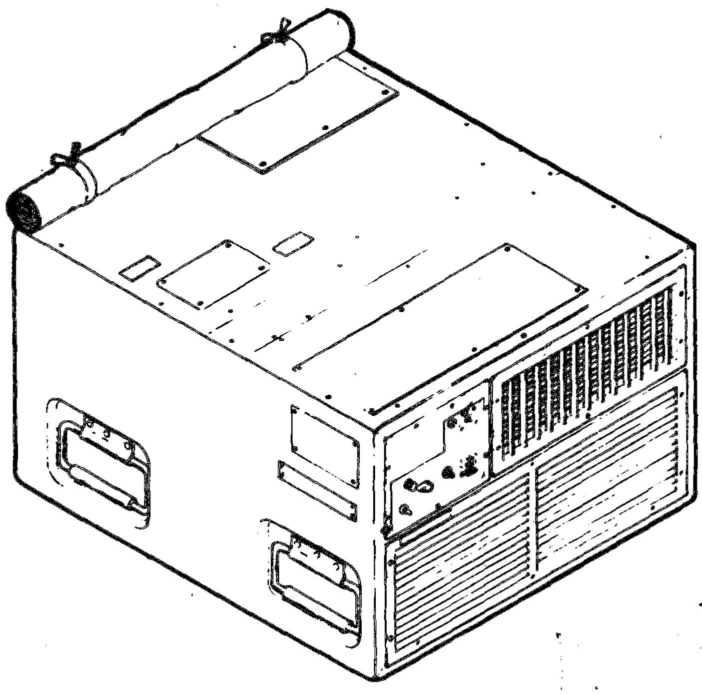
TM 5-4120-383-14

TECHNICAL MANUAL

OERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL



AIR CONDITIONER

HORIZONTAL COMPACT

9,000 BTU/HR

208 VOLT, 3 PHASE,

50/60 HERTZ

MODEL F 9000H-3S

(4120-01-164-7420)

HEADQUARTERS, DEPARTMENT OF THE ARMY

9 MAY 1985

WARNING

The panels, doors, and screens on this unit are there for a purpose.

Do not operate this unit with them off or open unless the instructions tell you to. When this is necessary do so with care.

- All electrical connections can shock and sometimes kill.
- Moving parts can cut off fingers or hands.
- Do not wear loose clothing near moving parts such as fans and shafts.

Read all Warnings and instructions carefully before operating or working on this unit. Read and understand all Warnings listed in the front of this manual.

WARNING

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

DEATH

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

Never use a heating torch on any part that contains Refrigerant R-22. Do not let liquid refrigerant touch you and do not inhale refrigerant gas.

WARNING

DANGEROUS CHEMICAL
is used in this equipment.

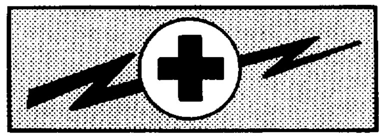
DEATH

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

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or goggles in any situation where skin - eye - contact is possible.

Prevent contact of refrigerant gas with flame or hot surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas.

WARNING



HIGH VOLTAGE

is used in the operation of this equipment.

DEATH ON CONTACT

may result if personnel fail to observe safety precautions.

Remove personal items such as watches and rings prior to working on this equipment.

Never work on electrical 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. When the technician is aided by operators, he must warn them about dangerous areas.

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

Be careful not to contact high-voltage connections of 208 volts ac input when installing or operating this equipment.

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body.

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

Warning: Do not be misled by the term "low voltage." Potentials as low as 50 volts may cause death under adverse conditions.

WARNING

Acetone and methyl-ethyl ketone (MEK) are flammable and their vapors can be explosive. Repeated or prolonged skin contact or inhalation of vapors can be toxic. Use a well-ventilated area, wear gloves, and keep away from sparks or flame.

WARNING

Clean parts in a well ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly.

Dry cleaning solvent (Fed Spec. P-D-680) used to clean parts is potentially dangerous to personnel and property.

Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 50°C).

Wear eye protection when blowing solvent from parts. Air pressure should not exceed 30 psig (2.1 kg/cm^2).

WARNING

Compressed air used for cleaning purposes will not exceed 30 psi (2.1 kg/cm^2).

WARNING

The burning of polyurethane foams 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 nearby, you should take care to ventilate the area thoroughly. An exhaust system like that of a paint spray booth should be used.

Air-supplied respirators, approved by the National Institute for Occupational Safety and Health or the U.S. Bureau of Mines, should be used for all welding in confined spaces and in places where ventilation is inadequate.

Persons who have chronic or recurrent respiratory conditions, including allergies and asthma, should not work in these areas.

CHANGE
No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 1 JULY 1992

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

AIR CONDITIONER, HORIZONTAL, COMPACT,
9,000 BTU/HR, 208 VOLT, 3 PHASE,
50/60 HERTZ
MODEL F9000H-3S
NSN 4120-01-164-7420

Approved for public release; Distribution is unlimited

TM 5-4120-383-14, 9 May 1985 is changed as follows:

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

Remove pages	Insert pages
5-27 and 5-28	5-27 and 5-28
5-37 and 5-38	5-37 and 5-38
B-11 and B-12	B-11 and B-12
E-1 and E-2	E-1 and E-2

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

By Order of the Secretary of the Army:

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

Official

Milton H. Hamilton

MILTON H. HAMILTON
Administrative Assistant to the
Secretary of the Army
01507

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TECHNICAL MANUAL

TM5-4120-383-14

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 9 May 1985

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL FOR AIR CONDITIONER, HORIZONTAL, COMPACT, 9,000 BTU/HR 208 VOLTS, 3 PHASE, 50/60 HERTZ (4120-01-164-7420)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

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

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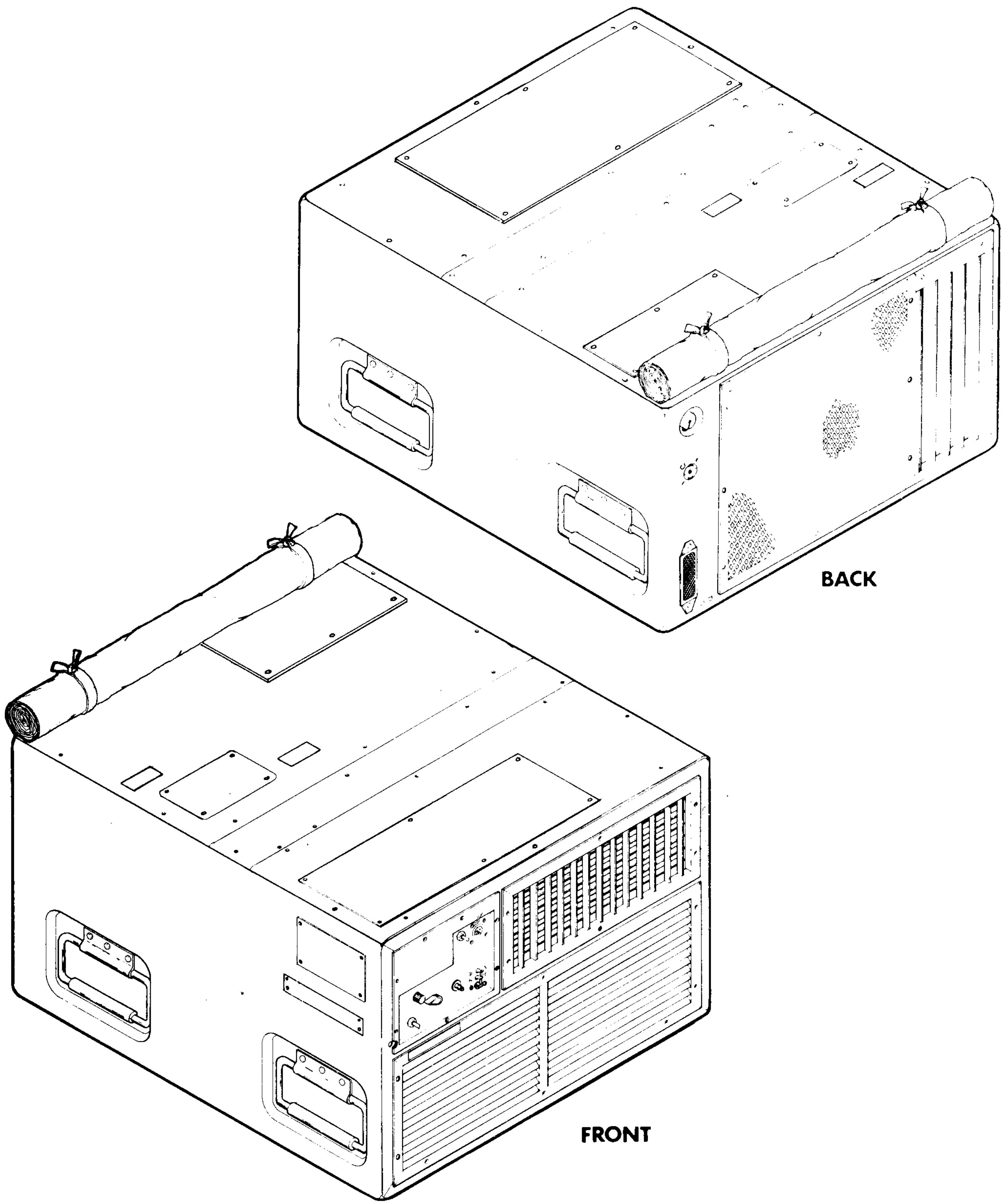


Figure 1-1. Air Conditioner

CHAPTER 1

INTRODUCTION

Section I GENERAL INFORMATION

1-1. SCOPE.

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

b. Model Number and Equipment Name. Keco Model F9000H-3S Horizontal, Compact, 9,000 BTU/HR, 208 Volt, 3 Phase, 50/60 Hertz, Air Conditioner.

c. Purpose of Equipment. Cools and heats enclosed space (shelter). 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 conditioned area.

1-2. MAINTENANCE FORMS AND RECORDS.

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

1-3. HAND RECEIPT MANUAL.

This manual has a companion document with a TM number followed by "-HR" (which stands for Hand Receipt). The TM5-4120-383-14-HR consists of preprinted hand receipts (DA Form 2062) that list end item related equipment (i.e., COEI, BII, and AAL) you must account for. As an aid to property accountability, additional -HR manuals may be requisitioned from the following source in accordance with procedures in Chapter 3, AR 310-2:

The US Army Adjutant General Publications Center
2800 Eastern Boulevard
Baltimore, MD 21220.

1-4. 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 or performance. Tell us why a procedure is hard to perform. Put it on a SF 368 (Quality Deficiency Report). Mail it to us at:

Commander, U.S. Army Troop Support Command
Attention: AMSTR-MPS
4300 Goodfellow Boulevard
St. Louis, Missouri 63120-1798.

We will send you a reply.

Section II EQUIPMENT DESCRIPTION

1-5. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.

a. The Model F9000H-3S Air Conditioner is designed to circulate, filter, and cool or heat air in the room or enclosure in which it is installed.

b. The Model F9000H-3S has a capability of providing a maximum of 10,000 BTU/HR of cooling or 7,000 BTU/HR of heating. It is designed to automatically maintain the air in the room or enclosure at the desired temperature selected on the control panel.

c. The unit is self-contained in a single cabinet that is ideally suited for van or shelter type installations. The only external requirements are a source of 208 volt ac, 3 phase, 50/60

1-5. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES. -Continued

hertz input power, a suitable ground and an entry to a suitable drain. The drain must be lower than the base of the cabinet, in its operating location, for disposal of condensate waste water. It is designed to operate in almost any environmental condition from artic to tropic and is fully portable for movement from one location to another.

d. The primary installation requirement is that the exhaust air from the compressor/condenser section must be vented to the outside atmosphere. This subject is fully covered in the installation instructions contained in Chapter 4, "Organizational Maintenance Instructions."

e. When using this equipment in a secure area, caution must be exercised in meeting the established electromagnetic radiation standards. These standards may limit the use of the equipment's remote capability and require additional shielding for the ducts.

1-6. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.

(See fig. 1-2 Sheets 1 and 2)

1 FABRIC COVER. Protects back or exposed side of the unit during periods of shut down. Must be rolled up when operating in the cool mode or when fresh (outside) air is being used in any mode.

2 CONDITIONED AIR SUPPLY LOUVER. Provides directional control of conditioned air.

3 CONDITIONED (EVAPORATOR) AIR FAN. Draws the room or enclosure air in over the filter and blows it out over the evaporator and heaters to supply conditioned air. The speed is adjustable. See Item 16.

4 TEMPERATURE SELECTOR (THERMOSTAT) SENSING BULB. Senses the temperature of the room or enclosure air as it is drawn back into the air conditioner. This bulb is part of the TEMPERATURE SELECTOR control (thermostat) that is located on the control panel module.

5 CONDITIONED AIR FILTER. Filters room or enclosure air as it is recirculated.

6 CONDITIONED AIR FAN MOTOR. Drives the conditioned air fan.

7 RETURN AIR LOUVER WITH FILTER CLAMPS. The recirculated air from the room or enclosure is drawn in through this louver. The conditioned air filter, item 5, is mounted on clips on the inside of this louver.

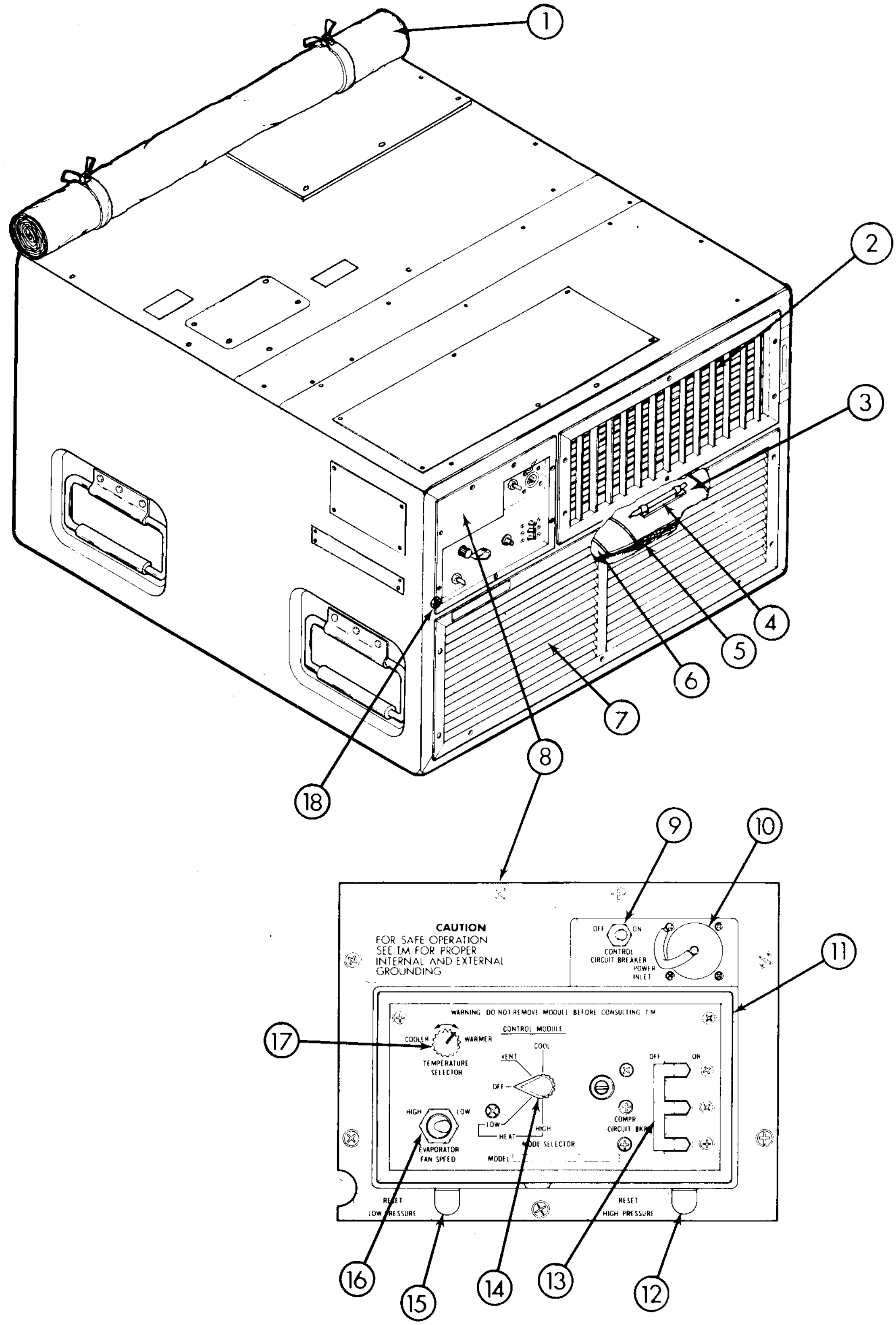


Figure 1-2. Location of Major Components (Sheet 1 of 2)

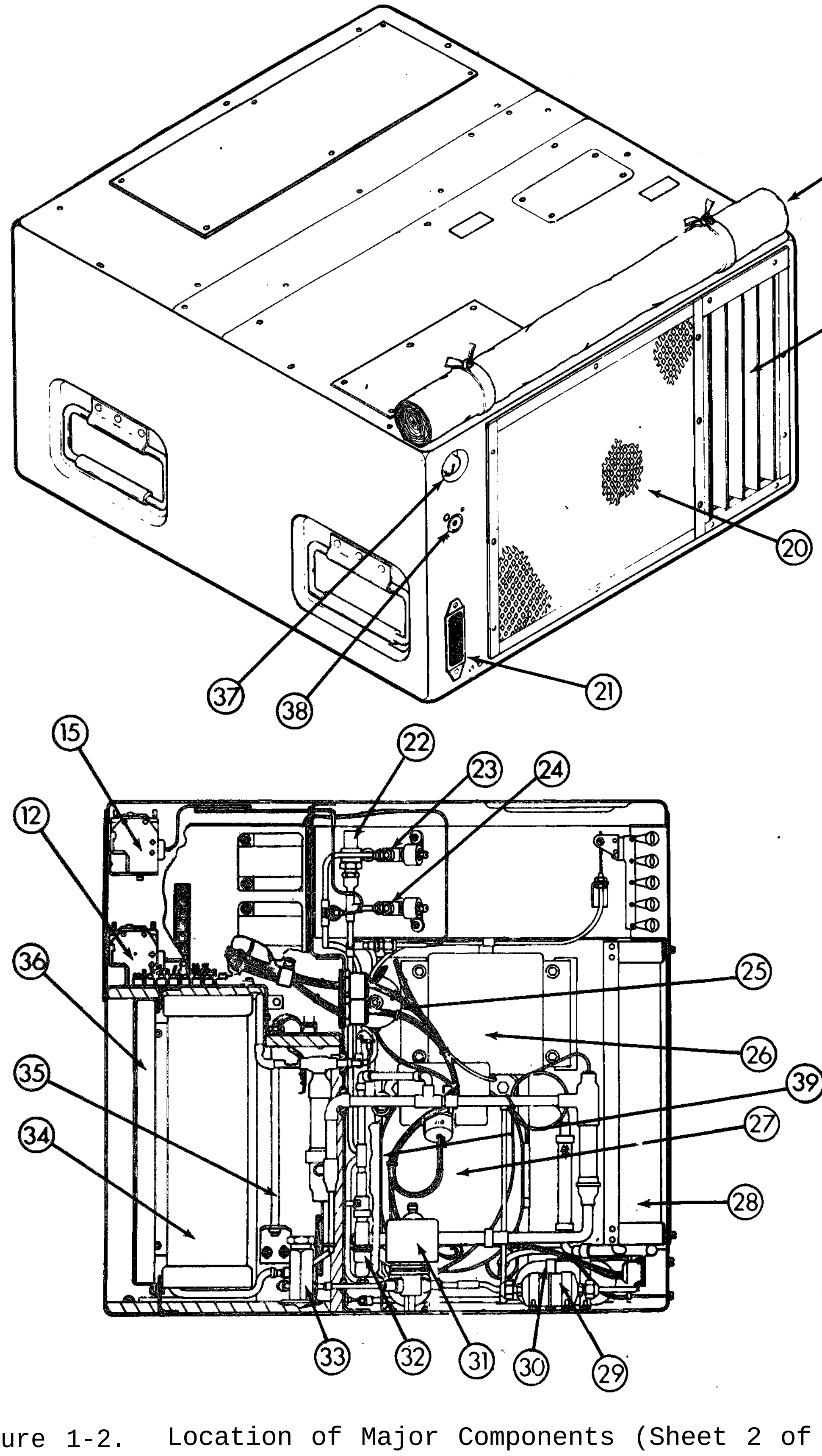


Figure 1-2. Location of Major Components (Sheet 2 of 2)

1-6. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.-Continued

8 JUNCTION BOX AND CONTROL PANEL MODULE. Contains major unit controls. See items 9 thru 16 for a description of some of these controls.

9 CONTROL CIRCUIT BREAKER. Protects control circuit.

10 INPUT POWER RECEPTACLE (PRIMARY LOCATION). Connection point for main input power cable. See item 37 for alternate receptacle.

11 CONTROL PANEL MODULE. Contains switches and controls for operating the air conditioner. See items 13, 14, 16 and 17 for a description of these switches and controls.

12 HIGH REFRIGERANT PRESSURE CUTOUT SWITCH. This switch is factory set to shut the compressor off if the refrigerant discharge line pressure rises to 435 to 455 psig (30.58 to 31.99 kg/cm^2).

NOTE

This switch must be hand reset after the pressure drops to 320 psig (22.50 kg/cm^2).

13 COMPR CIRCUIT BKR (Compressor Circuit Breaker). Protects the compressor.

14 MODE SELECTOR SWITCH. Allows selection of unit operating mode.

15 LOW REFRIGERANT PRESSURE CUTOUT SWITCH. This switch is factory set to shut the compressor off if the refrigerant suction line pressure drops to 10 to 20 psig (0.703 to 1.406 kg/cm^2). This switch must be hand reset after the pressure rises above 40 psig (2.812 kg/cm^2).

16 EVAPORATOR FAN SPEED. Allows selection of HIGH or LOW unit conditioned air (evaporator) fan speed.

17 TEMPERATURE SELECTOR (THERMOSTAT) SWITCH. This switch allows selection of the desired temperature while operating in the cool or heat modes.

18 GROUND CONNECTION POINT. Shelter or van electrical ground connection point.

19 CONDENSER DISCHARGE AIR LOUVER ASSEMBLY. This louver assembly is automatically controlled by the actuating cylinder, item 39.

20 CONDENSER AIR INLET GUARD. This expanded metal screen protects the condenser from damage.

1-6. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.-Continued

21 FRESH AIR VENTILATION GUARD. Screens and filters fresh air entering the unit.

NOTE

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

22 RELIEF VALVE. This safety valve opens when the refrigerant discharge line pressure rises above 540 psig (37.97 kg/cm^2).

23 CHARGING VALVE, REFRIGERANT SUCTION LINE. Provides a connection point for charging and checking suction line pressure.

24 CHARGING VALVE, REFRIGERANT DISCHARGE LINE. Provides a connection point for charging and checking discharge line pressure.

25 SOLENOID VALVE, PRESSURE EQUALIZING. This valve is normally open when the compressor is NOT running to equalize the pressure at the suction and discharge sides of the compressor. It closes when the compressor starts.

26 CONDENSER FAN AND MOTOR. This fan and motor draws outside air over the condenser coil to remove heat from the refrigerant passing through the tubes of the condenser coil.

27 COMPRESSOR. Consists of a reciprocating compressor driven by an electrical motor, hermetically sealed inside a steel container with a lifetime charge of oil. An external (crankcase) heater is attached to the lower part of the container. The purpose of the heater is to prevent possible damage to the compressor caused by liquid refrigerant accumulation in the crankcase during a period of shut down. The heater is connected directly to input power and is thermostatically controlled to prevent overheating.

28 CONDENSER COIL. Made up of interconnected parallel copper tubes retained in a series of multiple, closely spaced aluminum fins. This coil serves as a heat exchanger to remove the heat from the compressed refrigerant vapor so that it will condense into a liquid.

29 DEHYDRATOR, DESICCANT, REFRIGERANT (FILTER/DRIER). Removes moisture and contaminants from the refrigerant.

30 RECEIVER. The receiver acts as a storage tank for the liquid refrigerant.

1-6. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.-Continued

31 SOLENOID VALVE, LIQUID LINE. This valve is normally open when the compressor is NOT running and is thermostatically controlled during cooling cycles when operating in the COOL mode.

32 PRESSURE REGULATING VALVE. This valve regulates the suction pressure by recirculating a part of the compressor discharge hot gas to the suction line when the suction pressure drops below a preset value. This action prevents frosting of the evaporator coil.

33 EXPANSION VALVE. Meters refrigerant flow to the evaporator during cooling cycles when operating in the COOL mode.

34 EVAPORATOR COIL. Similar in construction to the multiple-tube, finned condenser coil. This coil serves as a heat exchanger for the refrigerant to absorb heat from the room or enclosure air circulated through the evaporator section.

35 HEATING ELEMENTS. Consists of two banks of heating elements. Only one bank operates in the “LOW HEAT” mode. Both banks operate in the “HIGH HEAT” mode. One bank shuts off when the thermostat is satisfied in both HIGH and LOW HEAT modes.

36 MIST ELIMINATOR. The purpose of the mist eliminator is to trap droplets of condensed water from the evaporator, so that they will not be blown into the air conditioned space.

37 INPUT POWER RECEPTACLE (ALTERNATE LOCATION). The main power cable may be connected here. See item 10 for primary location. See installation instructions for switch over instructions if this power receptacle is used.

38 REFRIGERANT SIGHT GLASS. Visually indicates the condition of the refrigerant flowing in the refrigerant lines during cooling cycles when operating in the COOL mode.

39 ACTUATING CYLINDER. This hydraulic cylinder operates discharge louver assembly. It will start to open the louver assembly at 150 to 180 psig (10.55 to 12.66 kg/cm^2) and fully open louver assembly at 220 to 260 psig (15.74 to 18.28 kg/cm^2) compressor discharge pressure to allow unit operation when outside temperature is low.

1-7. EQUIPMENT DATA.

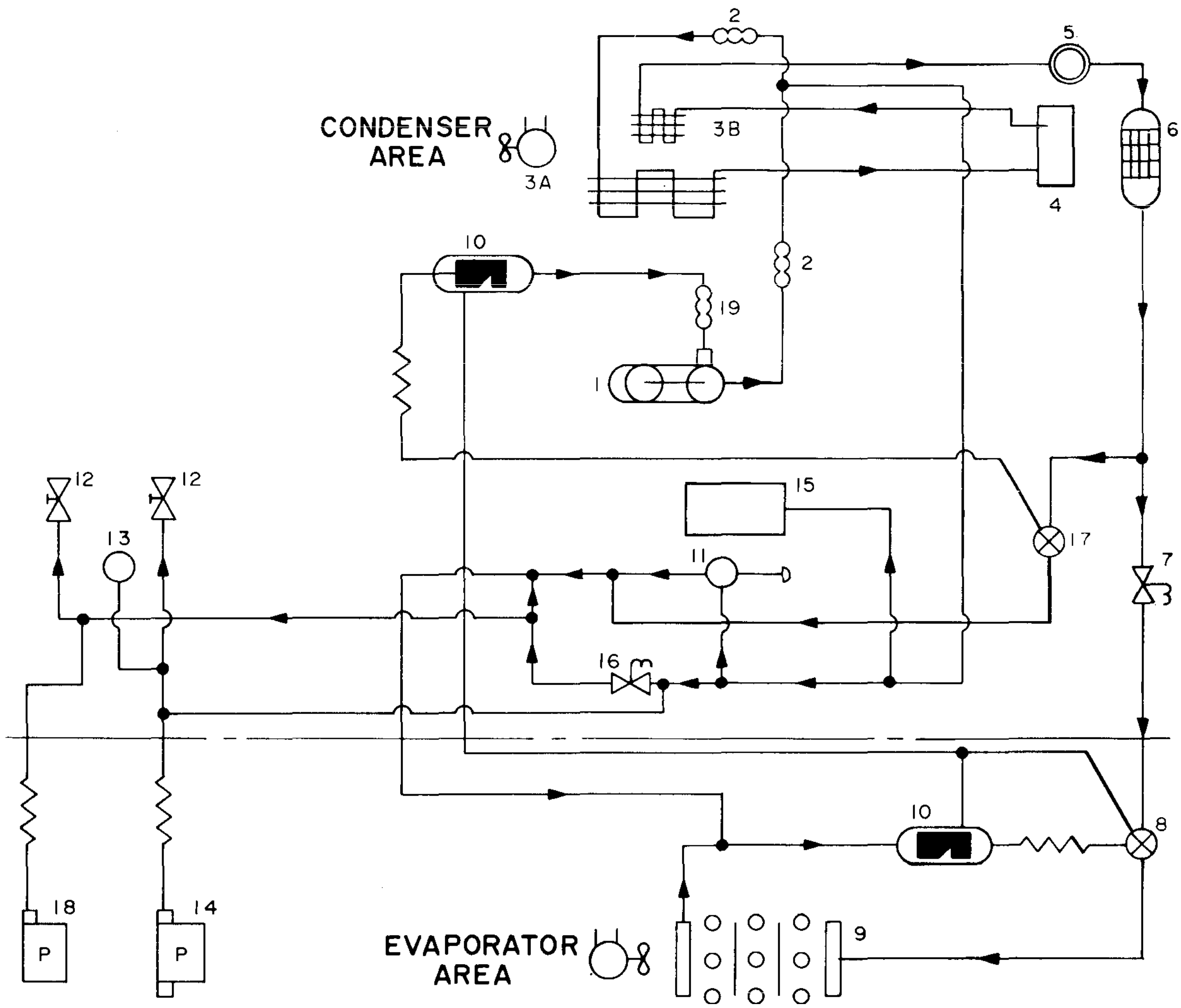
AMBIENT OPERATING TEMPERATURE RANGE	
LOW	-50°F (-45°C)
HIGH	+120°F (+49°C)
PERFORMANCE	
COOLING CAPACITY	10,000 BTU/HR
HEATING CAPACITY	7,000 BTU/HR
POWER REQUIRED	
VOLTAGE	208
PHASE	3
HERTZ	50/60
DIMENSIONS	
WIDTH	24.0 inch (60.96 cm)
DEPTH	26.5 inch (67.31 cm)
HEIGHT	16.0 inch (40.64 cm)
WEIGHT	185 pounds (83.9 kg)
REFRIGERANT	
TYPE	R-22
CHARGE	2.2 pounds (1.0 kg)

Section III TECHNICAL PRINCIPLES OF OPERATION

1-8. REFRIGERATION CYCLE.

a. Cooling Cycle. (See fig. 1-3.)

- The COMPRESSOR (1) takes cold, low pressure refrigerant gas and compresses it to a high temperature, high pressure gas. This gas flows through the metal tubing to the CONDENSER COIL (3A) and (3B) and RECEIVER (4).



FIND NO.	QTY	NOMENCLATURE
1	1	COMPRESSOR, RECIPROCATING
2	2	HOSE ASSY, METAL
3A	1	COIL, CONDENSER WITH ANGLE
3B	1	SUB COOLER
4	1	RECEIVER, LIQUID REFRIGERANT
5	1	INDICATOR, SIGHT, LIQUID
6	1	DEHYDRATOR, DESICCANT, REFRIGERANT
7	1	SOLENOID VALVE WITH LEADS
8	1	VALVE, EXPANSION (PRIMARY)
9	1	COIL, EVAPORATOR
10	2	BULB WELL
11	1	REGULATOR, FLUID PRESSURE
12	2	VALVE, SERVICE
13	1	VALVE, PRESSURE RELIEF
14	1	SWITCH, PRESSURE (HIGH)
15	1	CYLINDER ASSY ACTUATING, LINEAR
16	1	SOLENOID VALVE WITH LEADS
17	1	VALVE, EXPANSION (QUENCH)
18	1	SWITCH PRESSURE (LOW)
19	1	HOSE ASSY, METAL

Figure 1-3. Refrigeration Schematic

1-8. REFRIGERATION CYCLE.-Continued

- The condenser fan draws outside ambient air over and through the two section CONDENSER COIL (3A) and (3B). The high temperature, high pressure gas from the COMPRESSOR (1) is cooled by the flow of air and is changed into a high pressure liquid.

- The LIQUID SIGHT GLASS (5) indicates the presence of moisture and quantity of refrigerant in the system.

- The DEHYDRATOR, DESICCANT, REFRIGERANT (filter/drier) (6) removes any moisture (water vapor) or dirt that may be carried by the liquid refrigerant.

- The SOLENOID VALVE (7) is controlled by the TEMPERATURE SELECTOR 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.

- The EXPANSION VALVE (8) controls the amount and pressure of liquid refrigerant to the EVAPORATOR COIL (9). The EXPANSION VALVE (8) senses the temperature and pressure of the refrigerant as it leaves the evaporator coil. By use of the sensing bulb in the BULB WELL (10) and an “external equalizer line” the valve constantly adjusts the flow of liquid refrigerant to the EVAPORATOR COIL (9).

- As the liquid refrigerant leaves the EXPANSION VALVE (8) it enters the EVAPORATOR COIL (9). As the liquid enters the coil at a reduced pressure, the reduction in pressure and the warmer air being forced across the tubes of the coil cause the refrigerant to boil or "flash" to a gas. The evaporator blower circulates the warm air from the conditioned space over and through the evaporator coil. Liquid absorbs heat when it changes from a liquid to a gas. As air from the conditioned spaces comes in contact with the EVAPORATOR COIL (9), the air is cooled.

- To prevent compressor overload and damage during start-up, SOLENOID VALVE, pressure equalizing (16) is closed at start of cooling cycle. This valve opens when compressor is not running to equalize pressure on both sides of compressor.

1-8. REFRIGERATION CYCLE.-Continued

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 (9).

- When the TEMPERATURE SELECTOR on the control module senses that cooling conditions have reached the set point, it closes the SOLENOID VALVE (7) to shut off refrigerant flow to the EVAPORATOR COIL (9).

- As the compressor suction pressure starts to drop, the PRESSURE REGULATOR (11) opens to allow flow of hot gas from the compressor.

- The QUENCH VALVE (17) 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 (17) opens to allow liquid refrigerant to mix with the hot gas.

- The LINEAR ACTUATING CYLINDER ASSEMBLY (15) automatically controls the condenser discharge louver assembly.

- The SERVICE VALVES (12) are provided for charging, and general servicing of the high and low pressure sides of the refrigerant system.

- The LOW PRESSURE SWITCH (18), the HIGH PRESSURE SWITCH (14) and the PRESSURE RELIEF VALVE (13) are provided to protect the unit from damage due to pressure extremes.

- The flexible METAL HOSE ASSEMBLIES (2) and (19) provide vibration isolation between the compressor and other components of the refrigeration system.

1-9. HEATING.

a. When the MODE SELECTOR is set for HIGH heat, all heating elements, located behind the evaporator coil are energized. These elements are protected from overheating by a thermal cutout switch. Half of the elements are thermostatically controlled by the TEMPERATURE SELECTOR. The remaining half are on all of the time. When set for LOW, only the thermostatically controlled elements are energized.

b. The two speed fan can be set for either HIGH or LOW operation during heating.

CHAPTER 2

OPERATING INSTRUCTIONS

Section I DESCRIPTION AND USE OF OPERATOR’S CONTROLS AND INDICATORS

2-1. GENERAL.

The Model F9000H-3S Air Conditioner is designed for a wide variety of installations and for operation under a wide range of climatic conditions. It is also designed for continuous or intermittent operation as a self-contained unit or may be connected to external filtering equipment for operation under chemical-biological-radiological (CBR) environmental conditions. Operators must be aware of any peculiarities or operational limitations for their specific installation.

2-2. OPERATOR'S CONTROLS.

All necessary operator controls are illustrated in Figures 2-1 and 2-2. Usage of controls is detailed in Operational Checks (para 2-6).

CAUTION

Under normal operating conditions, before starting the air conditioner in any mode, make sure that the fabric cover on the back of the cabinet is rolled up and secured, that the condenser fan intake screen and fan guard are in place and unobstructed, and that the evaporator fan intake and discharge grille louvers are fully open. EXCEPTIONS: Under extreme climatic conditions, such as blowing snow, which might enter the compressor section, the unit may be operated in the VENTILATE, LO HEAT or HI HEAT mode with the fabric cover rolled down and snapped in place. When operated in this manner, outside air cannot be drawn through the fresh air damper, which should be positioned fully closed. The fabric cover cannot be rolled down if the unit is connected to a CBR filter.

DO NOT OPERATE IN THE COOL MODE WITH THE FABRIC COVER ROLLED DOWN.

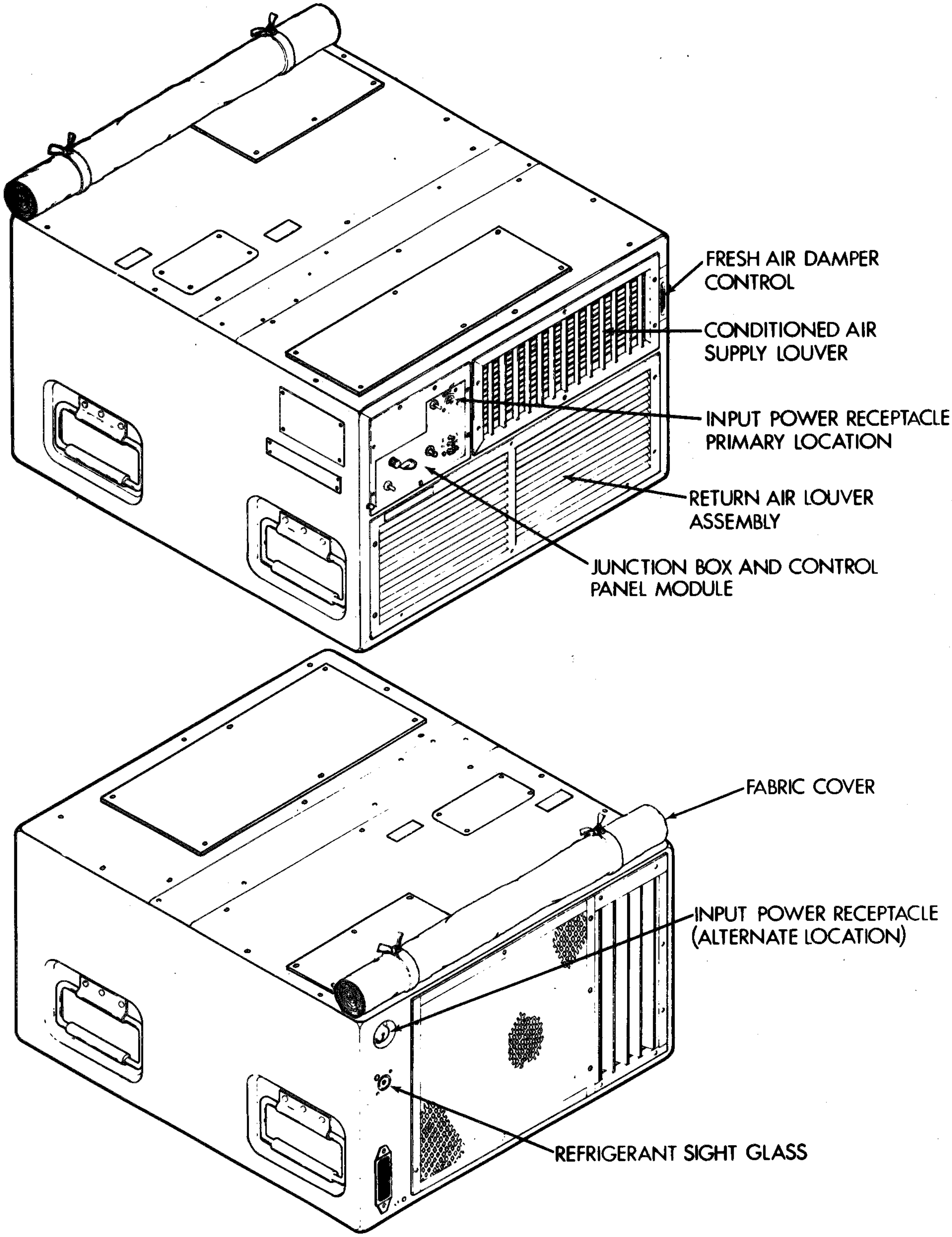


Figure 2-1. Operator’s Controls and Indicators

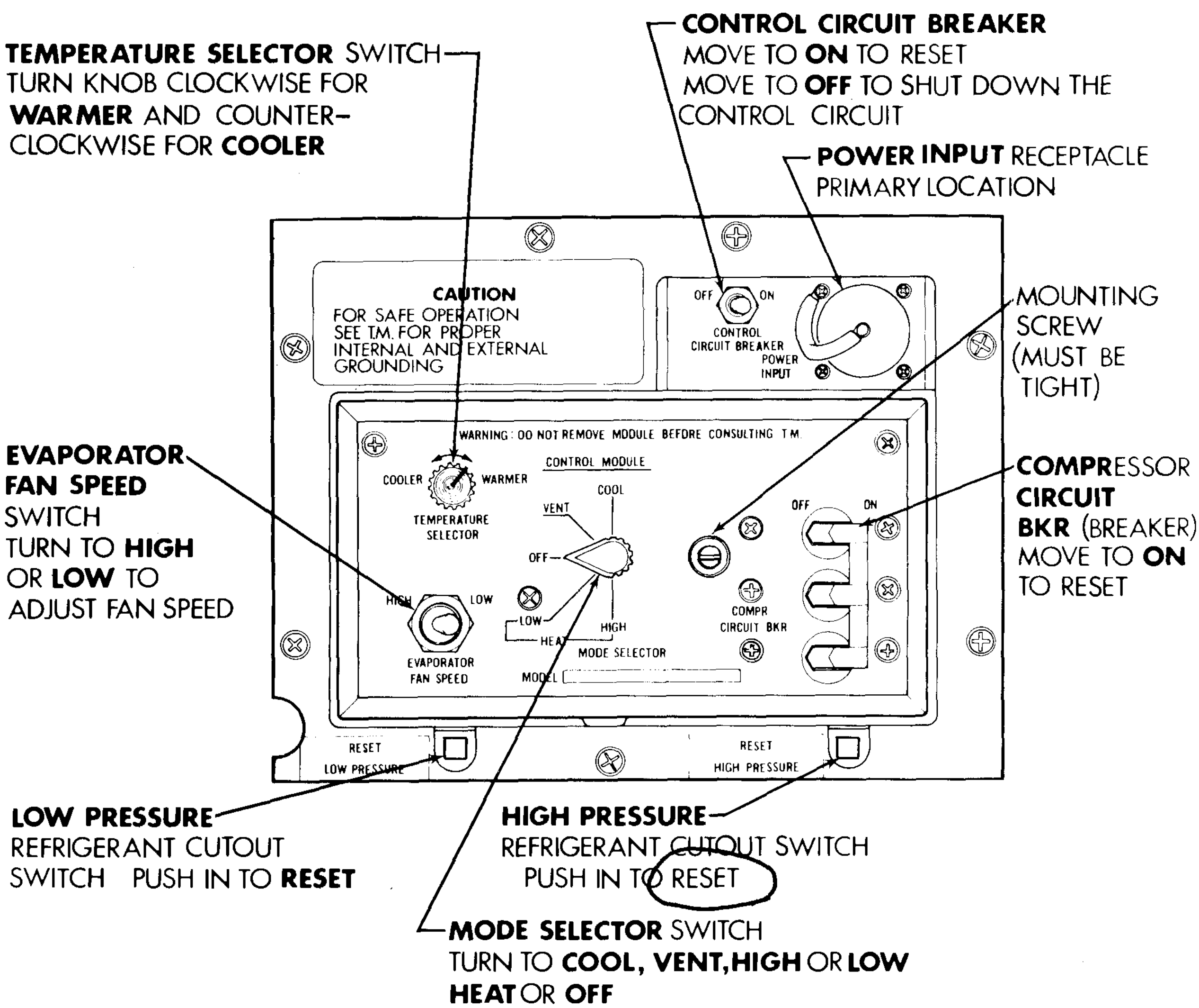


Figure 2-2. Operator's Controls and Indicators

2-3. INDICATORS.

(See fig. 2-2.)

The refrigerant sight glass is the only visual indicator incorporated in the Model F9000H-3S air conditioner. The refrigerant sight glass has a small chamber with a glass window through which the refrigerant condition can be observed. It is installed in the liquid refrigerant line downstream from the condenser coil. Liquid refrigerant actually flows through the sight glass chamber only during cooling cycles when the air conditioner is in operation in the COOL mode. The unit must be operated approximately 15 minutes at maximum cooling prior to checking condition of refrigerant at sight glass. The sight glass is equipped with a center indicator that is moisture sensitive. Dry refrigerant is indicated by green, it turns to chartreuse when the moisture content becomes undesirable, and to yellow when the level becomes unacceptable. Excessive moisture in the refrigerant may damage or possibly destroy the compressor. If the liquid refrigerant observed in the sight glass has a milky appearance or frequent bubbles appear, the volume of refrigerant is low and the system should be charged. Either moisture or low charge indications should be reported to direct support maintenance for appropriate refrigeration system action.

CAUTION

Do not operate the air conditioner in the COOL mode if the refrigerant color has reached the yellow band or if numerous bubbles appear in the sight glass. COOL mode operation may be continued with the refrigerant color in the chartreuse band or with only an occasional bubble appearing in the window, but the sight glass should be rechecked after each four hours of operation to insure that the condition has not become worse.

Section II PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-4. GENERAL.

Preventive maintenance checks and services (PMCS) are essential to the efficient operation of the air conditioner and to prevent possible damage that might occur through neglect or failure to observe warning symptoms in a timely manner. Checks and services performed by operators are limited to those functions which can be accomplished from the outside of the cabinet.

a. Before You Operate. Always keep in mind and observe the WARNINGS and CAUTIONS contained in this technical manual and plates installed on the equipment that are associated with the functions you are about to perform. Perform your before (B) PMCS from Table 2-1.

b. While You Operate. Always keep in mind and observe the WARNINGS and CAUTIONS contained in this technical manual and plates installed on the equipment that are associated with operational functions. Perform your during (D) PMCS from Table 2-1.

c. After You Operate. Be sure to perform your after (A) PMCS from Table 2-1.

d. If Your Equipment Fails to Operate. Troubleshoot within your capabilities and with proper equipment. Report any deficiencies as appropriate using the proper form as specified in DA Pamphlet 738-750.

NOTE

Within designated intervals, these checks are to be performed in the order listed. If the equipment must be kept in continuous operation check and service only those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

Table 2-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B - Before
D - During

A - After
W - Weekly

M - Monthly

Item No.	Interval B	D	A	W	M	Item To Be Inspected	Procedures Check for and have repaired or adjusted as necessary.	Equipment Is Not Ready/ Available If:
1	●					Information plates	Check for legibility and loose or missing hardware.	
2	●					Fabric Cover	Check that cover is rolled up for normal operation.	
					●		Roll down cover and check for condition of snaps, mildew, tears or worn edges.	Cover is missing or damaged.
3	●					Panels	Check for cracks, dents, or missing hardware.	Panels missing or damaged.
4	●					Screens and Guards	Check for obstructionis, damage, loose or missing hardware.	Screens or guard damaged or missing.
5	●					Louvers	Check for obstructions, damage, proper adjustment loose or missing hardware.	Louvers are damaged or missing.
					●		Check louvers for freedom of operations. Lubricate as required.	
6	●	●	●		●	Air Filter	Check that filter is clean.	Filter is totally clogged or missing.

Table 2-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES – Continued

Item No.	Interval B	Interval D	Interval A	Interval W	Interval M	Item To Be Inspected	Procedures Check for and have repaired or adjusted as necessary.	Equipment Is Not Ready/ Available If:
7	●					Fresh Air Damper	Check for proper adjustment.	
					●		Freedom of operation.	Control wheel missing or inoperable.
8		●				Condensate Drain	No water dripping anywhere except drain.	Water is leaking in an area that would cause damage or be a hazard.
9	●					Control Module	Inspect for damage, secure mounting, and proper operation in accordance with paragraph 2-6.	Control module damaged or operating improperly.
10		●				Refrigerant Sight Glass	After 15 minutes of operation in maximum cooling, check for bubbles or milky flow indicating low refrigerant charge. Check for yellow color which indicates presence of moisture.	Bubbles, milky flow, or yellow color is observed.

Section III OPERATION UNDER USUAL CONDITIONS.

2-5. ASSEMBLY AND PREPARATION FOR USE.

The Model F9000H-3S Air Conditioner is a completely assembled, self-contained unit as received. No specific operator preparation for use is required once the unit is in place.

2-6. OPERATIONAL CHECKS.

(See fig. 2-1 and 2-2.)

The air conditioner should be checked for operation in all modes after installation is completed and when it is to be placed back in operation after an extended shut down period.

CAUTION

> Do not perform the operational check in COOL mode until input power has been supplied to the unit for at least four hours. Liquid refrigerant tends to migrate into the compressor crankcase and cylinders during periods when the compressor heater is not operating. Under moderate climatic conditional the compressor heater will normally “boil” all liquid refrigerant out within a four hour period. If the air conditioner has been exposed to below freezing temperatures without input power, an eight hour warm up period is recommended.

a. Unsnap and roll up the fabric cover on the back of the cabinet. Secure it in the stowed position with the two straps.

b. Individually adjust all louvers in conditioned air supply louver assembly to the fully open (horizontal) position.

c. Using the operating levers, adjust the louvers in both sections of the return air louver assembly to the fully open position.

d. Turn the fresh air damper control to the fully closed (up) position.

e. Check that the unit is connected to the proper power source and that power has been connected to the unit for four hours.

f. Check to see that the CONTROL CIRCUIT BREAKER and the COMPR CIRCUIT BKR are in the ON position.

2-6. OPERATIONAL CHECKS.-Continued

g. Turn the MODE SELECTOR switch to VENT (ventilate). The evaporator fan should start immediately. Use a paper streamer or other method to check the airflow into the return air louver and out of the conditioned air supply louver. Check the EVAPORATOR FAN SPEED switch at both the HIGH and the LOW speed settings. There should be noticeably more airflow at the HIGH speed setting.

h. To check maximum ventilation with fresh air, first turn the fresh air damper control wheel to fully open (down) then adjust the louvers in both sections of the return air louver fully closed. Check the fresh air inlet located on the lower left corner of the back of the unit using a paper streamer or other method to be sure that air is being drawn in.

NOTE

For maximum ventilation with fresh air, it is necessary that room or enclosure air have a means of exit through an open door or window. If the room or enclosure is tightly closed, an overpressure will build up and decrease the volume of fresh air drawn in.

i. Fully open the return air louvers and fully close the fresh air damper.

j. Turn the TEMPERATURE SELECTOR (thermostat) knob to the full WARMER (clockwise) position. Then turn the MODE SELECTOR switch to LOW HEAT. Place your hand in the airflow from the conditioned air supply louver and feel for a temperature rise. When the supply air temperature has reached a relatively stable level, turn the MODE SELECTOR switch to HIGH HEAT and feel for a further temperature rise. Next, turn the TEMPERATURE SELECTOR thermostat control knob to the fully COOLER (counterclockwise) position. Feel that supply air temperature drops to approximately the same relatively stable level previously noted in LOW HEAT. Finally, turn the MODE SELECTOR switch to LOW HEAT and feel the discharge air temperature drop to ambient level (room temperature).

NOTE

The TEMPERATURE SELECTOR (thermostat) control has an effective functional range between 60°F and 90°F (16°C and 32°C). In extreme conditions when ambient air temperature is below 60°F (16°C) or above 90°F (32°C), the operation in either LOW HEAT or HIGH HEAT mode will vary from that described above.

2-6. OPERATIONAL CHECKS.-Continued

CAUTION

If a knocking or pounding noise is heard when the compressor starts in the following check, immediately turn the MODE SELECTOR out of the COOL position. Leave input power connected and wait at least two hours before attempting another start in COOL mode.

k. Turn the TEMPERATURE SELECTOR control knob to the fully WARMER (clockwise) position, then turn the MODE SELECTOR switch to COOL. Note that the evaporator and condenser fans start immediately and that the compressor starts approximately 30 seconds later. Hold your hand in the airflow from the conditioned air supply louver: there should be no change in temperature. Now turn the TEMPERATURE SELECTOR control knob to the fully COOLER (counterclockwise] position and feel the supply air temperature begin to drop almost immediately. Leave controls in the present position and perform the next check.

l. After 15 minutes of operation check the sight glass to determine the refrigerant condition. The sight glass is equipped with a center indicator that is moisture sensitive. Dry refrigerant is indicated by green, it turns to chartreuse when the moisture content becomes undesirable and to yellow when the level becomes unacceptable. Excessive moisture in the refrigerant may damage or possibly destroy the compressor. If the liquid refrigerant observed in the sight glass has a milky appearance or frequent bubbles appear, the volume of refrigerant is low and the system should be charged. Either moisture or low charge indications should be reported to direct support maintenance for appropriate refrigeration system action.

CAUTION

Do not operate the air conditioner in the COOL mode if the refrigerant color has reached the yellow band or if numerous bubbles appear in the sight glass. COOL mode operation may be continued with the refrigerant color in the chartreuse band or with only an occasional bubble appearing in the window, but the sight glass should be rechecked after each four hours of operation to insure that the condition has not become worse.

m. Turn the MODE SELECTOR switch to OFF. Observe that all air conditioner functions cease.

2-7. GENERAL OPERATING PROCEDURES.

The Model F9000H-3S air conditioner is designed for operation in a wide range of climatic conditions either continuously or intermittently. The amount of operator attention required will vary depending on specific local conditions for each installation. Under usual conditions, the air conditioner will be set up for the appropriate mode of operation at the beginning of a season and will only need starting and stopping and minor adjustments for the rest of the season. Table 2-2 provides the recommended initial control settings to establish the desired mode of operation. Minor adjustments may be required to obtain the desired mixture of recirculated and fresh air and the airflow patterns of conditioned air.

NOTE

Under some climatic conditional local practices may be established to close the fresh air damper and/or roll down and snap in place the fabric cover during shutdown periods. If such practices are in effect, the operator must first unsnap, roll up, and secure the fabric cover and appropriately adjust the fresh air damper before turning the MODE SELECTOR switch to the desired operating mode.

Table 2-2. INITIAL OPERATOR CONTROL SETTINGS

Mode	Mode Selector	Temperature Selector	Fresh Air Damper	Return Air Louver	Conditioned Air Supply Louver	Fabric Cover
Ventilation with 100% Recirculated Air	VENT	Any Setting	Fully Closed	Fully Open	Optional	Optional
Ventilation with make-up Fresh Air	VENT	Any Setting	Partially Open	Partially Closed	Optional	Open (Rolled)
Ventilation with 100% Fresh Air	VENT	Any Setting	Fully Open	Fully Closed	Optional	Open (Rolled)
Heating with 100% Recir-culated Air	LOW HEAT or HIGH HEAT	Desired Temperature	Fully Closed	Fully Open	Slightly Downward	Optional
Heating with make-up Fresh Air	LOW HEAT or HIGH HEAT	Desired Temperature	Partially or Fully Closed	Partially or Fully Closed	Slightly Downward	Open (Rolled)
Cooling with 100% Recir-culated Air	COOL	Desired Temperature	Fully Closed	Fully Open	Slightly Upward	Open (Rolled)
Cooling with make-up Fresh Air	COOL	Desired Temperature	Partially or Fully Open	Partially or Fully Closed	Slightly Upward	Open (Rolled)
Any Mode - with make-up Air Through CBR Filter	Desired Mode	Desired Temperature	Fully Open	Partially or Fully Closed	Optional	Open (Rolled)

2-8. INFORMATION PLATES.

A number of information plates are provided on the exterior of the air conditioner cabinet. These plates are located on, or adjacent to, the control or device to which they apply. See figure 2-3 for locations and printed information.

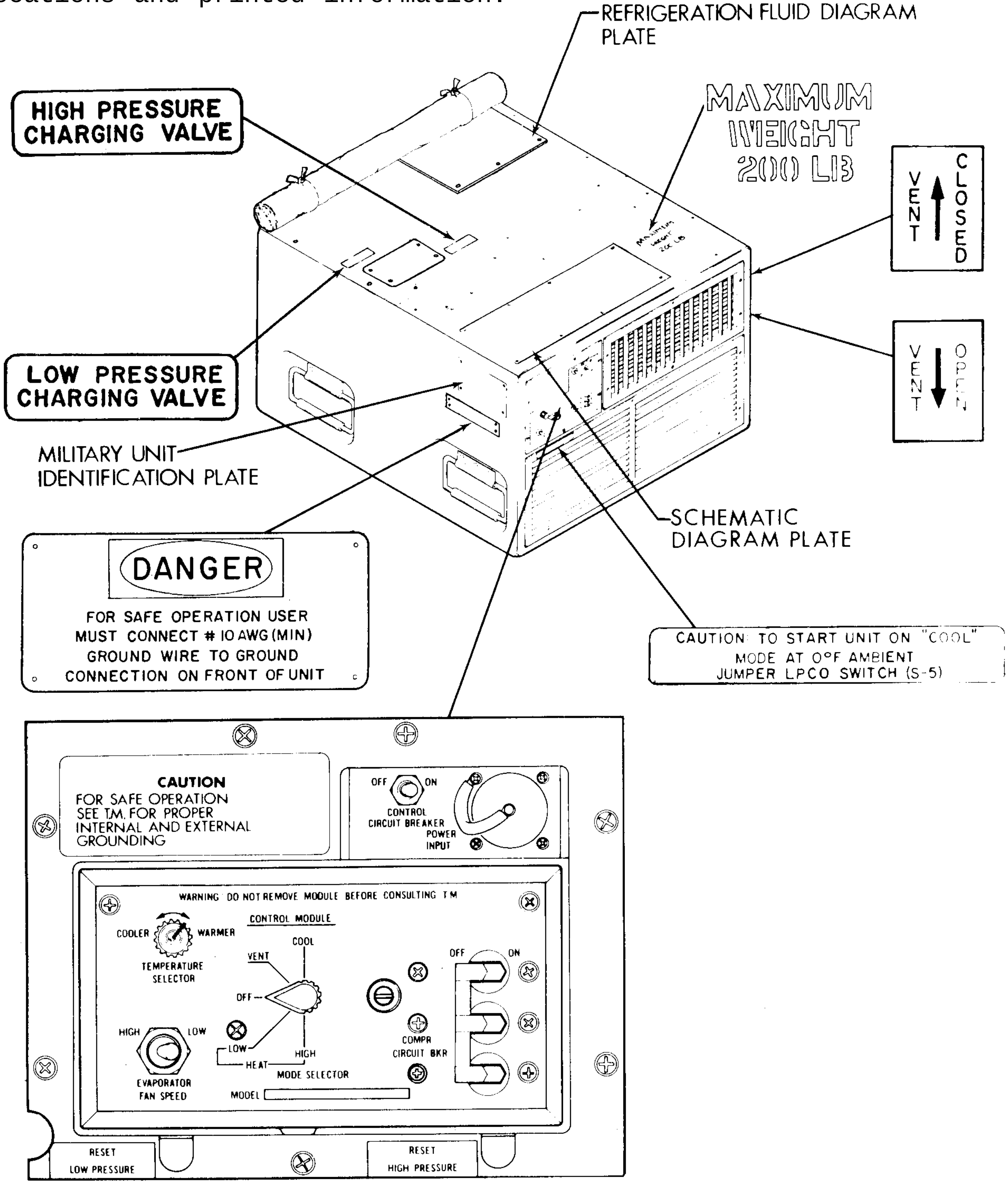


Figure 2-3. Instruction Plates, Stencil Marking Information, and Locations

2-9. PREPARATION FOR MOVEMENT.

No special operator preparation is required when the air conditioner is to be moved to another location.

a. Close the louvers in the evaporator intake and discharge grilles.

b. Close the fresh air damper.

c. Roll the fabric cover down and snap it in place to the back of the cabinet.

Section IV OPERATION UNDER UNUSUAL CONDITIONS

2-10. GENERAL.

The Model F9000H-3S Air Conditioner is designed to operate normally within a wide range of climatic conditions. However, some extreme conditions require special operating and servicing procedures to prevent undue loading and excessive wear on the equipment.

2-11. OPERATION IN EXTREME HEAT.

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 extremely high temperatures. Some of the steps that may be taken are:

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

b. When appropriate use shades or awnings to shut out direct rays of the sun.

c. When possible limit the use of electric lights and other heat producing equipment.

d. Limit the amount of hot, outside air introduced through the fresh air damper to that essential for ventilation.

2-11. OPERATION IN EXTREME HEAT.-Continued

NOTE

Weather stripping, 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 is anticipated.

e. Clean filter, mist eliminator, and coils more frequently.

2-12. OPERATION IN EXTREME COLD.

CAUTION

Do not disturb electrical wiring that has been exposed to extremely low temperatures. Both the wire and insulation become brittle when cold and are easily broken.

The air conditioner is designed to operate in the HEAT mode at temperatures down to -50°F (-45°C) and in the COOL mode at outside temperatures down to 0°F (-18°C). Extra care should be taken to minimize the heating load when operating in extremely low temperatures. Some of the steps that may be taken are:

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

b. Open shades and awnings to permit entry of direct rays of the sun, if appropriate.

c. Limit the amount of cold, outside air introduced through the fresh air damper to that essential for ventilation.

NOTE

Weather stripping, the installation of storm doors, and windows, if appropriate, and insulation of surfaces exposed to the outside is recommended when operation at extremely low temperatures for extended periods is anticipated.

d. Before attempting to start the unit in the COOL mode or when fresh air is being used during the HEAT mode, be sure that cover is rolled up and all exposed air openings are clear of ice and snow.

