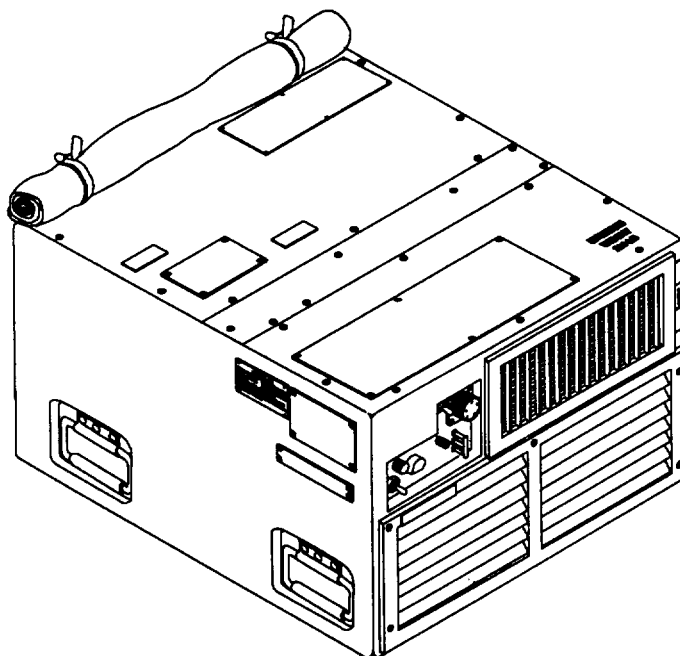


TECHNICAL MANUAL

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



AIR CONDITIONER HORIZONTAL COMPACT  
9,000 BTU/HR

MODEL F9000H-1SA  
115 VOLT, SINGLE PHASE, 50/60HERTZ  
(4120-01-326-4370)  
AND  
MODEL F9000H-3SA  
208 VOLT, 3 PHASE, 50/60 HERTZ  
(4120-01-330-6542)

OPERATING INSTRUCTIONS

OPERATOR PMCS

OPERATOR  
TROUBLESHOOTING

UNIT  
MAINTENANCE INSTRUCTIONS

UNIT PMCS

UNIT TROUBLESHOOTING

DIRECT SUPPORT  
MAINTENANCE INSTRUCTIONS

GENERAL SUPPORT  
MAINTENANCE INSTRUCTIONS

Approved for public release; distribution is unlimited.

**WARNING****DEATH**

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

To prevent shock hazard, connect a 10 AWG (minimum) ground wire to the air conditioner external ground. Make sure that shelter is properly grounded.

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

Ground capacitors before touching. High voltages can be stored in a charged capacitor.

**WARNING**

Compressed air used for cleaning purposes will not exceed 30 psi (2.1 kg/cm<sup>2</sup>) to avoid injury to personnel.

Do not use steam to clean coils. Refrigerant lines could rupture causing personal injury.

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

**WARNING**

Dry cleaning solvent used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Use in well ventilated area.

Adhesive remover is flammable and the 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.

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

Never use a heating torch on any part that contains refrigerant 22. All refrigerant 22 must be discharged from the system and the entire system must be purged with dry nitrogen before beginning any debrazing operation.

Use great care to avoid contact with liquid refrigerant or inhaling 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 surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas.

Never pressurize refrigerant lines with oxygen, mixture with oil will cause an explosion.

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.

TECHNICAL MANUAL

TM9-4120-400-14

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

**OPERATOR'S, UNIT, DIRECT SUPPORT,  
AND GENERAL SUPPORT MAINTENANCE MANUAL  
FOR  
AIR CONDITIONER, HORIZONTAL, COMPACT,  
9,000 BTU/HR, MODEL F9000H-1SA  
115 VOLTS, SINGLE PHASE, 50/60 HERTZ  
(4120-01-326-4370)  
AND  
MODEL F9000H-3SA,  
208 VOLTS, 3 PHASE, 50/60 HERTZ  
(4120-01-330-6542)**

**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 procedures, 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-MMTS, 4300 Goodfellow Boulevard, St. Louis, Missouri 63120-1798. A reply will be furnished to you.

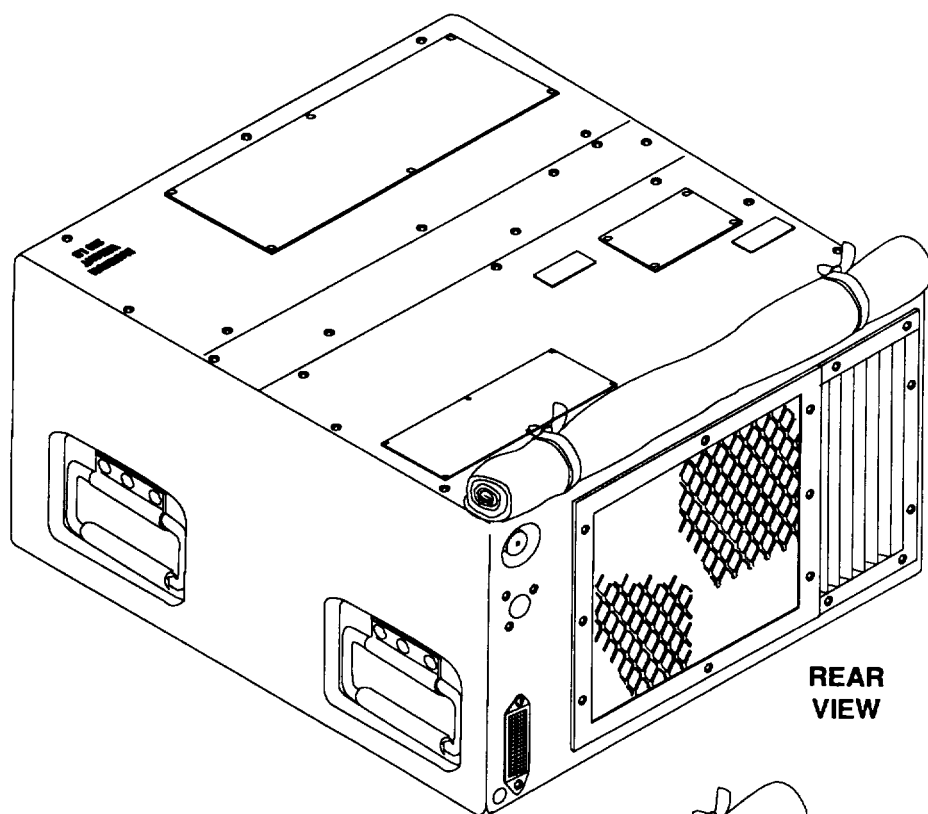
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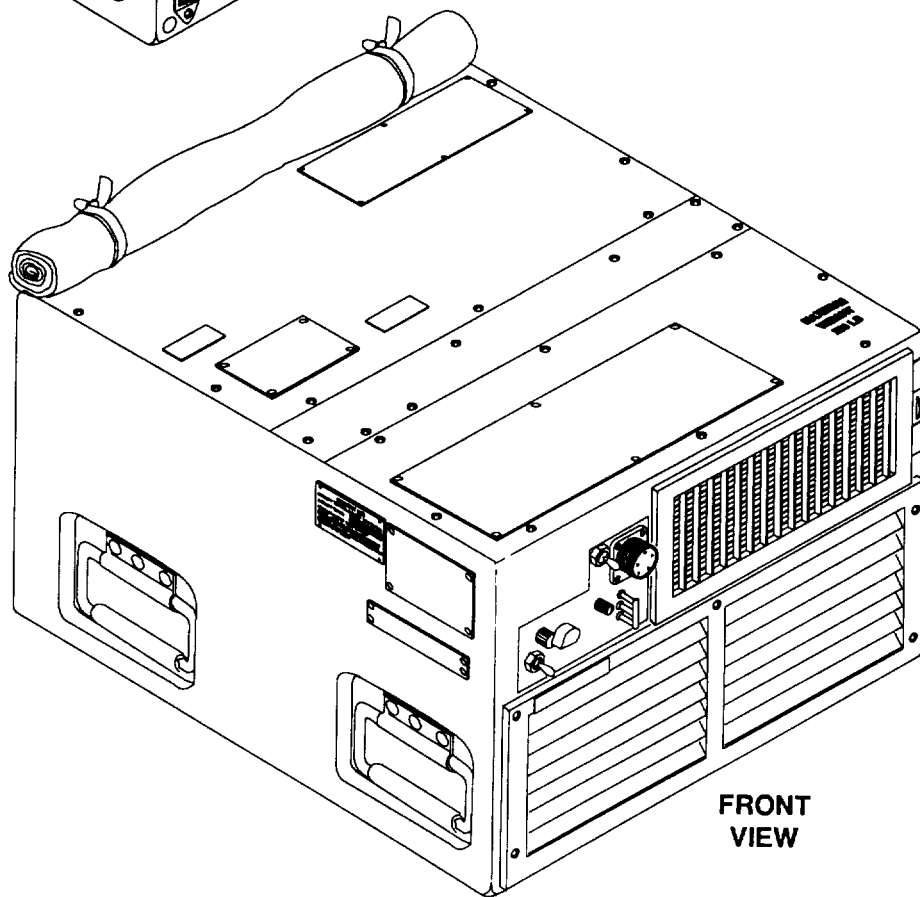
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REAR  
VIEW



FRONT  
VIEW

Figure 1-1. Air Conditioner

# CHAPTER 1

## INTRODUCTION

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### Section I GENERAL INFORMATION

#### 1-1. SCOPE.

- a. Type of Manual. Operator's, Unit, Direct Support, and General Support Maintenance Manual.
- b. Model and Equipment Name. Keco Model F9000H-3SA, Horizontal, Compact, 9,000 BTU/HR, 208 Volt, 3 Phase, 50/60 Hertz, Air Conditioner and Keco Model F9000H-1SA, Horizontal Compact 9,000 BTU/HR, 115 Volt, Single Phase, 50/60 Hertz, Air Conditioner.
- c. Purpose of Equipment. Cools and heats enclosed space (shelter). The units covered by this manual are 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. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE.

For destruction of Army materiel to prevent enemy use see TM 750-244-3.

#### 1-4. PREPARATION FOR STORAGE OR SHIPMENT.

See Chapter 4, Section VII for administrative storage or shipment information.

#### **1-5. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR's).**

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-QX  
4300 Goodfellow Boulevard  
St. Louis, Missouri 63120-1798.

We will send you a reply.

#### **1-6. WARRANTY.**

See Warranty Technical Bulletin TB9-4120-400-24 for details and procedures of warranty program for equipment covered by this manual.

### **Section II EQUIPMENT DESCRIPTION**

#### **1-7. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.**

a. The Model F9000H-3SA and Model F9000H-1SA Air Conditioners are designed to circulate, filter, and cool or heat air in the room or enclosure in which they are installed.

b. The Model F9000H-3SA and F9000H-1SA have the capability of providing a maximum of 10,000 BTU/HR of cooling or 7,000 BTU/HR of heating. They are 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 hertz input power for the F9000H-3SA, and a source of 115 volt ac, single phase, 50/60 hertz power for the F9000H-1SA, 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 arctic 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, "Unit 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.

#### **1-8. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.**

See figure 1-2.

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.

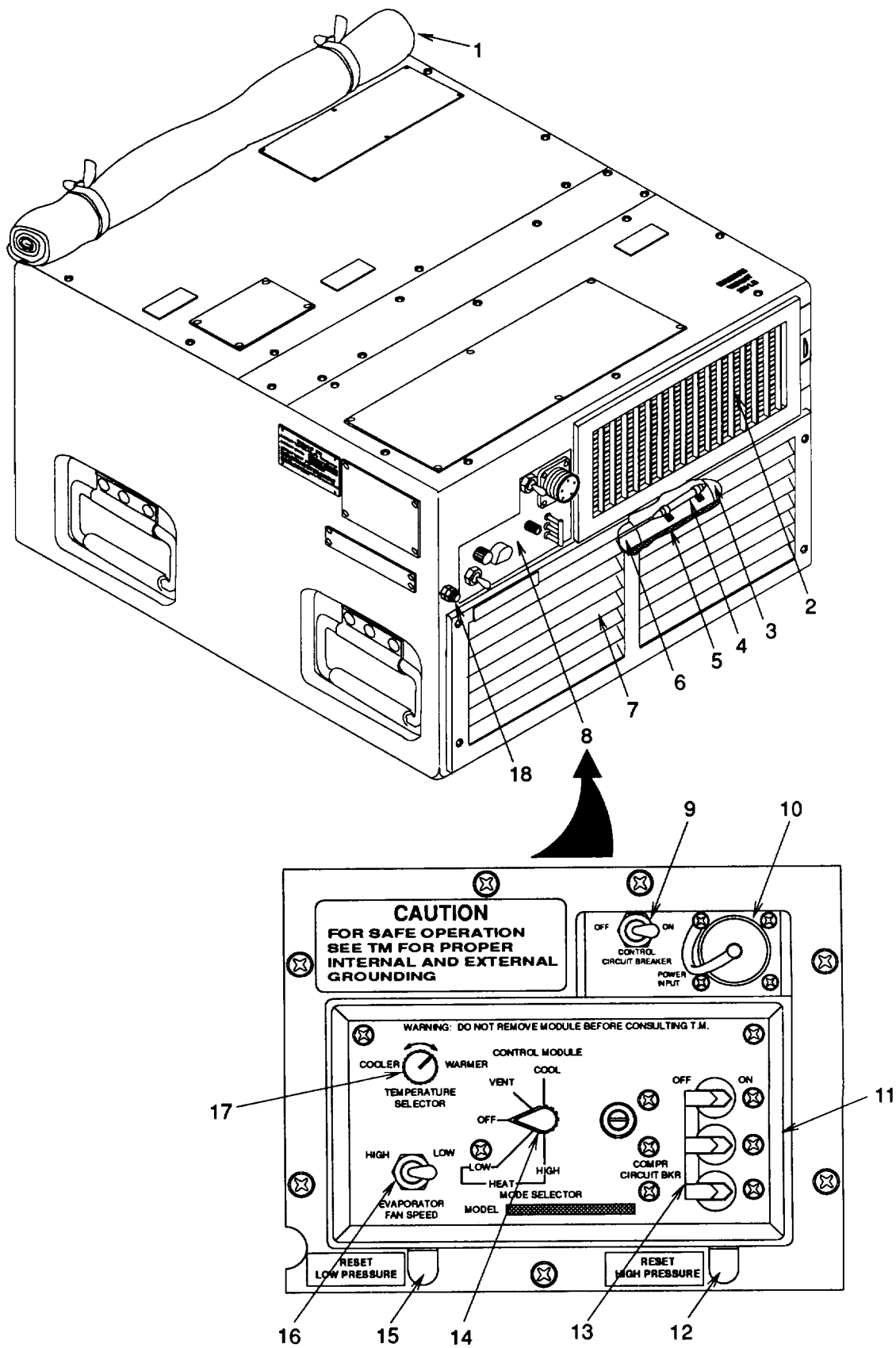


Figure 1-2. Location of Major Components (Sheet 1 of 2)



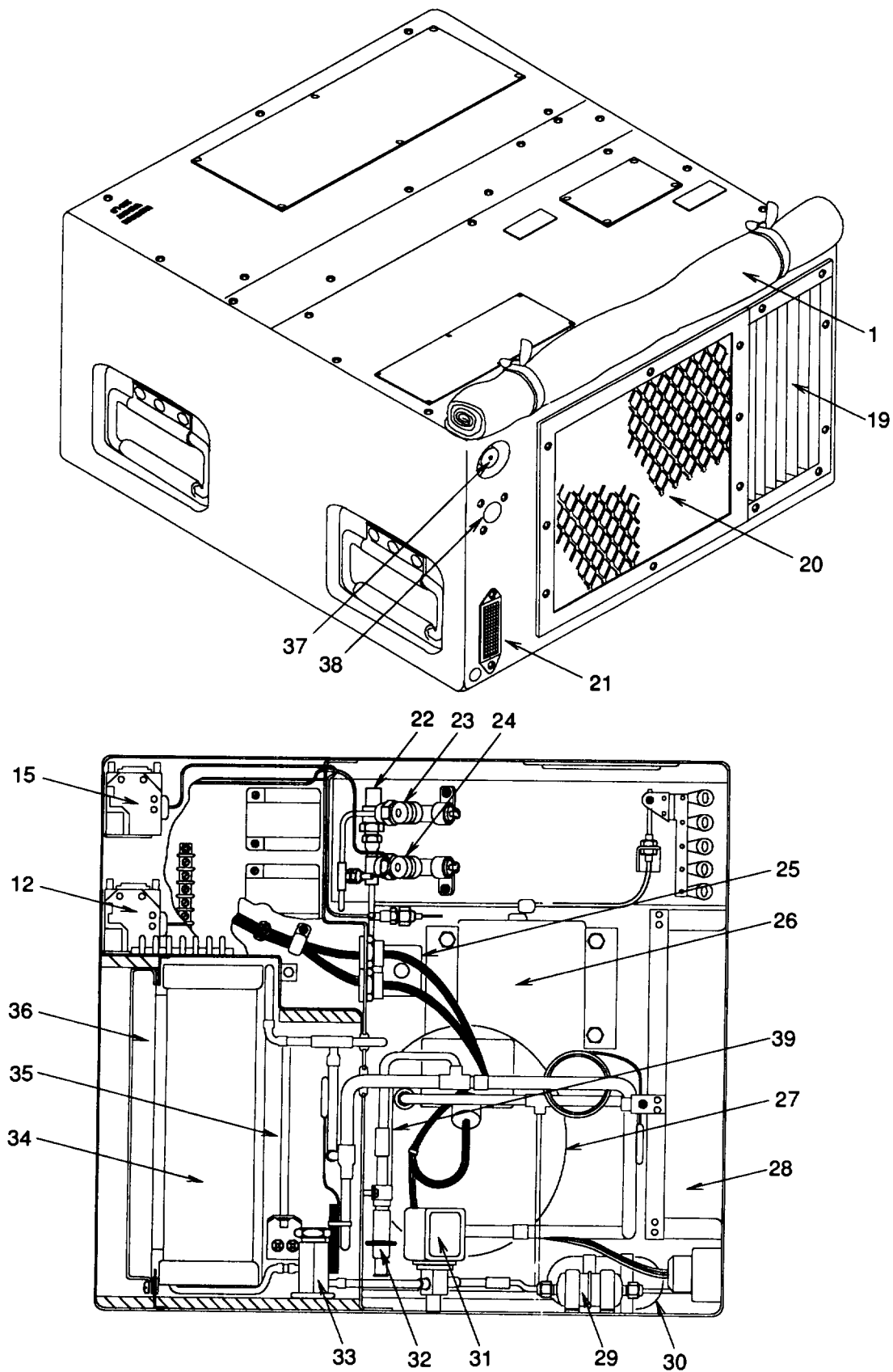


Figure 1-2. Location of Major Components (Sheet 2 of 2)

**1-8. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - continued**

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.

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 CUTOFF SWITCH. This switch is factory set to shut the compressor off if the refrigerant discharge line pressure rises to 470 to 490 psig (33.04 to 34.45 kg/cm<sup>2</sup>).

**NOTE**

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

13 COMPRESSOR CIRCUIT BREAKER (Compressor Circuit Breaker). Protects the compressor.

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

15 LOW REFRIGERANT PRESSURE CUTOFF 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<sup>2</sup>). This switch must be hand reset after the pressure rises above 40 psig (2.812 kg/cm<sup>2</sup>).

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.

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

**1-8. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS. - continued**

**NOTE**

The air conditioner can be equipped for operation in nuclear-biological-chemical (NBC) 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<sup>2</sup>).

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.

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.

**1.8. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS. - continued**

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<sup>2</sup>) and fully open louver assembly at 220 to 260 psig (15.74 to 18.28 kg/cm<sup>2</sup>) compressor discharge pressure to allow unit operation when outside temperature is low.

**1-9. DIFFERENCES BETWEEN MODELS**

The basic difference between the Model F9000H-3SA and the Model F9000H-1SA air conditioners is the source of power. The F9000H-3SA uses 208 volt, 3 phase, 50/60 hertz power and the F9000H-1SA uses 115 volt, single phase, 50/60 hertz power. The operator needs to ensure that the correct power cable and correct power source is used for each of the two types of unit.

**1-10. EQUIPMENT DATA.**

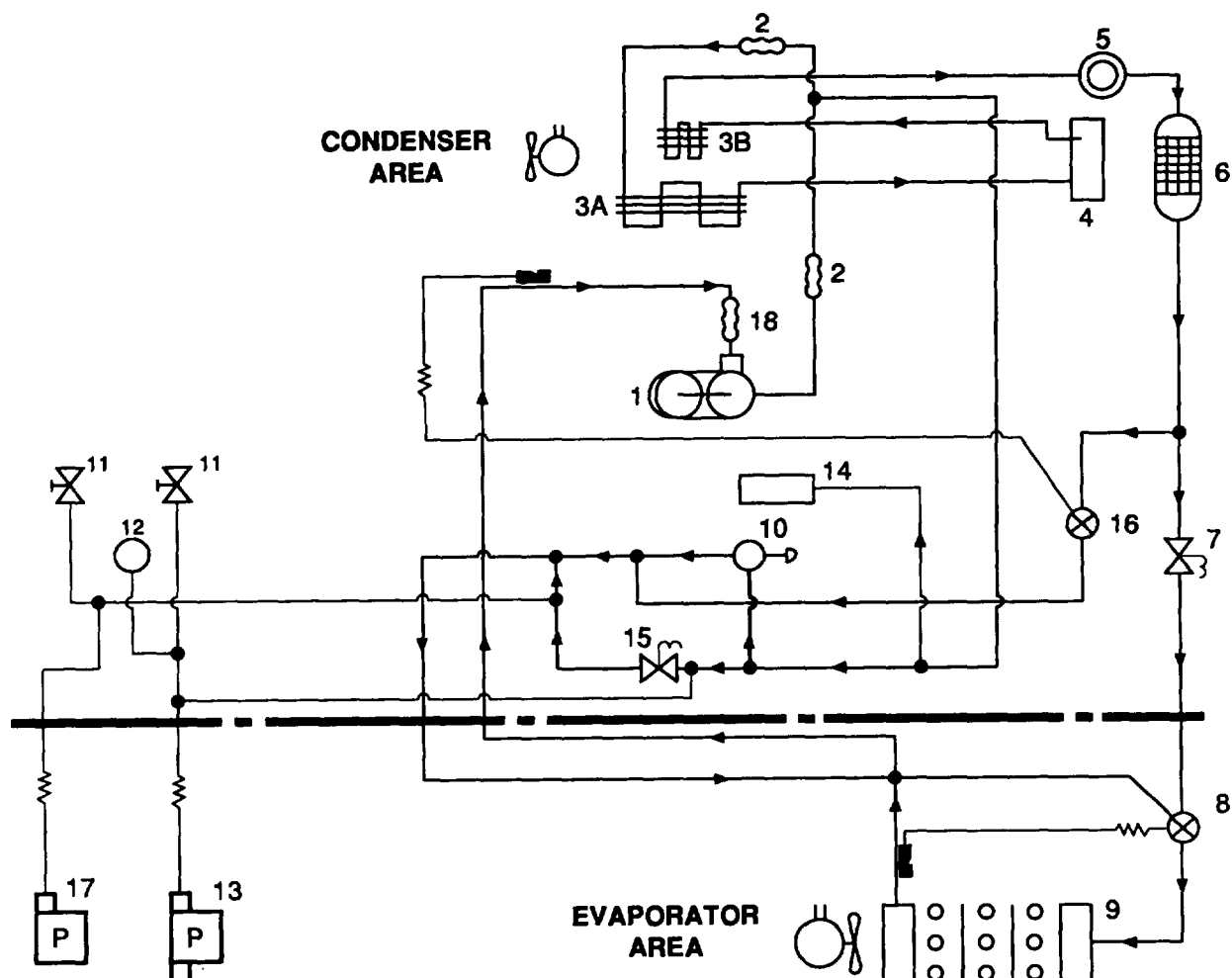
	<b>F9000H-3SA</b>	<b>F9000H-1SA</b>
<b>AMBIENT OPERATING TEMPERATURE RANGE</b>		
<b>LOW</b>	<b>-50°F (-45°C)</b>	<b>-50°F (-45°C)</b>
<b>HIGH</b>	<b>+120°F (+49°C)</b>	<b>+120°F (+49°C)</b>
<b>PERFORMANCE AT 50 HERTZ</b>		
COOLING CAPACITY	8,333 BTU/HR	8,333 BTU/HR
HEATING CAPACITY	7,000 BTU/HR	7,000 BTU/HR
<b>PERFORMANCE AT 60 HERTZ</b>		
COOLING CAPACITY	10,000 BTU/HR	10,000 BTU/HR
HEATING CAPACITY	7,000 BTU/HR	7,000 BTU/HR
<b>POWER REQUIRED</b>		
VOLTAGE	208	115
PHASE	3	1
HERTZ	50/60	50/60
AMPERAGE	10	20
KILOWATTS	4	4
<b>DIMENSIONS</b>		
WIDTH	24.0 inch (60.96 cm)	24.0 inch (60.96 cm)
DEPTH	26.5 inch (67.31 cm)	26.5 inch (67.31 cm)
HEIGHT	16.0 inch (40.64 cm)	16.0 inch (40.64 cm)
WEIGHT	185 pounds (83.9 kg)	185 pounds (83.9 kg)
<b>REFRIGERANT</b>		
TYPE	R-22	R-22
CHARGE	2.2 pounds (1.0 kg)	2.2 pounds (1.0 kg)

## Section III TECHNICAL PRINCIPLES OF OPERATION

### 1-11. REFREIGERATION 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).
  - 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, 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 (15) is closed at start of cooling cycle. This valve opens when compressor is not running to equalize pressure on both sides of compressor.
- b. Bypass System. This unit has a bypass system which allows cooling operation at low cooling loads without cycling the compressor on and off. In bypass the refrigerant is piped from the discharge to the suction side of the compressor, bypassing the EVAPORATOR COIL (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 (10) opens to allow flow of hot gas from the compressor.
  - The QUENCH VALVE (16) 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 (16) opens to allow liquid refrigerant to mix with the hot gas.
  - The LINEAR ACTUATING CYLINDER ASSEMBLY (14) automatically controls the condenser discharge louver assembly.



