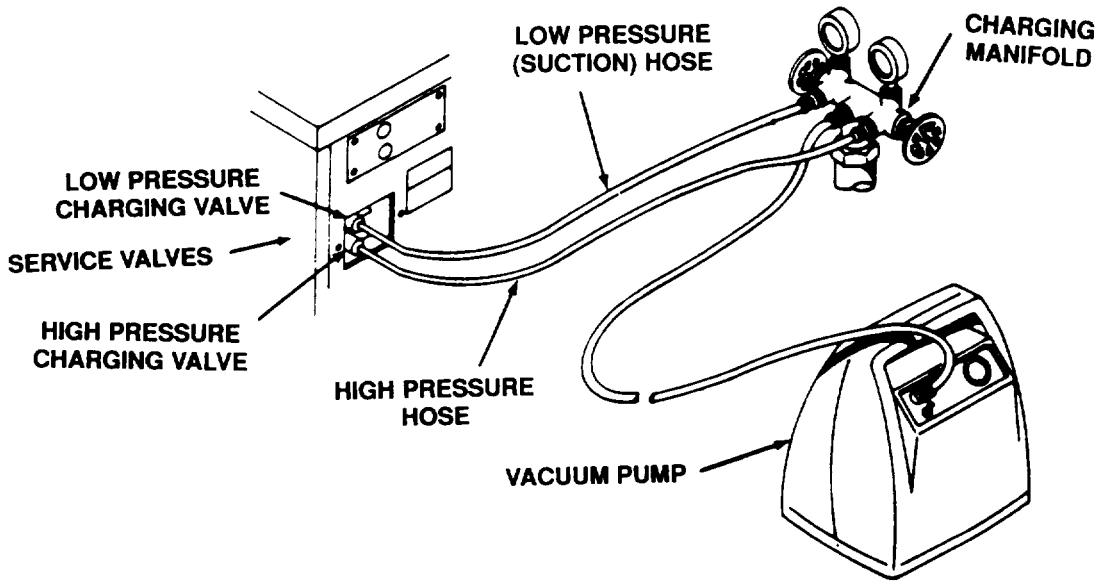


Figure 5-8. Evacuation Setup

1. Remove service valve caps.

2. Attach the manifold hoses to the unit service valve. Make sure the high pressure hose is comected to the high pressure service valves and the low pressure (suction) hose is connected to the low pressure service valve.

3. Attach center hose from charging manifold to the vacuum pump. See Figure 5-6.

b. EVACUATION PROCEDURE.

1. Start the vacuum pump.
2. Open the charging mantiold valves.
3. Open both unit service valves.
4. Run the vacuum pump until at least 29 inches of mercury is reached.

NOTE

Inability to reach 29 inches of mercury may indicate a leak in the refrigerant system or a problem with the vacuum pump.

Twenty-nine inches of mercury will not be reached at higher than sea level elevations. Refer to Table 5-7 for corrective factors.

Table 5-7. ELEVATION CORRECTION FOR VACUUM GAUGE READINGS

ELEVATION (FEET)	INCHES OF MERCURY
2000	28
3000	27
4000	26
5000	25
6000	24
7000	23

5. Continue running the pump for 1 hour, observing the vacuum pump gauge. If the gauge needle moves back and forth, there is a refrigerant leak which must be located and corrected. Refer to Paragraph 5-3.
6. Close all manifold charging valves.
7. Close both unit service valves.
8. Stop vacuum pump.
9. Recharge the refrigerant system. Refer to Paragraph 5-8.

CAUTION

Do not attempt to charge liquid refrigerant into the suction (low pressure) line. Damage to the compressor may result.

CAUTION

If compressor knocking or pounding is heard when charging with gas, shut down at once and release some refrigerant.

CAUTION

When adding refrigerant use extreme care to avoid adding refrigerant to the system too fast, slugging and damage to the compressor could result·

NOTE

Whenever the refrigeration system has been opened, a new dehydrator (filter-drier) must be installed before recharging the system. Refer to Paragraph 5-22·.

NOTE

Two kinds of refrigerant drums are in general use. One is equipped with a single shutoff valve and must be inverted when charging with liquid refrigerant. The other is equipped with a vapor valve and a liquid valve, which makes it possible to charge either liquid or vapor when the drum is upright.

NOTE

Whenever available, use recycled refrigerant for charging the refrigeration system.

5-8. REFRIGERANT CHARGING WITH GAS

a. SETUP. See Figure 5-7.

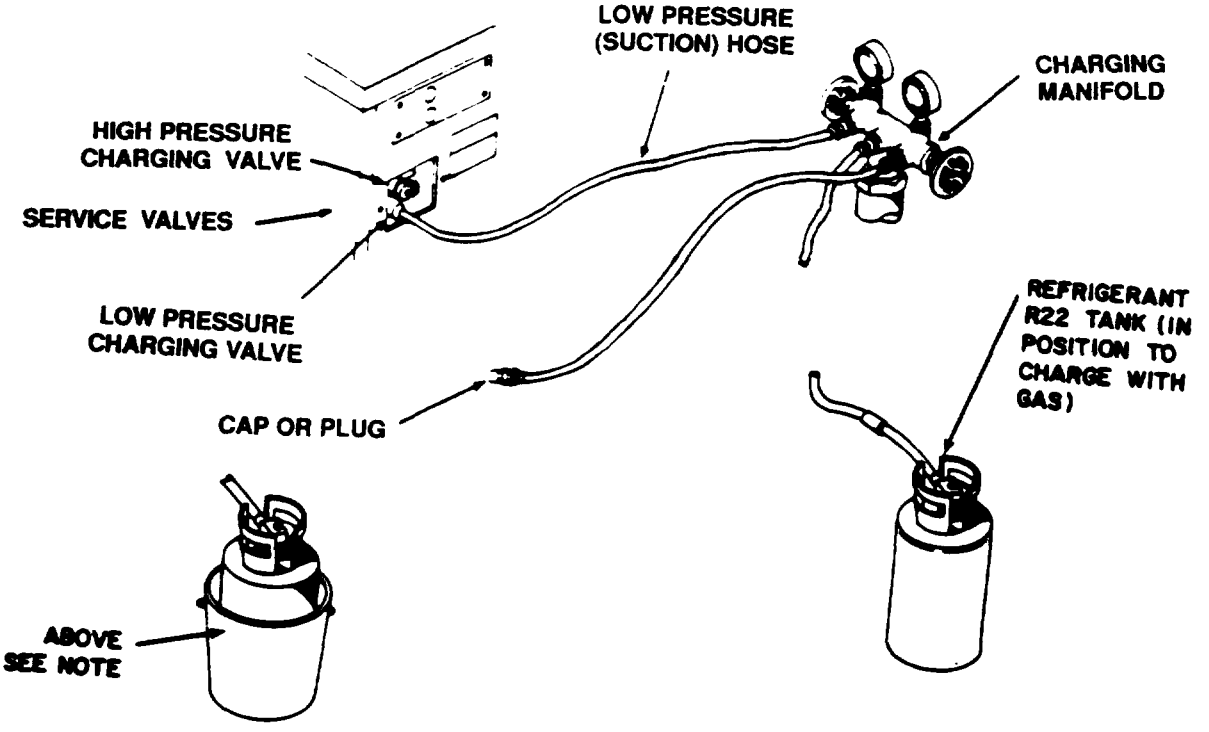


Figure 5-7. Charging with Refrigerant Gas.

1. Remove two screws and access cover from air conditioner.

WARNING

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to breakdown and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. In case of refrigerant leaks, ventilate area immediately.

2. Remove the valve cap from the low pressure (suction) service valve.

3. Position the refrigerant tank in an upright position close to the service valves.

4. Connect the center hose on the charging manifold to the refrigerant tank.

5. Loosely connect the low pressure charging hose to the low pressure (suction) service valve.

6. Open the refrigerant tank valve slightly to purge air from the charging hose. Close refrigerant valve.

7. Tighten hose connection at the low pressure (suction) service valve.

8. Position mode selector switch to COOL and the temperature selector switch to maximum INCREASE.·

CAUTION

Do not turn air conditioner on when system is completely discharged. Damage to the air conditioner may result.

NOTE

On cold days, it may be necessary to place refrigerant drum in container of warm water not to exceed 120°F (48.9 °C).

b. CHARGING PROCEDURE-SYSTEM COMPLETELY DISCHARGED.

1. Open the low pressure service valve to full open position.

CAUTION

When adding refrigerant use extreme care to avoid adding refrigerant to the system too fast. Slugging and damage to the compressor could result.

NOTE

Whenever available, use recycled refrigerant for charging the refrigeration system.

2. SLOWLY open the refrigerant tank valve one full turn.

3. Closely watch the low pressure manifold gauge. When the pressure stops increasing, turn the air conditioner ON and allow the unit to operate while continuing to charge the system.

4. Continuously observe the sight glass. When bubbles no longer appear in the sight glass, the system is charged.

5. Close the refrigerant tank valve.

6. Close the low pressure (suction) service valve.

7. Carefully loosen the charging hose to release trapped pressure.

8. Disconnect the charging line and install valve cap on the low pressure service valve.

9. Continue to operate unit for 15 minutes and recheck sight glass for bubbles. If bubbles are present, add additional refrigerant Refer to Subparagraph c. below.

c. **CHARGING PROCEDURE--ADD REFRIGERANT TO A PARTIALLY CHARGED SYSTEM.**

1. Follow setup procedures described in subparagraph a. above.

2. Open the low pressure service valve to full open position.

3. Turn the air conditioner ON.

4. SLOWLY open the refrigerant tank valve one full turn.

5. Continue to operate unit while charging the system.

6. Continuously observe the sight glass. When bubbles no longer appear in the sight glass, the system is charged.

7. Close the refrigerant tank valve.

8. Close the low pressure (suction) service valve.

9. Carefully loosen the charging hose to release trapped pressure.

10. Disconnect the charging hose and install valve cap on low pressure service valve.

11. Reinstall access cover and secure with two screws.

NOTE

If frequent servicing is required, perform a leak test. Refer to Paragraph 5-3.

5-9. REFRIGERANT CHARGING WITH LIQUID

CAUTION

Do not attempt to charge liquid refrigerant into the suction (low pressure) line. Damage to the compressor may result.

CAUTION

If compressor knocking or pounding is heard when charging with gas, shut down at once and release some refrigerant.

When adding refrigerant use extreme care to avoid adding refrigerant to the system too fast. Slugging and damage to the compressor could result.

NOTE

Whenever the refrigeration system has been opened, a new dehydrator (filter-drier) must be installed before recharging the system. Refer to Paragraph 5-22.

Two kinds of refrigerant drums are in general use. One is equipped with a single shutoff valve and must be inverted when charging with liquid refrigerant The other is equipped with a vapor valve and a liquid valve, which makes it possible to charge either liquid or vapor when the drum is upright.

Whenever available, use recycled refrigerant for charging the refrigeration system.

a. SETUP. See Figure 5-8.

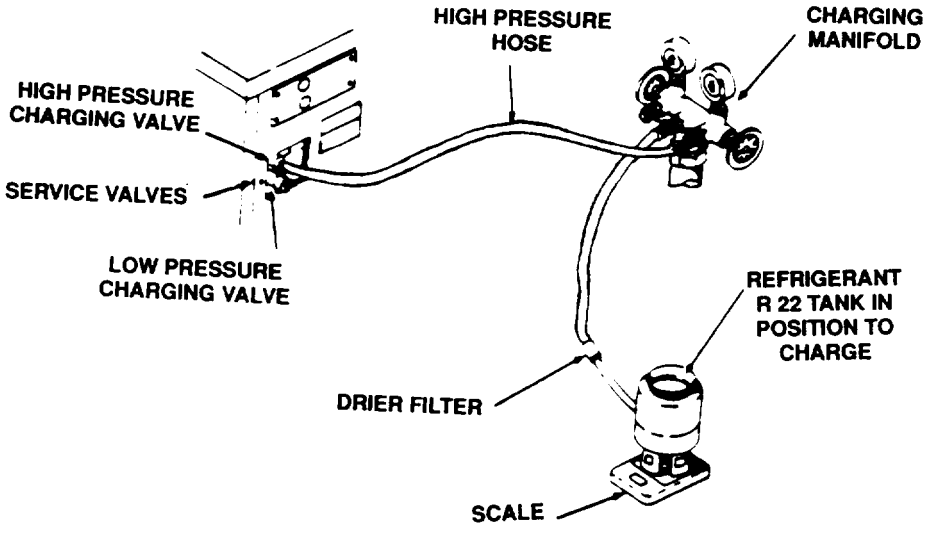


Figure 5-8. Liquid Refrigerant Charging Setup.

1. Remove two screws and access cover from air conditioner.
2. Using only R22 refrigerant, set refrigerant tank on scale with the valve down.
3. Record the weight by marking the dial on the scale with a grease pencil.
4. Subtract 3.0 pounds (1.35 kg) from reading and mark on dial with grease pencil.
5. Cap or plug the center hose on the charging manifold.
6. Install a filter/drier in the low pressure service hose.

WARNING

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. In case of refrigerant leaks, ventilate area immediately.

7. Connect the low pressure service hose to the refrigerant tank.
8. Remove valve cap from high pressure service valve.
9. Loosely connect the high pressure service hose to the high pressure service valve.

b. CHARGING PROCEDURE.

1. Open low pressure manifold valve and refrigerant tank valve.
2. Open high pressure charging manifold valve slightly to purge service hose, then close.
3. Tighten service hose connection at high pressure service valve.
4. Open high pressure service valve.

5. Open high pressure charging manifold valve.

6. Observe scale. Continue to charge system until tank weight has decreased by 3.0 pounds (1.35 kg).

7. Immediately close high pressure service valve.

8. Close high pressure charging manifold valves and refrigerant tank valve.

9. SLOWLY loosen high pressure service hose to release hose pressure.

10. Close low pressure manifold valve.

11. Disconnect service hose from air conditioner and replace valve cap.

12. Position mode selector switch to COOL and temperature selector switch to maximum INCREASE.

13. Operate air conditioner for 15 minutes.

14. Check sight glass for bubbles. If bubbles are present, the system is undercharged. Add refrigerant gas. Refer to Paragraph 5-8.

15. Reinstall access cover and secure with two screws.

5-10. MOTOR, EVAPORATOR--CONDENSER--REPAIR

a. REMOVAL. See Figure 5-9.

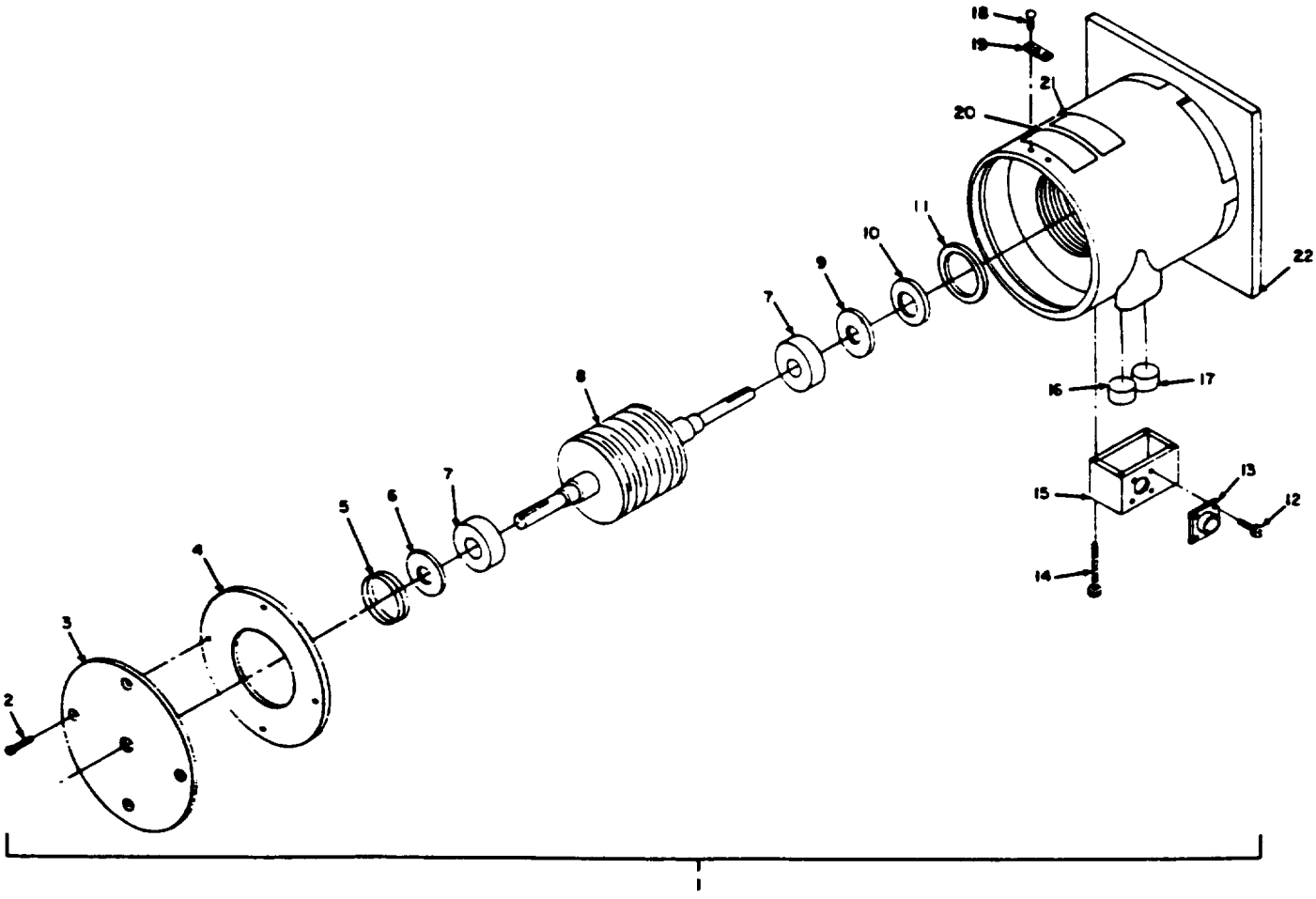


Figure 5-9. Evaporator Fan Motor.