2-12. OPERATION IN EXTREME COLD.-Continued

e. When the unit is to be used at low temperatures in the COOL mode, the low refrigerant pressure cutout switch must be jumped. Contact organizational maintenance. (See para 4-39.)

f. Be sure that all dampers are operating freely.

g. If unit is not being used or is being used in the HEAT mode without fresh air, close (roll down) and secure the fabric cover.

2-13. OPERATION IN DUSTY OR SANDY CONDITIONS.

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. Some of the steps that may be taken are:

a. Frequent cleaning of filters, mist eliminator, coils and all other areas of dust and sand accumulation. In extreme conditions, daily cleaning of filters may be necessary.

b. Limit the amount of dusty or sandy outside air introduced through the fresh air damper to that essential for ventilation.

c. Roll down and secure the fabric cover on the back of the cabinet during periods of shutdown.

2-14. OPERATION IN UNUSUALLY WET CONDITIONS.

The air conditioner is designed for normal exposure to the elements, so it is reasonably waterproof. Some of the steps that should be taken in an extremely wet climate are:

a. More frequent inspection and cleaning of the mist eliminator condensate trap, and drain lines to insure proper drainage and prevent accumulation of water inside the cabinet.

b. Roll down and secure the fabric cover on the back of the cabinet during periods of wet, windy weather when the air conditioner is not in operation.

c. Roll up and secure the fabric cover during dry weather when the air conditioner is not in operation so that the interior can dry out and condensation will not accumulate.

2-15. OPERATION IN SALT AIR OR SEA SPRAY.

Salt air or sea spray may cause many of the same clogging problems as encountered when operating in a dusty or sandy environment. In addition, the nature of salt presents serious corrosion problems. Some of the steps that should be taken when operating in a salt air or sea spray environment are:

a. Frequent cleaning during which all exposed surfaces should be thoroughly spray rinsed or sponged with fresh water to remove salt deposits.

b. Roll down and secure the fabric cover on the back of the cabinet during all periods when the air conditioner is not in operation.

2-16. OPERATION UNDER EMERGENCY CONDITIONS.

a. CBR Hazard. When operation is anticipated under potential chemical-biological-radiological (CBR) conditions, a CBR filtering unit should be connected to the fresh air intake. It may be necessary to remove the guard and fabricate a special adapter for this connection. Adjust the return air louvers in conjunction with the CBR filter controls to provide a higher overpressure within the room or enclosure.

b. Power Conservation. During periods when full electrical power is in critically short supply, if the air conditioner cannot be turned off completely, it should be operated in VENTILATE mode only when possible.

CHAPTER 3

OPERATOR'S MAINTENANCE INSTRUCTIONS

Section I LUBRICATION INSTRUCTIONS

3-1. GENERAL.

The Model F9000H-3S Air Conditioner and its major components are designed so that very little lubrication is required during their serviceable lifetime. The refrigerant compressor and its drive motor are hermetically sealed in a single canister; sealed bearings are incorporated in the drive motor and the compressor is supplied with a complete charge of oil and requires no lubrication. Sealed bearings are incorporated in the evaporator and condenser fan motors. Report stiffness or binding of all operational controls to organizational maintenance for appropriate action.

Section II TROUBLESHOOTING

3-2. USE OF TROUBLESHOOTING TABLE.

Table 3-1 contains troubleshooting information useful to operators in diagnosing and correcting malfunctions or unsatisfactory operation of the air conditioner.

a. The Troubleshooting Table lists the common malfunction symptoms operators are most likely to encounter during operation of the air conditioner; test and inspection steps to be followed to determine the cause; and the corrective action that should be taken for each possible cause listed.

3-2. USE OF TROUBLESHOOTING TABLE.-Continued

b. The operator should first find the malfunction symptom which most closely describes the immediate situation. Then perform the test, inspection, and corrective action steps in the order in which listed.

c. This manual cannot list all possible malfunction symptoms that may be encountered, nor can it list all possible test, inspection and corrective action steps that may be taken. If a malfunction occurs for which no symptom is listed, or if the listed corrective actions do not resolve the trouble, notify your supervisor.

d. Troubles or corrective actions beyond the scope of operator capabilities must be reported to organizational maintenance.

Table 3-1. OPERATOR TROUBLESHOOTING

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

1. AIR CONDITIONER DOES NOT START IN ANY MODE.

Step 1. Check that input power has not been disconnected.

Connect input power.

CAUTION

During cool weather do not start in COOL mode for four hours.

Step 2. Check if CONTROL CIRCUIT BREAKER or COMPR CIRCUIT BKR has tripped.

Reset circuit breaker(s).

2. REDUCED COOLING CAPACITY.

Step 1. Check that MODE SELECTOR switch is turned to COOL.

Turn switch to COOL.

Table 3-1. OPERATOR TROUBLESHOOTING-Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 2. Check operation of TEMPERATURE SELECTOR.

Set control at maximum COOLER, then, if condition improves, adjust properly.

Step 3. Check that supply and return air louvers are properly adjusted.

Adjust louvers properly.

Step 4. Check that excessive hot, outside air is not being introduced through fresh air damper.

Fully close damper, then, if condition improves, adjust properly.

Step 5. Check that all doors, windows, and other openings in room or enclosure are tightly closed.

Tightly close all openings.

Step 6. Check if EVAPORATOR FAN SPEED switch is set at LOW speed.

Set switch to HIGH speed.

Step 7. Check that condenser air inlet guard or discharge air louver are not obstructed.

Remove obstruction.

Step 8. Check condition of refrigerant in sight glass.

If refrigerant color is in the yellow zone or numerous bubbles appear in window, turn selector to OFF and contact direct support maintenance.

3. REDUCED HEATING CAPACITY.

Step 1. See that MODE SELECTOR switch is properly set.

Set switch on LOW or HIGH HEAT.

Table 3-1. OPERATOR TROUBLESHOOTING-Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 2. Check operation of TEMPERATURE SELECTOR switch.

Set control to fully WARMER then, if condition improves, adjust properly.

Step 3. Check that supply and return air louvers are properly adjusted.

Adjust louvers to open position.

Step 4. Check that excessive cold, outside air is not being introduced through fresh air damper.

Fully close damper, then, if condition improves, adjust properly.

Step 5. Check that all doors, windows, and other openings in room or enclosure are tightly closed.

Tightly close all openings.

4. TOO MUCH HEAT.

Step 1. See that MODE SELECTOR switch is properly set.

Set switch on LOW HEAT. (When MODE SELECTOR switch is set for HIGH HEAT, half of the heaters will operate all of the time.)

Step 2. Check operation of TEMPERATURE SELECTOR switch.

Adjust to a slightly COOLER setting.

CHAPTER 4

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

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

4-1. GENERAL.

a. Repair parts are listed and illustrated in TM5–4120-383-24P. No special tools are required for maintenance of the equipment. Test, maintenance, and diagnostic equipment (TMDE), and support equipment include standard electrical test equipment found in any organizational maintenance electric shop.

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

c. Tool Kit, Service, Refrigeration Unit, NSN 5180-00–596–1474, contains hand tools and equipment used for air conditioner maintenance. The following common items not contained in the refrigeration unit tool kit are also required for air conditioner maintenance.

Description	National Stock Number
Brush, Bristle	7520-00-223-8000
Brush, Wire	7920-00-282-9246
Bucket	7240-00-137-1609
Heat Gun	4940-01-042-4855
Multimeter	6625-00-553-0142
Pliers, Long Round Nose	5120-00-268-3579

4-1. GENERAL.-Continued

Rubber Gloves	8415-00-266-8677
Safety Goggles	4240-00-052-3776
Screwdriver, Cross Tip No. 2 One Inch Long Blade	5120-00-227-7293
Screwdriver Offset, Cross Tip No. 1	5120-00-256-9014

Section II SERVICE UPON RECEIPT OF EQUIPMENT

4-2. SITE AND SHELTER REQUIREMENTS.

The air conditioner is designed so that it is adaptable to a variety of installation arrangements. Most typical installations are made by preparing an opening in an exterior wall of the room or enclosure to be conditioned and positioning the air conditioner so that the front of the cabinet is inside the room or enclosure and the back of the cabinet is outside. Alternate installations may be made with the entire cabinet either inside or outside the conditioned area. The following are minimum requirements for all installations:

a. A relatively level surface capable of bearing the weight of the air conditioner on which to set the base. To insure proper condensate drainage, the surface should be level within 5° from front to back and side to side. See fig. 4-1, Sheets 1, 2 and 3 for mounting dimensions.

b. An unobstructed flow of air from outside the conditioned area to the intake and discharge of the condenser fan (back face of air conditioner).

c. An unobstructed flow of air from inside the conditioned area to the conditioned air supply and discharge openings (front face of air conditioner).

d. An unobstructed flow of air from outside the conditioned area to the fresh air intake (back face of air conditioner).

e. Access to the front and back of the air conditioner for routine operation and servicing and for necessary maintenance actions.

f. Access to and sufficient headroom to allow removal of the front and rear top panels is necessary, if the unit is to be serviced when installed.

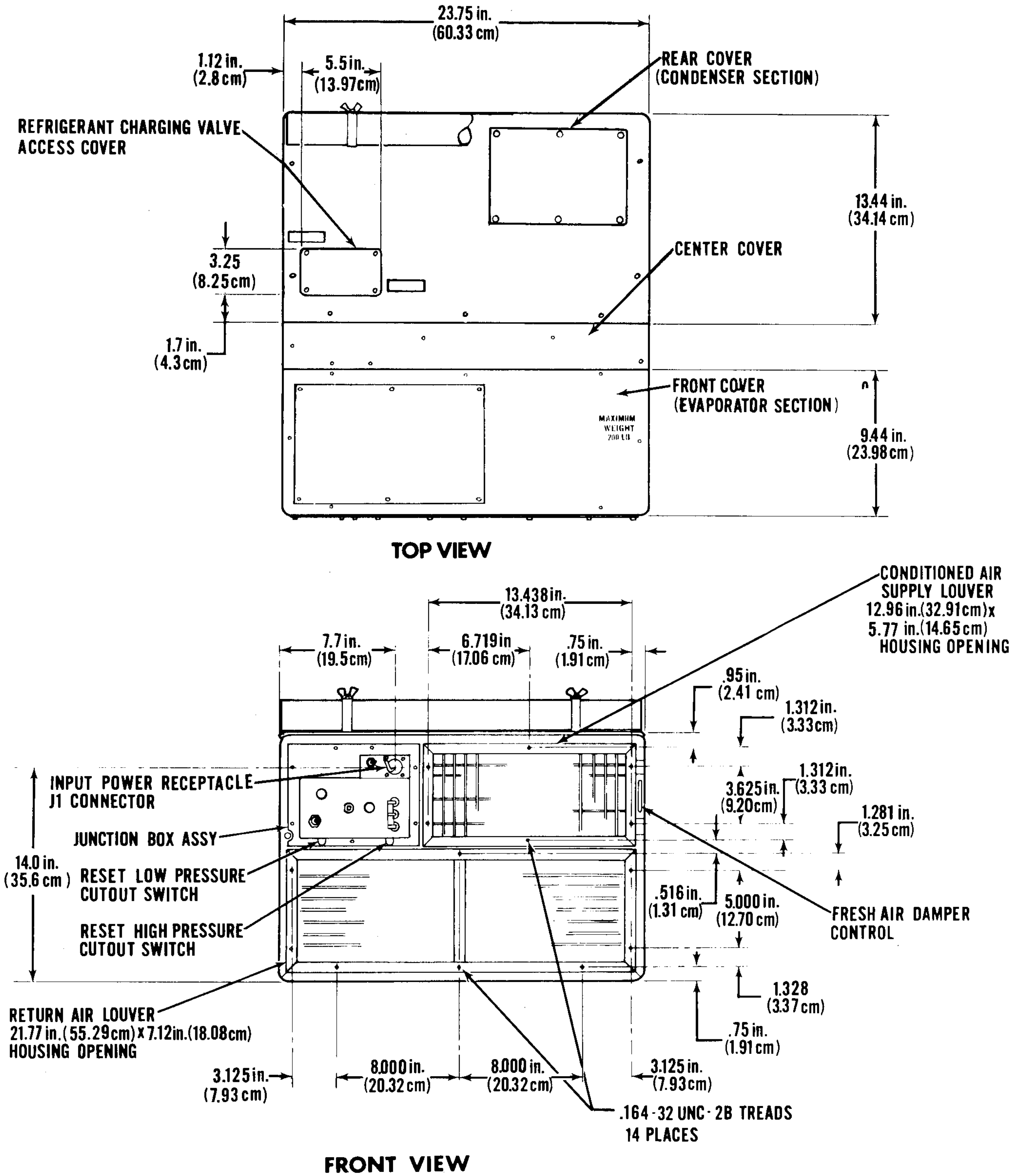
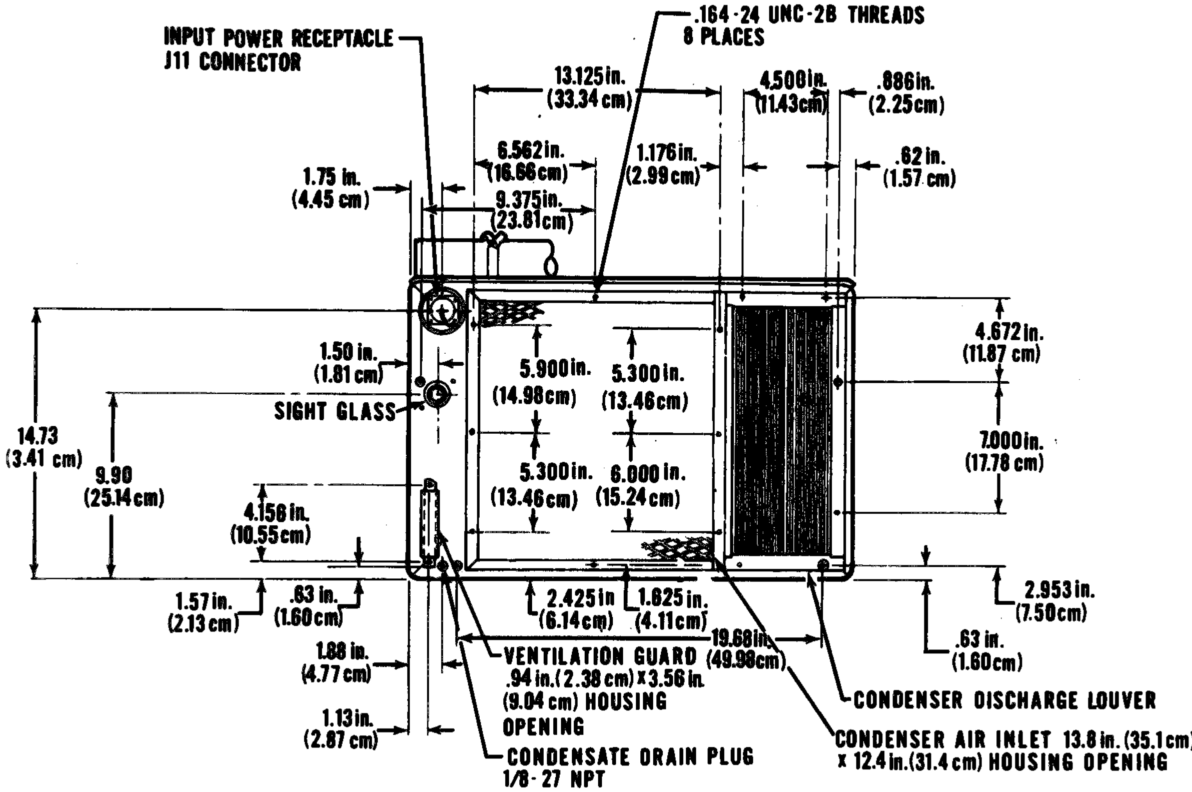
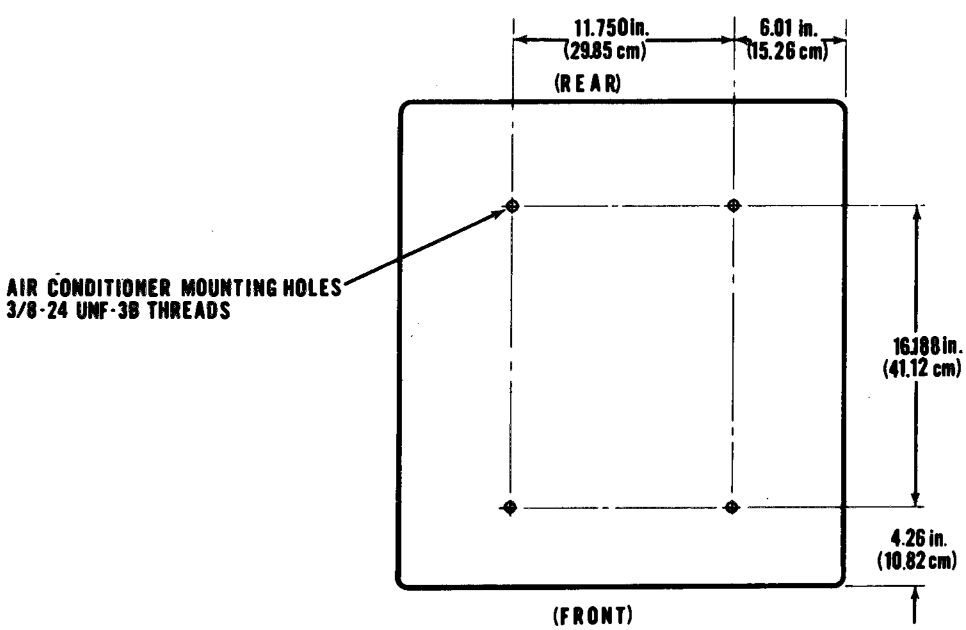


Figure 4-1. Installation Dimensions (Sheet 1 of 3)

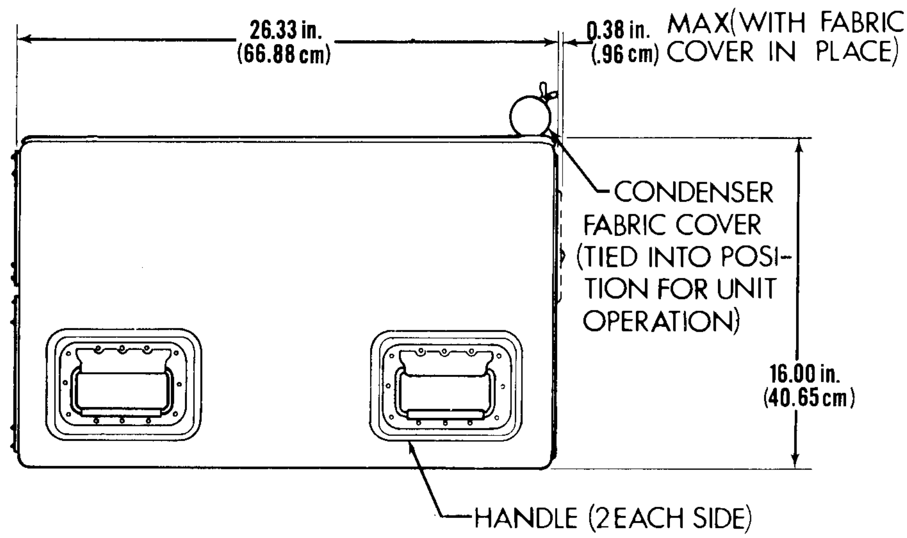


REAR VIEW

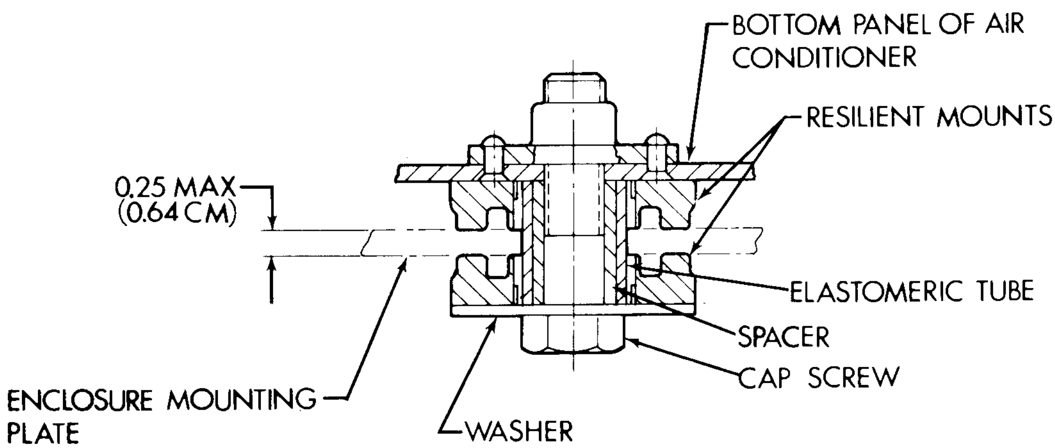


BOTTOM VIEW

Figure 4-1. Installation Dimensions (Sheet 2 of 3)



RIGHT SIDE
VIEW



CROSS SECTION OF
BOTTOM MOUNTING
HOLE AND
HARDWARE
(TYPICAL 4 PLACES)

Figure 4-1. Installation Dimensions (Sheet 3 of 3)

4-2. SITE AND SHELTER REQUIREMENTS.-Continued

g. A source of 208 volt, 3 phase, 50/60 hertz input power rated at 8.3 amps. The power source outlet should be located as near as possible to the installed location of the air conditioner. The power source wiring must include a disconnect switch. However, provisions should be made to insure that power is not disconnected during normal operation and that the disconnect is not used to turn off the air conditioner for normal shutdown.

h. Check that no source of dangerous or objectionable fumes are near the fresh air intake.

i. If possible make use of terrain features such as trees and buildings to provide a shaded location. This minimizes the cooling load on the refrigeration system.

j. If possible avoid a location where the condenser and fresh air intakes will be laden with dust, dirt, soot, smoke or other debris.

4-3. SERVICE UPON RECEIPT OF MATERIAL.

a. Unloading. The Model F9000H-3S Air Conditioner is packaged in a container designed for shipment and handling with the cabinet in an upright position. The base of the container is constructed as a shipping pallet with provisions for the insertion of the tongs of a fork on materials handling equipment.

(1) Remove all blocking and tiedowns that may have been used to secure the container to the carrier.

(2) Use a forklift truck or other suitable material handling equipment to remove the packaged unit from the carrier.

CAUTION

Use care in handling to avoid damage to the air conditioner. If an overhead lifting device must be used, use an appropriate sling so that the weight of the unit is borne by the base of the shipping container.

b. Unpacking.

(1) General. Normally, the packaged air conditioner should be moved into the immediate area in which it is to be installed before it is unpacked.

4-3. SERVICE UPON RECEIPT OF MATERIAL.–Continued

NOTE

The shipping container is of such a design that it may be retained for reuse for mobility purposes if frequent relocation of the air conditioner is anticipated.

(2) Remove Shipping Container. Cut the metal bands that hold the top and sides of the container to the base. Lift the container vertically and remove it from the base and cabinet.

(3) Remove Packaging. Remove the cushioning around the top of the cabinet and retain, if reuse is anticipated. Remove the preservation barrier by tearing around the bottom of the cabinet. Remove the technical publications envelope and accessory sack that are taped to the cabinet and put them in a safe place.

NOTE

It is recommended that the cabinet be left bolted to the shipping pallet until time to place it in the installation position. All receiving inspection actions can be conducted without removal from the pallet.

c. Receiving Inspection. Perform receiving inspection of the air conditioner in the following manner:

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

(2) Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pamphlet 738-750 (The Army Maintenance Management System).

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

NOTE

The unit weight (less shipping pallet) is 185 pounds (83.9 kg). When lifting or moving the unit on the shipping pallet, a forklift may be used. When lifting the unit into position use four people, one at each lifting handle.

4-3. SERVICE UPON RECEIPT OF MATERIAL.-Continued

(4) Remove Pallet. Tilt the unit and pallet or raise the unit using a forklift. Remove the four bolts from the bottom of the pallet. Using 4 people (one at each lifting handle), carefully lift the unit from the shipping pallet.

4-4. INSTALLATION INSTRUCTIONS.

a. Air Conditioner Preparation For Installation.

(1) Two input power connectors are provided on the air conditioner. (See fig. 4-1.) Connector J1 is located on the front of the air conditioner above the control panel module. Connector J11 is located on the rear of the air conditioner in the upper left corner. Determine which connector best suits your installation. If power source is inside of conditioned area use J1. If power source is outside of conditioned area use J11.

(a) Air conditioners are shipped from the factory wired for the use of the J1 power connector. If this connector is used no change is necessary. (See fig. 4-2.)

(b) If the J11 connector is to be used leads TB1.1-TB3.1, TB1.2-TB3.2, and TB1.3-TB3.3 on terminal board TB3 must be moved from terminals 1, 2, and 3 to terminals 4, 5, and 6 respectively. Proceed as follows:

1 Remove top front (evaporator section) cover from air conditioner.

2 Disconnect wire TB1.1-TB3.1 from TB3 terminal 1 and reconnect to terminal 4.

3 Disconnect wire TB1.2-TB3.2 from TB3 terminal 2 and reconnect to terminal 5.

4 Disconnect wire TB1.3-TB3.3 from TB3 terminal 3 and reconnect to terminal 6.

5 Install top front (evaporator section) cover.

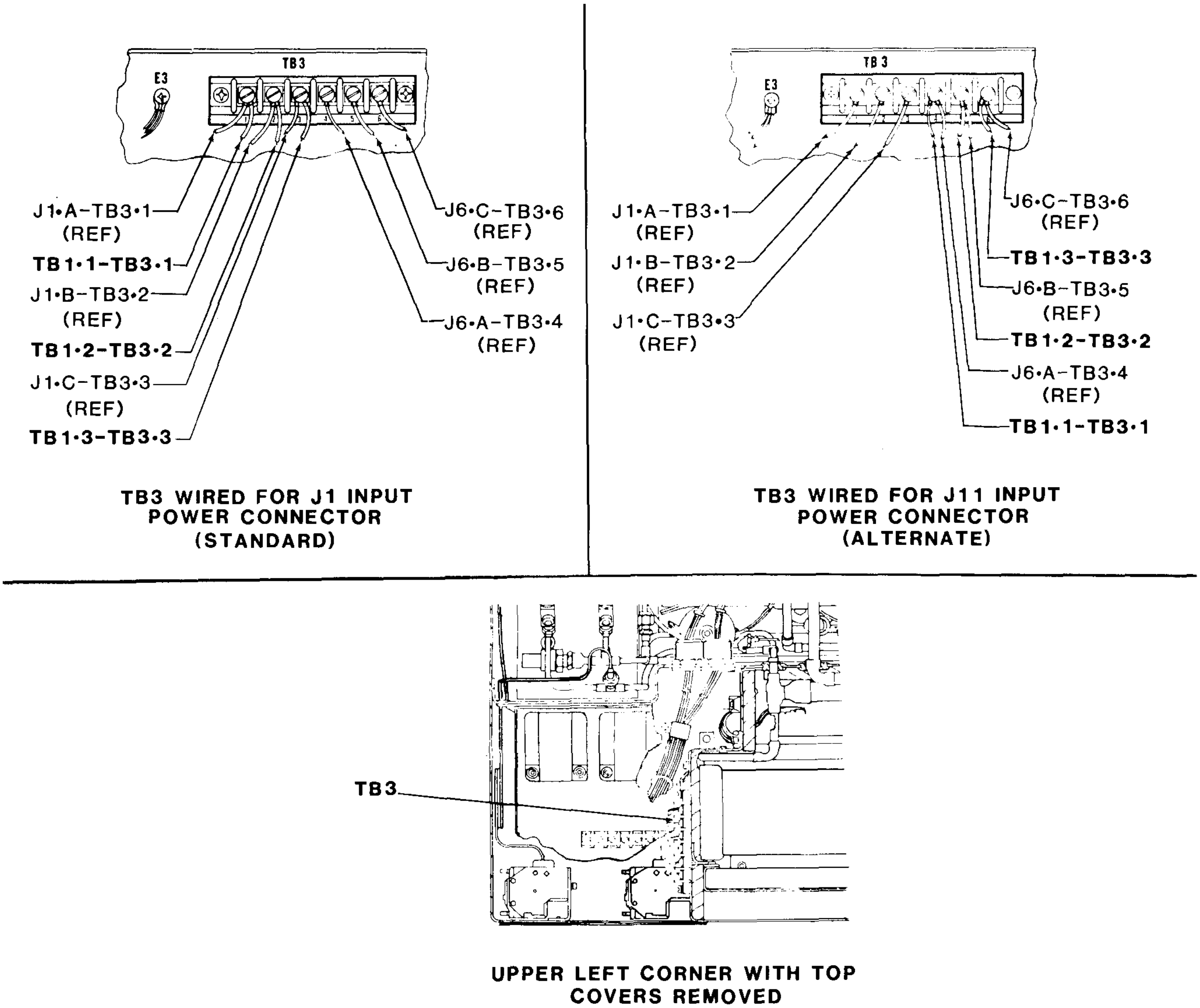


Figure 4-2. Wiring Connection Changes for J1/J11 Power Input Connector

4-4. INSTALLATION INSTRUCTIONS.-Continued

(2) Connectors are provided to permit remote installation of the control module. If it is determined that it is desirable to mount the control module in a remote (mounted elsewhere in the conditioned space) location the following steps must be taken. (See fig. 4-3.)

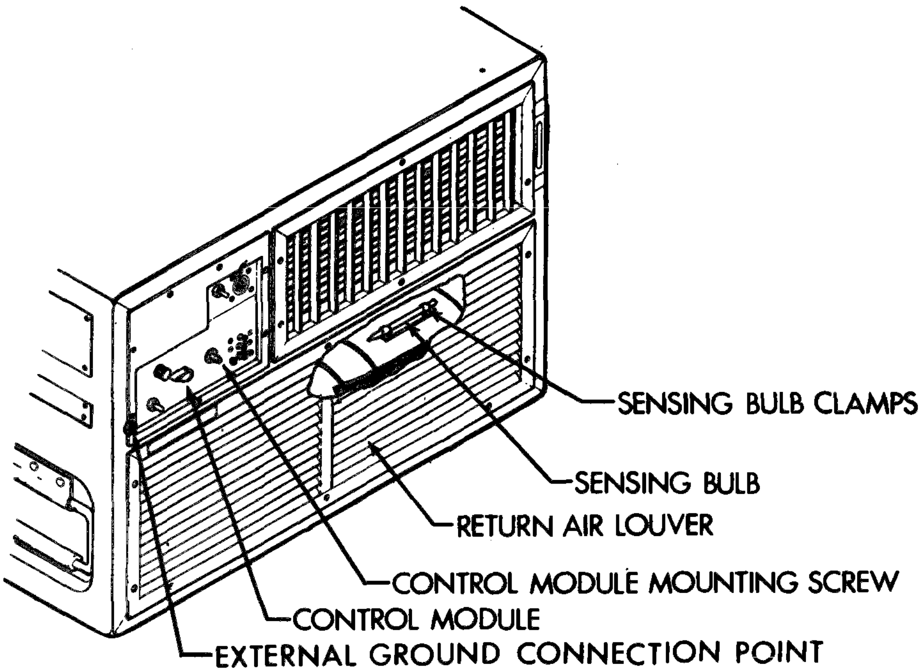


Figure 4-3. Control Module Removal

(a) Remove return air louver (para 4-13).

(b) Loosen sensing bulb clamp screws and slip sensing bulb out of clamps.

(c) Loosen control module mounting screw and carefully pull control module out of unit. Use care to avoid damage to sensing line.

(d) Carefully work sensing bulb through frame and out of the unit.

4-4. INSTALLATION INSTRUCTIONS.-Continued

(e) Determine where control module is to be located. Note that the sensing bulb controls the thermostatic action of the TEMPERATURE SELECTOR. It should be mounted where a true room or enclosure temperature will be indicated. Do not place near heat or cool producing items. A false temperature control would result.

(f) Secure control module and sensing bulb.

(g) The receptacle and plug needed to fabricate the interconnecting cable are provided with unit. Determine length of wire needed to connect plug and receptacle between unit and control module.

(h) See interconnecting remote control cable diagram, figure 4-4, sheet 4 and fabricate the interconnecting cable. This cable will connect between P2A/B and J2A/B.

(i) Connect cable.

(j) Install return air louver (para 4-13).

(3) No other preparation is necessary if the air conditioner is to be installed by the typical exterior wall opening method and operated as a self-contained unit.

b. Installation Instructions. Appropriate alterations to the facility to accommodate the selected method of installation must be completed before actual installation of the air conditioner.

(1) Shelter/Enclosure Preparation. The following information describes a typical through the wall type installation. You may want to alter these instructions to suit your specific application. See figure 4-5 for a through the wall installation that allows removal of the front and rear top panels for service with the unit installed.

COMPONENT REFERENCE LIST		
ELEC REF DES	PART NUMBER	DESCRIPTION
B1	13208E4182-7	COMPRESSOR, RECIPROCATING
B2	13221E9334-3	MOTOR, CONDENSER FAN
B3	13216E6140-3	MOTOR, EVAPORATOR FAN
C1	M39014/05-2461	CAPACITOR, FILTER
C6	13218E6961	CAPACITOR
CB1	13216E6205-1	CIRCUIT BREAKER, COMPRESSOR
CB2	13216E6178-1	CIRCUIT BREAKER, CONTROL
CR1	13216E6223	RECTIFIER, SEMICONDUCTOR DEVICE
E1	MS24693-S50	TERMINAL STUD (CONTROL MODULE GND)
E2	MS24693-S52	TERMINAL STUD (JUNCTION BOX GND)
E3 AND E4	MS35206-246	TERMINAL STUD (SYSTEM GND)
HR1 THRU 6	13216E6124-1	HEATER ELEMENT
J1 AND J11	MS3100R-18-11P	CONNECTOR, RECEPTACLE, POWER INPUT
J2	13216E6177	CONNECTOR, RECEPTACLE JUNCTION BOX
J3	13216E6193-2	CONNECTOR, RECEPTACLE, EVAPORATOR FAN
J4	13216E6193-3	CONNECTOR, RECEPTACLE, COMPRESSOR
J5	13216E6193-2	CONNECTOR, RECEPTACLE, CONDENSER FAN
J6	13216E6193-5	CONNECTOR, RECEPTACLE, POWER INPUT
J8	13216E6193-1	CONNECTOR, RECEPTACLE SOLENOID VALVE
		BY-PASS
J9	13216E6193-1	CONNECTOR, RECEPTACLE, SOLENOID VALVE
		EQUALIZER
J10	PART OF B1	CONNECTOR, RECEPTACLE, COMPRESSOR
	13208E4182	
K1	13225E8024-1	RELAY, TIME DELAY
K2	MS24192D1	RELAY, HEATER
K3	MS24192D1	RELAY, COMPRESSOR MOTOR
K4	13216E6184	RELAY, CONDENSER FAN
K5	13216E6183	RELAY, PHASE SEQUENCE
L1	13216E6158	VALVE, SOLENOID, BY-PASS
L2	13216E6158	VALVE, SOLENOID, PRESSURE EQUALIZER
P1	MS3106R-18-11S	CONNECTOR, PLUG, POWER INPUT
P2	13216E6209-2	CONNECTOR, PLUG, CONTROL MODULE
P3	PART OF	CONNECTOR, PLUG, EVAPORATOR FAN
	13216E6140	
P4	MS3106R-20-15P	CONNECTOR, PLUG, COMPRESSOR
P5	PART OF	CONNECTOR, PLUG, CONDENSER FAN
	13221E9334	
P6	MS3106R-18-11S	CONNECTOR, PLUG, POWER INPUT
P8	13216E6173	CONNECTOR, PLUG, SOLENOID VALVE BY-PASS
P9	13216E6173	CONNECTOR PLUG, SOLENOID VALVE EQL
P10	MS3106R-20-15S	CONNECTOR, PLUG, COMPRESSOR
S1	13216E6201	SWITCH, ROTARY SELECTOR
S2	13216E6200	SWITCH, TOGGLE
S3	13216E6203	SWITCH, TEMPERATURE CONTROL
S4	13216E6215-3	SWITCH, HIGH PRESSURE CUTOUT
S5	13216E6215-1	SWITCH, LOW PRESSURE CUTOUT
S6	13216E6224	SWITCH, HEATER CUTOUT
T1	13221E9117	TRANSFORMER
TB1	13216E6232-6	TERMINAL BOARD, JUNCTION BOX
TB2	13216E6220-1	TERMINAL BOARD
TB3	13216E6232-6	TERMINAL BOARD, POWER INPUT

TO ENERGIZE THE UNIT FROM THE AUXILIARY POWER INPUT SOURCE (J11), THE LEADS ORIGINATING FROM TB1-1, TB1-2 AND TB1-3 ON TB3-1, -2 AND -3 MUST BE CHANGED TO TB3-4, -5, AND -6 RESPECTIVELY.

Figure 4-4. Wiring Diagram (Sheet 1 of 4)

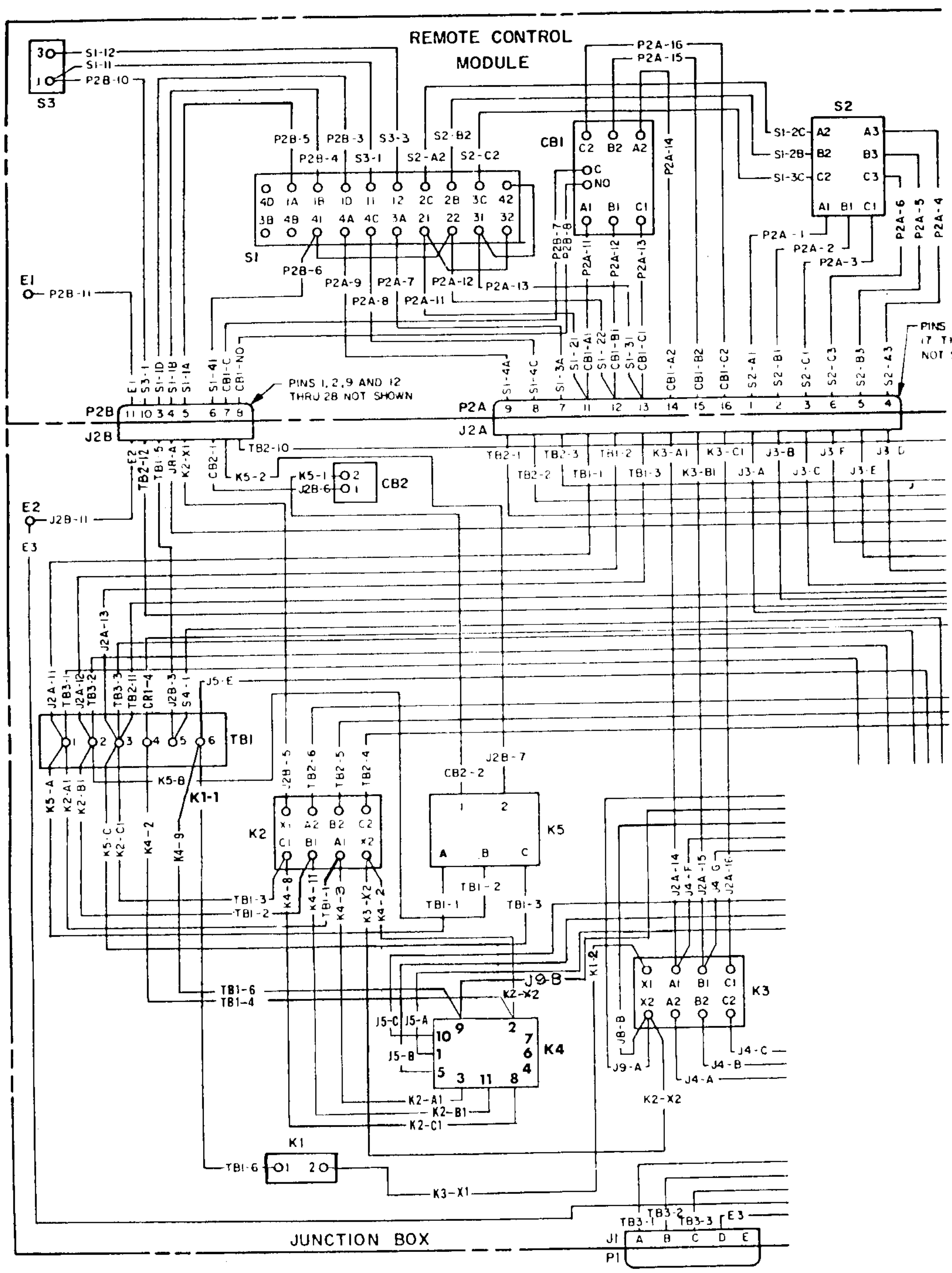


Figure 4-4. Wiring Diagram (Sheet 2 of 4)

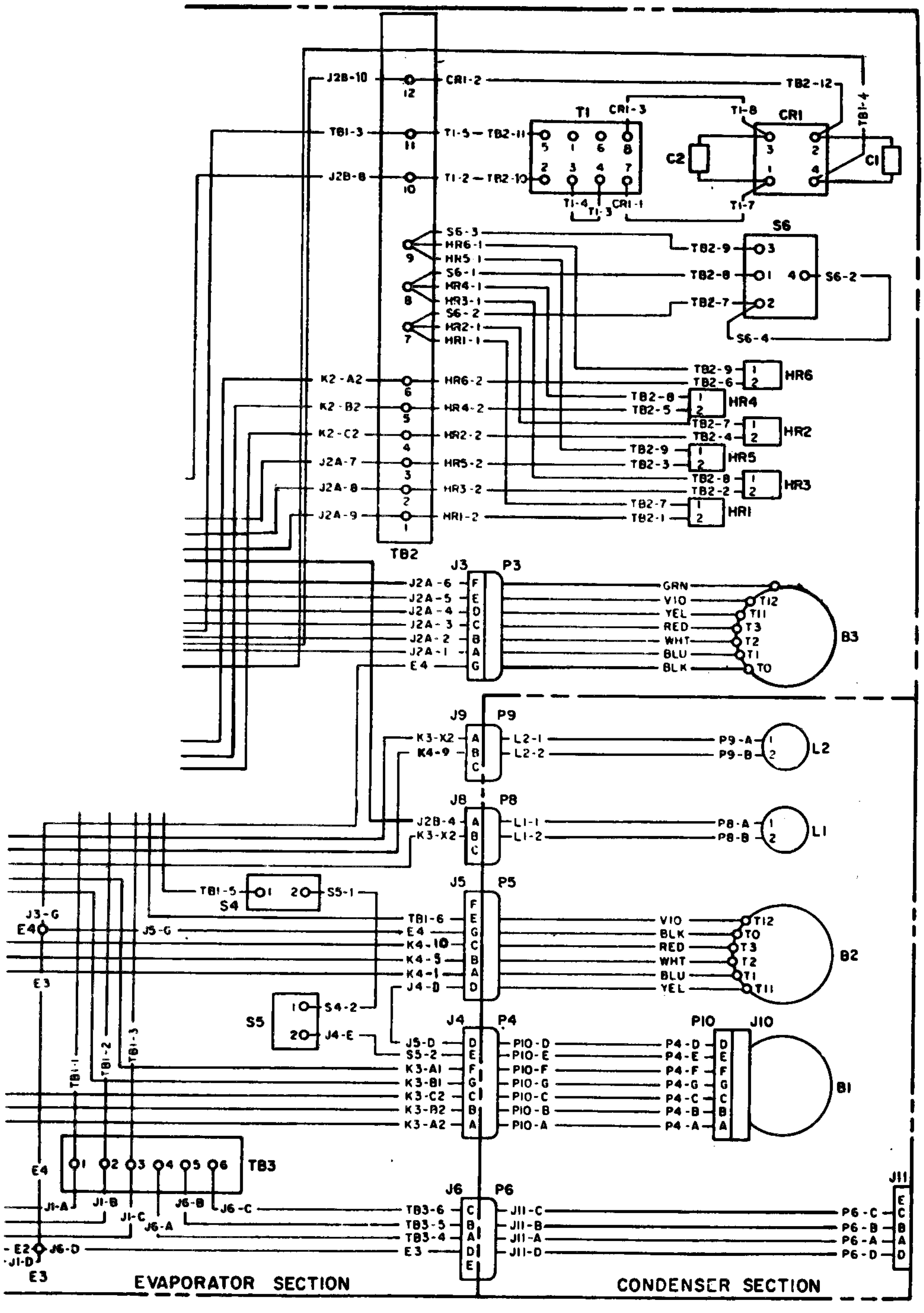
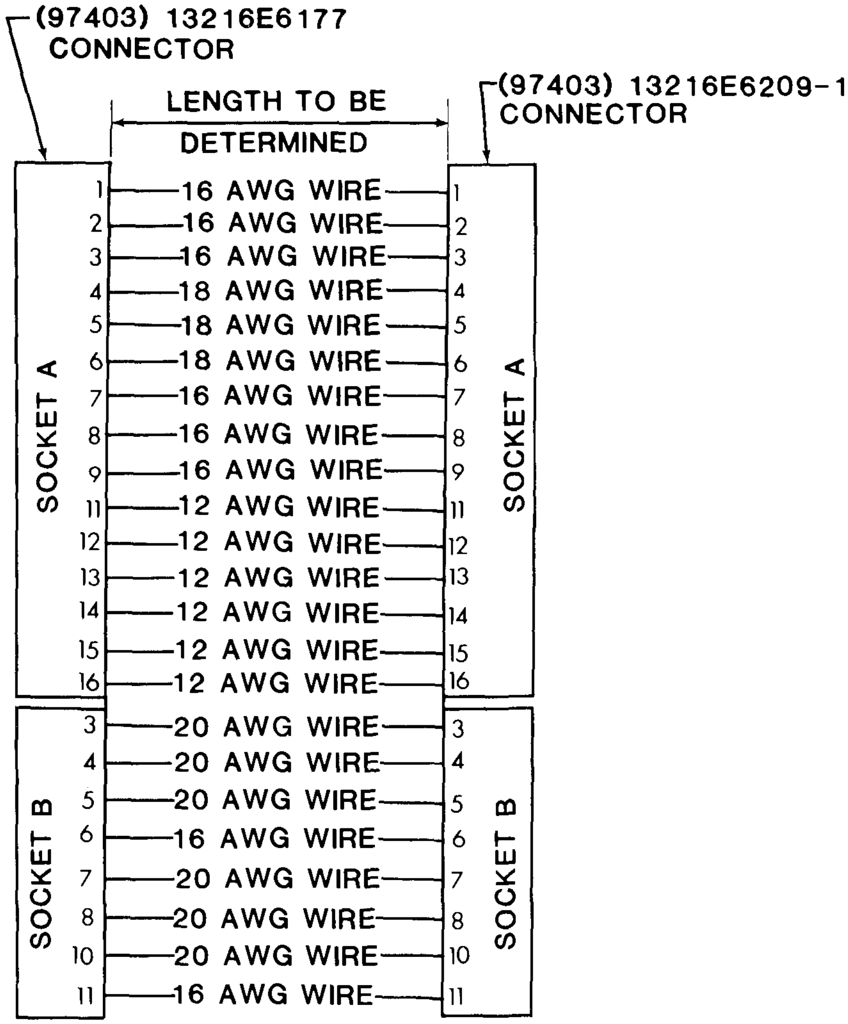
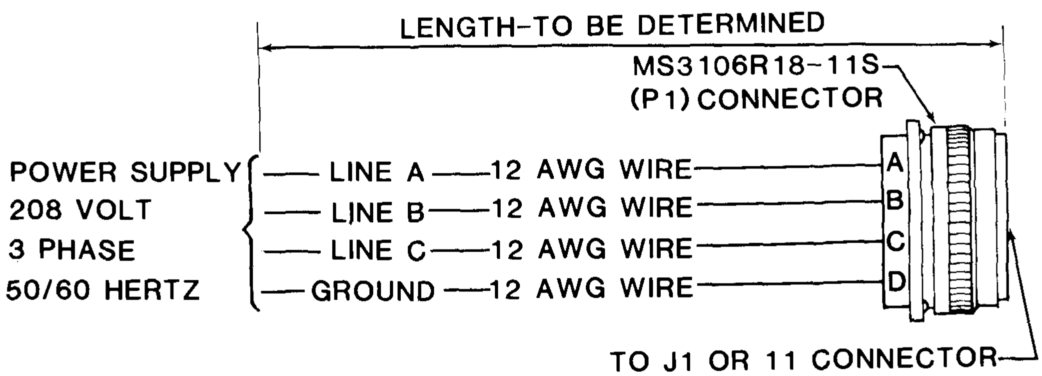


Figure 4-4. Wiring Diagram (Sheet 3 of 4)



INTERCONNECTING REMOTE CONTROL CABLE DIAGRAM



INPUT POWER CABLE DIAGRAM

Figure 4-4. Wiring Diagram (Sheet 4 of 4)

4-4. INSTALLATION INSTRUCTIONS.-Continued

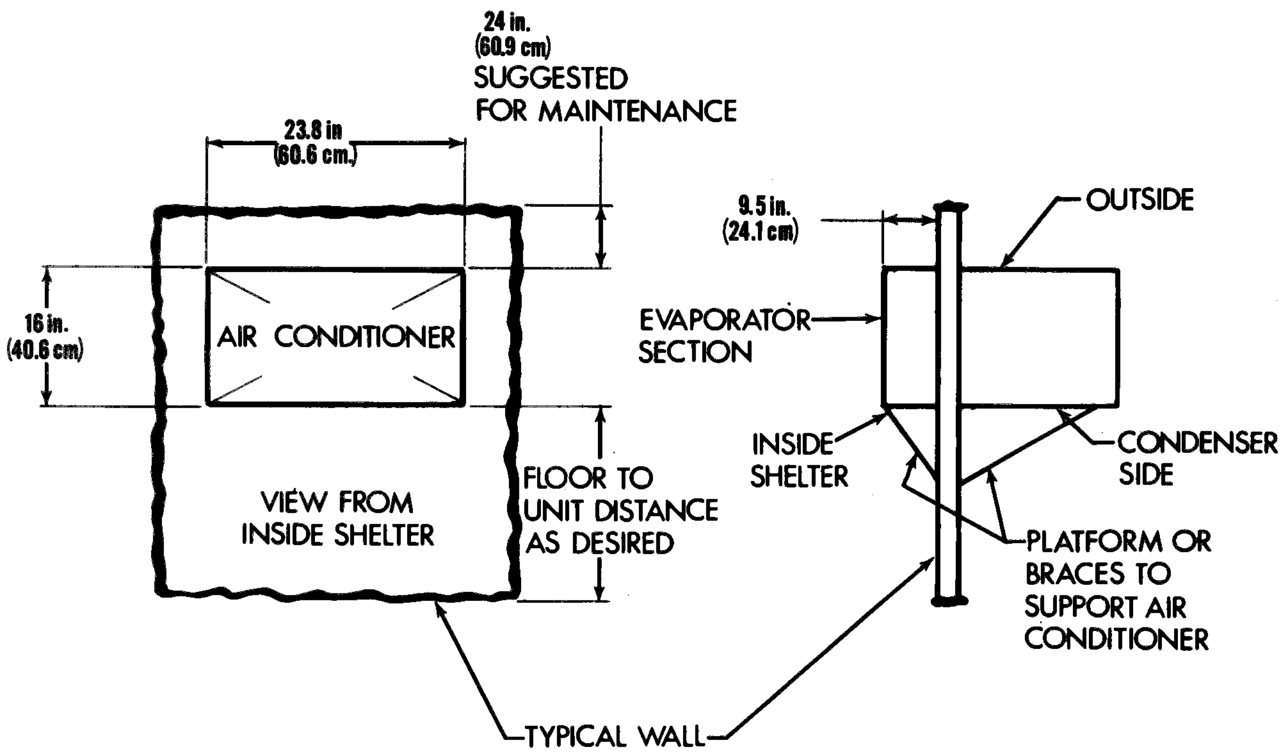


Figure 4-5. Typical Through the Wall Installation

(a) Determine best location.

(b) Make cutout in wall slightly larger than overall dimension of air conditioner.

(c) Fabricate a mounting platform or braces. Provide mounting holes to match holes in bottom of air conditioner. See figure 4-1, Sheet 2.

4-4. INSTALLATION INSTRUCTIONS.-Continued

(2) Lift air conditioner into position. Use adequate equipment or four people to lift the unit into position.

(3) Secure unit to mounting platform or braces with four sets of mounting hardware provided with unit. See figure 4-1, sheet 3, for cross section view of bottom mounting holes and hardware.

WARNING

For safe operation, connect a 10 AWG (minimum) ground wire to the air conditioner external ground. Make sure that shelter is properly grounded.

(4) Connect a 10 AWG (minimum) ground wire from shelter ground to air conditioner external ground. The air conditioner external ground connection point is located on front left side of control module. (See figure 4-3.)

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

(6) Fabricate an input cable of required length using the MS3106R18-11S connector supplied with air conditioner for connection to J1 or J11. (See chart below and figure 4-4 Sheet 4.) If J11 connector is used, be sure the wiring to TB3 terminal board is relocated in accordance with paragraph 4-4 a.

Pin	Internal wiring connection J1 and J11
A	Phase A
B	Phase B
C	Phase C
D	Ground
E	Blank (not used)

4-4. INSTALLATION INSTRUCTIONS.-Continued

(7) Remove the condensate drain plug from lower left rear corner of the unit. If air conditioner is mounted in a location where water pouring from this drain will be objectionable or create a hazard, connect a drain line at this point. The fitting used must have a male 1/8 - 27 NPT connection to unit. Hose, rigid pipe or tubing can be used to direct drain water to a more desirable disposal location.

(8) Connect power cable to input power source (208 volt, 3 phase, 50/60 hertz) and air conditioner.

(9) Run operational checks in accordance with paragraph 2-6.

4-5. PRELIMINARY SERVICING AND ADJUSTMENT OF EQUIPMENT.

Lubrication.

a. General. The refrigerant compressor and its drive motor are hermetically sealed in a canister. **The compressor is supplied with a complete charge of oil and requires no lubrication.** The evaporator and condenser fan motors also have permanently lubricated, sealed bearings. No lubrication of these items is required.

b. Mechanical Lubrication. The only mechanical items which may require lubrication are the conditioned air supply and return louvers, the condenser air discharge louver and control linkages and the devices which operate the fresh air damper door. These points should be checked and lubricated, as necessary during preventive maintenance service. A few drops of light oil should be applied to pivot points, bearing surfaces, and linkages to prevent or eliminate stiffness or binding. Be sure to wipe off all excess oil with a cloth or paper towel. These items are in an area of high volume airflow and excess oil will tend to attract and accumulate dust particles from the passing air. Graphite may be used as an alternate lubricant during extreme cold weather operation.

Section III PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

4-6. GENERAL.

Systematic, periodic, preventive maintenance checks and services (PMCS) are essential to insure that the air conditioner is ready for operation in any mode at all times. The purpose of a preventive maintenance program is to discover and correct defects and deficiencies before they can cause serious damage or complete failure of the equipment. Any effective preventive maintenance program must begin with the training of operators to report all unusual conditions noted during daily checks or actual operation to organizational maintenance. All defects and deficiencies discovered during maintenance inspections must be recorded, together with corrective action taken, on DA Form 2404 (Equipment Inspection and Maintenance Worksheet).

4-7. INSPECTION AND SERVICE.

a. A schedule for organizational preventive maintenance inspection and service should be established immediately after installation of the air conditioner. A quarterly interval, equal to three calendar months or 250 hours of operation, whichever occurs first, is recommended for usual operating conditions. When operating under unusual conditions, such as a very dusty or sandy environment, it may be necessary to reduce the interval to monthly or even less if conditions are extreme.

b. Table 4-1 lists the organizational preventive maintenance checks and services that should be performed at quarterly (or otherwise established) intervals. Figure 4-6 shows the location of PMCS items. The PMCS items in the table have been arranged and numbered in a logical sequence to provide for greater personnel efficiency and least amount of required maintenance downtime. The "Para Ref" (Paragraph Reference) column on the right side of the table provides the paragraph number where detailed, step-by-step disassembly/reassembly maintenance procedures may be found. The item number column will be used as a source of item numbers for the TM Number Column on DA Form 2404.

WARNING

Disconnect input power before disassembly of the air conditioner for PMCS to prevent dangerous, possibly fatal, electrical shock.

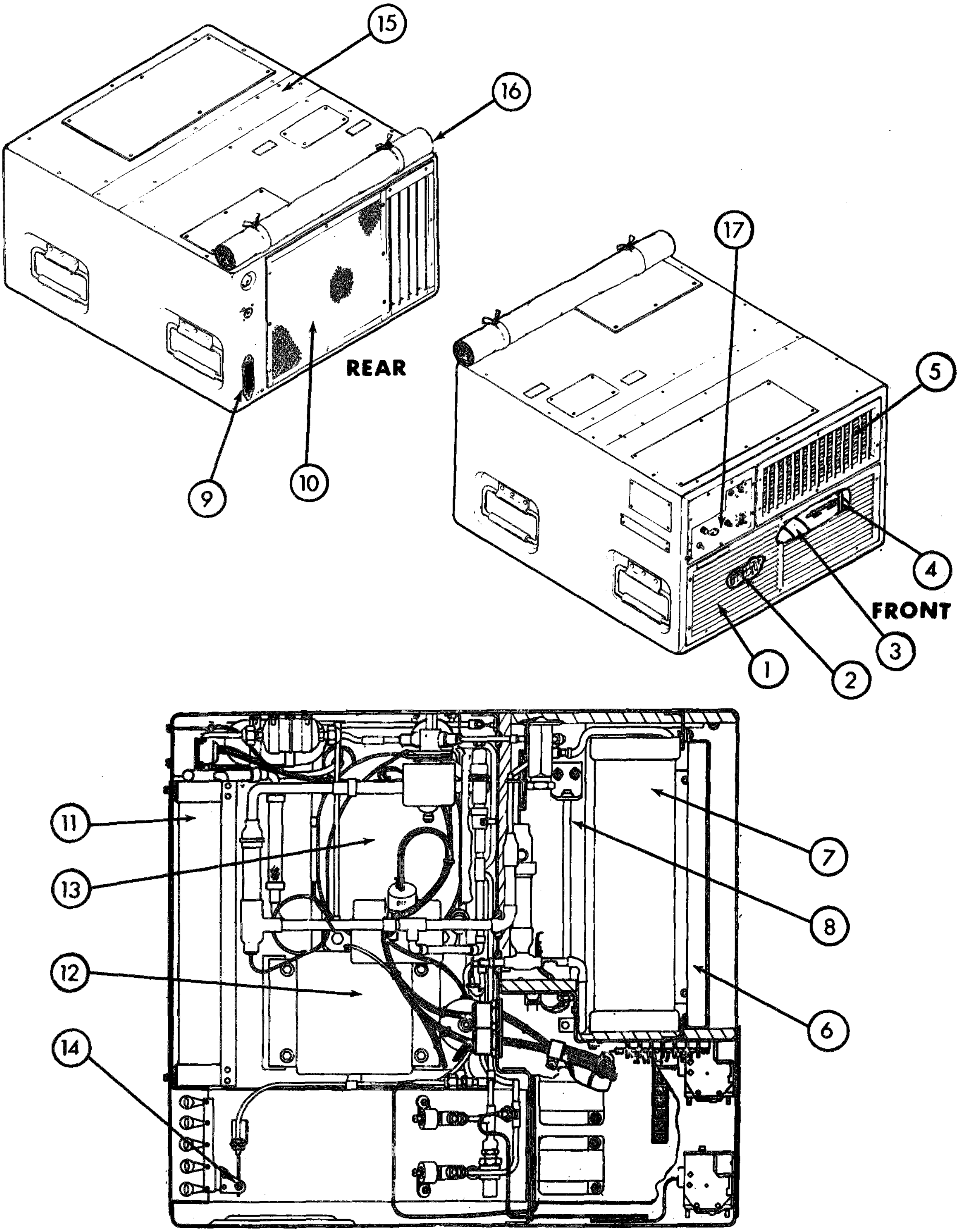


Figure 4-6. Location of PMCS Items

Table 4-1. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) QUARTERLY SCHEDULE

Item No.	Item to be Inspected/Serviced	Procedures	Para Ref.
1	Return Air Louver	a. Check operation of louvers for stiffness or binding.	4-13
		b. Remove, clean, inspect, repair, and lubricate as necessary.	
		c. Set aside for the present and reinstall after item 4.	
2	Conditioned Air Filter	a. Remove, clean, inspect, and service filter.	4-13
		b. Discard filter and obtain replacement if damaged.	
		c. Place filter aside for the present and reinstall after item 4.	
3	Conditioned Air (Evaporator) Fan and Motor	a. Wipe or vacuum all dust or dirt from fan, motor, and all other components and surfaces in the area.	4-33
		b. Inspect fan for damaged or bent blades, the motor for signs of overheating and all mounting hardware for tightness and security.	
		c. Inspect wiring harness for damage or chafing and all electrical. connections for tightness.	
4	Condensate Drain Tubing	a. Check for loose connections missing clamps, indications of water leaks, and damaged or missing tubing.	4-19
		b. Repair or replace as indicated.	
		c. Install filter and return air louver,	

Table 4-1. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)
QUARTERLY SCHEDULE-Continued

Item No.	Item to be Inspected/Serviced	Procedures	Para Ref.
5	Conditioned Air Supply Louver	a. Check operation of louvers for stiffness or binding.	4-14
		b. Remove, clean, inspect, repair, and lubricate as necessary.	
		c. Set aside for the present and reinstall after item 8.	
6	Mist Eliminator	a. Remove, clean, and inspect top front cover. Set aside for present and reinstall after item 8.	4-16
		b. Remove, clean, inspect, and service mist eliminator.	
		c. Replace mist eliminator if it is damaged.	
		d. set aside for the present and reinstall after item 8.	
		WARNING Compressed air used for cleaning purposes will not exceed 30 psi (2.1 kg/cm^2).	
7	Evaporator Coil	a. Blow accumulated dust and dirt out of air passages in evaporator coil using compressed air or the discharge side of a portable vacuum cleaner. Blow from front to back in opposite direction from operational airflow.	4-37
		b. Inspect coil for obvious damage and all mounting hardware for tightness and security.	