FIND NO.	QTY	NOMENCLATURE
1	1	COMPRESSOR, RECIPROCATING
2	2	HOSE ASSEMBLY, 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	1	REGULATOR, FLUID PRESSURE
11	2	VALVE, SERVICE
12	1	VALVE, PRESSURE RELIEF
13	1	SWITCH, PRESSURE (HIGH)
14	1	CYLINDER ASSEMBLY, ACTUATING, LINEAR
15	1	SOLENOID VALVE WITH LEADS
16	1	VALVE, EXPANSION (QUENCH)
17	1	SWITCH, PRESSURE (LOW)
18	1	HOSE ASSEMBLY, METAL

Figure 1-3. Refrigeration Schematic

**1-11. REFRIGERATION CYCLE. - continued**

- The SERVICE VALVES (11) are provided for charging, and general servicing of the high and low pressure sides of the refrigerant system.
- The LOW PRESSURE SWITCH (17), the HIGH PRESSURE SWITCH (13) and the PRESSURE RELIEF VALVE (12) are provided to protect the unit from damage due to pressure extremes.
- The flexible METAL HOSE ASSEMBLIES (2) and (18) provide vibration isolation between the compressor and other components of the refrigeration system.

**1-12. 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 HEAT, 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

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

##### **2-1. GENERAL.**

The Model F9000H-3SA, and F9000H-1SA, AirConditioners are designed for a wide variety of installations and for operation under a wide range of climatic conditions. They are also designed for continuous or intermittent operation as self-contained units or maybe connected to external filtering equipment for operation under Nuclear Biological and Chemical (NBC) 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)



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 VENT, LOW HEAT or HIGH 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 NBC filter.

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



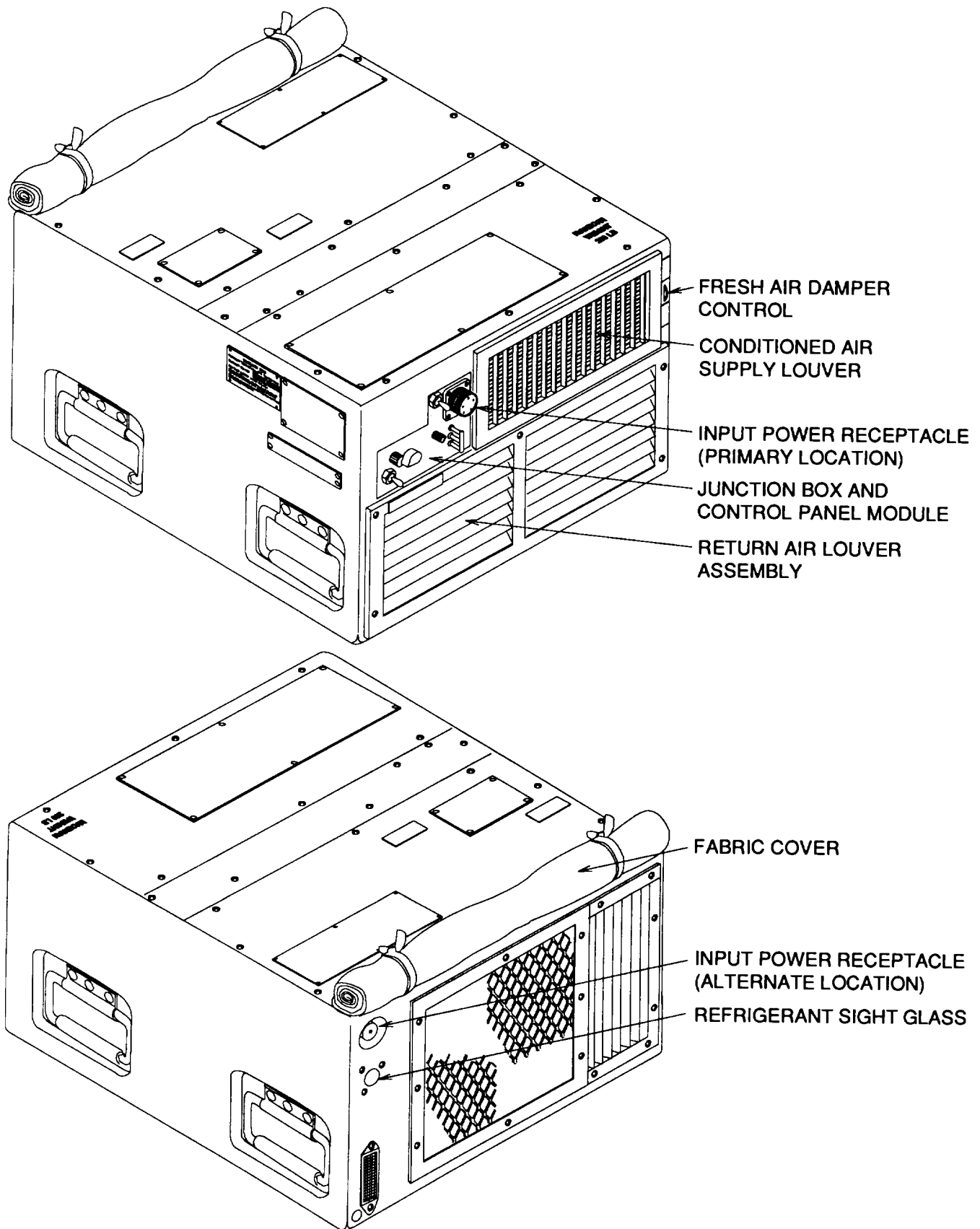


Figure 2-1. Operator's Controls and Indicators

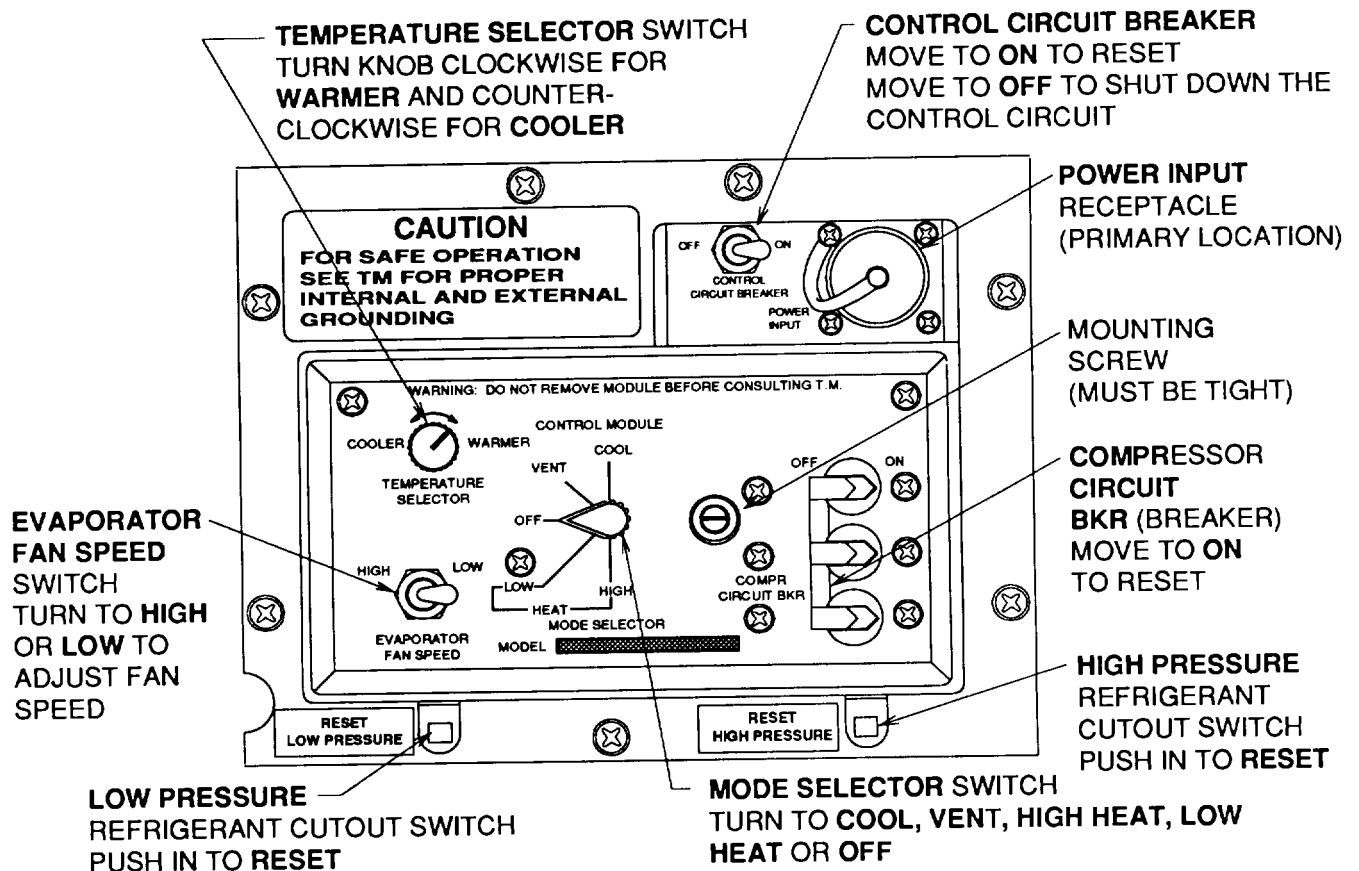


Figure 2-2. Operator's Controls and Indicators

**2-3. INDICATORS.**

(See fig. 2-2.) The refrigerant sight glass is the only visual indicator incorporated in the Model F9000H-3SA, and F9000H-1SA air conditioners. 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.



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 OPERATOR 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. The Preventive Maintenance Checks and Services table lists the inspections and care of the air conditioner required to keep it in good operating condition.

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 using the proper forms, See DA Pam 738-750.

e. Service Intervals. The interval column of the PMCS table tells when to do a certain check or service.

f. Procedure Column. The procedure column of the PMCS table tells how to do the required check and service.

g. Reporting and Correcting Deficiencies. If the air conditioner does not perform as required, refer to Chapter 3 under Troubleshooting for possible problems. Report any malfunctions or failures on DA Form 2404, or refer to DA Form 738-750.

**2-4. GENERAL. - continued**

h. The Equipment is Not Ready/Available If column states when the air conditioner cannot be used

**NOTE**

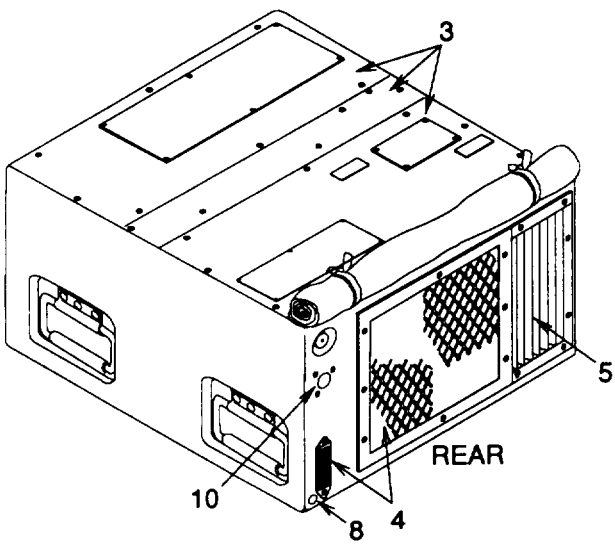
Within designated intervals, these checks are to be performed in the order listed. If the equipment must be kept in continuous operation, check and service only those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut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

**Table 2-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES**

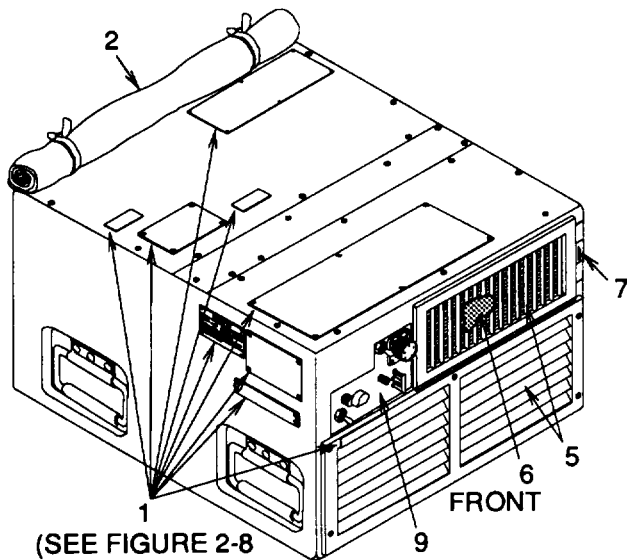
B - Before      D - During      A - After      M - Monthly

Item No.	Interval				Item To Be Inspected	Procedures Check for and have repaired or adjusted as necessary.	Equipment Is Not Ready/Available If:
	B	D	A	M			



REAR



FRONT

(SEE FIGURE 2-8 FOR MARKING INFORMATION)

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.

**Table 2-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - continued**

B - Before      D - During      A - After      M - Monthly

Item No.	Interval				Item To Be Inspected	Procedures Check for and have repaired or adjusted as necessary.	Equipment Is Not Ready/Available If:
	B	D	A	M			
4	•				Screens and Guards	Check for obstructions, damage, loose or missing hardware.	Screens or guard damaged or missing.
5	•				Louvers	Check for obstructions, damage, proper adjustment, loose or missing hardware.  Check louvers for freedom of operations. Lubricate as required.	Louvers are damaged or missing.
6	•	•	•	•	Air Fitter	Check that filter is clean.	Filter is totally clogged or missing.
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-3SA and F9000H-1SA Air Conditioners are completely assembled, self-contained units as received. No specific operator preparation for use is required once the unit is in place.

#### 2-6. OPERATIONAL CHECKS.

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.



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 conditions, 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.

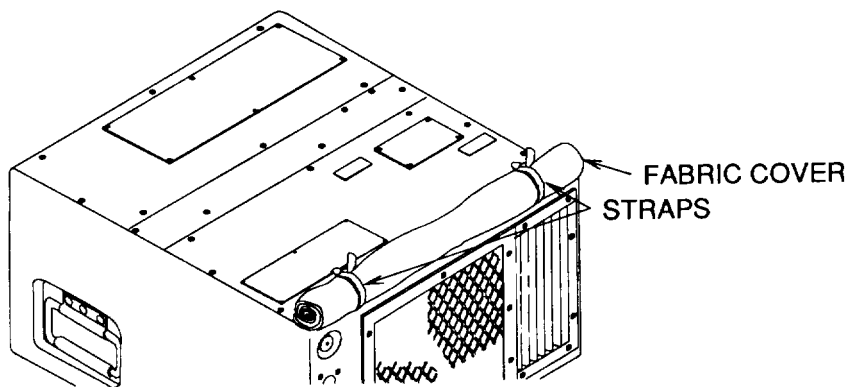


Figure 2-3. Fabric Cover

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

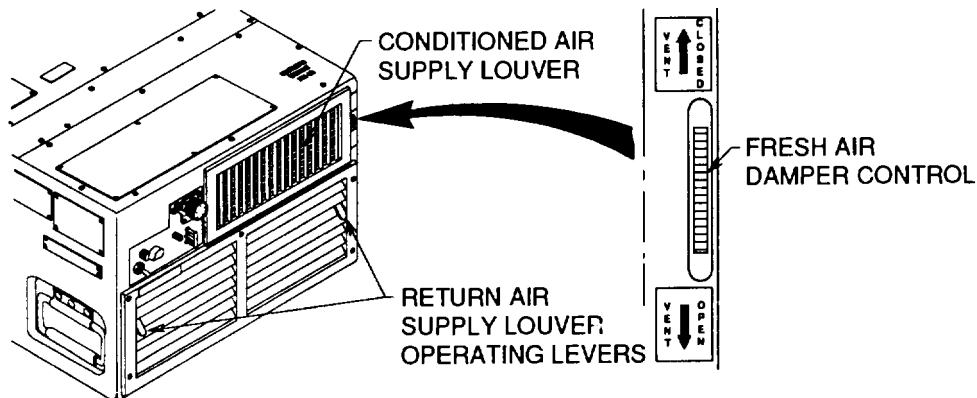
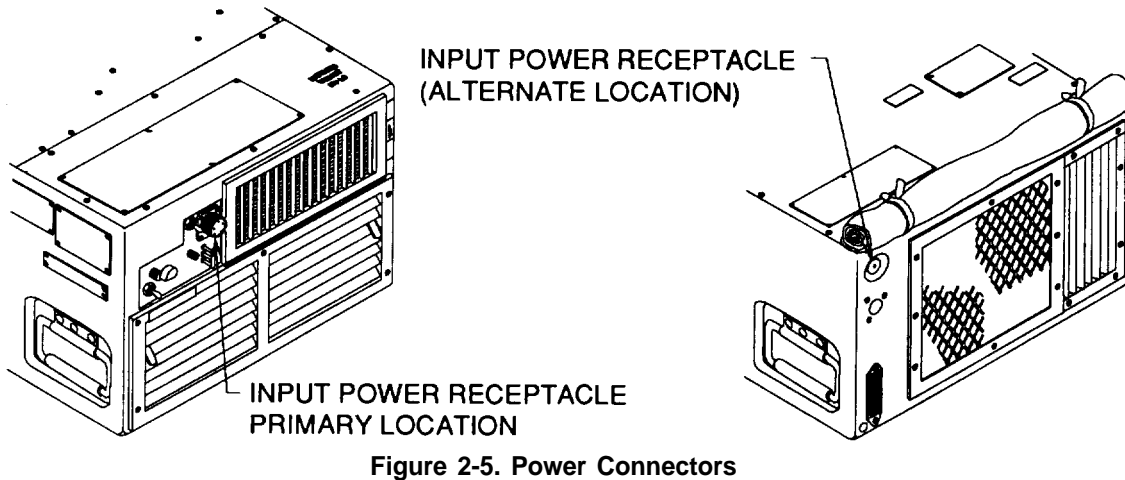


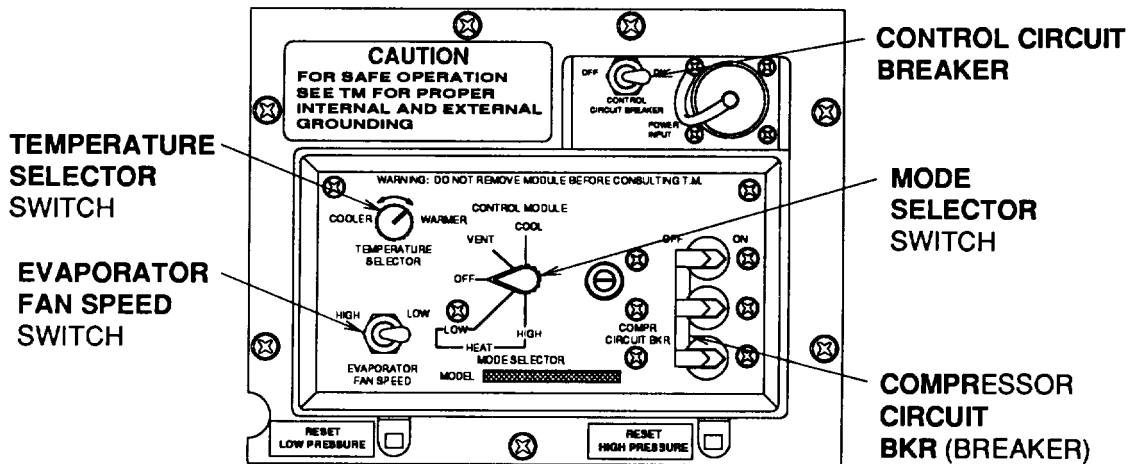
Figure 2-4. Fresh Air Damper and Conditioned Air Louvers

**2-6. OPERATIONAL CHECKS. - continued**

- 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.



- 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.

**2-6. OPERATIONAL CHECKS. - continued****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 over pressure 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.



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.

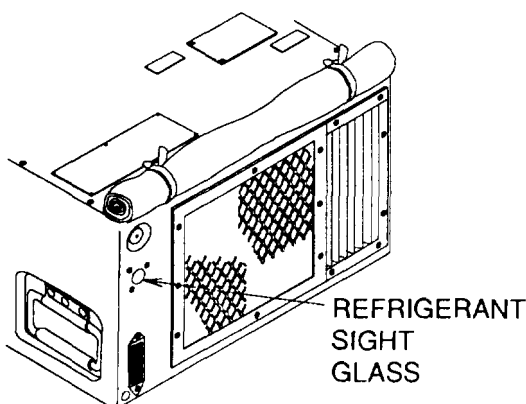


Figure 2-7. Refrigerant Sight Glass



## 2-6. OPERATIONAL CHECKS. - continued

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.



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-3SA and F9000H-1SA air conditioners are 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 conditions, 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% Recirculated 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% Recirculated Air	COOL	Desired Temperature	Fully Closed	Fully Open	Slightly Upward	Open (Rolled
Cooling with make-up Fresh Air		Desired Temperature	Partially or Fully Closed	Partially or Fully Closed	Slightly Upward	Open (Rolled
Any Mode with make-up Air Through NBC 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.

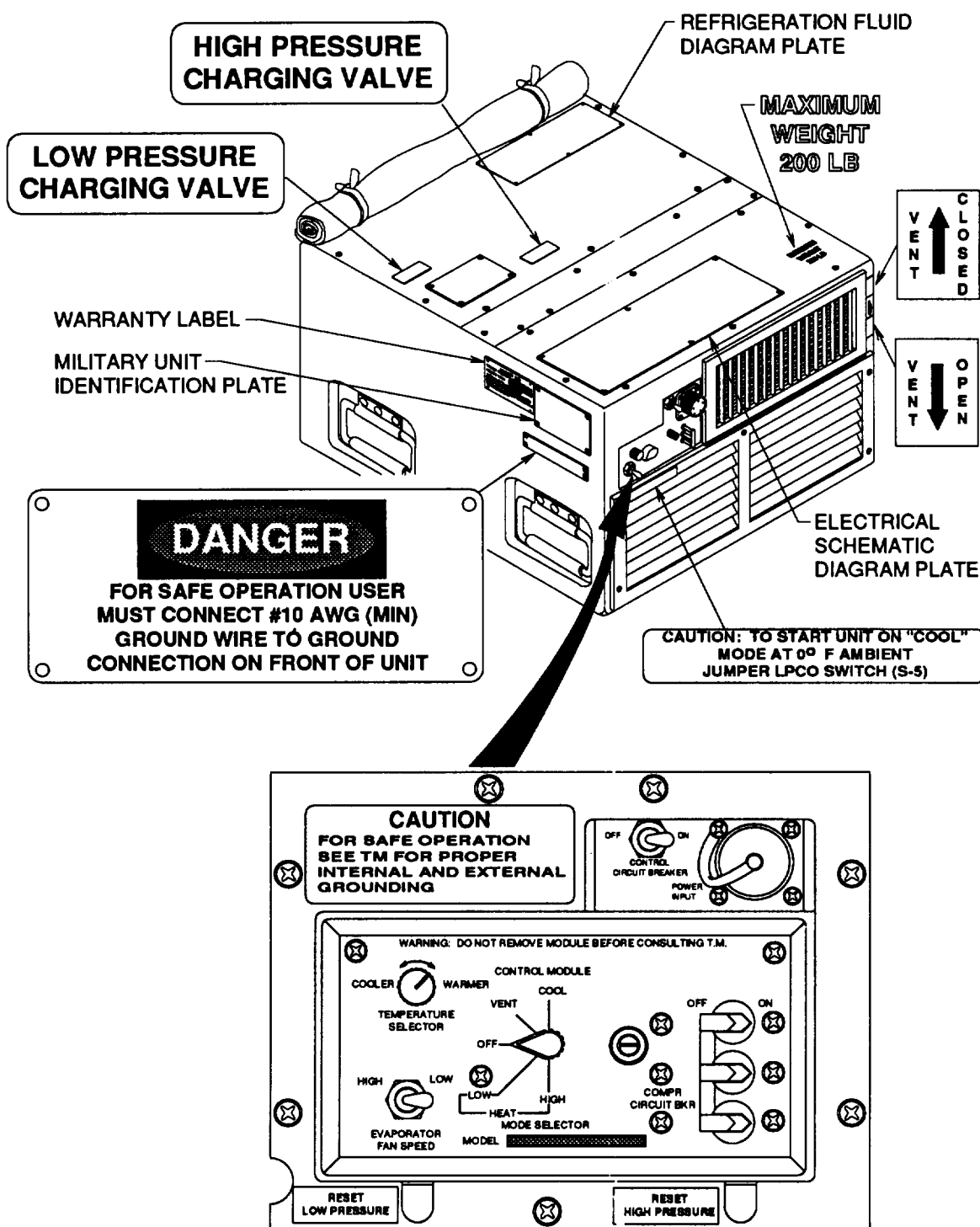


Figure 2-8. Instruction Plates, Stencil Marking Information, and Locations

**2-9. PREPARATION FOR MOVEMENT.**

No special operator preparation is required when the air conditioner is to be moved to another location. Installation procedures and preparation for movement will be performed by unit maintenance

**Section IV OPERATION UNDER UNUSUAL CONDITIONS****2-10. GENERAL.**

The Model F9000H-3SA and F9000H-1SA Air Conditioners are 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 maybe 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.
- e. Clean filter, mist eliminator, and coils more frequently.
- f. Increase frequency of PMCS.