WARNING

High voltage can kill.

1. Disconnect power supply.

2. Remove motor from casing. Refer to Paragraph 4-24.

b. DISASSEMBLY.

1. Remove four screws (2) horn front bracket (3).

2. Using a rubber mallet gently tap motor shaft through frame and stator assembly (22) and remove shaft assembly (8) and front bracket (3).

3. Carefully pull rotor and shaft assembly (8) out of frame and stator assembly (22). Inspect frame and stator assembly for damage.

4. Using a bearing puller, remove bearings (7) from motor shaft. Bearings should be inspected for wear, flat spots, and heat discoloration. Inspect motor shaft for gouges or worn bearing surfaces.

5. Disconnect power supply from unit.

6. Spin impeller fan. Motor should turn freely without roughness.

7. Using a multimeter, check connector pins A to B, C, D, E, B to C, D, E, C to D, E, D to E for continuity. If continuity is not indicated, motor is defective. If impeller fans do not turn freely, bearings may be defective. Refer to Paragraph 4-25 and Paragraph 5-10.

c. REPAIR.

1. Repair damaged bearings by replacement.

2. Repair damaged rotor and shaft by replacement.

3. Repair damaged rotor core windings by replacing the entire motor or having the motor rewound. Refer to Table 5-8 for motor burnout test.

Table 5-8 MOTOR BURN-OUT TEST

STEP NO.	PROCEDURE
1	Motor must be fully assembled to perform test.
2	Use a megger set on the 500 V range.
3	Place one probe on the motor case and the other probe on pins A, B, C, D, or E.
4	If less than 12 megohms is indicated, the motor should be replaced or windings replaced.

d. ASSEMBLY.

1. Carefullly press bearings (7) onto rotor and shaft assembly (8) using an arbor press.

2. Insert rotor and shaft assembly (8) into frame and stator assembly (22). Assure that the long end of the shaft is inserted.

3. Install front bracket (3) over motor shaft and align with holes in frame and stator assembly (22).

4. Secure front bracket (3) with four screws (2).

e. INSTALLATION

1. Replace motor in unit. Refer to Paragraph 4-24.

2. Connect power supply.

5-11. COMPRESSOR

a. SAFETY PRECAUTIONS.

1. Compressor motor burnout produces acid which can cause severe burns on skin contact.

2. Wear rubber gloves to avoid acid burns when handling sludge from a burned out compressor.

3. When discharging gas or liquid refrigerant avoid eye or skin contact with the product. Sudden and irreversible skin damage can result from freezing.

4. If the entire refrigerant charge is to be removed, it should be discharged outside enclosed areas.

5. Do not discharge reftigerant near an open flame. Highly toxic and corrosive gas may result.

6. Wear thermal protective gloves and a face protector or safety glasses when skin or eye contact with refrigerant is possible.

b. DIAGNOSING COMPRESSOR MOTOR BURNOUT.

1. Motor burnout indicates other problems contributed to the failure. These problems must be corrected or avoided to prevent a repetition of the burnout.

2. A compressor motor that fails to to start may be due to improper voltage, a malfunction of the compressor start relay, or a compressor mechanical fault.

3. To check for motor burnout, refer to subparagraph e. “Testing”.

WARNING

Wear rubber gloves to prevent acid burns when handling sludge from a burned out compressor.

4. After removal of compressor from the unit, burnout can be confirmed by tipping the compressor toward the discharge port and drawing a small quantity of oil into a clear glass container. If the oil is black, contains sludge, and has a sharp acid odor, the motor is burned out.

c. BURNOUT CLEANUP PROCEDURES. See Figure 5-10.

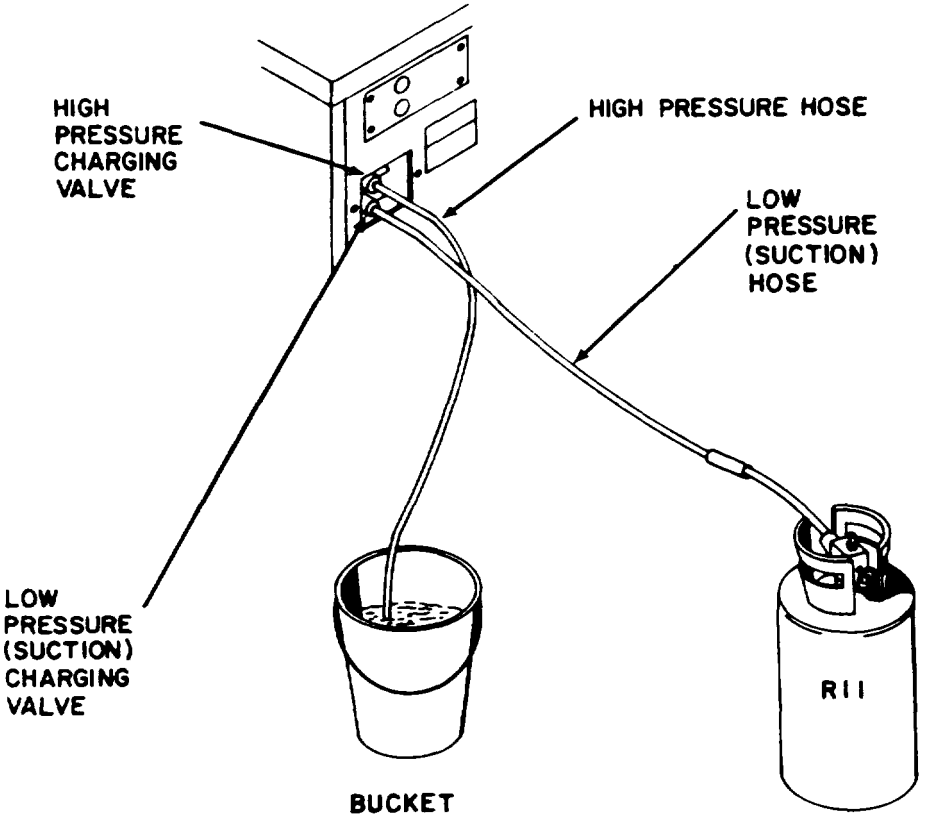


Figure 5-10. Burnout Purging Setup.

WARNING

Use grat care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or saftey glasses in any situation where skin or eye contact is possible.

WARNING

Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. In case of refrigerant leaks, ventilate area immediately.

WARNING

Wear rubber gloves to prevent acid burns when handling sludge from a burned out compressor.

NOTE

When a hermetically sealed motor burns out, the stator winding decomposes forming carbon, water and acid which contaminate the refrigerant system. These contaminants must be thoroughly removed from the system to prevent repeated motor failures. Motor burnout may also cause damage to the air conditioner electrical system. The following cleanup procedures must be followed in case of compressor motor burnout.

NOTE

Simple failure without motor burnout does not require extensive cleaning of the entire refrigerant system.

1. Release refrigerant from the system. Refer to Paragraph 5-5.
2. Remove burned out compressor. Refer to subparagraph g.
3. Connect hose from high pressure service valve to a bucket to collect contaminants. Connect a hose from a cylinder of R11 directly to the low pressure (suction) service valve. See Figure 5-10.
4. Fabricate jumper tubing to connect discharge and suction lines that were previously disconnected when compressor was removed from the unit.
5. Remove dehydrator. Refer to paragraph 5-22.
6. Fabricate jumper line to replace dehydrator.
7. Slowly open the high pressure service valve.
8. Open the low pressure (suction) service valve.

9. Slowly open the refrigerant cylinder (Rll) valve and allow to flow through the system until the discharge becomes clear.

10. Close the refrigerant cylinder valve, low pressure service valve, and the high pressure service valve.

11. Remove fabricated jumper line for dehydrator.

12. Install replacement dehydrator. Refer to Paragraph 5-22.

13. Repeat steps 9 and 10.

14. Disconnect service hoses and remove refrigerant cylinder.

15. Remove compressor jumper lines.

16. Install new compressor. Refer to subparagraph h.

d. INSPECTION. See Figure 5-11.

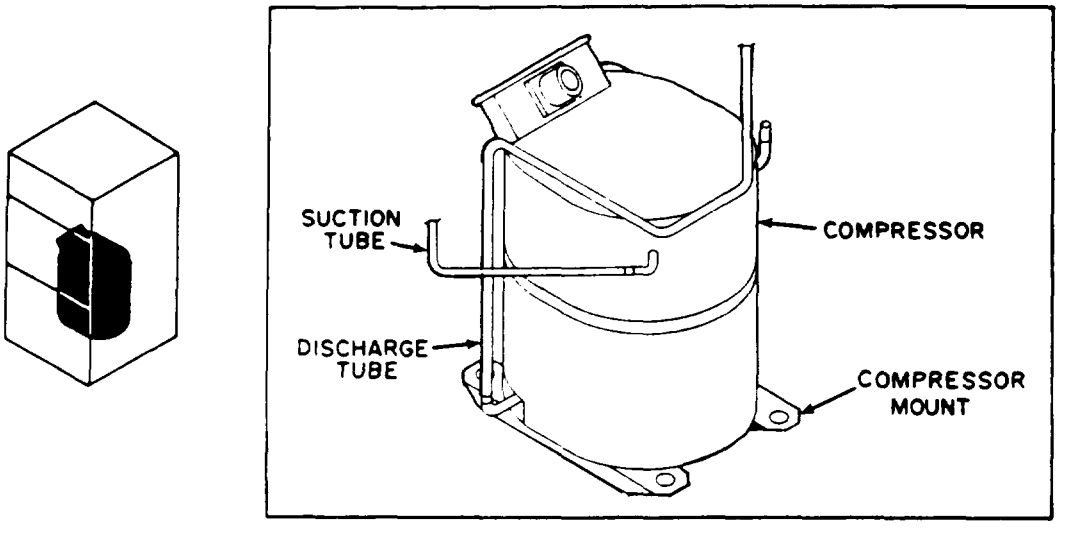


Figure 5-11. Compressor.

1. Disconnect power supply.
2. Loosen two panel fasteners and remove lower panel.
3. Loosen four captive screws and remove junction box with control panel.
4. Remove two screws and access cover.

WARNING

Make sure compressor and heater are cool before touching. Severe burns can result from touching while hot.

5. Visually inspect compressor for damage or defecta in the crankcase heater, thermostat, and terminal box.
6. Check the compressor hermetic seal (welded cover) for damage or leaks.
7. Check mounting hardware for security.
8. Check electrical connection for security.

e. TESTING.

1. To Test for Compressor Motor Burnout.

WARNING

High voltage can kill.

(a) Check for proper voltage, 115 V, 50/60 Hz.

(b) Disconnect power supply.

(c) Check for for malfunction of the compressor relay K1. Replace if defective. Refer to Paragraph 4-20.

(d) Disconnect compressor power supply at J3/P3.

(e) Check the compressor internal thermostat switch by checking the continuity between pins D and E of J3. If continuity is not indicated, switch is open. Compressor motor may be burned out.

(f) Using a multimeter, check continuity of J3 from pins A to B, B to C, A to C. If continuity is not indicated, compressor motor maybe burned out. See Figure 5-12.

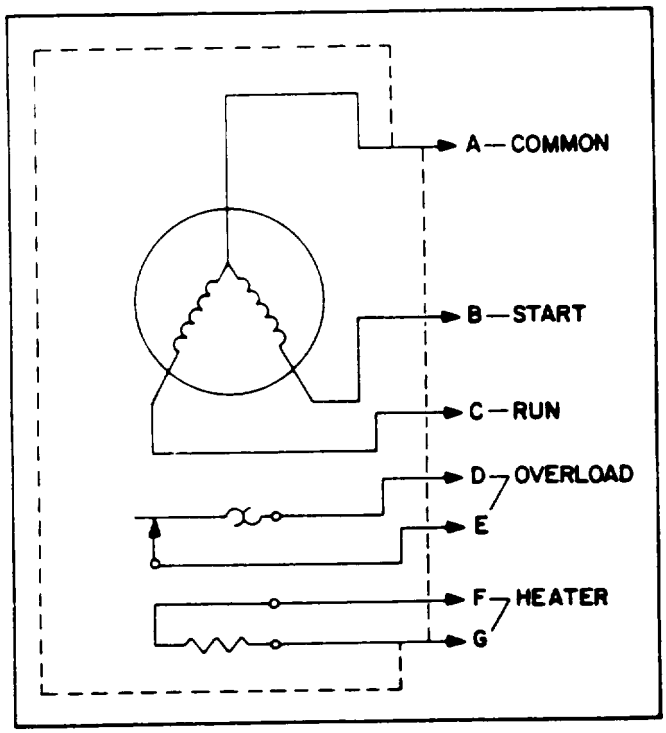


Figure 5-12. Compressor Electrical Schematic Diagram.

(g) Using a megger set on the 500 Vscale, check pins A, B, or C of J3 to compressor housing. Reading should exceed 1 megohm. If reading is less, motor is burned out.

(h) If motor is burned out, perform cleanup procedures. Refer to subparagraph c.

2. To Test Compressor Crankcase Heater Thermostat Switch.

WARNING

High voltage can kill.

(a) Disconnect power supply.

(b) Disconnect P3 from J3.

(c) Using a multimeter set on the ohm scale, check continuity of pins F to G, on J3. If continuity is not indicated, switch or crankcase heater is defective and should be replaced. Continue testing to isolate defective component. See Figure 5-12.

(d) Remove terminal box cover. Disconnect thermostats witch lead from crankcase heater lead. Check continuity between pin G and thermostat switch lead. If continuity is not indicated, stitch is defective.

NOTE

Crankcase heater thermostat is normally closed and is set to open at 120 °F (49 ºC) +/- 5 °F. Switch should close at 105 °F (41 °C) +/– 5 °F.

(e) Reconnect P3 to J3 and unit power supply. Operate the unit for 60 minutes on maximum COOLER. Disconnect Power at P3. Recheck continuity as above. If continuity is indicated, switch is defective and should be replaced.

3. To Test Crankcase Heater

WARNING

High voltage can kill.

CAUTION

All covers should be in plain and secure while unit is operating.

(a) Disconnect power supply.

(b) Disconnect P3 from J3.

(c) Remove the terminal box cover. Using a multimeter set on the ohm scale, check the continuity at the heater lead and pin F. If continuity is not indicated, heater is defective and should be replaced. See Figure 5-12.

f. REPAIR.

WARNING

Make sure compressor and heater are cool before touching. Severe burns can result from touching while hot.

Repair burned out compressor or compressor motor by replacement of entire unit.

g. REMOVAL.

WARNING

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. In case of refrigerant leaks, ventilate area immediately.

1. Release refrigerant. Refer to Paragraph 5-5.
2. Cut tie straps securing harness assembly.
3. Disconnect and remove harness at P3.
4. Nitrogen purge. Refer to Paragraph 5-6.
5. Debraze suction port tubing.
6. Debraze discharge port tubing.

WARNING

Make sure compressor and crankcase heater are cool before attempting removal. Severe burns could result.

7. Remove 4 nuts (2),4 socket head shoulder screws (l), 12 flat washers (3 and 6),4 spacers (5), and 8 resilient washers (4). Remove screws (1) through bottom of air conditioner casing. Save for reinstallation. See Figure 5-13.