Table 4–1. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) QUARTERLY SCHEDULE–Continued

Item No.	Item to be Inspected/Serviced	Procedures	Para Ref.
8	Heating Elements	a. Wipe or vacuum any remaining dust or dirt from heating elements, heater thermostat, and all other components and surfaces in the area. **NOTE** Use a clean, dry cloth (or one slightly moistened with water) for all wiping operations. NEVER use an oily or greasy cloth, any oily residue left on any surface will attract and accumulate much more dust and dirt than dry surfaces. b. Inspect heating elements and thermostat for obvious damage and all mounting hardware for tightness and security. c. Inspect wiring harness for damage or chafing and all electrical connections for tightness. d. Install mist eliminator, conditioned air supply louver, and top front cover.	4-35
9	Fresh Air Ventilation Guard	a. Remove, clean, inspect, and service. b. Discard and obtain replacement if damaged. c. Reinstall.	4-12

Table 4-1. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) QUARTERLY SCHEDULE-Continued

Item No.	Item to be Inspected/Serviced	Procedures	Para Ref.
10	Condenser Air Inlet Guard	a. Remove, clean, inspect, and repair guard, as necessary. b. Place guard aside for the present and reinstall after item 14. **WARNING** Compressed air used for cleaning purposes will not exceed 30 psi (2.1 kg/cm^2).	4-12
11	Condenser Coil	a. Blow accumulated dust and dirt out of air passages in condenser coil using compressed air or the discharge side of a portable vacuum cleaner. Blow from inside for reverse airflow direction. b. Inspect coil for obvious damage and all mounting hardware for tightness and security.	4-40
12	Condenser Fan and Motor	a. Wipe or vacuum dust and dirt from fan and motor and all other components and surfaces in the immediate area. b. Inspect fan for damage or bent blades, motor for signs of overheating, and all mounting hardware for tightness and security. c. Inspect wiring harness for damage or chafing and all electrical connections for tightness.	4-36

Table 4-1. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) QUARTERLY SCHEDULE-Continued

Item No.	Item to be Inspected/Serviced	Procedures	Para Ref.
13	Compressor	a. Wipe or vacuum dust or dirt from the compressor canister and remaining components and surfaces in the lower section of the cabinet.	
		b. Inspect compressor crankcase heater element for signs of over-heating or deterioration.	
		c. Inspect wiring harness for damage or chafing and all electrical connections for tightness.	4-31
		d. Check all mounting hardware for damage or chafing.	
14	Condenser Dis-charge Air Louver and Actuator	a. Check all mounting hardware and linkage connections for tightness.	4-17
		b. Clean and lubricate as necessary.	
		c. Install condenser air inlet guard and top rear cover.	
15	Covers, Name-plates and Housing	a. Wipe all surfaces clean.	4-15, 4-11, and 4-41
		b. Check that all Warning and instruction plates are in place and legible.	
		c. Replace missing or illegible plates.	
		d. Check that all covers are in place, that there is no missing or loose hardware and no dents, breaks, or damage that would be a hazard or interfere with unit operation.	

Table 4-1. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) QUARTERLY SCHEDULE-Continued

Item No.	Item to be Inspected/Serviced	Procedures	Para Ref.
16	Fabric Cover	a. Roll down cover and inspect for tears, cracks, or any other sign of damage or deterioration. b. If washing is necessary, use fresh water with a small amount of mild detergent. c. Reroll and secure cover in the stowed position. If cover was washed, be sure it is thoroughly dry before rerolling.	4-10
17	Operational Checks	**CAUTION** Do not check operation in COOL mode until after input power has been reconnected for a sufficient time to eliminate any danger of liquid refrigerant accumulation in the compressor cylinder. Under moderate conditional if input power has been disconnected, a four hour warm-up period should be allowed. If the air conditioner has been exposed to below freezing temperatures without input power, an eight hour warm up period is recommended. a. Be sure MODE SELECTOR switch is in the OFF position and reconnect input power.	2-6

Table 4–1. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) QUARTERLY SCHEDULE-Continued

Item No.	Item to be Inspected/Serviced	Procedures	Para Ref.
		b. Perform functional check of air conditioner in all operational modes in accordance with the instructions in paragraph 2-6. c. Set-up air conditioner for desired operational mode. d. Record performance of quarterly PMCS, including all corrective actions taken. NOTE If the air conditioner has been in operation under unusual conditions, the proper interval for the above PMCS items must be reduced as necessary.	

Section IV TROUBLESHOOTING

4-8. USE OF TROUBLESHOOTING TABLE.

Table 4-2 contains troubleshooting information useful to organizational maintenance technicians in diagnosing and correcting malfunctions or unsatisfactory operation of the air conditioner.

a. The Troubleshooting Table lists the common malfunction symptoms and unsatisfactory performance characteristics technicians are most likely to encounter; test and inspection steps to be followed to determine the cause; and the corrective action(s) that should be performed for each possible cause listed.

4-8. USE OF TROUBLESHOOTING TABLE.-Continued

b. The technicians should first find the malfunction symptom or unsatisfactory performance characteristic in the table which most closely describes the immediate situation; then perform the test and inspections, and corrective action steps in the order in which they are listed.

c. This manual cannot list all possible situations which may be encountered, nor can it list all test and inspection, and corrective action steps which may be taken. If a condition is encountered which cannot be resolved within the capabilities and experience of organizational maintenance personnel assistance should be requested from direct support maintenance.

Table 4-2. TROUBLESHOOTING

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

1. AIR CONDITIONER DOES NOT START IN ANY MODE.

Step 1. Check if circuit breakers are tripped.

Reset circuit breakers.

Step 2. Check if input power has been disconnected.

Connect input power.

WARNING

Disconnect input power before performing internal electrical troubleshooting. Voltages used can be lethal.

CAUTION

If input power has been disconnected for an unknown period of time, do not start in COOL MODE until power has been reconnected for a minimum of four hours.

Step 3. Check for loose or damaged electrical connectors or damaged wires in wiring harnesses.

Table 4-2. TROUBLESHOOTING-Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Tighten or replace connectors, or repair damaged wires.

Step 4. Check that internal wiring at terminal board TB3 is wired for connector to which input power is connected.

See paragraph 4-4 and move wires if necessary.

Step 5. Check for defective circuit breaker. (See para 4-30.)

Replace circuit breaker if defective.

Step 6. Check for defective MODE SELECTOR switch. (See para 4-24.)

Replace switch if defective.

2. CONDITIONED (EVAPORATOR) AIR FAN DOES NOT START OR STOPS DURING OPERATION IN ANY MODE.

WARNING

Disconnect input power before performing internal electrical troubleshooting. Voltages used can be lethal.

Step 1. Check operation of evaporator fan motor. (See para 4-33.)

Test motor. Replace motor if defective.

Step 2. Check operation of MODE SELECTOR switch. (See para 4-24.)

Test switch. Replace switch if defective.

Step 3. Check electrical connections and wiring. (See fig. 4-4 and para 4-20.)

Tighten or replace connectors or repair or replace damaged wires.

Table 4-2. TROUBLESHOOTING-Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 4. Check fan for binding. (See para 4-33.)

Relieve binding or replace fan.

3. CONDENSER FAN FAILS TO OPERATE.

WARNING

Disconnect input power before performing internal electrical troubleshooting. Voltages used can be lethal.

Step 1. Check operation of condenser fan motor. (See para 4-36.)

Test motor. Replace motor if defective.

Step 2. Check electrical connections and wiring. (See fig. 4-4 and para 4-20.)

Tighten or replace connectors, or repair or replace damaged wires.

Step 3. Check fan for binding. (See para 4-36.)

Relieve binding or replace fan.

Step 4. Disconnect condenser fan relay. (See fig. 4-4 and para 4-29.) Actuate primary with 24 volt dc source, then check continuity of contact that should be closed.

Replace bad relay.

4. INSUFFICIENT COOLING.

Step 1. Check to see that MODE SELECTOR switch is properly positioned.

Set switch to COOL.

Step 2. Check sight-glass liquid level indicator that refrigerant is colorless and clear. Yellow, milky

Table 4-2. TROUBLESHOOTING-Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

or bubbly refrigerant indicates low level or excessive moisture.

Report condition to direct support maintenance.

Step 3. Inspect condenser coil for dirt.

Clean coil with 25-30 psi compressed air.

Step 4. Inspect evaporator return air filter for dirt. (See para 4-13.)

Clean filter.

Step 5. Check if TEMPERATURE SELECTOR switch is set incorrectly or is defective. (See para 4-22.)

Adjust setting or replace switch, or other corrective action.

Step 6. Check if supply air outlet louver is bent or stuck in closed position. (See para 4-14.)

Repair or replace louver.

Step 7. Observe evaporator fan motor for worn or defective condition. (See para 4-33.)

Report fault to direct support maintenance or replace motor.

Step 8. Check if evaporator fan is loose or defective. (See para 4-33.)

Tighten setscrew or replace fan.

5. COMPRESSOR WILL NOT START.

Step 1. Check that compressor or control circuit breakers or selector switch is properly set.

Reset controls properly.

Table 4-2. TROUBLESHOOTING-Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 2. Check if contacts of HIGH-or-LOW PRESSURE cut-out switch are open.

Reset pressure switches. Report fault to direct support maintenance if condition continues.

Step 3. Check for loose electrical connections or faulty wiring. (See fig. 4-4 and para 4-20.)

Tighten loose connections. Fix wiring if necessary.

Step 4. Make continuity check of control circuit to determine whether open circuit exists.

Fix open circuit or replace wire.

Step 5. Check continuity across primary and secondary winding of control transformer for defective windings. (See para 4-32.)

Replace bad transformer.

Step 6. Check forward and reverse resistance of rectifier assembly diodes. (See para 4-32.)

Replace bad rectifier.

Step 7. Observe operation of time delay relay. (See para 4-29.)

Replace bad relay.

Step 8. Substitute compressor relay known to be good, and check operation. (See para 4-29.)

Replace bad relay.

Step 9. Test compressor motor by checking continuity of the following pins at the compressor electrical receptacle. (See fig. 4-4 for pin identifications.)

(1) Pins A and B, B and C, and C and A. Continuity should exist.

Table 4-2. TROUBLESHOOTING-Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

(2) Pins A, B, and C and compressor housing. No continuity should exist.

(3) Pins D and E. Continuity should exist when compressor is cool enough for internal thermostat to be closed. If compressor is hot, let cool and retest.

Report faulty motor to direct support maintenance.

6. COMPRESSOR STARTS, BUT GOES OUT ON OVERLOAD.

Step 1. Observe condenser fan motor for failure. (See para 4-36.)

Replace bad motor.

Step 2. Check for high head pressure.

Clean condenser coil and louvers. Check fan for proper operation.

7. EVAPORATOR AIR OUTPUT VOLUME LOW.

Step 1. Check for dirty or damaged filter or louvers. (See para 4-13.)

Clean or replace filter. Clean or replace louvers as required.

Step 2. Check for dirty or iced evaporator coil.

Deice and clean coil.

Step 3. Inspect evaporator fan for damage. (See para 4-33.)

Replace fan.

Step 4. Check for bad fan motor. (See para 4-33.)

Replace motor.

Table 4-2. TROUBLESHOOTING-Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 5. Check to be sure that EVAPORATOR FAN SPEED switch is not set at LOW speed.

Reset switch to HIGH speed.

8. CONDENSER AIR OUTLET VOLUME LOW.

Step 1. Check for dirty condenser coil or guard.

Clean coil and guard.

Step 2. Inspect condenser fan for damage. (See para 4-36.)

Replace fan.

Step 3. Check that air outlet louvers are not stuck or jammed in closed position.

Free louvers and control cable. Adjust control, or report to direct support maintenance if actuating cylinder is not working properly.

9. AIR CONDITIONER FAILS TO HEAT.

Step 1. Check MODE SELECTOR switch for improper setting.

Set MODE SELECTOR switch to LOW HEAT or HIGH HEAT.

Step 2. Make sure that TEMPERATURE SELECTOR switch is set properly.

Reset switch, if necessary.

Step 3. Check for dirty evaporator return air filter. (See para 4-13.)

Clean filter.

Step 4. Check evaporator fan motor for proper operation. (See para 4-33.)

Replace bad motor.

Table 4-2. TROUBLESHOOTING-Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 5. Make continuity check of TEMPERATURE SELECTOR switch or MODE SELECTOR switch. (See para 4-22 and 4-24.)

Replace bad switch.

Step 6. Inspect heaters and wiring for loose connections or damage. (See para 4-35.)

Tighten connections and fix bad wiring. Replace bad heater elements.

Step 7. Check continuity of heater relay coils. (See para 4-29.)

Replace bad relay.

Step 8. Check operation of heater high-temperature cutout thermostatic switch. It should open when temperature rises above setting. (See para 4-34.)

Replace bad thermostatic switch.

10. EXCESSIVE NOISE.

Step 1. Check evaporator or condenser fan for vibration.

Tighten fans on shafts. Tighten all mounting screws.

Step 2. Check evaporator or condenser fan motor for wear, as indicated by noisy operation or excessive side or end play. (See para 4-33 and 4-36.)

Replace worn or bad motor. (Refer to direct support maintenance for repairs.)

Step 3. Listen for compressor knocks or chatter.

Stop air conditioner and report condition to direct support maintenance.

Section V MAINTENANCE PROCEDURES

4-9. GENERAL.

The procedures in this section have been arranged in the order in which the items appear in the organizational (O) maintenance level column on the Maintenance Allocation Chart (MAC) which is provided in Appendix B. Step-by-step procedures have been provided for all action authorized to be performed by organizational maintenance in the order in which they appear on the MAC. Actions authorized to be performed by direct and general support maintenance have been duly noted; step-by-step procedures for these actions may be found in Chapters 5 and 6 respectively.

4-10. FABRIC COVER

The fabric cover is made of vinyl impregnated nylon cloth. It is used to cover the exposed condenser (rear) openings during periods of shutdown or storage. (See fig. 4-7.)

a. Inspection. Inspect for rips, cuts, tears, or punctures in the fabric, and for damaged or missing snap fasteners and eyelets. Refer repair or replacement to direct support maintenance.

b. Cleaning. Wash the fabric cover using a solution of fresh water and a mild detergent. A soft scrubbing brush may be used to remove caked deposits. Thoroughly rinse with fresh water and air dry.

c. Lubrication. Apply silicone spray lubricant to the snap fasteners, if they are difficult to open and close.

d. Removal. — MAC says only at F

(1) Unsnap four snap fasteners.

(2) Remove three sets of screws, lock washers, and flat washers. Lift fabric cover from unit.

e. Installation.

(1) Secure fabric cover to the unit with three sets of screws, lock washers, and flat washers.

4-10. FABRIC COVER.–Continued

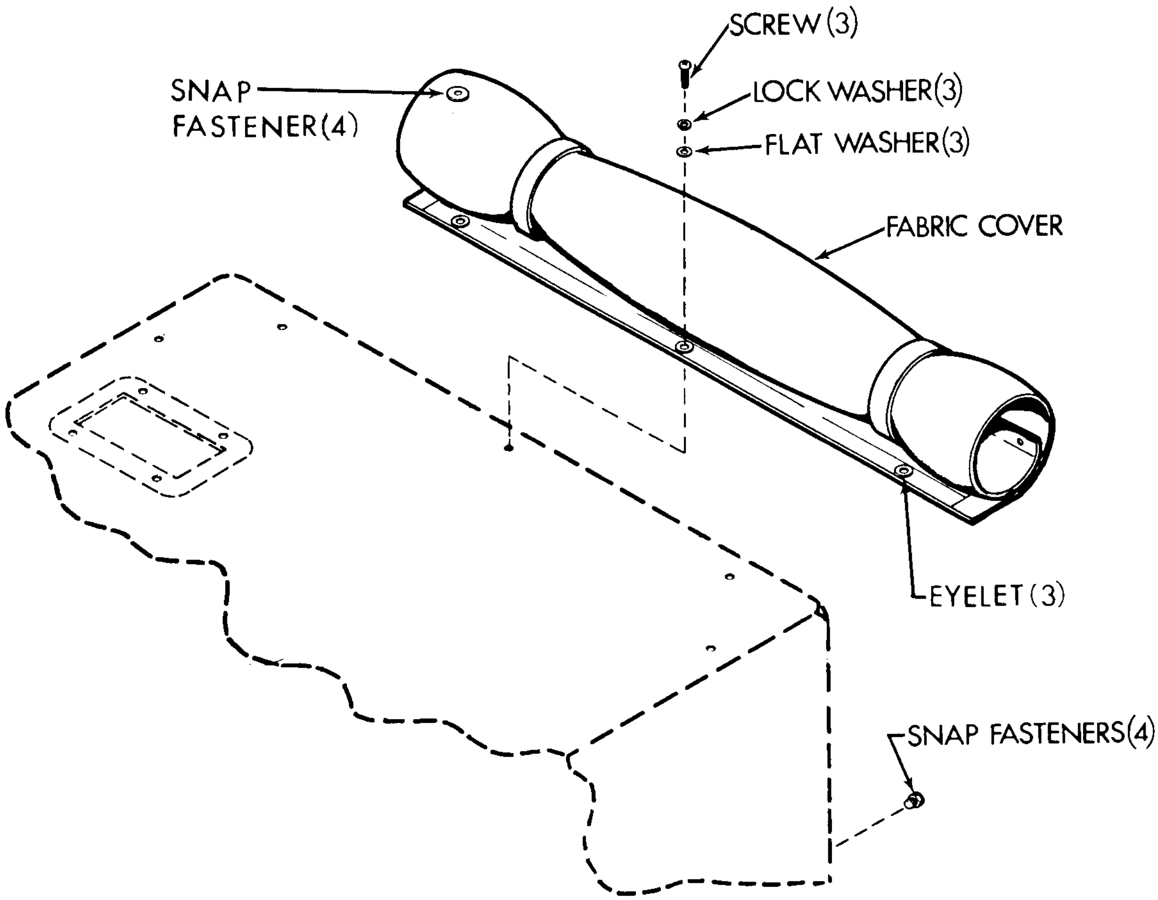


Figure 4-7. Fabric Cover

(2) If unit is to be put back into service, roll cover up and tie in place.

(3) If unit is to be stored or shut down for an extended period, roll cover down and secure snaps.

4-11. TOP COVERS.

only at
f in MAC

The top of the unit is enclosed with easily removed top covers. (See fig. 4-8.)

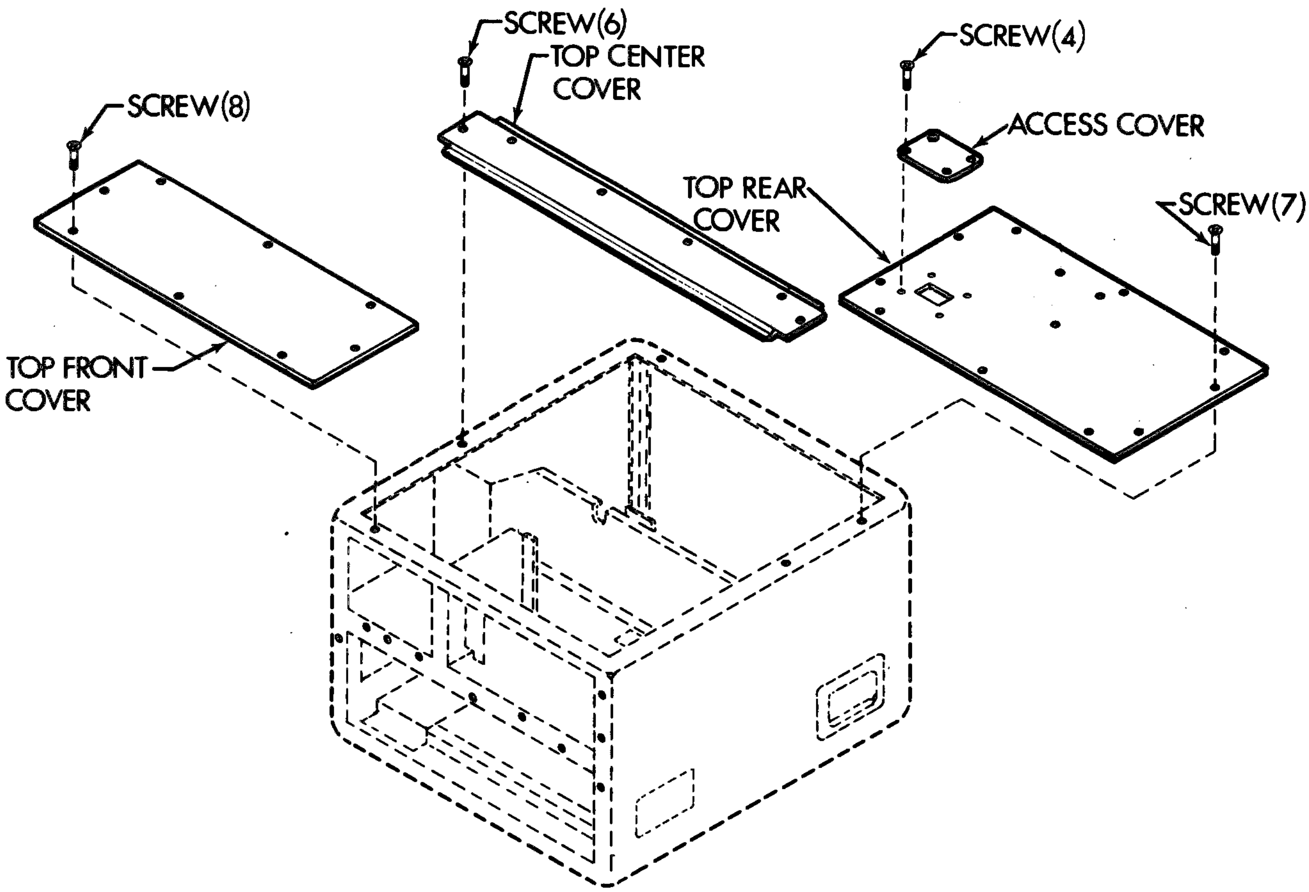


Figure 4-8. Top Covers

a. Removal.

WARNING

Disconnect input power from the air conditioner before performing maintenance on any part of the electrical system. The voltages used can be lethal.

(1) Disconnect power at power source.

(2) Top rear cover and access cover can be removed independently. Top center cover must be removed last.

4-11. TOP COVERS-Continued

(3) To totally remove rear cover, first remove the fabric cover (para 4-10).

(4) Remove eight screws and top front cover.

(5) Remove seven screws and top rear cover.

(6) Remove six screws and top center cover.

WARNING

Dry cleaning solvent (Fed Spec P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 59°C).

b. Cleaning. Clean the covers with a cloth dampened with a detergent solution or dry cleaning solvent (Fed Spec P-D-680). Use a soft brush if necessary to dislodge caked on dirt. Dry the items thoroughly.

c. Inspect. Inspect top covers for breaks, cracks, dents, loose, or missing mounting hardware or other defects. Refer repairs or replacement to direct support maintenance.

d. Installation.

(1) Install center cover first and secure with six screws.

(2) Install front and rear top covers and secure with 15 screws.

(3) Install fabric cover (para 4-10).

(4) Connect power at power source.

4-12. SCREENS AND GUARDS.

The condenser air inlet guard is located on the center rear of the unit. The fresh air ventilation guard is located on the lower left rear of the unit. (See fig. 4-9.)

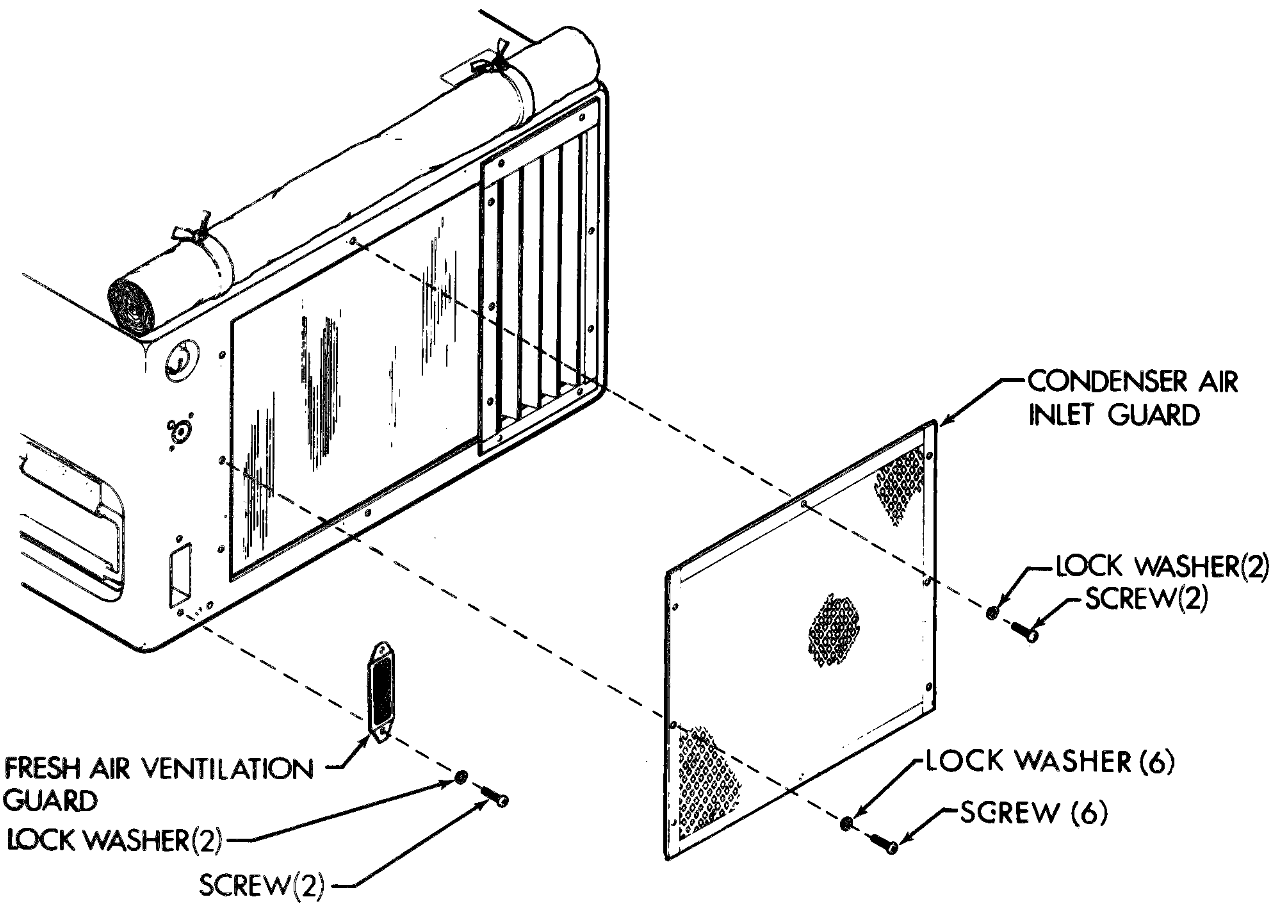


Figure 4-9. Rear Screens

WARNING

When the unit is to be operated in a chemical/biological/radiological (CBR) environment the fresh air opening must be sealed or connected to an appropriate CBR filtering device.

a. Removal.

(1) Remove 2 each screws and lock washers and remove the fresh air ventilation guard.

4-12. SCREENS AND GUARDS.-Continued

(2) Remove 2 each screws and lock washers from horizontal frames of condenser air inlet guard.

NOTE

The 6 screws on the vertical frames of the condenser air inlet guard secure the condenser coil to the air conditioner housing.

(3) Remove 6 each screws and lock washers from vertical frames and remove condenser air inlet guard.

b. Clean.

(1) Usually it is only necessary to wipe or brush the dirt from the guards.

WARNING

Dry cleaning solvent (Fed Spec P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 59°C).

(2) If the guards are extremely dirty, clean with a detergent solution or dry cleaning solvent (Fed Spec P-D-680).

c. Inspect. Check for general condition. Refer requirements for repair or replacement to direct support maintenance.

d. Installation. Secure the guards with screws and lock washers.

only at F in MAC

4-13. RETURN AIR LOUVER AND AIR FILTER.

The return air louver is located on the lower front of the unit. The air filter is clipped to the back side of the louver. (See fig. 4-10.)

a. Removal.

(1) Remove 8 screws and lock washers and pull louver from unit.

(2) Remove filter from clips on back of louver.

4-13. RETURN AIR LOUVER AND AIR FILTER.-Continued

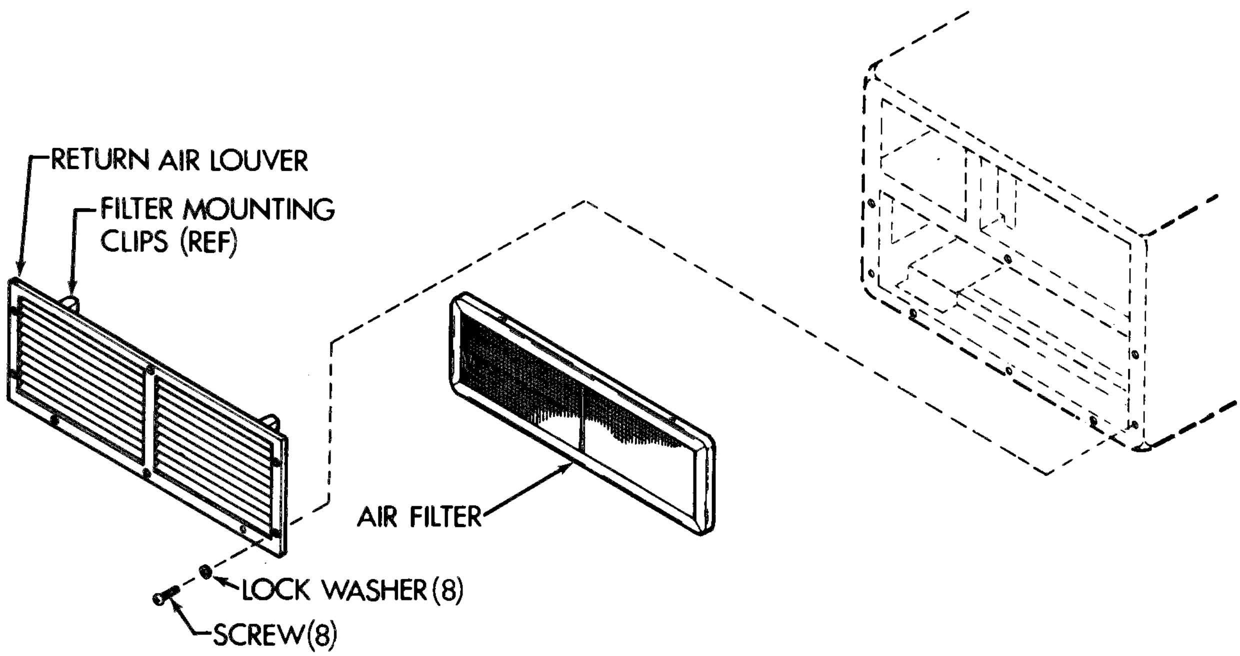


Figure 4-10. Return Air Louver and Air Filter

b. Clean.

(1) Usually it is only necessary to wipe or brush the dirt from the louver. If the louver is extremely dirty, it can be washed following the same procedure as the filter.

WARNING

Dry cleaning solvent (Fed Spec P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 59°C).

(2) Immerse filter in mild detergent solution or dry cleaning solvent (Fed Spec P-D-680).

4-13. RETURN AIR LOUVER AND AIR FILTER.-Continued

(3) Agitate until dirt is removed, using a soft brush if necessary to loosen caked-on dirt.

(4) Rinse in clear water or clean dry cleaning solvent.

(5) Drain, then hold filter horizontal and tap each edge on bench or floor to dislodge droplets.

(6) Be sure filter is totally dry prior to installation.

c. Inspect.

(1) Check the louver for general condition. Bent louvers can usually be straightened with the fingers. Refer further repair or replacement to direct support.

(2) Inspect filter for damage. Perforations or punctures in screen and aluminum foil mesh can permit passage of unfiltered air.

(3) Inspect for packed or crushed mesh material obstructing airflow through filter.

(4) Check for deformation of the frame. Straighten if possible without crushing mesh material.

(5) Replace filter if crushed, punctured, badly deformed, or broken.

d. Servicing.

(1) Louvers. Apply a few drops of light oil to all pivot points and bearing surfaces of louvers. Wipe or blot up all excess oil with a cloth.

(2) Filter. Apply coater (Item 1, Section II, Appendix E) to the media in the filter element. Let dry and wipe off excess coater.

e. Installation.

(1) Air flow arrows should point away from louver.

(2) Place filter in retainer clips.

(3) Secure louver with screws and lock washers.

4-14. SUPPLY AIR LOUVER.

The supply air louver is located on the upper right front corner of the unit. (See fig. 4-11.)

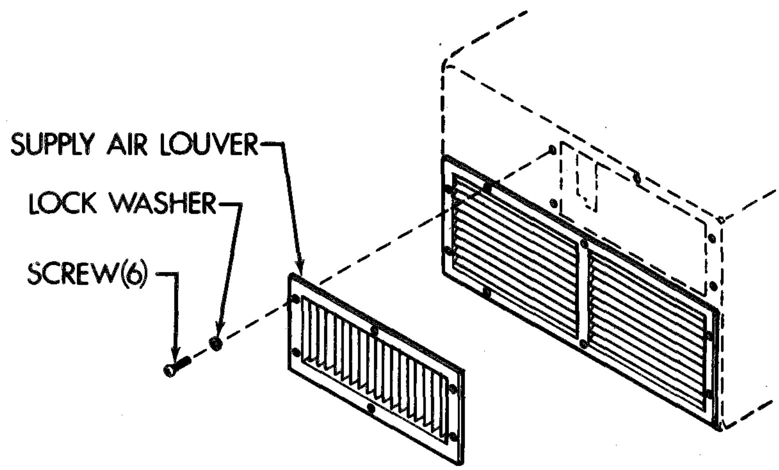


Figure 4-11. Supply Air Louver

a. Removal. Remove 6 screws and lock washers and pull louver from the unit.

b. Clean.

(1) Usually it is only necessary to wipe or brush dirt from louver.

WARNING

Dry cleaning solvent (Fed Spec P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 59°c).

(2) If louver is extremely dirty, immerse in a detergent solution or dry cleaning solvent (Fed Spec P-D-680).

4-14. SUPPLY AIR LOUVER.-Continued

(3) Agitate until dirt is removed, using a soft brush if necessary to loosen caked-on dirt.

(4) Rinse in clean water or clean dry cleaning solvent.

(5) Dry thoroughly.

c. Inspect. Check the louver for general condition. Bent louvers can usually be straightened with the fingers. Refer requirements for further repair or replacement to direct support maintenance.

d. Servicing. Apply a few drops of light oil to all pivot points and bearing surfaces of louvers. Wipe or blot up all excess oil with a cloth.

e. Installation. Secure louver with screws and lock washers.

4-15. INFORMATION PLATES.

See figure 2-3 for location and information contained on Warning and instruction plates. If any plates are missing, damaged, or illegible, they should be replaced. Refer replacement to direct support maintenance.

4-16. MIST ELIMINATOR.

The mist eliminator traps moisture blown from the evaporator coil. It is located below the top front cover, between the evaporator coil and the supply air louver. (See fig. 4-12.)

a. Removal.

(1) Disconnect power at power source.

(2) Remove eight screws and top front cover.

(3) Pull mist eliminator up and out of mounting frame.

4-16. MIST ELIMINATOR.-Continued

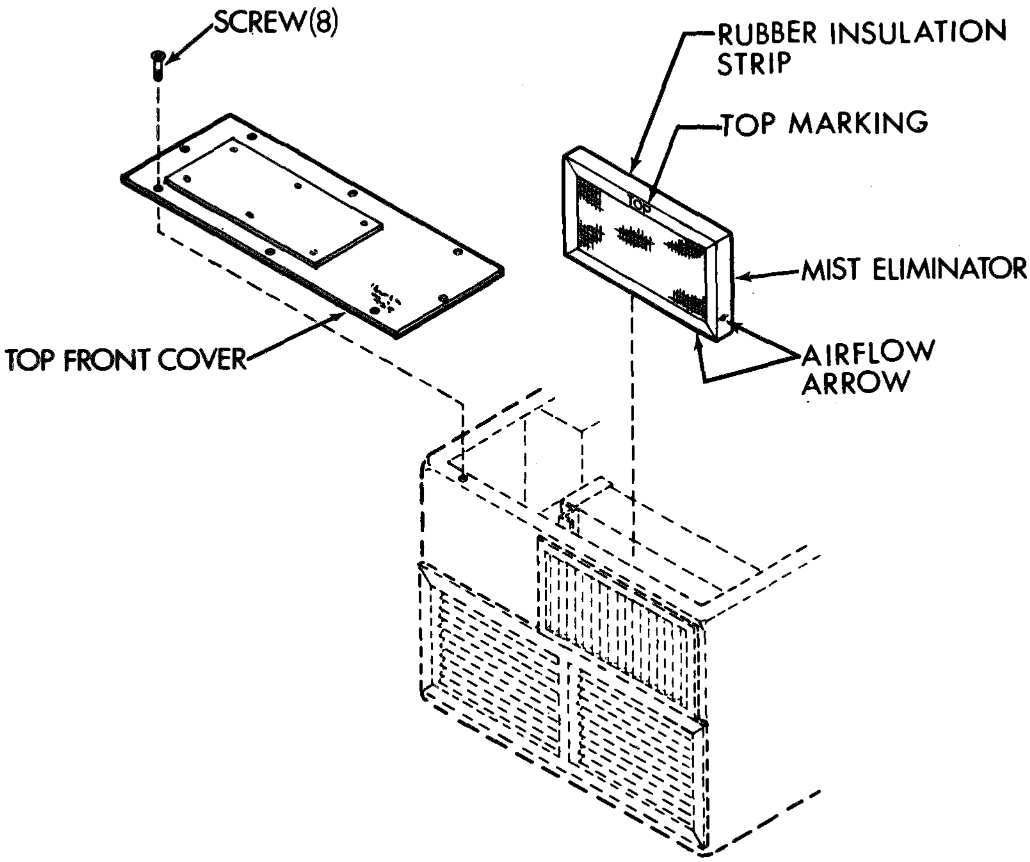


Figure 4-12. Mist Eliminator

WARNING

Dry cleaning solvent (Fed Spec P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 59°C).

b. Clean.

(1) Immerse in a detergent solution or dry cleaning solvent (Fed Spec P-D-680).

4-16. MIST ELIMINATOR.-Continued

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

(3) Rinse in clean water or clean dry cleaning solvent.

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

c. Inspect.

(1) Inspect for damage such as perforations or punctures in the screen and aluminum.

(2) Inspect for packed or crushed material that would reduce airflow.

(3) Check for deformation of frame. Straighten if possible without crushing aluminum.

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

(5) Replace rubber insulation strip across top of mist eliminator if it is missing or damaged.

d. Installation.

(1) TOP marking must be up and airflow arrows, located on side or bottom, must point outward away from coil.

(2) Slide mist eliminator down into mounting frames observing air flow arrows and top marking.

(3) Install top front cover and secure with eight screws.

(4) Connect power at power source.

4-17. CONDENSER AIR DISCHARGE LOUVER AND LINKAGE.

This louver is located at the right rear of the unit and is automatically operated by a refrigerant pressure actuated cylinder and a push-pull cable. The louvers open as refrigerant pressure in the condenser coil increases. This causes the louver to open more fully to increase the flow of cooler air across the condenser coil. (See fig. 4-13.)

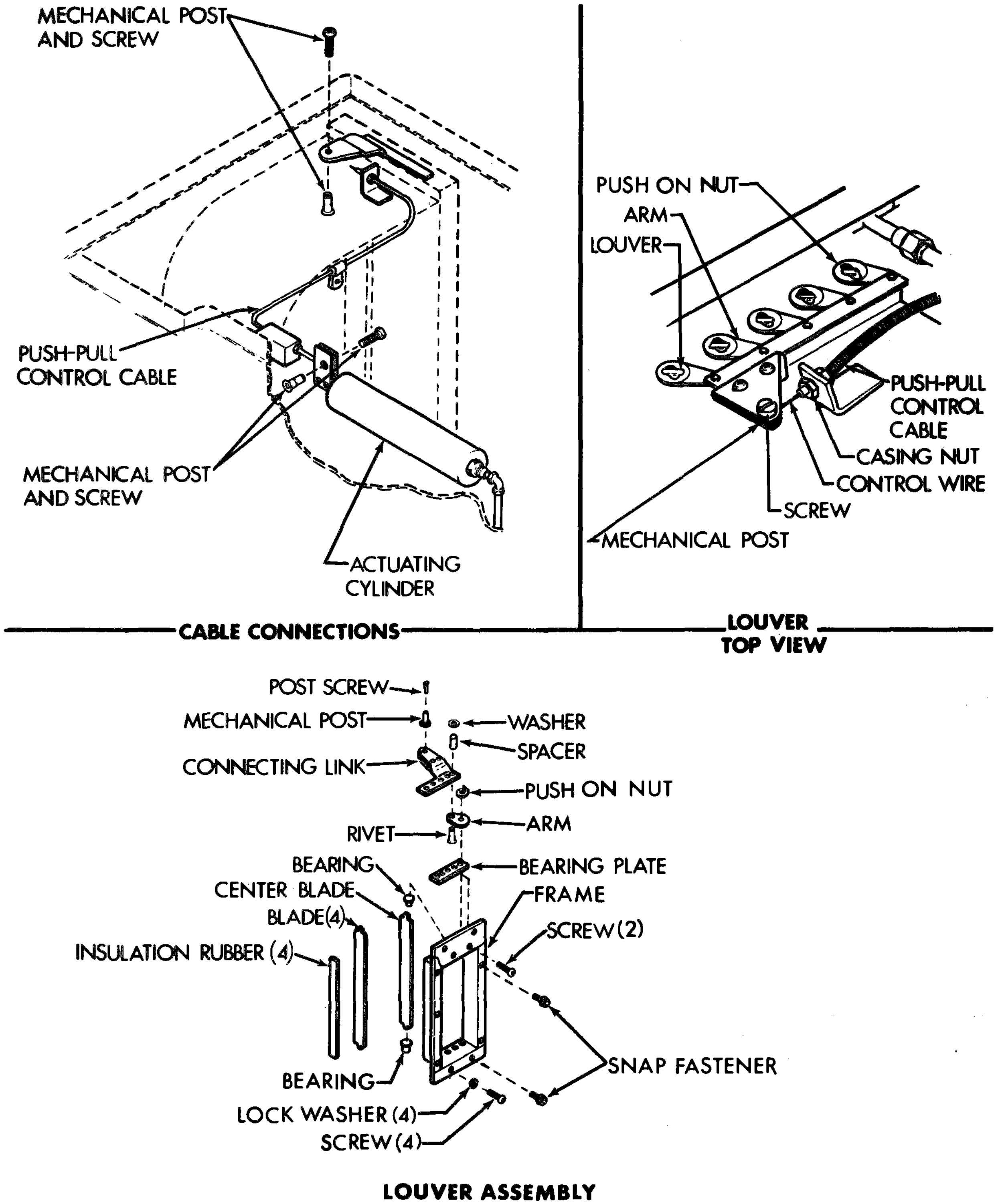


Figure 4-13. Condenser Air Discharge Louver and Linkage

4-17. CONDENSER AIR DISCHARGE LOUVER AND LINKAGE.-Continued

a. Clean/Inspect.

(1) Disconnect power at power source.

(2) Remove top rear cover (para 4-11).

(3) The louver can be cleaned with a soft brush or washed with water and a mild detergent solution.

(4) Check louver for bent blades, missing or damaged gaskets, and missing hardware or bearings.

(5) Clean linkage with a soft brush and damp rag.

(6) Check push-pull cable attaching hardware (mechanical post and screws etc.) for tightness.

b. Adjustment.

WARNING

DANGEROUS CHEMICAL is used in this equipment.

DEATH

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

Do not attempt to loosen or remove any of the connections to the copper tubing.

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

(1) If unit has been operating wait until it has cooled to ambient temperature approximately four hours.

(2) Loosen mechanical post screw on louver connecting link.

(3) Close louvers.

(4) Pull wire tight with needle nose pliers and tighten mechanical post screw.

(5) Louvers must be tightly closed.

4-17. CONDENSER AIR DISCHARGE LOUVER AND LINKAGE.-Continued

c. Replacement.

WARNING

Do not tamper with cylinder or refrigerant tubing connections. If actuating cylinder is suspected bad, contact direct support maintenance.

(1) Louver blade only.

NOTE

Individual Louver Blades are flexible enough for removal.

- Remove top rear cover (para 4-11).
- Remove push on nut from louver blade to be removed.
- Flex or spring blade to remove ends from bearings.
- Remove blade.
- Replace bearings if they are damaged.
- Flex or spring new blade and install.
- Install push on nut.

(2) Louver and linkage assembly removal.

- Remove condenser air inlet guard. (See para 4-12.)
- Loosen mechanical post screw and pull push-pull control cable wire from louver connecting link.
- Remove four screws and lock washers and two snap fasteners.
- Slide louver assembly from unit.
- Remove push-pull control cable and attaching hardware (mechanical post, screws, etc.).
- Inspect all parts and replace if damaged.

4-17. CONDENSER AIR DISCHARGE LOUVER AND LINKAGE.-Continued

(3) Louver and linkage assembly installation.

- Install push-pull control cable assembly using attaching hardware.
- Slide louver assembly into unit and secure with four screws, lock washers, and two snap fasteners.
- Insert push-pull control cable wire end through mechanical post.
- Close louvers and pull control cable wire tight with needle nose pliers and tighten mechanical post screw.
- Install condenser air inlet guard. (See para 4-12.)
- Reinstall top rear cover (para 4-11).
- Connect power at power source.

4-18. FRESH AIR DAMPER AND ACTUATOR.

The wheel type actuator plate located on the upper right front of the unit controls the internal fresh air damper. Turn up to close and down to open. (See fig. 4-14.)

a. Clean/Inspect.

(1) Disconnect power at power source.

(2) Remove top covers (para 4-11), supply air louver (para 4-13), and return air louver (para 4-14).

(3) Wipe loose dirt from controls and linkages with a clean cloth.

(4) Check push-pull control cable for operation by turning actuator plate wheel.

(5) Check that damper arm moves when actuator plate is turned.

b. Removal.

(1) Loosen screw on mechanical post and disconnect push-pull control cable.

4-18. FRESH AIR DAMPER AND ACTUATOR.-Continued

(2) Remove two screws, lock washers, and flat washers and lift damper from air conditioner.

(3) Remove screw, lock washer, nut, spacer and loop clamp.

(4) Loosen screw in actuator plate blind nut to free end of push-pull control cable.

(5) Remove outer nuts from both ends of push-pull control cable and remove cable from unit.

(6) Remove screw, nut, two spring washers and actuator plate.

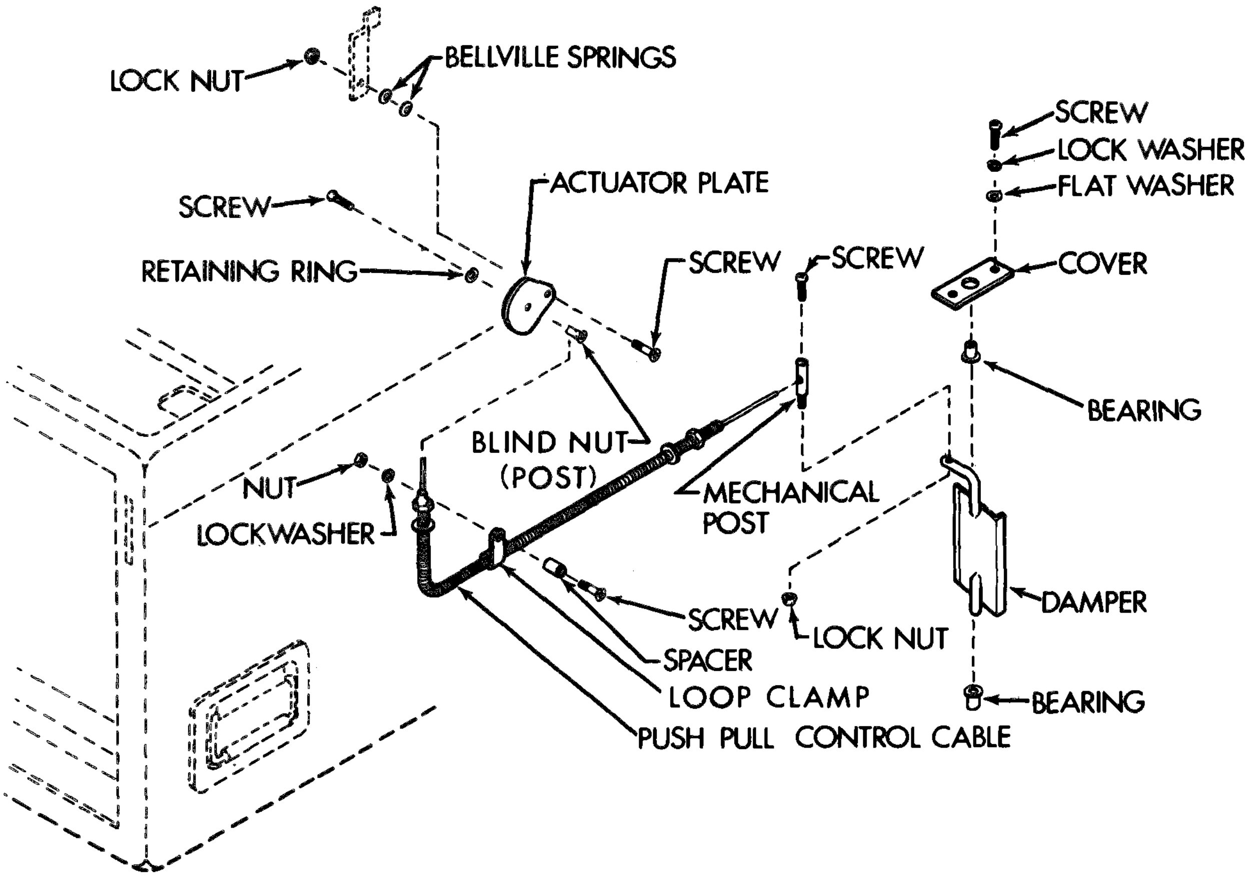


Figure 4-14. Fresh Air Damper and Actuator

4-18. FRESH AIR DAMPER AND ACTUATOR.-Continued

c. Replace. Inspect all parts and replace if damaged.

d. Installation.

(1) Install actuator plate with screw, two spring washers, and nut.

(2) Install damper in opening of housing.

(3) Secure damper cover to housing with two screws lock washers, and flat washers.

(4) With one nut on each end of push-pull control cable, install ends of cable through openings in housing.

(5) Install outer nuts on push-pull control cable and insert ends into mechanical posts of damper and actuator plate.

(6) Tighten outer nuts on push-pull control cable.

(7) Install loop clamp, spacer, screw, nut, and washer.

e. Adjustment.

(1) Loosen screw on both mechanical posts to release push-pull control cable ends.

(2) Move arm on damper in both directions and determine the center between the two extreme stop points.

(3) Move actuator plate so that it is also centered on the curved portion of the plate.

(4) Tighten screws in both mechanical posts.

(5) Check actuator plate for smooth operation.

(6) Install top covers (para 4-11), supply air louver (para 4-14), and return air louver (para 4-13).

(7) Connect power at power source.

4-19. CONDENSATE DRAIN.

(See fig. 4-15.)

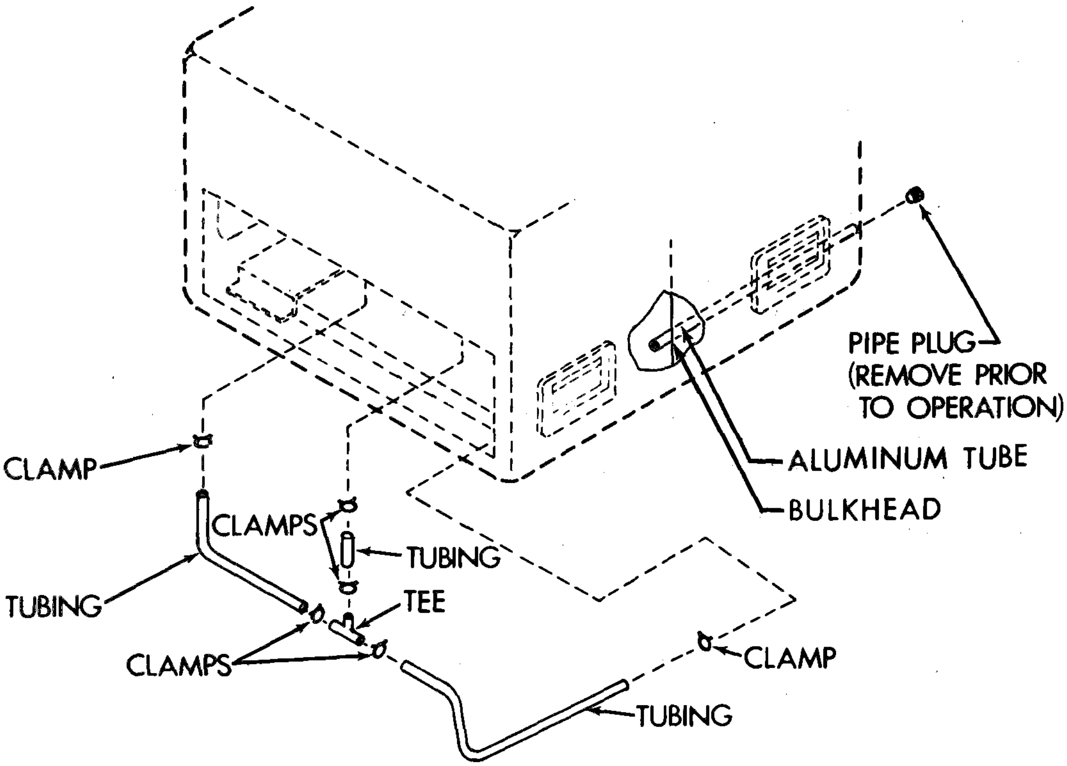


Figure 4-15. Condensate Drain Lines

a. Removal.

(1) Disconnect power at power source.

(2) Remove return air louver (para 4-13).

(4) Pull tubing loose from connection points in drain pan and housing.

b. Inspection.

(1) Check tubing for cuts, splits, and deteriorated condition.

4-19. CONDENSATE DRAIN.-Continued

(2) Check that aluminum tube from bulkhead to rear of unit is not clogged.

c. Replace. Replace all damaged parts found during inspection.

d. Installation.

(1) Slide clamps onto tubes.

(2) Slip tubing and clamps into place.

(3) Install the return air louver (para 4-13).

(4) Connect power at power source.

4-20. ELECTRICAL WIRING REPAIR – GENERAL.

Preferred repair methods consist of replacing wires, terminals connectors etc., rather than splicing wires, bendinq ends to form terminals, and other make-shift procedures, although the latter may be appropriate for emergency field repairs. Determine the proper size and length of wire, or the terminal, or connector to be used for replacement by referring to Table 4-3, "Wire List", and to the wiring diagram figure 4-4.

a. Soldering Connections. Wire connections must be made mechanically sound before they are soldered; solder alone does not provide sufficient strength to prevent breakage. Joining surfaces of connections to be soldered must be clean and bright. If a separate flux is used, it should conform to Specification MIL-F-14256, rosin base flux, item 6, Appendix E and should be brushed onto the joint before soldering. If a flux-core solder is used, it should always be rosin-core electrical solder. If an uncored solder is used, it should be a lead-tin solder, item 7, Appendix E conforming to Specification QQ-S-571. Wires should always be heated to the point at which the solder will melt completely and flow into all parts of the joint. Excessive build-up of solder "gobs" on the joint should be avoided or removed.

b. Insulating Joint. The preferred method of insulating electrical joints is by the use of heat-shrink tubing. To apply, cut a piece of heat-shrink tubing of suitable diameter to a length of 1 inch (2.5 cm) for covering joints at terminals or connectors or to a length about 1/2 inch (1.3 cm) longer than the joint to be insulated. Slide the tubing over the wire before making the joint. After the joint is made, slide the tubing so that it covers the joint, and shrink in place with moderate heat.

Table 4-3. WIRE LIST

Termination		Termination		AWG WIRE Size	Length	
From	Terminal Type	To	Terminal Type		IN.	CM
		LOOSE WIRES				
S1-12	13216E6191-1	S3-3	MS25036-149	20	10	25.4
S1-11	13216E6191-1	S3-1	MS25036-149	20	7	17.8
S1-2C	13216E6191-1	S2-A2	13216E6191-1	20	7	17.8
S1-2B	13216E6191-1	S2-B2	13216E6191-1	20	9	22.9
S1-3C	13216E6191-1	S2-C2	13216E6191-1	20	8	20.3
S6-4	MS25036-153	S6-2	MS25036-153	16	2	5.1
S6-3	MS25036-153	TB2-9	13216E6191-2	16	18	45.7
S6-1	MS25036-153	TB2-8	13216E6191-2	16	18	45.7
S6-2	MS25036-153	TB2-7	13216E6191-2	16	18	45.7
		AUXILIARY POWER CABLE ASSEMB				
J11-A		P6-A		12	40	101.6
J11-B		P6-B		12	40	101.6
J11-C		P6-C		12	40	101.6
J11-D		P6-D		12	40	101.6
		COMPRESSOR WIRING HARNES				
P4-A		P10-A		12	22	55.9
P4-B		P10-B		12	22	55.9
P4-C		P10-C		12	22	55.9
P4-D		P10-D		20	22	55.9
P4-E		P10-E		20	22	55.9
P4-F		P10-F		16	22	55.9
P4-G		P10-G		16	22	55.9
		TRANSFORMER AND RECTIFIER WIRING HARNESS				
T1-2		TB2-10	13216E6191-1	20	13	33.1
T1-5		TB2-11	13216E6191-1	20	13	33.1
CR1-2	13216E6191-1	TB2-12	13216E6191-1	20	17	43.2
T1-7		CR1-1	13216E6191-1	20	9	22.9
T1-8		CR1-3	13216E6191-1	20	9	22.9
TB1-4	MS25036-149	CR1-4	13216E6191-1	20	17	43.2

Table 4–3. WIRE LIST-Continued

Termination		Termination		AWG Wire Size	Length	
From	Terminal Type	To	Terminal Type		IN.	CM
		CONTROL MODULE HARNESS				
P2A-1		S2-Al	13216E6191-2	16	9	22.9
P2A-2		S2-B1	13216E6191-2	16	9	22.9
P2A-3		S2-C1	13216E6191-2	16	9	22.9
P2A-4		S2-A3	13216E6191-1	20	10	25.4
P2A-5		s2-B3	13216E6191-1	20	10	25.4
P2A-6		s2-C3	13216E6191-1	20	10	25.4
P2A-7		S1-3A	13216E6191-2	16	8	20.3
P2A-8		S1-4C	13216E6191-2	16	9	22.9
P2A-9		S1-4A	13216E6191-2	16	9	22.9
P2A-10		CB1-A1	13216E6191-3	16	7	17.8
P2A-11		S1-21	13216E6191-2	12	9	22.9
P2A-12		CB1-B1	13216E6191-3	16	7	17.8
P2A-12		S1-22	13216E6191-2	12	9	22.9
P2A-13		CB1-C1	13216E6191-3	16	7	17.8
P2A-13		S1-31	13216E6191-2	12	9	22.9
P2A-14		CB1-A2	13216E6191-3	12	10	25.4
P2A-15		CB1-B2	13216E6191-3	12	11	27.9
P2A-16		CB1-C2	13216E6191-3	12	11	27.9
P2B-3		S1-lD	13216E6191-1	20	12	30.5
P2B-4		S1-lB	13216E6191-1	20	11	27.9
P2B-5		S1-lA	13216E6191-1	20	11	27.9
P2B-6		S1-41	13216E6191-2	16	7	17.8
P2B-7		CB1-C	13216E6192	20	11	27.9
P2B-8		CB1-NO	13216E6192	20	11	27.9
P2B-10		S3-1	MS25036-149	20	12	30.5
P2B-11		El	MS25036-153	16	7	17.8
S1-21		S1-32	13216E6191-2	16	3	7.6
S1-22		S1-41	13216E6191-2	16	4	10.2
S1-31		S1-42	13216E6191-2	16	3	7.6
		JUNCTION BOX HARNESS				
J2A-1		J3-A		16	15	38.1
J2A-2		J3-B		16	15	38.1
J2A-3		J3-C		16	15	38.1
J2A-4		J3-D		18	15	38.1
J2A-5		J3-E		18	15	38.1
J2A-6		J3-F		18	15	38.1
J2A-7		TB2-3	13216E6191-2	16	10	50.8
J2A-8		TB2-2	13216E6191-2	16	19	48.3
J2A-9		TB2-1	13216E6191-2	16	19	48.3

Table 4-3. WIRE LIST-Continued

Termination		Termination		AWG Wire Size	Length	
From	Terminal Type	To	Terminal Type		IN.	CM
		JUNTION BOX HARNESS-Continued				
J2A-11		TB1-1	MS25036-156	12	14	35.6
J2A-12		TB1-2	MS25036-156	12	13	33.0
J2A-13		TB1-3	MS25036-156	12	13	33.0
J2A-14		K3-A1	MS25036-112	12	9	22.9
J2A-15		K3-B1	MS25036-112	12	10	25.4
J2A-16		K3-C1	MS25036-112	12	11	27.9
J2B-3		TB1-5	MS25036-149	20	13	33.0
J2B-4		J8-A		20	22	55.9
J2B-5		K2-X1	MS25036-149	20	17	43.2
J2B-6		CB2-1	MS25036-101	20	15	38.1
J2B-7		K5-2		20	17	43.2
J2B-8		TB2-10	13216E6191-1	20	25	63.5
J2B-10		TB1-4	MS25036-149	20	14	35.6
J2B-11		E2	MS25036-153	16	10	25.4
J3-G		E4	MS25036-153	16	14	35.6
J4-A		K3-A2	MS25036-112	12	29	73.7
J4-B		K3-B2	MS25036-112	12	29	73.7
J4-C		K3-B2	MS25036-112	12	30	76.2
J4-D		J5-D		16	4	10.2
J4-E		S5-2	13216E6191-1	20	24	61.0
J4-F		K3-A1	MS25036-108	16	26	66.0
J4-G		K3-B1	MS25036-108	16	26	66.0
J5-A		K4-1		16	25	63.5
J5-B		K4-5		16	25	63.5
J5-C		K4-10		16	25	63.5
J5-E		TB1-6	MS25036-153	16	26	66.0
J5-G		E4	MS25036-153	16	10	25.4
J6-A		TB3-4	MS25036-156	12	12	30.5
J6-B		TB3-5	MS25036-156	12	13	33.0
J6-C		TB3-6	MS25036-156	12	14	35.6
J6-D		E3	MS25036-156	12	12	30.5
J8-B		K3-X2	MS25036-149	20	26	66.0
J9-A		K3-X2	MS25036-149	20	25	63.5
J9-B		K4-9		20	24	61.0
J1-A		TB3-1	MS25036-156	12	33	83.8
J1-B		TB3-2	MS25036-156	12	33	83.8
J1-C		TB3-3	MS25036-156	12	34	86.4
J1-D		E3	MS25036-156	12	34	86.4
TB1-1	MS25036-149	K5-A		20	13	33.0
TB1-1	MS25036-153	K2-A1	MS25036-108	16	14	35.6
TB1-2	MS25036-153	TB3-2	MS25036-153	16	34	86.4

4-20. ELECTRICAL WIRING REPAIR - GENERAL.-Continued

Table 4-3. WIRE LIST–Continued

Termination		Termination		AWG Wire Size	Length	
From	Terminal Type	To	Terminal Type		IN.	CM
		JUNCTION BOX HARNESS-Continued				
TB1-2	MS25036-153	K2-B1	MS25036-108	16	14	35.6
TB1-2	MS25036-149	K5-B		20	5	12.7
TB1-3	MS25036-156	TB3-3	MS25036-156	12	34	86.4
TB1-3	MS25036-156	TB2-11	MS25036-156	12	28	71.1
TB1-3	MS25036-149	K5-C		20	12	30.5
TB1-3	MS25036-153	K2-C1	MS25036-108	16	17	43.2
TB1-4	MS25036-149	TB2-12	13216E6191-1	20	28	71.1
TB1-4	MS25036-153	K4-2		16	10	25.4
TB1-5	MS25036-149	S4-1	13216E6191-1	20	20	50.8
TB1-6	MS25036-149	K1-1		20	10	25.8
TB2-4	13216E6191-2	K2-C2	MS25036-108	16	32	81.3
TB2-5	13216E6191-2	K2-B2	MS25036-108	16	32	81.3
TB2-6	13216E6191-2	K2-A2	MS25036-108	16	32	81.3
K1-2		K3-X1	MS25036-149	20	13	33.0
TB1-6	MS25036-149	K4-9		20	9	22.9
K2-C1	MS25036-108	K4-8		16	8	20.3
K2-B1	MS25036-108	K4-11		16	8	20.3
K2-A1	MS25036-108	K4-3		16	7	17.8
K2-X2	MS25036-149	K3-X2		20	5	12.7
K2-X2	MS25036-149	K4-2		20	6	15.2
K5-1		CB2-2	MS25036-101	20	6	15.2
TB1-1	MS25036-156	TB3-1	MS25036-156	12	35	88.9

c. Splicing Wires. To repair broken or cut wires that are otherwise sound, the mating ends can be stripped and spliced. A commercial butt splice can be crimped onto the ends to joint them, or a “Western Union” wire splice can be made. The latter is made by stripping 1/4 - 1/2 inch (0.6 - 1.3 cm) of insulation from the wire ends, and sliding on a piece of insulation tubing as described above. Hold the ends parallel and facing opposite directional then twist each end around the other wire at least three turns. Solder and apply insulation as described above.