**2-12. OPERATION IN EXTREME COLD.**

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 maybe 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.

## **2-12. OPERATION IN EXTREME COLD. - continued**

### **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.
- e. When the unit is to be used at low temperatures in the COOL mode, the low refrigerant pressure cutout switch must be jumped. Notify supervisor.
- 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.
- d. Increase frequency of PMCS.

## **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. NBC Hazard. When operation is anticipated under potential nuclear-biological-chemical (NBC) conditions, a NBC 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 NBC 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

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Section I LUBRICATION INSTRUCTIONS

**3-1. GENERAL.**

The Model F9000H-3SA and 9000H-1SA Air Conditioners and their 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 bearing 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 unit 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.
- 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 maybe 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 unit maintenance.

SYMPTOM INDEX

Trouble	Malfunction No.
AIR CONDITIONER	
Does Not Start In Any Mode. . . . .	1
ReducedCoolingCapacity. . . . .	2
Reduced Heating Capacity. . . . .	3
Too Much Heat . . . . .	4

Table 3-1. OPERATOR TROUBLESHOOTING


MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
<p><b>1. AIR CONDITIONER DOES NOT START IN ANY MODE.</b></p> <p>Step 1. Check that input power has not been disconnected.</p> <p>Connect input power.</p> <div></div> <p>During cool weather do not start in COOL mode for four hours.</p> <p>Step 2. Check if CONTROL CIRCUIT BREAKER or COMPR CIRCUIT BKR has tripped.</p> <p>Reset circuit breaker(s).</p>
<p><b>2. REDUCED COOLING CAPACITY.</b></p> <p>Step 1. Check that MODE SELECTOR switch is turned to COOL.</p> <p>Turn switch to COOL.</p> <p>Step 2. Check operation of TEMPERATURE SELECTOR.</p> <p>Set control at maximum COOLER, then, if condition improves, adjust properly.</p> <p>Step 3. Check that supply and return air louvers are properly adjusted.</p> <p>Adjust louvers properly.</p> <p>Step 4. Check that excessive hot, outside air is not being introduced through fresh air damper.</p> <p>Fully close damper, then, if condition improves, adjust properly.</p> <p>Step 5. Check that all doors, windows, and other openings in room or enclosure are tightly closed.</p> <p>Tightly close all openings.</p>



Table 3-1. Operator Troubleshooting - continued

<b>MALFUNCTION</b>	<b>TEST OR INSPECTION</b>	<b>CORRECTIVE ACTION</b>
	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.
<b>3. REDUCED HEATING CAPACITY.</b>		
	Step 1. See that MODE SELECTOR switch is properly set.	Set switch on LOW or HIGH HEAT.
	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.
<b>4. TOO MUCH HEAT.</b>		
	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.

## Section III MAINTENANCE PROCEDURES

### 3-3. GENERAL

There are no operator maintenance procedures.

## CHAPTER 4

## UNIT MAINTENANCE INSTRUCTIONS

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## Section I LUBRICATION INSTRUCTIONS

### 4-1. 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 II REPAIR PARTS, SPECIAL TOOLS, TEST MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE), AND SUPPORT EQUIPMENT

### 4-2. GENERAL.

- a. Repair parts are listed and illustrated in TM9-4120-400-24P. 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 unit maintenance electric shop.
- b. For authorized common tools and equipment refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

### Section III SERVICE UPON RECEIPT OF EQUIPMENT

#### **4-3. 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 50 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.
- g. A source of 208 volt, 3 phase, 50/60 hertz input power rated at 10.0 amps for the F9000H-3SA or a source of 115 volt, single phase, 50/60 hertz input power rated at 19.4 amps for the F9000H-1SA. 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. 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.

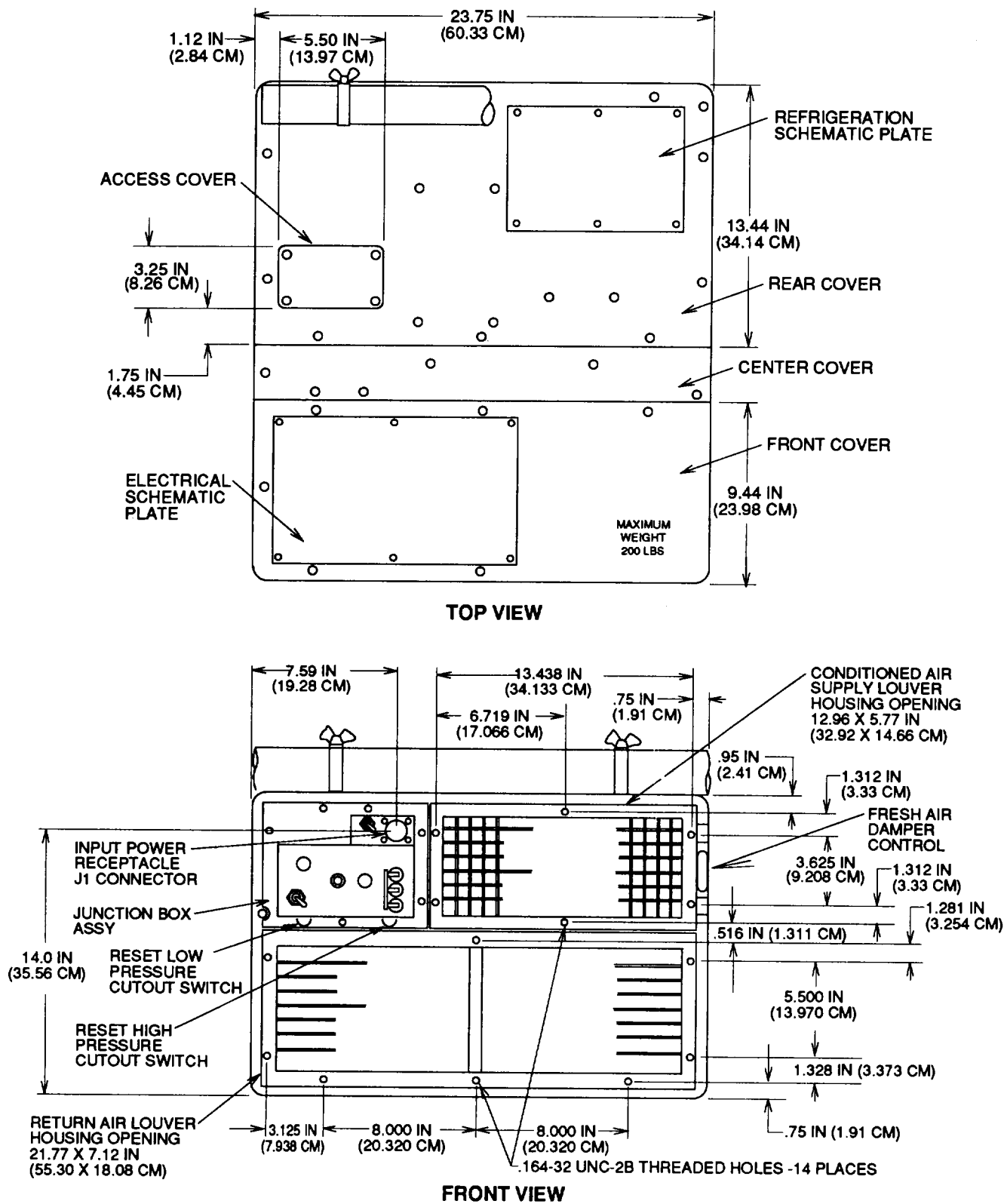


Figure 4-1. Installation Dimensions (Sheet 1 of 3)

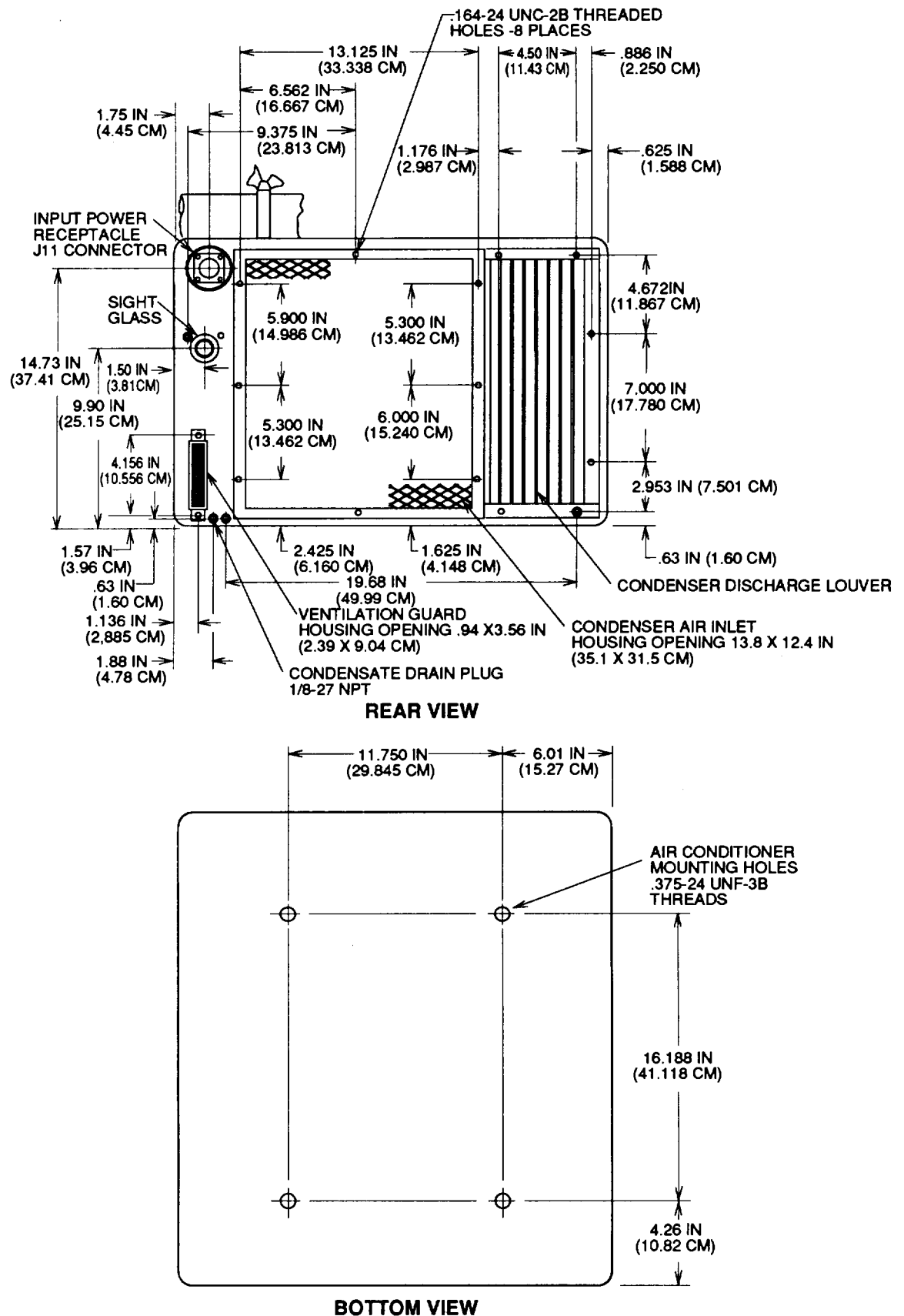


Figure 4-1. Installation Dimensions (sheet 2 of 3)

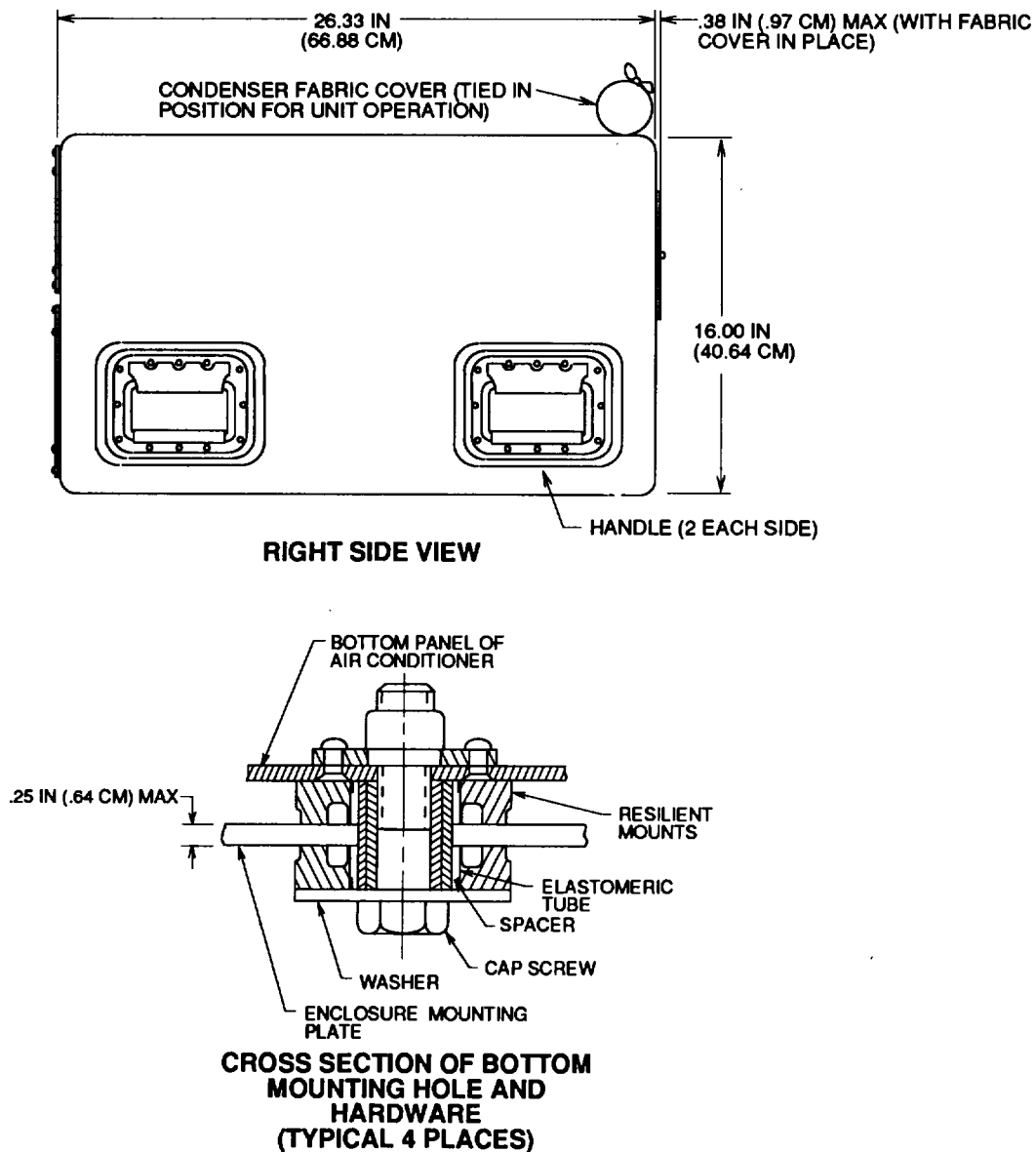


Figure 4-1. Installation Dimensions (Sheet 3 of 3)



#### 4-4. SERVICE UPON RECEIPT OF MATERIAL.

- a. Unloading. The 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.



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.

#### 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 Packing. Remove the cushioning around the top of the cabinet and retain, if reuse is anticipated. Remove the presentation 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 shipment is complete. Report all discrepancies in accordance with instructions of DA Pamphlet 738-750 (The Army Maintenance Management System).
- (3) Check to see whether the equipment has been modified.

#### 4-4. SERVICE UPON RECEIPT OF MATERIAL. - CONTINUED

##### NOTE

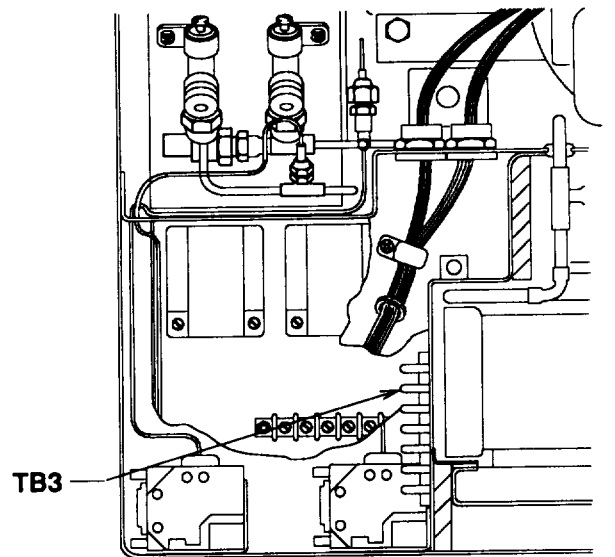
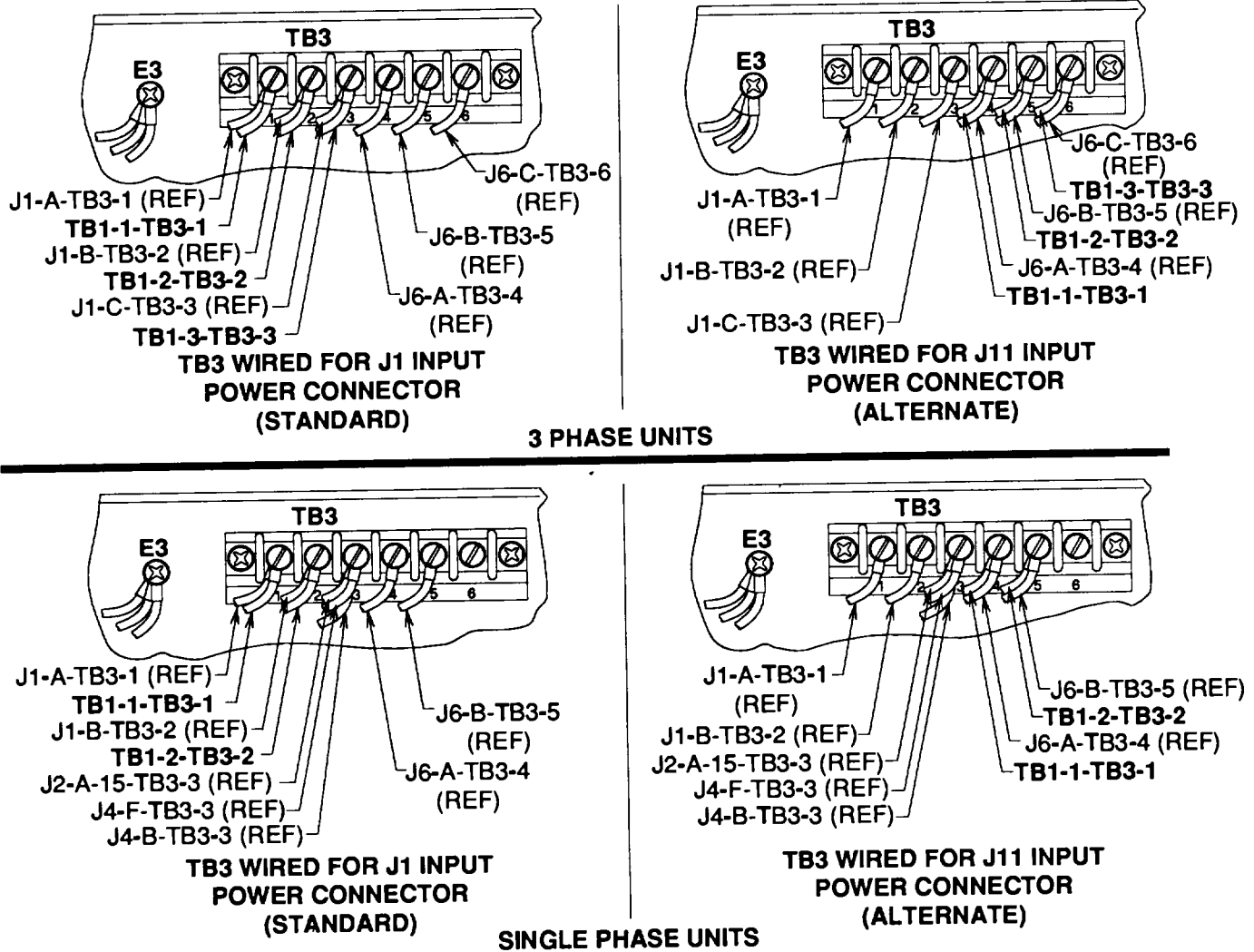
The unit weight (less shipping pallet) is 190 pounds (86.2 kg) for the F9000H-3SA and 172 pounds (78.0 kg) for the F9000H-1SA. When lifting or moving the unit on the shipping pallet, a forklift maybe used. When lifting the unit into position use four people, one at each lifting handle.

- (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.

#### 4-5. 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 on the F9000H-3SA, 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. If the J11 connector is to be used on the F9000H-1SA, leads TB1-1- -TB3-1 and TB1-2- -TB3-2 on terminal board TB3 must be moved from terminals 1 and 2 to terminals 4 and 5 respectively. Proceed as follows:
    - 1 Remove top front (evaporator section) panel 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 (F9000H-3SA only) Disconnect wire TB1-3--TB3-3 from TB3 terminal 3 and reconnect to terminal 6.
    - 5 Install top front (evaporator section) panel.
- (2) Connectors are provided to permit remote installation of the control module. To install the control module in a remote location (within the conditioned space) the following steps must be taken. (See fig. 4-3.)
  - (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.



UPPER LEFT CORNER WITH TOP COVERS REMOVED

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

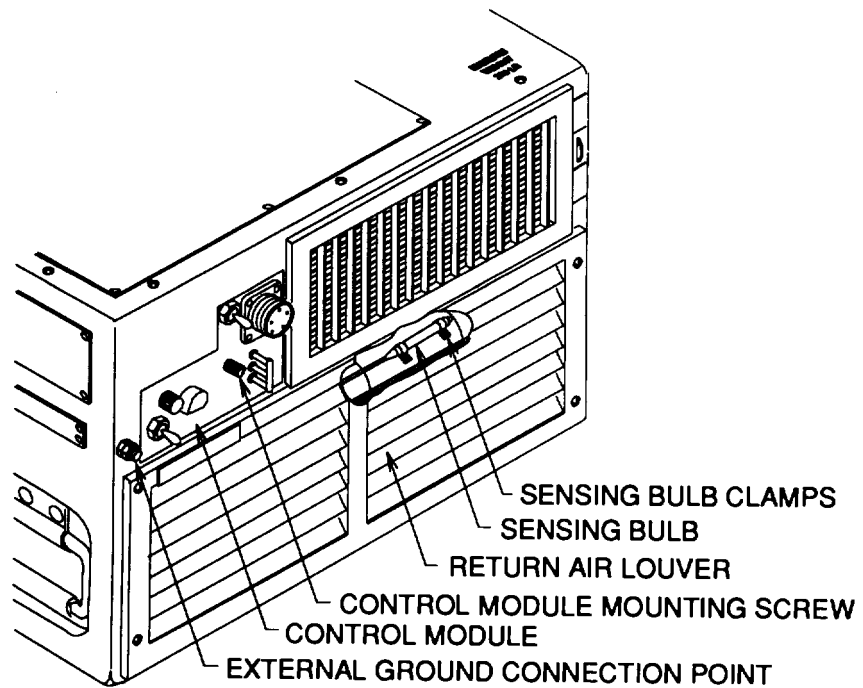


Figure 4-3. Control Module Removal

#### 4-5. INSTALLATION INSTRUCTIONS. - continued

- (e) Determine where control module is to be located. Note that sensing bulb controls thermostatic action of 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. 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 remote control cable diagram, figure 4-4, sheet 7 and fabricate the interconnecting cable for either the F9000H-3SA or F9000H-1SA. 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 4-6 for a through the wall installation that allows removal of the front and rear top panels for service with the unit installed.
    - (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.
  - (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**

Death on contact may result if personnel fail to observe safety precautions.

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.