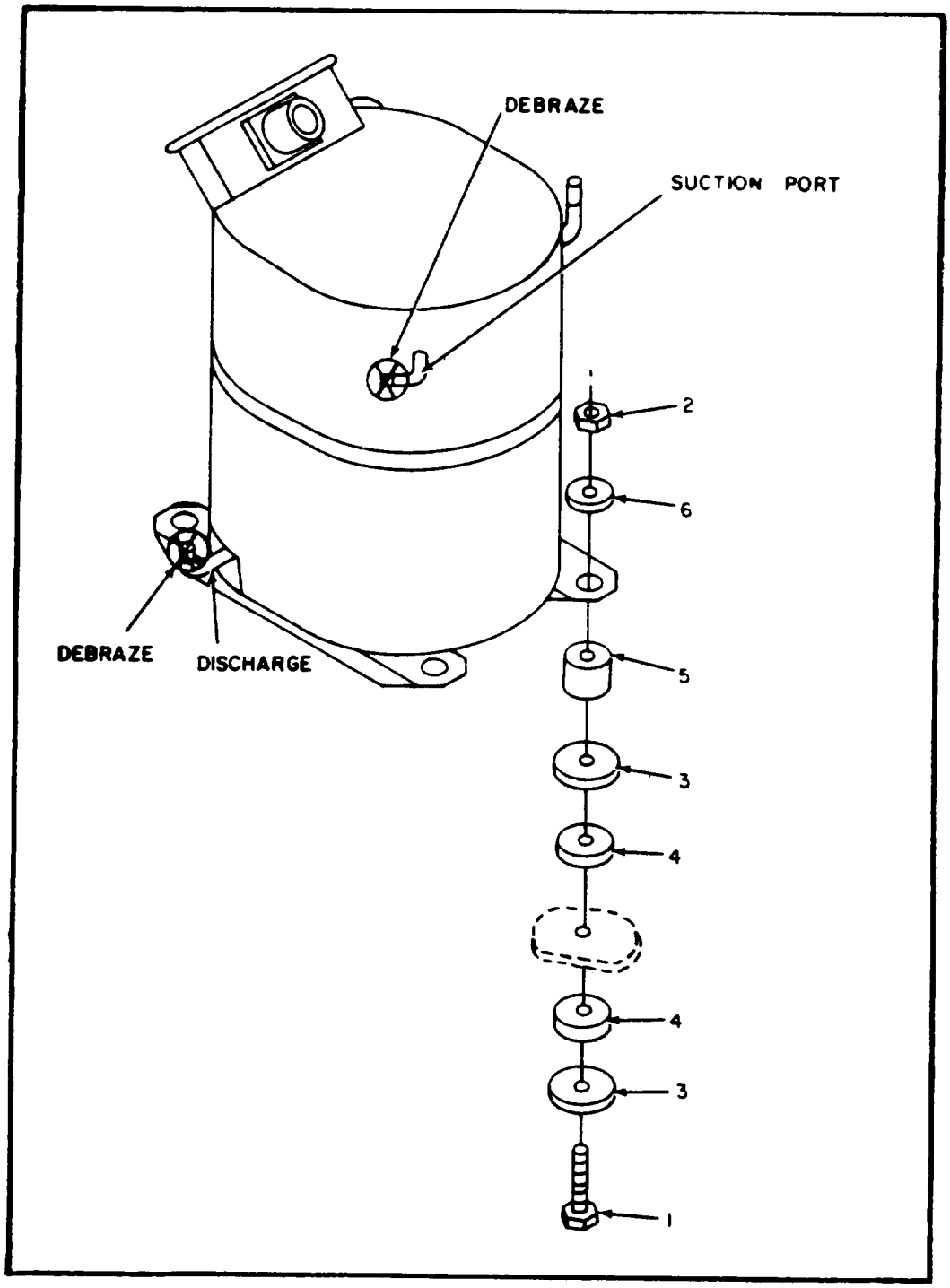


Figure 5-13. Recommended Debraze/Brazing Locations and Compressor Removal/Instllation.

WARNING

If compressor is being removed due to burnout, use care when lifting compressor to avoid touching compressor sludge. Acid in the sludge can cause burns. Rubber gloves should be worn.

8. Carefully lift compressor from air conditioner.

h. REPLACEMENT.

CAUTION

If compressor is being replaced due to motor burnout, decontaminate the refrigerant system. Failure to do so will result in failure of the new compressor.

NOTE

Prior to installing compressor, inspect resilient mounts for deterioration. Replace if deteriorated. Inspect mounting hardware and replace if damaged.

1. Place compressor on resilient washers (4), flat washers (3), and spacers (5) while aligning with mounting holes.

2. Insert four socket head shoulder screws (l), flat washers (3), and resilient washers (4) through bottom of unit casing.

3. Install flat washers (6) and nuts (2). Tighten securely.

CAUTION

Compressor tube connections are factory sealed to prevent moisture or dirt contamnation of compressor. Do not remove plugs until compressor is to be connected to refrigerant tubing.

4. Nitrogen purge. Refer to Paragraph 5-6

5. Braze discharge port tubing in place. See Figure 5-13.

6. Braze suction port tubing in place. See Figure 5-13.

7. Install harness connector P3.

8. Secure harness assembly in place with tie straps.

9. Replace dehydrator. Refer to Paragraph 5-11.

10. Perform leak test. Refer to paragraph 5-3.
11. Evacuate system. Refer to paragraph 5-7.
12. Charge system with refrigerant. Refer to Paragraph 5-8.
13. Install junction box and control panel and tighten four captive screws.
14. Install lower panel and tighten panel fasteners.
15. Install access cover and secure with two screws.

5-12. EVAPORATOR COIL

a. REMOVAL. See Figure 5-14.

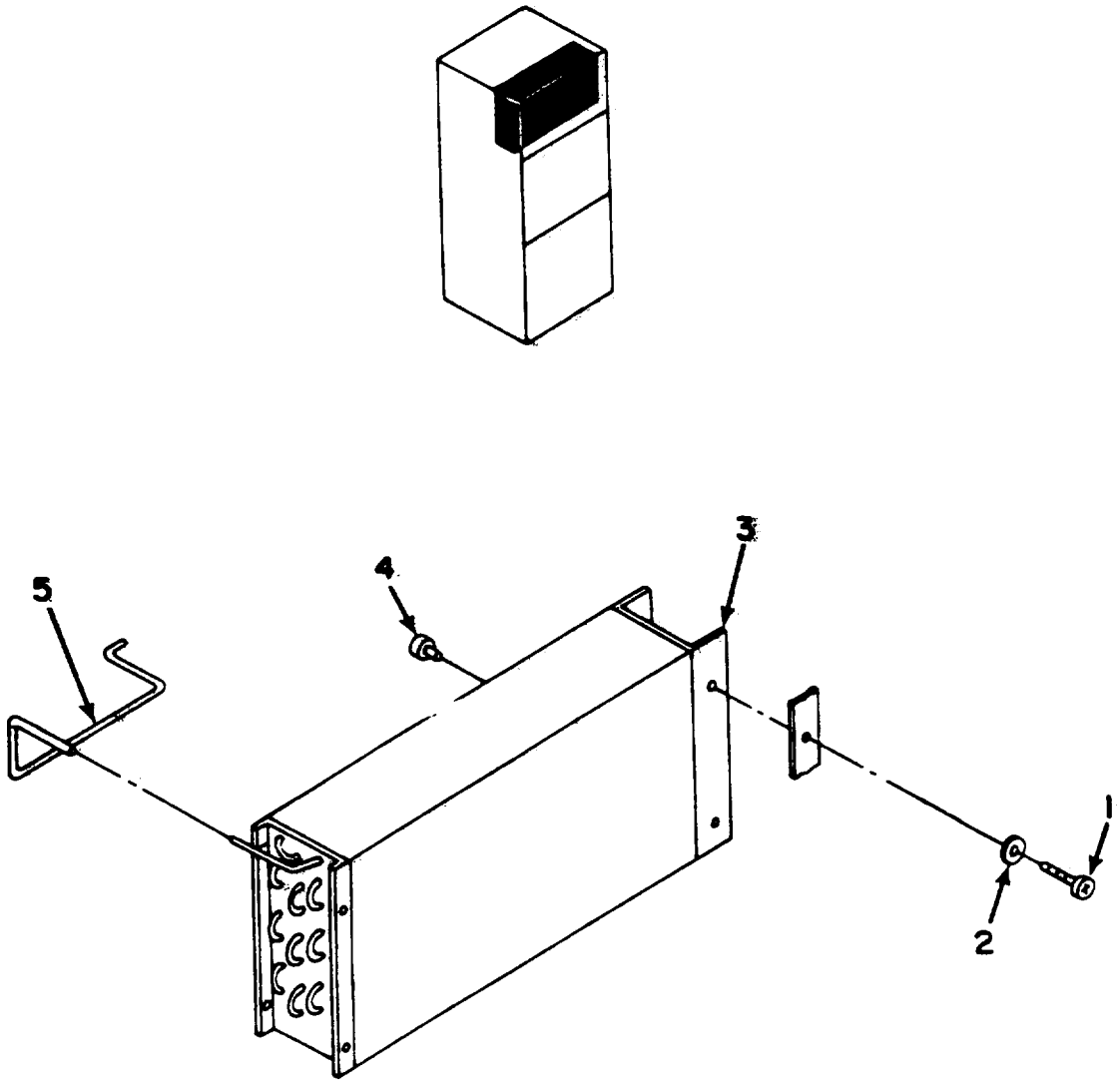


Figure 5-14. Evaporator Coil.

WARNING

High voltage can kill.

1. Disconnect power supply.

WARNING

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. In case of refrigerant leaks, ventilate area immediately.

2. Release refrigerant Refer to Paragraph 5-5.

3. Remove 11 screws and rain seal washers and top panel.

4. Remove four screws, Iockwashers, and flat washers and discharge grille.

5. Remove mist eliminator .

6. Nitrogen purge. Refer to Paragraph 5-6.

7. Debraze tubing at the most convenient points to remove the evaporator coil (3). Refer to Paragraph 5-2.

8. Remove four screws (1) and flat washers (2).

9. Lift evaporator coil (3) and attached tubing from casing.

10. Debraze remaining tubing from evaporator coil (3).

b. TEST.

1. Test coil for blockage or restrictions by applying 10 to 30 psig of dry air to coil.

2. Make sure air flows through coil.

c. REPAIR.

1. Repair leaks.
2. Straighten bent fins
3. Repair or replace damaged tubing.
4. Replace coil, if repair is impractical.

d. INSTALLATION.

1. Nitrogen purge. Refer to Paragraph 5-6.
2. Braze tubing previously removed with evaporator coil. Refer to Paragraph 5-2.
3. Place evaporator coil in casing.
4. Connect tubing to evaporator coil by brazing. Refer to Paragraph 5-2.
5. Align evaporator coil with holes in casing.
6. Install mist eliminator.
7. Replace dehydrator. Refer to Paragraph 5-22.
8. Leak test the refrigeration system. Refer to Paragraph 5-3.
9. Evacuate the system. Refer to Paragraph 5-7.
10. Charge the system with refrigerant. Refer to Paragraph 5-8.
11. Install discharge grille and secure with four screws, lockwashers, and flat washers.
12. Install top panel and secure with eleven screws and rain seal washers.

5-13. CONDENSER COIL

a. TESTING.

WARNING

High voltage can kill.

1. Disconnect power supply.
2. Remove 16 screws and rain seal washers, and canvas cover.

3. Remove six screws (1) and flat washers (2) and condenser guard (3).

4. Loosen two panel fasteners and remove lower panel.

5. Loosen four captive screws and remove junction box with control panel.

6. Perform leak test. Refer to Paragraph 5-3. Repair if leaks are detected.

b. REMOVAL. See Figure 5-15

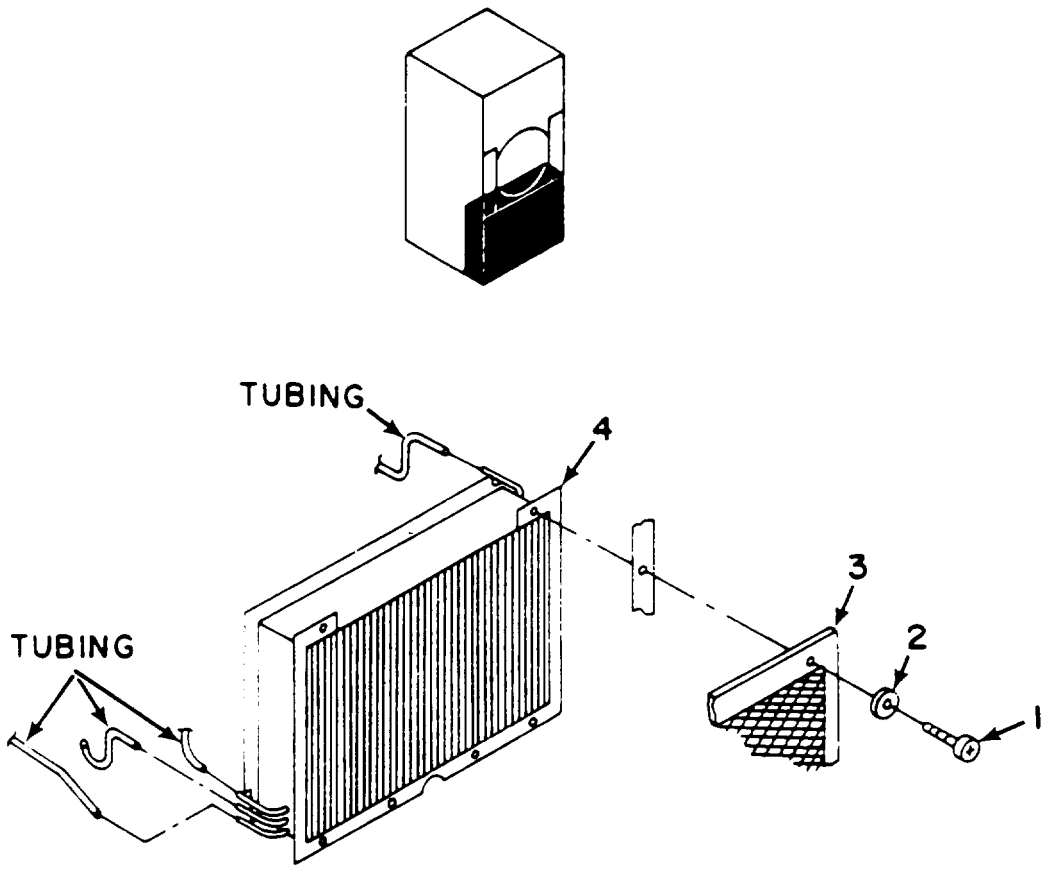


Figure 5-15. Condenser Coil.

WARNING

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. In case of refrigerant leaks, ventilate area immediately.

1. Release refrigerant. Refer to Paragraph 5-5.
2. Remove compressor.
3. Nitrogen purge. Refer to Paragraph 5-6.
4. Debraze tubing from condenser coil (4). Refer to Paragraph 5-2.
5. Carefully remove the condenser coil (4) from the casing.

c. REPAIR.

1. Repair leaks.
2. Straighten cooling fins.
3. Repair or replace damaged floating nuts.
4. Replace condenser coil if repair is impractical.

d. INSTALLATION.

1. Carefully place condenser coil (4) into casing.
2. Nitrogen purge. Refer to Paragraph 5-6.
3. Braze refrigeration tube connections to condenser coil.
4. Install compressor.
5. Align condenser coil (4) with holes in casing.
6. Attach condenser guard (3) with six screws (1) and flat washers (2).

7. Replace dehydrator. Refer to Paragraph 5-22.

8. Perform leak test. Refer to Paragraph 5-3.

9. Evacuate system. Refer to Paragraph 5-7.

10. Charge system with refrigerant. Refer to Paragraph 5-8.

11. Install junction box with control panel and tighten four captive screws.

12. Install lower panel and tighten two panel fasteners.

13. Install canvas cover and secure with sixteen screws and rain seal washers.

5-14. EXPANSION (QUENCH) VALVE

a. INSPECTION. See Figure 5-16.