4-20. ELECTRICAL WIRING REPAIR - GENERAL.-Continued

d. Crimping Terminals. To install a terminal on the end of a wire, strip 1/4 - 1/2 inch (0.6 - 1.3 cm) of insulation from the end of the wirel apply a one-inch (2.5 cm) piece of heat-shrink tubing (if the terminals are of the uninsulated type). Insert wire-end into the shank of the terminal. Crimp the shank and install heat-shrink tubing, if necessary.

4-21. CONTROL MODULE.

The control module is normally located in the upper left front corner of the unit. (See fig. 4-16.) It can be remote mounted, see paragraph 4-4a(2).

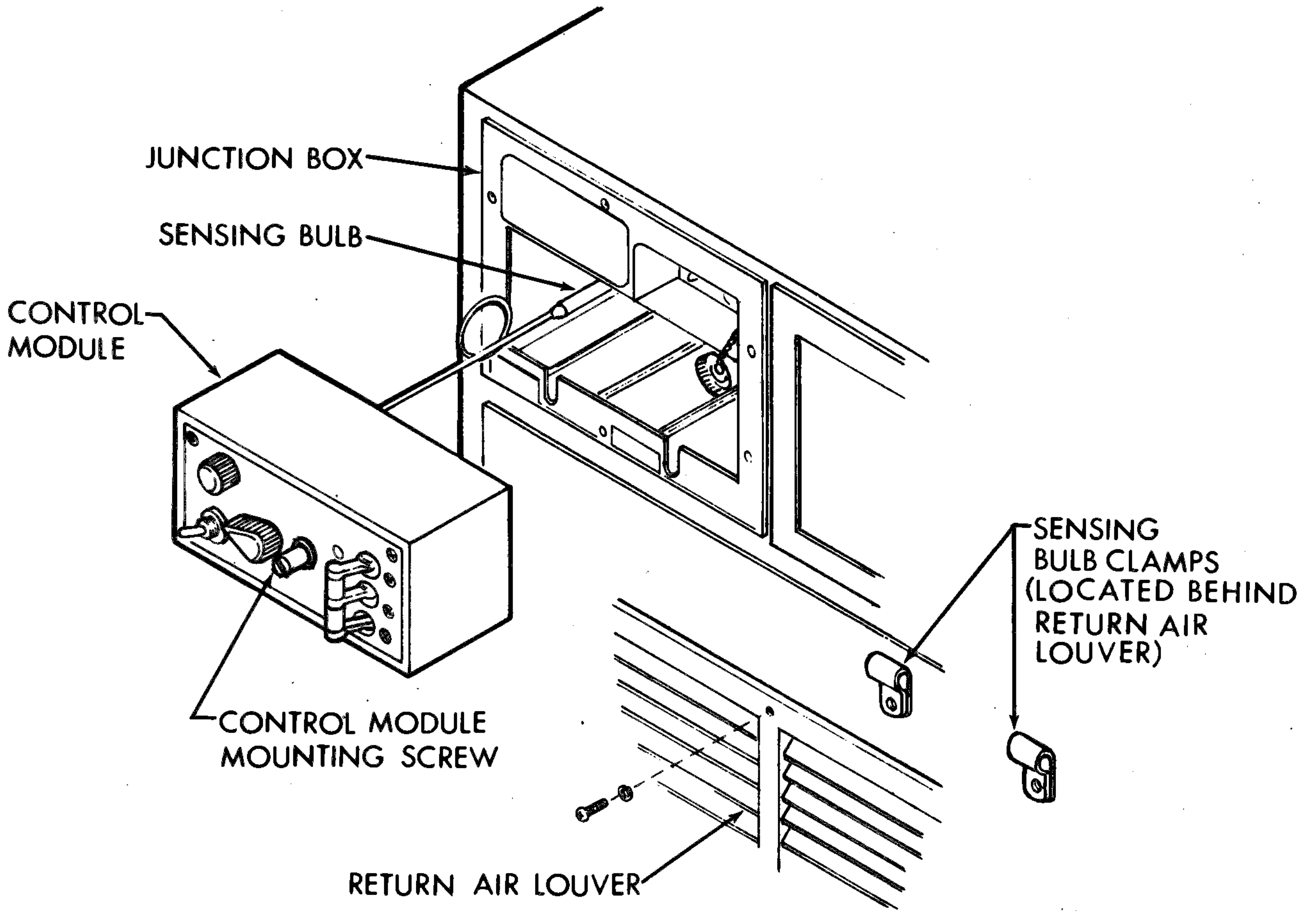


Figure 4-16. Control Module Removal

4-21. CONTROL MODULE.-Continued

a. Removal.

(1) Disconnect power at power source.

(2) Remove eight screws and return air louver.

(3) Loosen sensing bulb clamp screws and slip sensing bulb out of clamps.

(4) Loosen control module mounting screw and carefully pull control module out of unit. Use care to avoid damage to sensing line.

(5) Carefully work sensing bulb through the frame and out of unit.

b. Test/Repair. (See fig. 4-17.)

(1) See paragraphs 4-22 through 4-26 for testing of individual components.

(2) Repairs are limited to replacement of individual components and repair of wire connections.

c. Replace. If the control module is damaged beyond repair, replace with a new control module.

d. Installation. (See fig. 4-16.)

(1) Carefully work sensing bulb through junction box frame and into two mounting clamps behind return air louver.

(2) Tighten clamp screws.

(3) Slip control module into the opening in junction box. Take care not to crush or kink sensing bulb capillary line.

(4) Tighten control module mounting screw.

(5) Install return air louver and secure with eight screws.

(6) Connect power at power source.

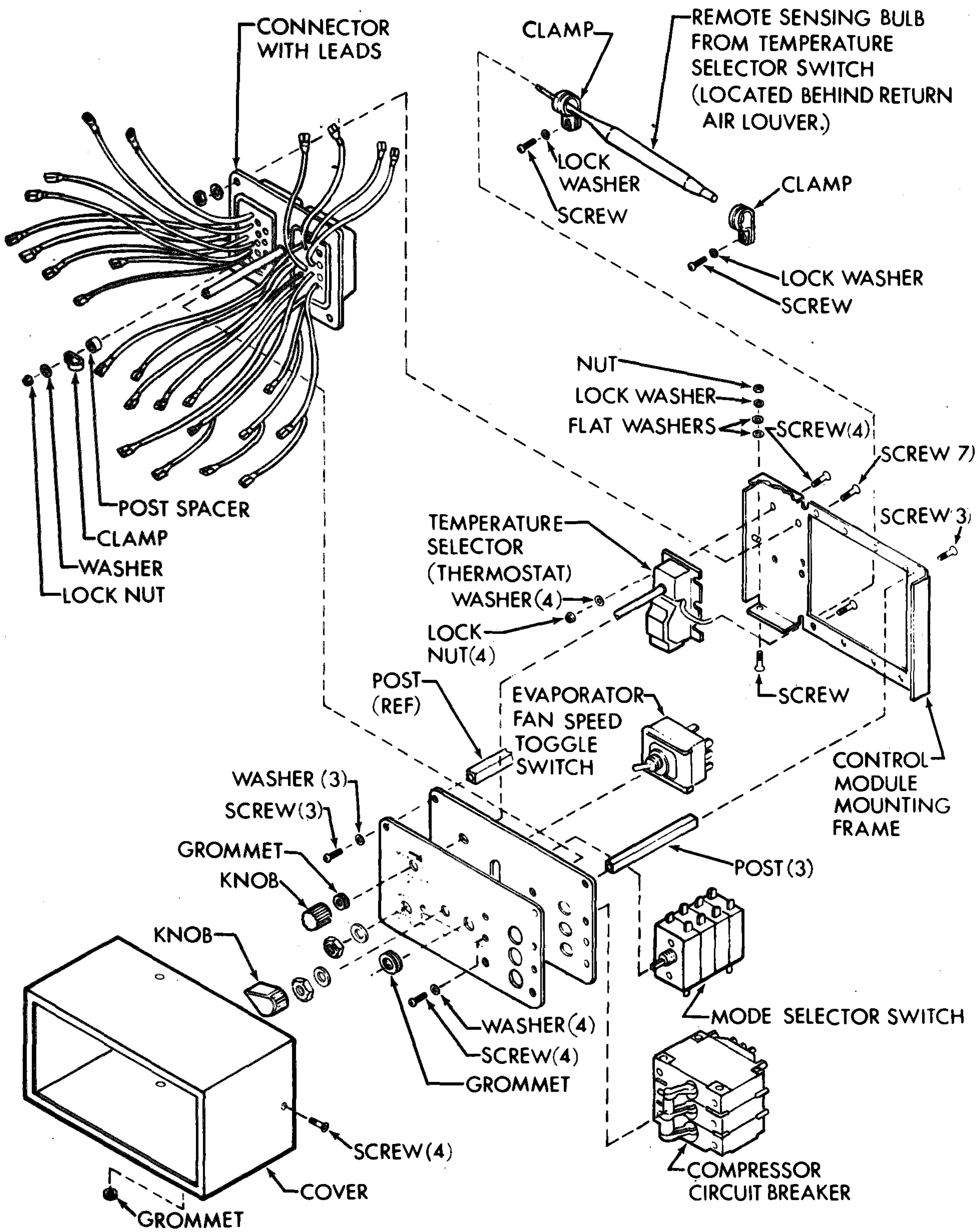


Figure 4-17. Control Module

4-22. TEMPERATURE SELECTOR (CONTROL SWITCH THERMOSTAT) S3.

The TEMPERATURE SELECTOR (control switch thermostat) S3 is located in the control module. (See fig. 4-18.)

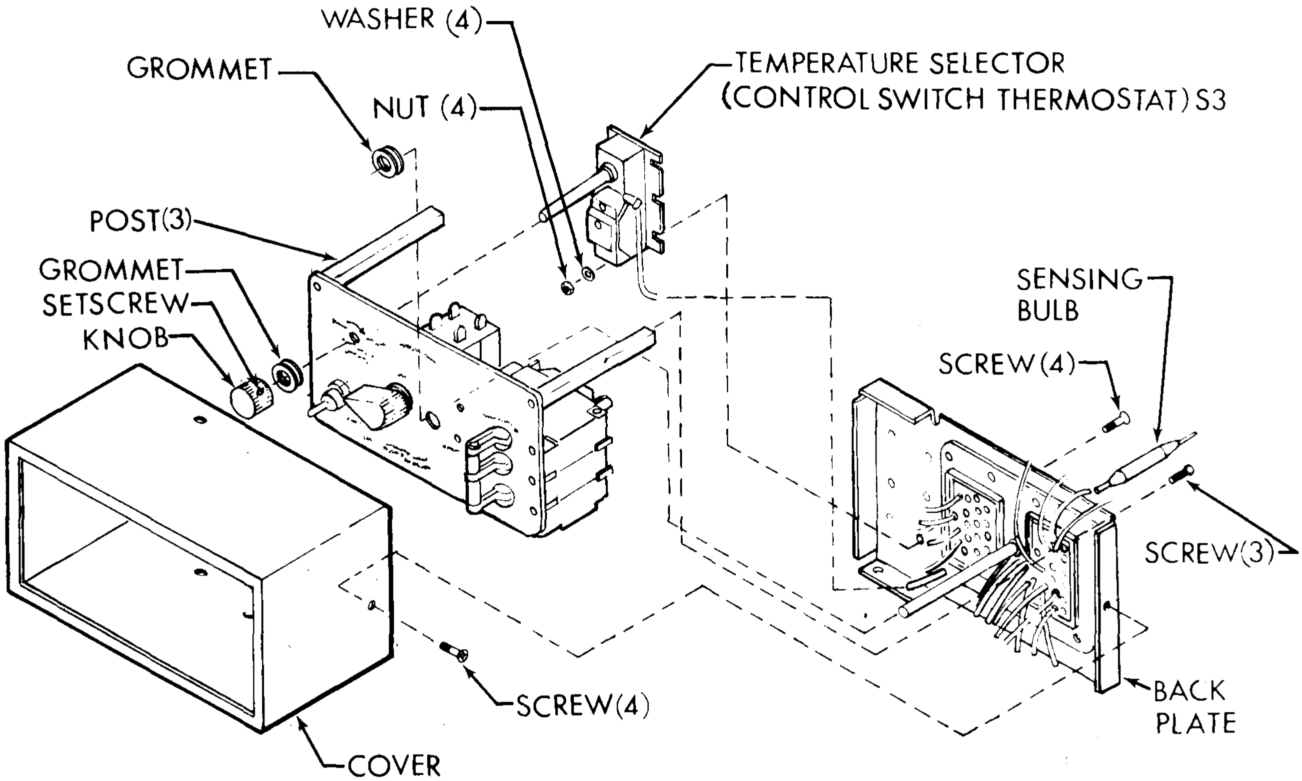


Figure 4-18. TEMPERATURE SELECTOR (Control Switch Thermostat) S3

a. Removal.

WARNING

Disconnect input power from the air conditioner before performing maintenance on any part of the electrical system. The voltages used can be lethal.

(1) Disconnect power at power source.

(2) See para 4-21a and remove control module.

(3) See fig. 4-18 and remove four screws and pull cover off.

(4) Loosen setscrew in TEMPERATURE SELECTOR knob. Remove knob.

4-22. TEMPERATURE SELECTOR (CONTROL SWITCH THERMOSTAT) S3.- Continued

(5) Remove three screws from posts and slip back plate off.

(6) Tag and disconnect wires from TEMPERATURE SELECTOR.

(7) Remove four screws, washers, and nuts and pull TEMPERATURE SELECTOR from back plate.

b. Test.

(1) Place the sensing bulb in a container of warm water, 75° to 85°F (24° to 30°C) and set multimeter to measure resistance on Rx1 scale. Place multimeter leads on terminals 1 and 3 of the thermostat (blue and red). Turn the knob to the extreme cooler position. There should be no indication of continuity on multimeter. Turn the knob to the extreme warmer position. Continuity should be indicated on the multimeter.

(2) Center or mid-range of the Temperature Selector represents a setting of about 75°F (24°C). With the sensing bulb remaining in the container of warm water, 75° to 85°F (24° to 30°C), slowly turn the knob from the extreme warmer position towards the cooler position. Continuity should cease before or near mid-range of the knob.

c. Replace. Replace TEMPERATURE SELECTOR if defective.

d. Installation.

(1) Place TEMPERATURE SELECTOR on back plate and secure with four screws, washers and nuts.

(2) See wiring diagram figure 4-4 and tags and connect wire leads. Remove tags.

(3) Align holes in back plate with the three posts and secure with screws.

(4) Check that grommets are in place in shaft holes. Install TEMPERATURE SELECTOR knob and tighten setscrew.

(5) Slip cover in place and secure with four screws.

(6) See paragraph 4-21c and install control module.

(7) Connect power at power source.

4-23. EVAPORATOR FAN SPEED SWITCH S2.

The EVAPORATOR FAN SPEED switch S2 is located in the control module. (See fig. 4-19.)

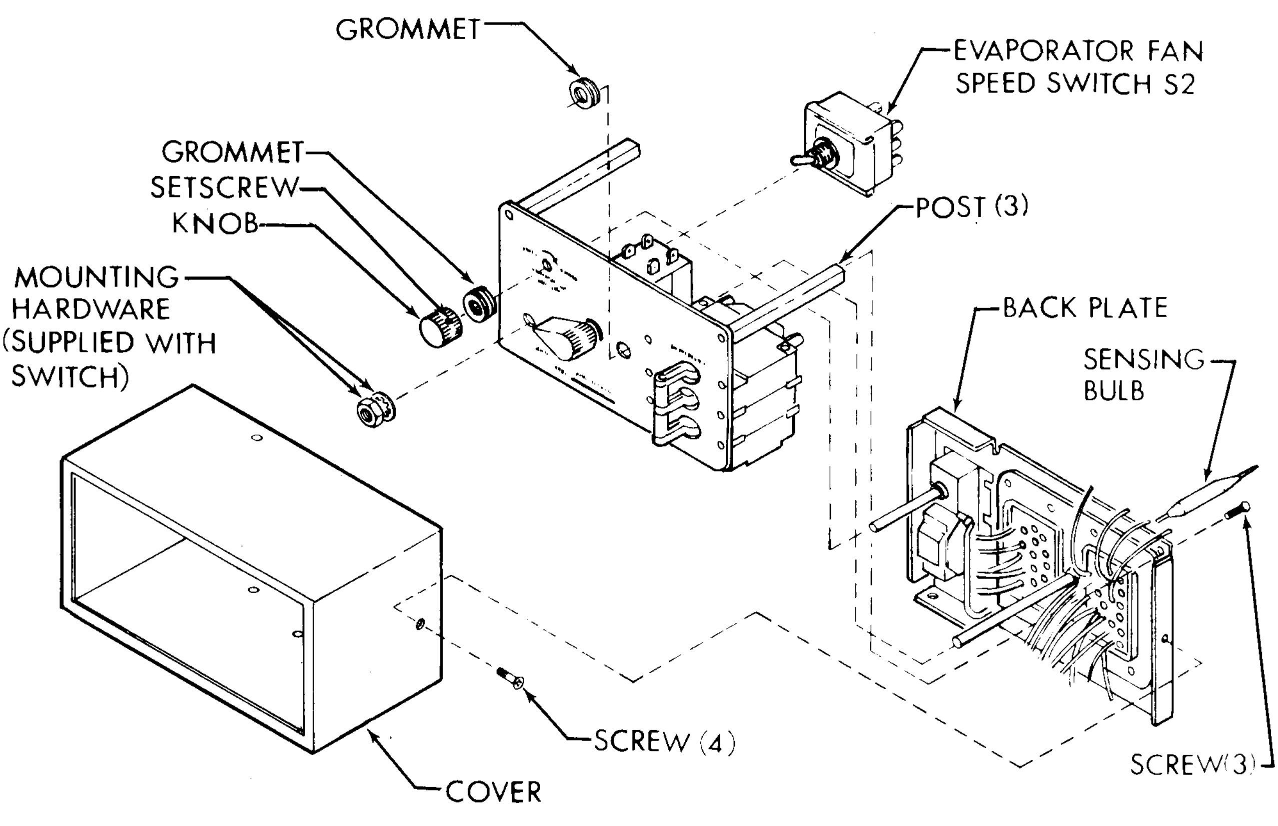


Figure 4-19. EVAPORATOR FAN SPEED Switch S2

a. Removal.

WARNING

Disconnect input power from the air conditioner before performing maintenance on any part of the electrical system. The voltages used can be lethal.

4-23. EVAPORATOR FAN SPEED SWITCH S2.-Continued

(1) Disconnect power at power source.

(2) See paragraph 4-21a and remove control module.

(3) See figure 4-19 and remove four screws and pull cover off.

(4) Loosen the setscrew in TEMPERATURE SELECTOR knob. Remove knob.

(5) Remove the three screws from the posts and slip the back plate off.

(6) Tag and disconnect wires from EVAPORATOR FAN SPEED switch.

(7) Remove nut and washer and pull switch from the panel.

b. Testing. Check continuity in both positions. Continuity should be indicated.

c. Replace. Replace EVAPORATOR FAN SPEED switch if defective.

d. Installation.

(1) Insert switch into control panel and secure with nut and washer.

(2) See the wiring diagram figure 4-4 and tags and connect wire leads. Remove tags.

(3) Align holes in the back plate with the three posts and secure with screws.

(4) Check that grommets are in place in shaft holes. Install TEMPERATURE SELECTOR knob and tighten setscrew.

(5) Slip cover in place and secure with four screws.

(6) See paragraph 4-21c and install control module.

(7) Connect power at power source.

4-24. MODE SELECTOR SWITCH S1.

The MODE SELECTOR switch S1 is the rotary type switch located in the control module. (See fig. 4-20.)

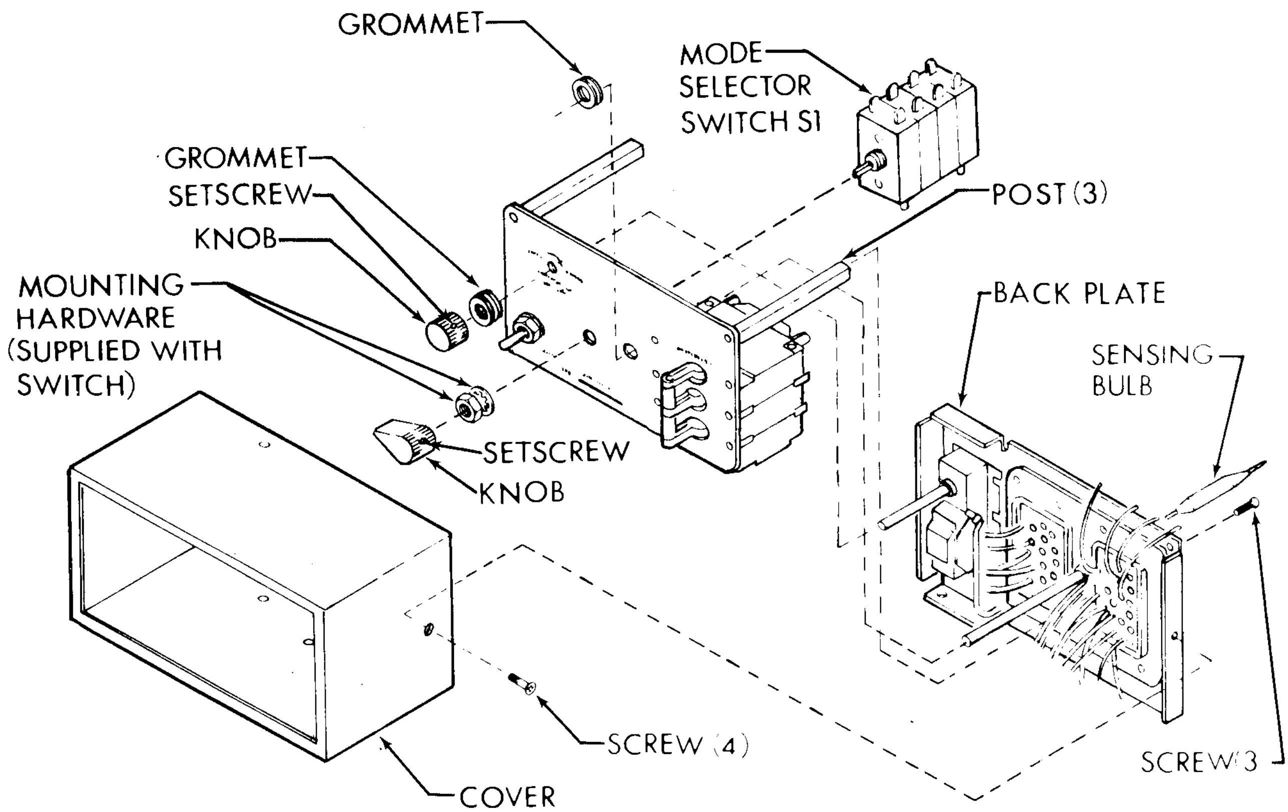


Figure 4-20. MODE SELECTOR Switch S1

a. Removal.

WARNING

Disconnect input power from the air conditioner before performing maintenance on any part of the electrical system. The voltages used can be lethal.

(1) Disconnect power at power source.

(2) See paragraph 4-21a and remove control module.

(3) See figure 4-20 and remove four screws and pull cover off.

4-24. MODE SELECTOR SWITCH S1.-Continued

(4) Loosen setscrew in the TEMPERATURE SELECTOR knob. Remove knob.

(5) Remove the three screws from the posts and slip back plate off.

(6) Tag and disconnect wires from MODE SELECTOR switch.

(7) Loosen setscrew and pull knob from MODE SELECTOR switch.

(8) Remove nut and washer and pull MODE SELECTOR switch from the panel.

b. Test. See the mode position chart below and check continuity at pins indicated to each of the positions indicated. Replace the switch if continuities are not in accordance with those indicated.

MODE POSITION CHART

Position	Function	Switch Section and Terminals Connected			
		S1A	S1B	S1C	S1D
1	HEAT (HIGH)	12 and 1A	21 and 2C 22 and 2B	31 and 3C 32 and 3A	41 and 4C 42 and 4A
2	HEAT (LOW)	12 and 1A	21 and 2C 22 and 2B	31 and 3C	
3	OFF				
4	VENT		21 and 2C 22 and 2B	31 and 3C	
5	COOL	12 and 1B 11 and 1D	21 and 2C 22 and 2B	32 and 3B 31 and 3C	41 and 4D 42 and 4B

4-24. MODE SELECTOR SWITCH S1.–Continued

c. Replace. Replace MODE SELECTOR switch if defective.

d. Installation.

(1) Slip MODE SELECTOR switch shaft through panel hole and secure with mounting nut and washer supplied with switch.

(2) Place knob on MODE SELECTOR switch shaft and tighten setscrew.

(3) See wiring diagram figure 4-4 and tags and connect wire leads. Remove tags.

(4) Align holes in the back plate with the three posts and secure with screws.

(5) Check that grommets are in place in shaft holes. Install TEMPERATURE SELECTOR knob and tighten setscrew.

(6) Slip cover back in place and secure with four screws.

(7) See paragraph 4-21c and install control module.

(8) Connect power at power source.

4-25. COMPR CIRCUIT BKR CB1.

The COMPR CIRCUIT BKR is located in the control module.
(See fig. 4-21.)

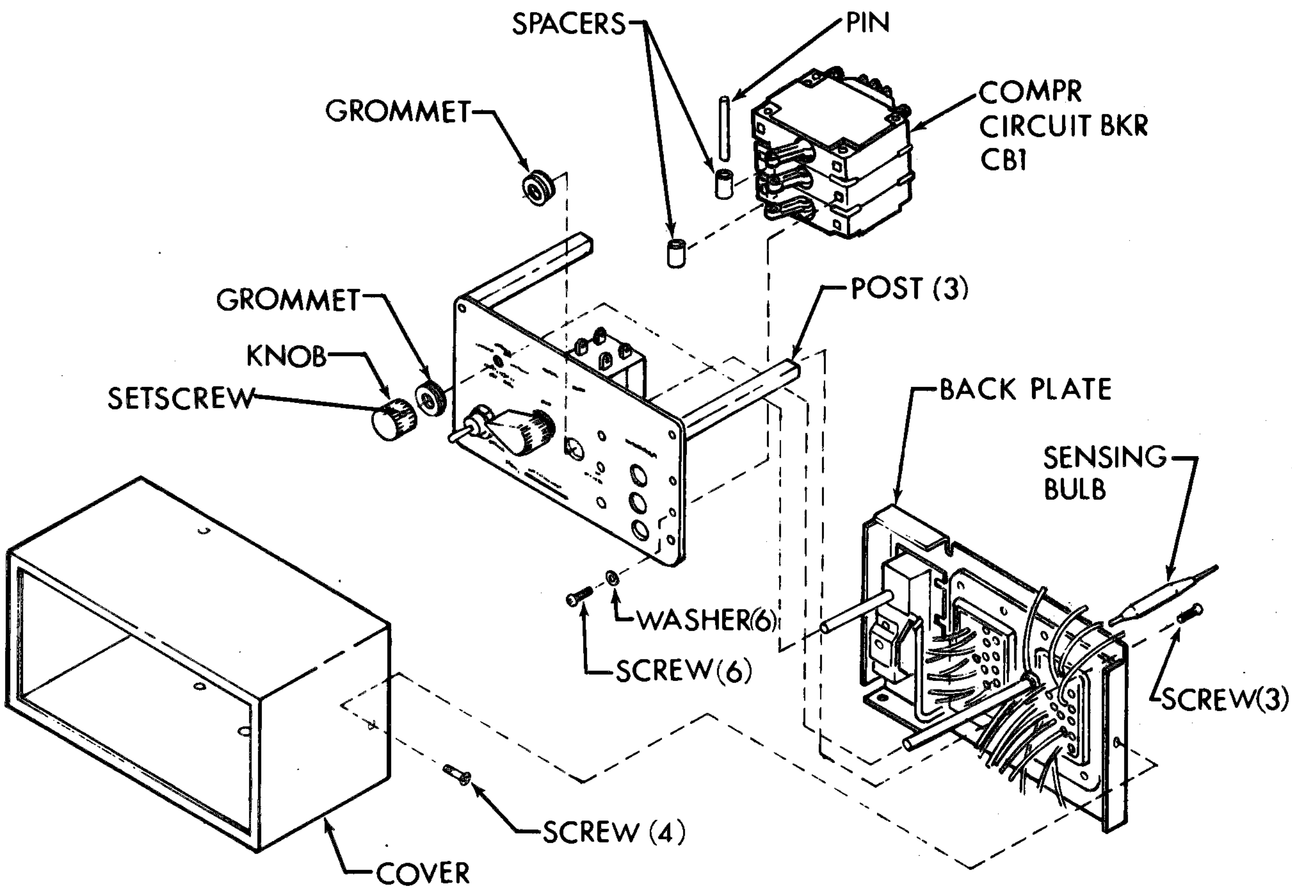


Figure 4-21. COMPR CIRCUIT BKR (Compressor Circuit Breaker) CB1

a. Removal.

WARNING

Disconnect input power from the air conditioner before performing maintenance on any part of the electrical system. The voltages used can be lethal.

(1) Disconnect power at power source.

(2) See paragraph 4-21a and remove control module.

4-25. COMPR CIRCUIT BKR CB1.-Continued

(3) See figure 4-21 and remove four screws and pull cover off.

(4) Loosen setscrew in the TEMPERATURE SELECTOR knob. Remove knob.

(5) Remove three screws from the posts and slip back plate off.

(6) Tag and disconnect wires from the circuit breaker.

(7) Remove pin and spacers from circuit breaker toggles.

(8) Remove screws and pull circuit breaker from the panel.

b. Test.

(1) Check to see that continuity exists on each pair of terminals when circuit breaker is in the on position.

(2) Check to see that there is no continuity between terminals with circuit breaker in the off position.

c. Replace. Replace COMPR CIRCUIT BKR if defective.

d. Installation.

(1) Insert circuit breaker toggles through control panel. Be sure off position matches lettering on panel.

(2) Secure circuit breaker to panel with screws and washers.

(3) Insert pin and spacers through circuit breaker toggles to lock them together.

(4) See wiring diagram figure 4-4 and tags and connect wire leads. Remove tags.

(5) Align holes in the back plate with the three posts and secure with screws.

(6) Check that grommets are in place in shaft holes. Install TEMPERATURE SELECTOR knob and tighten setscrew.

(7) Slip cover back in place and secure with four screws.

(8) See paragraph 4-21c and install control module.

(9) Connect power at power source.

4-26. CONTROL MODULE WIRING HARNESS.

(See fig. 4-22.)

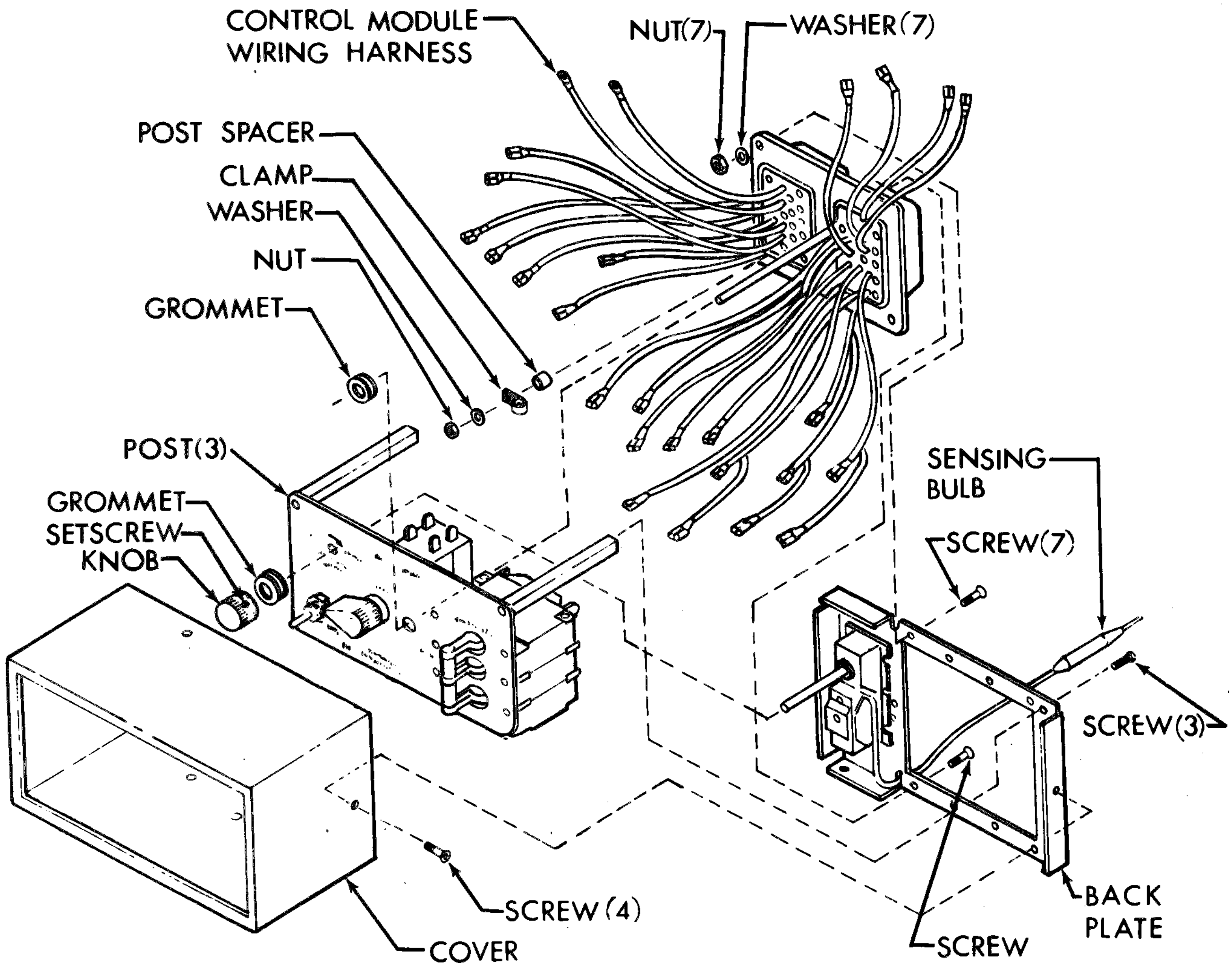


Figure 4-22. Control Module Wiring Harness

WARNING

Disconnect input power from the air conditioner before performing maintenance on any part of the electrical system. The voltages used can be lethal.

4–26. CONTROL MODULE WIRING HARNESS.-Continued

a. Inspect.

(1) Disconnect power at power source.

(2) See paragraph 4-21a and remove control module.

(3) See figure 4-22 and remove four screws and pull the cover off.

(4) Inspect connector for loose, damaged or missing pins. Replace if defective.

(5) Check individual wires for loose solder connections, loose terminal lugs, cut or frayed insulation, cut or broken wires.

b. Removal.

(1) Loosen setscrew in TEMPERATURE SELECTOR knob. Remove knob.

(2) Remove three screws from the posts and slip the back plate off.

(3) Tag and disconnect wires from components and ground stud.

(4) Remove attaching hardware and pull connector from back plate.

c. Testing. See the wiring diagram figure 4-4. Continuity test individual wires to corresponding pin in connector. Replace or repair wires with no continuity.

d. Repair.

(1) See paragraph 4-20 for general wire repair instructions.

(2) See table 4-3 Wire List for wire lengths and terminal information when individual wires are replaced.

e. Replace. Replace individual wires and terminals if defective.

f. Installation.

(1) Slip connector into back plate and secure with screws, nuts and washers.

(2) See the wiring diagram figure 4-4 and tags and connect wire leads. Remove tags.

4-26. CONTROL MODULE WIRING HARNESS.-Continued

(3) Align holes in back plate with three posts and secure with screws.

(4) Check that grommets are in place in shaft holes. Install TEMPERATURE SELECTOR knob and tighten setscrew.

(5) Slip cover back in place and secure with four screws.

(6) See paragraph 4-21c and install the control module.

(7) Connect power at power source.

4-27. JUNCTION BOX.

The junction box is located in the upper left front corner of the unit. (See fig. 4-23.)

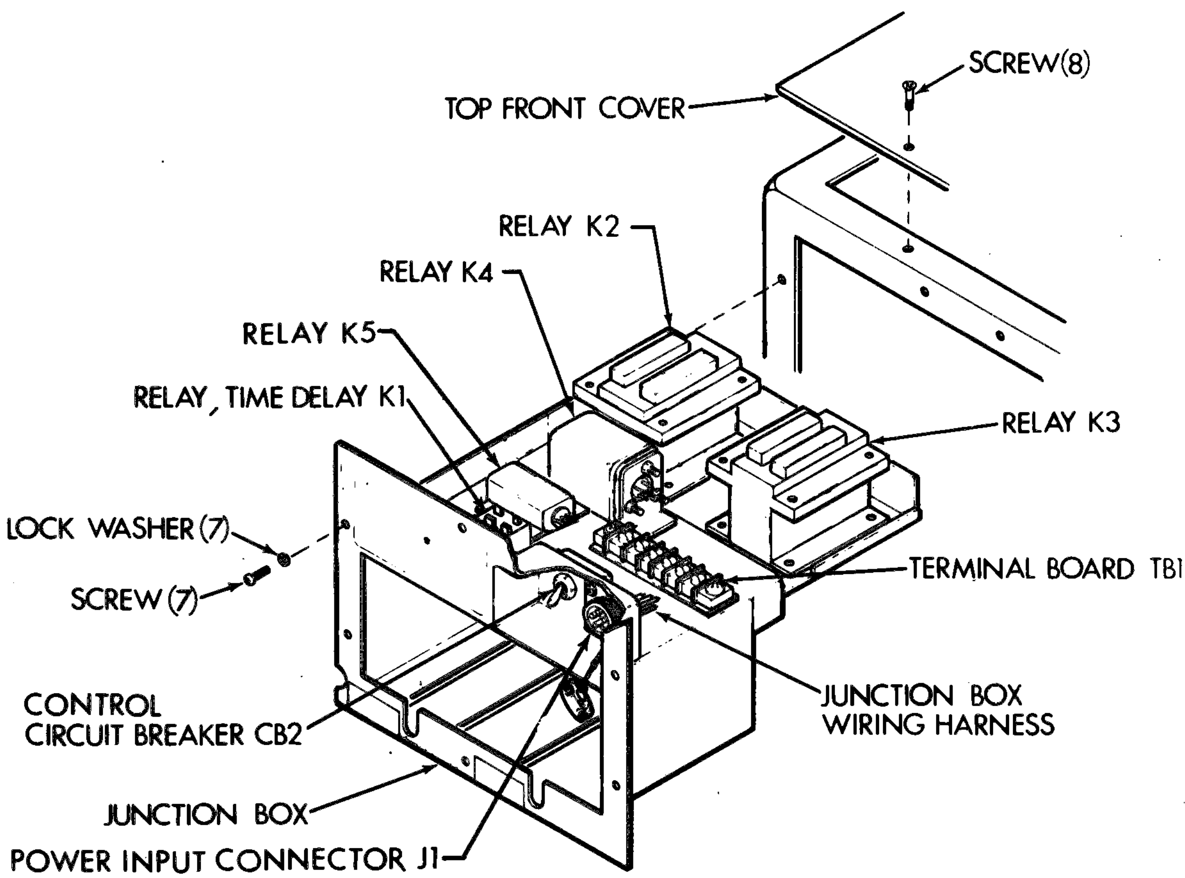


Figure 4-23. Junction Box

4-27. JUNCTION BOX.-Continued

a. Removal.

(1) Disconnect power at power source.

(2) See paragraph 4-21a and remove control module.

(3) Remove eight screws and top front cover (para 4-11).

(4) Remove seven screws and lock washers and carefully slide junction box out of unit.

NOTE

Most maintenance testing, and inspection of the junction box and individual components can be done at this stage. The junction box should be supported on a stand or table to avoid damage to wires or connections. If the complete junction box is to be replaced or removed proceed to step (5).

(5) Tag and disconnect individual wires and connectors of junction box harness from unit.

(6) Remove junction box.

b. Inspect.

(1) Inspect for missing or loose attaching hardware, damaged parts and excessive corrosion. Replace missing hardware and damaged parts. Tighten loose hardware and clean or repair parts as indicated.

(2) See paragraphs 4-28 through 4-30 for inspection/testing of wiring harness and individual components.

c. Replace. If the junction box is damaged beyond repair, replace with a new junction box.

d. Installation.

(1) If wiring harness was disconnected from unit, see the wiring diagram figure 4-4 and tags and connect wire leads and connectors. Remove tags.

(2) Carefully slide junction box into place and secure with seven screws and lock washers.

4-27. JUNCTION BOX.-Continued

(3) See paragraph 4-21c and install control module.

(4) Install top front cover and secure with eight screws (para 4-11).

(5) Connect power at power source.

4-28. JUNCTION BOX WIRING HARNESS.

(See fig. 4-24.)

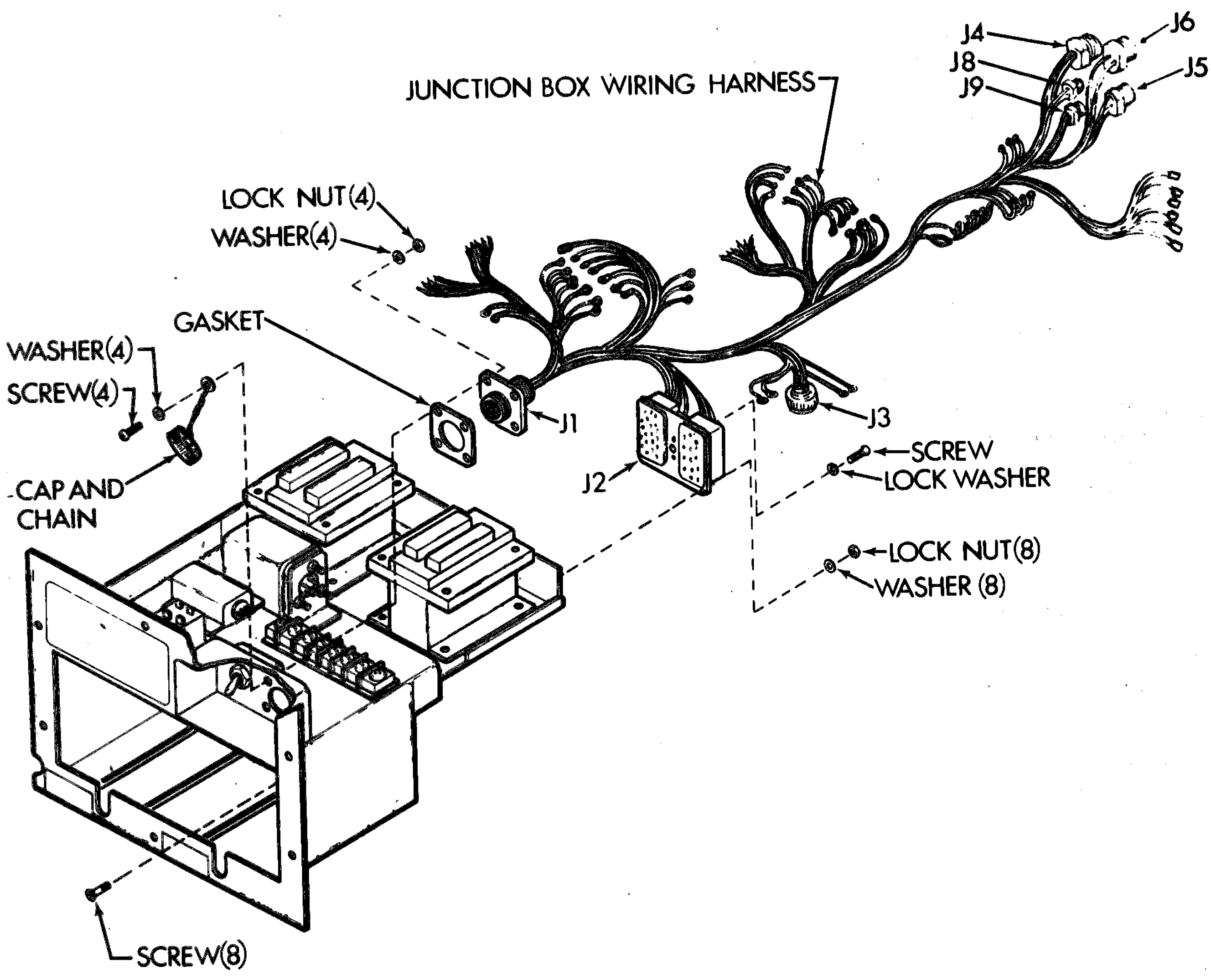


Figure 4-24. Junction Box Wiring Harness

4-28. JUNCTION BOX WIRING HARNESS.-Continued

WARNING

Disconnect input power from the air conditioner before performing maintenance on any part of the electrical system. The voltages used can be lethal.

a. Inspect.

(1) Disconnect power at power source.

(2) See paragraph 4-21a and remove control module.

(3) Remove top front cover (para 4-11).

(4) Remove seven screws and lock washers and carefully slide junction box out of unit.

(5) Inspect connector for loose, damaged or missing pins. Replace if defective.

(6) Check individual wires for loose solder connections, loose terminal lugs, cut or frayed insulation cut or broken wires.

b. Removal. Tag and disconnect individual wires and connectors from unit.

c. Testing. See wiring diagram figure 4-4. Continuity test individual wires. Replace or repair wires with no continuity.

d. Repair.

(1) See paragraph 4-20 for general wire repair instructions.

(2) See table 4-3 Wire List for wire lengths and terminal information when individual wires are replaced.

e. Replace. Replace individual wires, terminals or connectors if defective.

f. Installation.

(1) See wiring diagram figure 4-4 and tags and connect the wire leads and connectors. Remove tags.

(2) Carefully slide junction box into place and secure with seven screws and lock washers.

4-28. JUNCTION BOX WIRING HARNESS.-Continued

(3) See paragraph 4-21c and install control module.

(4) Install top front cover (para 4-11).

(5) Connect power at power source.

4-29. RELAYS.

Relays K2, K3, and K4 and time delay relay K1 and phase sequence relay K5 are located in junction box. (See fig. 4-25.)

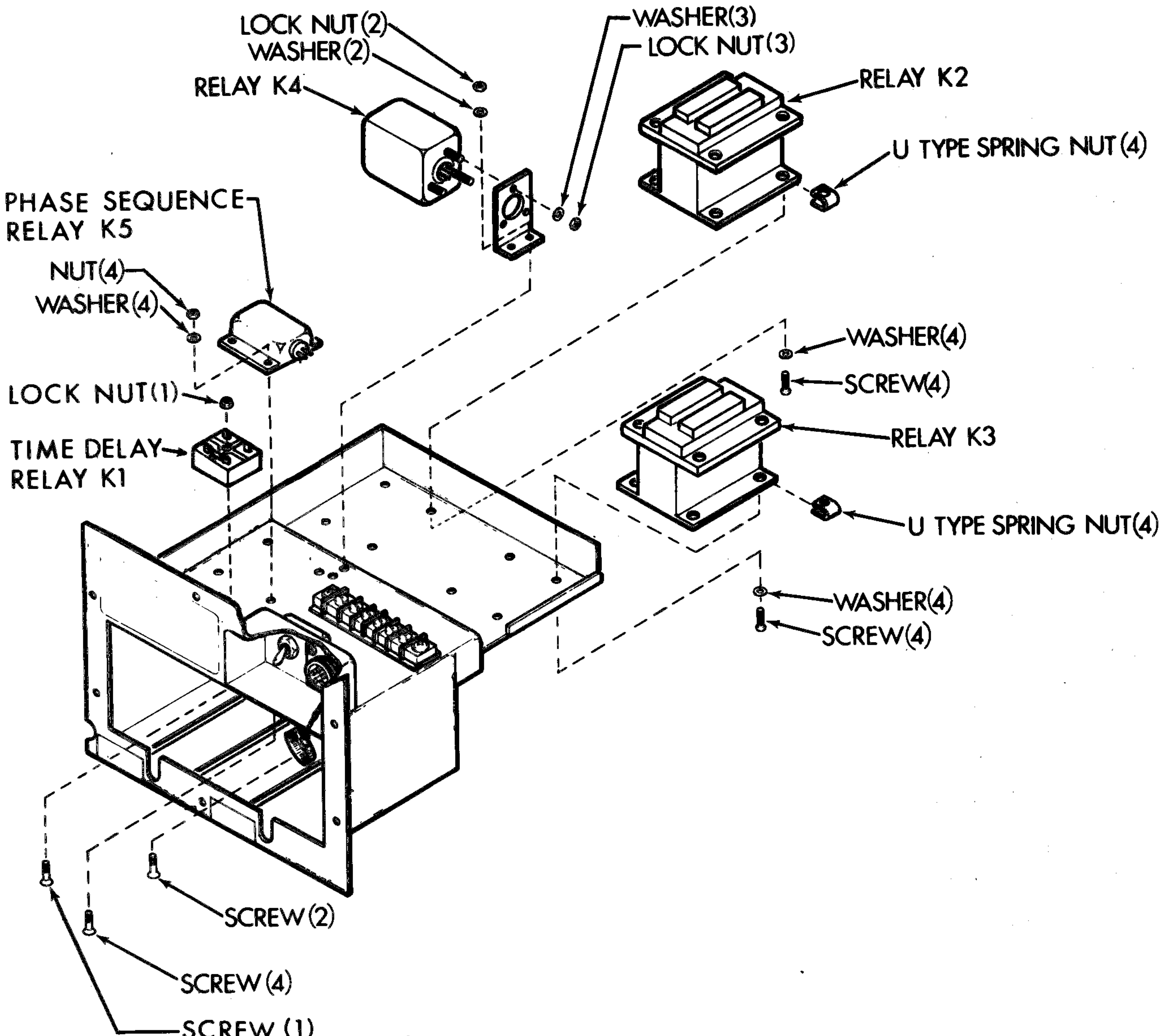


Figure 4-25. Relays

4-29. RELAYS.-Continued

WARNING

Disconnect input power from the air conditioner before performing maintenance on any part of the electrical system. The voltages used can be lethal.

a. Test.

(1) Disconnect power at power source.

(2) See paragraph 4-21a and remove control module.

(3) Remove top front cover (para 4-11).

(4) Remove seven screws and lock washers and carefully slide junction box out of unit.

(5) Relays K2 and K3.

(a) Apply 28VDC to terminals X1 and X2; X1 is positive, X2 is negative.

(b) Check continuity across terminals A1 and A2; B1 and B2, and C1 and C2. The multimeter must show that contacts are closed.

(c) Remove power. Multimeter must show that contacts are open.

(6) Relay K4.

(a) Apply 28VDC to terminals 2 and 9; 2 is positive, 9 is negative.

(b) Check continuity across terminals, 1 and 3; 5 and 11; and 10 and 8.

(c) Read Multimeter. It should indicate that terminals 1 and 3, 5 and 11, and 10 and 8 are closed. Terminals 1 and 4, 5 and 6, and 10 and 7 are open.

(d) Remove 28VDC power. Multimeter should indicate that terminals 1 and 4, 5 and 6, and 10 and 7 are closed and that terminals 1 and 3, 5 and 11, and 10 and 8 are open.

(7) Time delay relay K1.

(a) Connect multimeter to terminal A1 and A2 of relay K3.

4-29. RELAYS.-Continued

(b) Apply +28VDC to terminal 1 of K1 and 28VDC ground to terminal X2 of K3. Terminal 1 of K1 is positive and terminal X2 of K3 is negative.

(c) Multimeter must show continuity across terminals A1 and A2 of relay K3 within 30 ± 3 seconds after applying the 28 VDC.

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

(8) Phase sequence relay K5.

(a) This relay will energize only when all three phases of input power are in proper sequence and when input voltage and frequency are within 10% of that specified (208 volt, 60 hertz).

(b) Check that power connections are properly connected and that input power is within 10% of that specified.

b. Removal.

(1) Tag and disconnect wires to relay.

(2) See figure 4-25 and remove attaching hardware.

(3) Pull relay from junction box.

c. Replace. Replace individual relays if defective.

d. Installation.

(1) Mount relay using hardware indicated on figure 4-25.

(2) See figure 4-4 wiring diagram and tags and connect leads. If relay has solder connections be sure to protect solder joints with heat shrink or equal insulation tubing.

(3) Carefully slide junction box into place and secure with seven screws and lock washers.

(4) See paragraph 4-21c and install control module.

(5) Install top front cover (para 4-11).

(6) Connect power at power source.

4-30. CONTROL CIRCUIT BREAKER CB2.

The CONTROL CIRCUIT BREAKER is located in the junction box. (See fig. 4-26.)

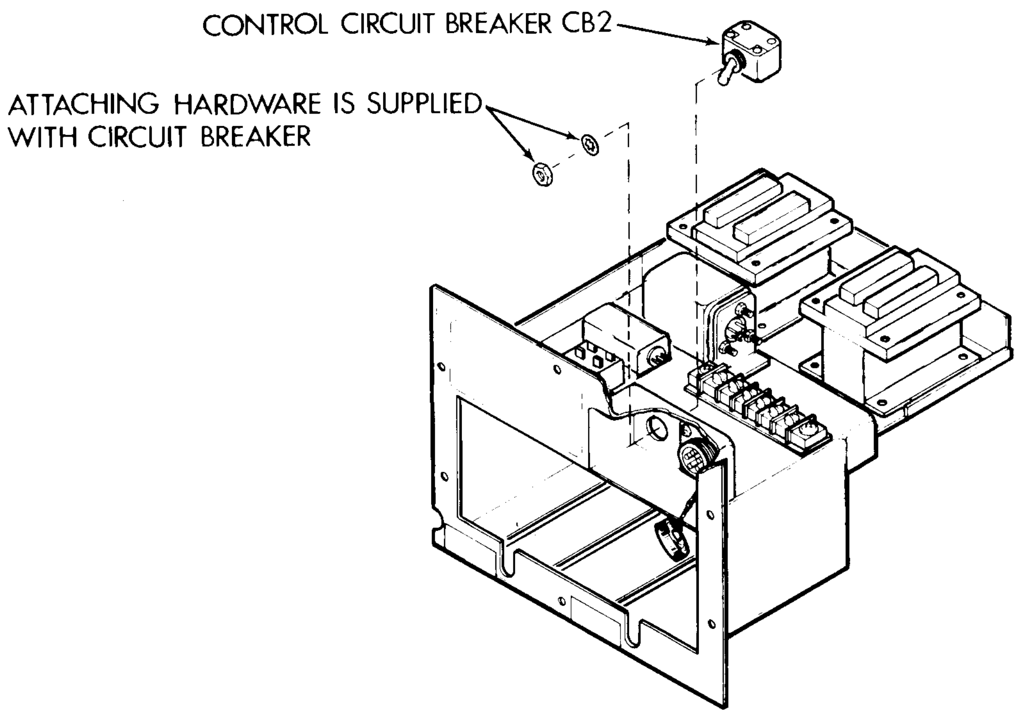


Figure 4-26. CONTROL CIRCUIT BREAKER CB2

WARNING

Disconnect input power from the air conditioner before performing maintenance on any part of the electrical system. The voltages used can be lethal.

a. Test.

(1) Disconnect power at power source.

(2) See paragraph 4-21a and remove control module.

(3) Remove top front cover (para 4-11).

4-30. CONTROL CIRCUIT BREAKER CB2.-Continued

(4) Remove seven screws and lock washers and carefully slide junction box out of unit.

(5) Tag and disconnect leads.

(6) Check that there is continuity between the two terminals with the circuit breaker in the on position.

(7) Check that there is no continuity between terminals with the circuit breaker in the off position.

b. Removal.

(1) Remove attaching nut and hardware from front of panel.

(2) Slip circuit breaker from back of panel.

c. Replace. Replace CONTROL CIRCUIT BREAKER if defective.

d. Installation.

(1) Slip circuit breaker into hole in panel and secure with nut and locking hardware provided with circuit breaker.

(2) See the wiring diagram figure 4-4 and tags and connect the wire leads. Remove tags.

(3) Carefully slide junction box into place and secure with seven screws and lock washers.

(4) See paragraph 4-21c and install control module.

(5) Install top front cover (para 4-11).

(6) Connect power at power source.

4-31. MISCELLANEOUS CABLES, HARNESSES, AND TERMINAL BOARDS.

WARNING

Disconnect input power from the air conditioner before performing maintenance on any part of the electrical system. The voltages used can be lethal.

a. Inspect/Test. (See fig. 4-27.)

(1) Disconnect power at power source.