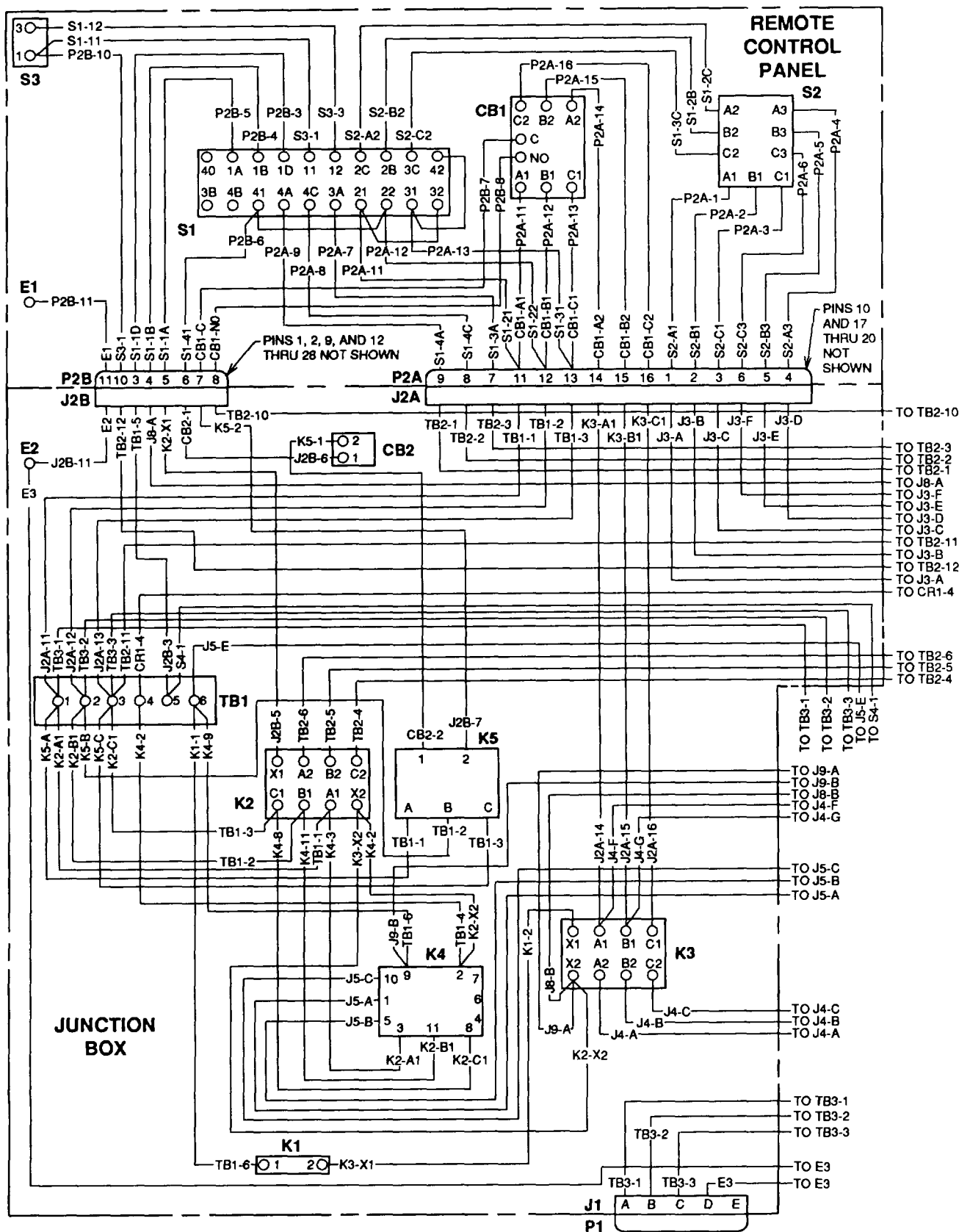
## COMPONENT REFERENCE LIST

ELEC REF DES	DESCRIPTION
B1	COMPRESSOR, RECIPROCATING
B2	MOTOR, CONDENSER FAN
B3	MOTOR, EVAPORATOR FAN
C1	CAPACITOR, FILTER
C2	CAPACITOR
CB1	CIRCUIT BREAKER, COMPRESSOR
CB2	CIRCUIT BREAKER, CONTROL
CR1	RECTIFIER, SEMICONDUCTOR DEVICE
E1	TERMINAL STUD (CONTROL MODULE GND)
E2	TERMINAL STUD (JUNCTION BOX GND)
E3 AND E4	TERMINAL STUD (SYSTEM GND)
HR1 THRU HR6	HEATER ELEMENT
J1 AND J11	CONNECTOR, RECEPTACLE, POWER INPUT
J2A AND J2B	CONNECTOR, RECEPTACLE, JUNCTION BOX
J3	CONNECTOR, RECEPTACLE, EVAPORATOR FAN
J4	CONNECTOR, RECEPTACLE, COMPRESSOR
J5	CONNECTOR, RECEPTACLE, CONDENSER FAN
J6	CONNECTOR, RECEPTACLE, POWER INPUT
J8	CONNECTOR, RECEPTACLE, SOLENOID VALVE BY-PASS
J9	CONNECTOR, RECEPTACLE, SOLENOID VALVE EQUALIZER
J10	CONNECTOR, RECEPTACLE, COMPRESSOR
K1	RELAY, TIME DELAY
K2	RELAY, HEATER
K3	RELAY, COMPRESSOR MOTOR
K4	RELAY, CONDENSER FAN
K5	RELAY, PHASE SEQUENCE
L1	VALVE, SOLENOID, BY-PASS
L2	VALVE, SOLENOID, PRESSURE EQUALIZER
P1	CONNECTOR, PLUG, POWER INPUT
P2A AND P2B	CONNECTOR, PLUG, CONTROL MODULE
P3	CONNECTOR, PLUG, EVAPORATOR FAN
P4	CONNECTOR, PLUG, COMPRESSOR
P5	CONNECTOR, PLUG, CONDENSER FAN
P6	CONNECTOR, PLUG, POWER INPUT
P8	CONNECTOR, PLUG, SOLENOID VALVE, BY-PASS
P9	CONNECTOR, PLUG, SOLENOID VALVE EQUALIZER
P10	CONNECTOR, PLUG, COMPRESSOR
S1	SWITCH, ROTARY SELECTOR
S2	SWITCH, TOGGLE
S3	SWITCH, TEMPERATURE CONTROL
S4	SWITCH, HIGH PRESSURE CUTOUT
S5	SWITCH, LOW PRESSURE CUTOUT
S6	SWITCH HEATER CUTOUT
T1	TRANSFORMER
TB1	TERMINAL BOARD, JUNCTION BOX
TB2	TERMINAL BOARD
TB3	TERMINAL BOARD, POWER INPUT

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

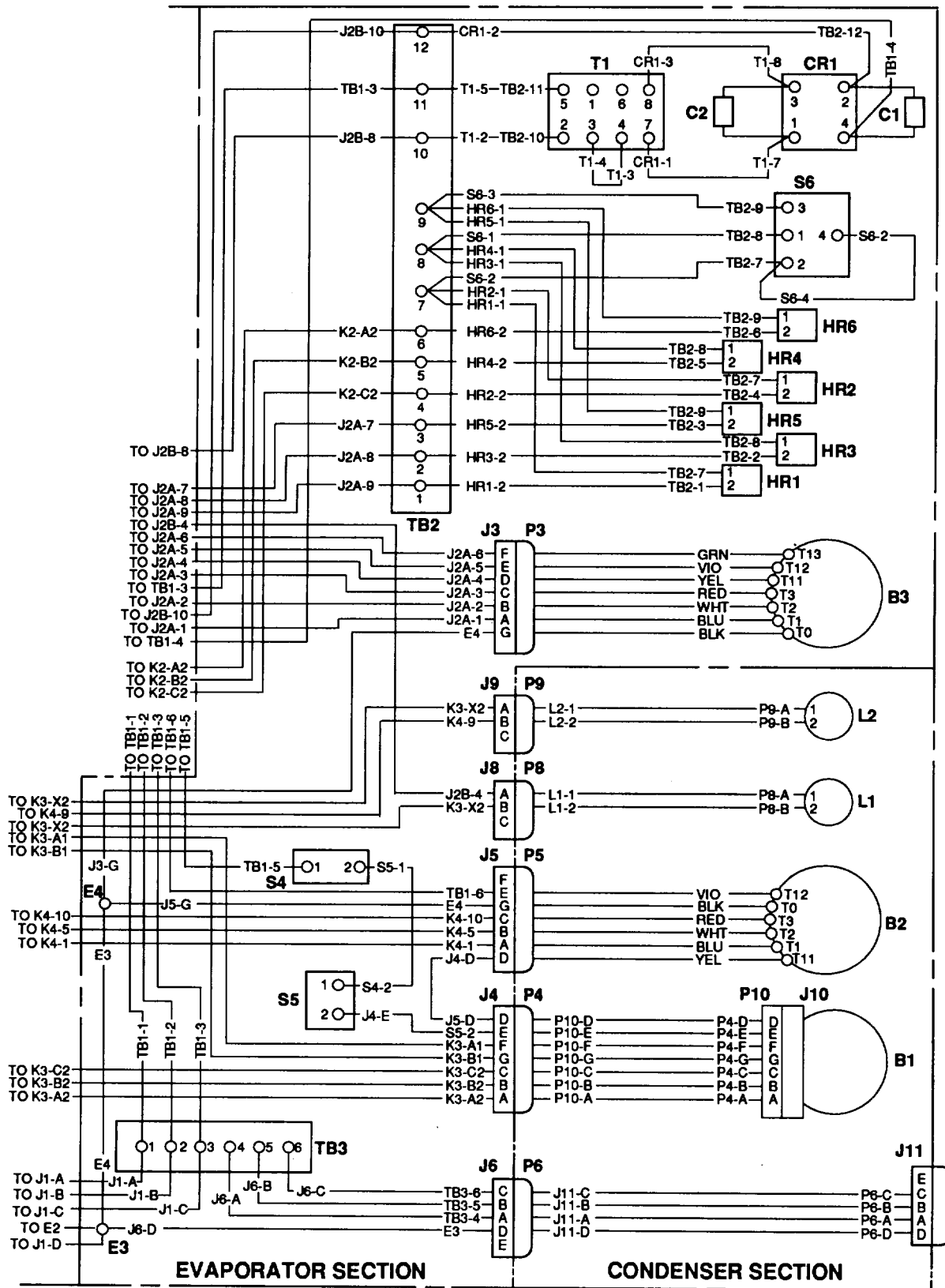
NOTE: SHEETS 1,2, AND 3 APPLY TO 3 PHASE UNITS ONLY. SEE SHEETS 4,5, AND 6 FOR SINGLE  
PHASE UNITS AND SHEET 7 FOR INPUT POWER AND CONTROL CABLE DIAGRAMS.

Figure 4-4. Wiring Diagram (Sheet 1 of 7)



NOTE: SHEETS 1, 2, AND 3 APPLY TO 3 PHASE UNITS ONLY. SEE SHEETS 4, 5, AND 6 FOR SINGLE PHASE UNITS AND SHEET 7 FOR INPUT POWER AND CONTROL CABLE DIAGRAMS.

Figure 4-4. Wiring Diagram (Sheet 2 of 7)



NOTE: SHEETS 1,2, AND 3 APPLY TO 3 PHASE UNITS ONLY. SEE SHEETS 4,5, AND 6 FOR SINGLE PHASE UNITS AND SHEET 7 FOR INPUT POWER AND CONTROL CABLE DIAGRAMS.

Figure 4-4. Wiring Diagram (Sheet 3 of 7)



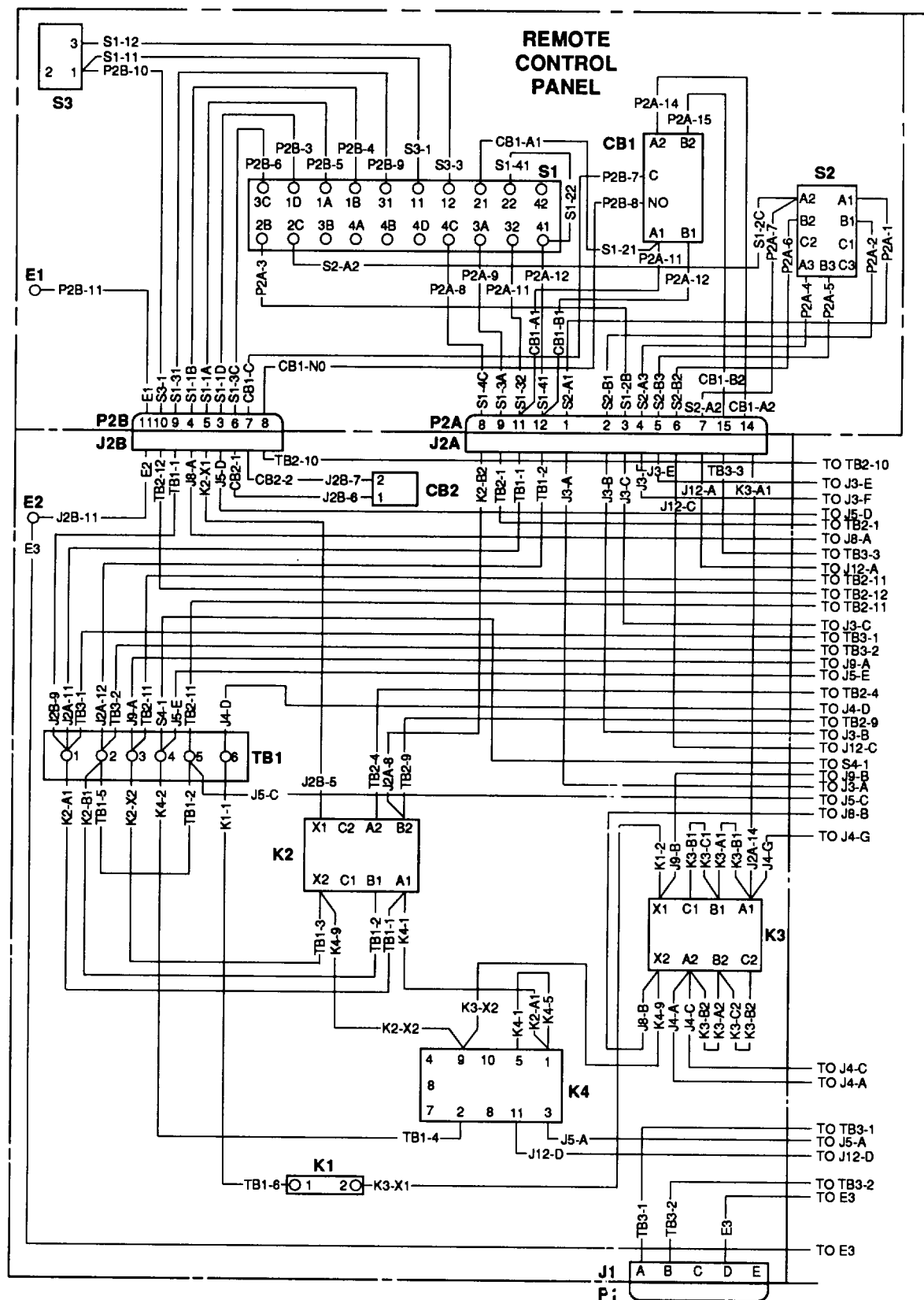
## COMPONENT REFERENCE LIST

ELEC REF DES	DESCRIPTION
B1	COMPRESSOR, RECIPROCATING
B2	MOTOR, CONDENSER FAN
B3	MOTOR, EVAPORATOR FAN
C11	CAPACITOR, FILTER
C2	CAPACITOR, CONDENSER RUN
C3	CAPACITOR, EVAPORATOR RUN
C4	CAPACITOR, COMPRESSOR RUN
C5	CAPACITOR, COMPRESSOR START
C6	CAPACITOR
CB1	CIRCUIT BREAKER, COMPRESSOR
CB2	CIRCUIT BREAKER, CONTROL
CR1	RECTIFIER, SEMICONDUCTOR DEVICE
E1	TERMINAL STUD (CONTROL MODULE GND)
E2	TERMINAL STUD (JUNCTION BOX GND)
E3 AND E4	TERMINAL STUD (SYSTEM GND)
HR1 THRU HR4	HEATER ELEMENT
J1 AND J11	CONNECTOR, RECEPTACLE, POWER INPUT
J2A AND J2B	CONNECTOR, RECEPTACLE, JUNCTION BOX
J3	CONNECTOR, RECEPTACLE, EVAPORATOR FAN
J4	CONNECTOR, RECEPTACLE, COMPRESSOR
J5	CONNECTOR, RECEPTACLE, CONDENSER FAN
J6	CONNECTOR, RECEPTACLE, POWER INPUT
J8	CONNECTOR, RECEPTACLE, SOLENOID VALVE BY-PASS
J9	CONNECTOR, RECEPTACLE, SOLENOID VALVE EQUALIZER
J10	CONNECTOR, RECEPTACLE, COMPRESSOR
J12	CONNECTOR, RECEPTACLE, EVAPORATOR AND CONDENSER RUN CAPACITORS
K1	RELAY, TIME DELAY
K2	RELAY, HEATER
K3	RELAY, COMPRESSOR MOTOR
K4	RELAY, CONDENSER FAN
K5	RELAY, COMPRESSOR START
L1	VALVE, SOLENOID, BY-PASS
L2	VALVE, SOLENOID, PRESSURE EQUALIZER
P1	CONNECTOR, PLUG, POWER INPUT
P2A AND P2B	CONNECTOR, PLUG, CONTROL MODULE
P3	CONNECTOR, PLUG, EVAPORATOR FAN
P4	CONNECTOR, PLUG, COMPRESSOR
P5	CONNECTOR, PLUG, CONDENSER FAN
P6	CONNECTOR, PLUG, POWER INPUT SWITCH
P8	CONNECTOR, PLUG, SOLENOID VALVE, BY-PASS
P9	CONNECTOR, PLUG, SOLENOID VALVE EQUALIZER
P10	CONNECTOR, PLUG, COMPRESSOR
P12	CONNECTOR, PLUG, EVAPORATOR AND CONDENSER RUN CAPACITORS
S1	SWITCH, ROTARY SELECTOR
S2	SWITCH TOGGLE
S3	SWITCH, TEMPERATURE CONTROL
S4	SWITCH, HIGH PRESSURE CUTOUT
S5	SWITCH, LOW PRESSURE CUTOUT
S6	SWITCH, HEATER CUTOUT
T1	TRANSFORMER
TB1	TERMINAL BOARD, JUNCTION BOX
TB2	TERMINAL BOARD
TB3	TERMINAL BOARD, POWER INPUT
TB4	TERMINAL BOARD

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

NOTE: SHEETS 4, 5, AND 6 APPLY TO SINGLE PHASE UNITS ONLY. SEE SHEETS 1,2, AND 3 FOR  
3 PHASE UNITS AND SHEET 7 FOR INPUT POWER AND CONTROL CABLE DIAGRAMS.

Figure 4-4. Wiring Diagram (Sheet 4 of 7)

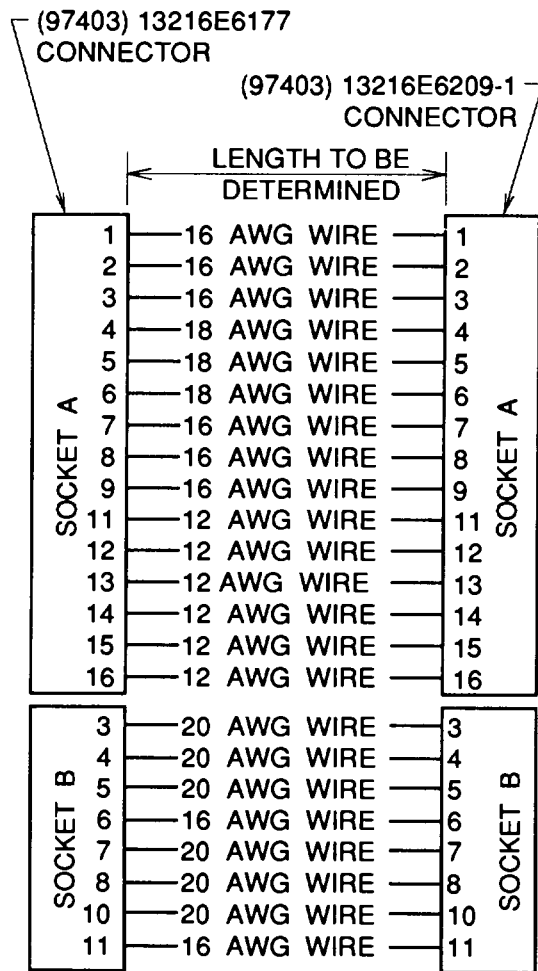


NOTE: SHEETS 4, 5, AND 6 APPLY TO SINGLE PHASE UNITS ONLY. SEE SHEETS 1, 2, AND 3 FOR 3 PHASE UNITS AND SHEET 7 FOR INPUT POWER AND CONTROL CABLE DIAGRAMS.

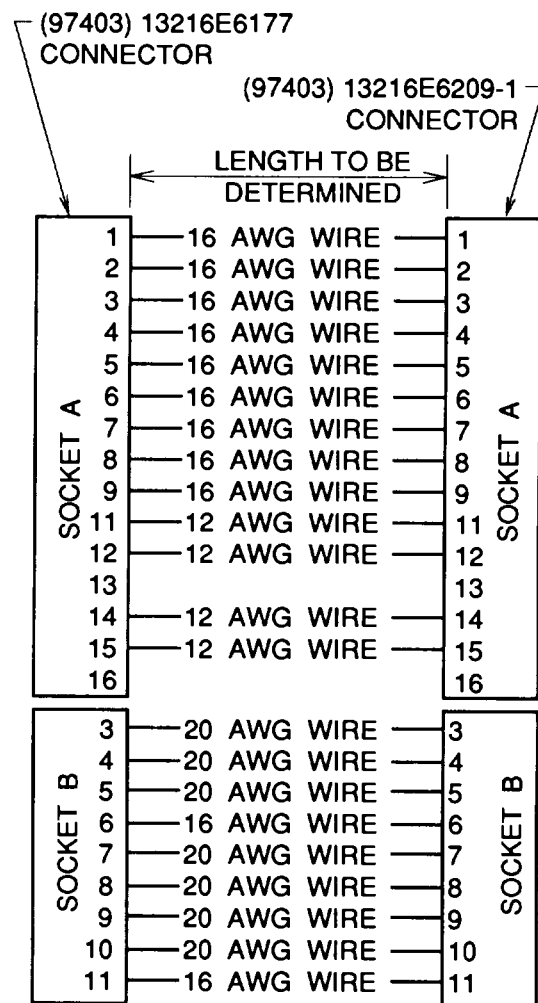
Figure 4-4. Wiring Diagram (Sheet 5 of 7)

NOTE: SHEETS 4, 5, AND 6 APPLY TO SINGLE PHASE UNITS ONLY. SEE SHEETS 1, 2, AND 3 FOR 3 PHASE UNITS AND SHEET 7 FOR INPUT POWER AND CONTROL CABLE DIAGRAMS.