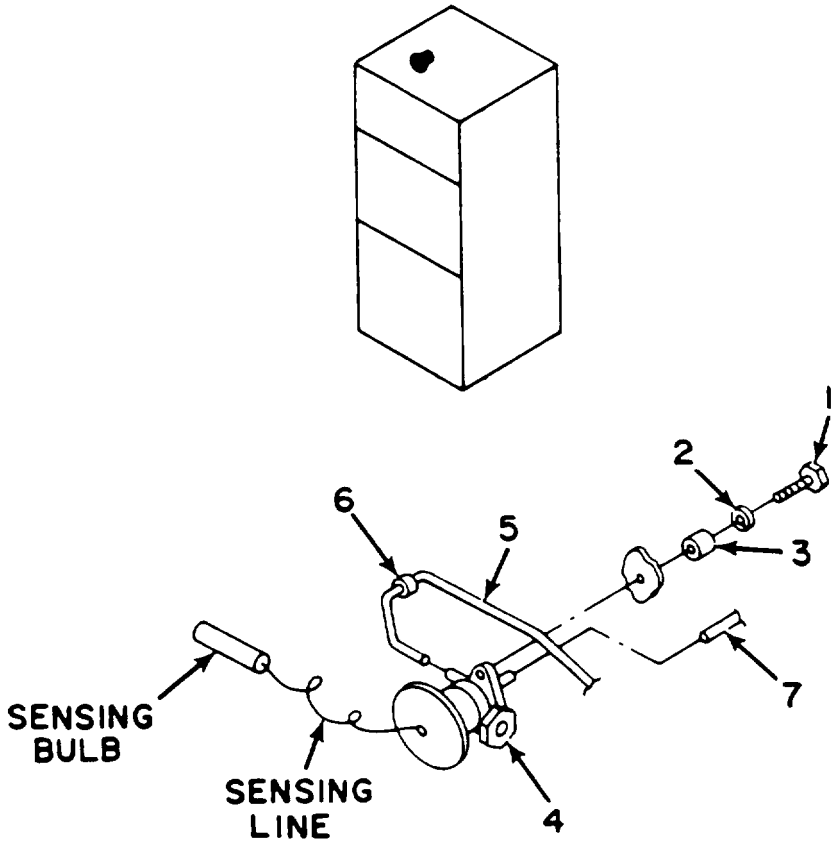


Figure 5-16. Expansion (Quench) Valve.

WARNING

High voltage can kill.

1. Discommct power supply.

2. Remove 16 screws and rain seal washers, and canvas cover.

3. Remove 11 screws and rain seal washers, and top panel.

4. Remove two screws and access cover.

WARNING

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. In case of refrigerant leaks, ventilate area immediately.

5. Visually inspect expansion valve (4) for damage. Check for evidence of leakage. Perform leak test, if leakage is suspected. Refer to Paragraph 5-3.

b. TESTING. See Figure 5-12.

1. Tape a thermometer to the tubing near the expansion valve sensing bulb.

2. Connect a charging manifold low pressure (suction) hose to the low pressure service valve. See Figure 5-12. Make sure the high pressure hose and the center hose on the charging manifold are either capped or plugged. Close the manifold valves.

3. Connect the power supply and turn the mode selector switch to COOL and temperature selector switch to maximum INCREASE.

4. Slowly open the low pressure service valve. Operate the unit for 30 minutes to allow the system and the thermometer to stabilize.

5. Observe the low pressure (suction) gauge. Record the gauge reading and add 2 psig for estimated line loss.

6. Refer to Table 5-9 and convert pressure recorded in Step 6 (including 2 psig additional for line loss) to temperature.

7. Observe and record the temperature indicated on the thermometer. Deduct the temperature calculated in Step 7 from this reading to obtain superheat. Superheat of the expansion valve should be 6 °F +/– 1/2 °F hotter than the temperature calculated in Table 5-9. The expansion valve should be replaced if superheat is not specified.

8. If the superheat is within the specified limits:

(a) Disconnect the power supply.

(b) Remove thermometer.

(c) Slowly close the low pressure service valve.

(d) Remove the low pressure hose from the service valve after first slowly releasing the hose pressure.

c. **REMOVAL.**

WARNING

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. In case of refrigerant leaks, ventilate area immediately.

5. Visually inspect expansion valve (4) for damage. Check for evidence of leakage. Perform leak test, if leakage is suspected. Refer to Paragraph 5-3.

b. TESTING. See Figure 5-12.

1. Remove mastic from sensing bulb.

2. Remove sensing bulb and line from clamped position.

3. Remove two bolts (1), spacers (3), and lockwashers (2) from valve (4).

4. Wrap solenoid and quench valve (4) with wet rags to act as a heat sink during debrazing and prevent damage to valves.

5. Nitrogen purge. Refer to Paragraph 5-6.

6. Debraze valve connections and remove valve (4). Inspect and replace if necessary.

d. INSTALLATION.

1. Wrap solenoid valves and replacement expansion valve (4) with wet rags to act as a heat sink and prevent damage to valves.

2. Nitrogen purge. Refer to Paragraph 5-6.

3. Braze replacement expansion valve (4) in place.

4. Secure expansion valve (4) in place with two bolts (1), spacers (3), and lockwashers (2).

5. Inject approximately 1 ounce of thermal mastic onto sensing bulb.

CAUTION

Use care to avoid kinking or breaking sensing line.

6. Insert sensing bulb into position by moving back and forth to distribute thermal mastic and until sensing bulb is fully seated.

7. Install replacement dehydrator. Refer to Paragraph 5-22.

8. Perform leak test. Refer to Paragraph 5-3.

9. Evacuate system. Refer to Paragraph 5-7.

10. Charge system with refrigerant. Refer to Paragraph 5-8.

11. Install top panel and secure with 11 screws and rain seal washers.

12. Install access cover and secure with two screws.

13. Install canvas cover and secure with 16 screws and rain seal washers.

5.15. EXPANSION VALVE

a. INSPECTION. See Figure 5-17.

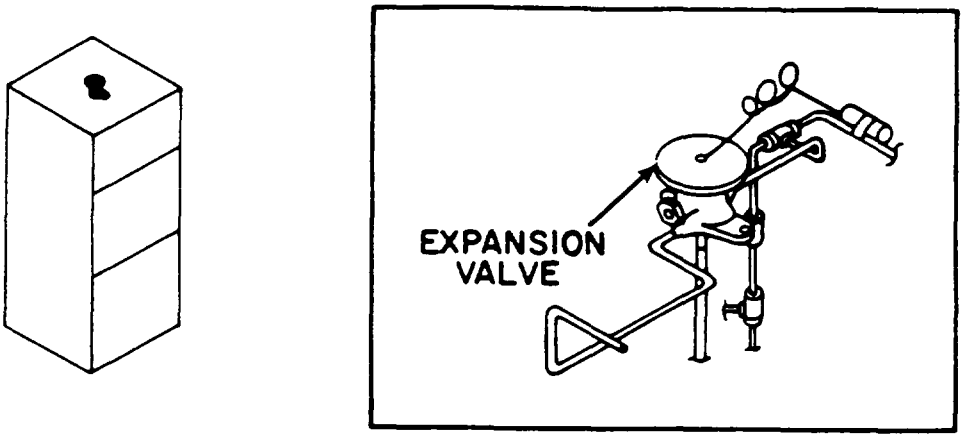


Figure 5-17. Expansion Valve.

WARNING

High voltage can kill.

1. Disconnect power supply.
2. Remove eleven screws and rain seal washers and top panel.

WARNING

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. In case of refrigerant leaks, ventilate area immediately.

3. Visually inspect expansion valvefordamage. Check for evidence of leakage. Refer to Paragraph 5-3.

b. TESTING.

1. Tape a thermometer to the tubing near the expansion valve sensing bulb.

2. Remove the access cover and two screws.

3. Connect a charging manifold, low pressure (suction) hose to the low pressure service valve. See Figure 5-18. Make sure the high pressure hose and the center hose on the charging manifold are either capped or plugged. Close the manifold valves.

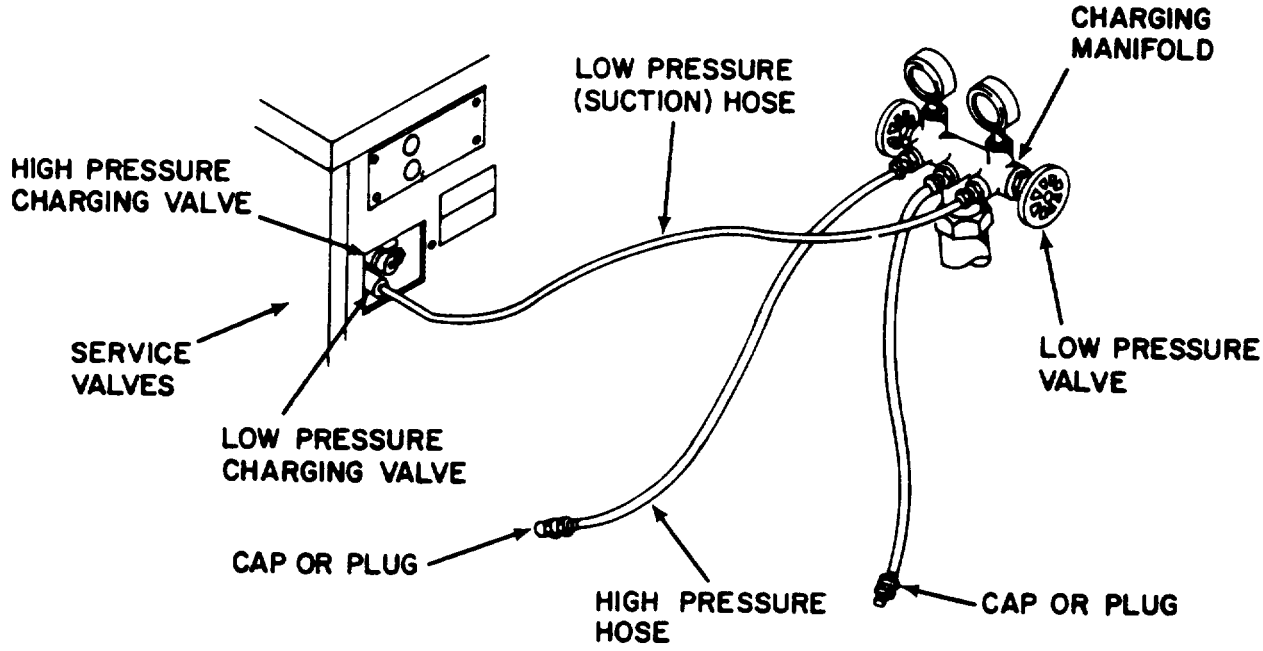


Figure 5-18. Low Pressure Test Setup.

4. Connect the power supply and turn the mode selector switch to COOL and temperature selector switch to maximum INCREASE.

5. Slowly open the low pressure service valve. Operate the unit for 30 minutes to allow the system and the thermometer to stabilize.

6. Observe the low pressure (suction) guage. Record the gauge reading and add 2 psig for estimated line loss.

7. Refer to Table 5-9 and convert pressure recorded in Step 6 (including 2 psig additional for line loss) to temperature.

Table 5-9. TEMPERATURE-PRESSURE EQUIVALENTS

Temperature °F	Temperature °C	Pressure PSIG	Pressure kg/cm^2	Temperature °F	Temperature °C	Pressure PSIG	Pressure kg/cm^2
0	–17.77	24.0	1.68	25	–3.88	48.8	3.43
1	–17.22	24.8	1.74	26	-3.33	49.9	3.50
2	–16.66	25.6	1.80	27	–2.77	51.2	3.60
3	–16.10	26.4	1.86	28	–2.22	52.4	3.68
4	–15.55	27.3	1.92	29	–1.66	53.6	3.77
5	–15.00	28.2	1.98	30	–1.11	54.9	3.86
6	–14.44	29.1	2.05	31	-0.55	56.2	3.95
7	–13.88	30.0	2.11	32	0.00	57.5	4.04
8	–13.33	30.9	2.17	33	0.55	58.8	4.13
9	–12.77	31.8	2.23	34	1.11	60.1	4.22
10	–12.22	32.8	2.31	35	1.66	61.5	4.31
11	–11.66	33.7	2.37	36	2.22	62.8	4.42
12	–11.11	34.7	2.44	37	2.77	64.2	4.51
13	–10.55	35.7	2.51	38	3.33	65.6	4.61
14	–10.00	36.7	2.58	39	3.88	67.1	4.72
15	–9.44	37.7	2.65	40	4.44	68.5	4.82
16	-8.88	38.7	2.72	41	5.00	70.0	4.92
17	-8.33	39.8	2.80	42	5.55	71.4	5.02
18	-7.77	40.8	2.67	43	6.11	73.0	5.13
19	–7.22	41.9	2.95	44	6.66	74.5	5.24
20	-6.66	43.0	3.02	45	7.22	76.0	5.34
21	-6.11	44.1	3.10	46	7.77	77.6	5.46
22	–5.55	45.3	3.19	47	8.33	79.2	5.57
23	-5.00	46.4	3.26	48	8.88	80.8	5.68
24	4.44	47.6	3.35				

8. Observe and record the temperature indicated on the thermometer. Deduct the temperature calculated in Step 7 from this reading to obtain superheat. Superheat of the expansion valve should be 6 °F +/– 1/2 °F hotter than the temperature calculated in Table 5-9. The expansion valve should not be adjusted if superheat is not specified.

9. If the superheat is within the specified limits:

   (a) Disconnect the power supply.

   (b) Remove thermometer.

   (c) Slowly close the low pressure service valve.

   (d) Remove the low pressure hose from the service valve after first slowly releasing the hose pressure.

   (e) Reinstall the access cover and secure with two screws.

c. REMOVAL.

WARNING

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. In case of refrigerant leaks, ventilate area immediately.

1. Release refrigerant. Refer to Paragraph 5-5.
2. Cut tie straps securing excess sensing line.
3. Wrap expansion valve with wet rags to act as a heat sink during debrazing.
4. Nitrogen purge. Refer to Paragraph 5-6.

WARNING

The burning of polyurethane foam is dangerous. Due to the chemical composition of a polyurethane foam, toxic fumes are released when it is burned or heated.

If it is burned or heated indoors, such as during a brazing operation in its proximity, precautions should be taken to adequately ventilate the area.

5. Debraze expansion valve from refrigeration tubing. Inspect and replace if defective. Refer to Paragraph 5-2.

d. INSTALLATION.

1. Wrap replacement expansion valve with wet rags to act as a heat sink.

2. Nitrogen purge. Refer to Paragraph 5-6.

WARNING

The burning of polyurethane foam is dangerous. Due to the chemical composition of a polyurethane foam, toxic fumes are released when it is burned or heated.

3. Braze replacement expansion valve in place. Refer to Paragraph 5-2.

CAUTION

Use care to avoid kinking or breaking sensing line.

4. Coil and secure excess sensing line with tie straps.

5. Replace dehydrator. Refer to Paragraph 5-22.

6. Perform leak test. Refer to Paragraph 5-3.

7. Evacuate system. Refer to Paragraph 5-7.

8. Charge system with refrigerant. Refer to Paragraph 5-8.

9. Reinstall top panel and secure with eleven screws and rain seal washers.

10. Reinstall access cover and secure with two screws.

11. Reinstall canvas cover and secure with sixteen screws and rain seal washers.

5-16. SOLENOID VALVES

a. REMOVAL. See Figure 5-19.

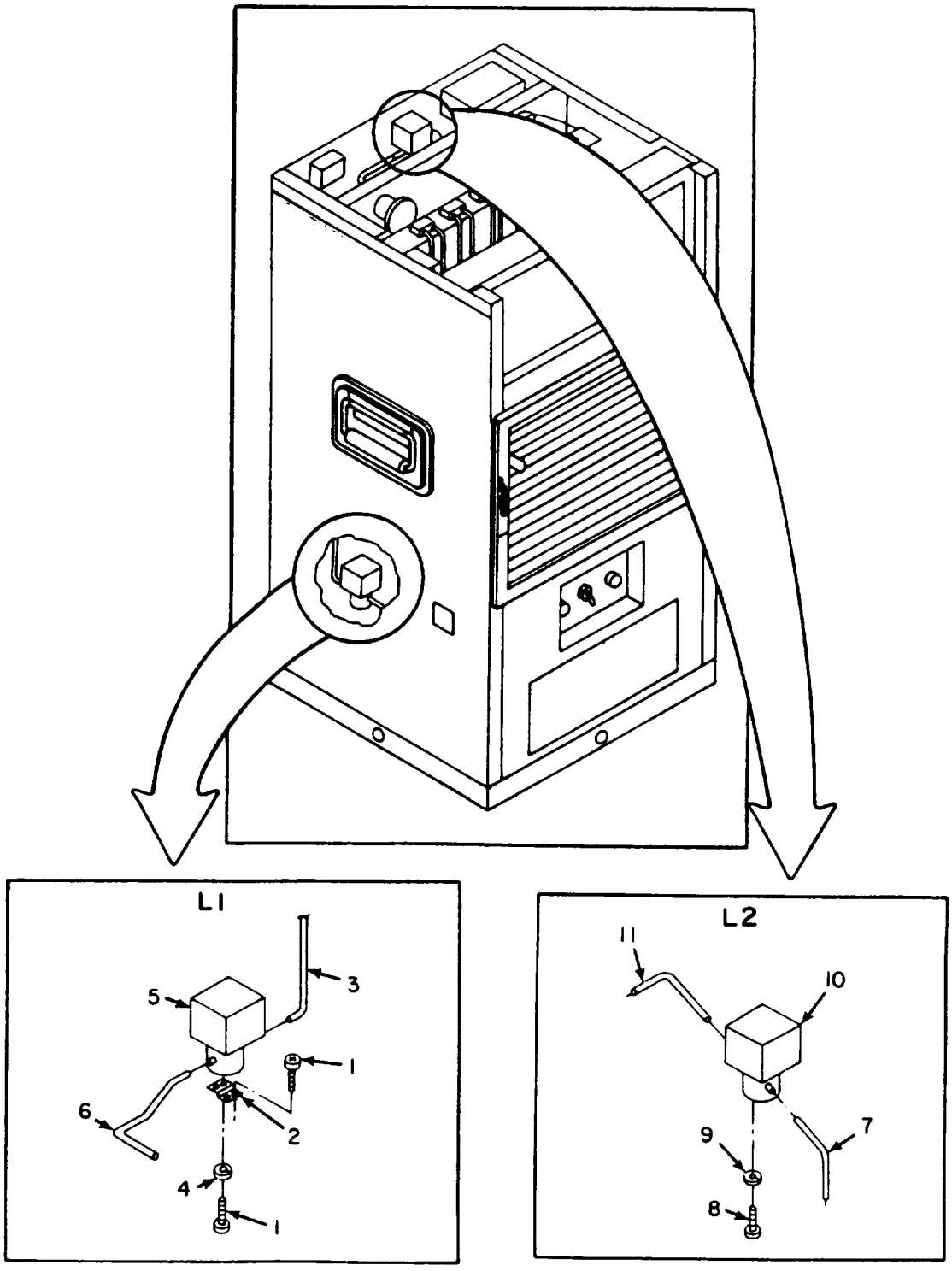


Figure 5-19. Solenoid Valves.