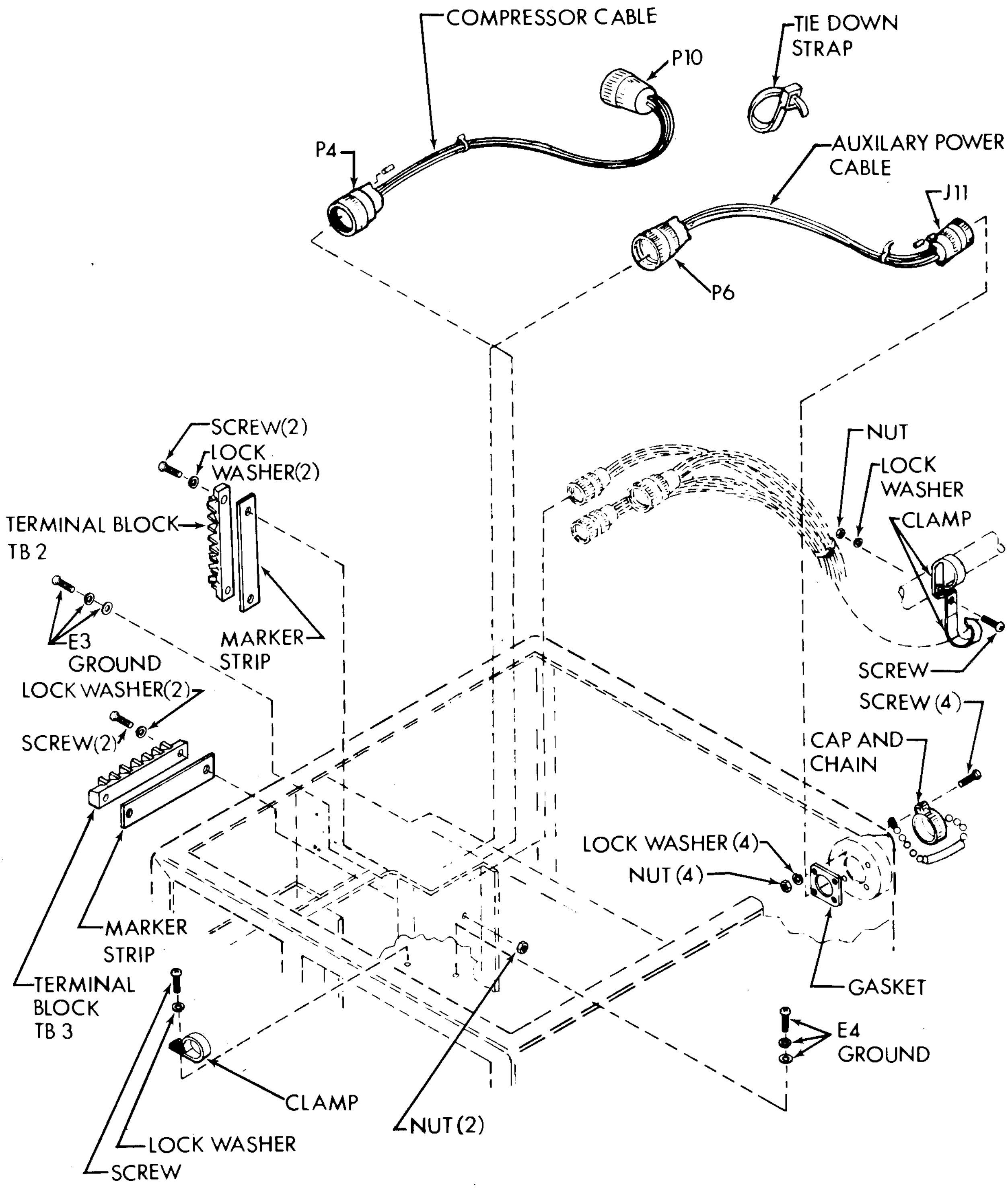


Figure 4-27. Miscellaneous Cables, Harnesses, and Terminal Boards

4-31. MISCELLANEOUS CABLES, HARNESSES, AND TERMINAL BOARDS.- Continued

(2) Remove top rear cover (para 4-11) for access to compressor and auxiliary power input cables.

(3) For full access to terminal blocks TB2 and TB3 it is necessary to:

(a) Remove top front cover (para 4-11).

(b) Remove junction box and control module (para 4-21 and 4-27).

(4) Check terminals on terminal boards that they are tight and free of corrosion.

(5) Disconnect connectors and check for loose, damaged, or missing pins.

(6) Check individual wires for loose solder connections, cut or frayed insulation and cut or broken wires.

(7) See wiring diagram (fig. 4-4) and continuity test individual wires. Repair or replace wires with no continuity.

b. Repair.

(1) See paragraph 4-20 for general wire repair instructions.

(2) See table 4-3 Wire List for wire lengths and terminal information when individual wires are replaced.

c. Replace. Replace individual wires, connectors, or terminal boards if defective.

d. Installation.

(1) Connect all disconnected connectors.

(2) Install junction box and control module (para 4-21 and 4-27).

(3) Install top front and rear covers (para 4-11).

(4) Connect power at power source.

4-32. TRANSFORMER, RECTIFIER, CAPACITORS, AND HARNESS.

The transformer rectifier and capacitors C1 and C2 are located behind the junction box in the upper front left corner of the unit. (See fig. 4-28.)

WARNING

Disconnect input power from the air conditioner before performing maintenance on any part of the electrical system. The voltages used can be lethal.

a. Inspect.

(1) Disconnect power at the power source.

(2) Remove top front cover (para 4-11).

(3) Remove junction box and control module (para 4-21 and 4-27).

(4) Check that solder connections and terminals are tight and in good condition.

(5) Check that harness wires have no cuts, broken wires, or frayed insulation.

(6) Check that attaching hardware is tight and in good condition.

(7) Inspect electrical parts for obvious damage such as cracks, evidence of overheating and broken terminals.

(8) Replace all damaged or broken parts.

b. Test.

(1) Transformer T1.

(a) Tag and disconnect leads. Do not remove jumper between pins 3 and 4 on transformer. Check for continuity across the primary winding pin 2 to pin 5 and across the secondary winding pin 7 to pin 8. If either winding is open, replace transformer.

(b) Check for shorts between one terminal of each winding and transformer case and also between one primary terminal and one secondary terminal using an insulation tester, megger or multimeter on high ohms setting. Replace transformer if a short is indicated.

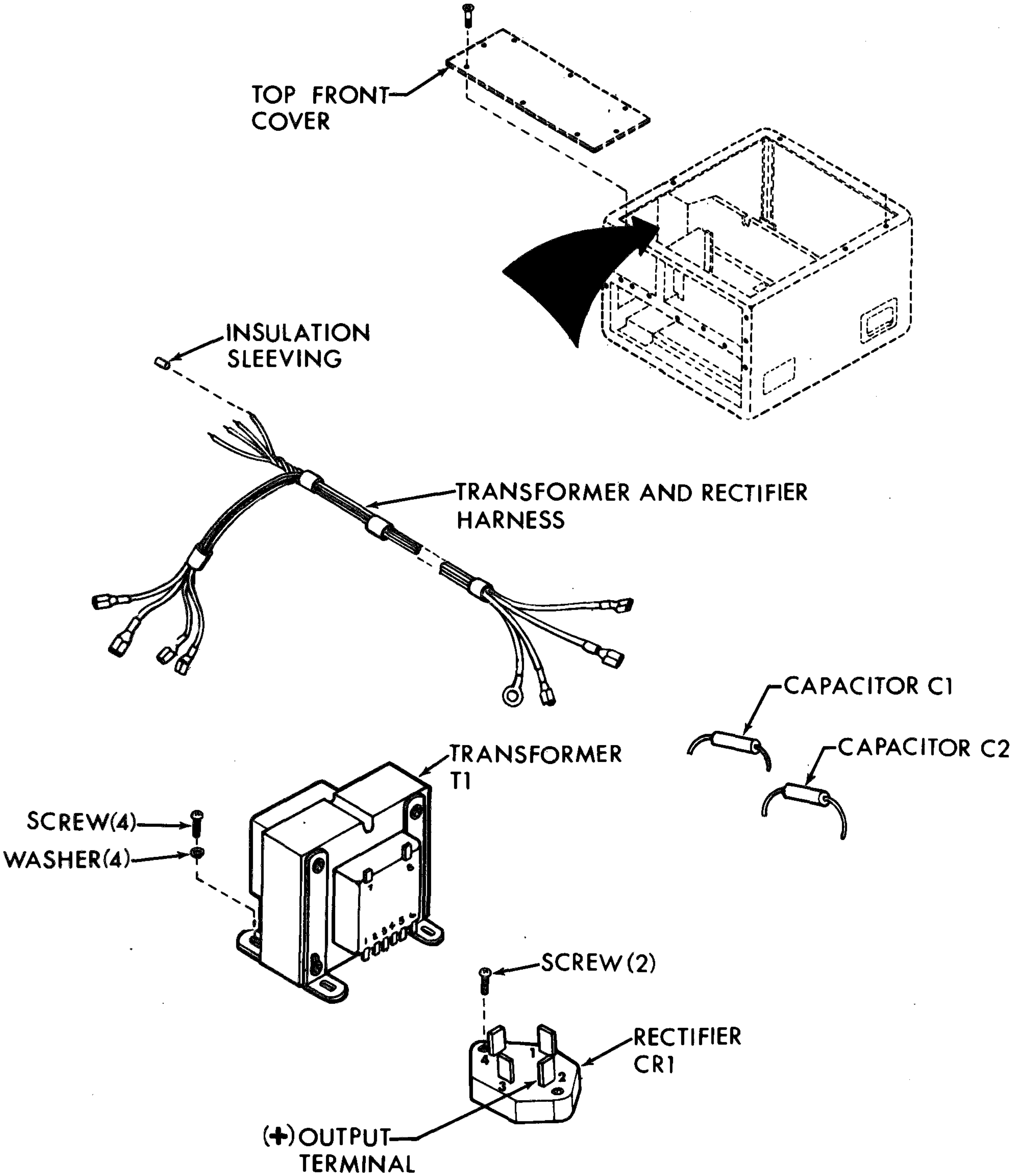


Figure 4-28. Transformer and Rectifier

4-32. TRANSFORMER, RECTIFIER, CAPACITORS, AND HARNESS.–Continued

(c) Apply 208 volts AC to terminals 2 and 5 (input terminals). Voltage at transformer terminals 7 and 8 should be 27 to 33 volts AC. Remove power from transformer. Replace defective transformer.

(2) Rectifier CR1.

(a) Tag and disconnect leads.

(b) Using a multimeter on high ohms setting connect negative (-) lead to terminal 2 and positive (+) lead to terminal 1 or 3. A low resistance reading should be obtained.

(c) Connect positive lead to terminal 2 and negative lead to terminal 1 or 3. A very high resistance or open circuit reading should be obtained.

(d) Connect positive lead to terminal 4 and negative lead to terminal 1 or 3. A low resistance reading should be obtained.

(e) Connect negative lead to terminal 4 and positive lead to terminal 1 or 3. A very high resistance or open circuit reading should be obtained.

(f) Replace defective rectifier.

NOTE

When rectifier CR1 is replaced capacitors C1 and C2 should also be replaced.

(3) Capacitors.

(a) Disconnect one lead of capacitor from circuit.

(b) Using an ohmmeter set to read high resistance, place the positive (+) probe on disconnected capacitor lead. Place negative (-) probe of ohmmeter on the second lead of capacitor while watching ohmmeter needle.

(c) The ohmmeter needle should move only very slightly or not at all. If needle moves quickly to top of the scale and remains there, capacitor contains a short circuit and must be replaced.

4-32. TRANSFOMER, RECTIFIER, CAPACITORS, AND HARNESS.-Continued

NOTE

The ohmmeter test does not show the behavior of a capacitor under load. Such testing requires special equipment which is not economically practical for testing small capacitors. If breakdown under load is suspected replace the capacitor.

c. Replace.

(1) Transformer.

(a) Tag and disconnect wire leads.

(b) Remove four screws and lock washers and pull transformer from unit.

(c) Attach transformer to unit with four screws and lock washers.

(d) Slip heat shrinkable insulation tubing on ends of wires to be soldered.

(e) See wiring diagram figure 4-4 and tags and connect all wire leads. Remove tags.

(f) Slip heat shrink tubing over all exposed solder connections and shrink in place.

(2) Rectifier/Capacitors.

(a) Tag and disconnect wire leads.

(b) Remove two screws and pull rectifier from unit.

(c) Remove capacitors.

(d) Install capacitors.

(e) Attach rectifier to unit with two screws.

(f) See wiring diagram figure 4-4 and tags and connect all wire leads. Remove tags.

(3) Install junction box and control module. (See para 4-21 and 4-27.)

(4) Install top front cover (para 4-11).

(5) Connect power at power source.

4-33. EVAPORATOR FAN, MOTOR, AND HOUSING.

The evaporator fan, motor, and housing are located behind the return air louver assembly. (See fig. 4-29.)

WARNING

Disconnect input power from the air conditioner before performing maintenance on any part of the electrical system. The voltages used can be lethal.

a. Inspect/Service.

(1) Disconnect power at power source.

(2) Remove return air louver assembly (para 4-13).

(3) Check that all parts are in place and in good condition.

(4) Inspect fan for damaged or bent blades and the motor for signs of overheating. Check all mounting hardware for tightness.

(5) Disconnect P3 motor connector plug and check for loose, damaged, or missing pins.

(6) Inspect fan housing for damage and missing or defective hardware.

(7) Wipe or vacuum all dust or dirt from fan, motor, and housing.

(8) Repair of fan and housing is by replacement.

b. Test.

(1) The motor is capable of operating at two speeds. Therefore there are two sets of field coils.

(2) Use an ohmmeter or continuity tester to check continuity between pins A and B, A and C, D and E, and E and F. Continuity should exist. If continuity does not exist allow motor to cool and retest. If continuity still does not exist replace motor.

(3) Check continuity from pin G to pins A, B, C, D, E, and F. Continuity should not exist.

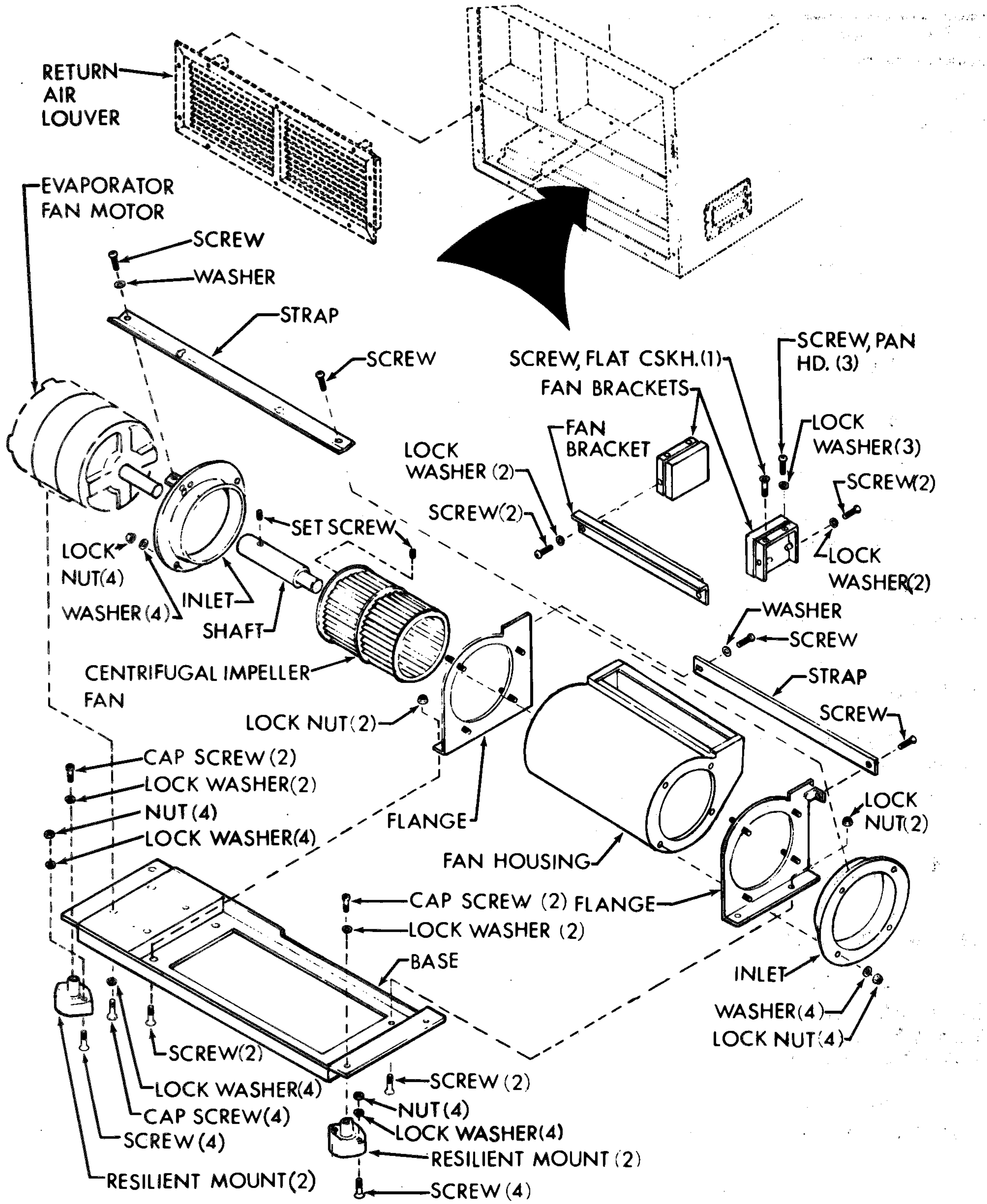


Figure 4-29. Evaporator Fan, Motor, and Housing

4-33. EVAPORATOR FAN, MOTOR, AND HOUSING.-Continued

NOTE

If all the preceding inspections and tests are satisfactory but the motor will still not operate properly, notify direct support maintenance, who may desire to make further tests before it is removed.

c. Removal/Disassembly.

(1) Loosen clamps and remove the TEMPERATURE SELECTOR remote sensing bulb from top of fan housing. (See fig. 4-17.)

(2) Remove straps and fan brackets from top or outlet of fan.

(3) Remove four cap screws and lock washers holding four corners of base to the resiliant mounts.

(4) Lift fan, motor, and base assembly out of unit.

(5) Remove four nuts and lock washers from each inlet ring.

(6) Remove four cap screws and lock washers from bottom of base and pull motor, shaft, and fan out of housing.

(7) Loosen setscrews in fan and shaft and pull them from motor.

(8) Remove four screws and lock nuts that attach flanges to base and remove flanges and fan housing from base. Slip flanges and fan housing apart.

(9) Check condition of resilient mounts. If damage is detected remove defective mount by tilting air conditioner and removing screws from bottom side of cabinet.

NOTE

Be sure that correct part number resilient mounts are ordered and installed properly. The two mounts on the motor end are different than those on the fan end.

d. Replace. Replace any defective components found during inspection and test.

e. Installation/Assembly.

(1) If resilient mounts were removed, see note above and install new mounts.

4-33. EVAPORATOR FAN, MOTOR, AND HOUSING.-Continued

(2) Align pins in flanges with holes in housing and attach flanges to the base with four screws and lock nuts.

(3) Slip shaft. extension on to the motor shaft and tighten setscrew.

(4) Slip inlet ring on to fan shaft before mounting fan.

(5) Slip fan on to shaft extension and tighten fan setscrew. The hub must be turned so that it is mounted toward the motor. The direction of rotation is counterclockwise facing the motor shaft.

(6) Carefully slip fan and motor assembly in place.

(7) Attach motor to the base with four cap screws and lock washers.

(8) Attach two inlets to the flanges with eight washers and lock nuts.

(9) Place fan and motor assembly in unit and install four cap screws and lock washers to secure base to the resilient mounts.

(10) Install fan brackets and straps on outlet side of fan housing.

(11) Slip TEMPERATURE SELECTOR remote sensing bulb into clamps on fan strap and tighten clamps. (See fig. 4-17.)

(12) Connect P3 motor connector.

(13) Check that drain tubes have not been disconnected.

(14) Install return air louver assembly (para 4-13).

(15) Connect power at power source.

4-34. HEATER THEMOSTAT.

The heater thermostat S6 mounts on the forward inside surface of the top center cover. (See fig. 4-30.)

WARNING

Disconnect input power from the air conditioner before performing maintenance on any part of the electrical system. The voltages used can be lethal.

4-34. HEATER THERMOSTAT.-Continued

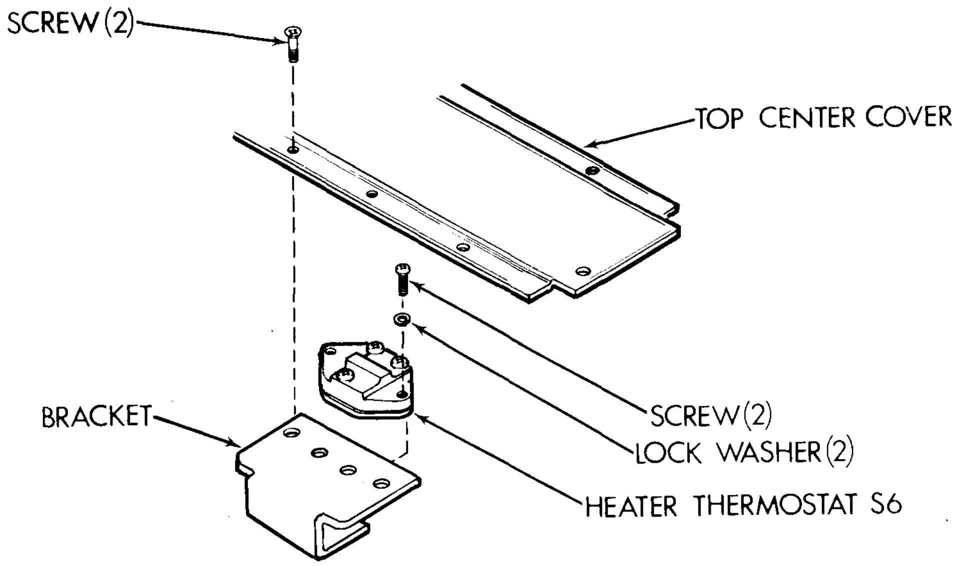


Figure 4-30. Heater Thermostat

a. Inspect/Test.

(1) Disconnect power at power source.

(2) Remove top front cover (para 4-11).

(3) Remove two screws and slip heater thermostat and bracket forward.

(4) Inspect for cracks, loose connections, and obvious damage. Replace if defective.

(5) Remove two screws and lock washers and pull thermostat from bracket.

(6) Tag and disconnect leads.

(7) Using a multimeter check continuity on terminals 1 and 2 of the thermostat. Continuity should be indicated.

4-34. HEATER THERMOSTST.-Continued

(8) Repeat step (7) with meter connected to terminals 3 and 4.

(9) Tape the bulb of a thermometer or junction of a thermocouple to the body of the heater thermostat, and connect the multimeter to terminals 1 and 2 . Use a 150 watt lamp bulb or a heat source. Gradually apply heat while observing both the thermometer and the multimeter. Continuity should drop out at 145 to 155°F (63 tO 68°C). Remove heat source and let the thermostat cool while observing the thermostat and multimeter. Continuity should be re-established at 100 to 120°F (38 to 49°C).

(10) Repeat step (9) with meter connected to terminals 3 and 4.

b. Replace. Replace heater thermostat if defective.

c. Installation.

(1) See tags and wiring diagram figure 4-4 and connect leads. Remove tags.

(2) Attach thermostat to bracket with two screws and lock washers.

(3) Attach thermostat and bracket assembly to flange of the top center cover with two screws.

(4) Install top front cover (para 4-11).

(5) Connect power at power source.

4-35. HEATER ELEMENTS.

The heater elements are located in the upper front compartment behind the evaporator coil. (See fig. 4-31.)

WARNING

Disconnect input power from the air conditioner before performing maintenance on any part of the electrical system. The voltages used can be lethal.

a. Inspect/Test.

(1) Disconnect power at power source.

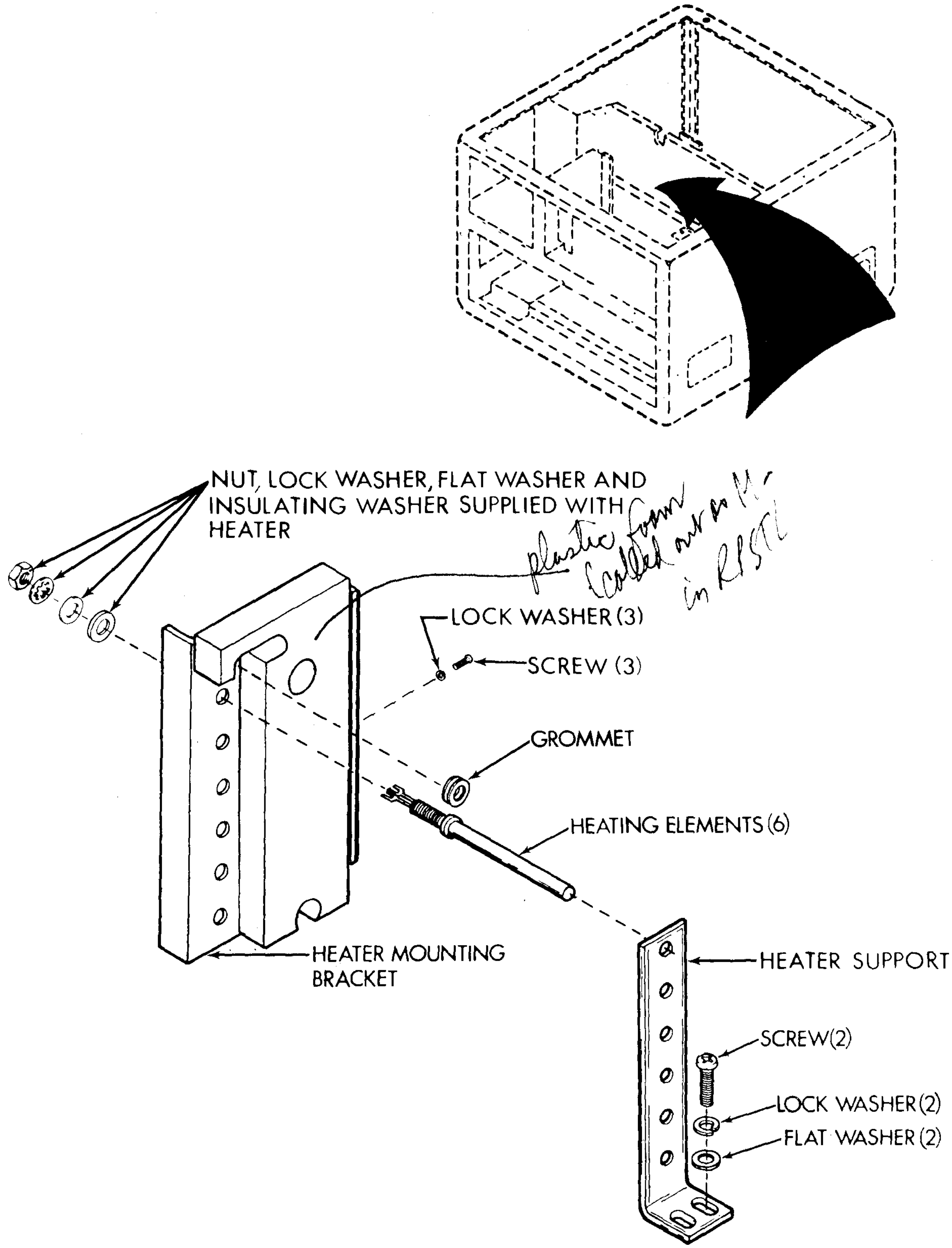


Figure 4-31. Heater Elements

4-35. HEATER ELEMENTS.-Continued

WARNING

Allow heaters to cool before touching. Severe burns can result from touching hot heaters.

(2) Remove three top covers (para 4-11).

(3) To gain access to terminal board TB2 where heater element leads are connected the junction box and control module must also be removed. (See para 4-21 and 4-27.)

(4) Visually inspect each heater for obvious damage, deformation, cracked or broken sheath, burnt out spots, and loose, broken, or otherwise damaged leads.

(5) Using a multimeter check continuity of each heating element. Continuity should be indicated.

b. Removal.

(1) Tag and disconnect leads from terminal board TB2.

(2) Remove two screws, lock washers, and flat washers and remove heater support.

(3) Remove attaching hardware from heater mounting bracket.

(4) Slip bracket up enough to gain access to top heater.

(5) Remove retaining nut, lock washer, flat washer, and insulating washer and slip heater out of bracket.

(6) Remove remaining heaters using same methods as (4) and (5) above.

c. Cleaning. Use a clean dry cloth to wipe dust and dirt from heaters. Do not use solvent or detergent.

d. Replace. Replace any defective heater elements.

e. Installation.

(1) Position heater mounting bracket into top of unit so heaters can be mounted one at a time.

(2) Start with bottom most heater to be installed.

4-35. HEATER ELEMENTS.-Continued

(3) Slip heater through the bracket hole and secure with nut, lock washer, flat washer, and insulating washer provided with heater.

(4) Install remaining heaters one at a time. Slide mounting bracket down progressively as each heater is installed.

(5) Place heater support in the unit and slip ends of heaters through support holes.

(6) Install mounting hardware in heater support and heater mounting bracket.

(7) See tags and wiring diagram figure 4-4 and connect heater leads at terminal board TB2. Remove tags.

(8) Install junction box and control module. (See para 4-21 and 4-27.)

(9) Install top covers (para 4-11).

(10) Connect power at power source.

4-36. CONDENSER FAN, MOTOR, AND HOUSING.

The condenser fan and motor are located in the rear of condenser section of the unit. (See fig. 4-32.)

WARNING

Disconnect input power from the air conditioner before performing maintenance on any part of the electrical system. The voltages used can be lethal.

a. Inspect/Service.

(1) Disconnect power at power source.

(2) Remove all three top covers (para 4-11).

(3) Check that all parts are in place and in good condition.

(4) Inspect impeller fan for damaged or bent blades and the motor for signs of overheating. Check all mounting hardware for tightness.

(5) Disconnect P5 motor connector plug and check for loose, damaged, or missing pins.

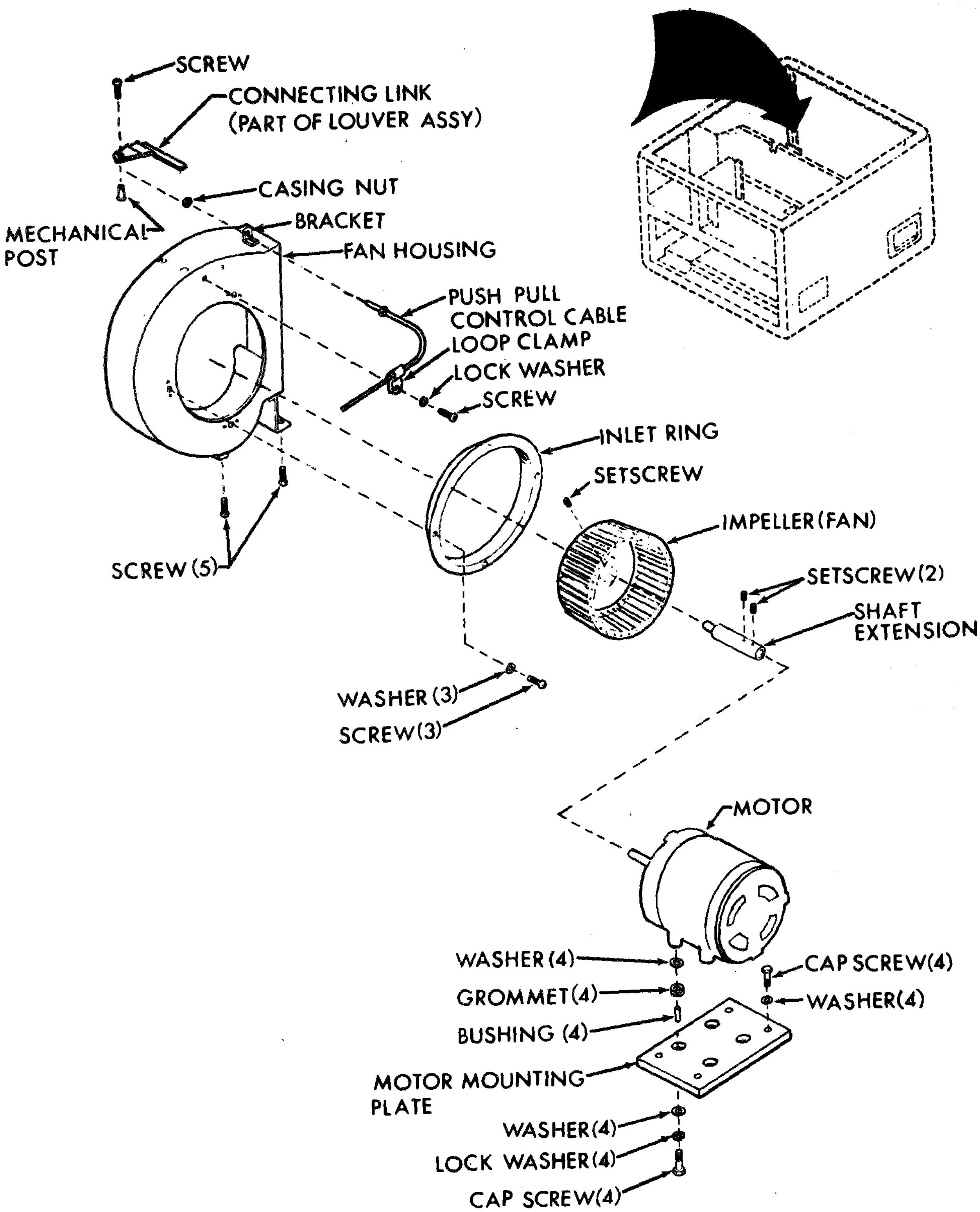


Figure 4-32. Condenser Fan, Motor, and Housing

4-36. CONDENSER FAN, MOTOR, AND HOUSING.-Continued

(6) Inspect condenser fan housing for damage and for missing or defective hardware.

(7) Wipe or vacuum all dust or dirt from impeller fan, condenser fan housing, and motor.

(8) Repair of fan and housing is by replacement.

b. Test.

(1) Use a continuity tester to check continuity of field coils between pins A and B and between pins A and C. Continuity should exist.

(2) Check continuity from pin G to pins A, B, C, D, and E. Continuity should not exist.

(3) Check continuity of thermal protectors between pins D and E. If continuity does not exist allow motor to cool and then recheck. If continuity still does not exist replace motor.

NOTE

If all the above inspections and tests are satisfactory, but the motor will still not operate properly, notify direct support maintenance, who may desire to make further tests before it is removed.

c. Removal/Disassemby.

(1) Remove four cap screws and washers from top of motor mounting plate.

(2) Cut plastic tie down straps to free cable.

(3) Unscrew P4, P5, P6, P8, and P9 connectors and push aside.

(4) Loosen two setscrews on motor shaft extension at motor end and slide shaft extension and fan from motor shaft.

(5) Carefully lift motor and mounting plate up and out of unit.

(6) Remove motor extension shaft from fan by loosening setscrew on fan hub.

4-36. CONDENSER FAN, MOTOR, AND HOUSING.-Continued

(7) If motor is to be repaired or replaced remove it from mounting plate by removing four cap screws and hardware.

(8) Refer motor repairs to direct support maintenance.

NOTE

The impeller fan and condenser fan housing must be removed together as follows.

(9) Remove three screws and washers, and fan inlet ring.

CAUTION

Use care not to break refrigeration tubing.

(10) Remove three screws, lock washers, washers, and loop clamps that secure charging valves, pressure relief valve, and tubing to condenser fan housing.

(11) Remove screw, lock washer, and loop clamp holding push-pull control cable assembly to fan housing.

(12) Loosen screw in mechanical post to release push-pull control cable assembly from louver assembly connecting link.

(13) Remove push-pull control cable assembly from fan housing bracket by removing one casing nut.

(14) Remove eight screws, lock washers, and condenser air inlet guard (para 4-12).

(15) Remove four screws, lock washers, two screw snaps, and louver assembly (para 4-17).

(16) Remove five screws attaching condenser fan housing to unit. Screws are accessible from underneath the unit.

(17) Carefully remove condenser fan housing (with fan inside) by rotating housing 90° counterclockwise and pulling straight out.

(18) Separate impeller fan from condenser fan housing.

d. Replace. Replace all defective components found during inspection and test.

e. Installation/Assembly.

(1) Place impeller fan in condenser fan housing.

4-36. CONDENSER FAN, MOTOR, AND HOUSING.-Continued

(2) Carefully place condenser fan housing in unit by rotating housing 90° counterclockwise and sliding into place.

(3) Secure condenser fan housing to unit with five attaching screws.

(4) Install louver assembly and secure with four screws and lock washers, and two screw snaps (para 4-17).

(5) Install condenser air inlet guard and secure with eight screws and lock washers (para 4-12).

(6) Slide push-pull control cable through condenser fan housing bracket, casing nut, and into mechanical post on louver assembly connecting link.

(7) Tighten casing nut to secure push-pull control assembly to condenser fan housing bracket. See paragraph 4-17 for cable adjustment before tightening screw in mechanical post.

(8) Secure push-pull control cable assembly to side of condenser fan housing with screw, lock washer and loop clamp.

(9) Secure charging valves, pressure relief valve, and refrigeration tubing to condenser fan housing with three loop clamps, screws, washers, and lock washers.

(10) Install fan inlet ring and secure with three screws and washers.

(11) Slide motor shaft extension into hub of impeller fan and secure with setscrew.

CAUTION

After bringing motor mounting bolts up snug, tighten one full turn on each of the four bolts to compress grommets flange by .06 inches.

(12) Insert four bushings and grommets into four motor mounting holes and attach motor to mounting plate with eight flat washers, four lock washers, and four cap screws.

(13) Carefully place motor and mounting plate down into unit and align holes in motor mounting plate with those in unit.

(14) Install four cap screws and washers in motor mounting plate but do not tighten them all the way.

4-36. CONDENSER FAN, MOTOR, AND HOUSING.-Continued

(15) Slide motor shaft extension onto motor shaft and secure with two setscrews.

(16) Spin fan by hand and check for equal clearance between the inlet ring and outer edges of fan. Adjust mounting plate as necessary.

(17) Tighten cap screws in motor mounting plate and check that fan rotates freely and has adequate clearance.

(18) Connect P4, P5, P6, P8, and P9 connector plugs and secure cable and harnesses with new plastic tie down straps or lacing cord.

(19) Install three top covers (para 4-11).

(20) Connect power at power source.

4-37. EVAPORATOR COIL (CLEANING).

The evaporator coil is located in the upper front section of the air conditioner. (See fig. 4-33.)

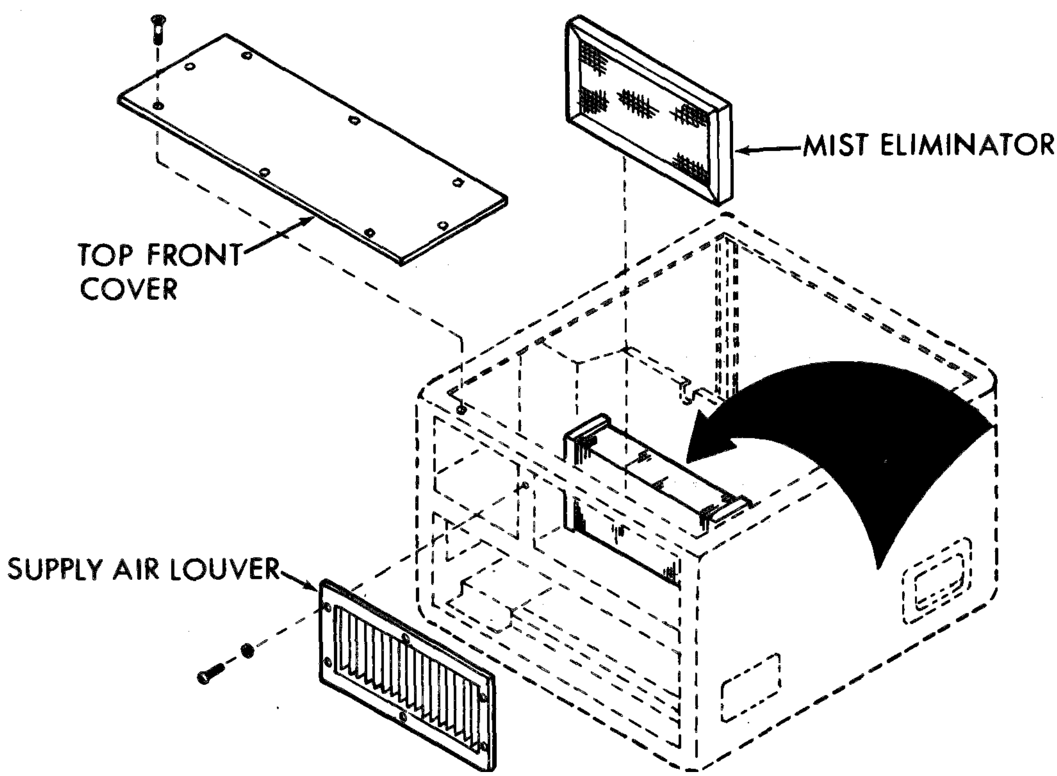


Figure 4-33. Evaporator Coil

4-37. EVAPORATOR COIL (CLEANING).-Continued

WARNING

Disconnect input power from the air conditioner before performing maintenance on any part of the electrical system. The voltages used can be lethal.

a. Disassemble.

(1) Disconnect power at power source.

(2) Remove eight screws and top front cover.

(3) Remove six screws, washers, and supply air louver.

(4) Lift mist eliminator out of unit.

b. Inspect.

(1) Check for accumulated dirt. Clean if accumulation of dirt is evident.

(2) Check fins for dents, bent edges, or any condition that would block or distort air flow. Straighten all damaged fins with a plastic fin comb.

WARNING

Compressed air used for cleaning purposes will not exceed 30 psi (2.1 kg/cm^2).

CAUTION

Do not use steam to clean coil.

c. Cleaning. Clean coil with a soft bristled brush, vacuum cleaner, and brush attachment, or use compressed air at 30 psi (2.1 kg/cm^2) or less from the inside of the coil to blow the dirt out. Take care to avoid fin damage. When using compressed air wear safety glasses or goggles. Dirt can be blown into your eyes. Should a leak or major damage be evident refer to direct support maintenance.

4-37. EVAPORATOR COIL (CLEANING).-Continued

d. Assemble.

(1) Install the mist eliminator. TOP mark must be up and air flow arrows should point away from coil.

(2) Install supply air louver and secure with six screws and washers.

(3) Install top front cover and secure with eight screws.

(4) Connect power at power source.

4-38. SOLENOID VALVE (COIL REMOVAL).

The L1 and L2 Solenoid valves are located in the rear condenser/ compressor compartment. (See fig. 4-34.)

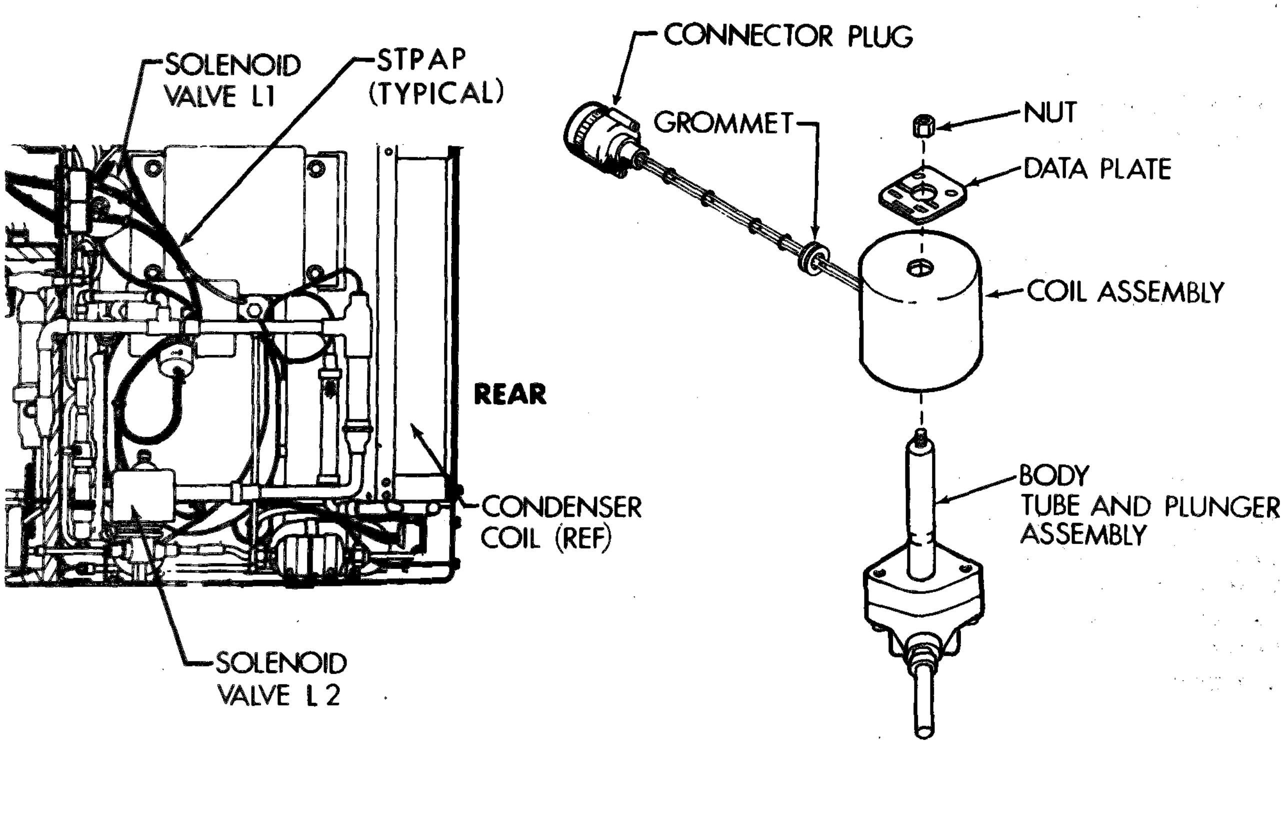


Figure 4-34. Solenoid Valve Coil Removal

4-38. SOLENOID VALVE (COIL REMOVAL).-Continued

WARNING

Disconnect input power from the air conditioner before performing maintenance on any part of the electrical system. The voltages used can be lethal.

NOTE

The following basic instructions apply to both the by-pass solenoid L1 and the pressure equalizer solenoid L2.

a. Test.

(1) Disconnect power at power source.

(2) Remove fabric cover (para 4-10) and top rear cover (para 4-11).

(3) Disconnect the solenoid valve connector plug. P8 for L1 solenoid and P9 for L2 solenoid.

(4) Use continuity tester or multimeter set on lowest OHMS scale to check for continuity between pins A and B in each connector plug. If continuity is not found, the coil is open and must be replaced.

(5) Check for continuity between each pin in connector plug and coil casing. If continuity is found the coil is grounded and should be replaced.

(6) If continuity checks are satisfactory apply 24 volts dc from an external power supply across pins A and B in connector plug. Listen for a sharp click when the valve changes position. If a click is not heard, internal valve problems are indicated and the entire valve should be replaced. Refer to direct support maintenance.

b. Repair. The only authorized repair to solenoid valve is coil replacement. The coil can be replaced without opening the refrigeration pressure system.

WARNING

Do not attempt any disassembly of the solenoid valve other than coil removal with a refrigerant charge in the system. Refrigerant will be sprayed out dangerously if the screws that attach the tube and plunger assembly to the valve body are loosened.

4-38. SOLENOID VALVE (COIL REMOVAL).-Continued

c. Remove.

(1) Remove top nut that attaches coil to the valve body. Remove coil, data plate, and connector plug.

(2) Cut plastic tie down straps as necessary to remove solenoid valve cable.

(3) If connector plug is to be reused unsolder it from leads.

(4) If grommet is to be reused remove it from defective coil assembly.

d. Installation.

(1) Slip grommet over leads and install in hole in coil assembly.

(2) Solder leads from coil assembly to connector plug.

(3) Place coil assembly and data plate on to valve body and secure with nut.

(4) Reconnect connector plug.

(5) Secure wires to existing harnesses with new plastic tie down straps or lacing cord.

(6) Install top rear cover (para 4-11) and fabric cover (para 4-10).

(7) Connect power at power source.

4-39. LOW PRESSURE CUTOUT SWITCH (LPCO) JUMPER.

If unit is to be operated in the “cool” mode at or below 0°F (-17.8°C) ambiant the low pressure cutout (LPCO) switch (S5) must be jumpered. See figure 4-35 and proceed as follows:

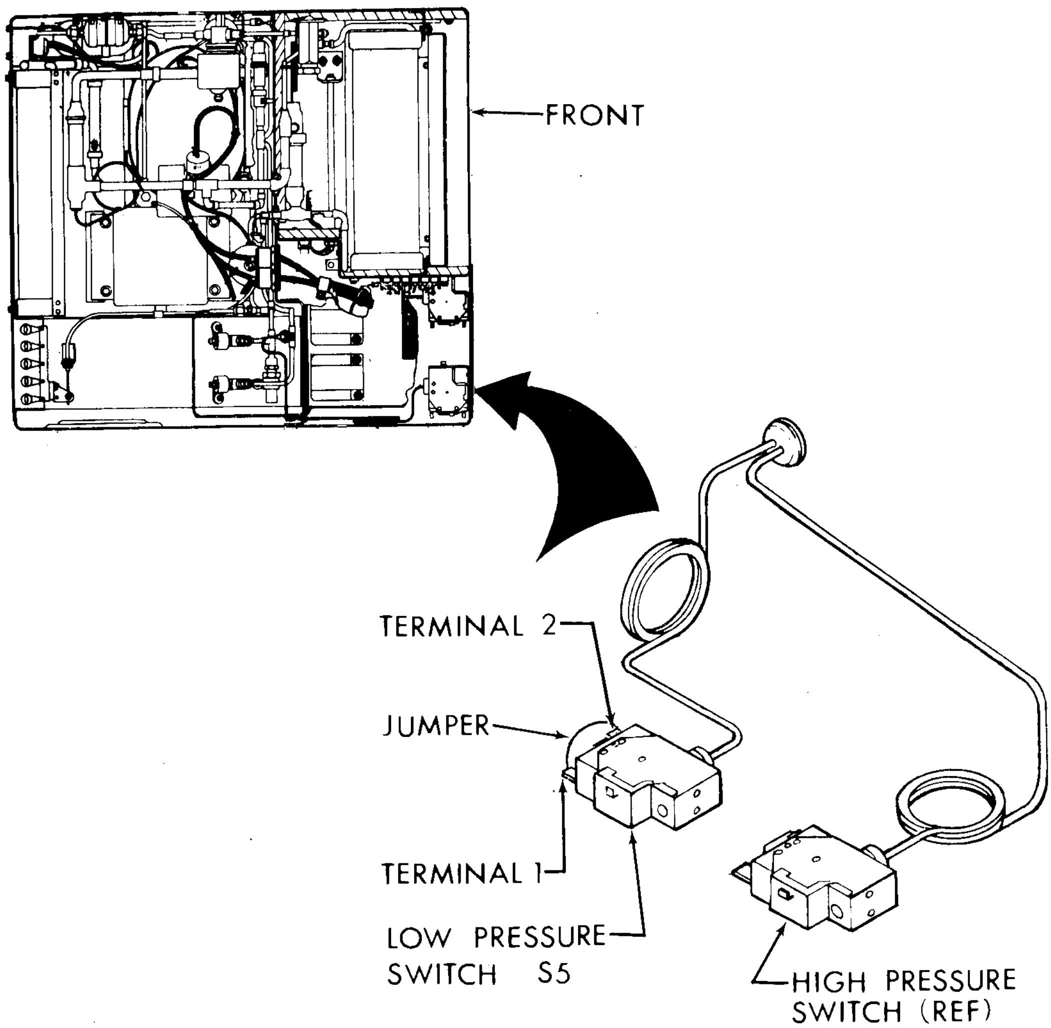


Figure 4-35. Jumper Across LPCO Switch

WARNING

Disconnect input power from the air conditioner before performing maintenance on any part of the electrical system. The voltages used can be lethal.

4-39. LOW PRESSURE CUTOUT SWITCH (LPCO) JUMPER.-Continued

a. Disassemble.

(1) Disconnect power at power source.

(2) Remove control module and junction box (para 4-21 and 4-27). It is not necessary to totally remove all wire connections and capillary line so long as the junction box can be pulled out enough to gain access to the pressure switches. Support the junction box so that wires and capillary line are not damaged.

(3) Remove top front cover (para 4-11).

(4) Install jumper wire (20 AWG minimum) between terminals 1 and 2 of low pressure cutout switch. Check that jumper will not short out against frame of control panel.

(5) Fabricate CAUTION tag (shown below) to place on control panel to show that low pressure cutout switch has been bypassed.

CAUTION

Air conditioner low pressure cutout switch (S5) has been bypassed. Compressor will not shut off under low suction pressure conditions.

CAUTION TAG EXAMPLE

b. Assemble.

(1) Install junction box and control module (para 4-21 and 4-27).

(2) Install top front cover (para 4-11).

(3) Connect power at power source.

NOTE

Remove the LPCO jumper when outside air temperature increases to 40°F (5°C).

4-40. CONDENSER COIL (CLEANING).

The condenser coil is located across the rear of the unit. (See fig. 4-36.)

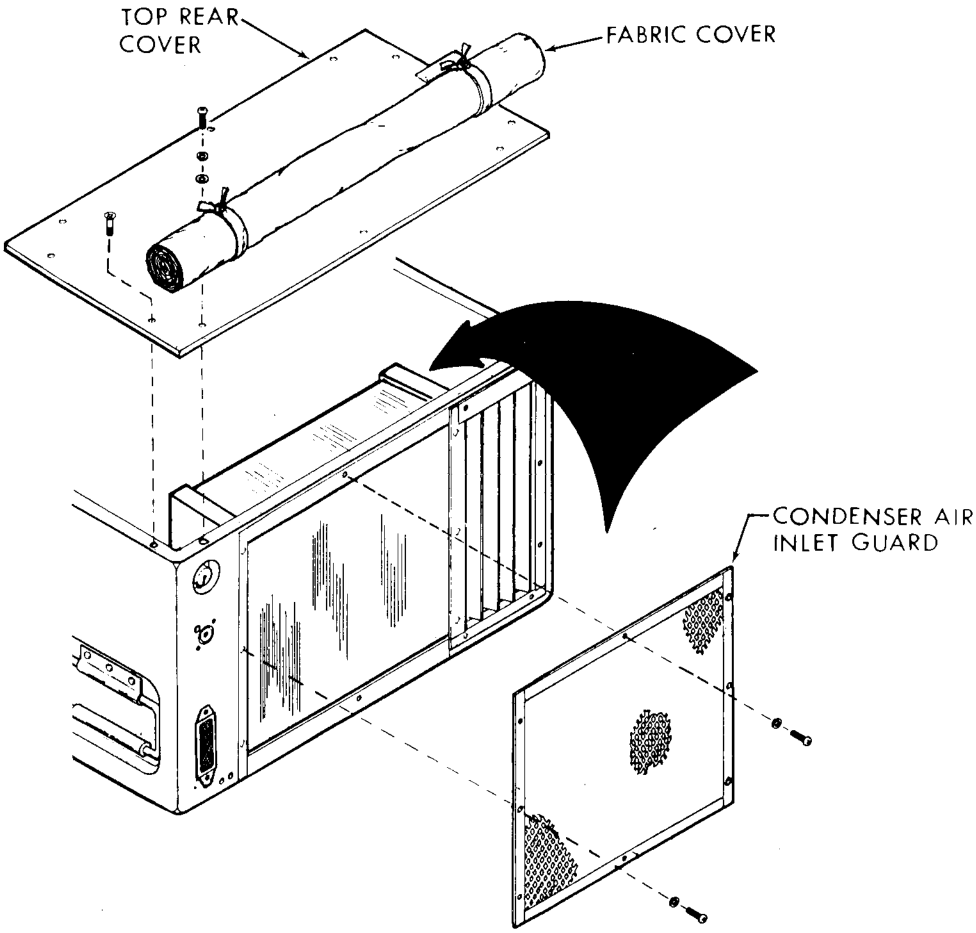


Figure 4-36. Condenser Coil

a. Disassemble.

WARNING

Disconnect input power from the air conditioner before performing maintenance on any part of the electrical system. The voltages used can be lethal.

(1) Disconnect power at the power source.

(2) Remove three screws, lock washers, flat washers, and fabric cover.

4-40. CONDENSER COIL (CLEANING).-Continued

(3) Remove seven screws and top rear cover.

NOTE

The six screws on the vertical frames of the condenser air inlet guard secure the condenser coil to the air conditioner housing.

(4) Remove eight screws and condenser air inlet guard.

b. Inspect.

(1) Check for accumulated dirt. Clean if an accumulation of dirt is evident.

(2) Check fins for dents, bent edges or any condition that would block or distort air flow. Straighten all damaged fins with a plastic fin comb.

WARNING

Compressed air used for cleaning purposes will not exceed 30 psi (2.1 kg/cm^2).

WARNING

Do not use steam to clean coil.

c. Cleaning. Clean coil with a soft bristled brush, vacuum cleaner, and brush attachment, or use compressed air at 30 psi or less from the inside of the coil to blow dirt out. Take care to avoid fin damage. When using compressed air wear safety glasses or goggles. Dirt can be blown into your eyes. Should a leak or major damage be evident refer to direct support maintenance.

d. Assemble.

(1) Install condenser air inlet guard and secure with eight screws.

(2) Install top rear cover, fabric cover, and secure with ten screws.

(3) Connect power at power source.

4-41. HOUSING.

Inspect/Service.

a. Check for missing, loose, or damaged hardware. Replace all missing or damaged hardware.

b. Inspect for dents, bends, and cracked welds. Refer defects to be repaired to direct support maintenance.

4-42. CONNECTORS (Installation).

a. There are three connectors supplied with each air conditioner. (See fig. 4-37.)

(1) Input power cable connector (P1). This connector is used at the unit end of the input power cable. It can be connected to the J1 receptacle located above the control module or the J11 receptacle located on the upper left rear corner of the unit.

NOTE

If the J11 receptacle is used see paragraph 4-4 and figure 4-2 for wiring changes.

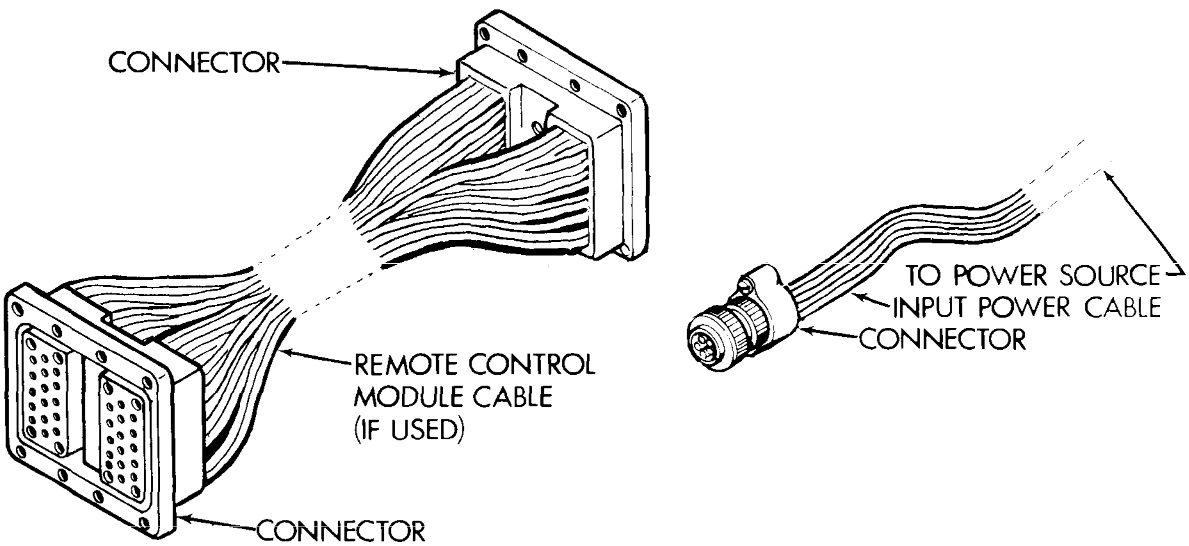


Figure 4-37. Connectors (Installation)

4-42. CONNECTORS (INSTALLATION).-Continued

(2) Remote control module cable connectors. The other two connectors are used when the control module is to be installed remote from the air conditioner. (See para 4-4.)

WARNING

Disconnect input power from the air conditioner before performing maintenance on any part of the electrical system. The voltages used can be lethal.

b. Inspect.

(1) Disconnect power at power source.

(2) The power cable connector and the remote control cable connectors (when used) should be inspected for:

(a) Loose, missing, or damaged pins.

(b) Loose, damaged, cut, or broken wires to the connector.

(c) Loose or bad solder connections.

(d) Excessive corrosion.

(e) Obvious damage.

(3) Repair loose wires and solder connections.

c. Replace. Damaged wires or connectors and connectors with missing, loose, or damaged pins should be replaced.

4-43. INSTALLATION HARDWARE.

Each unit is supplied with mounting hardware for the four base attachment points. (See fig. 4-38.)

a. Inspect. Inspect hardware to be sure it is tight, properly installed, and in good condition.

b. Replace. Replace missing, damaged, or defective parts.