4-17

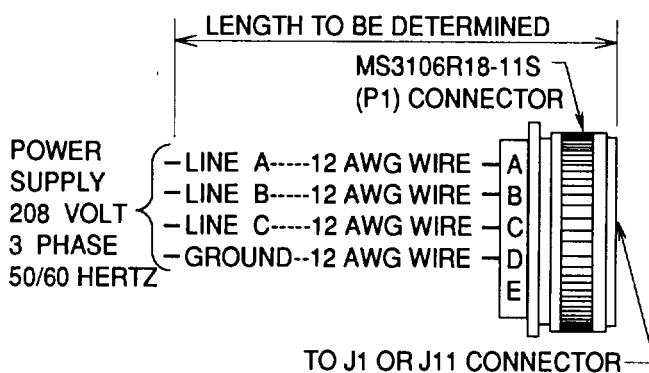


3 PHASE UNITS

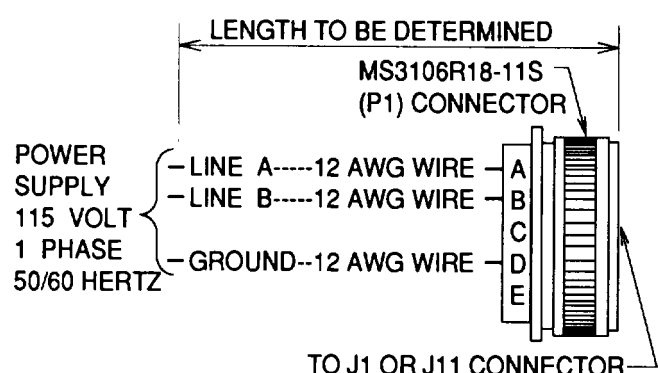


SINGLE PHASE UNITS

INTERCONNECTING REMOTE CONTROL CABLE DIAGRAMS



3 PHASE UNITS

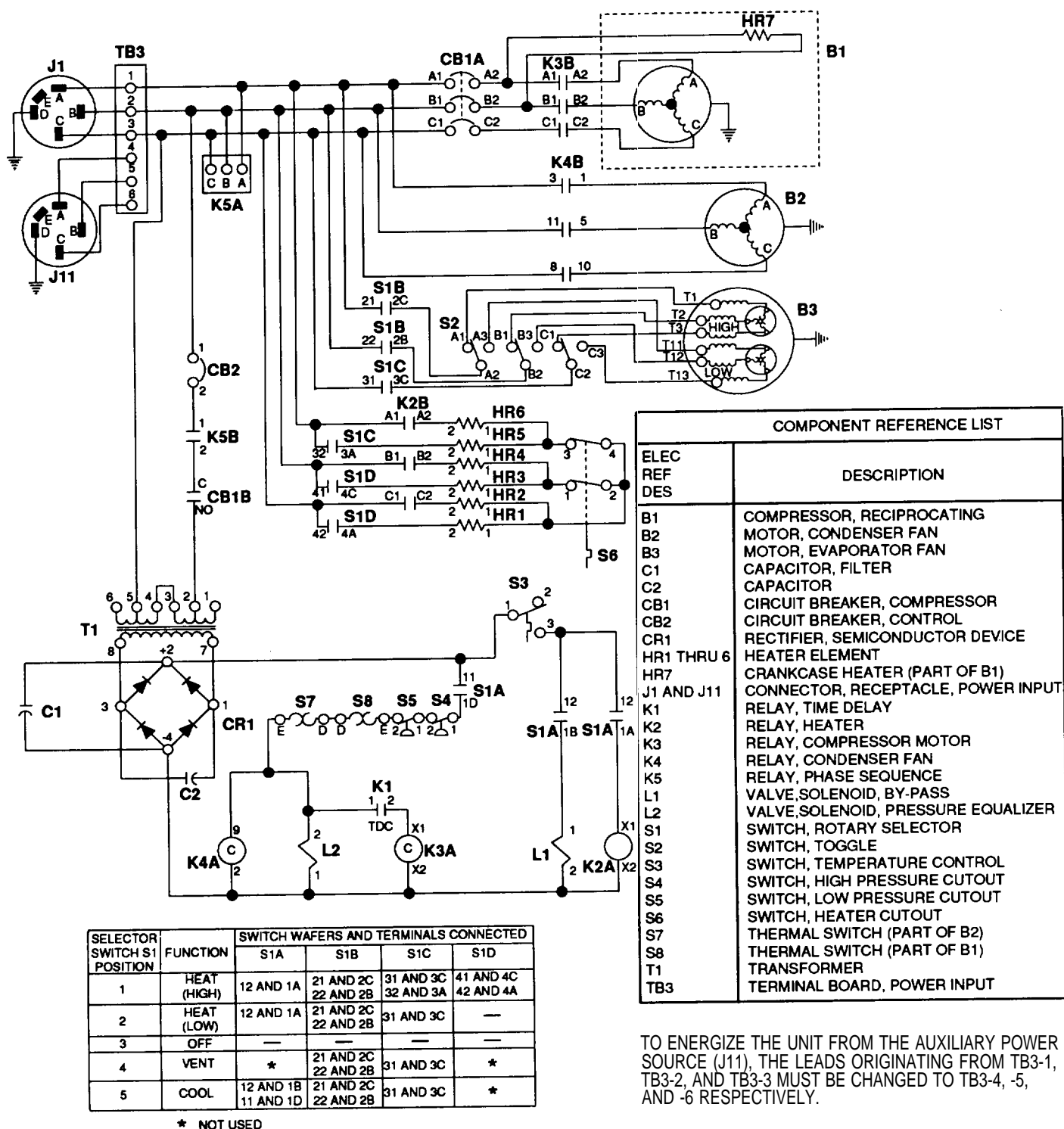


SINGLE PHASE UNITS

INPUT POWER CABLE DIAGRAMS

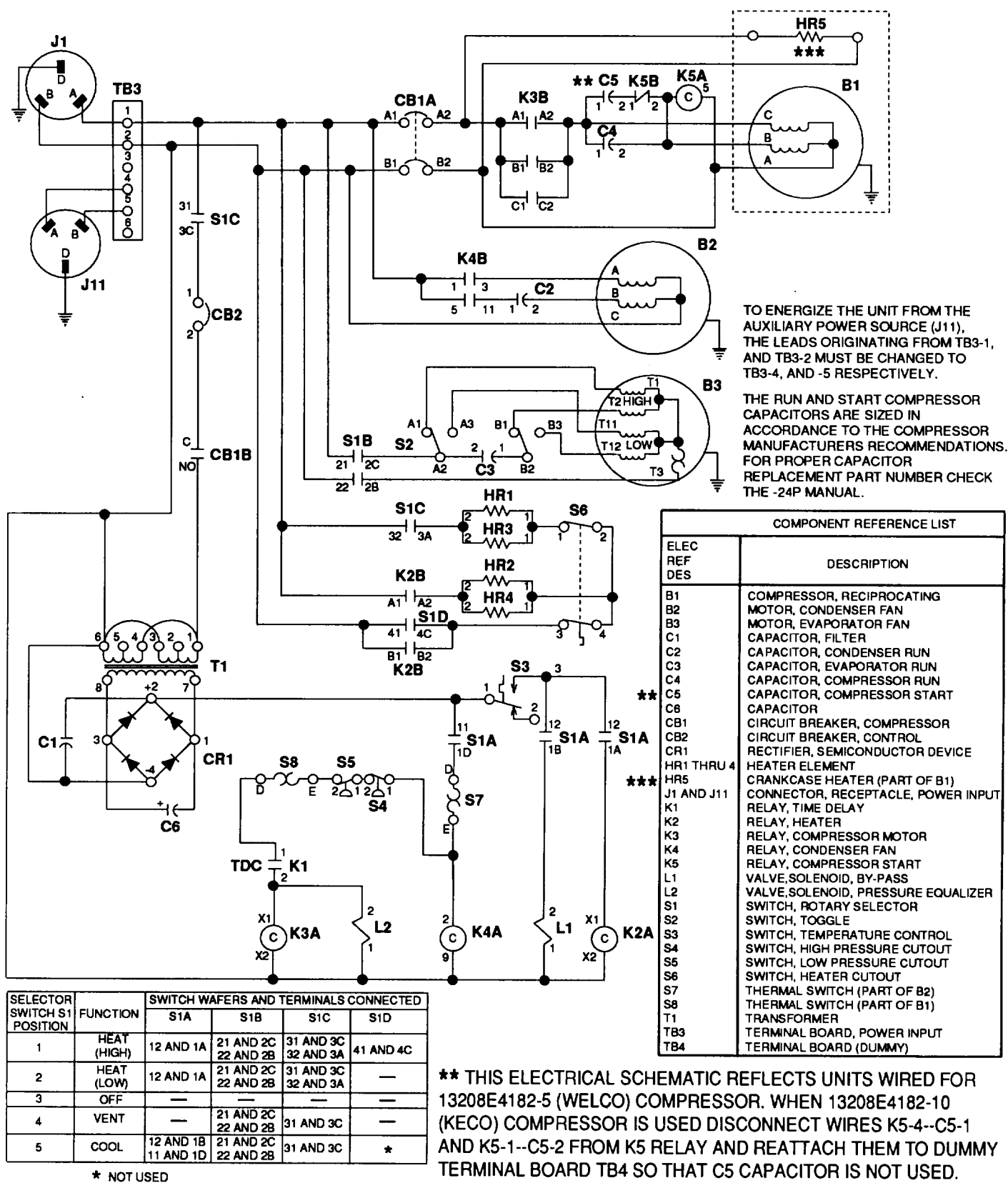
NOTE: FOR UNIT WIRING DIAGRAMS SEE SHEETS 1, 2, AND 3 FOR 3 PHASE UNITS AND SHEETS 4,5, AND 6 FOR SINGLE PHASE UNITS .

Figure 4-4. Wiring Diagram (Sheet 7 of 7)



NOTE: THIS SHEET APPLIES TO 3 PHASE UNITS ONLY. SEE SHEET 2 FOR SINGLE PHASE UNITS.

Figure 4-5. Electrical Schematic (Sheet 1 of 2)



NOTE: THIS SHEET APPLIES TO SINGLE PHASE UNITS ONLY. SEE SHEET 1 FOR 3 PHASE UNITS.

Figure 4-5. Electrical Schematic (Sheet 2 of 2)

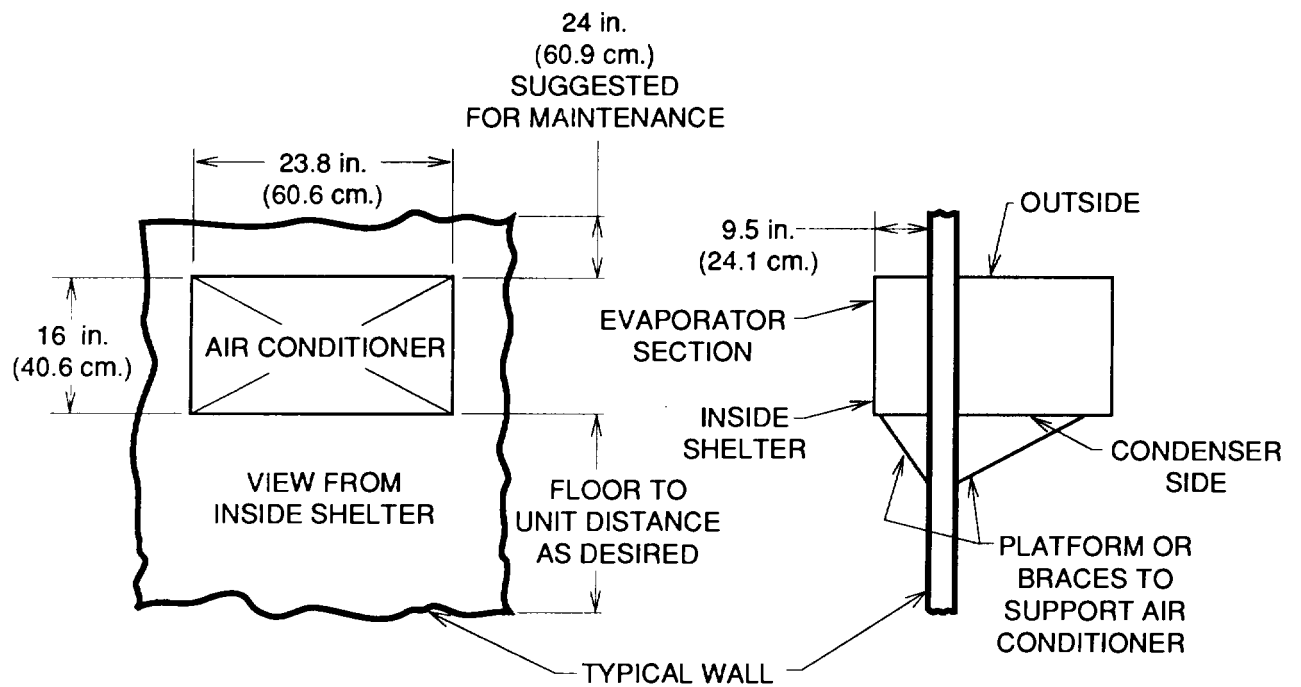


Figure 4-6. Typical Through the Wall Installation

4-5. INSTALLATION INSTRUCTIONS. - continued

- (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 7.) If J11 connector is used, be sure the wiring to TB3 terminal board is relocated in accordance with paragraph 4-5 a.

F9000H-3SA		F9000H-1SA	
Pin	Internal wiring connection J1 and J11	Pin	Internal wiring connection J1 andJ11
A	Phase A	A	115 volt
B	Phase B	B	Neutral
C	Phase C	C	Blank (not used)
D	Ground	D	Ground
E	Blank (not used)	E	Blank (not used)

- (7) Remove the condensate drain plug from lower left rear comer 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 (F9000H-3SA to 208 volt, 3 phase, 50/60 hertz or F9000H-1SA to 115 volt, single phase, 50/60 hertz) and air conditioner.
- (9) Run operational checks in accordance with paragraph 2-6.

NOTE

For more information on air conditioner installations, refer to MIL-HDBK-116 Environmental Control of Small Shelters.



**Section IV UNIT 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 unit 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 unit 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 unit preventive maintenance checks and services that should be performed at quarterly (or otherwise established) intervals. 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.

Table 4-1. Unit Preventive Maintenance Checks and Services (PMCS) Quarterly Schedule

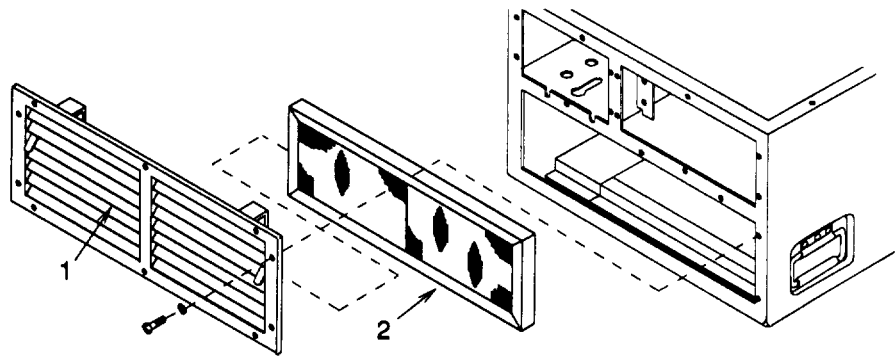
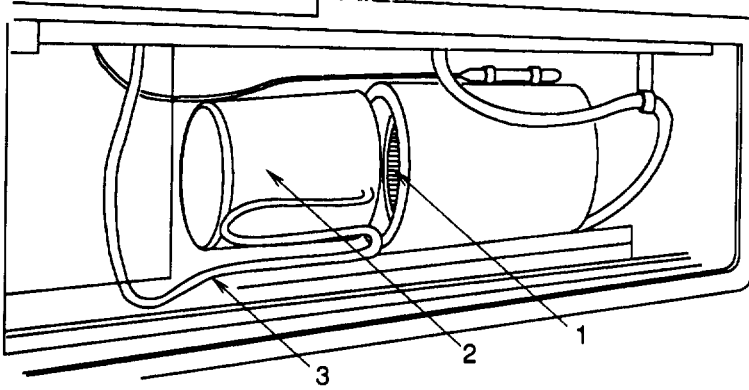
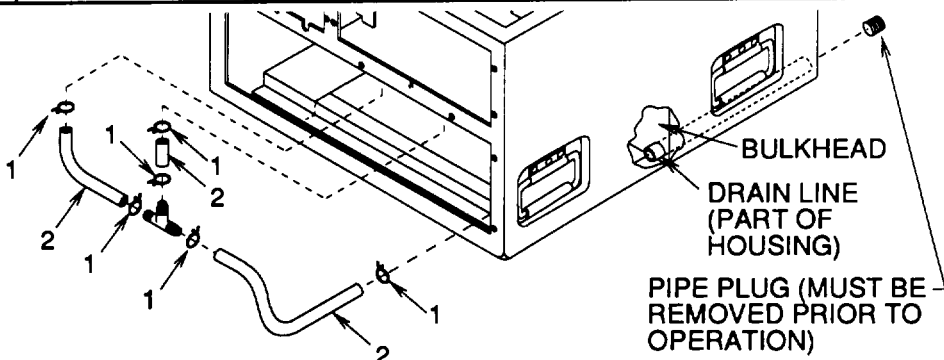
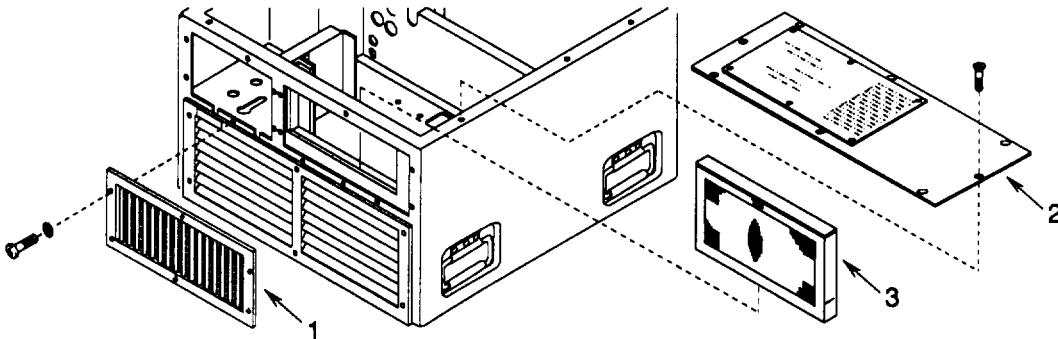
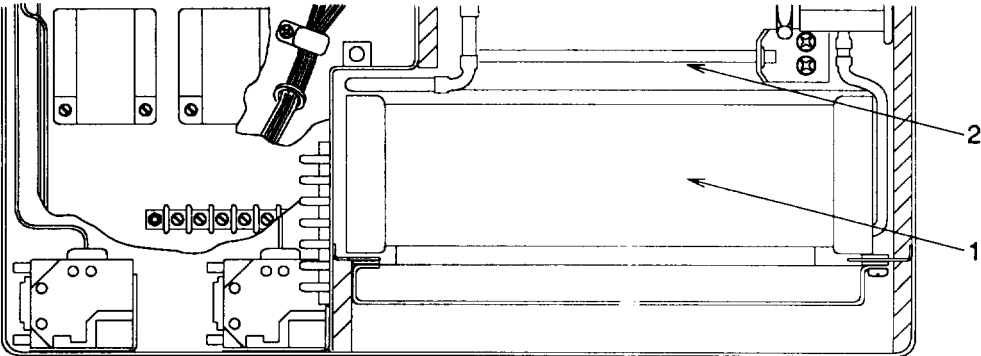
Item No.	Item to be Inspected/Serviced	Procedures	Para Ref.
			
1	Return Air Louver	a. Check operation of louvers (1) for stiffness or binding. b. Remove, clean, inspect, repair, and lubricate as necessary. c. Set aside for the present and reinstall after item 4.	4-13
2	Conditioned Air Filter	a. Remove, clean, inspect, and service filter (2). b. Discard filter (2) and obtain replacement, if damaged. c. Place filter aside for the present and reinstall after item 4.	4-13
			
3	Conditioned Air (Evaporator) Fan and Motor	a. Wipe all dust or dirt from fan (1), motor (2), and all other components and surfaces in the area. b. Inspect fan (1) for damaged or bent blades, the motor (2) for signs of overheating, and all mounting hardware for tightness and security. c. Inspect wiring harness (3) for damage or chafing and all electrical connections for tightness.	4-41

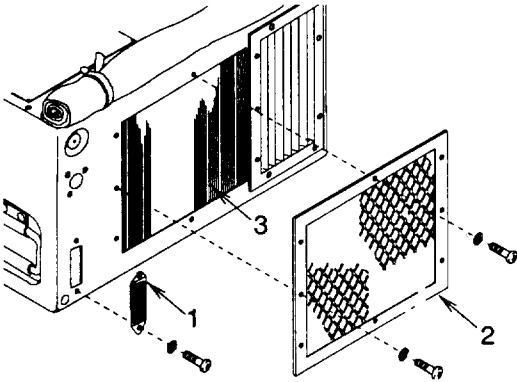
Table 4-1. Unit Preventive Maintenance Checks and Services (PMCS)  
Quarterly Schedule - continued

Item No.	Item to be Inspected/Service	Procedures	Para Ref.
4	 <p>Condensate Drain Tubing</p>	<p>a. Check for loose connections, missing clamps (1), indications of water leaks, and damaged or missing tubing (2).</p> <p>b. Repair or replace as indicated.</p> <p>c. Install filter and return air louver.</p>	4-19
5	 <p>Conditioned Air Supply Louver</p>	<p>a. Check operation of louvers (1) for stiffness or binding.</p> <p>b. Remove, clean, inspect, repair, and lubricate as necessary.</p> <p>c. Set aside for the present and reinstall after item 8.</p>	4-14
6	Mist Eliminator	<p>a. Remove, clean, and inspect top front panel (2). Set aside for present and reinstall after item 8.</p> <p>b. Remove, clean, inspect, and service mist eliminator (3).</p> <p>c. Replace mist eliminator (3) if it is damaged.</p> <p>d. Set aside for the present and reinstall after item 8.</p>	4-16

**Table 4-1. Unit Preventive Maintenance Checks and Services (PMCS)**  
**Quarterly Schedule - continued**

Item No.	Item to be Inspected/Service	Procedures	Para Ref.
7	Evaporator Coil	<div style="border: 1px solid black; padding: 2px; text-align: center; margin-bottom: 10px;"><b>WARNING</b></div> <p>Compressed air used for cleaning purposes will not exceed 30 psi (2.1 kg/cm<sup>2</sup>).</p>  <p>a. Blow accumulated dust and dirt out of air passages in evaporator coil (1) using compressed air. Blow from front to back in opposite direction from operational airflow.</p> <p>b. Inspect coil (1) for obvious damage and all mounting hardware for tightness and security. Straighten any bent fins.</p>	4-45
8	Heating Elements	<p>a. Wipe any remaining dust or dirt from heating elements (2), heater thermostat, and all other components and surfaces in the area.</p> <p style="text-align: center;"><b>NOTE</b></p> <p>Use a clean, dry cloth (or one slightly moistened with water) for all wiping operations. NEVER use an oily or greasy cloth, oily residue left on any surface will attract and accumulate much more dust and dirt than dry surfaces.</p> <p>b. Inspect heating elements (2) and thermostat for obvious damage and all mounting hardware for tightness and security.</p> <p>c. Inspect wiring harness for damage or chafing and all electrical connections for tightness.</p> <p>d. Install mist eliminator, conditioned air supply louver, and top front panel.</p>	4-43

**Table 4-1. Unit Preventive Maintenance Checks and Services (PMCS)  
Quarterly Schedule - continued**

Item No.	Item to be Inspected/Service	Procedures	Para Ref.
			
9	Fresh Air Ventilation Guard	a. Remove, clean, and inspect ventilation guard (1). b. Discard and obtain replacement, if damaged. c. Reinstall.	4-12
10	Condenser Air Inlet Guard	a. Remove, clean, and inspect, inlet guard (2), as necessary. b. Place guard (2) aside for the present and reinstall after item 14.	4-12
		<div style="border: 1px solid black; padding: 2px; display: inline-block;"><b>WARNING</b></div> <p>Compressed air used for cleaning purposes will not exceed 30 psi (2.1 kg/cm<sup>2</sup>).</p>	
11	Condenser Coil	a. Blow accumulated dust and dirt out of air passages in condenser coil (3) using compressed air. Blow from inside for reverse airflow direction. b. Inspect coil (3) for obvious damage and all mounting hardware for tightness and security. Straighten any bent fins.	4-48

**Table 4-1. Unit Preventive Maintenance Checks and Services (PMCS)  
Quarterly Schedule - continued**

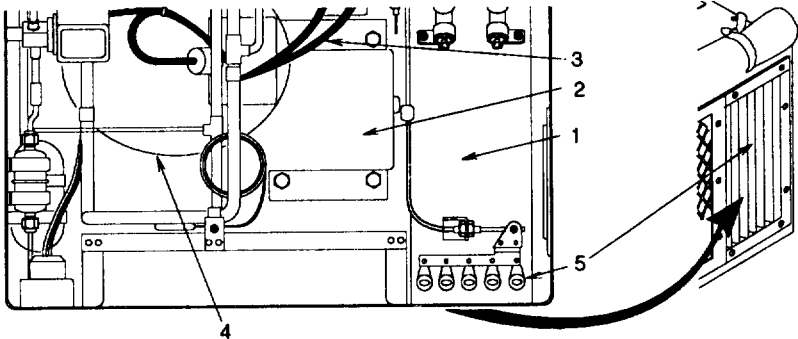
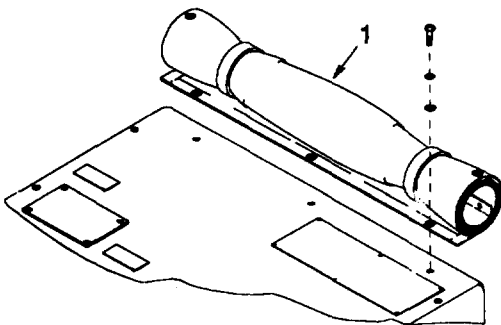
Item No.	Item to be Inspected/Service	Procedures	Para Ref.
			
12	Condenser Fan and Motor	<ol style="list-style-type: none"> <li>Wipe dust and dirt from fan (1) and motor (2) and all other components and surfaces in the area.</li> <li>Inspect fan (1) for damage or bent blades, motor (2) for signs of overheating, and all mounting hardware for tightness and security.</li> <li>Inspect wiring harness (3) for damage or chafing and all electrical connections for tightness.</li> </ol>	4-44
13	Compressor	<ol style="list-style-type: none"> <li>Wipe dust or dirt from the compressor (4) canister and remaining components and surfaces in the lower section of the cabinet.</li> <li>Inspect compressor crankcase heater element for signs of over-heating or deterioration.</li> <li>Inspect wiring harness for damage or chafing and all electrical connections for tightness.</li> <li>Check all mounting hardware for damage or chafing.</li> </ol>	4-34
14	Condenser Discharge Air Louver and Actuator	<ol style="list-style-type: none"> <li>Check all mounting hardware and linkage connections for tightness.</li> <li>Clean and lubricate as necessary.</li> <li>Install condenser air inlet guard and top rear panel.</li> </ol>	4-17
15	Panels, Nameplates and Housing	<ol style="list-style-type: none"> <li>Wipe all surfaces clean.</li> <li>Check that all Warning and instruction plates are in place and legible.</li> <li>Replace missing or illegible plates.</li> <li>Check that all panels 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.</li> </ol>	4-11 and 4-15

Table 4-1. Unit Preventive Maintenance Checks and Services (PMCS)  
Quarterly Schedule - continued

Item No.	Item to be Inspected/Service	Procedures	Para Ref.
16	Fabric Cover	 <ol style="list-style-type: none"> <li>Roll down cover (1) and inspect for tears, cracks, or any other sign of damage or deterioration.</li> <li>If washing is necessary, use fresh water with a small amount of mild detergent.</li> <li>Reroll and secure cover in the stowed position. If cover was washed, be sure it is thoroughly dry before rerolling.</li> </ol>	4-10
17	Operational Checks	<p style="text-align: center;"><b>CAUTION</b></p> <p>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. Under moderate conditions, 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.</p> <ol style="list-style-type: none"> <li>Be sure MODE SELECTOR switch is in the OFF position and reconnect input power.</li> <li>Perform functional check of air conditioner in all operational modes in accordance with the instructions in paragraph 2-6.</li> <li>Set-up air conditioner for desired operational mode.</li> <li>Record performance of quarterly PMCS, including all corrective actions taken.</li> </ol>	2-6

## Section V TROUBLESHOOTING

**4-8. USE OF TROUBLESHOOTING TABLE..**

Table 4-2 contains troubleshooting information useful to unit 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. Included are 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.
- b. The technicians should first find the malfunction symptom or unsatisfactory performance characteristic in the table which most closely describes the immediate situation. 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 unit maintenance personnel, assistance should be requested from direct support maintenance.