WARNING

High voltage can kill.

1. Disconnect power supply.
2. Remove 16 screws and rain seal washers, and canvas cover.
3. Remove 11 screws and rain seal washers and top panel.
4. Loosen two panel fasteners and remove lower panel.
5. Loosen four captive screws and remove junction box with control panel.

WARNING

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. In case of refrigerant leaks, ventilate area immediately.

6. Release refrigerant. Refer to Paragraph 5-5.
7. Remove four screws (1), two lockwashers (4) and bracket (2) from L1 (5).
8. Remove screw and clamp for pressure regulator.
9. Remove two screws (8) and lockwashers (9) for mounting bracket of L2 (10).
10. Disconnect electrical leads.
11. Wrap wet rags around solenoid valves and quench valve to act as a heat sink during debrazing.
12. Nitrogen purge. Refer to Paragraph 5-6.
13. Debraze solenoid valves from tubing.

b. INSTALLATION.

1. Secure L1 (5) with four screws (1), two lockwashers (4), and bracket (2).

2. Secure L2 (10) with two screws (8) and lockwashers (9) to mounting bracket.

3. Install mounting bracket.

4. Wrap wet rags around solenoid valves and quench valve to act as a heat sink during brazing.

5. Nitrogen purge. Refer to Paragraph 5-6.

6. Braze solenoid valves to tubing.

7. Connect electrical leads.

8. Install screw and clamp for pressure regulator.

9. Replace dehydrator. Refer to Paragraph 5-22.

10. Perform leak test. Refer to Paragraph 5-3.

11. Evacuate system. Refer to Paragraph 5-7.

12. Charge system with refrigerant. Refer to Paragraph 5-8.

13. Install junction box and control panel and tighten four captive screws.

14. Install lower panel and tighten two panel fasteners.

15. Install top panel and secure with 11 screws and rain seal washers.

16. Install access cover and secure with two screws.

17. Install canvas cover and secure with 16 screws and rain seal washers.

5-17. PRESSURE REGULATOR VALVE

a. INSPECTION. See Figure 5-20.

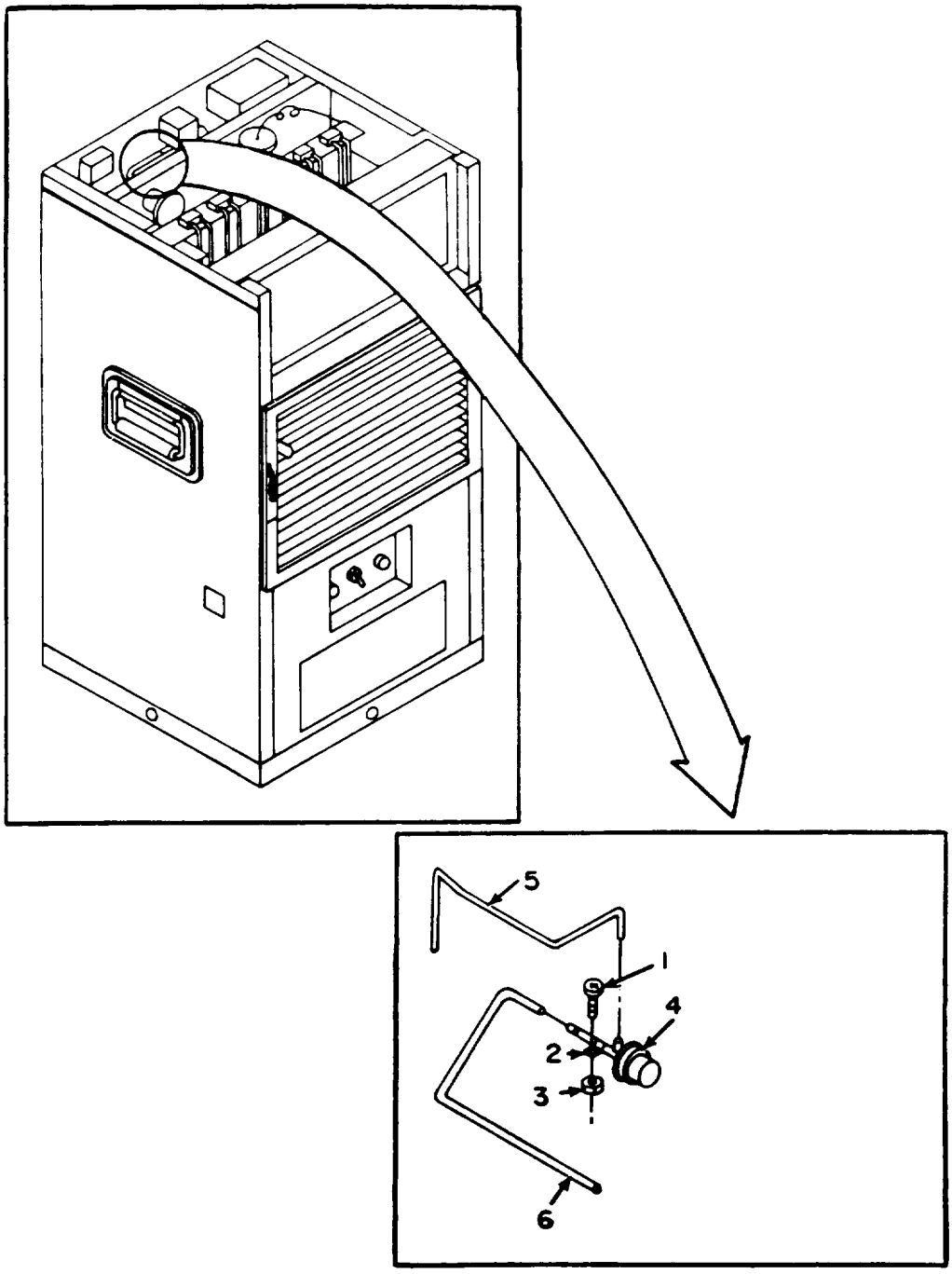


Figure 5-20. Pressure Regulator Valve and Attaching Hardware.

WARNING

High voltage can kill.

1. Disconnect power supply.
2. Remove 16 screws and rain seal washers and canvas cover.
3. Remove two screws and access cover.
4. Remove 11 screws and rain seal washers and top panel.
5. Visually inspect pressure regulator valve for damage or evidence of leakage.
6. Perform leak test if leakage is suspected. Refer to Paragraph 5-3.
7. Check for missing hardware such as screw, clamp, or nut. Refer to Figure 5-20.

b. REMOVAL.

WARNING

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. In case of refrigerant leaks, ventilate area immediately.

1. Release refrigerant. Refer to Paragraph 5-5.
2. Remove screw (1), nut (3) and clamp (2).
3. Nitrogen purge. Refer to Paragraph 5-6.
4. Wrap expansion valve with wet rags to act as a heat sink during debrazing.
5. Debraze pressure regulator valve from tubing and remove.

c. TESTING.

1. Install pressure regulator in a test fixture.

2. Attach a nitrogen bottle with regulator and hose to inlet port of regulator.

3. Connect another hose with pressure guage to outlet port.

4. Slowly apply 100 psig of nitrogen to the pressure regulator being tested.

5. Outlet port pressure gauge should not read more than 70 psig. If reading is higher, the pressure regulator is defective.

NOTE

Do not attempt to adjust pressure regulator valves. The valves are factory set and sealed.

d. INSTALLATION.

1. Nitrogen purge. Refer to Paragraph 5-6.

2. Wrap replacement valve with wet rags to act as a heat sink during brazing.

3. Braze pressure regulator valve (4) to tubing.

4. Secure pressure regulator valve (4) and tubing in place with clamp (2), screw (1), and nut (3).

5. Replace dehydrator. Refer to Paragraph 5-22.

6. Perform leak test. Refer to Paragraph 5-3.

7. Evacuate system. Refer to Paragraph 5-7.

8. Charge system with refrigerant. Refer to Paragraph 5-8.

9. Reinstall top panel and secure with 11 screws and rain seal washers.

10. Reinstall access cover and secure with two screws.

11. Reinstall canvas cover and secure with 16 screws and rain seal washers.

5-18. PRESSURE SWITCHES, HIGH AND LOW PRESSURE CUT-OUT

a. INSPECTION. See Figure 5-21.

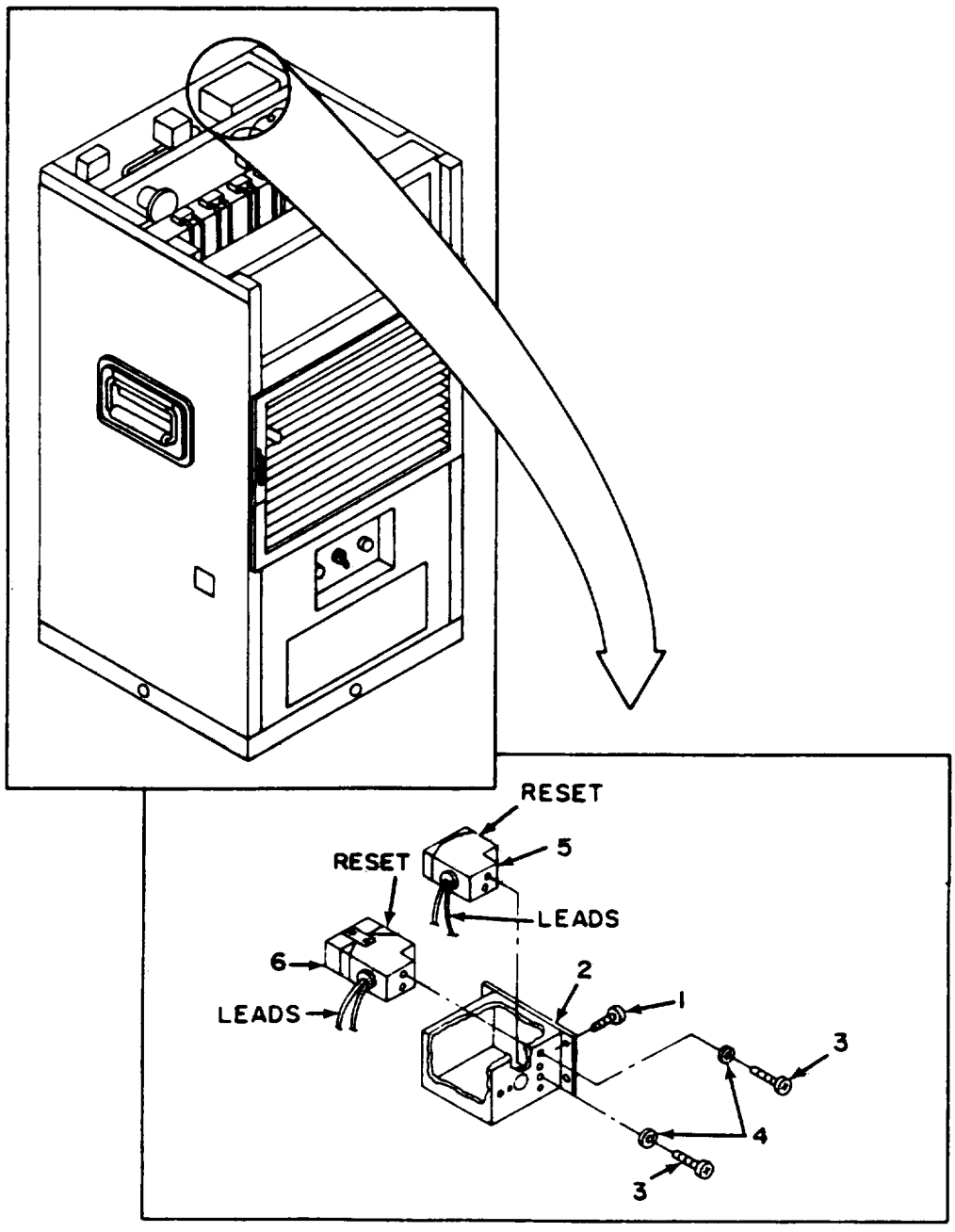


Figure 5-21. High and Low Pressure Cut-Out Switches.

WARNING

High voltage can kill.

1. Disconnect power supply.

2. Remove 16 screws and rain seal washers and canvas cover.

3. Remove 11 screws and rain seal washers and top cover.

4. Inspect for loose electrical and refirgeration connections, damage to sensing lines, evidence of electrical shorts, and deterioration of grommet.

b. Testing.

WARNING

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. In case of refrigerant leaks, ventilate area immediately.

1. Release refrigerant. Refer to Paragraph 5-5.

2. Remove four screws (1) and switch enclosure (2).

3. Remove motor.

4. High Pressure Switch Testing.

(a) Tag and disconnect electrical leads and connect a multimeter across the electrical contacts of the high pressure switch (6).

(b) Loosen the flare nut and disconnect the high pressure sensing line.

(c) Connect a nitrogen cylinder to the high pressure switch sensing line.

NOTE

The nitrogen cylinder gauge should be calibrated from 0 to 1000 psig.

(d) While observing the multimeter, slowly apply 415 psig nitrogen pressure to the high pressure switch. Continuity should be indicated on the multimeter.

(e) Slowly increase the nitrogen pressure. The switch should trip at 480 psig +/– 10 psig. The switch tripping will be indicated by a break in continuity. Replace switch if it does not operate within tolerances.

(f) Reduce the nitrogen pressure to zero and disconnect the nitrogen cylinder and multimeter from the high pressure switch.

5. Low Pressure Switch Testing.

(a) Tag and disconnect low pressure switch electrical leads. Connect a multimeter across the electrical leads.

(b) Connect a nitrogen cylinder to the low pressure switch sensing line.

(c) Slowly apply 40 psig nitrogen pressure. Push the reset button. Continuity should be indicated.

(d) Slowly decrease the nitrogen pressure. The switch should tip at 25 psig +/– 5 psig. Continuity will be broken when the switch trips. Replace switch if it does not operate within tolerances.

(e) Reduce the nitrogen pressure to zero and disconnect the nitrogen cylinder and multimeter.

c. REMOVAL

1. Remove four screws retaining instruction plate and switch enclosure (2).

NOTE

Hold enclosure when removing hardware.

2. Remove two screws (3) and lockwashers (4) securing switches (5 and 6).

3. Carefully remove the switches (5 and 6) from the enclosure (2).

4. Pull sensing line through grommet.

d. INSTALLATION.

1. Place switches (5 and 6) and sensing lines in unit. Excess sensing line should be coiled and secured with 1–inch tape.

2. Carefully feed sensing line through grommet.

3. Mount switches (5 and 6) inside enclosure (2) and secure with two screws (3) and lockwashers (4).

4. Mount enclosure (2) and instruction plate with four screws (1).

5. Connect the sensing line with flare nut to the refrigerant tubing.

6. Connect electrical leads.

7. Replace motor.

8. Replace dehydrator. Refer to Paragraph 5-22.

9. Perform leak test. Refer to Paragraph 5-3.

10. Evacuate system. Refer to Paragraph 5-7.

11. Charge system with refrigerant. Refer to Paragraph 5-8.

12. Install top panel and secure with 11 screws and rain seal washers.

13. Install canvas cover and secure with 16 screws and rain seal washers.

5-19. PRESSURE SWITCH

a. INSPECTION. See Figure 5-22.