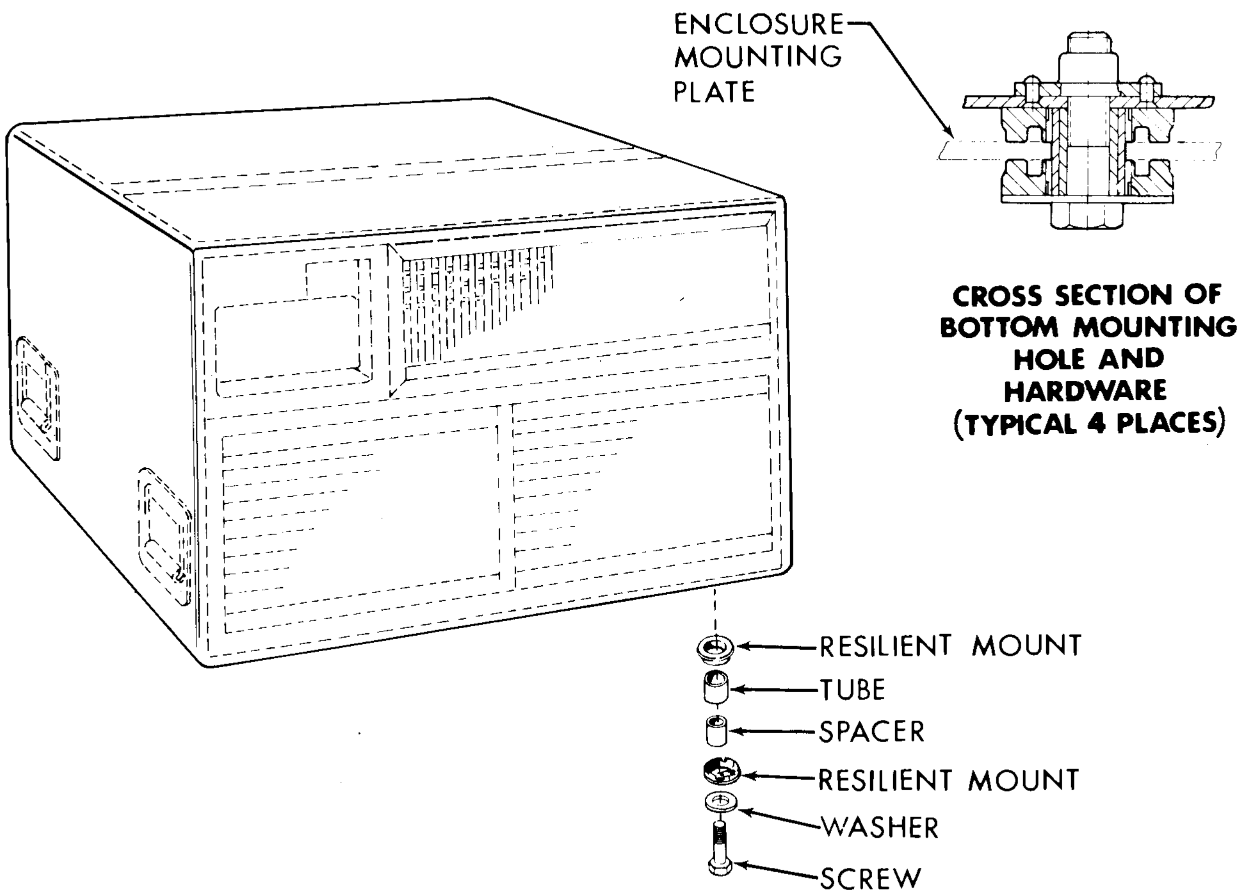


Figure 4-38. Installation Hardware

Section VI PREPARATION FOR STORAGE OR SHIPMENT

4-44. PREPARATION FOR STORAGE.

a. Administrative Storage of Equipment. See TM 740-90-1. Administrative storage is short term storage -- 1 to 45 days. It covers storage of equipment which can be readied for mission performance within 24 hours. Before placing an item in administrative storage, the next scheduled preventive maintenance checks and services should be performed, all known deficiencies corrected, and all current modification work orders applied. The administrative storage site should provide required protection from the elements and allow access for visual inspection when applicable.

(1) Unroll fabric cover.

(2) Snap cover in place.

b. Intermediate Storage - 46 to 180 days. No special handling is required other than protection from damage and the elements.

(1) Unroll fabric cover.

(2) Snap cover in place.

(3) Place air conditioner in a dry, covered area.

c. Long Term or Flyable Storage. There is no time limit for this type of storage.

(1) Unroll fabric cover.

(2) Snap cover in place.

(3) Bolt unit to a skid base, preferably the original used to ship unit if it is still available and in good condition.

(4) Wrap unit with two layers of heavy plastic sheet or barrier paper.

(5) Tape and strap wrapping in place.

(6) Mark air conditioner per standard Army Procedures.

CHAPTER 5

DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

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

5-1. GENERAL.

a. Repair parts are listed and illustrated in TM5-4120-383-24P. No special tools are required for direct support maintenance of the air conditioner. Test, maintenance and diagnostic equipment (TMDE), and support equipment include standard electrical test equipment and standard pressure and vacuum gages, vacuum pumps, and servicing manifolds found in any direct support maintenance refrigeration shop.

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

c. Tool Kit, Service, Refrigeration Unit, NSN 5180-00-597-1474, contains hand tools and equipment used for air conditioner maintenance. The following common items not contained in the refrigeration unit tool kit are also required for air conditioner maintenance.

Description	National Stock Number
Brush, Bristle	7520-00-223-8000
Brush, Wire	7920-00-282-9246
Bucket	7240-00-137-1609
Heat Gun	4940-01-042-4855
Multimeter	6625-00-553-0142
Pliers, Long Round Nose	5120-00-268-3579
Rubber Gloves	8415-00-266-8677
Safety Goggles	4240-00-052-3776
Screwdriver, Cross Tip No. 2 One Inch Long Blade	5120-00-227-7293
Screwdriver, Offset, Cross Tip No. 1	5120-00-256-9014
Nitrogen Regulator	6685-00-449-7484

Section II TROUBLESHOOTING

5-2. USE OF 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 tests/inspections and corrective actions in the order listed.

b. For a specific malfunction perform the troubleshooting procedures listed in Table 4-2 before performing the procedures listed in Table 5-1.

c. This manual cannot list all malfunctions which may occur. However, all tests or inspections and corrective actions 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.

WARNING

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.

5-2. USE OF TROUBLESHOOTING TABLE.-Continued

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.

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.

Never pressurize lines with oxygen, mixture with oil will cause an explosion.

Table 5-1. TROUBLESHOOTING

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 6, Table 4-2 Troubleshooting for organizational maintenance before proceeding with Step 1.

Step 1. Check that the COMPR CIRCUIT BKR is ON.

Reset to ON position. If circuit breaker will not remain ON, check and/or replace. (See para 4-25.)

Table 5-1. TROUBLESHOOTING-Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 2. Check that the LOW and HIGH PRESSURE cutoff switches are not tripped.

Press and release the LOW and HIGH PRESSURE switches to RESET. If switches do not remain in, check and/or replace switches. (See para 5-26.)

Step 3. Check that the compressor motor thermal cutoff switch is operational. (See para 5-32.)

Replace compressor if thermal cutoff switch is defective.

Step 4. Inspect and check compressor for burnout. (See para 5-32.)

Replace burned out compressor.

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 for dirt in condenser coil. (See para 4-40.)

Clean condenser coil.

Step 3. Check if HIGH PRESSURE cutoff switch RESET is out.

Push and release HIGH PRESSURE switch to RESET.

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-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 4. Check head pressure (high pressure side). (See para 5-19.)

a. If pressure is too high, check HIGH PRESSURE cutout switch and replace if defective. (See para 5-26.)

b. If pressure is excessive and sight glass is clear, release excess refrigerant. (See para 5-11.) Release pressure until requirements of paragraph 5-19 are met.

Step 5. Check if LOW PRESSURE cutoff switch RESET is tripped.

Push and release LOW PRESSURE switch to RESET. (See para 2-1.)

Step 6. Check head pressure (low pressure side). (See para 5-19.)

Add refrigerant if low. (See para 5-16.)

Step 7. Check quench valve. (See para 5-22.)

Replace if defective.

Step 8. Check compressor motor internal overload switch. (See para 5-32.)

Replace compressor if motor internal overload switch is defective.

Table 5-1. TROUBLESHOOTING-Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 9. Check solenoid valves L1 and L2. (See para 5-24.)

Replace or replace if defective.

A

3. **INSUFFICIENT COOLING ACTION.**

Step 1. Check control settings. (See para 2-2.)

a. Move MODE SELECTOR switch to COOL.

b. Move TEMPERATURE SELECTOR switch to COOLER. If normal cooling does not resume in 15 minutes, go to Step 2.

Step 2. Check air movement.

a. Remove any obstructions to air flow (evaporator and condenser sides).

b. Remove, clean, and/or replace air filter. (See para 4-13.)

c. Remove, clean, and/or replace mist eliminator. (See para 4-16.)

d. Clean evaporator coil. (See para 4-37.)

NOTE

Frost on the evaporator coil is usually caused by an obstruction to air flow or dirty coils, filter, or mist eliminator.

Step 3. Check actuating cylinder to make sure louvers are opening. (See para 5-25.)

Replace if defective.

Step 4. Check to make sure evaporator and condenser fans are tight on motor shaft. (See para 4-33 and 4-36.)

Tighten if loose.

Table 5-1. TROUBLESHOOTING-Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 5. Check area near condenser guard and fresh air inlet for heat hource over 120°F (40°C).

Remove heat source.

Step 6. Check sight glass after operating unit for 15 minutes with TEMPERATURE SELECTOR switch in maximum COOLER position. Center should be bubble free and green.

If charge is low add refrigerant. (See para 5-16.) Bubbles may also be caused by clogged dehydrator. (See para 5-31.)

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 7. Check for refrigerant leaks. (See para 5-14.)

Repair or change defective part.

WARNING

High voltage can kill.

Step 8. Check solenoid valves L1 and L2. (See para 5-23.)

Repair or replace if defective.

Table 5-1. TROUBLESHOOTING-Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 9. Check pressure regulator valve. (See para 5-24.)

Replace if defective.

Step 10. Check expansion valve for proper operation. (See para 5-21.)

Replace if defective.

Step 11. Check quench valve for proper operation. (See para 5-22.)

Replace if defective.

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.

Step 1. Check refrigerant tubing and components for leaks using a leak detector. (See para 5-14.)

Repair or replace as required.

Step 2. Check pressure relief valve. (See para 5-28.)

Replace if defective.

Table 5-1. TROUBLESHOOTING–Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

5. UNIT OPERATES CONTINUOUSLY ON COOLING CYCLE.

Step 1. Check position of TEMPERATURE SELECTOR switch. (See para 2-2.)

Move selector to WARMER.

WARNING

High voltage can kill.

Step 2. Check TEMPERATURE SELECTOR switch S3. (See para 4-22.)

Replace if defective.

WARNING

High voltage can kill.

Step 3. Check solenoid valve L1. (See para 5-23.)

Replace if defective.

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.

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-Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

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

a. Release refrigerant. (See para 5-11.)

b. Remove dehydrator. (See para 5-30.)

c. Purge and dry system. (See para 5-12.)

d. Install new dehydrator. (See para 5-30.)

e. Leak Test System. (See para 5-14.)

f. Evacuate system. (See para 5-15.)

g. Recharge with refrigerant. (See para 5-16.)

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. (See para 5-21.)

Replace if defective.

Step 2. Check quench valve. (See para 5-22.)

Replace if defective.

Step 3. Check compressor for internal noise and loose mounting. (See para 5-32.)

a. Repair loose mounting.

b. Replace compressor if defective.

Section III MAINTENANCE PROCEDURES

5-3. GENERAL.

The procedures in this section have been arranged in the order in which the items appear in the direct (F) maintenance level column on the Maintenance Allocation Chart (MAC) which is provided in Appendix B. Step-by-step procedures have been provided for all action authorized to be performed by direct maintenance in the order in which they appear on the MAC. Actions authorized to be performed by organizational and general support maintenance have been duly noted; step-by-step procedures for these actions may be found in Chapters 4 and 6 respectively.

5-4. FABRIC COVER.

For removal, inspection, lubrication, cleaning and installation see paragraph 4-10.

a. Repair. Minor rips, cuts, tears, or punctures may be repaired by applying a patch to the inside surface.

b. Replace. For damage of greater extent, or missing eyelets or snap fasteners replace the entire cover.

5-5. TOP COVERS.

For removal, cleaning, inspection and installation see paragraph 4-11.

a. Repair. The only authorized repairs for these panels are replacement of gaskets, insulation and information plates.

(1) Use only gaskets, insulation, or name plates identified in TM5-4120-383-24P.

NOTE

An initial supply of adhesive is supplied as Item 2, Section II, Expendable Supplies and Materials List. (See Appendix E.)

(2) Remove as much old gasket or insulation material as possible by pulling or scraping it away from the metal surface.

5-5. TOP COVERS.-Continued

WARNING

Acetone and methyl-ethyl ketone (MEK) are flammable and their vapors can be explosive. Repeated or prolonged skin contact or inhalation of vapors can be toxic. Use a well-ventilated area, wear gloves, and keep away from sparks *or* flame.

(3) Soften and remove old adhesive and gasket residue, using acetone or methyl-ethyl ketone (MEK) and a stiff brush.

(4) Coat mating surfaces of metal and gasket with adhesive. Let both surfaces air dry until adhesive is tacky but will not stick to fingers.

(5) Starting with an end, carefully attach gasket to the metal. Press into firm contact all over.

(6) Minor dents and bent edges can be straightened using common sheet metal repair procedures.

(7) Should touch up or refinishing be necessary see TM 43-0139.

b. Replace. Replace panels that are badly dented, bent, or punctured.

5-6. SCREENS, GUARDS, AND LOUVERS.

For removal, cleaning, servicing, inspection and installation see paragraphs 4-12, 4-13, and 4-14.

a. Repair. The only authorized repairs are replacements of gaskets and the straightening of bent blades.

NOTE

An initial supply of adhesive is supplied as Item 2, Section II, Expendable Supplies and Materials List. (See Appendix E.)

(1) Remove as much old gasket material as possible by pulling or scraping it away from the metal surface.

5-6. SCREENS, GUARDS, AND LOUVERS.–Continued

WARNING

Acetone and methyl-ethyl ketone (MEK) are flammable and their vapors can be explosive. Repeated or prolonged skin contact or inhalation of vapors can be toxic. Use a well-ventilated area, wear gloves, and keep away from sparks or flame.

(2) Soften and remove old adhesive and gasket residue, using acetone or methyl-ethyl ketone (MEK) and a stiff brush.

(3) Coat mating surfaces of metal and gasket with adhesive. Let both surfaces air dry until adhesive is tacky but will not stick to fingers.

(4) Starting with an end, carefully attach gasket to metal. Press into firm contact all over.

(5) Minor dents and bent edges can be straightened using common sheet metal repair procedures.

(6) Straighten slightly bent louver blades by hand.

(7) Should touch up or refinishing be necessary, see TM 43-0139.

b. Replace. Replace screens, guards, or louvers that are badly dented or bent or screens that are punctured or torn.

5-7. INFORMATION PLATES.

See figure 2-3 for location and information contained on Warning and instruction plates.

Replace. If any plates are missing, damaged, or illegible, they should be replaced.

a. Remove old plate by drilling rivets out. Use a drill stop or similar tool to avoid damage to internal parts.

b. Install new plate with proper size rivets.

5-8. EVAPORATOR, FANS MOTOR, AND HOUSING REPAIR.

Direct support maintenance repair of the evaporator fan motor is limited to replacement of the electrical connector, thermal overloads and bearings. Repair of the evaporator fan and fan housing is by replacement. For inspection, testing, removal and installation see paragraph 4-36.

NOTE

Check nameplate on motor for manufacturer and model number and use repair instructions below which pertain to the motor in your air conditioner.

Repair. For additional information on electric motor repair refer to FM 20-31 (Electric Motor and Generator Repair).

Motor Assembly, IMC Magnetics Corp., Model FBT 4625-3. (See fig. 5-1.

(1) To replace connector:

(a) Loosen cable clamp.

(b) Tag and unsolder leads.

(c) Remove old connector.

(d) See wiring diagram figure 4-4 and tags and solder leads to new connector. Remove tags.

(e) Secure cable clamp.

(2) To replace overload (thermal) protectors:

(a) Remove two screws and lock washers from thermal overload protector housing.

(b) Remove housing.

(c) Tag and disconnect leads to overload protector.

(d) Remove old overload protector.

(e) See tags and connect leads to new overload protector. Remove tags.

(f) Install overload protector housing with two screws and lock washers.

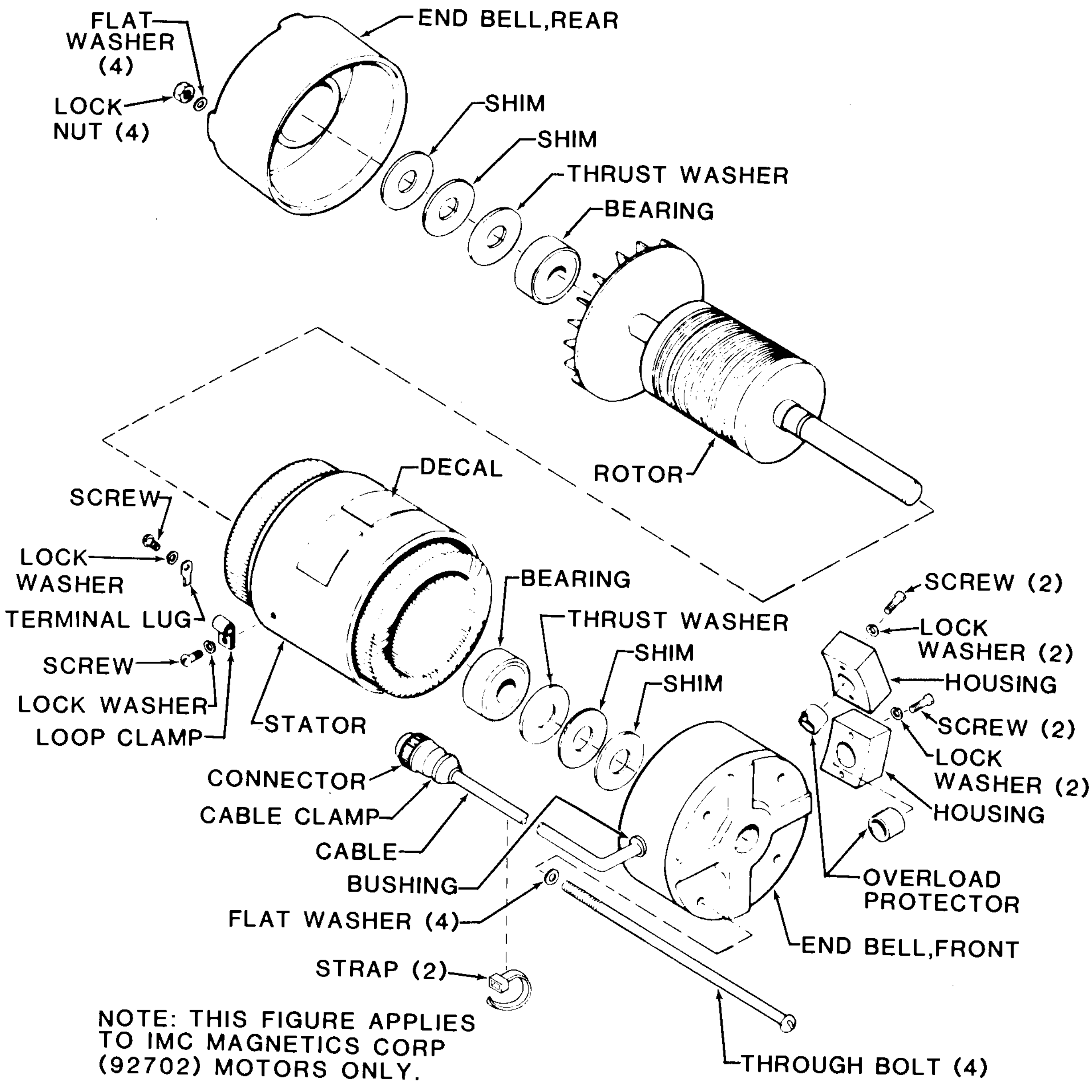


Figure 5-1. Motor Assembly, IMC Model FBT 4625-3

5-8. EVAPORATOR, FAN, MOTOR, AND HOUSING REPAIR.-Continued

(3) To replace bearings:

(a) Match-mark stator and both end bells to ease reassembly.

(b) Remove four locknuts and flat washers and pull through bolts out of motor.

(c) Carefully separate end bells from stator. Use a brass or plastic bar and hammer and tap rear end bell away from stator. Tap opposite sides, top, and bottom in alternating sequence to break end bells loose.

CAUTION

Remove the front end-bell carefully to avoid damaging wires. Wires may be left in place if care is taken to avoid damaging them.

(d) Unscrew loop clamp from the side of stator.

(e) Remove end bells.

(f) Press out or carefully drive bearings out of end bells. Retain shims and thrust washer for use at reassembly if they are not damaged.

(g) Examine rotor, stator, and shafts for nicks, gouges, deformations, and evidence of overheating.

(h) Dress high metal defects in shafts with a fine file or stone. If damage exceeds repairable limits, replace motor.

(i) Coat shaft surfaces of rotor with oil (MIL-L-2104, Grade 20) and slide bearings on shaft ends. They should seat against shoulders at inner ends of shaft.

(j] Coat thrust washers and shims with oil (MIL-L-2104, Grade 20) and slide them over each end of shaft with the thrust washers next to the bearings.

(k) Coat bearing cavity of each end-bell with oil. Slide end bell carefully into position over shaft so that OD of bearing enters ID of bearing cavity in end-bell. Work end-bells onto shaft until bore fits over end of stator. Keep the match-marks made at time of disassembly in alignment.

5-8. EVAPORATOR, FAN, HOTOR, AND HOUSING REPAIR.-Continued

(l) Place a flat washer on each through bolt and insert through bolts through holes in both end-bells. Place flat washers and lock nuts on through bolts, and tighten finger-tight.

(m) Tap around both end-bells with a plastic or rawhide mallet while tightening nuts on through bolts. Tighten in 1-2 turn increments in alternating sequence until all nuts are equally tightened. Check for freedom of rotation by turning motor shaft by hand. There should be no drag or binding.

(n) Check end-play of shaft. End play should be 0.002 - 0.005 inch (0.051 - 0.127 mm). If end-play is not within limits, disassemble motor and add or remove shims to adjust.

(o) Secure cable to stator housing with loop clamp.

b. Motor Assembly, Welco Industries Inc., Model M-4720-26A. (See fig. 5-2.)

(1) To replace connector:

(a) Loosen cable clamp.

(b) Tag and unsolder leads.

(c) Remove old connector.

(d) See wiring diagram figure 4-4 and tags and solder leads to new connector. Remove tags.

(e) Secure cable clamp.

(2) To replace overload (thermal) protectors:

(a) Remove four screws and lock washers from overload protector housing.

(b) Remove overload protector housing.

(c) Tag and disconnect leads to overload protector.

(d) Remove old overload protector.

(e) See tags and connect leads to new overload protector. Remove tags.

5-8. EVAPORATOR, FAN, MOTOR, AND HOUSING REPAIR.-Continued

(f) Install overload protector housing with four screws and lock washers.

(3) To replace bearings:

(a) Match-mark stator and both end bells to ease reassembly.

(b) Remove four screws each from front and rear brackets.

(c) Carefully separate end brackets from stator. Using a brass or plastic bar and hammer tap opposite sides, top and bottom in alternating sequence to break end brackets loose.

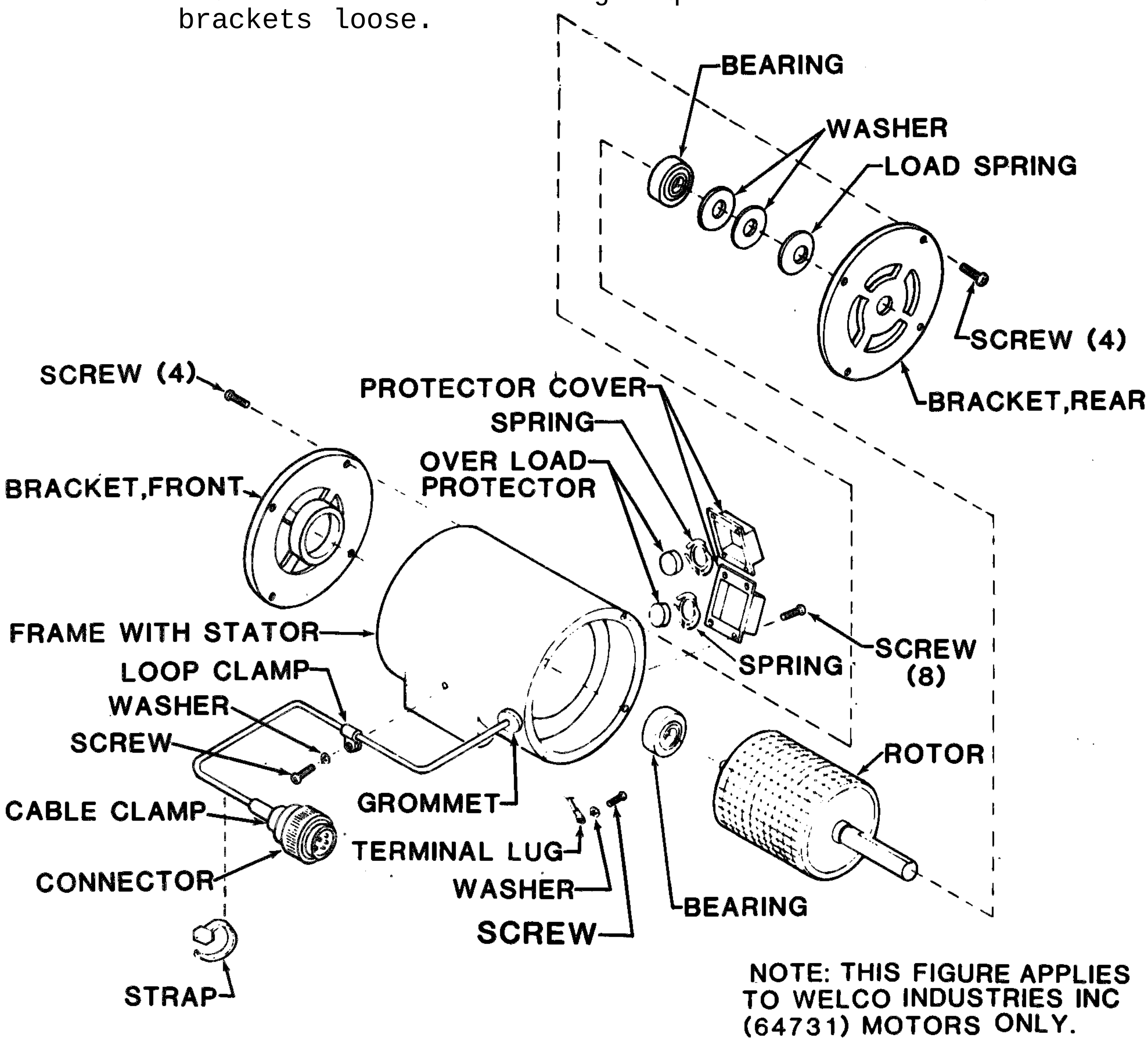


Figure 5-2. Motor Assembly, Welco Model M-4720-26A

5-8. EVAPORATOR, FAN, MOTOR, AND HOUSING REPAIR.-Continued

(d) Remove end brackets.

(e) Press out or carefully drive bearings out of end brackets. Retain washers and load spring from rear brackets (shaft end) for use at reassembly if they are not damaged.

(f) Examine rotor, stator and shafts for nicks, gouges, deformations and evidence of overheating.

(g) Dress high metal defects in shafts with a fine file or stone. If damage exceeds repairable limits, replace motor.

(h) Coat shaft surfaces of rotor with oil (MIL-L-2104, Grade 20) and slide bearings on shaft ends. They should seat against shoulders at the inner ends of shaft.

(i) Coat washers and load spring with oil (MIL-L-2104, Grade 20) and slide them over end of rear shaft with load spring installed last.

(j) Coat bearing cavity of each end-bracket with oil. Slide end-bracket carefully into position over shaft so that OD of bearing enters ID of bearing cavity in end-bracket. Work end-brackets onto shaft until bore fits over end of stator. Keep match-marks made at time of disassembly in alignment.

(k) Place four screws in each end-bracket.

(l) Tap around both end-brackets with a plastic or rawhide mallet while tightening screws. Tighten in alternating sequence until all screws are equally tightened. Check for freedom of rotation by turning motor shaft by hand. There should be no drag or binding.

(m) Check end-play of shaft. End play should be 0.002 - 0.005 inch (0.051 - 0.127 mm). If end-play is not within limits, disassemble motor and add or remove shims to adjust.

5-9. CONDENSER FAN, MOTOR, AND HOUSING REPAIR.

Direct support maintenance repair of the condenser fan motor is limited to replacement of the electrical connector, thermal overloads, and bearings. Repair of the evaporator fan and fan housing is by replacement. For access, inspection testing, removal and installation see paragraph 4-36 and figure 4-32.

NOTE

Check nameplate on motor for manufacturer and model number and use repair instructions below which pertain to the motor in your air conditioner.

Repair. For further information on electric motor repair refer to FM 20-31 (Electric Motor and Generator Repair).

a. Motor Assembly, Welco Industries Inc., Model M4720-50. (See fig. 5-3.)

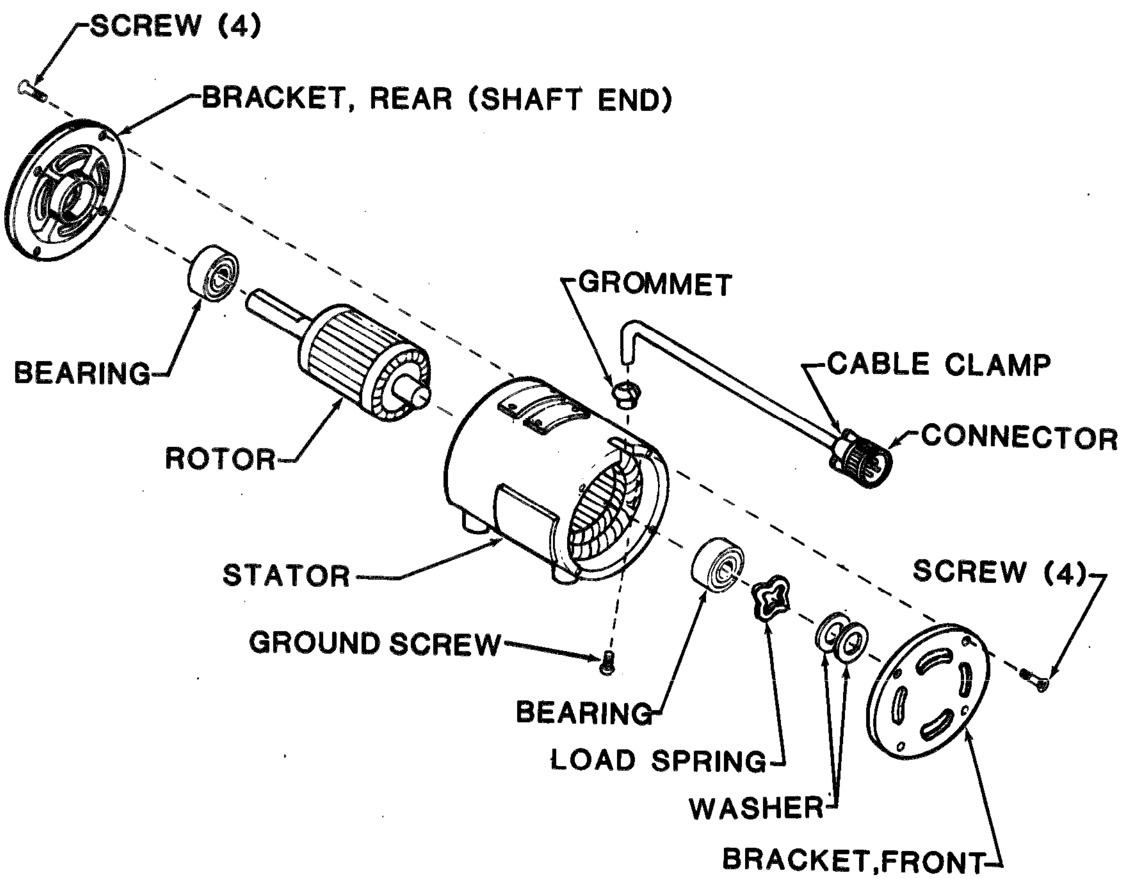


Figure 5-3. Motor Assembly, Welco Model M-4720-50

5-9. CONDENSER FAN, MOTOR, AND HOUSING REPAIR.–Continued

(1) To replace connector:

(a) Loosen cable clamp.

(b) Tag and unsolder leads.

(c) Remove old connector.

(d) See wiring diagram figure 4-4 and tags and solder leads to new connector. Remove tags.

(e) Secure cable clamp.

(2) To replace overload (thermal) protectors:

Overload protectors are not replaceable on this motor. If testing (para 4-36) indicates an open overload protector, replace motor.

(3) To replace bearings:

(a) Match-mark stator and both end brackets to ease reassembly.

(b) Remove four screws each from front and rear brackets.

(c) Carefully separate end brackets from stator. Using a brass or plastic bar and hammer tap opposite sides, top and bottom in alternating sequence to break end brackets loose.

(d) Remove end brackets.

(e) Press out or carefully drive bearings out of end brackets. Retain washers and load spring from front bracket for use at reassembly if they are not damaged.

(f) Examine rotor, stator, and shafts for nicks, gouges, deformations, and evidence of overheating.

(g) Dress high metal defects in shafts with a fine file or stone. If damage exceeds repairable limits, replace motor.

5-9. CONDENSER FAN, MOTOR, AND HOUSING REPAIR.-Continued

(h) Coat shaft surfaces of rotor with oil (MIL-L-2104, Grade 20) and slide bearings on shaft ends. They should seat against shoulders at the inner ends of shaft.

(i) Coat washers and load spring with oil (MIL-L-2104, Grade 20) and slide them over end of front shaft with load spring installed first.

(j) Coat bearing cavity of each end-bracket with oil. Slide end-bracket carefully into position over shaft so that OD of bearing enters ID of bearing cavity in end-bracket. Work end-brackets onto shaft until bore fits over end of stator. Keep match-marks made at time of disassembly in alignment.

(k) Place four screws in each end-bracket.

(l) Tap around both end-brackets with a plastic or rawhide mallet while tightening screws. Tighten in alternating sequence until all screws are equally tightened. Check for freedom of rotation by turning motor shaft by hand. There should be no drag or binding.

(m) Check end-play of shaft. End play should be 0.002 - 0.005 inch (0.051 - 0.127 mm). If end-play is not within limits, disassemble motor and add or remove shims to adjust.

b. Motor Assembly, Custom Motor Design and Manufacturing Inc., Model 700-01-0602. (See fig. 5-4)

(1) To replace connector:

(a) Loosen cable clamp.

(b) Tag and unsolder leads.

(c) Remove old connector.

(d) See wiring diagram figure 4-4 and tags and solder leads to new connector. Remove tags.

(e) Secure cable clamp.

5-9. CONDENSER FAN, MOTOR, AND HOUSING REPAIR.-Continued

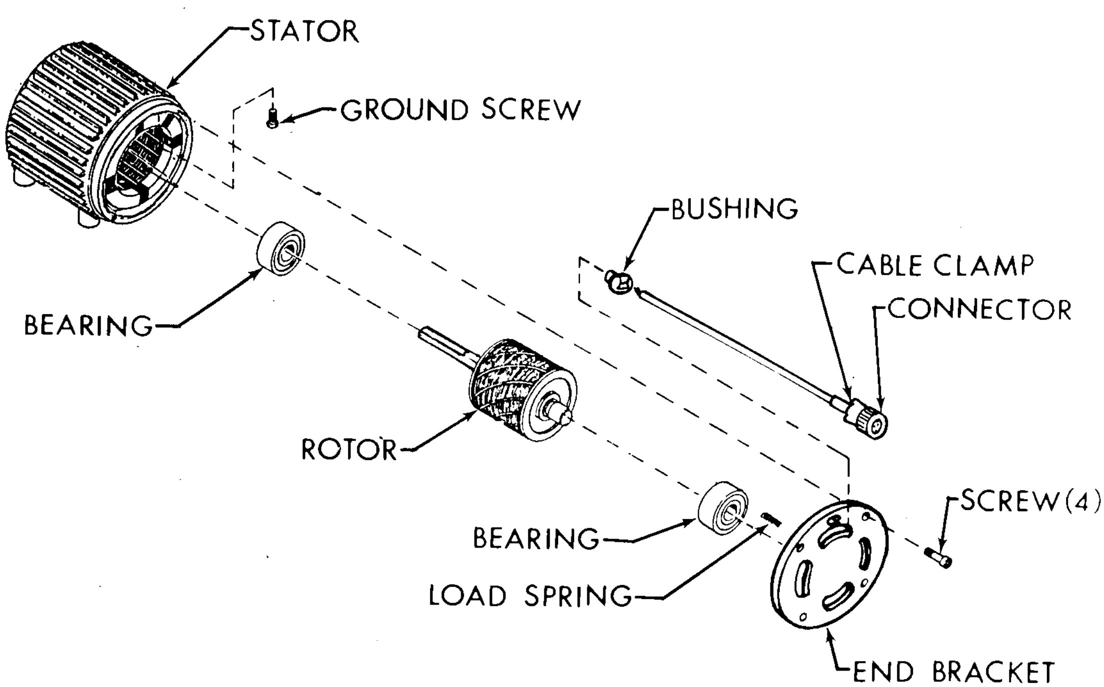


Figure 5-4. Motor Assembly, Custom Motor Design and Manufacturing Inc. Model 700-01-0602

(2) To replace overload (thermal) protectors:

Overload protectors are not replaceable on this motor. If testing (para 4-36) indicates an open overload protector, replace motor.

(3) To replace bearings:

(a) Match-mark stator and both end bells to ease reassembly.

(b) Remove four screws from end bracket.

(c) Carefully separate end bracket from stator. Using a brass or plastic bar and hammer tap opposite sides, top, and bottom in alternating sequence to break end bracket loose.

5-9. CONDENSER FAN, MOTOR, AND HOUSING REPAIR.-Continued

CAUTION

Remove the end bracket carefully to avoid damaging wires. Wires may be left in place if care is taken to avoid damaging them.

NOTE

Be sure load spring is not lost during motor disassembly. Note its position for use in reassembly.

(d) Remove end bracket.

(e) Carefully slide rotor out of stator housing.

(f) Press out or carefully drive bearings out of end bracket and stator housing. Retain load spring for use at reassembly if not damaged.

(g) Examine rotor, stator, and shafts for nicks, gouges, deformations, and evidence of overheating.

(h) Dress high metal defects in shafts with a fine file or stone. If damage exceeds repairable limits, replace motor.

(i) Coat shaft surfaces of rotor with oil (MIL-L-2104, Grade 20) and slide bearings on shaft ends. They should seat against shoulders at the inner ends of shaft.

(j) Coat the bearing cavity of end bracket and stator housing with oil and carefully slide rotor into stator until bearing is seated.

(k) Work end bracket onto shaft until bore fits over end of stator. Keep the matchmark made during disassembly in alignment.

(l) Place four screws through end bracket into stator housing.

(m) Tap around end-bracket with a plastic or rawhide mallet while tightening screws. Tighten in alternating sequence until all screws are equally tightened. Check for freedom of rotation by turning motor shaft by hand. There should be no drag or binding.

5-10. REFRIGERATION SYSTEM REPAIRS GENERAL.

The refrigeration system must be totally discharged before any maintenance action is performed on any system component. Leak testing and dehydrator replacement is required after any system component has been removed and replaced. The system must be evacuated before it is charged. The system must be properly charged to function properly.

WARNING

DANGEROUS CHEMICAL
is used in this equipment.

DEATH

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

Use great care to avoid contact with liquid refrigerant gas being discharged under pressure. Sudden and irreverisble tissue damage can result from freezing. Wear thermal protective gloves and a face protector or goggles in any situation where skin - eye - contact is possible.

Prevent contact of refrigerant gas with flame or hot surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas.

WARNING

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

DEATH

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

WARNING

Never use a heating torch on any part that contains Refrigerant R-22. Do not let liquid refrigerant touch you and do not inhale refrigerant gas.

5-11 DISCHARGING THE REFRIGERANT SYSTEM.

(See fig. 5-5.)

WARNNG

Death or serious injury may result if personnel fail to observe safety precautions. Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or goggles in any situation where skin-eye-contact is possible.

Prevent contact of refrigerant gas with flame or hot surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly poisonous arid corrosive gas.

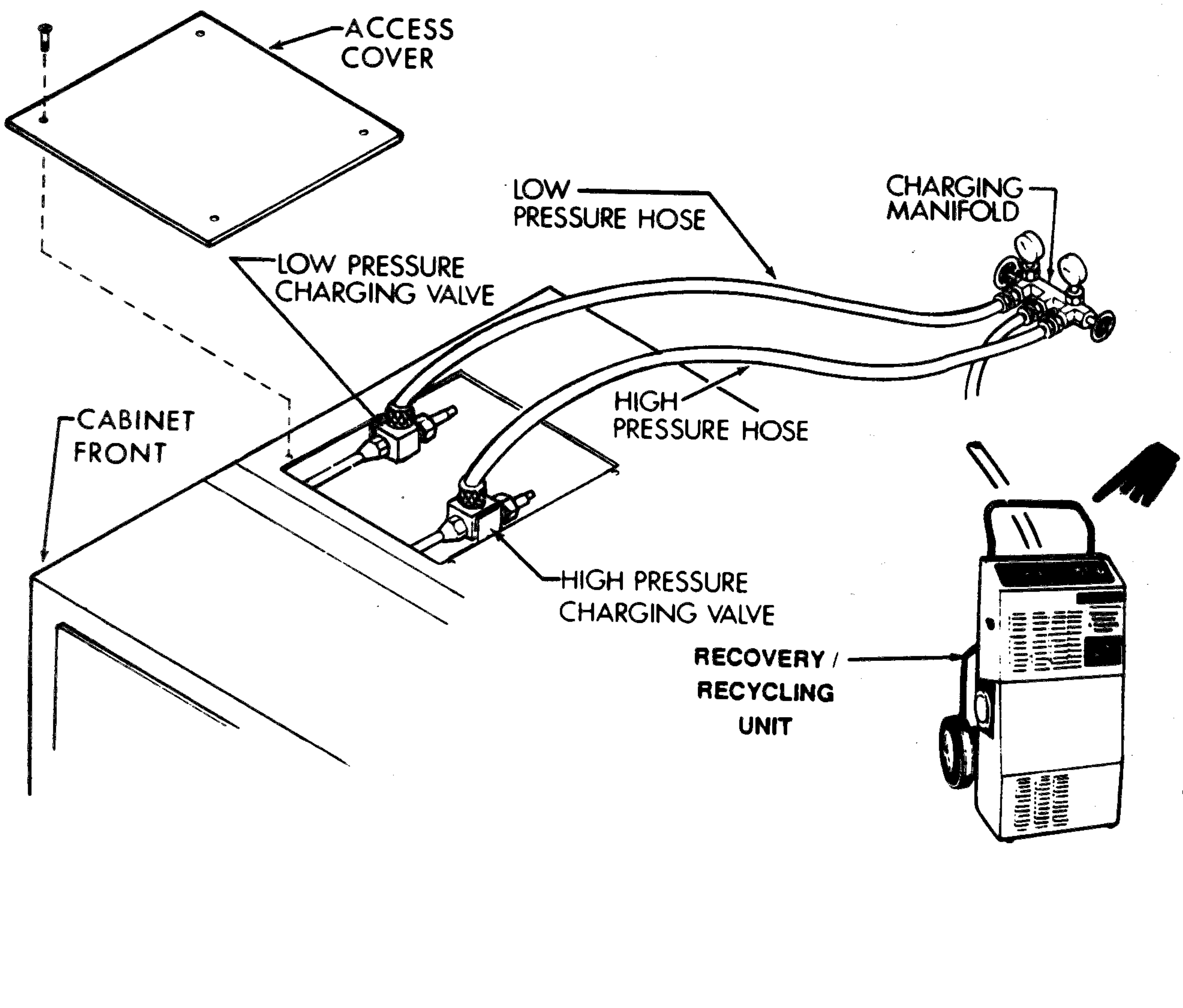


Figure 5-5. Discharging Refrigerant

5-11. DISCHARGING THE REFRIGERANT SYSTEM - Continued

NOTE

In accordance with Environmental Protection Agency regulations refrigerants cannot be discharged into the atmosphere, A refrigerant recovery & recycling unit must be used whenever discharging the refrigerant system.

a. Disconnect power at power source.

b. Remove four screws and refrigerant charging valve access cover.

c. Connect charging manifold to charging valves.

NOTE

Operation of the recovery/recycling unit must be by AUTHORIZED PERSONNEL ONLY

d. Connect and operate a recovery/recycling unit in accordance with the manufacturer's instructions.

5-12. PURGING THE REFRIGERANT SYSTEM.

Preliminary procedures:	Discharge the refrigerant system. (See para 5-11.)
Supplies:	Nitrogen cylinder (item 8, Appendix E)

5-12. PURGING THE REFRIGERANT SYSTEM.-Continued

The refrigeration system must be purged with dry nitrogen, item 8, Appendix E before any brazing is performed on any components. A flow of dry nitrogen at the rate of 1 - 2 cfm (0.028 - 0.057 m^3/minute) should be continued during all brazing operations to minimize internal oxidation and scaling.

CAUTION

Nitrogen cylinders are pressurized containers. The pressure in the cylinder can exceed 2000 psi. A nitrogen pressure regulator should be used at all times when nitrogen is used for leak check or purge operations.

CAUTION

Nitrogen is an inert gas; however, it also presents danger as a suffocant and, therefore must also be discharged in a ventilated location.

Assuming that the system has been discharged (para 5-11), see figure 5-6 and proceed as follows:

a. See specific component removal instructions. It may be necessary to remove top rear cover prior to connecting hoses to service valves.

b. Be sure that refrigerant has been discharged. (See para 5-11.)

c. Connect center hose from charging manifold to a nitrogen regulator and dry nitrogen bottle.

d. The hose from the high pressure charging valve to the charging manifold should be connected.

e. The hose from the low pressure charging valve should be disconnected from the charging manifold.

f. Open both charging valves on unit.

g. Close the unused valve on the charging manifold and open the one connected to the high pressure hose.

h. Open the nitrogen cylinder valve and adjust the regulator so that approximately 1 - 2 cfm (0.028 - 0.057 m^3/minute) of nitrogen flows through the system.

i. Check discharge from hose attached to the low pressure charging valve to be sure that no oil is being forced out of the system.

5-12. PURGING THE REFRIGERANT SYSTEM.-Continued

j. Allow nitrogen to flow through the system at the rate of 1 - 2 cfm (0.028 - 0.057 m^3/minute) for a minimum of 5 minutes before starting any brazing operation, then allow it to continue to flow at the same rate until all brazing operations are completed.

k. After installation brazing operations are completed, allow nitrogen to flow for a minimum of 5 minutes.

l. Close nitrogen cylinder valve, nitrogen regulator, charging manifold valve, and both high and low pressure charging valves on the unit.

m. Disconnect hose from nitrogen tank.

n. Assuming that all repairs are completed, go to paragraph 5-14.

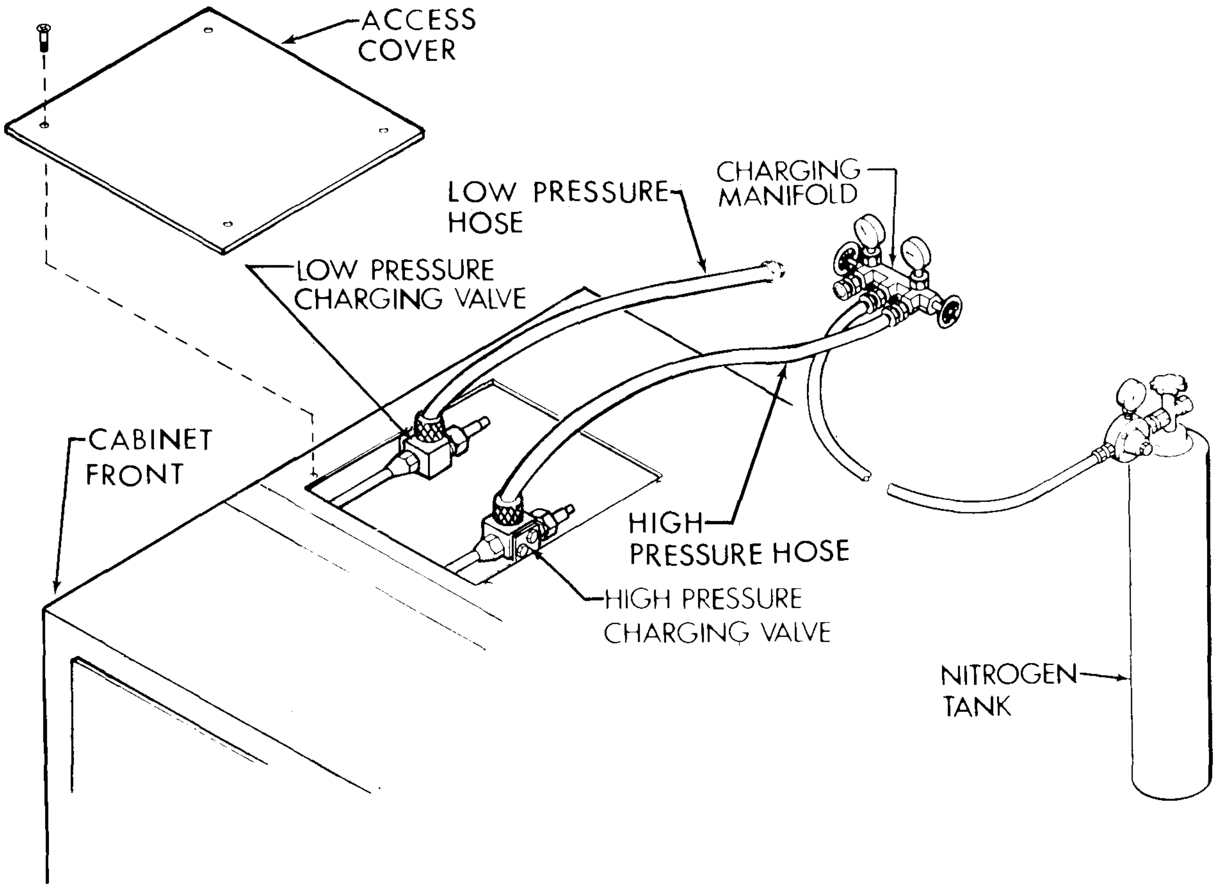


Figure 5-6. Nitrogen Tank Connection

5-13. BRAZING/DEBRAZING PROCEDURES.

Supplies: Brazing alloy (silver) (items 9 and 10, Appendix E)
Nituogen cylinder (item 8, Appendix E)
Brazing flux (item 11, Appendix E)
Abrasive cloth (item 12, Appendix E)
Rags (item 13, Appendix E)

a. General. All tubing in the refrigeration system is seamless copper with a bright internal finish that permits thorough cleaning and prevents entrapment of moisture or other impurities. Rigid grade copper is used for straight sections and soft grade for sections that must be bent. All interconnecting fittings, such as elbows, tees, etc., are also copper. The bodies of all valves and all connectors on other components are brass. All joints, except those provided with flare fittings, are made by brazing in accordance with MIL-B-7883, except that radiographic examination is not required.

b. Filler Alloy. Grade IV or VI brazing alloy and Type B flux, as specified in MIL-B-7883, must be used for all copper to brass joints. Grade III brazing alloy may be substituted for Grade IV or VI for copper to copper joints; flux is not required for copper to copper joints.

c. Debrazing. Debraze joints for removal of refrigeration system components as follows:

WARNING

All Refrigerant - 22 must be discharged from the system and the entire system must be purged with dry nitrogen before beginning any debrazing operation.

NOTE

Sometimes it may be easier to remove a component by cutting the copper lines at accessible areas, and after isolation of the component proceed to debraze the copper lines from the component.

(1) Determine which joints are to be debrazed. Due to limited work space inside the air conditioner it may be more convenient to remove a part of the interconnecting tubing with the component rather than debrazing joints on the component itself.

5-13. BRAZING/DEBRAZING PROCEDURES.-Continued

(2) Before debrazing a joint on a valve, disassemble the valve to the extent possible, then wrap all but the joint with a wet cloth to act as a heat sink.

WARNING

The polyurethane foam used as insulation in the air conditioner will break down to form toxic gases if exposed to the flame of a torch or brazing temperature.

(3) Protect insulation, wiring harnesses, and other components with appropriate shields.

(4) Be sure the work area is well ventilated and that dry nitrogen is flowing through the refrigeration system at a rate of 1 - 2 cfm (0.028 - 0.057 m^3/minute).

(5) Apply sufficient heat uniformly around the joint to quickly melt the filler alloy. If heat is applied slowly, or only on one side, the entire component or length of tubing will be heated and filler alloy in adjacent joints may also be melted. Remove heat as soon as the joint separates.

d. Cleaning Debrazed Joints. All filler alloy must be cleaned from debrazed joints before reassembly. Heat each piece of the joint until the filler alloy is melted and then wipe it away with a wire brush. Be sure no filler alloy or other debris is left inside any tubing, fitting, or component.

e. Reassembly. If tubing sections or fittings were removed with a component, debraze them from the component, clean the joints, and braze them to the new components before reinstallation.

f. Brazing. Braze joints within the air conditioner as follows:

(1) Position component to be installed.

(2) To prepare for brazing a joint on a valve, remove the electric coil.

(3) Protect insulation, wiring harnesses, and surrounding components with appropriate shields.

(4) Be sure work area is well ventilated and that dry nitrogen is flowing through the refrigeration system at a rate of 1 - 2 cfm (0.028 - 0.057 m^3/minute).

5-13. BRAZING/DEBRAZING PROCEDURES.-Continued

(5) Apply sufficient heat uniformly around the joint to quickly raise it to a temperature that will melt the filler alloy. Remove heat as soon as brazing is completed.

5-14. LEAK TESTING.

Supplies: Nitrogen cylinder (item 8, Appendix E)
Refrigerant-22 (item 4, Appendix E)

The entire refrigeration system should be thoroughly leak tested after repair or replacement of any component before it is recharged with Refrigerant-22. Leak testing is also the method for troubleshooting when a system has lost all or part of its refrigerant charge through an undetermined cause.

a. Disassembly.

NOTE

The following steps cover all the disassembly actions necessary to prepare a system for complete leak testing. If the air conditioner has been partially disassembled for repair, most of these actions will already have been accomplished.

(1) Disconnect power at power source.

(2) Remove top covers. (See para 4-11.)

(3) Remove supply air louver. (See para 4-14.)

(4) Remove mist eliminator. (See para 4-16.)

b. Testing Method. There are two acceptable methods for leak testing the refrigeration system.

(1) Refrigerant Gas Leak Detector. If an electronic refrigerant gas leak detector is available it should be used in accordance with the procedures contained in TM 9-4940-435-14, “Leak Detector, Refrigerant Gas”.

5-14. LEAK TESTING.-Continued

NOTE

The electronic refrigerant gas tester is highly sensitive to the presence of a small quantity of gas in the air, and due to this fact it is quite effective in the detection of small leaks. However, due to the rapid dispersion of refrigerant gas into the surrounding air, difficulty may be encountered in pinpointing large leaks. The detector must be used in a well ventilated but draft-free area.

(2) Soap Solutions. In this method, a strong solution of a liquid detergent and water is brushed onto all points of possible leakage while closely observing for the formation of bubbles.

CAUTION

If the soap solution testing method is used, thoroughly rinse with fresh water after testing is completed. A residual soap film will attract and accumulate an excessive amount of dust and dirt during operation.

c. Testing Procedures. To perform leak testing by use of the electronic detector, it is necessary that the system be pressurized with a proportion of refrigerant gas. To perform leak testing by use of the soap solution method, the system may be pressurized with dry nitrogen alone.

(1) To pressurize a system that has some refrigerant charge, for either leak testing method:

(a) Connect hoses from a charging manifold to charging valves.

NOTE

If it is possible that the problem may not be a leak and that you may not have to replace a refrigeration system component Refrigerant-22 may be substituted for nitrogen in the following test. If nitrogen is used you will have to discharge, evacuate, and recharge the system after test is completed.

(b) Connect a nitrogen pressure regulator and nitrogen bottle to center hose connection of charging manifold.

(c) Open unit charging valves and charging manifold valves.

5-14. LEAK TESTING.-Continued

(d) Open nitrogen tank valve and pressurize system to 350 psi (24.7 kg/cm^2).

(e) Perform leak tests.

(f) If a leak is found, discharge and purge system and repair leak. See specific instructions for component removal.

(g) If a leak was not found and Refrigerant-22 was used to pressurize system see charging instructions (para 5-16.).

(2) To pressurize a system that has been discharged and purged, for leak testing with an electronic detector:

(a) Connect hoses from charging manifold to charging valves.

(b) Connect drum of Refrigerant-22 to center hose connection of service manifold.

CAUTION

Connect the Refrigerant-22 drum so that only gas will be used for pressurization.

(c) Open both unit charging valves and charging manifold valves.

(d) Qpen refrigerant drum valve slightly and adjust as necessary to prevent formation of frost; and, allow system pressure to build up until gages read 40-50 psi (2.8 - 3.5 kg/cm^2).

(e) Close charging manifold valves and refrigerant drum valve.

(f) Remove Refrigerant-22 drum from center hose connection.

(g) Connect a cylinder of dry nitrogen to center hose connection.

(h) Open the charging manifold valves and the nitrogen cylinder valve; allow system pressure to build up until gages read 350 psi (24.7 kg/cm^2).

(i) Perform leak tests, then discharge and purge system, in accordance with paragraphs 5-11 and 5-12 before performing maintenance, or before evacuating and charging system, as appropriate.

5-14. LEAK TESTING.–Continued

(3) Final Leak Testing. Always perform a final leak test after performing any repair or replacement of components before the air conditioner is reassembled and the refrigeration system is evacuated and charged.

5-15. EVACUATING THE REFRIGERANT SYSTEM.

The refrigeration system must be evacuated to remove all moisture before it is charged with Refrigerant-22. (See fig. 5-7.)

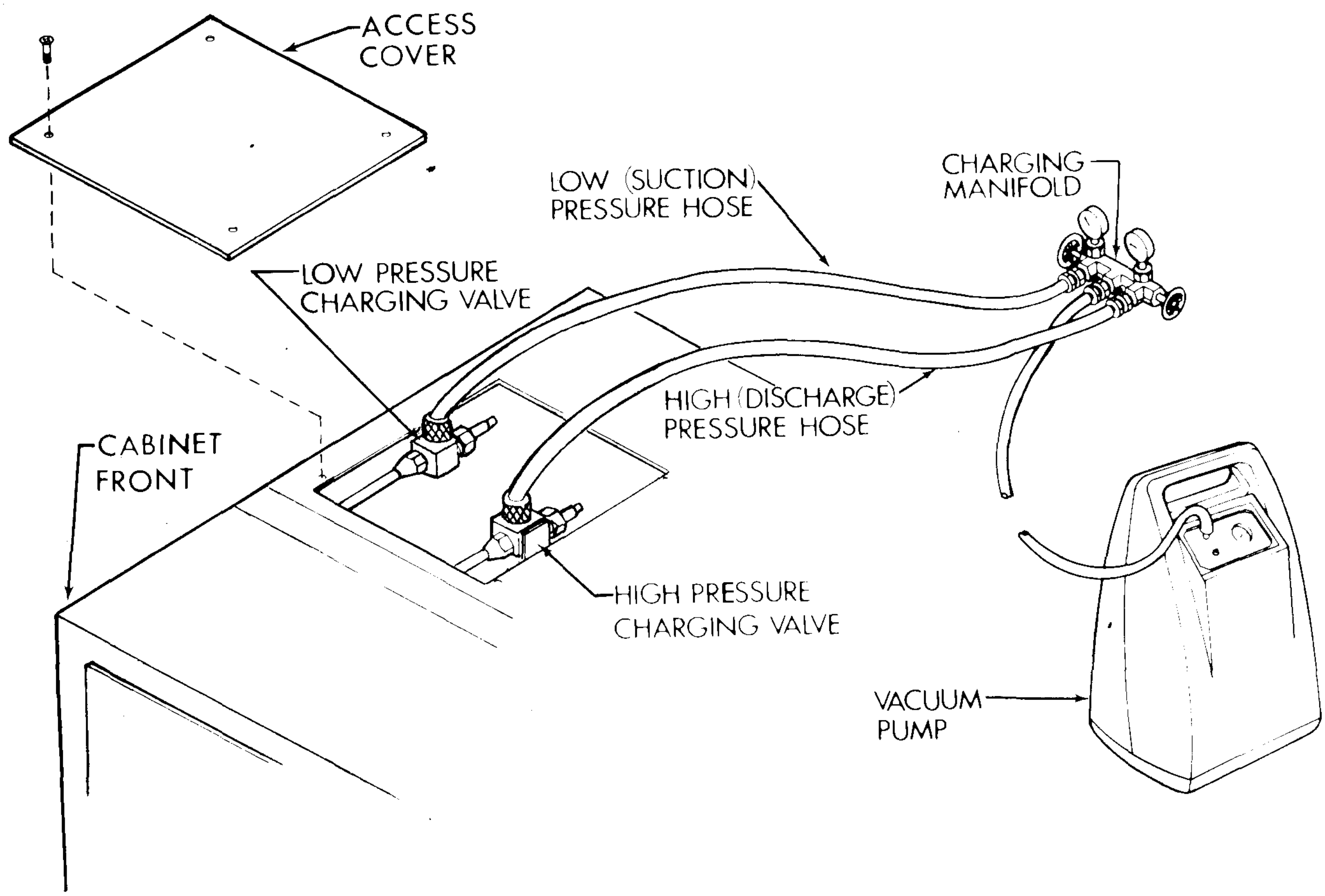


Figure 5-7. Evacuation of Refrigerant System

a. Check that system was leak tested and has NO LEAKS.

b. Check that new dehydrator was installed. If not, install one. (See para 5-30.)

5-15. EVACUATING THE REFRIGERANT SYSTEM.-Continued

c. Check that both charging valves and charging manifold valves are closed.

d. Attach hose assemblies to charging valves and charging manifold valves.

e. Attach center hose assembly to vacuum pump.

f. Start vacuum pump.

g. Open charging manifold valves.

h. Open both unit charging valves.

i. Run vacuum pump until at least 29 inches of mercury, measured on gage, is reached.