## SYMPTOM INDEX

Trouble	Malfunction No.
<b>AIR CONDITIONER</b>	
Does Not Start . . . . .	1
Insufficient Cooling . . . . .	4
Operates Continuously on Cooling Cycle. . . . .	8
Fails To Heat . . . . .	11
Excessive Noise . . . . .	12
<b>EVAPORATOR</b>	
Evaporator Fan	
Does Not Start . . . . .	2
Stops During Operation . . . . .	2
Evaporator Air Output Volume Low. . . . .	9
<b>CONDENSER</b>	
Condenser Fan Fails to Operate . . . . .	3
Condenser Air Outlet Volume Low . . . . .	10
<b>COMPRESSOR</b>	
Compressor Will Not Start. . . . .	5
Compressor Short Cycles . . . . .	6
Compressor Starts But Goes Out On Overload . . . . .	7



Table 4-2. TROUBLESHOOTING


MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<b>1. AIR CONDITIONER DOES NOT START IN ANY MODE.</b>		
Step 1. Check if circuit breakers are tripped.		
Reset circuit breakers.		
Step 2. Check if input power has been disconnected.		
Connect input power.		
		
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.		
Tighten or replace connectors, or repair damaged wires.		
Step 4. Check that internal wiring is connected to terminal board TB3 for correct input connector.		
See paragraph 4-5 and move wires if necessary.		
Step 5. Check for defective circuit breaker. (See para 4-25 or 4-33.)		
Replace circuit breaker if defective.		
Step 6. Check for defective MODE SELECTOR switch. (See para 4-24.)		
Replace switch if defective.		
<b>2. CONDITIONED (EVAPORATOR) AIR FAN DOES NOT START OR STOPS DURING OPERATION IN ANY MODE.</b>		
Step 1. Check operation of evaporator fan motor. (See para 4-41.)		
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.		
Step 4. Check fan for binding. (See para 4-41.)		
Relieve binding or replace fan.		

Table 4-2. TROUBLESHOOTING - continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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**3. CONDENSER FAN FAILS TO OPERATE.**

Step 1. Check operation of condenser fan motor. (See para 4-44.)

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 4-44.)

Relieve binding or replace fan.

Step 4. Test condenser fan relay. (See fig. 4-4 and para 4-32.)

Replace bad relay.

Step 5. (Three phase units only.) Check phase sequence relay. (See para 4-30.)

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 or bubbly refrigerant indicates low level or excessive moisture.

Notify supervisor.

Step 3. Inspect evaporator and condenser coil for dirt.

Clean coil with 25-30 psi compressed air. (See para 4-45 and 4-48.)

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

Clean filter.

Step 5. Inspect mist eliminator for dirt. (See para 4-16.)

Remove, clean, and/or replace mist eliminator.

Step 6. Check for obstructions to airflow.

Remove any obstructions to airflow (evaporator and condenser sides).

Table 4-2. TROUBLESHOOTING - continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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**4. INSUFFICIENT COOLING. - continued**

Step 7. Check if supply air outlet louver is blocked or set in closed position. (See para 4-14.)

Remove blockage or open louver.

Step 8. Observe evaporator fan motor for worn or defective condition. (See para 4-41.)

Replace motor.

Step 9. Check if evaporator and condenser fans are loose or defective. (See para 4-41 and 4-44.)

Tighten setscrew or replace fan.

Step 10. Check area near condenser guard and fresh air inlet for heat source over 12°F (40°C).

Remove heat source.

**5. COMPRESSOR WILL NOT START.**

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

Reset controls properly.

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

Reset pressure switches. Notify supervisor 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. (Three phase units only.) Check phase sequence relay.

Replace bad relay.

Step 6. Check continuity across primary and secondary winding of control transformer for defective windings. (See para 4-40.)

Replace bad transformer.

Step 7. Check forward and reverse resistance of rectifier assembly diodes. (See para 4-39.)

Replace bad rectifier.

Table 4-2. TROUBLESHOOTING - continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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**5. COMPRESSOR WILL NOT START. - continued**

Step 8. Observe operation of time delay relay. (See para 4-29.)

Replace bad relay.

Step 9. Substitute compressor relay known to be good, and check operation. (See para 4-31.)

Replace bad relay.

**NOTE**

Compressor start capacitor (single phase unit using keco compressor only) is not connected to start relay.

Step 10. Test compressor start capacitor (single phase unit using welco compressor only) .  
(See para 4-37.)

Replace bad capacitor.

Step 11. 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.

(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 supervisor.

**6. 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 4-48.)

Clean condenser coil.

Step 3. Check if HIGH PRESSURE cutout switch RESET is tripped.

Push and release HIGH PRESSURE switch to RESET.

Step 4. Check if LOW PRESSURE cutout switch RESET is tripped.

Push and release LOW PRESSURE switch to RESET.

Table 4-2. TROUBLESHOOTING - continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<b>7. COMPRESSOR STARTS, BUT GOES OUT ON OVERLOAD.</b>		
Step 1. Observe condenser fan motor for failure. (See para 4-44.)		
Replace bad motor.		
Step 2. Check for dirty condenser coil or guard. (See para 4-48.)		
Clean coil and guard.		
Step 3. Check that air outlet louvers are not stuck or jammed in closed position.		
Free louvers and control cable. Adjust control, or notify supervisor if actuating cylinder is not working properly.		
<b>8. UNIT OPERATES CONTINUOUSLY ON COOLING CYCLE.</b>		
Step 1. Check position of TEMPERATURE SELECTOR switch. (See para 2-2.)		
Move selector to WARMER.		
Step 2. Check TEMPERATURE SELECTOR switch S3. (See para 4-22.)		
Replace it defective.		
<b>9. EVAPORATOR AIR OUTPUT VOLUME LOW.</b>		
Step 1. Check for dirty or damaged filterer louvers. (See para 4-13.)		
Clean or replace filter. Clean or replace louvers as required.		
Step 2. Check for dirty or iced evaporator coil. (See para 4-45.)		
Deice and clean coil.		
Step 3. Inspect evaporator fan for damage. (See para 4-41.)		
Replace fan.		
Step 4. Check for bad fan motor. (See para 4-41.)		
Replace motor.		
Step 5. Check to be sure that EVAPORATOR FAN SPEED switch is not set at LOW speed.		
Reset switch to HIGH speed.		

Table 4-2. TROUBLESHOOTING - continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<b>10. CONDENSER AIR OUTLET VOLUME LOW.</b>		
Step 1. Check for dirty condenser coil or guard. (See para 4-48.)		
Clean coil and guard.		
Step 2. Inspect condenser fan for damage. (See para 4-44.)		
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 notify supervisor if actuating cylinder is not working properly.		
<b>11. AIR CONDITIONER FAILS TO HEAT.</b>		
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 4-41.)		
Replace bad motor.		
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 4-43.)		
Tighten connections and fix bad wiring. Replace bad heater elements.		
Step 7. Check continuity of heater relay coils. (See para 4-31.)		
Replace bad relay.		
Step 8. Check operation of heater high-temperature cutout thermostatic switch. It should open when temperature rises above setting. (See para 4-42.)		
Replace bad thermostatic switch.		

Table 4-2. TROUBLESHOOTING - continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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**12. 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 4-41 and 4-44.)

Replace worn or bad motor.

Step 3. Listen for compressor knocks or chatter.

Stop air conditioner and notify supervisor.

**Section VI UNIT MAINTENANCE PROCEDURES****4-9. GENERAL.**

The procedures in this section have been arranged in the order in which the items appear in the unit (0) 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 unit maintenance in the order in which they appear on the MAC.

## 4-10. FABRIC COVER.

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

### INITIAL SETUP

#### Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1  
Scrub Brush  
Appendix B, item 2

#### Materials/Parts

Fabric Cover  
Lockwashers (3)  
Detergent  
Appendix E, item 15

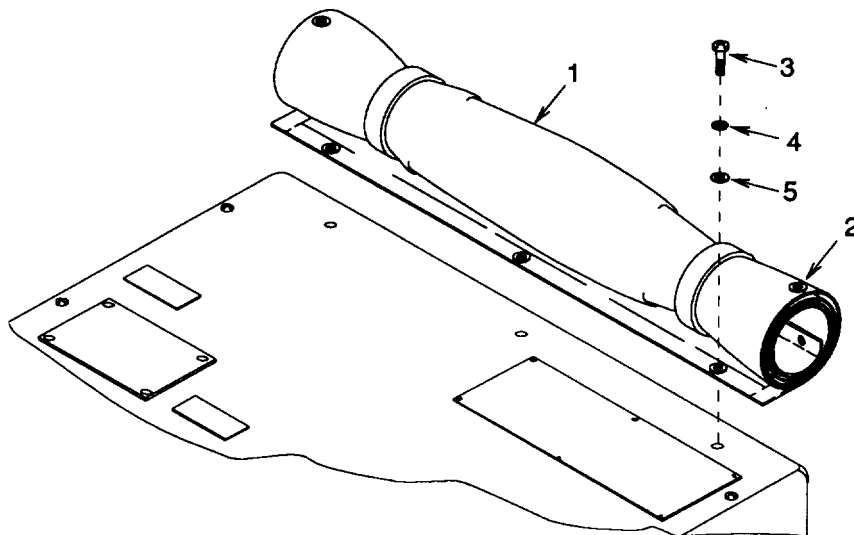


Figure 4-7. Fabric Cover

### REMOVAL

1. Unsnap four snap fasteners (2).
2. Remove three sets of screws (3), lock washers (4), and flat washers (5). Lift fabric cover (1) from unit.

### 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.

### REPLACEMENT

Check fabric cover for cuts, tears, and damaged or missing screw eyelets or snap fasteners. Replace cover if damaged.

### INSTALLATION

1. Secure fabric cover (1) to the unit with three sets of screws (3), lock washers (4), and flat washers (5).
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 (2).



**4-11. TOP PANELS.**

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

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
Appendix B, item 1  
Scrub Brush  
Appendix B, item 2

**Equipment Condition**

Disconnect power at power source.  
Remove fabric cover (para 4-10).

**General Safety Instructions****WARNING****Materials/Parts**

Dry cleaning solvent  
Appendix E, item 3  
Rags  
Appendix E, item 13  
Detergent  
Appendix E, item 15

Dry cleaning solvent used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Use in well ventilated area.

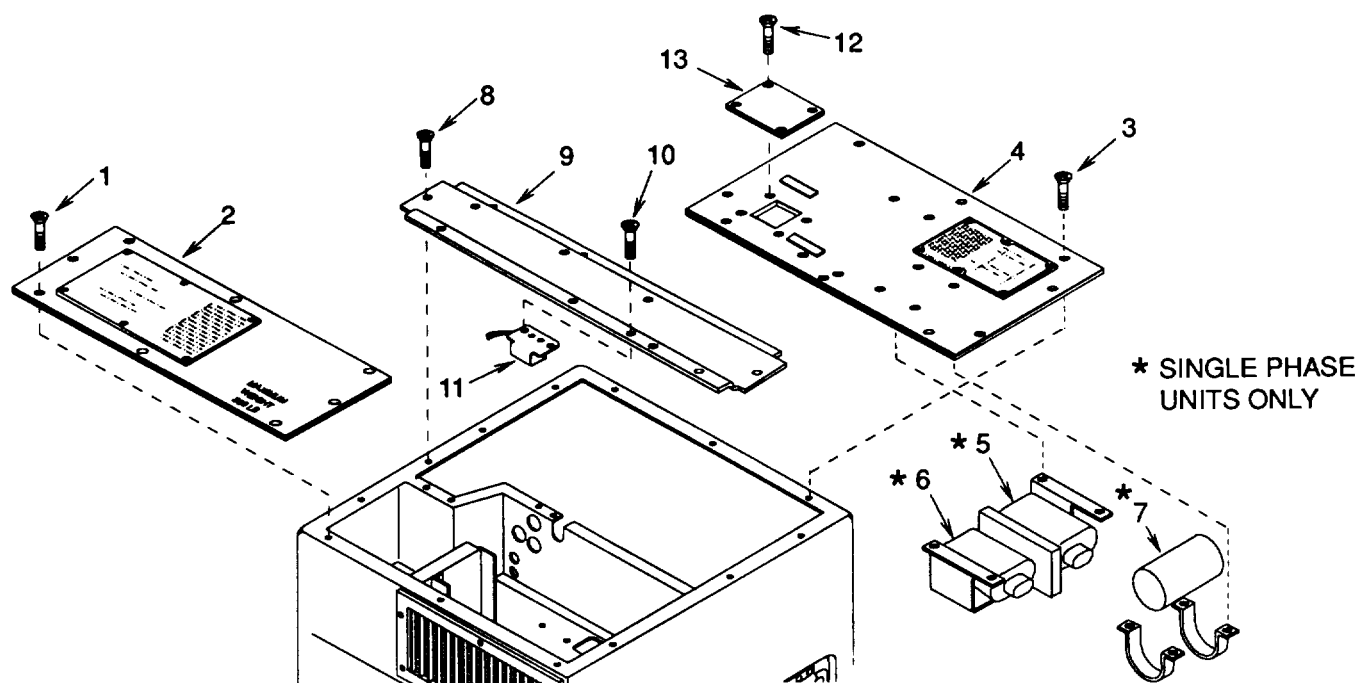


Figure 4-8. Top Panels

#### **4-11. TOP PANELS. - continued**

##### **NOTE**

Top rear panel (4) and access panel (13) can be removed independently. Top center panel (9) must be removed last.

##### **REMOVAL**

1. Remove eight screws (1) and top front panel (2).
2. Remove seven screws (3) and top rear panel (4).
3. On single phase unit only remove run capacitors C2 and C3 (5 and 6). (See para 4-36.)
4. On single phase unit only remove start capacitor C5 (7). (See para 4-37.)
5. Remove six screws (8) and top center panel (9).
6. Carefully raise top center panel (9) and remove two screws (10) and heater cutout switch bracket (11).
7. Remove four screws(12) and access panel (13).

##### **WARNING**

Dry cleaning solvent used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Use in well ventilated area.

##### **CLEANING**

Clean the panels with a rag dampened with a detergent solution or dry cleaning solvent. Use a soft brush if necessary to dislodge caked on dirt. Dry the items thoroughly.

##### **INSTALLATION**

1. Secure access panel (13) to top rear panel (4) with four screws 12).
2. Secure heater cutout switch bracket (11) to top center panel (9) with two screws (10).
3. Install top center panel (9) with six screws (8).
4. On single phase unit only install start capacitor C5 (7). (See para4-37.)
5. On single phase unit only install run capacitors C2 and C3 (5 and 6). (See para 4-36.)
6. Install top rear panel (4) with seven screws (3).
7. Install top front panel (2) with eight screws (1).

##### **NOTE**

FOLLOW-ON MAINTENANCE:  
Install fabric cover (para 4-10).  
Connect power at power source.

**4-12. REAR SCREENS AND GUARDS.**

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

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
 Appendix B, item 1  
 Scrub Brush  
 Appendix B, item 2

**Materials/Parts**

Dry cleaning solvent  
 Appendix E, item 3  
 Rags  
 Appendix E, item 13  
 Detergent  
 Appendix E, item 15  
 Lock washers (10)

**Equipment Condition**

Disconnect power at power source.

General Safety Instructions

**WARNING**

Dry cleaning solvent used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Use in well ventilated area.

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

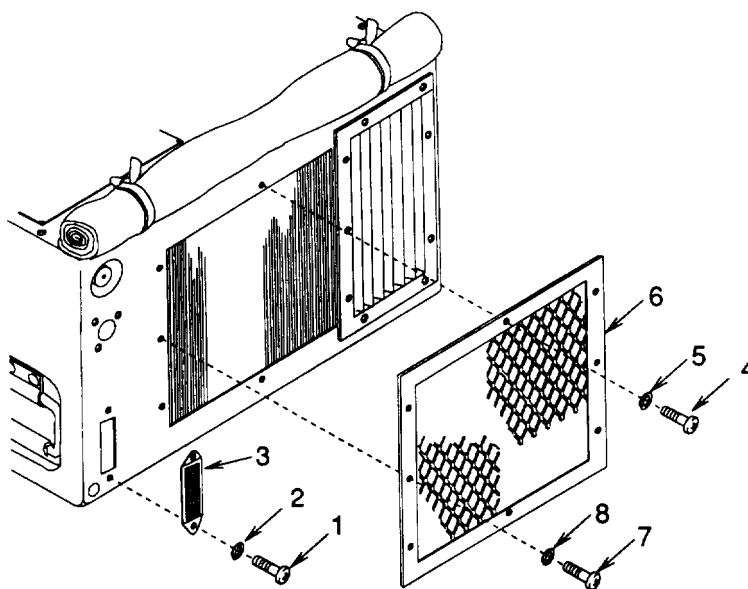


Figure 4-9. Rear Screens

**4-12. REAR SCREENS AND GUARDS. - continued**

**REMOVAL**

1. Remove two screws (1), lock washers (2), and fresh air ventilation screen (3).
2. Remove two screws (4) and lock washers (5) from horizontal frames of condenser air inlet screen (6).

**NOTE**

The six screws (7) on the vertical frames of the condenser air inlet screen also secure the condenser coil to the air conditioner housing.

3. Remove six screws (7), lock washers (8), and condenser air inlet screen (6).

**WARNING**

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

Dry cleaning solvent used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Use in well ventilated area.

**CLEANING**

1. Usually if is only necessary to wipe or brush the dirt from the screens.
2. If the screens are extremely dirty, clean with a detergent solution or dry cleaning solvent.

**INSTALLATION**

**NOTE**

The six screws (7) on the vertical frames of the condenser air inlet screen also secure the condenser coil to the air conditioner housing.

1. Install condenser air inlet screen (6) using six screws (7) and lock washers (8).
2. Install two screws (4) and lock washers (5).
3. Install fresh air ventilation screen (3) using two screws (1) and lock washers (2).

**NOTE**

FOLLOW-ON MAINTENANCE:  
Connect power at power source.

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

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

##### INITIAL SETUP

###### Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1  
Scrub Brush  
Appendix B, item 2

###### Equipment Condition

Disconnect power at power source.

###### General Instructions

**WARNING**

###### Materials/Parts

Dry cleaning solvent  
Appendix E, item 3  
Rags  
Appendix E, item 13  
Detergent  
Appendix E, item 15  
Lock washers (8)  
Air filter Coater  
Appendix E, item 1

Dry cleaning solvent used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Use in well ventilated area.

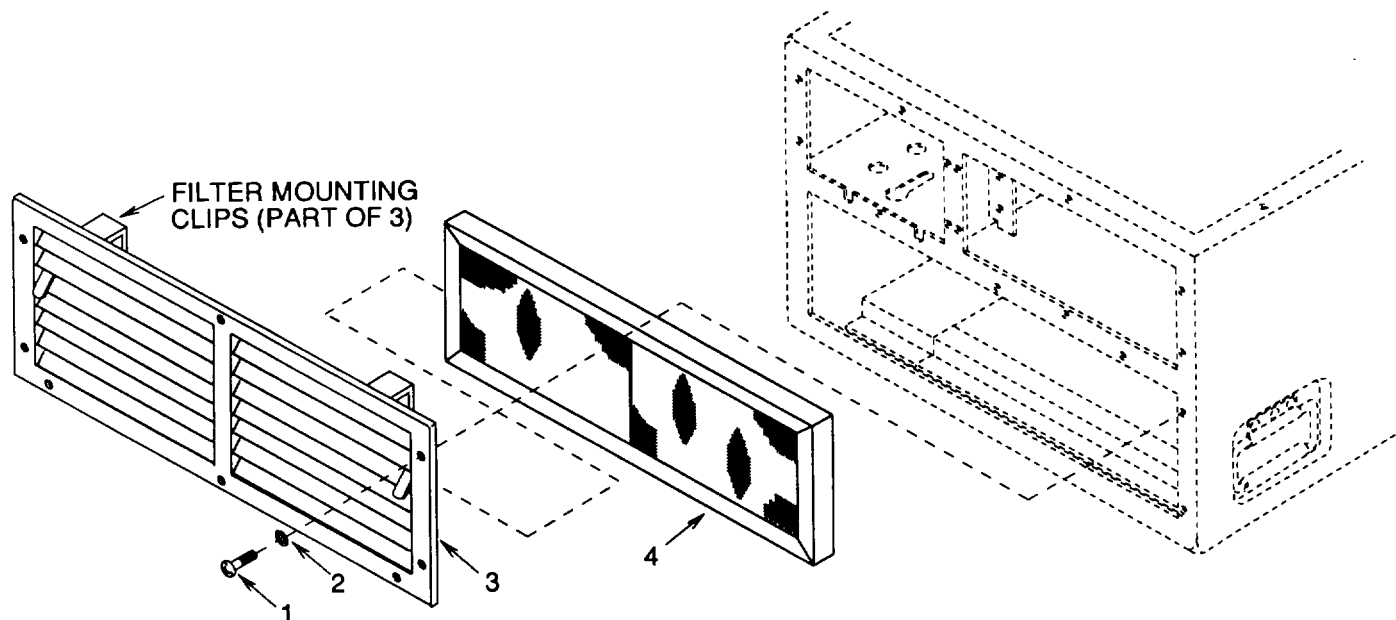


Figure 4-10. Return Air Louver and Air Filter

#### **4-13. RETURN AIR LOUVER AND AIR FILTER. - continued**

##### **REMOVAL**

1. Remove eight screws (1) and lock washers (2) and pull louver (3) from unit.
2. Remove filter (4) from clips on back of louver.

##### **WARNING**

Dry cleaning solvent used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Use in well ventilated area.

##### **CLEANING**

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.
2. Immerse filter in mild detergent solution or dry cleaning solvent.
3. Agitate until dirt is removed, using a soft brush if necessary to loosen caked-on dirt.
4. Rinse in clear water.
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.

##### **INSPECTION**

1. Check filter (4) for punctures, cuts, and damaged edges that would allow passage of unfiltered air.
2. Check filter (4) for packed or mashed areas that would block air flow.
3. Replace filter (4) if found bad.

##### **INSTALLATION**

1. Sparingly apply air filter coater.
2. Airflow arrows should point away from louver.
3. Place filter (4) in retainer clips.
4. Secure louver(3) with screws (1) and lock washers (2).

##### **NOTE**

FOLLOW-ON MAINTENANCE:  
Connect power at power source.

**4-14. SUPPLY AIR LOUVER.**

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

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
 Appendix B, item 1  
 Scrub Brush  
 Appendix B, item 2

**Equipment Condition**

Disconnect power at power source.  
 General Safety Instructions

**WARNING****Materials/Parts**

Dry cleaning solvent  
 Appendix E, item 3  
 Rags  
 Appendix E, item 13  
 Detergent  
 Appendix E, item 15  
 Lock washers (6)

Dry cleaning solvent used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Use in well ventilated area.

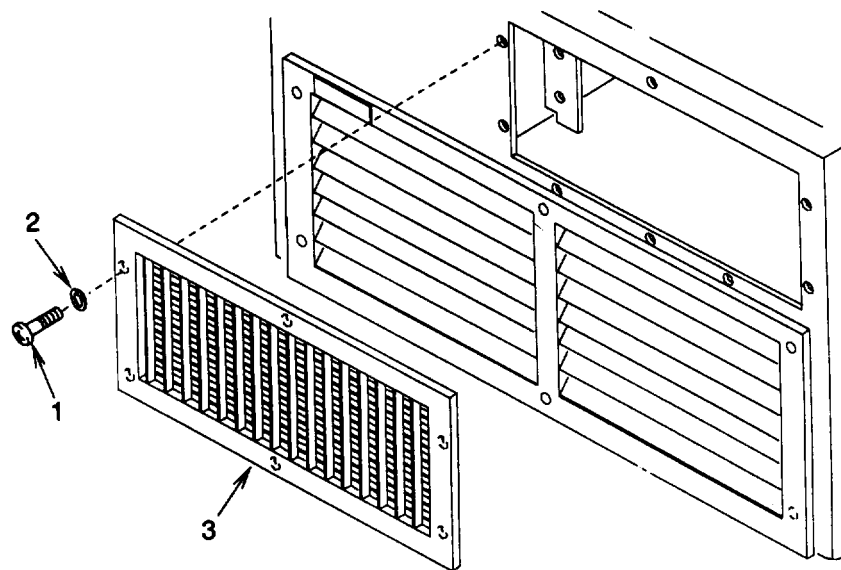


Figure 4-11. Supply Air Louver

**4-14. SUPPLY AIR LOUVER. - continued**

**REMOVAL**

Remove six screws (1) and lock washers (2) and pull louver (3) from the unit.

**WARNING**

Dry cleaning solvent used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Use in well ventilated area.

**CLEANING**

- 1. Usually it is only necessary to wipe or brush dirt from louver.
- 2. If louver is extremely dirty, immerse in a detergent solution or dry cleaning solvent.
- 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.

**INSTALLATION**

Secure louver (3) with screws (1) and lock washers (2).

**NOTE**

FOLLOW-ON MAINTENANCE:  
Connect power at power source.

**4-15. INFORMATION PLATES.**

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

**INITIAL SETUP**

**Tools**

Refrigeration Unit Service Tool Kit  
Appendix B, item 1  
Drill  
Appendix B, item 2  
Drill set  
Appendix B, item 2

Equipment Condition

Disconnect power at power source.

**Materials/Parts**

Drive screws (20)  
Electrical Schematic Plate  
Fluid Diagram Plate  
Identification Plate  
Danger Plate



#### 4-15. INFORMATION PLATES. - continued

##### INSPECTION

Replace any plate that is damaged, missing, or illegible.

##### REMOVAL

Remove old plate by drilling out drive screws. Use drill stop or similar tool to avoid damage to internal parts.

##### INSTALLATION

Install new plate with drive screws.

#### NOTE

FOLLOW-ON MAINTENANCE:  
Connect power at power source.