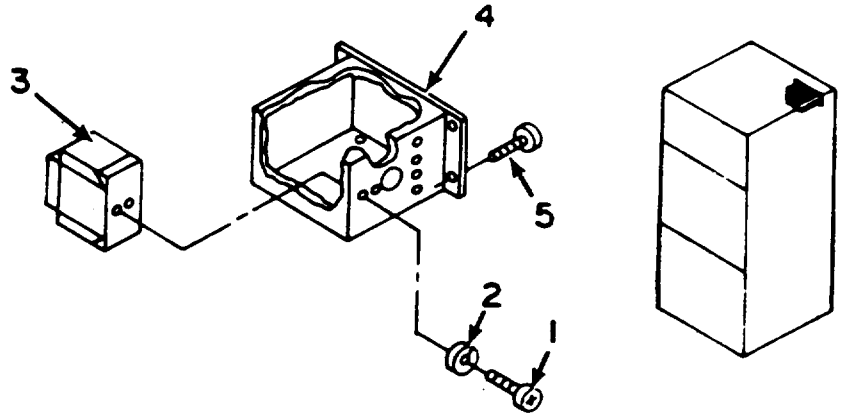


Figure 5-22. Pressure Switch.

WARNING

High voltage can kill.

1. Disconnect power supply.

2. Remove eleven screws and top panel.

3. Inspect for loose electrical and refrigeration connections and evidence of electrical shorts.

b. TESTING.

WARNING

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. In case of refrigerant leaks, ventilate area immediately.

1. Release refrigerant. Refer to Paragraph 5-5.

2. Remove four mounting screws (5) and enclosure (4).

3. Remove motor.

4. Pressure Switch Testing.

NOTE

Switch may be tested without removal from enclosure.

(a) Tag and disconnect electrical leads and connect a multimeter across the electrical contacts 2 and 3 of the pressure switch.

(b) Loosen the flare nut and disconnect the pressure switch line.

(c) Connect a nitrogen cylinder to the pressure switch line.

NOTE

The nitrogen cylinder gauge should be calibrated from 0 to 1000 psig.

(d) While observing the multimeter, slowly apply 350 psig nitrogen pressure to the pressure switch. No continuity on the multimeter should be indicated.

(e) Slowly increase the nitrogen pressure. The switch should trip at 405 psig +/– 17 psig. The switch tripping will be indicated by a break in continuity on the multimeter. Replace switch if it does not operate within tolerances.

(f) Reduce the nitrogen pressure to 350 psig while observing the multimeter. Continuity on the multimeter should be indicated.

(g) Slowly decrease the nitrogen pressure. The switch should trip at 285 psig +/– 17 psig. The switch tripping will be indicated by a break in continuity on the multimeter. Replace switch if it does not operate within tolerances.

c. REMOVAL.

1. Remove four screws retaining instruction plate and switch enclosure (4).

NOTE

Hold enclosure when removing hardware.

2. Remove two screws (1) and lockwashers (2) securing switch (3).

3. Carefully remove the switch (3) from the enclosure (4).

4. Pull sensing line through grommet.

d. INSTALLATION.

1. Place switch (3) and sensing line in unit. Excess sensing line should be coiled and secured with 1–inch tape.

2. Carefully feed sensing line through grommet.

3. Mount switch (3) inside enclosure (4) and secure with two screws (1) and lockwashers (2).

4. Mount enclosure (4) and instruction plate with four screws (5).

5. Connect the sensing line with flare nut to the refrigerant tubing.
6. Connect electrical leads.
7. Replace motor.
8. Replace dehydrator. Refer to Paragraph 5-22.
9. Perform leak test. Refer to Paragraph 5-3.
10. Evacuate system. Refer to Paragraph 5-7.
11. Charge system with refrigerant. Refer to Paragraph 5-8.
12. Install top panel and secure with 11 screws and rain seal washers.
13. Install canvas cover and secure with 16 screws and rain seal washers.

5-20. SERVICE VALVES

a. INSPECTION. See Figure 5-23.

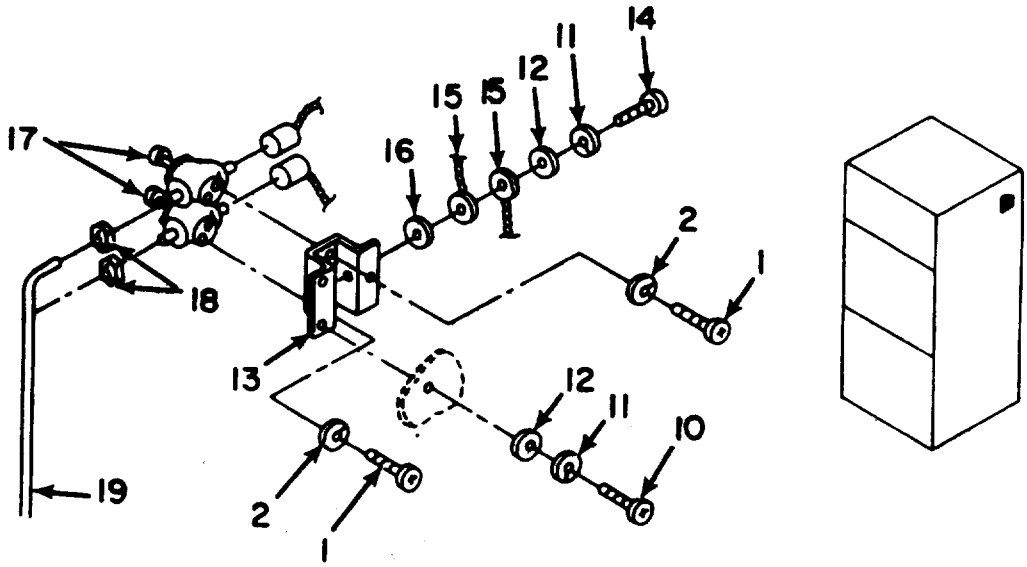


Figure 5-23. Service Valves.

WARNING

High voltage can kill.

1. Disconnect power supply

2. Remove two screws and access cover.

3. Visually inspect for damage.

4. Check for leaks. Perform leak test if leakage is suspected. Refer to Paragraph 5-3.

b. REMOVAL.

WARNING

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. In case of refrigerant leaks, ventilate area immediately.

1. Release refrigerant. Refer to Paragraph 5-5.

2. Remove screw (14), lockwasher (11), two flat washers (12 and 16), and protective caps with chain (15).

3. Remove two screws (1) and lockwashers (2) securing each valve (17).

4. Loosen flare nuts (18) and remove valves (17).

5. Remove three screws (10), lockwashers (11) and flat washers (12) and mounting bracket (13) if necessary.

6. Inspect and replace valves if damaged.

c. INSTALLATION.

1. Connect valves (17) to flare nuts (18) and tighten.

2. Secure valve (17) to bracket (13) with two screws (1) and lockwashers (2).

3. Secure bracket (13) to casing with three screws (10), lockwashers (11), and flat washers (12).

4. Install protective caps with chain (15) using screw (14), lockwasher (11), and two flat washers (12 and 16).

5. Replace dehydrator. Refer to Paragraph 5-22.

6. Perform leak test. Refer to Paragraph 5-3.

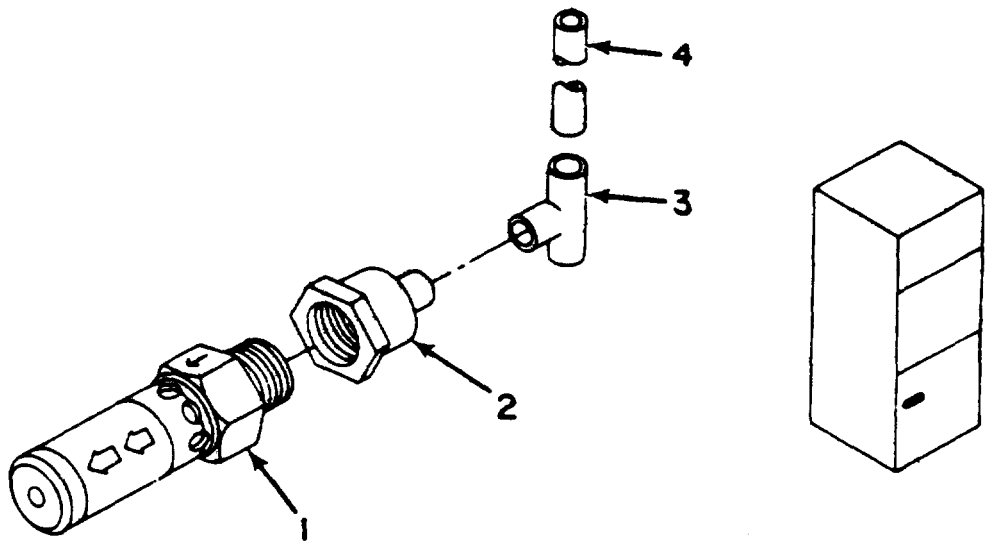
7. Evacuate system. Refer to Paragraph 5-7.

8. Charge system with refrigerant. Refer to Paragraph 5-8.

9. Install access cover and secure with two screws.

5-21. PRESSURE RELIEF VALVE

a. INSPECTION. See Figure 5-24.



5-24. Pressure Relief Valve.

W A R N I N G

High voltage can kill.

1. Disconnect power supply.
2. Loosen two panel fasteners and remove lower panel.
3. Loosen four captive screws and remove junction box with control panel.
4. Visually examine relief valve for damage.

b. TESTING.

WARNING

The following test should be performed by personnel qualified in using test equipment capable of handling pressure to 1000 psi.

WARNING

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. In case of refrigerant leaks, ventilate area immediately.

1. Release refrigerant. Refer to Paragraph 5-5.
2. Using an open end wrench remove the pressure relief valve (1) from the adapter (2).
3. Mount pressure relief valve in test fixture.
4. Using a pressure gauge calibrated from 0 to 1000 psig, connect a nitrogen cylinder to pressure relief valve.
5. Slowly apply nitrogen until gauge indicates 555 psig. Valve should be open at 555 psig +/– 10 percent (500 psig to 610 psig). There should not be leakage at pressures below 500 psig. Adjust valve if not within tolerance.

c. ADJUSTMENT.

1. Using the same setup as above and with nitrogen pressure at 555 psig, adjust the pressure relief valve to 555 psig. Use an open end wrench on the hex fitting and an adjustable wrench on the valve body.

2. Reduce nitrogen pressure to zero, disconnect cylinder, and remove pressure relief valve from test fixture.

3. If unable to adjust the pressure relief valve within tolerance, replace.

d. INSTALLATION.

1. Install replacement pressure relief valve (1) into adapter (2) and tighten.
2. Replace dehydrator. Refer to Paragraph 5-22.
3. Install two screws and access cover.
4. Perform leak test. Refer to Paragraph 5-3.
5. Evacuate system. Refer to Paragraph 5-7.
6. Charge system with refrigerant. Refer to Paragraph 5-8.
7. Install junction box and control panel and tighten four captive screws.
8. Attach lower panel and secure with two panel fasteners.
9. Replace access cover and secure with two screws.

5-22. DEHYDRATOR (F'ILTER/DRIER)

a. INSPECTION.

WARNING

High voltage can kill.

1. Disconnect power supply.
2. Loosen two panel fasteners and remove lower panel.
3. Loosen four captive screws and remove junction box with control panel.
4. Visually inspect dehydrator for damage. Check for missing or loose parts.

b. TESTING.

1. Perform leak test. Refer to Paragraph 5-3.
2. Tighten flare nuts (9) if leaks are detected around fittings.
3. Replace dehydrator if leaks are detected in body of dehydrator.

c. REMOVAL. See Figure 5-25.

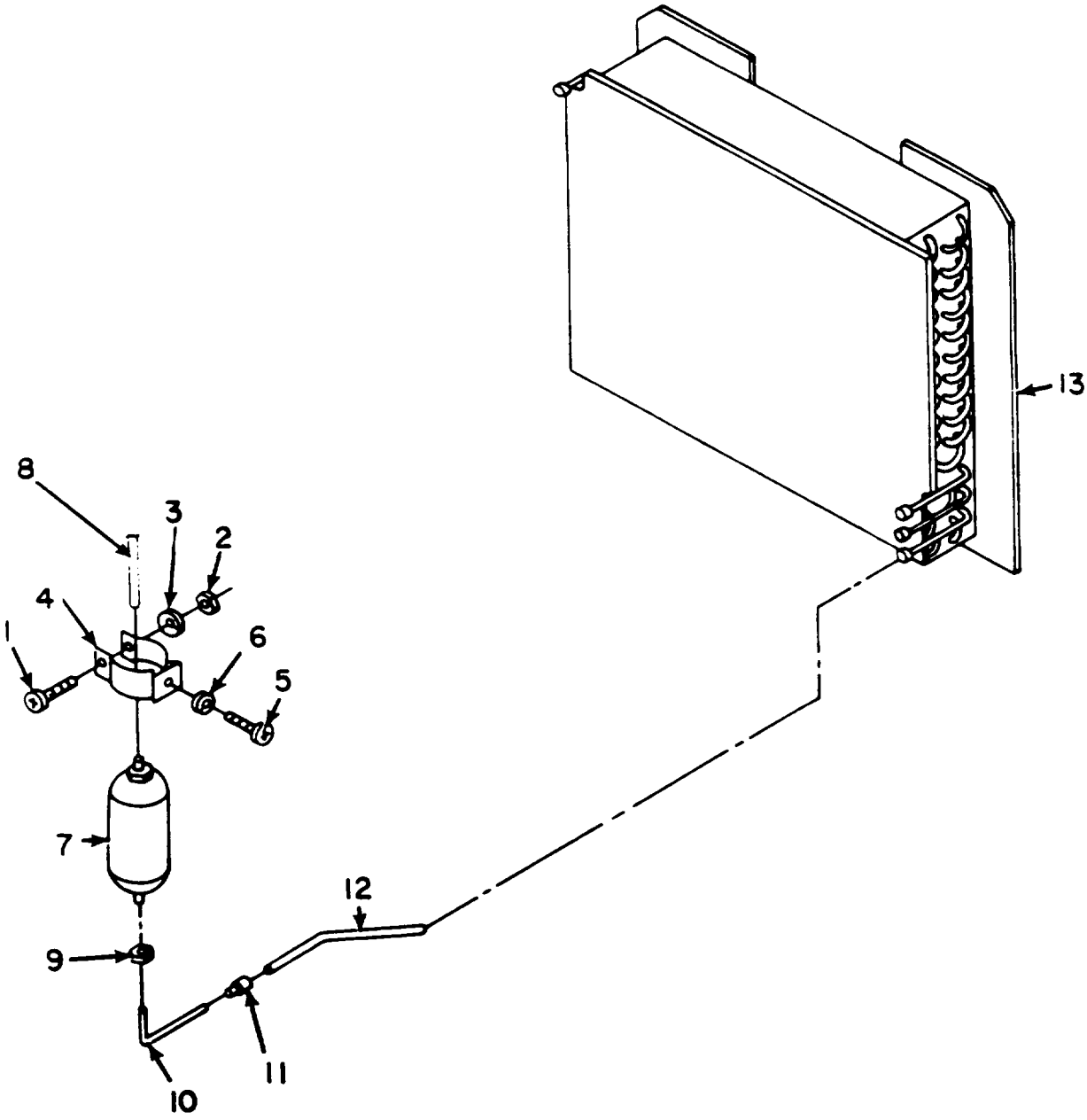


Figure 5-25. Dehydrator (Filter/Drier).

W A R N I N G

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. In case of refrigerant leaks, ventilate area immediately.

1. Release refrigerant. Refer to Paragraph 5-5.

2. Remove screw (5) and lockwasher (6) and release mounting clamp (4) from casing.

3. Loosen two flare nuts (9) and disconnect dehydrator (7) from refrigeration tubing.

4. Remove screw (1), lockwasher (3), and nut (2) to remove clamp (4) from dehydrator (7).

d. INSTALLATION.

1. Attach mounting clamp (4) to dehydrator (9) with screw (1), lockwasher (3), and nut (2), but do not tighten.

2. Connect dehydrator (7) to refrigeration tubing and tighten two flare nuts (9).

3. Secure dehydrator (7) to housing wall with clamp (4), screw (5), and lockwasher (6).

4. Tighten clamp (4) on dehydrator (7).

5. Perform leak test. Refer to Paragraph 5-3.

6. Evacuate system. Refer to Paragraph 5-7.

7. Charge system with refrigerant. Refer to Paragraph 5-8.

8. Install junction box and tighten four captive screws.

9. Install lower panel and tighten two panel fasteners.

5-23. RECEIVER

a. INSPECTION. See Figure 5-26.