NOTE

Inability to reach and hold 29 inches of mercury may indicate either a leak <u>or</u> a problem with the pump.

j. Continue running pump for one more hour, while observing the gage. If gage needle moves back and forth, you have a leak which must be located and corrected first. (See para 5-14.)

k. Close charging manifold valves.

l. Close both unit charging valves.

m. Stop vacuum pump.

n. Disconnect pump from center hose connection.

o. Go to paragraph 5-16, Charging the Refrigerant System.

5-16. CHARGING THE REFRIGERANT SYSTEM.

After the system has been satisfactorily evacuated, it must be fully charged with Refrigerant-22. (See fig. 5-8.)

CAUTION

Never introduce liquid refrigerant into the low pressure (suction) charging valve.

5-16. CHARGING THE REFRIGERANT SYSTEM - Continued

NOTE

The system must be evacuated before charging. Use only Refrigerant-22 to charge the unit. If available, use recycled refrigerant.

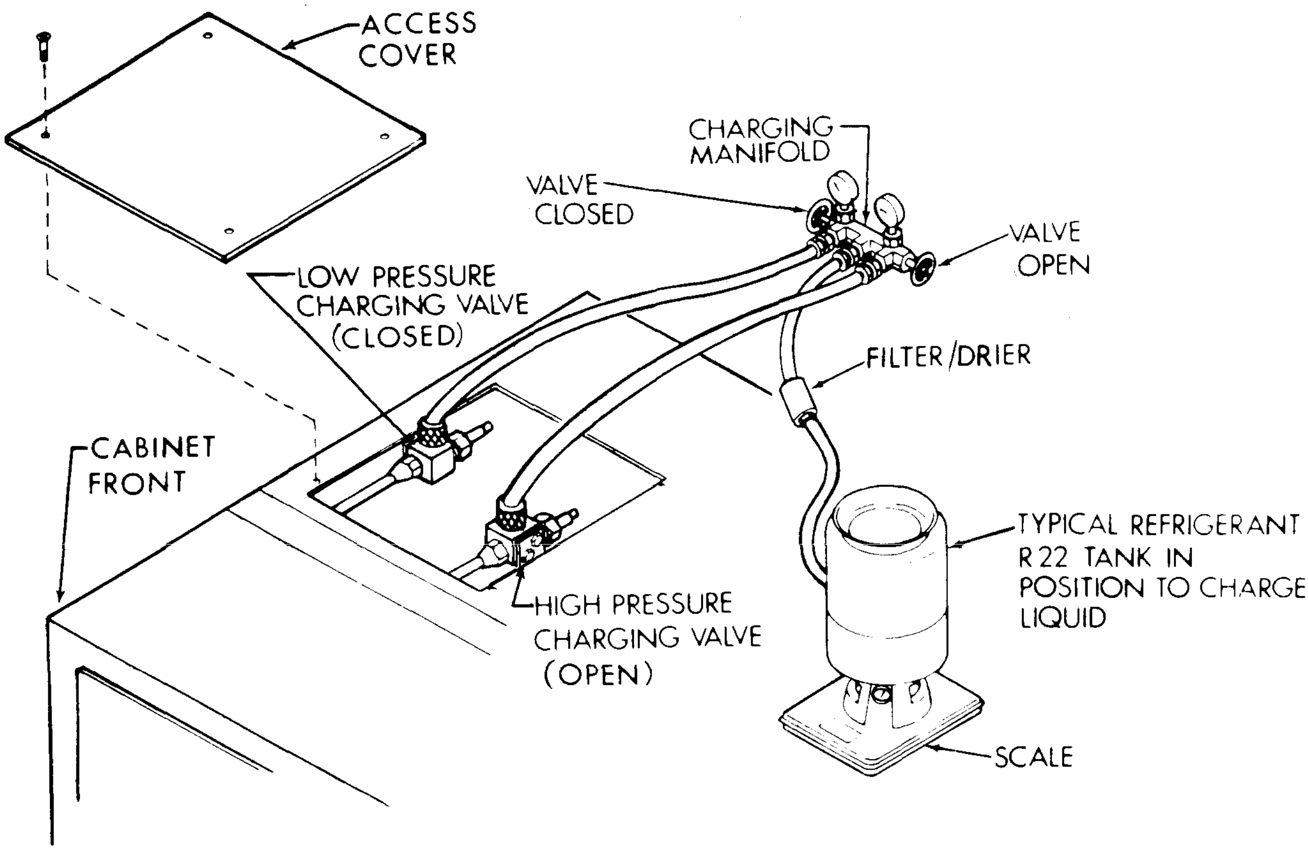


Figure 5-8. Refrigerant Charging

a. The charging operation should be done with all covers in place except for refrigerant charging valve access cover.

b. Check that the hose from the low pressure charging valve is connected to the compound gage side of the charging manifold. The hose from the high pressure charging valve should be connected to the pressure gage side of the charging manifold.

c. Connect center hose from charging manifold to a well charged drum of Refrigerant-22.

d. Loosen hose connections to the two air conditioner charging valves slightly.

5-16. CHARGING THE REFRIGERANT SYSTEM.-Continued

e. Open the two charging manifold valves.

f. Open Refrigerant-22 tank valve slightly to allow a small amount of refrigerant to purge air from hoses. Tighten hose connections at the air conditioner charging valves.

g. Close low pressure (suction) charging manifold valve. Never introduce liquid refrigerant into low pressure (suction) charging valve.

Position Refrigerant-22 tank so that liquid will be used for charging. (Some drums must be inverted and some are equipped with a selector valve.)

i. Use accurate scales to measure and record weight of Refrigerant-22 drum.

j. Open Refrigerant-22 drum valve.

k. Open high pressure charging valve on air conditioner. Allow liquid refrigerant to enter system until drum weight has decreased by 2.2 pounds (1.0 Kg) or until system pressure has equalized.

l. Close refrigerant drum valve and high pressure (discharge) manifold valve.

m. Reset low pressure cut out switch.

n. Connect power at power source.

o. Turn air conditioner on and operate in cool mode with TEMPERATURE SELECTOR set at maximum COOLER position.

p. If 2.2 pounds (1.0 Kg) full charge was obtained, skip steps q. through s. If system pressure equalized prior to obtaining a full charge of 2.2 pounds (1.0 Kg) proceed with step q.

q. Switch refrigerant drum to **gas only** position.

r. Be sure refrigerant drum has been switched to **gas** position and open refrigerant drum valve, low (suction) pressure charging manifold valve and low (suction) pressure charging valve on air conditioner.

s. Monitor weight of the refrigerant drum as air conditioner compressor pulls additional refrigerant gas into system until full 2.2 pounds (1.0 Kg) charge is obtained. When system is fully charged, immediately close refrigerant drum valve and air conditioner low pressure charging valve.

5-16. CHARGING THE REFRIGERANT SYSTEM.–Continued

t. Run air conditioner in COOL mode (with temperature control in coolest position) for 15 minutes.

CAUTION

Do not skip the next step.

u. After 15 minutes, observe sight glass on back of condenser section. Be sure that the refrigeration system is not in bypass. When system goes into bypass bubbles will appear in the sight glass.

- Green center means refrigerant moisture content is acceptable.
- Yellow center means there is too much moisture in system. It must be discharged, evacuated, and charged again.
- Milky white or bubbly liquid means system has a low charge.
- Clean bubble-free liquid around center means the system is fully charged.

v. If charge is low add gas refrigerant.

(1) Be sure drum is switched to **gas** position. Open drum valve.

(2) Continue to charge until sight glass is clean and bubble-free.

(3) Close low pressure air conditioner charging valve and refrigerant drum valve.

w. Turn MODE SELECTOR switch to OFF.

x. Check that high and low pressure air conditioner charging valves are closed and remove charging manifold hoses.

y. Install charging valve access cover.

5-17. REFRIGERATION SYSTEM TROUBLESHOOTING.

The two most likely malfunction symptoms to be reported to direct support maintenance are: (1) Unsatisfactory color or bubbles observed in the sight glass; and (2) reduced cooling capacity. Discussion with operators and/or organizational maintenance personnel as to how the symptoms appeared can often be more informative than the symptoms themselves.

a. Sight Glass Indications. There are two indications that may be observed in the sight glass; (1) color as a result of moisture content in the refrigerant, and (2) vapor bubbles in the liquid refrigerant.

(1) Color Change. A bright green color indicates that the refrigerant is dry. As moisture content increases, the color will gradually change from chartreuse until it reaches pure yellow. A gradual change from green into chartreuse over an extended period of time is normally an indication that the dehydrator is becoming saturated with moisture. A sudden change of color is highly unlikely unless a rupture occurs allowing all refrigerant to escape.

(2) Bubbles. The appearance of an occasional bubble in the sight glass can be expected, especially when operating in a high ambient temperature. A gradual increase in the number and frequency of bubbles is usually an indication that the refrigerant charge is being lost from the system through a small leak. The number and frequency of bubbles will also increase if the refrigeration system becomes overheated. The sudden appearance of numerous bubbles is usually an indication of a serious leak.

NOTE

When the system goes into bypass numerous bubbles will appear. This is normal. Be sure that the refrigeration system is under full load when observing the sight glass for refrigerant condition.

b. Reduction in Cooling Capacity. A reduction in cooling capacity will occur as a natural result if refrigerant is lost from the system; with a total loss of cooling if all refrigerant is lost. However, in some conditions a considerable proportion of the refrigerant may be lost before the reduced cooling capacity is noticeable. Sudden or erratic reduction, or complete loss of cooling capacity is often caused by the malfunction of one of the valves in the refrigeration system. Cooling capacity will also be reduced if the refrigeration system becomes overheated.

5-18. OVERHEATING CHECKS.

Overheating of the refrigeration system is often the cause of bubbles appearing in the sight glass, or a reduction in cooling capacity. Adequate cooling of the hot, compressed refrigerant vapor in the condenser is essential to the proper operation of the air conditioner. The following checks should be made to ensure that overheating is not the cause of the symptoms before troubleshooting the pressurized portion of the refrigeration system:

a. Be sure there is no external obstruction to air flow into the condenser intake screen and out of the condenser fan guard.

b. Be sure there is no obstruction within the intake screen and fan guard.

c. Be sure there are no obstructions or an excessive build-up of dust and dirt in the condenser coil.

NOTE

Addition of paint on coils will cause an insulation and retardation of heat transfer.

5-19. REFRIGERANT PRESSURE CHECK.

Except in cases where it is obvious that the refrigerant charge has been lost, the first step in troubleshooting problems in the refrigeration system should be to check discharge and suction pressures under operating conditions. Check pressures as follows:

a. Turn MODE SELECTOR switch to OFF.

b. Remove charging valve access cover.

c. Connect individual pressure gages or a refrigeration servicing manifold and hoses to high (discharge) and low (suction) charging (service) valves.

CAUTION

Take care that only a very small amount of refrigerant is allowed to escape during hose purging.

d. Loosen hose connections at gages or charging manifold.

5-19. REFRIGERANT PRESSURE CHECK.-Continued

e. Open high (discharge) pressure service valve slightly to purge air from hose. Tighten high pressure hose connection at gage fitting as soon as a hissing sound is heard.

f. Open low (suction) pressure service valve slightly to purge air from hose. Tighten low pressure hose connection at gage fitting as soon as a hissing sound is heard.

g. Open low (suction) and high (discharge) charging valves.

h. Both gages should read the same. Check the reading with the appropriate column in Table 5-2. If the system is even partially charged, the pressure should be approximately equal to that shown in the table for the appropriate ambient temperature. If the pressure is considerably less than shown in the table, the system does not contain enough refrigerant to continue the pressure check; proceed directly to leak testing. (See para 5-14.)

i. Turn air conditioner on and operate in COOL mode with TEMPERATURE SELECTOR in full COOLER setting for a few minutes.

j. With unit operating allow gages to stabilize. Take readings of the two gages.

(1) lf discharge and suction pressures are at, or near, the same value, a pressure equalizer solenoid valve L2 malfunction, or an internal compressor failure is indicated.

(2) If discharge pressure is low and suction pressure is normal (see Table 5-3) a low refrigerant charge is indicated.

(3) If discharge pressure is normal and suction pressure is either high or low, failure or maladjustment of the pressure regulator valve is indicated.

(4) If ice forms on evaporator coil, or evaporator coil does not cool, during operation, failure or malfunction of evaporator expansion valve is indicated.

(5) If discharge pressure is high and suction pressure is normal, a malfunction of quench valve is indicated. If discharge pressure is above 540 psig, pressure relief valve malfunction is also indicated.

k. When pressure tests are completed, proceed with the maintenance action indicated.

Table 5-2. PRESSURE-TEMPERATURE RELATIONSHIP OF SATURATED REFRIGERANT-22

Temperature		Pressure		Temperature		Pressure	
Deg F	Deg C	Psig	kg/cm^2	Deg F	Deg C	Psig	kg/cm^2
10	-12.3	32.93	2.315	66	18.9	114.2	8.029
12	-11.1	34.68	2.439	68	20.0	118.3	8.318
14	-10.0	36.89	2.593				
16	- 8.9	38.96	2.739	70	21.1	122.5	8.612
18	- 7.8	41.09	2.889	72	22.2	126.8	8.915
				74	23.3	131.2	9.225
20	- 6.6	43.28	3.043	76	24.4	135.7	9.541
22	- 5.5	45.23	3.180	78	25.6	140.3	9.864
24	- 4.3	47.85	3.364				
26	- 3.4	50.24	3.532	80	26.7	145.0	10.195
28	- 2.2	52.70	3.705	82	27.8	149.8	10.522
				84	28.9	154.7	10.877
30	- 1.1	55.23	3.883	86	30.0	159.8	11.236
32	0	57.83	4.066	88	31.1	164.9	11.594
34	1.1	60.51	4.254				
36	2.2	63.27	4.448	90	32.2	170.1	11.960
38	3.3	66.11	4.648	92	33.3	175.4	12.332
				94	34.5	180.9	12.719
40	4.4	69.02	4.853	96	35.6	186.5	13.113
42	5.5	71.99	5.062	98	36.7	192.1	13.506
44	6.6	75.04	5.276				
46	7.7	78.18	5.497	100	37.8	197.9	13.914
48	8.8	81.40	5.723	102	38.9	203.8	14.329
				104	40.0	209.9	14.758
50	10.0	84.70	5.955	106	41.1	216.0	15.187
52	11.1	88.10	6.257	108	42.2	222.3	15.630
54	12.2	91.5	6.433				
56	13.3	95.1	6.686	110	43.3	228.7	16.080
58	14.5	98.8	6.947	112	44.4	235.2	16.537
				114	45.6	241.9	17.008
60	15.6	102.5	7.206	116	46.7	248.7	17.486
62	16.7	106.3	7.474	118	47.8	255.6	17.971
64	17.8	110.2	7.748				

5-19. REFRIGERANT PRESSURE CHECK.-Continued

Table 5-3. NORMAL OPERATING PRESSURES

Temperatures	**Pressure Range (psig)**			
Outdoor Ambient	**55°F(12.8°C)**	**75°F(24°C)**	**100°F(38°C)**	**125°F(51.7°C)**
90°F(32°C) Return Air to Unit (Dry Bulb)	60-70 Suction 205-220 Discharge	62-72 Suction 225-245 Discharge	70-80 Suction 305-325 Discharge	80-95 Suction 400-425 Discharge
80°F(27°C) Return Air to Unit (Dry Bulb)	60-70 Suction 185-205 Discharge	60-70 Suction 215-235 Discharge	65-75 Suction 290-310 Discharge	70-80 Suction 385-415 Discharge

5-20. EVAPORATOR COIL.

The evaporator coil is located in the upper right front section of the air conditioner. (See fig. 5-9.) For cleaning instructions and inspection of installed items see paragraph 4-37.

a. <u>Removal</u>.

WARNING

Disconnect input power from the air conditioner before performing maintenance on any part of the electrical system. The voltages used can be lethal.

(1) Disconnect power at power source.

(2) Remove eight screws and top front cover.

(3) Remove six screws, lock washers, and supply air louver.

(4) Remove mist eliminator by lifting out of unit.

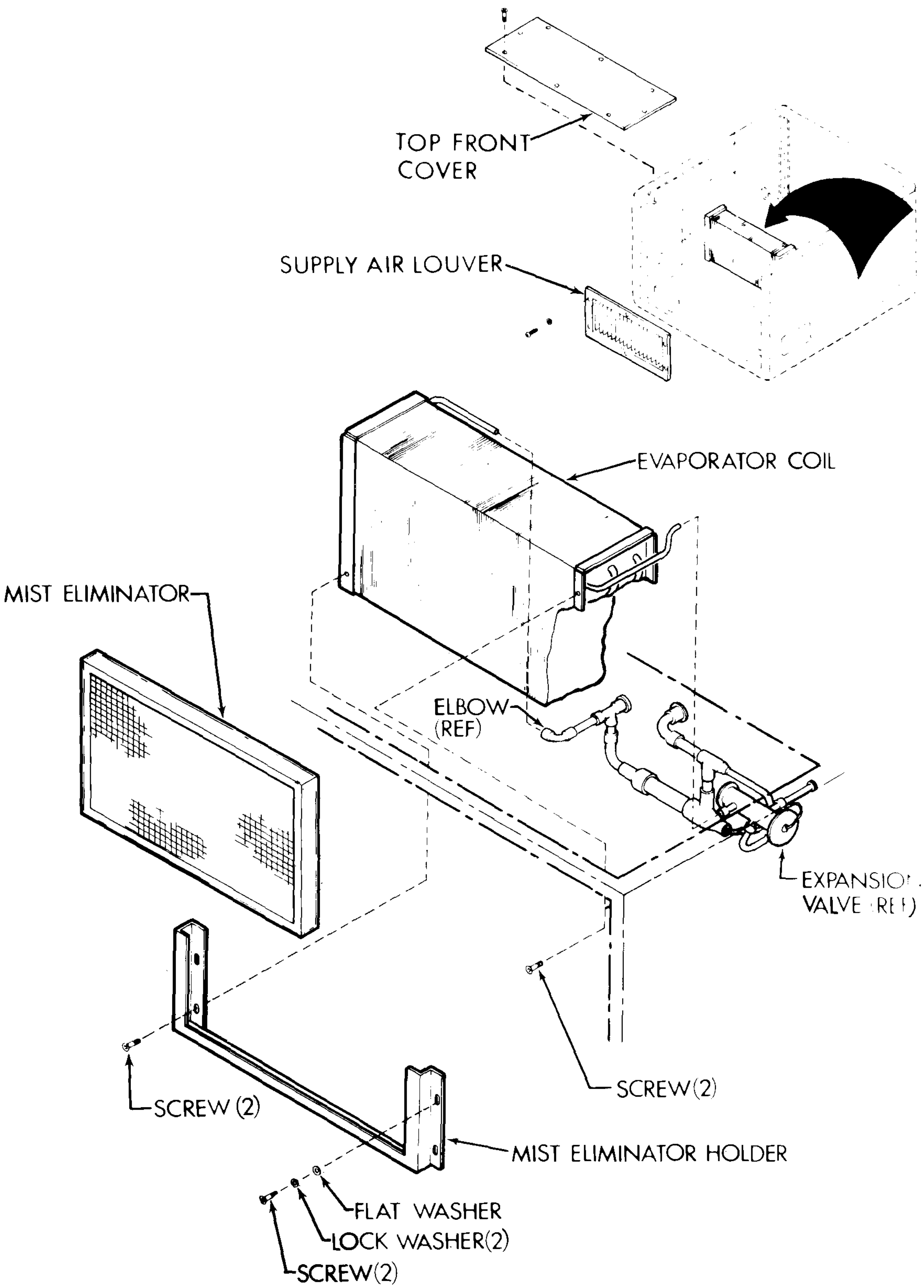


Figure 5-9. Evaporator Coil

5-20. EVAPORATOR COIL.-Continued

(5) Discharge and purge the refrigerant system per paragraphs 5-11 and 5-12.

(6) Unwrap insulation on joints to be debrazed.

(7) Debraze tube connections at elbow and expansion valve (para 5-13). Take care that expansion valve is not damaged during debrazing operations.

(8) Remove top two flat head screws that attach coil to housing. Remove side two flat head screws and two each screws, lock washers, and flat washers that attach the mist eliminator holder and coil to the housing.

WARNING

When handling coils wear gloves to avoid cuts and reduce fin damage on the coil.

(9) Slip evaporator coil and mist eliminator holder up and out of unit.

b. Replace. If coil is defective replace it.

c. Installation.

WARNING

When handling coils wear gloves to avoid cuts and reduce fin damage on the coil.

(1) Carefully position evaporator coil and mist eliminator holder.

(2) Secure mist eliminator holder and evaporator coil to housing with four flat head screws. Secure evaporator coil to housing with two each screws, lock washers, and flat washers. The four holes in the mist eliminator holder match the bottom four holes in the coil.

(3) Align tubing connections to elbow and expansion valve. Braze joints in accordance with paragraph 5-13. Take care that expansion valve is protected during brazing operation.

(4) Replace dehydrator. (See para 5-30.)

(5) Leak test coil, dehydrator, newly brazed joints, and joints in the area of newly brazed joints per paragraph 5-14.

5–20. EVAPORATOR COIL.-Continued

(6) Rewrap insulation that was removed prior to debrazing.

(7) Slide mist eliminator into its holder. TOP mark must be up and air flow arrows must point away from coil.

(8) Install supply air louver and top front cover.

(9) Evacuate and charge refrigeration system in accordance with paragraphs 5-15 and 5-16.

5-21. EXPANSION VALVE (PRIMARY).

The (primary) expansion valve is factory set at a superheat of 6 ±1/2°F (3.3 ±0.3°C) at 32°F (0°C) bath temperature. Do not attempt field adjustment of the valve.

a. Removal. (See fig. 5-10.)

(1) Disconnect power at power source.

(2) Remove top front cover (para 4-11).

(3) Discharge and purge refrigeration system per paragraphs 5-11 and 5-12.

(4) Unwrap insulation from joints of expansion valve.

(5) Soften thermal mastic in the bulb well using a cloth wrung out in hot water, a heat lamp, or heat gun if necessary and withdraw bulb from bulb well.

(6) Debraze three tube connections to valve.

(7) Remove valve from unit.

b. Replace. If expansion valve is suspected bad replace it.

c. Installation.

(1) Place expansion valve in unit and align tubing ends.

(2) Protect valve from overheating during brazing operations. Direct flame away from valve body and wrap valve body with wet rags.

(3) Braze joints in accordance with paragraph 5-13.

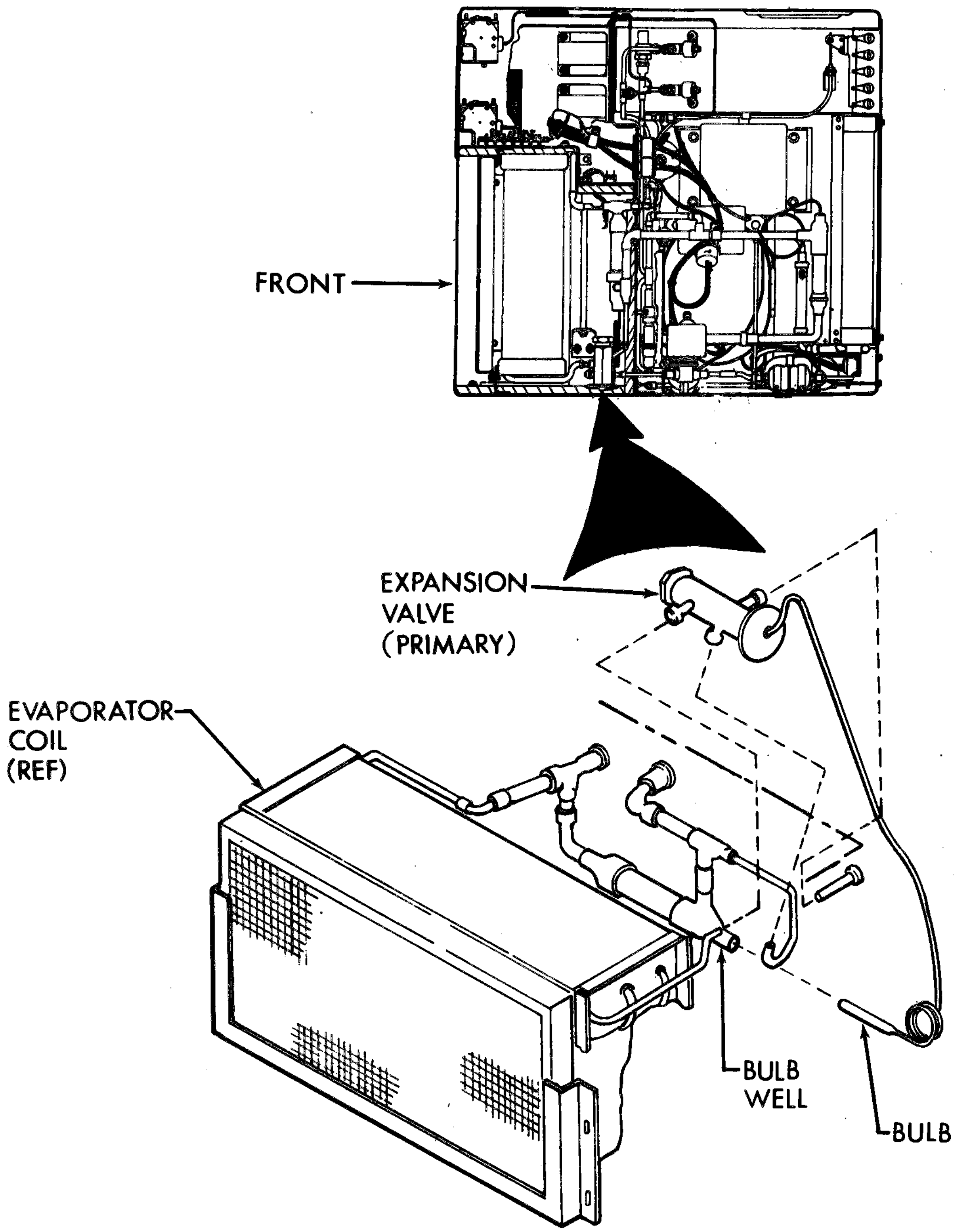


Figure 5-10. Expansion Valve (Primary)

5-21. EXPANSION VALVE (PRIMARY). - Continued

(4) Replace dehydrator. (See para 5-30.)

(5) Leak test all newly connected joints and all tube connections in the area.

(6) Rewrap insulation at expansion valve joints.

(7) Install sensing bulb in bulb well.

(a) Insert approximately one ounce of thermal mastic in bulb well.

(b) Insert sensing bulb from expansion valve into bulb well.

(c) Move bulb back and forth to distribute the mastic.

(d) Set bulb about one inch (2.5 cm) beyond open end of bulb well.

(8) Install top cover (para 4-11).

(9) Evacuate and charge the refrigeration system in accordance with paragraphs 5-15 and 5-16.

5-22. EXPANSION VALVE (QUENCH).

The liquid quench expansion valve is factory set at a superheat of 16 ±1/2°F (8.9 ±0.3°C) at 32°F (0°C) bath temperature. Do not attempt field adjustment of this valve.

a. Removal. (See fig. 5-11.)

(1) Disconnect power at power source.

(2) Remove top rear cover (para 4-11).

(3) Discharge and purge refrigeration system per paragraphs 5-11 and 5-12.

(4) Unwrap insulation from joints of the expansion valve.

(5) Soften the thermal mastic in bulb well using a cloth wrung out in hot water, a heat lamp, or heat gun if necessary and withdraw the bulb from the well.

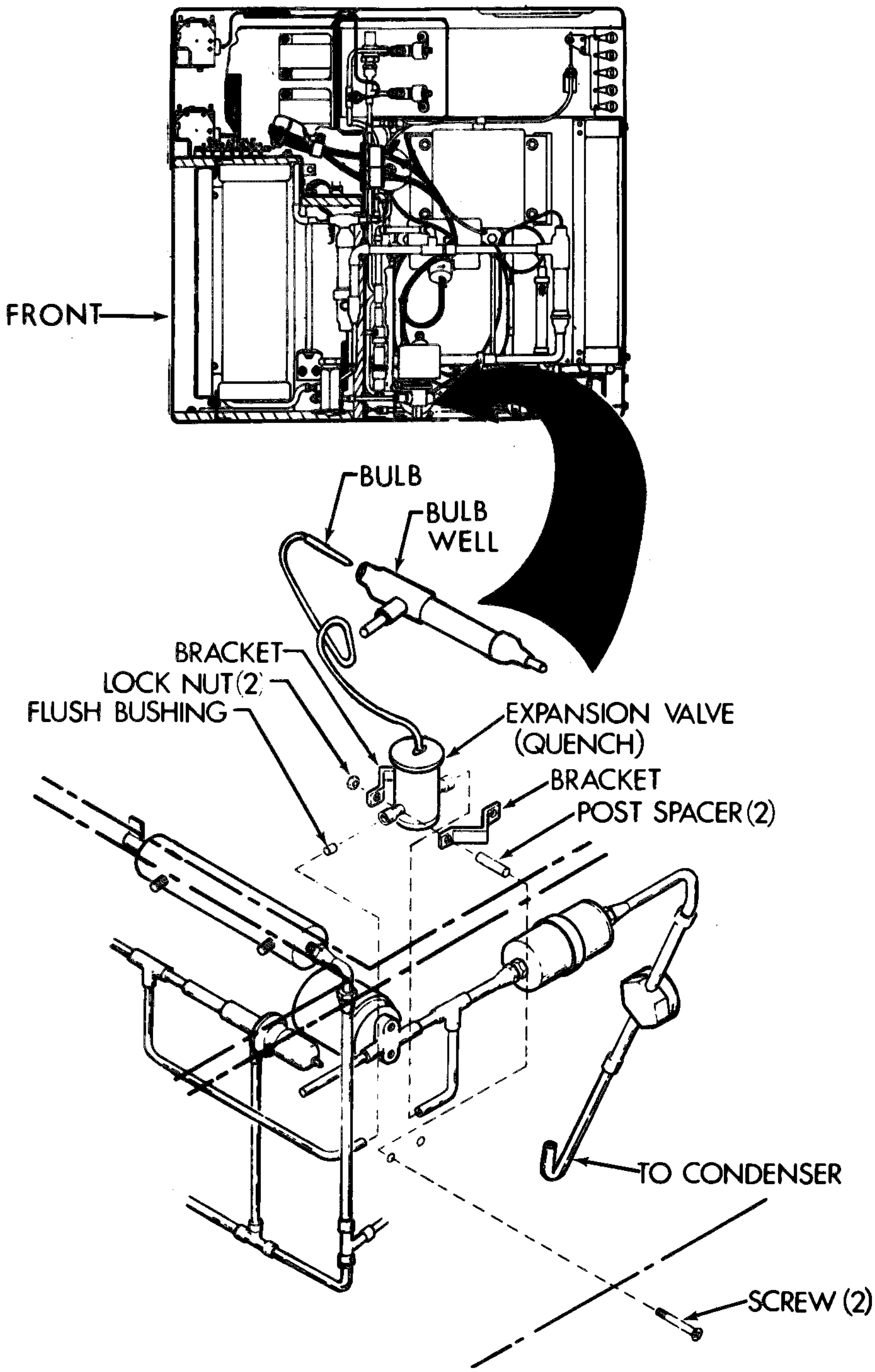


Figure 5-11. Expansion Valve (Quench)

5-22. EXPANSION VALVE (QUENCH).-Continued

(6) Debraze two tube connections to valve. If flush bushing is to be reused, remove it from old valve.

(7) Remove two screws, post spacers, brackets, and lock nuts.

(8) Remove valve from the unit.

b. Replace. If expansion valve is suspected bad replace it.

c. Installation.

(1) Install flush bushing in valve.

(2) Place expansion valve in unit and align tubing ends.

(3) Protect valve from overheating during brazing operations. Direct flame away from valve body and wrap valve body with wet rag.

(4) Braze joints in accordance with paragraph 5-13.

(5) Secure valve to housing with two each screws, post spacers, brackets, and lock nuts.

(6) Replace dehydrator. (See para 5-30.)

(7) Leak test all newly connected joints and all tube connections in the area.

(8) Rewrap insulation at expansion valve joints.

(9) Install sensing bulb in bulb well.

(a) Insert approximately one ounce of thermal mastic in bulb well.

(b) Insert sensing bulb from the expansion valve into bulb well.

(c) Move bulb back and forth to distribute the mastic.

(d) Set bulb about one inch (2.5 cm) beyond open end of bulb well.

(10) Install top rear cover (para 4-11).

(11) Evacuate and charge the refrigeration system in accordance with paragraphs 5-15 and 5-16.

5-23. SOLENOID VALVES.

See paragraph 4-38 for testing and solenoid coil replacement.

a. Removal. (See fig. 5-12.)

(1) Disconnect power at power source.

(2) Remove top rear cover (para 4-11).

NOTE

If only the coil is bad, it can be replaced without breaking into the refrigeration system. (See para 4-38.)

(3) Discharge and purge refrigeration system per paragraphs 5-11 and 5-12.

(4) Disconnect connector plug.

(5) Remove top nut that attaches coil to valve body and remove data plate, coil, and connector assembly.

(6) Cut plastic tie down straps as necessary to remove solenoid valve cable.

(7) If connector plug is to be reused unsolder it from leads.

(8) If grommet is to be reused remove it from old coil assembly.

(9) Be sure that refrigerant has been discharged.

(10) Remove two screws that attach tube and plunger assembly to valve body. Remove tube and plunger assembly, and then all other removable internal components from valve body.

(11) Remove hardware that attaches valve body to the housing.

(12) Debraze joints of refrigerant tubing from valve body (para 5-13) and remove valve body.

b. Replace. If solenoid valve is suspected bad replace it.

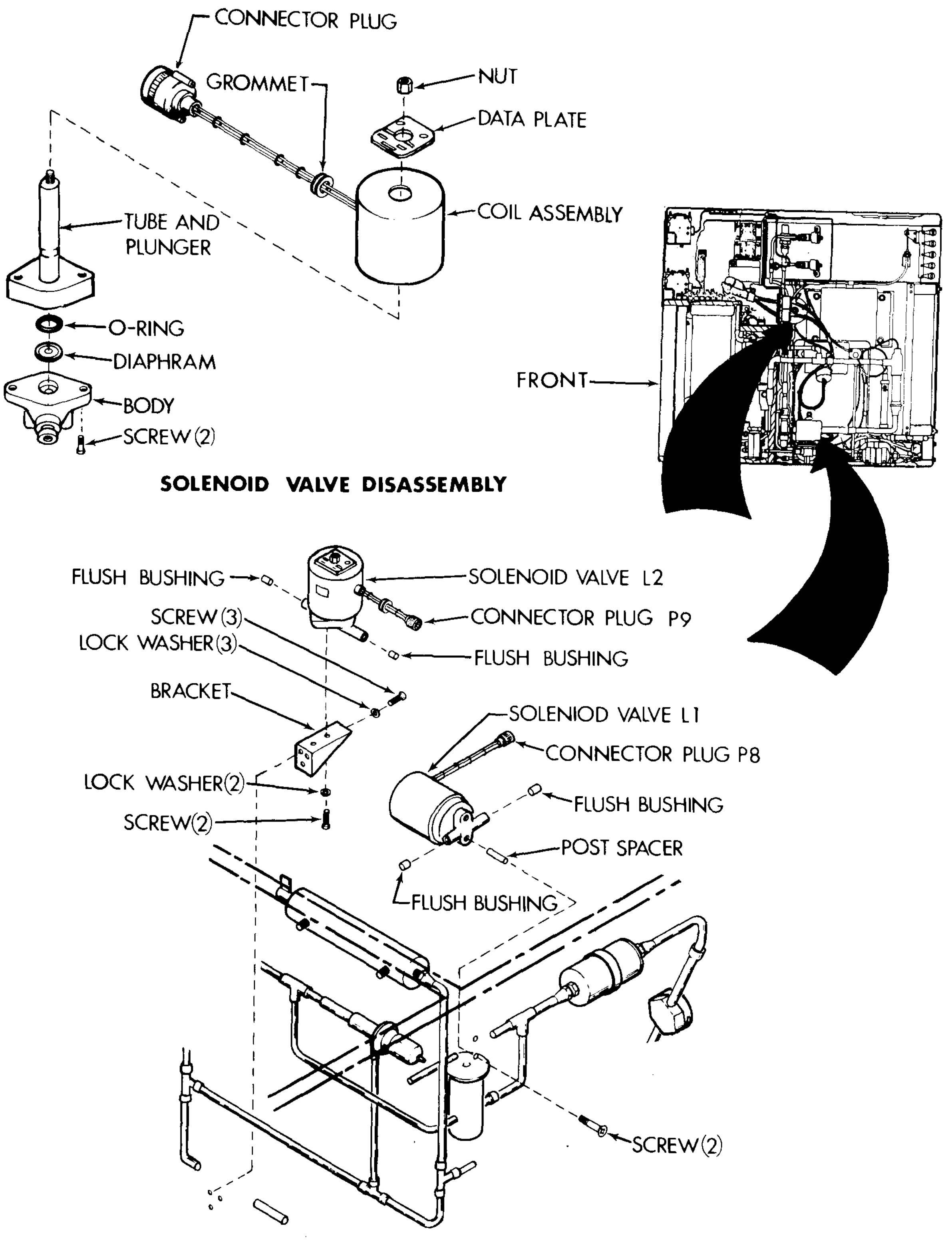


Figure 5-12. Solenoid Valves

5-23. SOLENOID VALVES.-Continued

c. Installation.

(1) Disassemble all removable components from new valve.

(2) Install flush bushings in valve body. Be sure dry nitrogen is flowing through system, then position valve body and braze joints of refrigerant tubing to valve body.

(3) Secure valve body to housing with hardware and brackets shown on figure 5-12.

(4) Reassemble internal components in the valve body and install the tube and plunger assembly, and two attaching screws.

(5) Install coil and connector assembly, data plate, and attaching nut on valve body.

(6) Connect connector plug.

(7) Replace dehydrator. (See para 5-30.)

(8) Leak test all newly connected joints and all tube connections in the area.

(9) Secure wires to existing harnesses with new plastic tie down straps or lacing cord.

(10) Install top rear cover (para 4-11).

(11) Evacuate and charge the refrigerant system in accordance with paragraphs 5-15 and 5-16.

5-24. PRESSURE REGULATOR.

The pressure regulator is located in the rear (compressor/condenser) compartment just below the actuating cylinder. The pressure regulator is factory set at 68 psig and sealed so that it is not field adjustable.

a. Removal. (See fig. 5-13.)

(1) Disconnect power at power source.

(2) Remove top front and rear covers (para 4-11).

(3) Discharge and purge refrigeration system per paragraphs 5-11 and 5-12.

(4) Remove screw, lock washer, clamp, and post spacer.

(5) Debraze two tube connections and remove pressure regulator.

b. Replace. If pressure regulator is suspected bad replace it.

c. Installation.

(1) Slip pressure regulator in place.

(2) Protect pressure regulator from overheating during brazing operations. Direct flame away from valve body and wrap valve body with a wet rag.

(3) Braze two joints in accordance with paragraph 5-13.

(4) Replace dehydrator. (See para 5-30.)

(5) Leak test newly connected joints and all connections in the area.

(6) Secure pressure regulator with a screw, lock washer, clamp and post spacer.

(7) Install top front and rear covers (para 4-11).

(8) Evacuate and charge the refrigeration system in accordance with paragraphs 5-15 and 5-16.

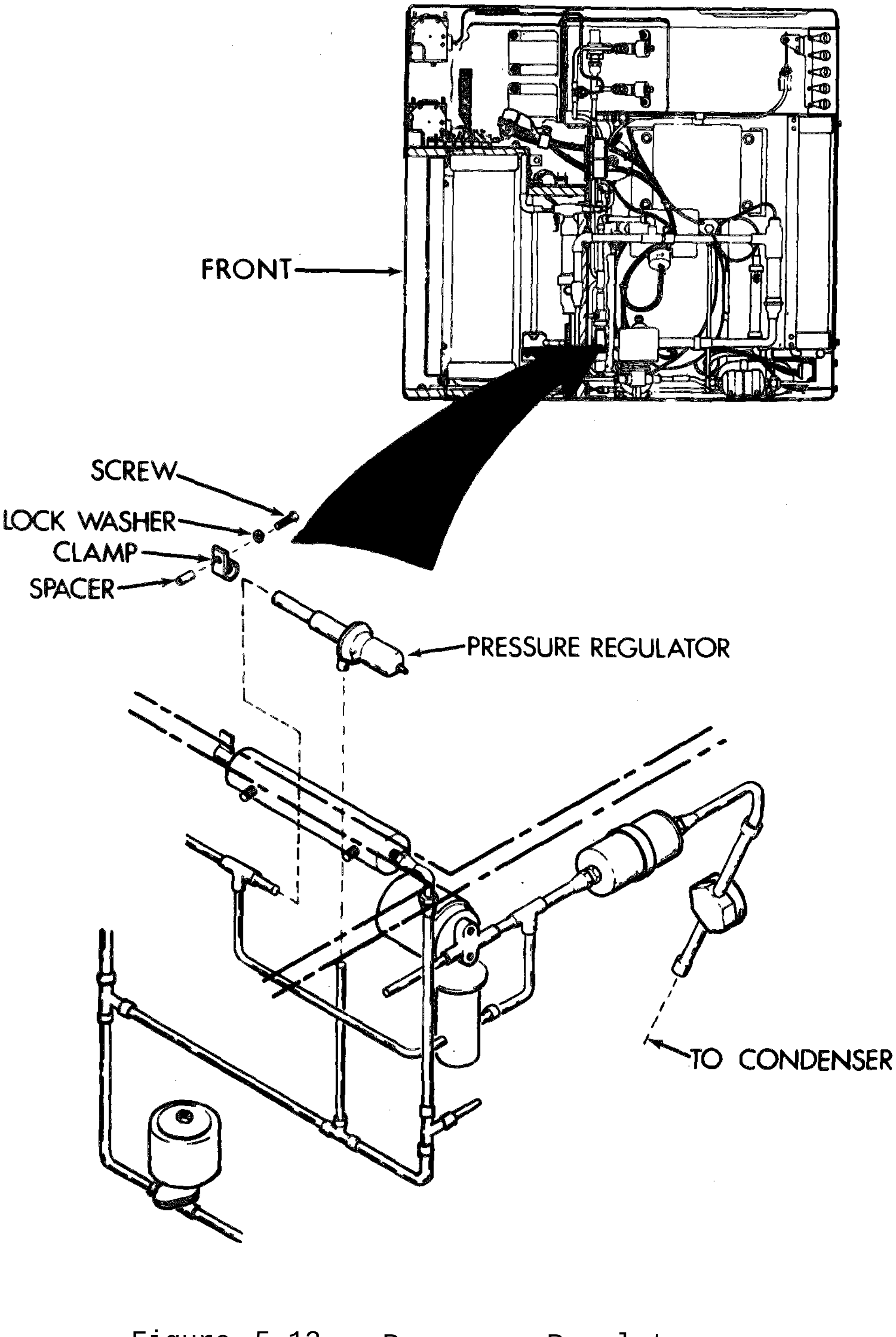


Figure 5-13. Pressure Regulator

5-25. ACTUATING CYLINDER.

The actuating cylinder is located in the rear (compressor/condenser) compartment.

a. Removal. (See fig. 5-14.)

(1) Disconnect power at power source.

(2) Remove top front and rear covers (para 4-11).

(3) Discharge and purge refrigeration system per paragraphs 5-11 and 5-12.

(4) Remove screw from the mechanical post assembly and slip the push-pull cable wire loose. Take care not to lose mechanical post.

(5) Disconnect actuator cylinder from the flare nut on elbow.

(6) Remove two nuts and lock washers and slip actuator cylinder out of the unit.

b. Inspect/Replace. Inspect actuating cylinder for defects and broken or missing parts. Replace if defective.

c. Installation/Adjustment.

(1) Align studs on actuating cylinder with holes in bulkhead and secure with two each lock washers and nuts.

(2) Connect swivel elbow flare nut to actuating cylinder.

(3) Loose assemble control cable and mechanical post.

(4) Close condenser discharge air louvers.

(5) Pull wire from push-pull cable tight and tighten screw in mechanical post assembly.

(6) Replace dehydrator. (See para 5-30.)

(7) Leak test newly connected joints and all connections in the area.

(8) Install top front and rear covers (para 4-11).

(9) Evacuate and charge the refrigeration system in accordance with paragraphs 5-15 and 5-16.

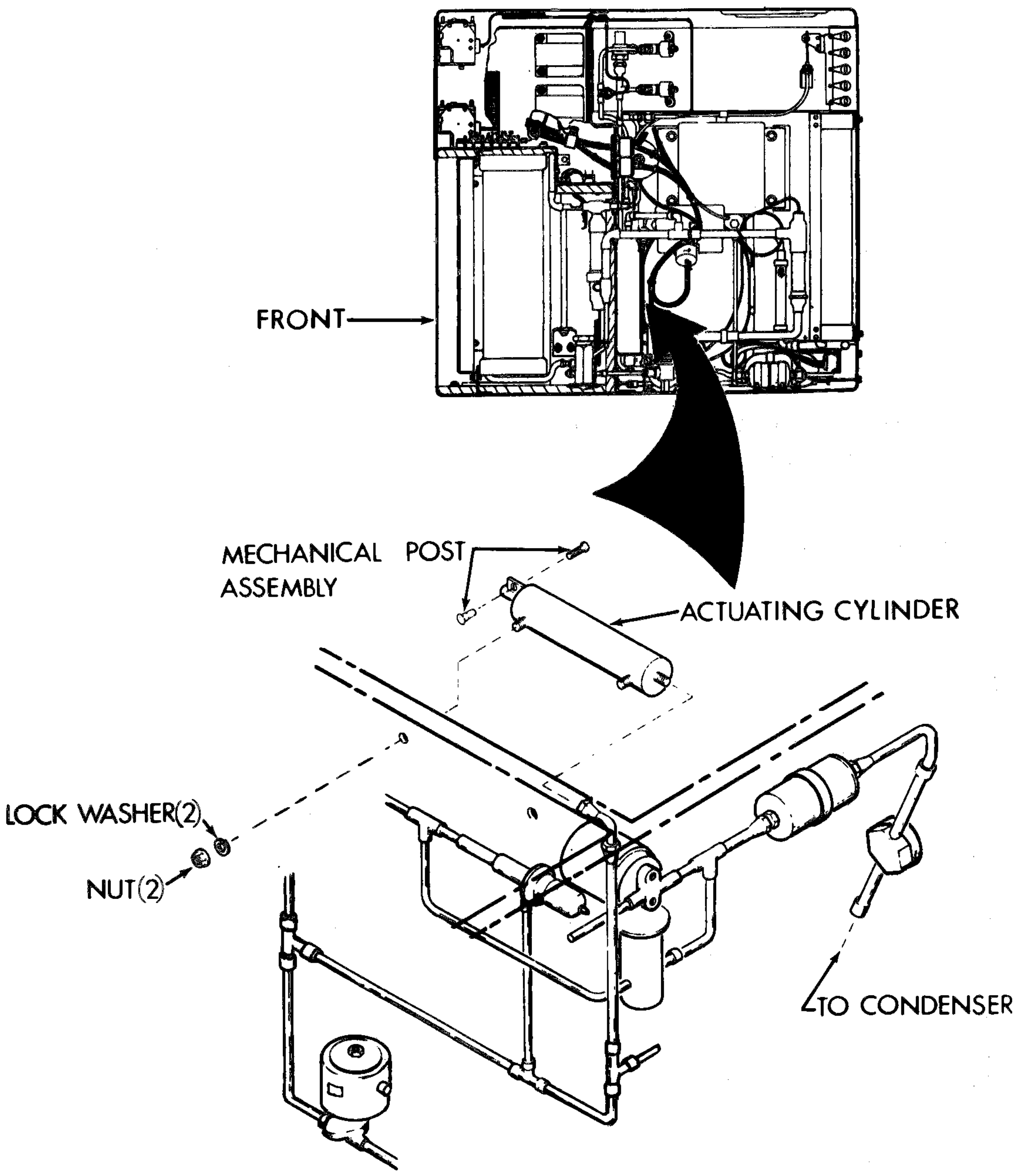


Figure 5-14. Actuating Cylinder

5-26. PRESSURE SWITCHES.

The HIGH PRESSURE switch S4 and LOW PRESSURE switch S5 are located on the front of the unit below the control module and junction box. (See fig. 5-15.)

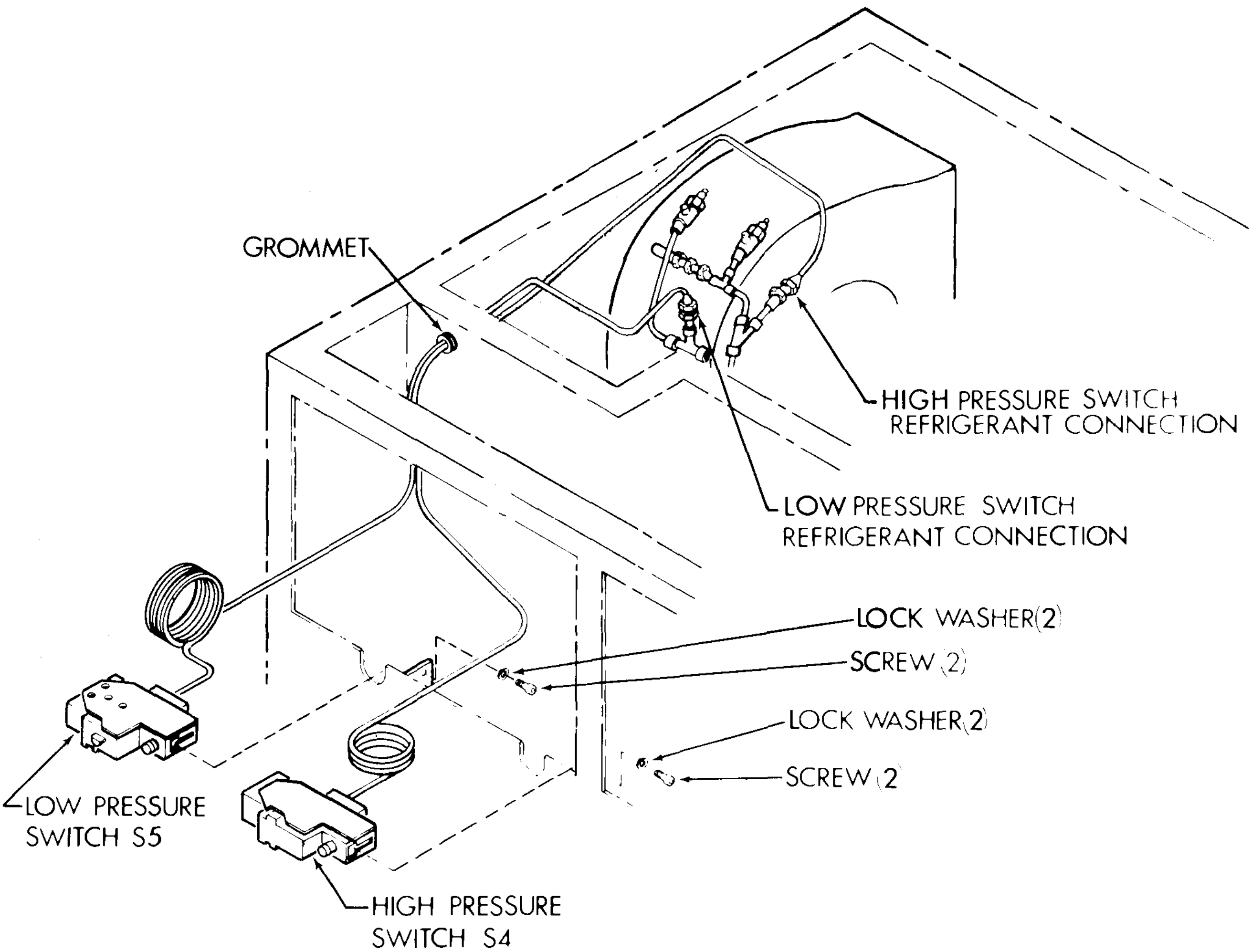


Figure 5-15. Pressure Switches

5-26. PRESSURE SWITCHES.-Continued

a. Inspect.

(1) Disconnect power at power source.

(2) Remove control module and junction box (para 4-21 and 4-26). It is not necessary to totally remove all wire connections and capillary line so long as the junction box can be pulled out enough to gain access to the pressure switches. Support the junction box so that wires and capillary line are not damaged.

(3) Remove front and rear top covers (para 4-11).

(4) Inspect pressure switches for visible signs of damage.

b. Test.

(1) Tag and disconnect wires to pressure switches.

(2) Press reset button on the switch. Use a continuity tester or multimeter to check for continuity between terminals 1 and 2 on each switch. If there is continuity the switch is properly closed. If no continuity is found on either switch, press and release the reset button again on that switch. If there is still no continuity, that switch must be replaced.

c. Removal. Assuming that steps a. (1), (2), and (3) and b. (1) above have been done proceed as follows.

(1) Discharge and purge refrigeration system per paragraphs 5-11 and 5-12.

(2) If HIGH PRESSURE switch is to be replaced, remove conditioned air supply louver (para 4-14) for access to mounting screws.

(3) Disconnect flare nut at end of capillary line from switch to be replaced.

(4) Remove two screws and lock washers from switch to be replaced.

(5) Carefully remove switch and capillary line.

5-26. PRESSURE SWITCHES.-Continued

d. Replace. Replace pressure switch found defective during inspection or test.

e. Installation.

(1) Insert capillary line through grommeted hole in bulkhead.

(2) Connect flare nut.

(3) Secure switch with two screws and lock washers.

(4) Carefully coil capillary line and position so it will not touch junction box when it is reinstalled.

(5) See tags and wiring diagram figure 4-4 and connect wire leads. Remove tags.

(6) Replace dehydrator. (See para 5-30.)

(7) Leak test newly connected joints and all connections in the area.

(8) Install junction box and control module (para 4-21 and 4-26).

(9) Install conditioned air supply louver (para 4-14) if it was removed.

(10) Install top front and rear covers (para 4-11).

(11) Evacuate and charge the refrigeration system in accordance with paragraphs 5-15 and 5-16.

5-27. SERVICE (CHARGING) VALVES.

The service (charging) valves are located in the rear (compressor/condenser) compartment. They are accessible through the top rear cover by removing the refrigerant charging valve access cover.

a. Removal. (See fig. 5-16.)

(1) Disconnect power at power source.

(2) Remove top rear cover (para 4-11).

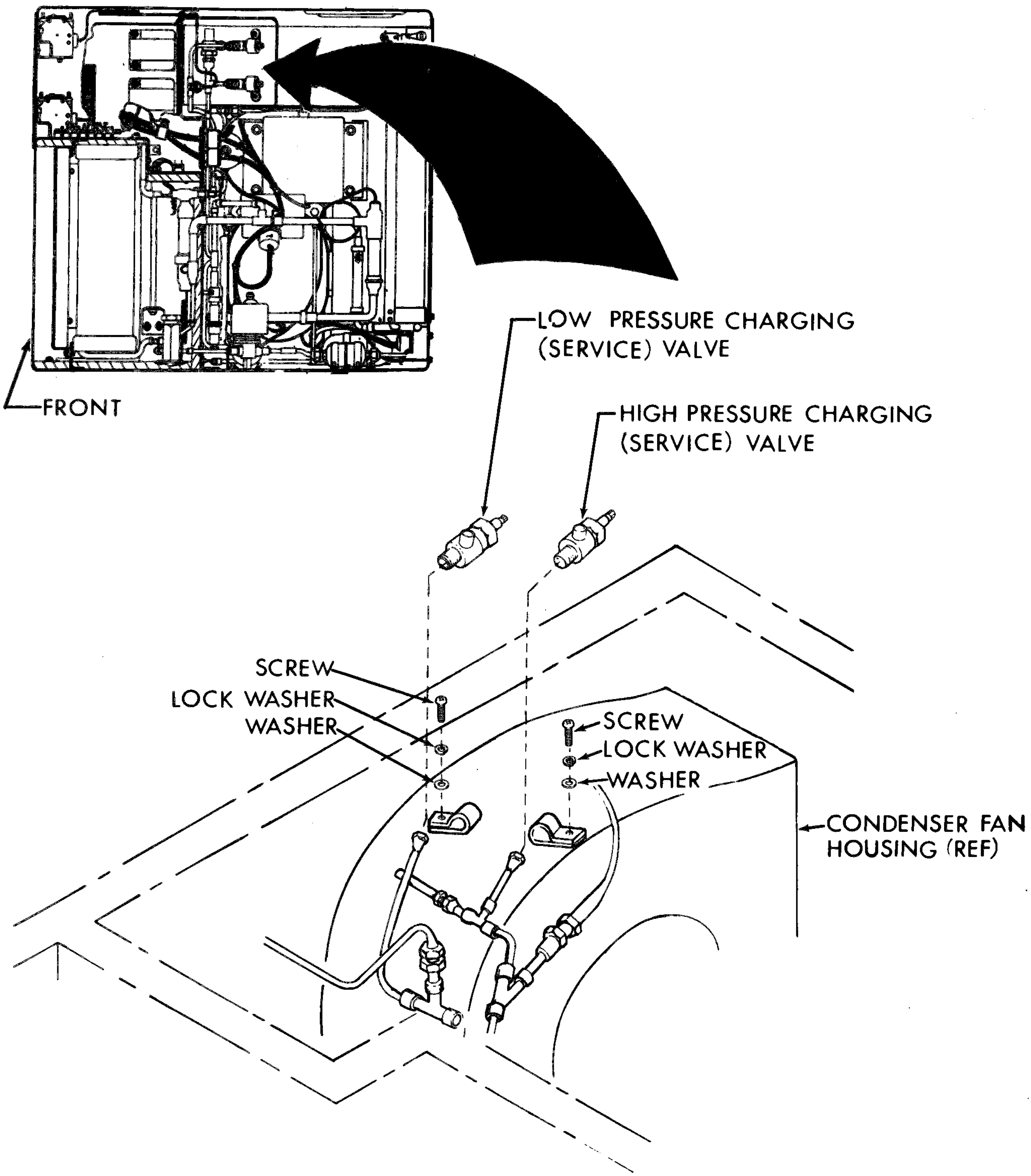


Figure 5-16. Service (Charging) Valves

5-27. SERVICE (CHARGING) VALVES.-Continued

(3) Discharge and purge refrigeration system per paragraphs 5-11 and 5-12.

(4) Remove screw, lock washer, flat washer, and loop clamp from the valve to be replaced.

(5) Disconnect flare nut from valve to be replaced and remove valve from unit.

b. Inspect/Replace. Inspect service valves for damage and replace if suspected bad.

c. Installation.

(1) Slip valve in place and tighten flare nut.

(2) Secure with screw, lock washer, flat washer, and loop clamp.

(3) Replace dehydrator. (See para 5-30.)

(4) Leak test newly connected joints and all connections in the area.

(5) Install top rear cover (para 4-11).

(6) Evacuate and charge the refrigeration system in accordance with paragraphs 5-15 and 5-16.

5-28. PRESSURE RELIEF VALVE.

The pressure relief valve is located in the rear (compressor/ condenser) compartment.

a. Removal. (See fig. 5-17.)

(1) Disconnect power at power source.

(2) Remove top rear cover (para 4-11).

(3) Discharge and purge refrigeration system per paragraphs 5-11 and 5-12.

(4) Remove screw, lock washer, flat washer, and loop clamp.

(5) Use two wrenches, one to hold fitting and the other to remove valve. Unscrew valve and remove it from unit.

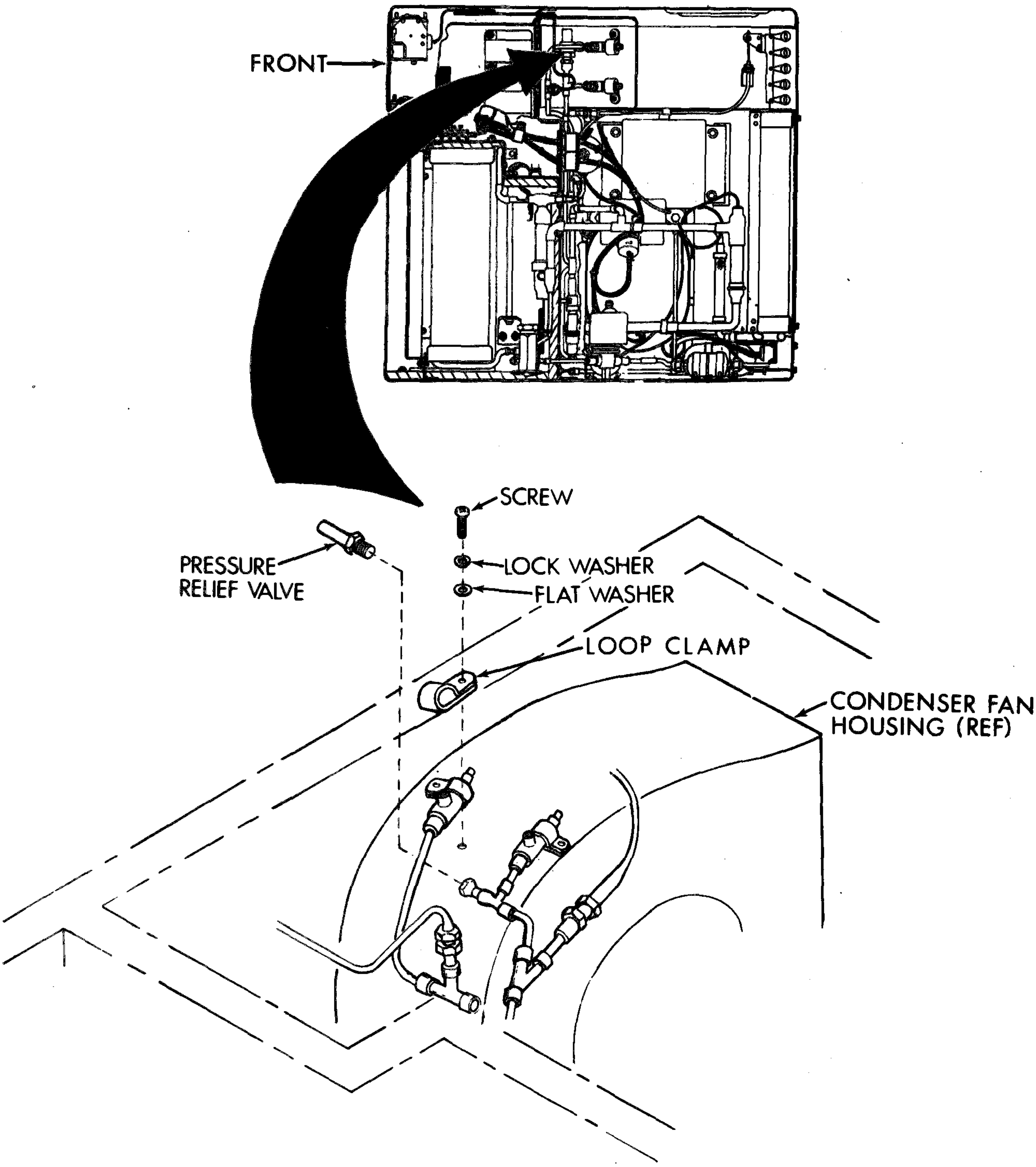


Figure 5-17. Pressure Relief Valve

5-28. PRESSURE RELIEF VALVE.-Continued

b. Inspect/Replace. Inspect pressure relief valve for damage and replace if suspected bad.

c. Installation.