#### 4-16. MIST ELIMINATOR.

---

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

###### Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1  
Scrub Brush  
Appendix B, item 2

###### Equipment Condition

Disconnect power at power source.

General Safety Instructions

#### WARNING

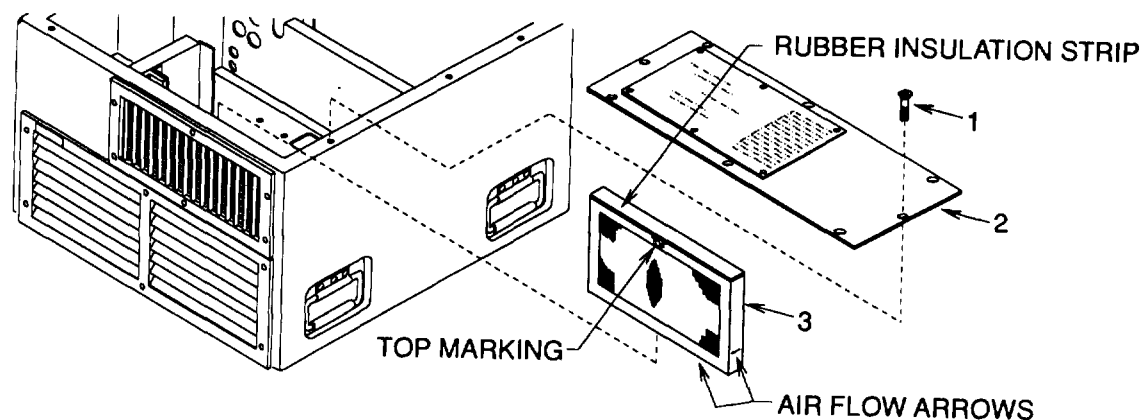
###### Materials/Parts

Dry cleaning solvent  
Appendix E, item 3  
Detergent  
Appendix E, item 15

Dry cleaning solvent used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Use in well ventilated area.

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**4-16. MIST ELIMINATOR. - continued**



**Figure 4-12. Mist Eliminator**

**REMOVAL**

1. Remove eight screws (1) and top front panel (2).
2. Pull mist eliminator (3) up and out of mounting frame.

**WARNING**

Dry cleaning solvent used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Use in well ventilated area.

**CLEANING**

1. Immerse in a detergent solution or dry cleaning solvent.
2. Agitate until dirt is removed, using a soft brush if necessary to loosen caked-on dirt.
3. Rinse in clean water.
4. Drain, then hold horizontal and tap each edge on bench or floor to dislodge droplets.

**INSPECTION**

1. Check mist eliminator (3) for punctures, cuts, and damaged edges that would allow air to bypass.
2. Check mist eliminator (3) for packed or mashed areas that would block airflow.
3. Replace mist eliminator (3) if found bad.

**4-16. MIST ELIMINATOR. - continued****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 (3) down into mounting frames observing airflow arrows and top marking.
3. Install top front panel (2) and secure with eight screws (1).

**NOTE**

FOLLOW-ON MAINTENANCE:  
Connect power at power source.

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


---

This task covers:      a. Cleaning      b. Inspection      c. Adjustment      d. Replacement

---

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
Appendix B, item 1  
Scrub Brush  
Appendix B, item 2

**Equipment      Condition**

Remove top rear panel (para 4-11).  
Remove condenser air inlet screen (para 4-12).

**General Safety Instructions****Materials/Parts**

Detergent  
Appendix E, item 15  
Rags  
Appendix E, item 13  
Lock washer  
Cotter Pins (5)

**WARNING**

Do not tamper with cylinder or refrigerant tubing connections. If actuating cylinder is suspected bad, notify supervisor.

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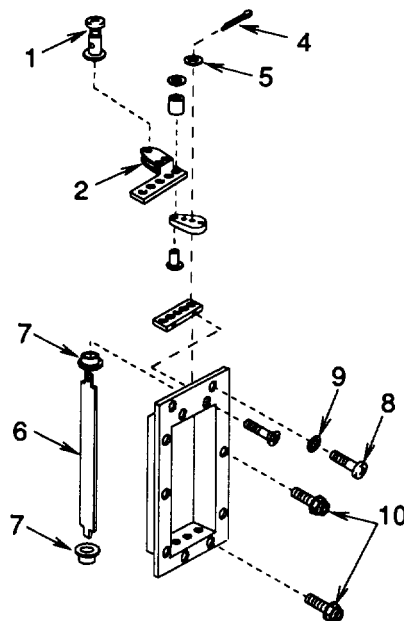
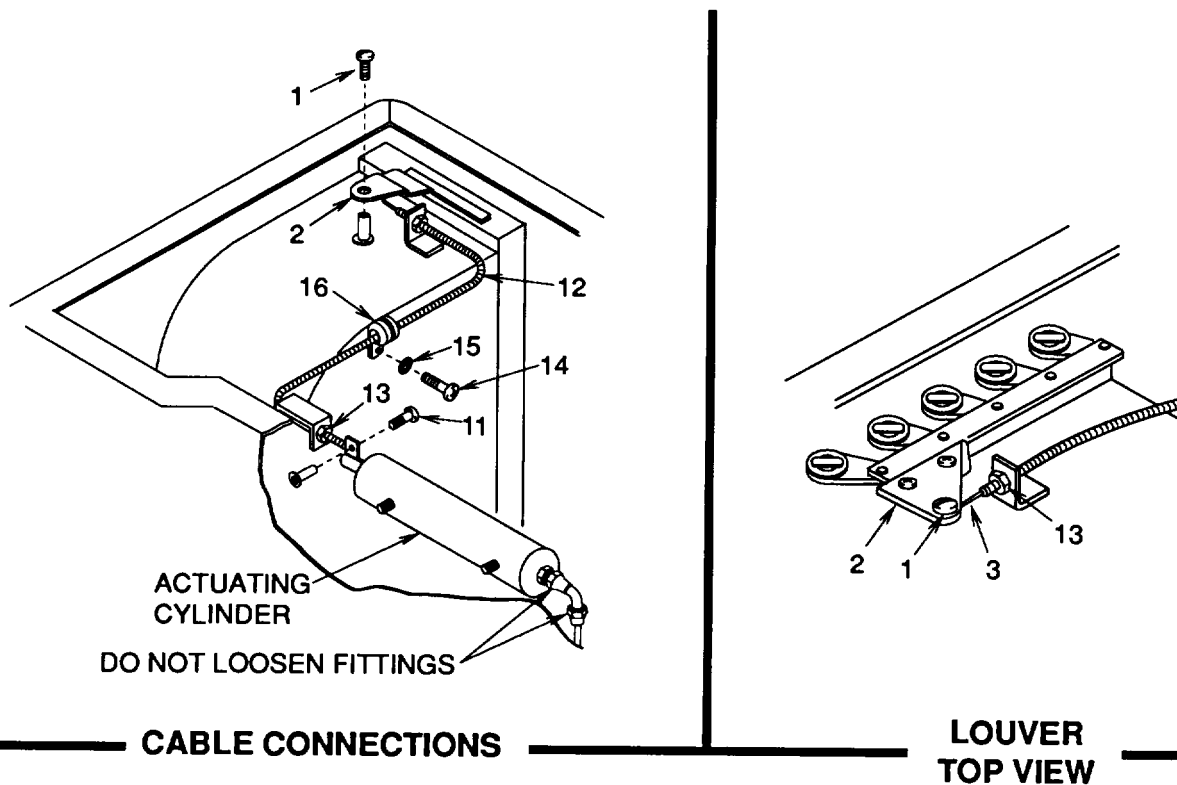
**CLEANING**

Clean the louver assembly with a soft brush or wash with water and a mild detergent solution.

**INSPECTION**

1. Check louver for bent blades(6), missing or damaged gaskets, and missing hardware or bearings.
2. Clean linkage with a soft brush and damp rag.
3. Check push-pull cable attaching hardware (mechanical post and screws etc.) for tightness.

**4-17. CONDENSER AIR DISCHARGE LOUVER AND LINKAGE. - continued**



**LOUVER ASSEMBLY (11)**

Figure 4-13. Condenser Air Discharge Louver and Linkage

**4-17. CONDENSER AIR DISCHARGE LOUVER AND LINKAGE. - continued****ADJUSTMENT**

1. If unit has been operating wait until it has cooled to ambient temperature, approximately four hours.
2. Loosen mechanical post screw (1) on louver connecting link (2).
3. Close louvers.
4. Pull wire (3) tight with needle nose pliers and tighten mechanical post screw (1).
5. Louvers must be tightly closed.

**REPLACEMENT****WARNING**

Do not tamper with cylinder or refrigerant tubing connections. If actuating cylinder is suspected bad, notify supervisor.

1. Louver blade only.

**NOTE**

Individual Louver Blades are flexible enough for removal.

- a. Remove cotter pin (4) and washers (5) from louver blade (6) to be removed.
  - b. Flex or spring blade (6) to remove ends from bearings (7).
  - c. Remove blade(6).
  - d. Replace bearings (7') if they are damaged.
  - e. Flex or spring new blade (6) and install.
  - f. Install washer (5) and cotter pin (4).
2. Louver, linkage assembly, and cable removal.
    - a. Loosen mechanical post screw (1) and pull push-pull control cable wire (3) from louver connecting link (2).
    - b. Remove four screws (8) and lock washers (9) and two snap fasteners (10).
    - c. Slide louver assembly from unit.
    - d. Loosen mechanical post screw (11) and pull push-pull control cable wire (12) from actuating cylinder.
    - e. Remove nuts (13) from the two ends of the cable.
    - f. Remove screw (14), lock washer (15), and clamp (16) from cable (12).
    - g. Replace any damaged parts.

**4-17. CONDENSER AIR DISCHARGE LOUVER AND LINKAGE. - continued**

3. Louver, linkage assembly, and cable installation.
- a. Install one nut (13) 1/2 inch from each end of cable (12).
  - b. Insert cable (12) into retaining brackets.
  - c. Install nuts (13) on each end of cable (12) and tighten.
  - d. Install clamp (16), screw (14), and lock washer (15).
  - e. Slide louver assembly into unit and secure with four screws (8), lock washers (9), and two snap fasteners(10).
  - f. Insert push-pull control cable wire end through mechanical post (1).
  - g. Insert end of wire thru mechanical post(11 ) and tighten screw(11 ) at actuating cylinder end.
  - h. Close louvers and pull control cable wire (3) tight with needle nose pliers and tighten mechanical post screw (1).

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install Top Rear Panel (para 4-11).  
Install condenser air inlet screen (para 4-12).

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

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This task covers:      a. Cleaning      b. Inspection

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INITIAL SETUP

Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

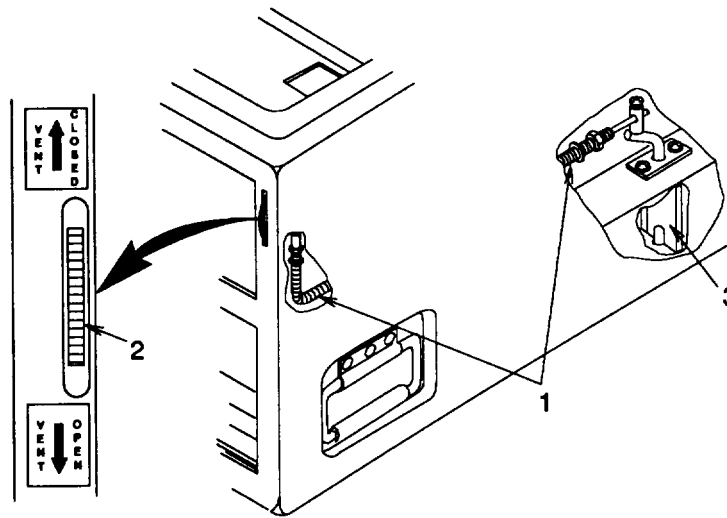
Equipment Condition

Remove supply air louver (para 4-14).  
Remove return air louver (para 4-13).

Materials/Parts

Rags  
Appendix E, item 13

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**4-18. FRESH AIR DAMPER AND ACTUATOR. - continued****Figure 4-14. Fresh Air Damper and Actuator****CLEANING**

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

**INSPECTION**

1. Check push-pull control cable (1) for operation by turning actuator plate wheel (2).
2. Check that damper (3) moves when actuator plate (2) is turned.

**NOTE**

**FOLLOW-ON MAINTENANCE:**  
Install return air louver (para 4-13).  
Install supply air louver (para 4-14).

# **4-19. CONDENSATE DRAIN.**

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

## **INITIAL SETUP**

### **Tools**

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

### **Equipment Condition**

Remove return air louver (para 4-13).

### **Materials/Parts**

#### **Tubing**

Appendix F, fig. F-15  
Tee Connector

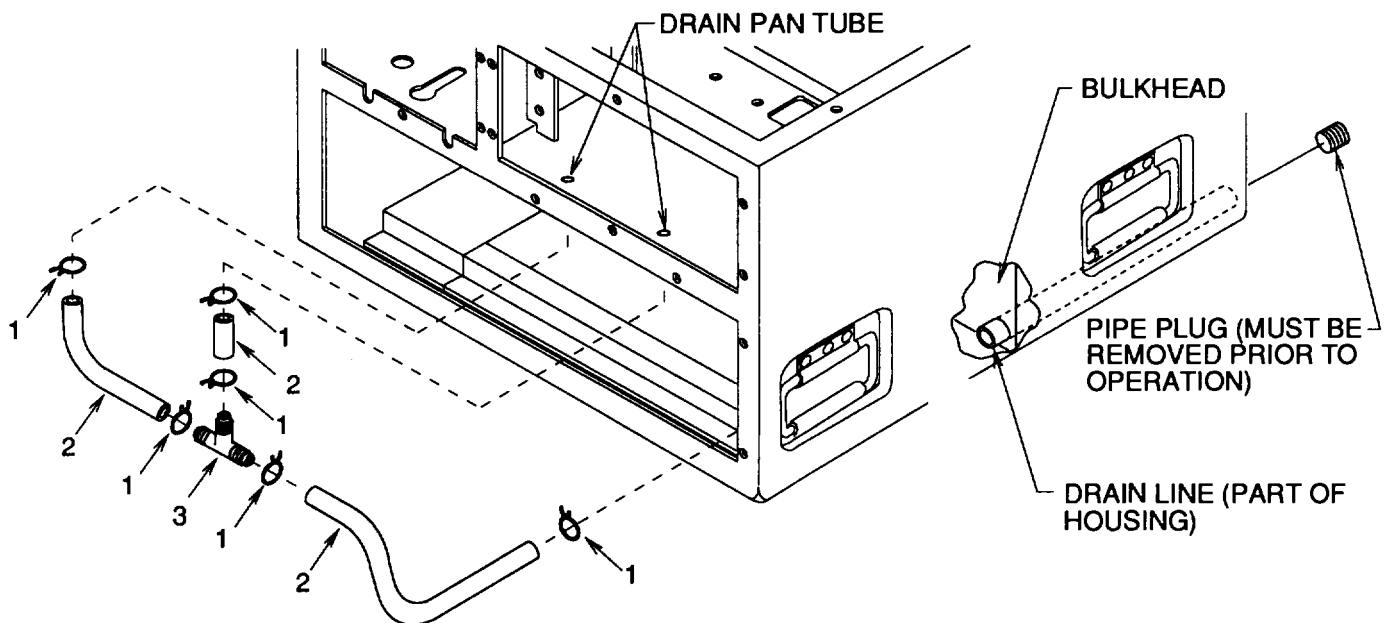


Figure 4-15. Condensate Drain Lines



**4-19. CONDENSATE DRAIN. - continued****REMOVAL**

1. Remove clamps (1).
2. Pull tubing (2) loose from connection points in drain pan and housing.
3. Pull tubing (2) loose from tee connector (3).

**INSPECTION**

1. Check tubing (2) for cuts, splits, and deteriorated condition.
2. Check that aluminum tube from bulkhead to rear of unit is not clogged.
3. Check that tee connector (3) is not clogged.

**CLEANING**

1. Clean drain tubes in bottom of drain pan.
2. Clean aluminum tube running from bulkhead to rear of unit.
3. Clean tee connector (3).
4. Flush tubes and tee connector with clean water.

**REPLACEMENT**

Replace damaged tubing or tee connection found during inspection.

**INSTALLATION**

1. Slide clamps (1) onto tubes (2).
2. Slip tubing (2) onto tee connector (3). Tighten clamps (1).
3. Slip tubing (2) onto connection points in drain pan and housing. Tighten clamps (1).

**NOTE**

**FOLLOW-ON MAINTENANCE:**  
Install return air louver (para 4-13).

4-20. ELECTRICAL WIRING REPAIR - GENERAL.

This task covers:      Repair

INITIAL SETUP

Tools	Materials/Parts
Refrigeration Unit Service Tool Kit Appendix B, item 1	Wire
Soldering Gun Kit Appendix B, item 2	Insulation Sleeving
Crimping Tool Kit Appendix B, item 2	Solder Appendix B, item 2
Heat Gun Appendix B, item 4	Flux Appendix B, item 2

REPAIR

1. 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. Flux should be brushed onto the joint before soldering. 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.
2. Insulating Joints.
 

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.
3. 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 directions, then twist each end around the other wire at least three turns. Solder and apply insulation as described above.
4. 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 wire, 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.

**4-20. ELECTRICAL WIRING REPAIR - GENERAL. - continued****NOTE**

Preferred repair methods consist of replacing wires, terminals, connectors, etc., rather than splicing wires, bending 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.

Table 4-3. WIRE LIST  
(A - indicates F9000H-3SA only, # - indicates F9000H-1SA only)

Termination		Termination		AWG Wire	Length	
From	Terminal Type	To	Terminal Type	Size	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
Δ S1-2C	13216E6191-1	S2-A2	13216E6191-1	20	7	17.8
Δ S1-2B	13216E6191-1	S2-B2	13216E6191-1	20	9	22.9
Δ S1-3C	13216E6191-1	S2-C2	13216E6191-1	20	8	20.3
S6-4	MS25036-108	S6-2	MS25036-108	16	2	5.1
S6-3	MS25036-108	TB2-9	13216E6191-2	16	18	45.7
S6-1	MS25036-108	TB2-7	13216E6191-2	16	18	45.7
S6-2	MS25036-108	TB2-8	13216E6191-2	16	18	45.7
# E2	MS25036-156	E3	MS25036-156	12	10	25.4
# E3	MS25036-156	E4	MS25036-156	12	10	25.4
# S4-2	13216E6191-1	S5-1	13216E6191-1	20	8	20.3
# K5-1	MS25036-153	C5-2	13211E8288	16	20	50.8
# K5-4	MS25036-153	C5-1	13211E8288	16	20	50.8
# C4-2	13216E6191-3	C5-2	MS25036-156	12	20	50.8

**AUXILIARY POWER CABLE ASSEMBLY**

J11-A	MS3100R18-11P	P6-A	MS3106R18-11S	12	40	101.6
J11-B	MS3100R18-11P	P6-B	MS3106R18-11S	12	40	101.6
Δ J11-C	MS3100R18-11P	P6-C	MS3106R18-11S	12	40	101.6
J11-D	MS3100R18-11P	P6-D	MS3106R18-11S	12	40	101.6

**COMPRESSOR WIRING HARNESS**

Δ P4-A	MS2106R20-15P	P10-A	MS2106R20-15S	12	22	55.9
Δ P4-B	MS2106R20-15P	P10-B	MS2106R20-15S	12	22	55.9
Δ P4-C	MS2106R20-15P	P10-C	MS2106R20-15S	12	22	55.9
# P4-A	-	K5-4	MS25036-156	12	22	55.9
# P4-B	-	K5-5	MS25036-156	12	22	55.9
# P4-C	-	C4-1	13216E6191-3	12	22	55.9
# P10-A	-	K5-4	MS25036-156	12	24	61.0
# P10-B	-	K5-5	MS25036-156	12	24	61.0
# P10-C	-	C4-1	MS25036-156	12	24	61.0
P4-D	MS2106R20-15P	P10-D	MS2106R20-15S	20	22	55.9
P4-E	MS2106R20-15P	P10-E	MS2106R20-15S	20	22	55.9
P4-F	MS2106R20-15P	P10-F	MS2106R20-15S	16	22	55.9
P4-G	MS2106R20-15P	P10-G	MS2106R20-15S	16	22	55.9

Table 4-3. WIRE LIST - continued  
(A - indicates F9000H-3SA only, # - indicates F9000H-1SA only)

Termination		Termination		AWG Wire	Length	
From	Terminal Type	To	Terminal Type	Size	IN.	CM

## TRANSFORMER AND RECTIFIER WIRING HARNESS

Δ T1-2	-	TB2-10	13216E6191-1	20	14	35.6
Δ T1-5	-	TB2-11	13216E6191-1	20	14	35.6
CR1-2	13216E6191-1	TB2-12	13216E6191-1	20	14	35.6
T1-7	-	CR1-1	13216E6191-1	20	14	35.6
T1-8	-	CR1-3	13216E6191-1	20	14	35.6
# T1-6	MS25036-149	CR1-4	13216E6191-1	20	14	35.6
# T1-1	-	TB2-10	13216E6191-1	20	14	35.6
# T1-6	-	TB2-11	13216E6191-1	20	14	35.6
# T1-3	-	T1-6	13216E6191-1	20	3	7.6

## CONTROL MODULE HARNESS

P2A-1	-	S2-A1	13216E6191-2	16	9	22.9
P2A-2	-	S2-B1	13216E6191-2	16	9	22.9
Δ 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
Δ P2A-6	-	S2-C3	13216E6191-1	20	10	25.4
Δ P2A-7	-	S1-3A	13216E6191-2	16	8	20.3
P2A-8	-	S1-4C	13216E6191-2	16	9	22.9
Δ P2A-9	-	S1-4A	13216E6191-2	16	9	22.9
P2A-11	-	CB1-A1	13216E6191-3	16	7	17.8
Δ P2A-11	-	S1-21	13216E6191-2	12	9	22.9
P2A-12	-	CB1-B1	13216E6191-3	16	7	17.8
Δ P2A-12	-	S1-22	13216E6191-2	12	9	22.9
Δ P2A-13	-	CB1-C1	13216E6191-3	16	7	17.8
Δ 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
Δ P2A-16	-	CB1-C2	13216E6191-3	12	11	27.9
P2B-3	-	S1-1D	13216E6191-1	20	12	30.5
P2B-4	-	S1-1B	13216E6191-1	20	11	27.9
P2B-5	-	S1-1A	13216E6191-1	20	11	27.9
Δ 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	-	E1	MS25036-153	16	7	17.8
Δ S1-21	-	S1-32	13216E6191-2	16	4	10.2
S1-22	-	S1-41	13216E6191-2	16	4	10.2
Δ S1-31	-	S1-42	13216E6191-2	16	4	10.2
Δ S2-B2	-	S1-2B	-	16	9	22.9
Δ S2-C2	-	S1-3C	-	16	9	22.9
Δ S2-A2	-	S1-2C	-	16	9	22.9
Δ S1-11	-	S3-1	-	20	8	20.3
Δ S1-12	-	S3-3	-	20	10	25.4
# P2A-3	-	S1-2B	13216E6191-1	20	9	22.9
# P2A-6	-	S2-B2	13216E6191-2	16	10	25.4
# P2A-7	-	S2-A2	13216E6191-3	16	8	20.3
# P2A-9	-	S1-3A	13216E6191-2	16	10	25.4
# P2A-11	-	S1-32	13216E6191-2	12	8	20.3
# P2A-12	-	S1-41	13216E6191-3	12	9	22.9
# P2B-6	-	S1-3C	13216E6191-1	20	7	17.8
# P2B-9	-	S1-31	13216E6191-1	20	11	27.9
# S1-21	-	CB1-A1	13216E6191-2	16	10	25.4
# S1-2C	-	S2-A2	13216E6191-2	16	10	25.4

Table 4-3. WIRE LIST - continued  
(A - indicates F9000H-3SA only, # - indicates F9000H-1SA only)