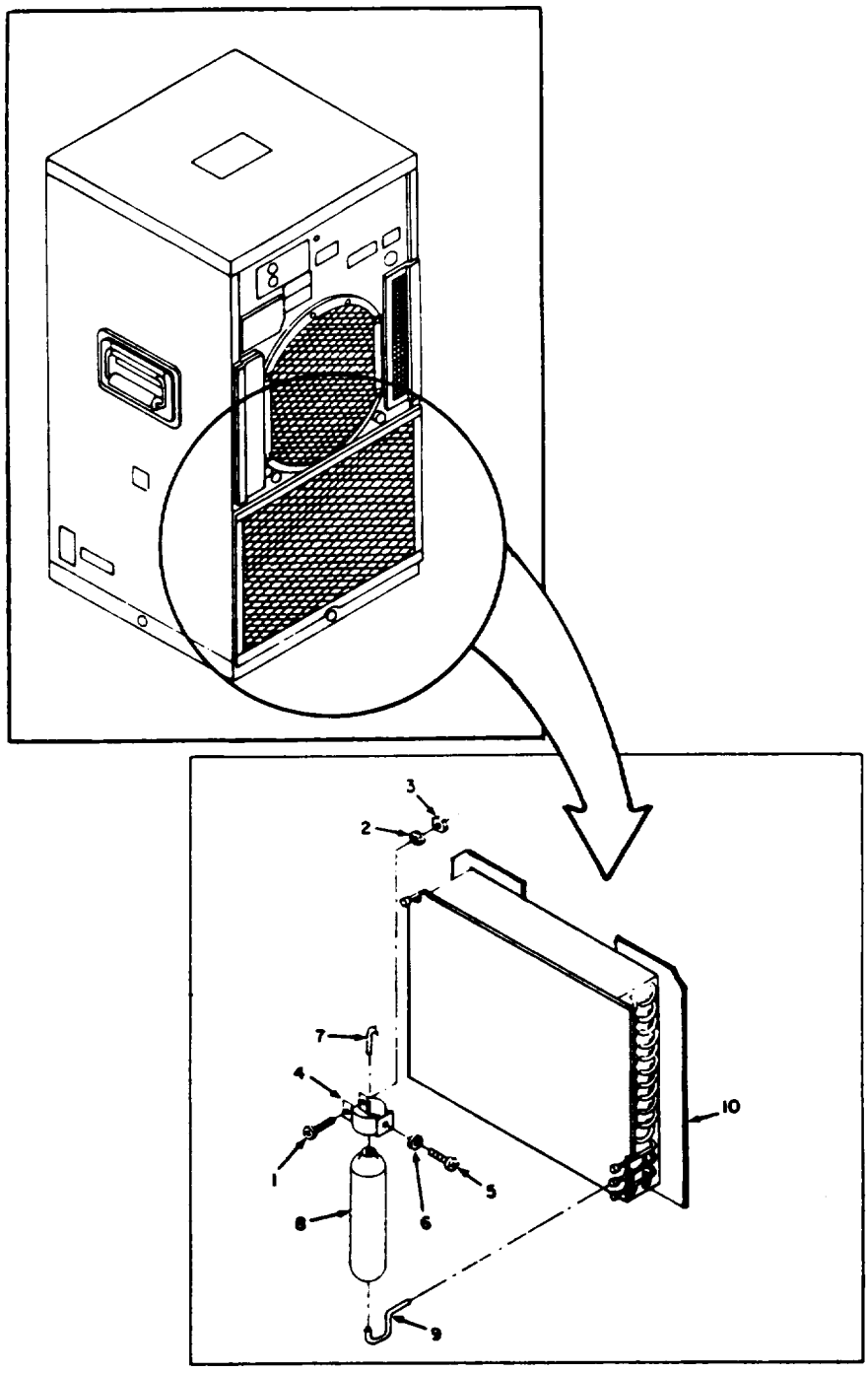


Figure- 5-26. Receiver.

WARNING

High voltage can kill.

1. Disconnect power supply.
2. Loosen two panel fasteners and remove lower panel.
3. Loosen four captive screws and remove junction box and control panel.
4. Visually check receiver (8) for damage that could cause leaking.
5. If leaks are suspected, perform leak test. Refer to Paragraph 5-3.
6. Check for loose or missing mounting hardware.

b. REMOVAL.

WARNING

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. In case of refrigerant leaks, ventilate area immediately.

1. Release refrigerant. Refer to Paragraph 5-5.
2. Remove compressor. Refer to Paragraph 5-11.
3. Nitrogen purge. Refer to Paragraph 5-6.

CAUTION

Wrap wet rags around solenoid valves and expansion valve during debrazing to act as a heat sink and prevent damage to valves.

4. Debraze refrigeration tubing connected to receiver.

5. Remove screw (5) and lockwasher (6) to release each of two bracket.

6. Remove receiver (8) and brackets (4) from casing.

7. Remove screw (1), lockwasher (2), and nut (3) to remove each bracket (4).

c. INSTALLATION.

1. Slide brackets (4) over receiver (8) and attach with screw (1), lockwasher (2), and nut (3) on each, but do not tighten.

2. Align brackets (4) with holes in casing and secure each with a screw (5) and lockwasher (6).

3. Nitrogen purge. Refer to Paragraph 5-6.

CAUTION

Wrap wet rags around solenoid valves and expansion valve during debrazing to act as a heat sink and prevent damage to valves.

4. Braze refrigeration tubing to receiver (8).

5. Tighten hardware on each bracket (4) to secure receiver (8).

6. Replace compressor. Refer to Paragraph 5-11.

7. Perform leak test. Refer to Paragraph 5-3.

8. Evacuate system. Refer to Paragraph 5-7.

9. Charge system with refrigerant. Refer to Paragraph 5-8.

10. Install junction box and control panel and secure with four captive screws.

11. Install lower panel and tighten panel fasteners.

5-24. SIGHT GLASS

a. REMOVAL See Figure 5-27.

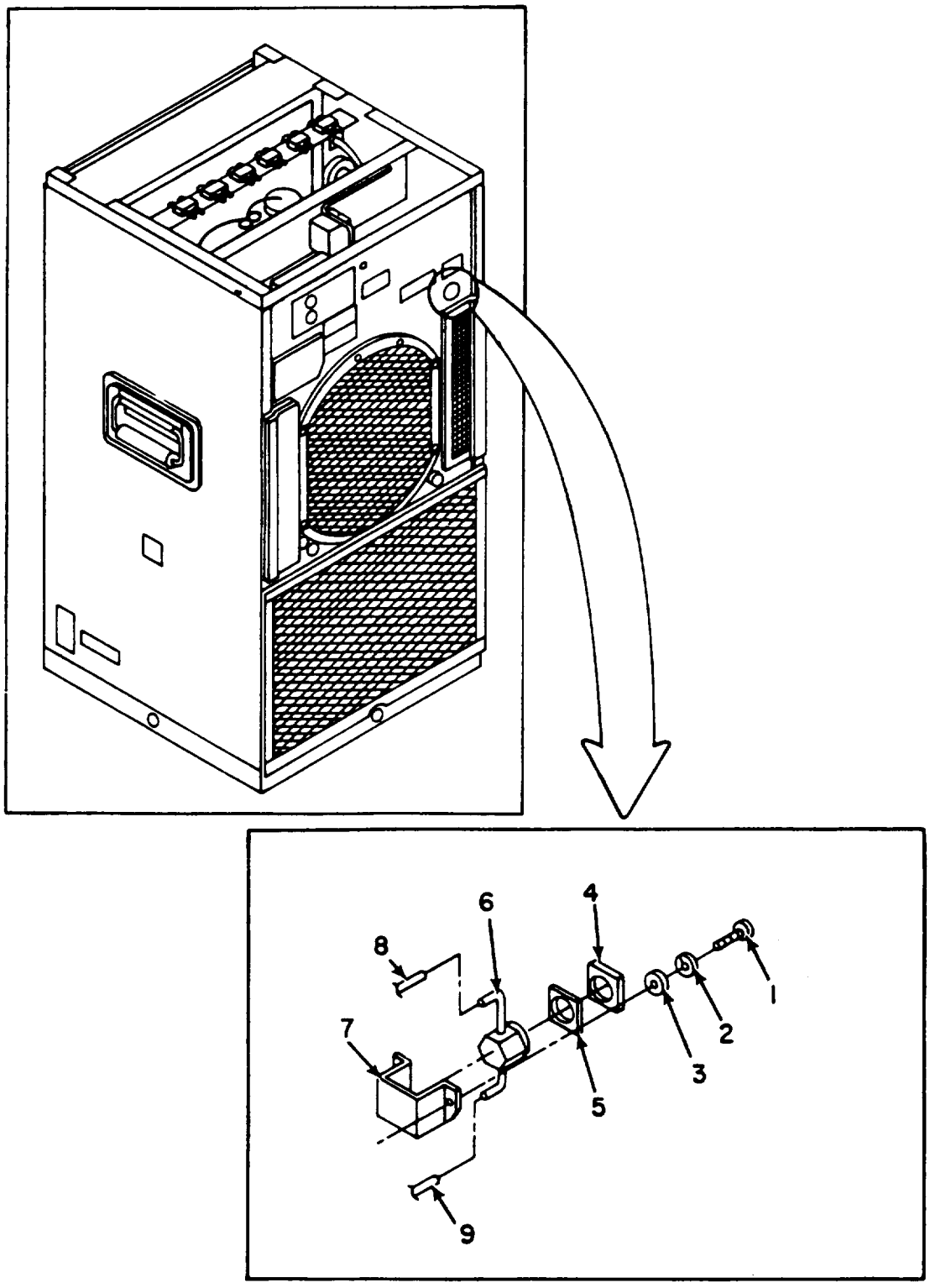


Figure 5-27. Sight Glass.

WARNING

High voltage can kill.

1. Disconnect power supply.
2. Remove 16 screws and rain seal washers, and canvas cover.
3. Remove 11 screws and rain seal washers, and top panel.
4. Remove screws for outside thermostat.
5. Remove two screws (1), lockwashers (2), and flat washers (3) for sight glass bracket.
6. Remove screws for external power connector.
7. Remove control knob.
8. Remove high and low reset panel.
9. Remove grounding stud wire.
10. Remove fan guard.
11. Remove CBR inlet cover.
12. Remove fresh air inlet screen.
13. Remove screws from K7 relay.
14. Remove back panel.

WARNING

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. In case of refrigerant leaks, ventilate area immediately.

15. Release refrigerant. Refer to Paragraph 5-5.

16. Debraze sight glass (6) from connecting tubing and remove from unit.

CAUTION

Remove and replace dehydrator. Refer to Paragraph 5-22.

b. INSTALLATION.

1. Braze sight glass (6) to tubing.
2. Nitrogen purge. Refer to Paragraph 5-6.
3. Charge system with refrigerant. Refer to Paragraph 5-8.
4. Install back panel.
5. Install K7 relay.
6. Install fresh air inlet screen.
7. Install CBR inlet cover.
8. Install fan guard.
9. Install grounding stud wire.
10. Install high and low reset panel.
11. Install control knob.
12. Install screws for external power connector.
13. Install sight glass bracket (7) with two screws (1), lockwashers (2), and flat washers (3).
14. Install screws for outside thermostat.
15. Install top panel and secure with 11 screws and rain seal washers.
16. Install canvas cover and secure with 16 screws and rain seal washers.
17. Connect power supply.

5-25. TUBES AND FITTINGS

a. INSPECTION.

WARNING

High voltage can kill.

1. Disconnect power supply.

2. Remove 16 screws and rain seal washers, and canvas cover.

3. Remove 11 screws and rain seal washers, and top panel.

4. Loosen two panel fasteners and remove lower panel.

5. Loosen four captive screws and remove junction box with control panel.

6. Inspect all refrigeration tubing, fittings, tees, and elbows for cracks, breaks, dents, kinks, nicks, and gouges. Check for dirt and corrosion. Mark and/or note location of damaged components.

7. Check for evidence of leakage. Perform leak test, if leakage is suspected. Refer to Paragraph 5-3.

b. REMOVAL.

1. Release refrigerant. Refer to Paragraph 5-5.

2. Nitrogen purge. Refer to Paragraph 5-6.

3. Debraze and remove defective tubes, fittings. etc.

c. REPLACEMENT.

1. Nitrogen purge. Refer to Paragraph 5-6.

2. Braze replacement tubing, fittings, etc. in place.

3. Replace dehydrator. Refer to Paragraph 5-22.

4. Perform leak test. Refer to Paragraph 5-3.

5. Evacuate system. Refer to Paragraph 5-7.

6. Charge system with refrigerant. Refer to Paragraph 5-8.

7. Install junction box and control panel and tighten four captive screws.

8. Install lower panel and tighten two panel fasteners.

9. Install top panel and secure with 11 screws and rain seal washers.

10. Install canvas cover and secure with 16 screws and rain seal washers.

5-26. CASING

a. INSPECTION.

WARNING

High voltage can kill.

1. Disconnect power supply.

2. Remove 16 screws and rain seal washers, and canvas cover.

3. Remove 11 screws and rain seal washers and top panel.

4. Internally and externally inspect housing for dents, cracks, breaks, dents, kinks, nicks, and gouges, deformation, loose or missing hardware, and other damage.

b. REPAIR.

NOTE

Components located in the repair area may have to be removed prior to the repair. Refer to applicable paragraphs in Chapters 4 and 5 for removal instructions.

1. Repair rivet nuts, rivets, and nut plates by replacement. Refer to Paragraph 5-2.

2. Seal all riveted joints after riveting with 13211E3465 sealant or MIL-A-46106, Type I adhesive sealant.

3. Replace loose, damaged, or missing insulation, acoustic foam, or rubber parts.

4. Remove damaged insulation or rubber foam.

WARNING

Dry cleaning solvent (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 to 138 °F (38°C to 59 °C).

5. Using abrasive cloth and P–D-680 solvent, thoroughly clean all areas to be bonded.

6. Bond acoustic foam and plastic foam with MMM-A-121 adhesive.

7. Bond rubber parts to metal with MMM–A-1617, Type II adhesive.

8. Repair handles by removing rivets and installing new handles.

NOTE

Components removed to allow repair must be reinstalled. Refer to applicable paragraph in Chapters 4 and 5.

9. Install top panel and secure with 11 screws and rain seal washers.

10. Install canvas cover and secure with 16 screws and rain seal washers.

11. Connect power supply.

CHAPTER 6

GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

Section I. TROUBLESHOOTING

Refer to Chapter 3, 4, and 5 for applicable troubleshooting instructions.

Section II. MAINTENANCE PROCEDURES

6-1. CASING.

a. REMOVAL.

WARNING

High voltage can kill.

1. Disconnect power supply,

WARNING

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. In case of refrigerant leaks, ventilate area immediately.

2. Release refrigerant and remove all components. Refer to Chapters 4 and 5,

b. Repair. Weld and replace casing members as necessary.

c. INSTALLATION.

1. Install new parts as required. Refer to Paragraph 5-26.

2. Install new insulation, gaskets, etc. Refer to Paragraph 5-26.

3. Install removed components and recharge the system with refrigerant. Refer to 5-26. Chapters 4 and 5.

4. Connect power supply.

APPENDIX A

REFERENCES

A-1. FIRE PROTECTION AND SAFETY

TB 5-4200-200-10	Hand Portable Fire Extinguisher for Army users

A–2. LUBRICATION

C91001L	Fuels, Lubricants, Oils, and Waxes

A-3. PAINTING

TM 43-0139	Painting Instructions for Field Use

A-4. MAINTENANCE

TM 9-4120–385-24P	Unit, Direct Support, and General Support Repair Parts and Special Tools List for Air Conditioner, Vertical Compact, 9,000 BTU/HR
DA PAM 738–750	The Army Maintenance Management System (TAMMS)

A–5. SHIPMENT AND STORAGE

TM 740-90-1	Administrative Storage of Equipment

A-6. DEMOLITION

TM 750-244-3	Procedures for Destruction of Equipment to Prevent Enemy Use

APPENDIX B

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-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 tools and test equipment required for each maintenance function as referenced from Section II.

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

B–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) and 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), end 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 material 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 equipment/components.

B–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, and modules with the next higher assembly.

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

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

d. Column 4. Maintenance Level. Column 4 specifies, 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. The symbol designations for the various maintenance levels are as follows:

C ..... Operator or Crew
O ..... Unit 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. Column 6. Remarks. This column shall contain a letter code in alphabetical order which shall be keyed to the remarks contained in Section IV.

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

a. Column 1. 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 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.