(1) Use two wrenches, one to hold fitting and the other to tighten valve. Screw valve into fitting.

(2) Secure valve with a screw, lock washer, flat washer, and clamp.

(3) Replace dehydrator. (See para 5-30.)

(4) Leak test newly connected joints and all connections in the area.

(5) Install top rear cover (para 4-11).

(6) Evacuate and charge refrigeration system in accordance with paragraphs 5-15 and 5-16.

5-29. CONDENSER COIL.

The condenser coil is located across the rear of the unit. For cleaning instructions see paragraph 4-39.

a. Removal. (See fig. 5-18.)

(1) Disconnect power at power source.

(2) Remove top rear cover (para 4-11).

NOTE

The six screws on the vertical frames of the condenser air inlet guard secure the condenser coil to the air conditioner housing.

(3) Remove condenser air inlet guard.

(4) Discharge and purge refrigeration system per paragraphs 5-11 and 5-12.

(5) See paragraph 5-32 and remove compressor.

(6) Remove auxiliary power input connector J11 from upper rear corner and place cable end out and over side of unit.

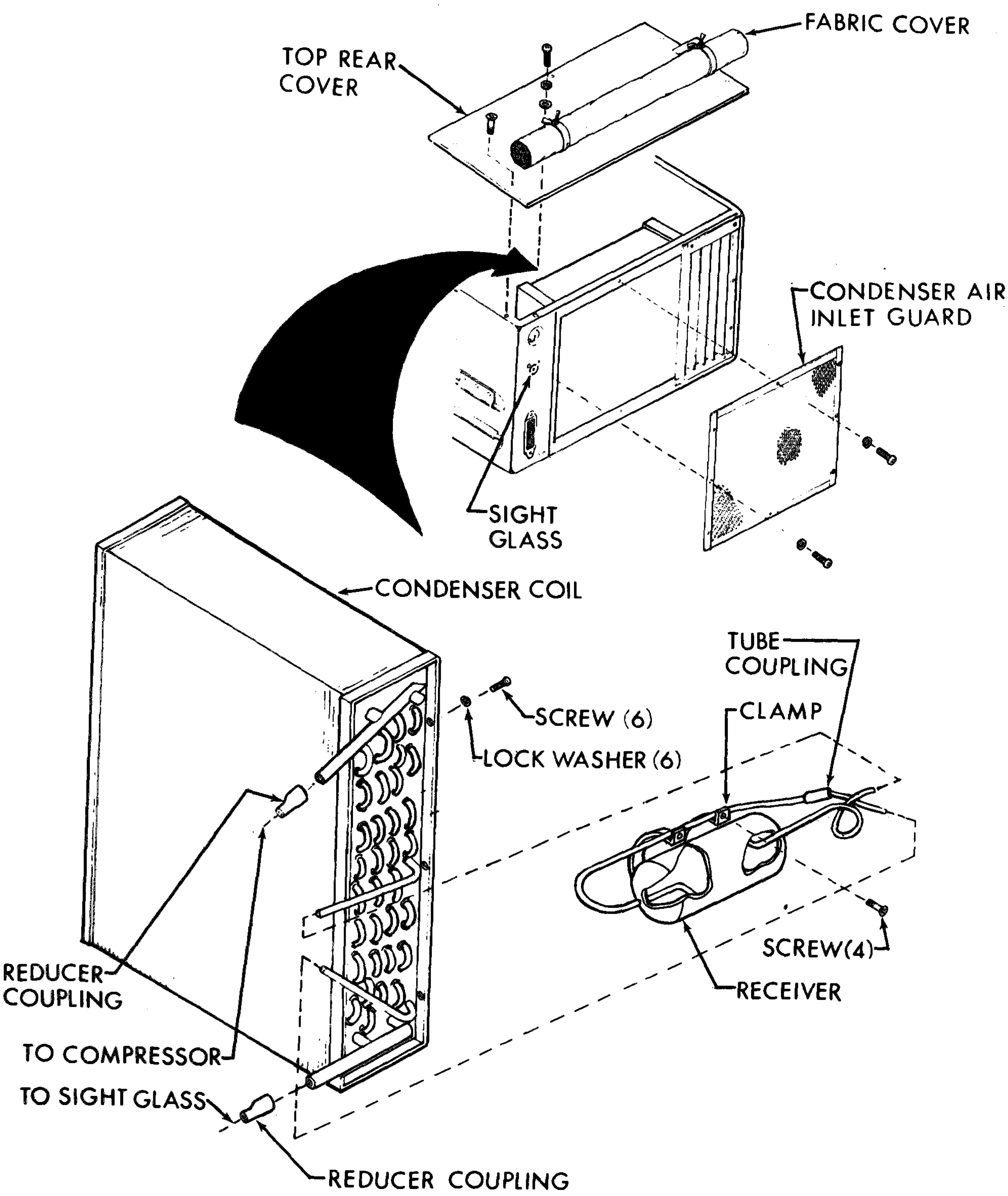


Figure 5-18. Condenser Coil

5-29. CONDENSER COIL.-Continued

(7) Disconnect flare nut nearest the sight glass from dehydrator.

(8) Remove sight glass mounting plate.

(9) Remove clamps from the receiver.

(10) Debraze reducer coupling from lower connection on the coil.

(11) Debraze reducer coupling from upper connection on the coil.

WARNING

When handling coils wear gloves to avoid cuts and reduce fin damage.

(12) Carefully lift condenser coil and receiver up and out of unit.

(13) Place old coil along side of new coil so that the receiver can be debrazed and brazed to the new coil.

b. Replace. If coil is defective replace it.

c. Installation.

(1) Remove (debraze) receiver. Braze receiver to new coil.

WARNING

When handling coils wear gloves to avoid cuts and reduce fin damage.

(2) Carefully place coil into position in unit.

(3) Align holes and secure the coil and condenser air inlet guard with six pan head screws through back of unit housing.

(4) Braze lower and upper reducer couplings with attached hardware to coil.

(5) Replace dehydrator with a new one and connect flare fittings.

(6) Install receiver clamps and sight glass mounting plate.

(7) See paragraph 5-32 and install compressor.

5-29. CONDENSER COIL.-Continued

(8) Install auxiliary power input connector J11.

(9) Leak test newly connected joints and all connections in the area.

(10) Install top rear cover (para 4-11).

(11) Evacuate and charge the refrigeration system in accordance with paragraphs 5-15 and 5-16.

5-30. DEHYDRATOR (FILTER/DRIER).

The dehydrator (filter-drier) is located in the rear (compressor/condenser) compartment. Replace the dehydrator whenever the refrigerant system is opened for any reason.

a. Removal. (See fig. 5-19.)

(1) Disconnect power at power source.

(2) Remove top rear cover (para 4-11).

(3) Discharge and purge refrigeration system per paragraphs 5-11 and 5-12.

(4) Remove screws and mounting clamps.

(5) Disconnect two flare nuts and remove dehydrator from unit.

b. Inspect/Replace. Inspect dehydrator for damage and replace if suspected bad. Always replace dehydrator if refrigeration system is opened for any reason.

c. Installation.

CAUTION

Replacement dehydrators are packaged with sealing caps on the flare fittings to prevent moisture contamination of the desiccant filtering media. Remove these caps immediately prior to installation. Never install a dehydrator from which caps have been removed for an extended or unknown period of time.

(1) Connect flare fittings to each end of dehydrator.

(2) Install mounting clamps.

5-30. DEHYDRATOR (FILTER/DRIER).-Continued

(3) Leak test newly connected joints and all connections in the area.

(4) Install top rear cover (para 4-11).

(5) Evacuate and charge the refrigeration system in accordance with paragraphs 5-15 and 5-16.

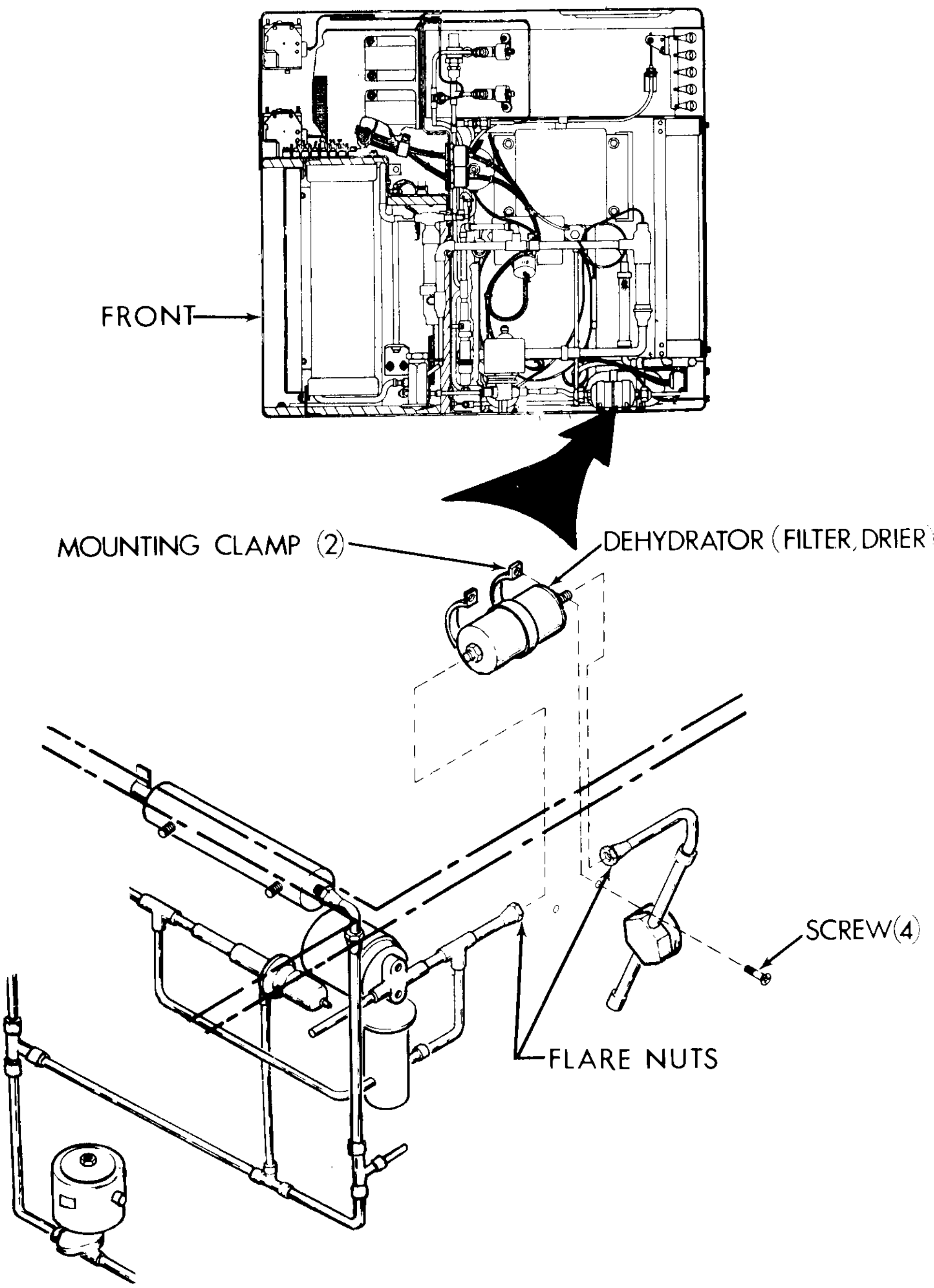


Figure 5-19. Dehydrator (Filter/Drier)

5-31. LIQUID INDICATOR (SIGHT GLASS).

The Liquid Indicator (sight glass) is located in the rear (compressor/condenser) compartment. It can be seen on the left rear outside face of the unit.

a. Removal. (See fig. 5-20.)

(1) Disconnect power at power source.

(2) Remove top rear cover (para 4-11).

(3) Discharge and purge the refrigeration system per paragraphs 5-11 and 5-12.

(4) Remove screws, lock washers, and mounting plate.

(5) Debraze joints and remove liquid indicator.

b. Replace. Replace liquid indicator if suspected bad.

c. Installation.

(1) Place liquid indicator in unit and align tubing ends.

(2) Protect liquid indicator from overheating during brazing operations. Direct flame away from liquid indicator body and wrap liquid indicator body with wet rags.

(3) Braze joints in accordance with paragraph 5-13.

(4) Secure liquid indicator with screws, lock washers, and mounting plate.

(5) Replace dehydrator. (See para 5-30.)

(6) Leak test all newly connected joints and all tube connections in the area.

(7) Install top rear cover (para 4-11).

(8) Evacuate and charge the refrigeration system in accordance with paragraphs 5-15 and 5-16.

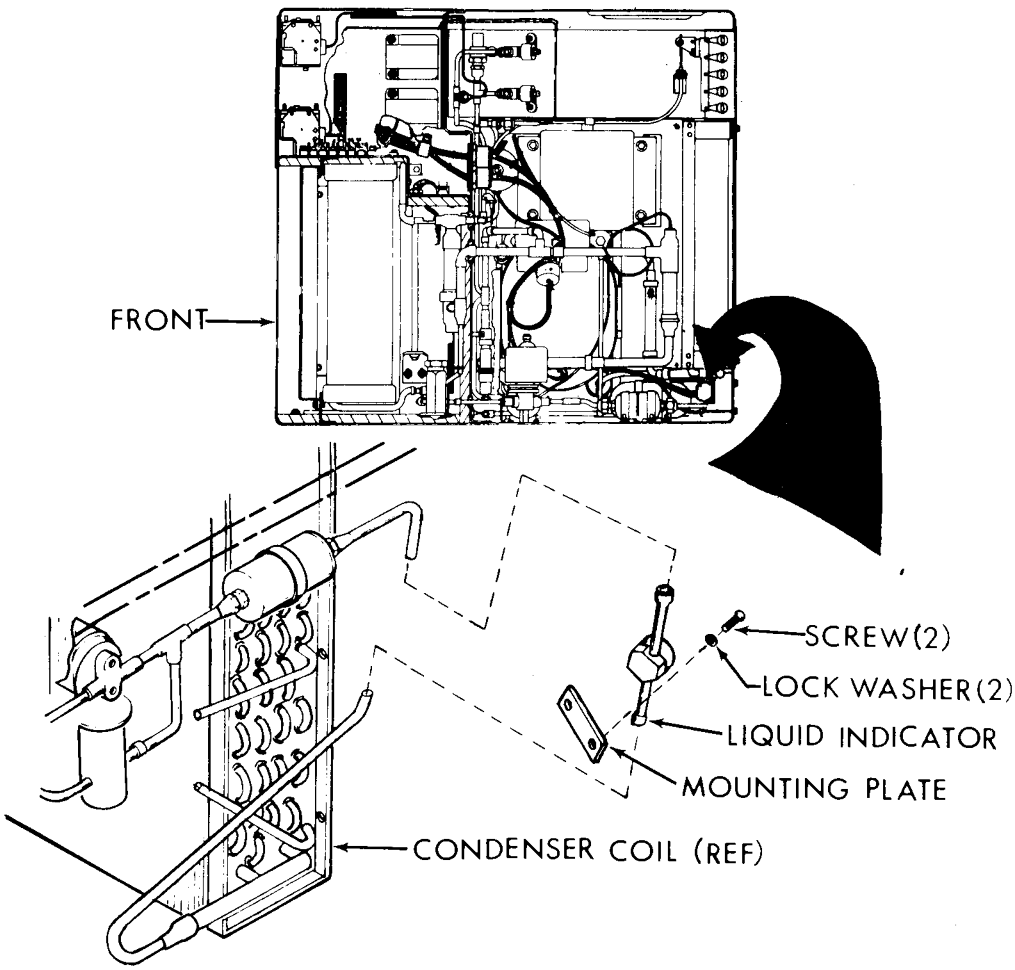


Figure 5-20. Liquid Indicator

5-32. COMPRESSOR.

The compressor and motor assembly are hermetically sealed in a metal canister. The crankcase heater element, related parts, and the electrical connector are attached to the canister externally and may be replaced without opening the refrigeration pressure system. The compressor is located in the rear (compressor/condenser) compartment. (See fig. 5-21.)

WARNING

> Disconnect input power to the air conditioner before performing any maintenance to the electrical system. Voltages used can be lethal. Shutting the unit off at the control module does not disconnect power to the compressor heater.

a. Inspect/Test. Electrically test heater element, wiring harness, and motor as follows:

(1) Disconnect input power at its source.

(2) Remove top rear cover (para 4-11).

(3) Disconnect wiring harness by removing P10 from J10 (located on compressor junction box).

(4) Remove compressor junction box cover.

(5) Inspect internal wiring in compressor junction box to ensure no wires are broken or grounded.

(6) Use a continuity tester or multimeter set on lowest OHMS scale to check for continuity between pins G and F in connector J10. If there is no continuity between these pins, heater is bad and should be replaced.

(7) Check continuity between pins D and E, if there is no continuity between these pins and the compressor has had time to cool down, the compressor motor internal overload switch (S8) is bad, replace compressor.

(8) Check continuity between pins A and B, B and C, and A and C. There should be continuity between each pair of pins. If there is no continuity the compressor motor is bad, replace compressor.

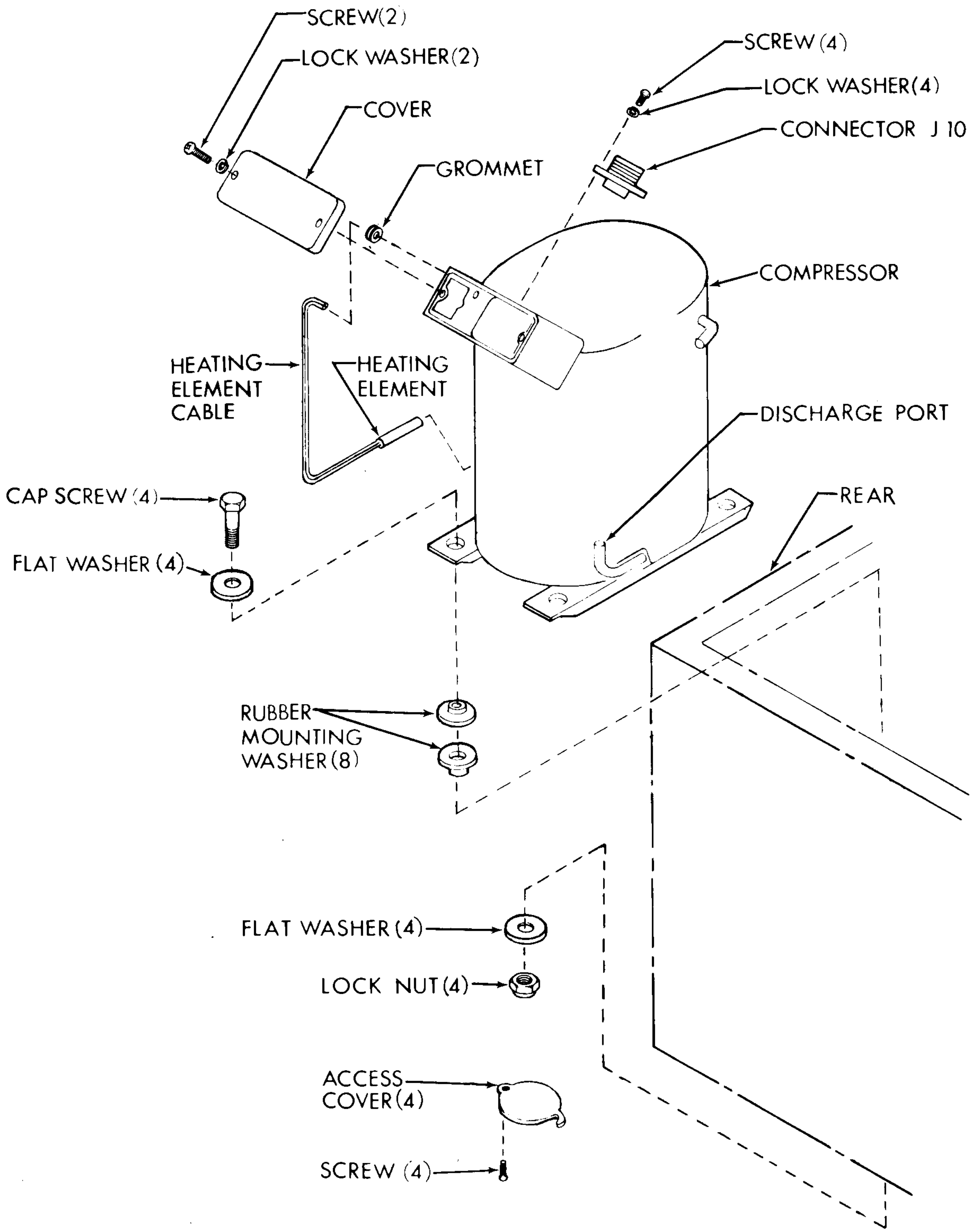


Figure 5-21. Compressor

5-32. COMPRESSOR.-Continued

(9) Check continuity between pins A, B, and C and the compressor body. No continuity should exist. If continuity exists the compressor is bad, replace compressor.

(10) Inspect J10 connector for loose, broken, or otherwise damaged pins or threaded connections. Replace connector if bad.

b. Repair/Replace.

(1) Heater. (Refrigerant system discharge is not required.)

(a) Assuming that power has been disconnected at power source and covers have been removed during access and testing proceed as follows:

(b) Tag and disconnect heater leads from pins F and G of J10. Pull leads out through grommet hole in side of junction box.

(c) Pull heater from mounting tube clip on lower side of compressor.

(d) Place new heater in mounting tube clip.

(e) Run wires through grommet hole in compressor junction box.

(f) See wiring diagram figure 4-4 and tags on removed heater. Connect heater leads to J10 pins F and G.

(2) Connector. (Refrigerant system discharge is not required.)

(a) Assuming that power has been disconnected at power source and covers have been removed during access and testing proceed as follows:

(b) Remove retaining hardware from connector. Pull connector out of junction box to gain access to solder connections.

(c) Tag and unsolder wires.

(d) Using tags and wiring diagram figure 4-4 solder wires to new connector. Remove tags.

5-32. COMPRESSOR.-Continued

(e) Secure connector to compressor junction box with screws and lock washers.

(3) Compressor. (See fig. 5-21.) Two people are required for compressor removal.

(a) Assuming that power has been disconnected at power source and that covers have been removed during access and testing proceed as follows:

(b) Discharge and purge refrigerant system per paragraphs 5-11 and 5-12.

(c) Debraze tube connections to compressor (para 5-13).

(d) Lift or tilt air conditioner to gain access to underside of housing.

(e) Loosen access cover screws and swing the four access covers out of the way.

(f) Remove four sets of compressor attaching hardware.

WARNING

If compressor is being removed due to burnout, use care when lifting to avoid touching compressor sludge. Acid in sludge can cause burns.

(g) Carefully lift compressor from unit.

(h) Check compressor, using the following procedure to see if a motor burnout is indicated.

- After removal of a bad compressor from refrigeration system, remove all external tubing and tip compressor toward discharge port to drain a small quantity of oil into a clear glass container.
- If oil is clean and clear, and does not have a burnt acid smell, the compressor did not fail because of motor burnout. If a burnout is not indicated proceed to c. (Installation).
- If oil is black, contains sludge, and has a burnt acid odor, the compressor failed because of motor burnout.

5-32. COMPRESSOR.-Continued

CAUTION

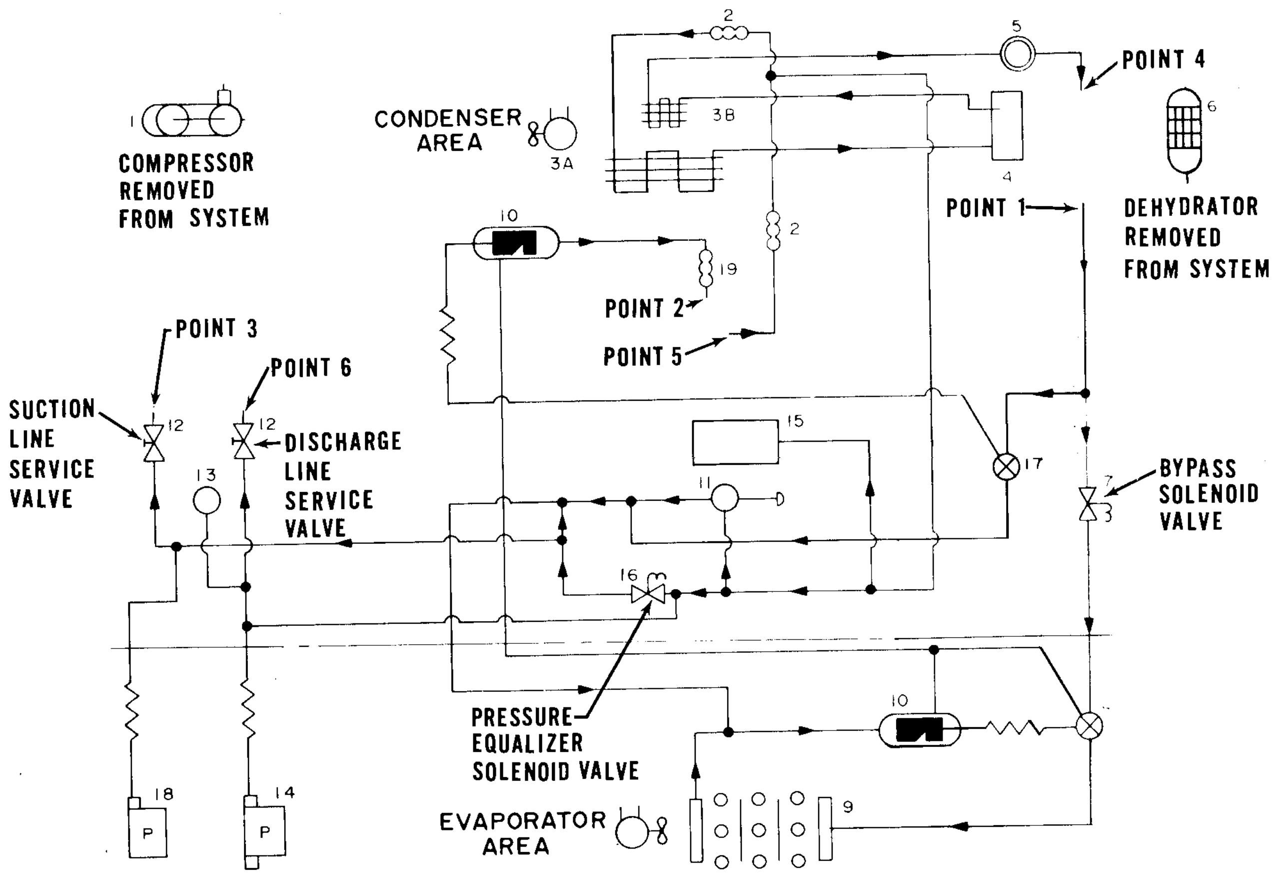
When a hermetic motor burns out, the stator winding decomposes forming carbon, water and acid which contaminates refrigerant systems. These contaminates must be thoroughly removed from the system to prevent repeated motor failures. Motor burn out may also cause damage to the air conditioner electrical system. The following clean up procedures must be followed in any case of compressure motor burnout.

(i) Perform removal procedure (step (3), preceding page).

(j) Remove the dehydrator (para 5-30). Do not replace with a new dehydrator at this time.

(k) Flush the refrigerant system with refrigerant solvent R-114 dichlorotetrafluroethane (National Stock Number 6830-00-782-6512). Flushing should be done under a pressure of 8 to 12 psig (.56 to .84 kg/cm^2), using a pump of approximately 1/3 horsepower. The R-114 may be recirculated if run through a 10 micron filter. Procedures for flushing the system are as follows:

- Refer to figure 5-22 and connect the discharge line of the pump to the tubing at point 1. Connect the recovery line to the tubing at point 2. Leave the suction line service valve (point 3) closed. Cap the tubing at points 4 and 5.
- Start the pump and flush the line for approximately 10 minutes then turn the pump off.
- Remove the recovery line from point 2 and cap the tubing at point 2.
- Connect the recovery line to the valve at point 3 and open the suction line service valve.
- Start the pump and flush the line for approximately 10 minutes, then turn the pump off.
- Disconnect the bypass solenoid valve plug P8 from receptacle J8.



FIND NO.	QTY	NOMENCLATURE
1	1	COMPRESSOR, RECIPROCATING
2	2	HOSE ASSY, METAL
3A	1	COIL, CONDENSER WITH ANGLE
3B	1	SUB COOLER
4	1	RECEIVER, LIQUID REFRIGERANT
5	1	INDICATOR, SIGHT, LIQUID
6	1	DEHYDRATOR, DESICCANT, REFRIGERANT
7	1	SOLENOID VALVE WITH LEADS
8	1	VALVE, EXPANSION (PRIMARY)
9	1	COIL, EVAPORATOR
10	2	BULB WELL
11	1	REGULATOR, FLUID PRESSURE
12	2	VALVE, SERVICE
13	1	VALVE, PRESSURE RELIEF
14	1	SWITCH, PRESSURE (HIGH)
15	1	CYLINDER ASSY ACTUATING, LINEAR
16	1	SOLENOID VALVE WITH LEADS
17	1	VALVE, EXPANSION (QUENCH)
18	1	SWITCH PRESSURE (LOW)
19	1	HOSE ASSY, METAL

Figure 5-22. Refrigerant Flow System with Dehydrator and Compressor Removed

5-32. COMPRESSOR.-Continued

- Energize the bypass solenoid valve by applying 24 volts dc across pins A and B of plug P8.
- Start the pump and flush the line for approximately 10 minutes, then turn the pump off.
- Switch the pump lines so that the discharge line is connected to the valve at point 3 and the recovery line is connected to the tubing at point 1.
- Start the pump and flush the line for approximately 10 minutes, then turn the pump off.
- Close the suction line service valve and move the discharge line from the valve at point 3 to the tubing at point 2.
- Start the pump and flush the line for approximately 10 minutes, then turn the pump off.
- De-energize the bypass solenoid valve by disconnecting the dc voltage source from pins A and B of plug P8.
- Start the pump and flush the line for approximately 10 minutes, then turn the pump off.
- Uncap the tubing at points 4 and 5.
- Disconnect the pump discharge line from the tubing at point 2 and connect it to the tubing at point 5.
- Disconnect the recovery line from the tubing at point 1 and connect it to the tubing at point 4.
- Cap the tubing at points 1 and 2.
- Start the pump and flush the line for approximately 10 minutes, then turn the pump off.
- Move the pump discharge line from the tubing at point 5 to the valve at point 6. Cap the tubing at point 5.
- Open the discharge line service valve.
- Start the pump and flush the line for approximately 10 minutes, then turn the pump off.

5-32. COMPRESSOR.-Continued

- Switch the pump lines so that the discharge line is connected to the tubing at point 4 and the recovery line is connected to the valve at point 6.
- Start the pump and flush the line for approximately 10 minutes, then turn the pump off.
- Remove the cap from the tubing at point 2. Disconnect the pump discharge line from the tubing at point 4 and connect it to the tubing at point 2. Cap the tubing at point 4.
- Disconnect the pressure equalizer solenoid valve plug P9 from receptacle J9.
- Energize the pressure equalizer solenoid valve by applying 24 volts dc across pins A and B of plug P9.
- Start the pump and flush the line for approximately 10 minutes, then turn the pump off.
- Remove the cap from the tubing at point 5.
- Remove the pump discharge line from the tubing at point 2 and connect it the tubing at point 5.
- Remove the recovery line from the valve at point 6 and connect it to the tubing at point 2. Close the valve at point 6.
- Start the pump and flush the line for approximately 10 minutes, then turn the pump off.
- De-energize the pressure equalizer solenoid valve by removing the voltage source from pins A and B of plug P9.
- Disconnect the discharge and recovery lines from the tubing and remove all caps from the tubing.

(1) Refer to figure 5-22 and purge the system with nitrogen at approximately 30 psig (2.11 kg/cm^2) as follows:

- Make sure caps are off the tubing at all points and that the suction and discharge line service valves are open.

5-32. COMPRESSOR.-Continued

- Connect the nitrogen line to the tubing at point 1 and release nitrogen into the system for approximately 5 minutes or until moisture ceases to be discharged from the system.
- Energize the bypass solenoid valve by applying 24 volts dc across pins A and B of plug P8.
- Release nitrogen into the system for approximately 5 minutes or until moisture ceases to be discharged from the system.
- Remove the nitrogen line from the tubing at point 1 and connect it to the tubing at point 2. Release nitrogen into the system for approximately 5 minutes or until moisture ceases to be discharged from the system.
- De-energize the bypass solenoid valve and release nitrogen into the system for approximately 5 minutes or until moisture ceases to be discharged from the system.
- Energize the pressure equalizer solenoid valve by applying 24 volts dc across pins A and B of plug P9.
- Release nitrogen into the system for approximately 5 minutes or until moisture ceases to be discharged from the system.
- Remove the nitrogen line from the tubing at point 2 and connect it to the tubing at point 5. Release nitrogen into the system for approximately 5 minutes or until moisture ceases to be discharged from the system.
- De-energize the pressure equalizer solenoid valve and release nitrogen into the system for approximately 5 minutes or until moisture ceases to be discharged from the system.
- Remove the nitrogen line from the tubing at point 5 and connect it to the tubing at point 4. Release nitrogen into the system for approximately 5 minutes or until moisture ceases to be discharged from the system.

5-32. COMPRESSOR.-Continued

- Remove the nitrogen line from the tubing at point 4 and connect it to the valve at point 6. Release nitrogen into the system for approximately 5 minutes or until moisture ceases to be discharged from the system.
- Remove the nitrogen line from the valve at point 6 and connect it to the valve at point 3. Release nitrogen into the system for approximately 5 minutes or until moisture ceases to be discharged from the system.
- Remove the nitrogen line from the valve at point 3.
- Close the suction line and discharge line service valves.
- Cap all open tubing until installation of new components.
- Replace dehydrator (para 5-30).
- Reconnect plugs P8 and P9 to receptacles J8 and J9 respectively.

c. Installation. (See fig. 5-21.)

CAUTION

The compressor is supplied with a complete charge of oil. Take care that oil is not lost when handling and installing compressor.

(1) Install eight rubber mounting washers in mounting holes of air conditioner housing and compressor mounting feet.

NOTE

If any refrigeration piping was disconnected with the compressor removal, transfer the piping to the replacement compressor before installing it in the air conditioner.

(2) Carefully set compressor down into unit and install four flat washers and cap screws.

(3) Tip unit up slightly and install four flat washers and lock nuts from bottom.

(4) Tighten all four sets of mounting hardware.

5-32. COMPRESSOR.-Continued

(5) Swing four access covers into place and tighten screws.

(6) Braze tube connections in accordance with paragraph 5-13.

(7) Replace dehydrator. (Not necessary if replaced after refrigerant system cleaning and purging.)

(8) Connect P10 connector.

(9) Leak test newly connected joints and all connections in the area.

(10) Install top rear cover (para 4-11).

(11) Evacuate and charge the refrigeration system in accordance with paragraphs 5-15 and 5-16.

5-33. TUBING AND FITTINGS.

The refrigeration system contains a number of pieces of copper tubing in a variety of material grades, sizes, lengths, and shapes, and a number of elbows, tees and adapters in several sizes. Observe the following when replacing any piece of tubing or fitting in the system:

WARNING

> Be sure the refrigeration system is fully discharged and purged, and that dry nitrogen is flowing through the system at a rate of 1-2 cfm (0.028 - 0.057 m^3/minute) before brazing or debrazing.

Test/Replace.

a. Replace tubing and fittings only with equal material, grade, size, length, and shape as the item removed.

b. Leak test the entire refrigeration system in accordance with paragraph 5-14 after any replacement action that required brazing.

c. Replace the dehydrator and leak test the dehydrator flare fittings as the final step in any maintenance action that required the refrigeration pressure system to be opened.

d. Evacuate and charge the refrigeration system in accordance with paragraphs 5-15 and 5-16 after all other maintenance actions are completed.

CHAPTER 6

GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

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

6-1. GENERAL.

Repair parts are listed and illustrated in TM 5-4120-383-24P. No special tools are required for general support maintenance of the air conditioner. Test, maintenance, and diagnostic equipment (TMDE), and support equipment, include standard electrical test equipment, and standard pressure and vacuum gages, vacuum pumps, and servicing manifolds found in any general support maintenance refrigeration shop.

Section II AUTHORIZED GENERAL SUPPORT MAINTENANCE ACTIONS

6-2. GENERAL.

The only items restricted to general support maintenance level by the Maintenance Allocation Chart (MAC) are the repair of replacement of insulation or lifting fittings on the housing, and replacement of the cabinet base. However, general support maintenance may be called upon, at times, to perform any or all of the MAC items listed for organizational and direct support maintenance for rehabilitation or overhaul of an air conditioner.

6-3. HOUSING.

See paragraph 4-41 for inspection and service of the housing.

a. Repair.

(1) Repairs are limited to rework of broken or cracked welds, straightening of bent or dented sheet metal and replacement of handles, gaskets, insulation, and rivnuts and some small sheet metal parts by drilling out rivets and installation of replacement parts.

(2) Disassemble unit as necessary and make repair as indicated.

(3) Gasket and insulation replacement.

(a) Use only gaskets, insulation, or name plates identified in TM 5-4120-383-24P.

NOTE

An initial supply of adhesive is supplied as Item 2, Section II, Expendable Supplies and Materials List. (See Appendix E.)

(b) Remove as much old gasket or insulation material as possible by pulling or scraping it away from the metal surface.

WARNING

Acetone and methyl-ethyl ketone (MEK) are flammable and their vapors can be explosive. Repeated or prolonged skin contact or inhalation of vapors can be toxic. Use a well-ventilated area, wear gloves, and keep away from sparks or flame.

(c) Soften and remove old adhesive and gasket residue, using acetone or methyl-ethyl (MEK) and a stiff brush.

(d) Coat the mating surfaces of the metal and gasket with adhesive. Let both surfaces air dry until the adhesive is tacky but will not stick to fingers.

(e) Starting with an end, carefully attach the gasket to the metal. Press into firm contact all over.

(f) Minor dents and bent edges can be straightened using common sheet metal repair procedures.

(g) Should touch up or refinishing be necessary, see TM 43-0139.

6-3. HOUSING.-Continued

b. Replacement.

(1) Housing replacement requires total unit disassembly. Normally if the unit is damaged to this extent it should be replaced.

(2) If housing replacement is attempted see individual installation instructions of components for reinstallation of items removed.

APPENDIX A

REFERENCES

A-1. SCOPE

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

A-2. FORMS

• Recommended Changes to Publications and Blank Forms	DA 2028
• Hand Receipt	DA 2062
• Equipment Inspection and Maintenance Worksheet	DA 2404
• Quality Deficiency Report	SF 368

A-3. TECHNICAL MANUALS.

• Painting Instructions for Field use	TM 43-0139
• Hand Receipt Manual	TM 5-4120-383-14HR
• Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools List	TM 5-4120-383-24P
• Procedures for Destruction of Equipment to Prevent Enemy Use	TM 750-244-3
• Administrative Storage of Equipment	TM 740-90-1

A-3. TECHNICAL MANUALS.-Continued

• Radio Interference Suppression	TM 11-483
• Leak Detector, Refrigerant Gas	TM 9-4940-435-14

A-4 . SPECIFICATIONS.

• Dry Cleaning Solvent	Fed. Spec. P-D-680

A-5. MISCELLANEOUS PUBLICATIONS.

• Hand Portable Fire Extinguishers Approved for Army Users	TB 5-4200-200-10
• Fuels, Lubricants, Oil, and Waxes	C91001L
• Army Regulations Handbook	AR 310-2
• The Army Maintenance Management System (TAMMS)	DA Pamphlet 738-750
• Electric Motor and Generator Repair	FM 20-31

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 categories.

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 application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance categories.

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

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

B-2. MAINTENANCE FUNCTIONS.

Maintenance functions will be limited to and defined as follows:

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

b. Test. To verify serviceability by measuring the mechanical 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, chemical fluids, or gases.

B-2 MAINTENANCE FUNCTIONS.-Continued

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

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

h. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. “Replace” is authorized by the MAC and is shown as the 3d position code of the SMR code.

i. Repair. The application of maintenance services, including fault location/trouble-shooting , removal/installation, and disassembly/assembly procedures, and maintenance actions to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/actions) prescribed to restore an item to a completely serviceable/ operational condition as prescribed by maintenance standards in appropriate technical publications (i.e., DMWR). 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 equipments/components.

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

a. Column 1, Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components assemblies, subassemblies, and modules with the next higher assembly. End item group number shall be "00."

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 category 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 categories appropriate work time figures will be shown for each category. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. The symbol designations for the various maintenance categories are as follows.

C . . . . Operator or Crew
O . . . . Organizational 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, TMDE, and support equipment required to perform the designated function.

f. Column 6, Remarks. Column 6 contains a note number which shall correspond to the notes contained in Section IV.

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

a. Column 1, Reference Code. The tool and test equipment reference code correlates with a code used in the MAC, Section II, Column 5.

b. Column 2, Maintenance Category. The lowest category of maintenance authorized to use the tool or test equipment.

c. Column 3, Nomenclature. Name or identification of the tool or test equipment.

d. Column 4, National Stock Number. The National stock number of the tool or test equipment.

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

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

a. Column 1, Reference Code. The code scheme recorded in column 6, Section II.

b. Column 2, Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

Section II

MAINTENANCE ALLOCATION CHART

(1) Group No.	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category C	O	F	H	D	(5) Tools & Equip.	(6) Remarks
01	HOUSING COVERS, PANELS, GRILLES, SCREENS AND INFORMATION PLATES								
	Covers	Inspect	0.1						
		Service		0.5					
		Repair			2.0	-can be replaced at org			Note 1
		Replace			1.0				
	Panels	Inspect	0.1						
		Service		0.5					
		Repair			2.0	-at org also			Note 1
		Replace			1.0				
	Screens and Guards	Inspect	0.1						
		Service	0.2			-at org also			Note 2
		Replace			0.5				
	Louvers	Inspect	0.1						
		Adjust	0.1						
		Service		0.1					
		Replace			1.0				
	Information Plates	Inspect	0.1			ok			
		Service	0.1						
		Replace			0.5				
02	AIR CIRCULATING AND CONDENSATE DRAIN SYSTEM								
	Air Filter	Inspect	0.2						
		Service		1.0					
		Replace		0.5					

MAINTENANCE ALLOCATION CHART-Continued

(1) Group No.	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category C	O	F	H	D	(5) Tools & Equip.	(6) Remarks
	Mist Eliminator	Inspect		0.5					
		Service		1.0					
		Replace		0.5					
	Condenser Air Discharge Louver and Linkage	Inspect		0.5					
		Service		1.0					
		Adjust		1.0					
		Replace		2.0					
	Fresh Air Damper and Actuator	Inspect		0.5					
		Service	0.1	0.5					
		Adjust	0.1	0.5					
		Replace		2.0					
Not in MARR or RPSTL	Condensate ~~Traps~~ ~~and~~ Drain Tubes Dele	Inspect	0.1	0.5					
		Service		0.5					
		Replace		1.0					
03	ELECTRICAL								
	Control Module	Inspect.	0.1						Note 3
		Adjust	0.1						
		Repair Test		2.0					Note 4
		Replace		0.5					
	Temperature Control (Thermostat)	Inspect		0.1					
		Adjust	0.1						
		Test		1.0					
		Replace		1.0					
	EVAPORATOR FAN SPEED Switch	Inspect		0.1					
		Adjust	0.1						
		Test Repair		0.5					
		Replace		1.0					
	MODE SELECTOR Switch	Inspect		0.1					
		Adjust	0.1						
		Test		0.5					
		Replace		1.0					

MAINTENANCE ALLOCATION CHART-Continued

(1) Group No.	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category C	O	F	H	D	(5) Tools & Equip.	(6) Remarks
	COMPR (compressor) CIRCUIT BKR (breaker)	Inspect		0.1					
		Test		0.5					
		Replace		1.0					
	Control Module Wiring Harness	Inspect		0.5					
		Test		1.0					
		Repair		1.0					
		Replace		2.0					
	Junction Box	Inspect		1.0					
		Repair		2.0					Note 4
		Replace		2.0					
	Junction Box Wiring Harness	Inspect		0.5					
		Test		1.0					
		Repair		1.0					
		Replace		12.0					
	Relays	Inspect		0.2					
		Test		1.0					
		Replace		1.5					
	Control Circuit Breaker	Inspect		0.1					
		Test		0.5					
		Replace		1.0					
	Unit Wiring Harness	Inspect		1.0					
		Test		2.0					
		Repair		1.0					
		Replace		4.0					
	Capacitor	Inspect		0.1					
		Test		0.2					
		Replace		0.5					
	Rectifier	Inspect		0.1					
		Test		0.5					
		Replace		1.0					

MAINTENANCE ALLOCATION CHART-Continued

(1) Group No.	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category C	O	F	H	D	(5) Tools & Equip.	(6) Remarks
	Transformer	Inspect		0.1					
		Test		0.5					
		Replace		1.0					
04	EVAPORATOR FAN MORTOR AND ~~HEATER~~ HOUSING								
	Fan and Housing	Inspect		0.5					
		Service		1.0					
		Replace		2.0					
	Motor	Inspect		0.5					
		Test		0.5					
		Repair			2.0				Note 5
		Replace		3.0					
	Heater Thermostat	Inspect		0.1					
		Test		1.0					
		Replace		0.5					
	Heater Elements	Inspect		0.1					
		Test		0.5					
		Replace		2.0					
05	CONDENSER FAN, AND MOTOR								
	Fan and Housing	Inspect		0.5					
		Service		0.5					
		Replace		1.0					
	Motor	Inspect		0.5					
		Test		0.5					
		Repair			2.0				Note 5
		Replace		3.0					

MAINTENANCE ALLOCATION CHART-Continued

(1) Group No.	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category C	O	F	H	D	(5) Tools & Equip.	(6) Remarks
06	REFRIGERATION SYSTEM								
	Evaporator Coil	Inspect		0.5					
		Service		1.0					
		Replace			8.0				
	Expansion Valves	Replace			8.0				
	Solenoid Valves	Test		0.5					
		Repair		1.0					Note 6
		Replace			8.0				
	Pressure Regulator	Replace			8.0				
	Actuating Cylinder	Inspect			0.1				
		Adjust			1.0				
		Replace			8.0				
	Pressure Switches	Inspect			0.1				
		Test			0.5				
		Replace			8.0				
	Service Valves	Inspect			0.5				
		Replace			8.0				
	Pressure Relief Valve	Inspect			0.5				
		Replace			8.0				
	Condenser Coil	Inspect		0.5					
		Service		1.0					
		Replace			8.0				
	Dehydrator	Inspect			0.1				
		Replace			8.0				
	Liquid Indicator	Inspect	0.5						
		Replace			8.0				

MAINTENANCE ALLOCATION CHART-Continued

(1) Group No.	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category C	O	F	H	D	(5) Tools & Equip.	(6) Remarks
	Compressor	Test Repair Replace			0.5 1.0 12.0				Note 7
	Tubing and Fittings	Test Replace			0.5 8.0				
07	HOUSING								
	Housing	Inspect Service Repair Replace		0.5 0.5		1.0 24.0			
08	ACCESSORY/LOOSE ITEMS								
	Connectors	Inspect Replace		0.5 2.0					
	Installation Hardware	Inspect Replace		0.5 1.0					

Section III TOOL AND TEST EQUIPMENT REQUIREMENTS

MAINTENANCE ALLOCATION CHART

(1) Tool/Test Equipment Ref Code	(2) Maintenance Category	(3) Nomenclature	(4) National/Nato Stock Number	(5) Tool Number

NOTE

No special tools and test equipment required. Standard tools and test equipment in the following kits are adequate to accomplish the maintenance functions listed in Section II:

(1) Tool/Test Equipment Ref Code	(2) Maintenance Category	(3) Nomenclature	(4) National/Nato Stock Number	(5) Tool Number
1	O-F-H	Tool kit, service, refrigeration Unit (SC 5180-90-CL-N18)	5180-00-597-1474	
2	F-H	Pump, Vacuum	4310-00-289-5967	
3	O-F-H	Soldering Gun Kit	3439-00-930-1638	
4	O-F-H	Brush, Bristle	7520-00-223-8000	
5	O-F-H	Brush, Wire	7920-00-282-9246	
6	O-F-H	Bucket	7240-00-137-1609	
7	O-F-H	Heat Gun	4940-01-042-4855	
8	O-F-H	Multimeter	6625-00-533-0142	
9	O-F-H	Pliers, Long Round Nose	5120-00-268-3579	
10	O-F-H	Rubber Gloves	8415-00-266-8677	
11	O-F-H	Safety Goggles	4240-00-052-3776	
12	O-F-H	Screwdriver, Cross Tip No. 2 One Inch Long Blade	5120-00-227-7293	
13	O-F-H	Screwdriver, Offset, Cross Tip No. 1	5120-00-256-9014	
14	F-H	Recover and Recycling Unit, Refrigerant (07295) 17500B	4130-01-338-2707	

Section IV REMARKS

MAINTENANCE ALLOCATION CHART

Reference Code	Remarks
Note 1	Replace gasket insulation and information plates.
Note 2	Straighten bent blades.
Note 3	External components only (knobs and switches).
Note 4	Replace components.
Note 5	Replace bearings, thermal overloads or connector.
Note 6	Replace solenoid valve coil only.
Note 7	Replace external components only.
	Other than those items listed above there are no supplemental instructions or explanatory remarks required for the maintenance functions listed in Section II. All functions are sufficiently defined in Section I. Active time listed for maintenance task functions are with the air conditioner in off-equipment position.

APPENDIX C

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS

Section I INTRODUCTION

C-1. SCOPE

This appendix lists components of end item and basic issue items for the Air Conditioner to help you inventory items required for safe and efficient operation.

C-2. GENERAL.

The Components of End Item and Basic Issue Items Lists 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 items these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to assist you in identifying the items.

b. Section III. Basic Issue Items. These are minimum essential items required to place the Air Conditioner in operation, to operate it and to perform emergency repairs. Although shipped separately packed, BII must be with the Air Conditioner 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 Table(s) of Organization and Equipment (TOE)/ Modification Table of Organization and Equipment (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 which will be used for requisitioning.

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 FSCM (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. Number	(2) National Stock Number	(3) Description FSCM and Part Number	Usable On Code	(4) U/M	(5) Qty Rqr
4-37		Connector, Receptacle Electrical (97403) 13216E6177		EA	1
4-37		Connector, Plug Electrical (97403) 13216E6209-1		EA	1
4-37		Connector, Plug Electrical (96906) MS3106R18-11S		EA	1
4-38		Screw, Cap, Hex Head (96906) MS90726-64		EA	4
4-38		Washer (97403) 13216E6138-2		EA	4
4-38		Mount Resilient (97403) 13216E6137		EA	8
4-38		Spacer (97403) 13216E6152		EA	4
4-38		Tube Elastomeric (97403) 13216E6153		EA	4

Section III BASIC ISSUE ITEMS

(1) Illus. Number	(2) National Stock Number	(3) Description FSCM and Part Number	(3) Usable On Code	(4) U/M	(5) Qty Rqr
		Department of the Army Technical Manual Operator's, Organizational, Direct Support, and General Support Maintenance Manual TM5-4120-383-14		EA	1
		Department of the Army Technical Manual Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools List TM5-4120-383-24P		EA	1

APPENDIX D

ADDITIONAL AUTHORIZATION LIST

Section I INTRODUCTION

D-1. SCOPE

This appendix lists additional items you are authorized for the support of the air conditioner.

D-2. GENERAL.

This list identifies items that do not have to accompany the air conditioner and that do not have to be turned in with it. These items are authorized to you by CTA, MTOE, TDA, or JTA.

D-3. EXPLANATION OF LISTING.

National stock number, descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment. “USABLE ON” codes are identified as follows: (Not applicable.)

Section II ADDITIONAL AUTHORIZATION LIST

(1) NATIONAL STOCK NUMBER	(2) DESCRIPTION FSCM AND PART NUMBER	USABLE ON CODE	(3) U/M	(4) QTY RQR
7520-00-559-9618	Cotton Duck Case		EA	1
7510-00-889-3494	Log Book Binder		EA	1

APPENDIX E

EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I INTRODUCTION

E-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).

E-2. EXPLANATION OF COLUMNS.

a. Column 1, Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use coater air filter, Item 1, Appendix E").

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

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

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

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

e. Column 5, Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., 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 SUPPLIES AND MATERIALS LIST

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
1	O	4130-00-860-0042	Coater, Air Filter, 1 pint container	ea
2	F	3040-00-664-0439	Adhesive, General Purpose, 1 pint container	ea
3	O	6850-00-264-9037	Dry Cleaning Solvent P-D-680 (81348)	gl
			NOTE Whenever available, use recycled refrigerant for charging the refrigeration system.	
4	F	6850-00-837-9927	Monochlorodifluoromethane, Technical: w/cylinder 22 lb (Refrigerant-22) BB-F- type 22 (81348)	cy
5	F	6830-00-782-6512	Dichlorotetrafluroethane Technical: w/cylinder (Refrigerant- BB-F- Type 114 (81	cy
6	O	3439-01-045-7940	Flux, Solder, Liquid, Rosin Base MIL-F-	qt
7	O		Solder, Lead-Tin, QQ-S-571 Type SN60WRP2	
8	F	6830-00-292-0732	Nitrogen	cy
9	F		Brazing alloy, silver QQ-B-564, grade O, I, or II	oz
10	F		Brazing alloy, silver QQ-B-564, grade III	oz
11	F	3439-00-640-3713	Flux, brazing O-F-499, type B	oz
12	F	5350-00-192-5047	Abrasive cloth	pg
13	F	7920-00-205-1711	Rags	pg
14	O		Silicon Spray, P/N AS (61014)	oz

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GLOSSARY

Section I ABBREVIATIONS

AAL	Additional Authorized List
AWG	American Wire Gauge
BII	Basic Issue Items
BKR	Breaker
BTU	British Thermal Unit
C	Centigrade
CBR	Chemical-Biological-Radiological
cfm	Cubic Feet per Minute
cm	Centimeter
cm^2	Square Centimeter
COEIL	Components of End Item List
COMPR	Compressor
CTA	Common Table of Allowances
EIR	Equipment Improvements Recommendations
F	Fahrenheit
Fig	Figure
FSCM	Federal Supply Code for Manufacturer
HR	Hour
JTA	Joint Table of Allowances
kg	Kilogram
LB	Pounds
LPCO	Low Pressure Cutout Switch
m^3	Cubic Meter
MAC	Maintenance Allocation Chart
MEK	Methyl-Ethyl Ketone
MTOE	Modified Table of Organization and Equipment
NPT	National Taper Pipe (Thread)
NSN	National Stock Number
Para	Paragraph
PMCS	Preventive Maintenance Checks and Services
psig	Pounds per Square Inch Gauge
RPSTL	Repair Parts and Special Tools List
TAMMS	The Army Maintenance Management System
TB	Terminal Board
TDA	Table of Distribution and Allowances
TMDE	Test Measurement and Diagnostic Equipment
TOE	Tables of Organization and Equipment
U/M	Unit of Measure
VDC	Volts Direct Current

Section II DEFINITION OF UNUSUAL TERMS

NONE

ALPHABETICAL INDEX

ALPHABETICAL INDEX - Continued

ALPHABETICAL INDEX - Continued

ALPHABETICAL INDEX - Continued

ALPHABETICAL INDEX - Continued

ALPHABETICAL INDEX - Continued

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Chief of Staff

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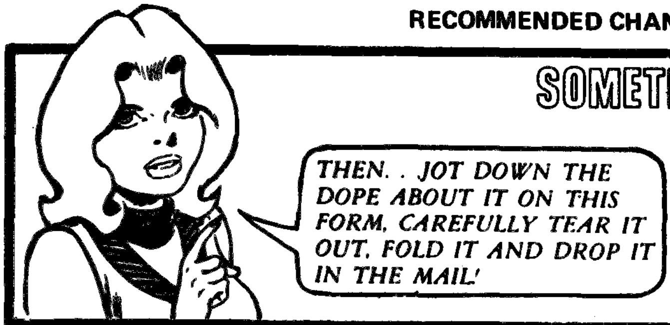

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COA, 3d ENGINEER BN
FT. LEONARDWOOD, MO 63108

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM5-4120-383-14	9 May 85	Air Conditioner Horizontal Compact 9,000 BTU/HR

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:
6	2-1 a			In line 6 of paragraph 2-1a the manual states the engine has 6 cylinders. The engine on my set only has 4 cylinders. Change the manual to show 4 cylinders.
81		4-3		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.
125	line 20			I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gasket but it doesn't fit. Supply says I got what I ordered, so the NSN is wrong. Please give me a good NSN

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

SIGN HERE: John Doe
JOHN DOE

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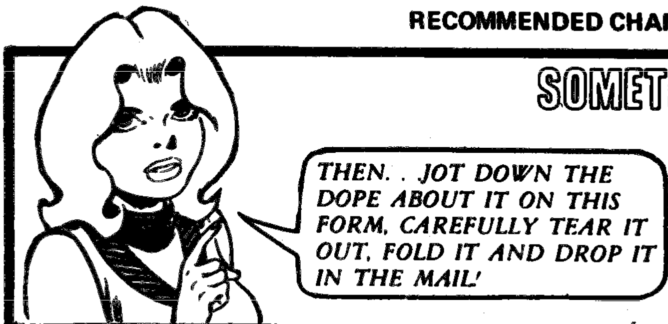

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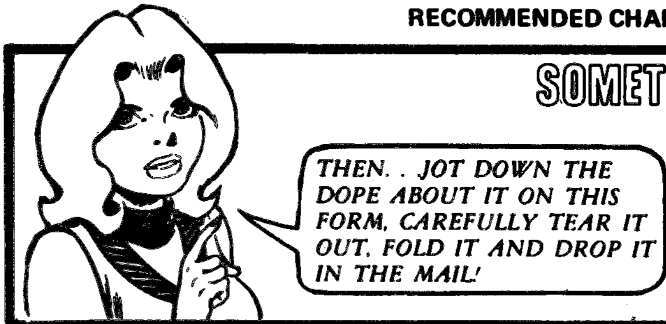

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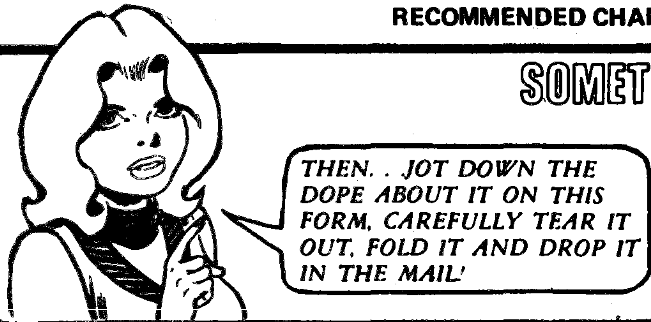

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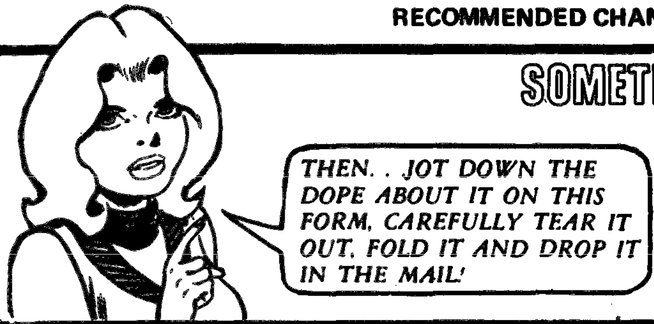

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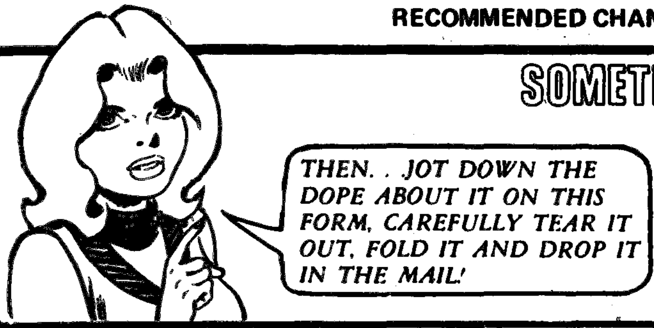

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The Metric System and Equivalents

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