B-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 FOR AIR CONDITIONERS, (VERTICAL COMPACT)

(1) GROUP NO.	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
01	HOUSING COVERS, PANELS,GRILLES, AND SCREENS								
	Covers	Inspect	0.1						
		Repair		0.5					
		Replace		0.5					
	Panels	Inspect	0.1						
		Repair		0.5					
		Replace		0.5					
	Screens and Guards	Inspect	0.1						
		Repair		0.1					
		Replace		0.25					
	Grilles/ Louvers	Inspect	0.1						
		Repair		0.2					
		Replace		0.25					
	Information Plates	Inspect	0.5						
		Replace		1.0					
02	AIR CIRCULATING CONDENSATE DRAIN SYSTEM								
	Air Filter	Inspect	0.5						
		Service		0.5					
		Replace		0.5					
	Mist Eliminator	Inspect		0.5					
		Service		0.5					
		Replace		0.75					
	Fresh Air Damper	Inspect		0.5					
		Repair		0.5					
		Replace		8.0					

Section II. MAINTENANCE ALLOCATION CHART FOR AIR CONDITIONERS, (VERTICAL COMPACT)-Continued

(1) GROUP NO.	(2) COMPONENTS ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
02	AIR CIRCULATING CONDENSATE DRAIN SYSTEM–Continued								
	Condensate Drain Lines	Inspect		0.2					
		Service		0.5					
		Replace		0.5					
03	ELECTRICAL								
	Control Panel	Inspect	0.5						
		Repair		2.0					
		Replace		2.0					
	Connector External Power	Inspect		0.1					
		Replace		0.5					
	Junction Box	Inspect		0.5					
		Repair		2.0					
		Replace		2.0					
	Relays	Inspect		1.0					
		Test		1.0					
		Replace		1.5					
	Main Unit Wiring Harness	Inspect		0.5					
		Test		2.0					
		Repair		6.0					
		Replace		6.0					
04	EVAPORATOR CONDENSER FAN MOTOR AND HEATER								
	Fan	Inspect		1.5					
		Repair		1.5					
		Replace		2.0					

Section II. MAINTENANCE ALLOCATION CHART FOR AIR CONDITIONERS, (VERTICAL COMPACT)-Continued

(1) GROUP NO.	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
04	EVAPORATOR CONDENSER FAN MOTOR AND HEATER-Continued								
	Motor	Inspect		0.5					
		Test		0.5					
		Repair			1.0				
		Replace		8.0					
	Heater Thermostat Switch	Inspect		0.25					
		Test		0.75					
		Replace		0.75					
	Heater Assembly	Inspect		0.5					
		Test		1.0					
		Replace		3.5					
05	REFRIGERATION SYSTEM								
	Compressor	Test			1.5				
		Repair			20.0				
		Replace			12.0				
	Evaporator and Condenser Coils	Inspect		0.5					
		Service		1.0					
		Replace			2.0				
	Expansion Valves	Test			.75				
		Replace			5.0				
	Solenoid Valves	Inspect	0.5						
		Test			0.5				
		Replace			4.0				
	Pressure Regulator	Test			2.0				
		Replace			3.0				
	Pressure Switches	Inspect			0.5				
		Test			2.0				
		Replace			3.0				

Section II. MAINTENANCE ALLOCATION CHART FOR AIR CONDITIONERS, (VERTICAL COMPACT) - Continued

(1) GROUP NO.	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			C	O	F	H	D		
05	REFRIGERATION SYSTEM– *Continued*								
	Service Valves	Inspect Replace			0.75 2.5				
	Pressure Relief Valve	Inspect Replace			0.75 2.5				
	Dehydrator	Inspect Replace			0.5 5.0				
	Sight Glass Liquid Indicator	Inspect Replace	0.5		 5.0				
	Tubing and Fittings	Test Replace			3.0 12.0				
06	HOUSING								
	Casing	Inspect Service Repair Replace		0.5 0.5	 4.0 120				

Section III. TOOLS AND TEST EQUIPMENT REQUIREMENTS

(1) REFERENCE CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL/NATO STOCK NUMBER	(5) TOOL NUMBER
	F - H	No special tools and test equipment required.		
		Tool Kit, Service Refrigeration Unit (SF 5180-90-CL-N18)	5180-00-596-1474	
		Soldering Gun Kit	3439-00-930-1638	
		Vacuum Pump	4310-00-098-5272	
		Recovery and Recycling Unit, Refrigerant	4130-01-338-2707	17500B (07295)
		Power Supply 28 Volt DC	6130-01-143-5947	

Section IV. REMARKS

REFERENCE CODE	REMARKS
	No supplemental instructions or explanatory remarks are required for the maintenance functions listed in Section II. All functions are sufficiently defined in Section 1. Active time listed for maintenance task functions are with the air conditioner in off-equipment position.

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APPENDIX C

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

Section I. INTRODUCTION

C-1. SCOPE

This appendix lists Components of End Items and Basic Issue Items (BII) for the air conditioner to help you inventory items required for safe and efficient operation.

C-2. GENERAL

The components of end item list are divided into the following sections:

a. Section II. Components of End Item. This listing is for informational purposes only, and is not authority to requisition replacements. These items are part of the end item, but are removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to assist in identifying items.

b. Section III. Basic issue Items. These are the minimum essential items required to place the air conditioner in operation, to operate it, and to perform emergency repairs. Although shipped separately packaged, BII must be with the shelter during operation and whenever it is transferred between property accounts. The illustrations will assist you with hard-to-identify items. This manual is your authority to request/requisition replacement BII, based on TOE/MTOE authorization of the end item.

C-3. EXPLANATION OF COLUMNS

The following provides an explanation of columns found in the tabular listings:

a. Column (1) – Illustration Number Illus Number). This column indicates the number of the illustration in which the item is shown.

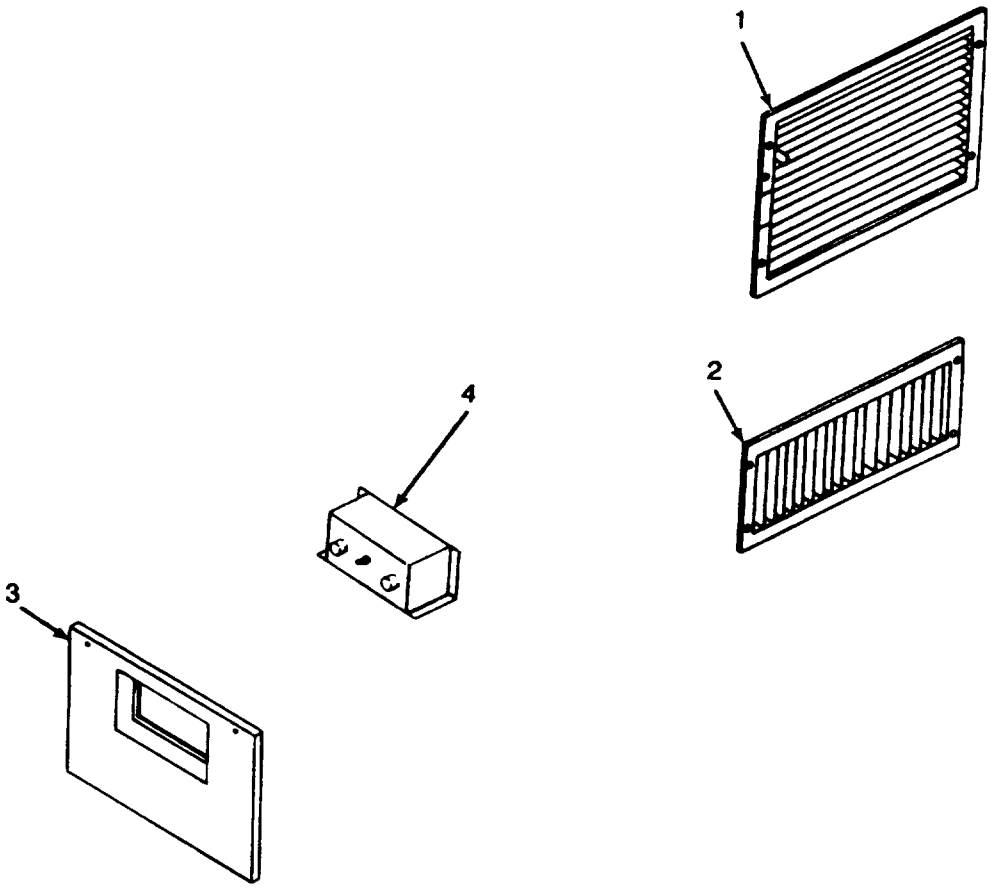
b. Column (2) – National Stock Number. Indicates the National Stock Number assigned to the item and will be used for requisitioning purposes.

c. Column (3) - Description. Indicates the Federal item name and, if required, a minimum description to identify and locate the item. The last line for each item, indicates the CAGEC (in parentheses) followed by the part number.

d. Column (4) - Unit of Measure (U/M). Indicates the measure used in performing the actual operational/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr).

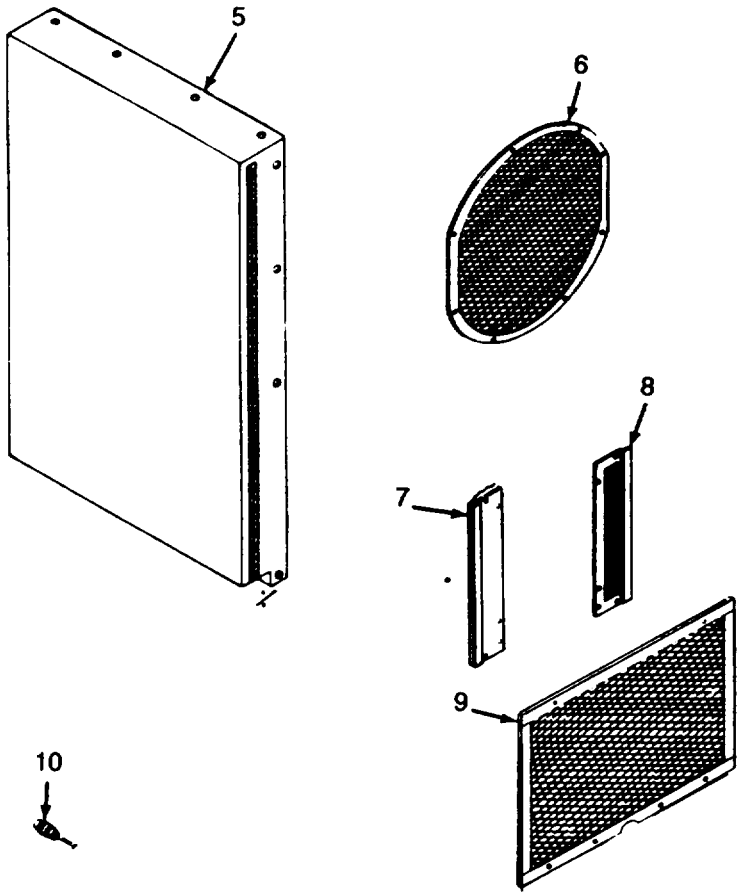
e. Column (5) – Quantity required (QTY RQR). Indicates the quantity of the item authorized to be used with/on the equipment.

Section II. COMPONENTS OF END ITEM



(1) ILLUS NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
1		GRILLE, RETURN AIR INTAKE (97403) 13214E3713		ea	1
2		GRILLE, DISCHARGE (97403) 13214E3712		ea	1
3		PANEL, LOWER (97403) 13220E6720-2		ea	1
4		CONTROL PANEL (97403) 13219E2934		ea	1

Section II. COMPONENTS OF END ITEM – Continued



(1) ILLUS NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
5		CANVAS COVER (97403) 13214E3703		ea	1
6		GUARD, FAN (97403) 13214E3612		ea	1
7		COVER, CBR (97403) 13214E3615		ea	1
8		SCREEN, FRESH AIR INLET (97403) 13214E3616		ea	1
9		GUARD, CONDENSER (97403) 13214E3533		ea	1
10		CONNECTOR (96906) MS3106R-20-4SX		ea	1

Section III. BASIC ISSUE ITEMS

(1) ILLUS NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC AND PART NUMBER	(4) USABLE ON CODE	(5) QTY RQR
		Department of Army Technical Manual; Operator, Unit, and Direct and General Support Maintenance Manual TM 9-4120-38514		1
		Department of Army Technical Manual; Organizational, Direct Support and General Support Repair Parts and Special Tools List for Air Conditioner Vertical, Compact 9000 BTU/HR TM 9-4120-385-24P		1

APPENDIX D

EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST (EDSML)

Section I. INTRODUCTION

D-1. SCOPE

This appendix lists expendable supplies and materials you will need to operate and maintain the air conditioner. These items are authorized to you by CTA 50-970, Expendable Items (Except Medical, Class V, Repair Parts, and Heraldic Items).

D-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 Coater, Air Filter, Item 1, Appendix C").

b. Column (2) - Level. This column identifies the lowest level of maintenance that requires the listed item (enter as applicable):

C – Operator/Crew
O- Unit 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 items name and, if required, a description to identify the item. The last line for each item indicates the commercial and Government Entity Code (CAGEC) in parentheses followed by the part number.

e. Column (5). Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. The measure is expressed by a two-character alphabetical abbreviation (e.g., EA, 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/DURABLE SUPPLIES AND MATERIALS LIST

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
1	O		13211E3465, Sealer	EA
2	O		QQ S-571, Solder, Tin Alloy Type, Wire Rosin, Core S/N 60WRP2	EA
3	O	3439-00-853-9276	QQ-B-654, Brazing Alloy, Grade III, Solder, Silver	EA
4	O	3439-00-224-3573	QQ-B-654, Brazing Alloy, Grade I, Solder, Silver	EA
5	F	6830-00-998-9510	BB-F-1421, Fluorocarbon, Refrigerant Type 22, Monochlorodifluoromethane	EA
6	F	5610-01-042-2456	13216E6210, Mastic, Thermal (1 gallon can)	EA
7	O	8040-00-851-0211	MIL-A-46106, Adhesive, Sealant, Silicone, RTV Color Aluminum Type I	EA EA
8	O		MIL-G-21164, Grease, Nato Type G353	
9	O		MIL-S-22473, Sealing Compound 10/25 LKG, Torque, Purple, Grade E	EA
10	O		MIL-S-22473, Sealing Compound 20/50 LKG, Torque, Purple, Grade E	EA
11	O	8030-00-990-5802	1320E0832, Sealing Liquid (4 ounce can)	EA
12	O		MMM–A-121, Adhesive, Bonding (1 pint can)	EA
13	O		MMM–A-132, Adhesive, Heat Resistant, Structural Metal to Metal, Type 1, Class 3 (one pint can)	EA
14	O		MIL–T-22361, Thread Compound, Antiseize, Zinc Dust-Petroleum.	EA
15	O	8040-00-096-4655	MMM–A-1617, Adhesive, Rubber Base, General Purpose	EA

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST – Continued

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
16	O		Sealer, Tape, Pressure Sensitive (0.500 inch wide, 72 yards long)	EA
17	O	6850-00-264-9037	P–D-680, Dry Cleaning Solvent (5 gallon can)	EA
18	F	4130-00-860-0042	Coater, Air Filter (1 pint can)	EA
19	F		Fluorocarbon, Refrigerant, Type 11, Trichloromonofluoromethane (50 pound cylinder)	EA
20	H		8RA5123C, Solder	EA
21	O		V–T–295, Thread, Type 11	EA
22	F	3439-00-640-3713	O-F-499, Flux, Brazing	EA
23	O		SAE-30, Oil Spray	EA

APPENDIX E
TORQUE LIMITS

This appendix lists standard torque values and provides general information and methods for applying torque. Special torque values and sequences are indicated in the maintenance procedures for application components.

Thread Size	Minimum Breakaway Torque (in/lb)	Thread Size	Minimum Breakaway Torque (in./lb)
10-32	2.0	5/8-18	32.0
1/4-28	3.5	3/4-16	50.0
5/16-24	6.5	7/8-14	70.0
3/8-24	9.5	1–12	90.0
7/16-20	14.0	1–1/8-12	117.0
1/2-20	18.0	1-1/8-12	143.0
9/16-18	24.0		

NOTE

To determine breakaway torque, thread nut onto screw or bolt until at least two threads stick out. Nut shall not make contact with mating part. Stop the nut. Torque necessary to begin turning nut again is the breakaway torque. Do not re-use self–locking nuts that do not meet minimum breakaway torque.

ALPHABETICAL INDEX

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By Order of the Secretary of the Army:

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

Offical:

MILTON H. HAMILTON
Administrative Assistant to the
Secretary of the Army
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RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

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

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 9-4120-385-14	28 JUNE 1992	Air Conditioner, Vertical, Compact, 9,000 BTU/HR NSN 4120-01-193-4999

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 Cylenders. The engine on my set only has 4 Cylenders. Clenge the manual to show 4 Cylenders.

Callout 16 on figure 4-3 is pointing at a bolt. In key to figure 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 bit it doesn't fit. Supply says I got what I ordered, so the NSN is Wrong. Please give me a good NSN

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

SIGN HERE John Doe
JOHN DOE

TEAR ALONG PERFORATED LINE

DA Form 2028-2
1 JUL 79

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RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 9-4120-385-14	28 JUNE 1992	Air Conditioner, Vertical Compact, 9,000, BTU/HR NSN 4120-01-193-4999

BE EXACT PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO

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

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The Metric System and Equivalents

Linear Measure

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

Weights

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

Liquid Measure

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

Square Measure

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

Cubic Measure

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

Approximate Conversion Factors

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

Temperature (Exact)

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

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