Termination		Termination		AWG Wire	Length	
From	Terminal Type	To	Terminal Type	Size	IN.	CM
JUNCTION BOX HARNESS						
J2A-1	-	J3-A	-	16	22	55.9
J2A-2	-	J3-B	-	16	22	55.9
J2A-3	-	J3-C	-	16	22	55.9
Δ J2A-4	-	J3-D	-	18	22	55.9
Δ J2A-5	-	J3-E	-	18	22	55.9
# J2A-5	-	J3-E	-	16	22	55.9
Δ J2A-6	-	J3-F	-	18	22	55.9
Δ J2A-7	-	TB2-3	13216E6191-2	16	32	81.3
Δ J2A-8	-	TB2-2	13216E6191-2	16	32	81.3
J2A-9	-	TB2-1	13216E6191-2	16	32	81.3
J2A-11	-	TB1-1	MS25036-156	12	18	45.7
J2A-12	-	TB1-2	MS25036-156	12	18	45.7
Δ J2A-13	-	TB1-3	MS25036-156	12	18	45.7
J2A-14	-	K3-A1	MS25036-112	12	18	45.7
Δ J2A-15	-	K3-B1	MS25036-112	12	18	45.7
Δ J2A-16	-	K3-C1	MS25036-112	12	18	45.7
Δ J2B-3	-	TB1-5	MS25036-149	20	18	45.7
J2B-4	-	J8-A	-	20	26	66.0
J2B-5	-	K2-X1	MS25036-149	20	18	45.7
J2B-6	-	CB2-1	MS25036-101	20	22	55.9
Δ J2B-7	-	K5-2	-	20	25	63.5
J2B-8	-	TB2-10	13216E6191-1	20	32	81.3
J2B-10	-	TB2-12	13216E6191-1	20	32	81.3
J2B-11	-	E2	MS25036-153	16	20	50.8
J3-G	-	E4	MS25036-153	16	36	91.5
J4-A	-	K3-A2	MS25036-112	12	36	91.5
Δ J4-B	-	K3-B2	MS25036-112	12	36	91.5
Δ J4-C	-	K3-C2	MS25036-112	12	36	91.5
Δ J4-D	-	J5-D	-	16	8	20.3
J4-E	-	S5-2	13216E6191-1	20	31	78.8
Δ J4-F	-	K3-A1	MS25036-108	16	36	91.5
Δ J4-G	-	K3-B1	MS25036-108	16	36	91.5
Δ J5-A	-	K4-1	-	16	32	81.3
Δ J5-B	-	K4-5	-	16	32	81.3
Δ J5-C	-	K4-10	-	16	32	81.3
Δ J5-E	-	TB1-6	MS25036-153	16	32	81.3
J5-G	-	E4	MS25036-153	16	32	81.3
J6-A	-	TB3-4	MS25036-156	12	15	38.1
J6-B	-	TB3-5	MS25036-156	12	15	38.1
Δ J6-C	-	TB3-6	MS25036-156	12	15	38.1
J6-D	-	E3	MS25036-156	12	16	40.6
J8-B	-	K3-X2	MS25036-149	20	36	91.5
Δ J9-A	-	K3-X2	MS25036-149	20	32	81.3
Δ J9-B	-	K4-9	-	20	32	81.3
J1-A	-	TB3-1	MS25036-156	12	43	109.2
J1-B	-	TB3-2	MS25036-156	12	43	109.2
Δ J1-C	-	TB3-3	MS25036-156	12	43	109.2
J1-D	-	E3	MS25036-156	12	43	109.2
Δ TB1-1	MS25036-149	K5-A	-	20	16	40.6
TB1-1	MS25036-153	K2-A1	MS25036-108	16	16	40.6
TB1-2	MS25036-153	TB3-2	MS25036-153	16	36	91.5
TB1-2	MS25036-153	K2-B1	MS25036-108	16	16	40.6
Δ TB1-2	MS25036-149	K5-B	-	20	16	40.6
Δ TB1-3	MS25036-156	TB3-3	MS25036-156	12	36	91.5
TB1-3	MS25036-156	TB2-11	MS25036-156	12	36	91.5
Δ TB1-3	MS25036-149	K5-C	-	20	16	40.6
Δ TB1-3	MS25036-153	K2-C1	MS25036-108	16	17	43.2
TB1-4	MS25036-153	K4-2	-	16	16	40.6
Δ TB1-5	MS25036-149	S4-1	13216E6191-1	20	28	71.1
TB1-6	MS25036-149	K1-1	-	20	10	25.8
Δ TB2-4	13216E6191-2	K2-C2	MS25036-108	16	36	91.5
Δ TB2-5	13216E6191-2	K2-B2	MS25036-108	16	36	91.5

**Table 4-3. WIRE LIST - continued**  
 (A - indicates F9000H-3SA only, # - indicates F9000H-1SA only)

Termination		Termination		AWG	Length	
From	Terminal Type	To	Terminal Type	Wire Size	IN.	CM
JUNCTION BOX HARNESS - continued						
Δ TB2-6	13216E6191-2	K2-A2	MS25036-108	16	36	91.5
K1-2	-	K3-X1	MS25036-149	20	13	33.0
Δ TB1-6	MS25036-149	K4-9	-	20	16	40.6
Δ K2-C1	MS25036-108	K4-8	-	16	14	35.6
Δ K2-B1	MS25036-108	K4-11	-	16	15	38.1
K2-A1	MS25036-108	K4-3	-	16	14	35.6
K2-X2	MS25036-149	K3-X2	-	20	14	35.6
K2-X2	MS25036-149	K4-2	-	20	14	35.6
Δ K5-1	-	CB2-2	MS25036-101	20	20	50.8
Δ TB1-1	MS25036-156	TB3-1	MS25036-156	12	36	91.5
Δ TB1-4	-	CR1-4	-	20	36	91.5
Δ S4-2	-	S5-1	-	20	8	20.3
Δ TB2-7	-	S6-2	-	16	18	45.7
Δ TB2-8	-	S6-1	-	16	18	45.7
Δ TB2-9	-	S6-3	-	16	18	45.7
Δ S6-2	-	S6-4	-	16	3	7.6
# J2A-4	-	J3-F	-	18	15	38.1
# J2A-6	-	J12-C	-	18	15	38.1
# J2A-7	-	J12-A	-	16	20	50.8
# J2A-8	-	K2-B2	MS25036-108	16	19	48.3
# J2A-15	-	TB3-3	MS25036-156	12	10	25.4
# J2B-3	-	J5-D	-	20	13	33.0
# J2B-7	-	CB2-2	MS25036-101	20	17	43.2
# J4-B	-	TB3-3	MS25036-156	12	29	73.7
# J4-C	-	K3-A2	MS25036-112	12	30	76.2
# J4-D	-	TB1-6	MS25036-153	16	4	10.2
# J4-F	-	TB3-3	MS25036-156	16	26	66.0
# J4-G	-	K3-A1	MS25036-108	16	26	66.0
# J5-A	-	K4-3	-	16	25	63.5
# J5-B	-	J12-E	-	16	25	63.5
# J5-C	-	TB1-5	MS25036-153	16	25	63.5
# J5-E	-	TB1-4	MS25036-153	16	26	66.0
# J9-A	-	TB1-3	MS25036-149	20	25	63.5
# J9-B	-	K3-X1	MS25036-149	20	24	61.0
# TB1-1	MS25036-156	TB3-1	MS25036-156	20	13	33.0
# TB1-4	MS25036-153	S4-1	MS25036-149	20	28	71.1
# TB1-5	MS25036-149	TB2-11	13216E6191-1	20	20	50.8
# TB2-4	13216E6191-2	K2-A2	MS25036-108	16	32	81.3
# TB2-9	13216E6191-2	K2-B2	MS25036-108	16	32	81.3
# K3-X2	MS25036-149	K4-9	-	20	9	22.9
# K2-A1	MS25036-153	K4-1	-	16	7	17.8
# K2-X2	MS25036-149	TB1-3	MS25036-149	20	5	12.7
# K2-X2	MS25036-149	K4-9	-	20	6	15.2
# K4-5	-	K4-1	-	16	4	10.2
# J12-D	-	K4-11	-	16	4	10.2
# S2-A2	-	S1-2C	-	20	9	22.9
# J2B-9	-	TB1-1	MS25036-149	20	16	40.6
# K4-5	-	K4-1	-	-	4	10.2
# TB1-2	MS25036-153	TB1-5	MS25036-153	16	4	10.2
# S1-2B	-	S2-B2	-	20	9	22.9
# S1-3C	-	S2-C2	-	20	8	20.3
CAPACITOR WIRING HARNESS						
# P12-A	MS3100R18-11S	C3-2	1316E6191-2	16	13	33.0
# P12-C	MS3100R18-11S	C3-1	1316E6191-2	16	13	33.0
# P12-D	MS3100R18-11S	C2-1	1316E6191-2	16	13	33.0
# P12-E	MS3100R18-11S	C2-2	1316E6191-2	16	13	33.0

**4-21 CONTR MODULE.**

This task covers:      a. Removal      b. Repair      c. Replacement      d. Installation

**INITIAL SETUP**Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

Equipment Condition

Remove return air louver (para 4-13).

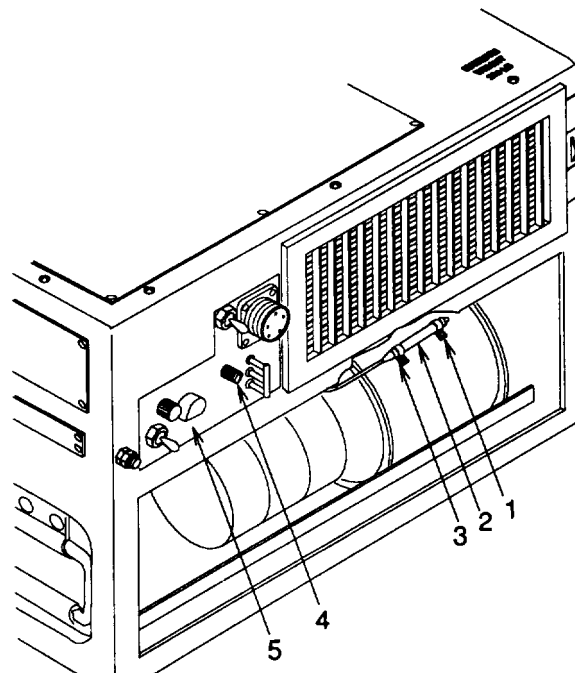


Figure 4-16. Control Module Removal

**REMOVAL**

1. Loosen sensing bulb clamp screws (1) and slip sensing bulb (2) out of clamps (3).
2. Loosen control module mounting screw (4) and carefully pull control module (5) out of unit. Use care to avoid damage to sensing line.
3. Carefully work sensing bulb (2) through the frame and out of unit.

**REPAIR**

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.

**4-21. CONTROL MODULE. - continued**

**R E P L A C E M E N T**

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

**INSTALLATION**

- 1. Carefully work sensing bulb (2) through junction box frame and into two mounting clamps (3) behind return air louver.
- 2. Tighten clamp screws (1).
- 3. Slip control module (5) into the opening in junction box. Take care not to crush or kink sensing bulb capillary line.
- 4. Tighten control module mounting screw (4).

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install return air louver (para 4-1 3).

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

This task covers:	a. Removal	b. Inspection	c. Testing	d. Replacement	e. Installation
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**INITIAL SETUP**

Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

Equipment Condition

Remove control module (para 4-21).

Materials/Parts

Temperature Selector  
Self-locking Nuts (4)  
Self-locking Screws (3)



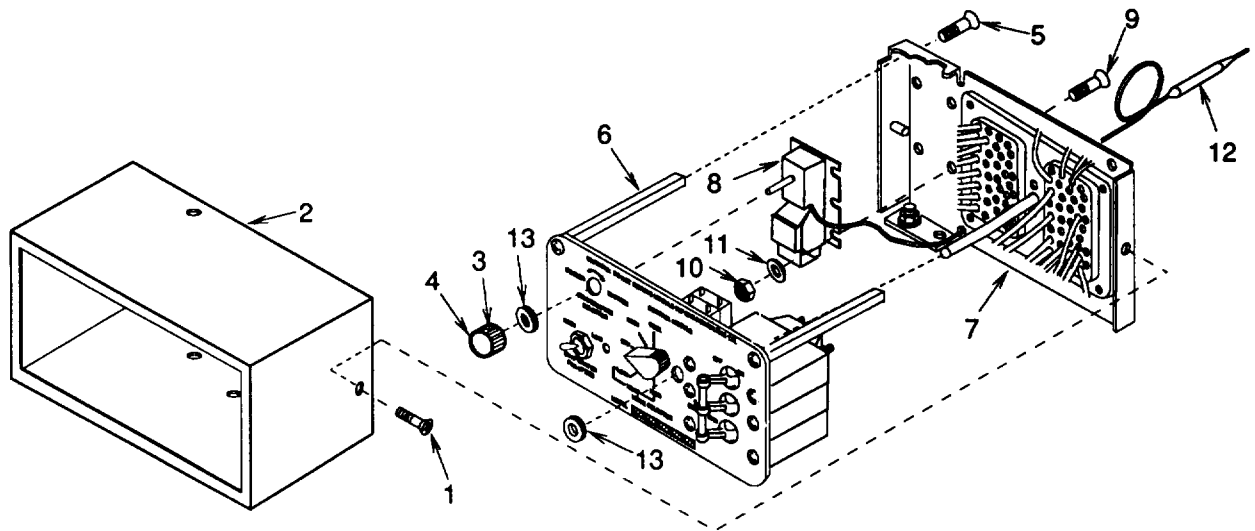
**4-22. TEMPERATURE SELECTOR (CONTROL SWITCH THERMOSTAT) S3. - continued**

Figure 4-17. TEMPERATURE SELECTOR (Control Switch Thermostat) S3

**REMOVAL**

1. Remove four screws (1) and pull cover (2) off.
2. Loosen setscrew (3) in TEMPERATURE SELECTOR knob (4). Remove knob.
3. Remove three self-locking screws (5) from posts (6) and slip back plate (7) off.
4. Tag and disconnect wires from TEMPERATURE SELECTOR (8).
5. Remove four screws (9), flat washers (11), and self-locking nuts (10) and pull TEMPERATURE SELECTOR (8) from back plate (7).

**INSPECTION**

Check TEMPERATURE SELECTOR (8) for kinked or damaged capillary line or bulb and loose, broken or missing terminals.

**TESTING**

1. Place the sensing bulb (12) in a container of warm water, 75° to 85°F (24° to 30°C) and set multimeter to measure resistance on lowest 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.

**REPLACEMENT**

Replace TEMPERATURE SELECTOR if defective.

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

**INSTALLATION**

- 1. Place TEMPERATURE SELECTOR (8) on back plate (7) and secure with four screws (9), flat washers (11), and self-locking nuts (10).
- 2. See tags and wiring diagram (fig. 4-4) and connect wire leads. Remove tags.
- 3. Check that grommets (13) are in place in shaft holes.
- 4. Slip back plate (7) In place and align holes in back plate with the three posts (6). Check that grommets (13) are still in place in shaft holes. Secure with three self-locking screws (5).
- 5. Install TEMPERATURE SELECTOR knob (4) and tighten setscrew (3).
- 6. Slip cover (2) in place and secure with four screws (1).

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install control module (para 4-21).

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

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

**INITIAL SETUP**

Tools	Equipment Condition
Refrigeration Unit Service Tool Kit Appendix B, item 1	Remove control module (para 4-21).
Materials/Parts	
Evaporator Fan Speed Switch Self-locking Screws (3)	

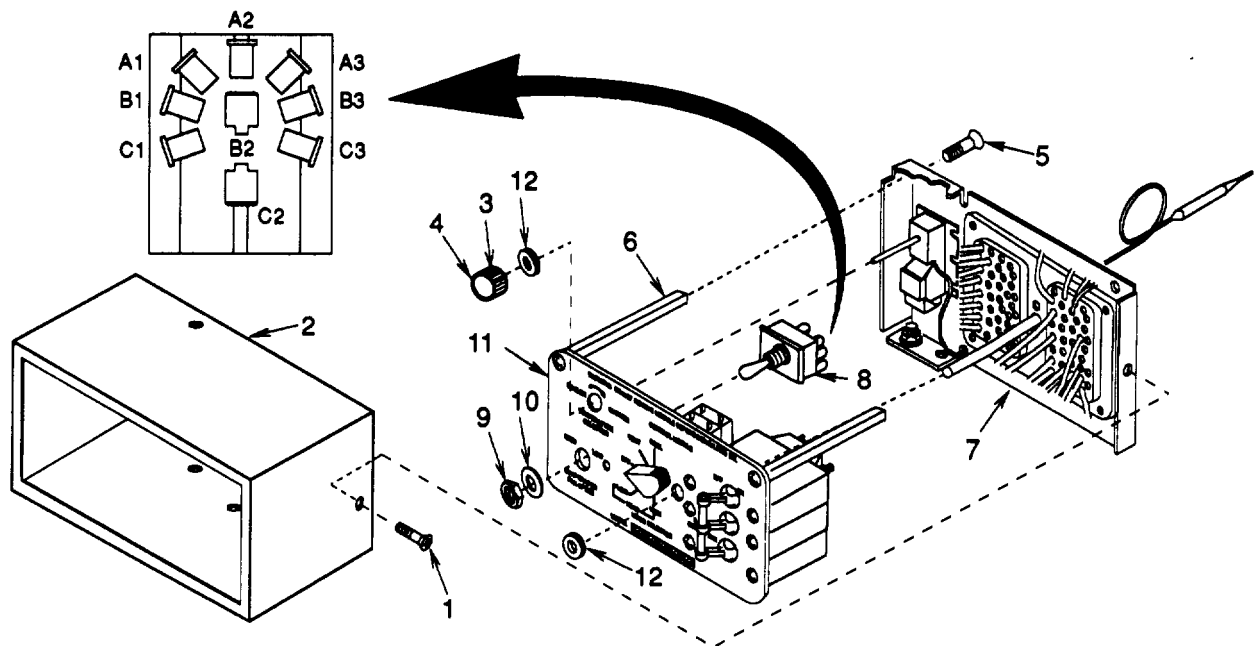
**4-23. EVAPORATOR FAN SPEED SWITCH S2. - continued**

Figure 4-18. EVAPORATOR FAN SPEED Switch S2

**REMOVAL**

1. Remove four screws (1) and pull cover (2) off.
2. Loosen the setscrew (3) in TEMPERATURE SELECTOR knob (4). Remove knob.
3. Remove the three self-locking screws (5) from the posts (6) and slip the back plate (7) off.
4. Tag and disconnect wires from EVAPORATOR FAN SPEED switch (8).
5. Remove nut (9) and washer (10) and pull switch (8) from the panel (11).

**INSPECTION**

Check switch for general condition and loose, broken, or missing terminals.

**NOTE**

Terminals C1 to C2 and C2 to C3 are not used in single phase units.

**TESTING**

1. With switch in high position (toward keyway) check continuity between terminals A1 to A2, B1 to B2, and C1 to C2. Continuity should be indicated across each pair of terminals.
2. With switch in low position (away from keyway) check continuity between terminals A2 to A3, B2 to B3, and C2 to C3.

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

REPLACEMENT

Replace EVAPORATOR FAN SPEED switch if defective.

INSTALLATION

- 1. Insert switch (8) into control panel (11) and secure with nut (9) and washer (10).
- 2. See tags and wiring diagram (fig. 4-4) and connect wire leads. Remove tags.
- 3. Check that grommets (12) are in place in shaft holes.
- 4. Slip back plate (7) in place and align holes in back plate with the three posts (6). Check that grommets (12) are still in place in shaft holes. Secure with three self-locking screws (5).
- 5. Install TEMPERATURE SELECTOR knob (4) and tighten setscrew (3).
- 6. Slip cover (2) in place and secure with four screws (1).

NOTE

FOLLOW-ON MAINTENANCE:  
Install control module (para 4-21).

4-24. MODE SELECTOR SWITCH S1.

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

INITIAL SETUP

Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

Equipment Condition

Remove control module (para 4-21).

Materials/Parts

Mode Selector Switch  
Self-locking Screws (3)

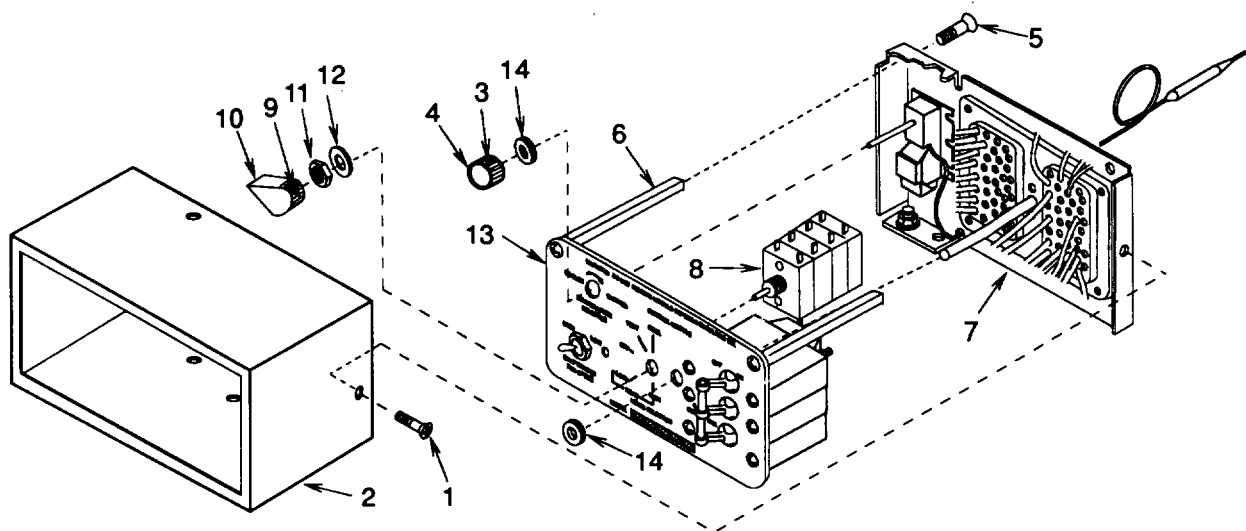
**4-24. MODE SELECTOR SWITCH S1. - continued**

Figure 4-19. MODE SELECTOR Switch S1

**REMOVAL**

1. Remove four screws (1) and pull cover (2) off.
2. Loosen setscrew (3) in the TEMPERATURE SELECTOR knob (4). Remove knob.
3. Remove the three self-locking screws (5) from the posts (6) and slip back plate (7) off.
4. Tag and disconnect wires from MODE SELECTOR switch (8).
5. Loosen setscrew (9) and pull knob (10) from MODE SELECTOR switch.
6. Remove nut (11) and washer (12) and pull MODE SELECTOR switch (8) from the panel (13).

**INSPECTION**

Check switch for general condition and loose, broken, or missing terminals.

**4-24. MODE SELECTOR SWITCH S1. - continued****TESTING**

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			
		S1 A	S1 B	S1 C	S1 D
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	31 and 3C	-

**REPLACEMENT**

Replace MODE SELECTOR switch if defective.

**INSTALLATION**

1. Slip MODE SELECTOR switch shaft through panel (13) and secure with mounting nut (11) and washer (12) supplied with switch.
2. Place knob (10) on MODE SELECTOR switch shaft and tighten setscrew (9).
3. See tags and wiring diagram (fig. 4-4) and connect wire leads. Remove tags.
4. Check that grommets (14) are in place in shaft holes.
5. Slip back plate (7) in place and align holes in back plate with the three posts (6). Check that grommets (14) are still in place in shaft holes. Secure with three self-locking screws (5).
6. Install TEMPERATURE SELECTOR knob (4) and tighten setscrew (3).
7. Slip cover (2) in place and secure with four screws (1).

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install control module (para 4-21).

**4-25. COMPR CIRCUIT BKR CB1.**

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

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

**Equipment Condition**

Remove control module (para 4-21).

**Materials/Parts**

Compressor Circuit Breaker  
Self-locking Screws (3)

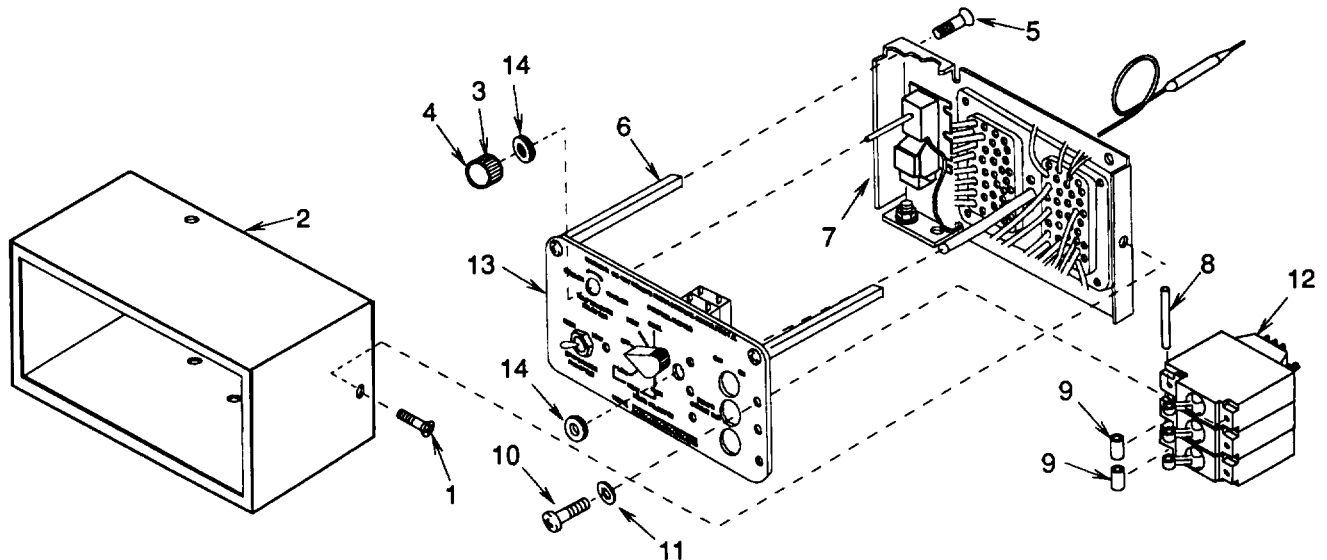


Figure 4-20. COMPR CIRCUIT BKR (Compressor Circuit Breaker) CB1

**REMOVAL**

1. Remove four screws (1) and pull cover (2) off.
2. Loosen setscrew (3) in the TEMPERATURE SELECTOR knob (4). Remove knob.
3. Remove the three self-locking screws (5) from the posts (6) and slip back plate (7) off.
4. Tag and disconnect wires from Compressor Circuit Breaker (12).
5. Remove pin (8) and spacers (9) from circuit breaker toggles.
6. Remove screws (10) and flat washers (11) and pull circuit breaker (12) from the panel (13).

**4-25. COMPR CIRCUIT BKR CB1. - continued**

**INSPECTION**

Check circuit breaker for general condition and loose, broken, or missing terminals.

**TESTING**

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.

**REPLACEMENT**

Replace COMPR CIRCUIT BKR if defective.

**INSTALLATION**

1. Insert circuit breaker toggles through control panel. Be sure off position matches lettering on panel.
2. Secure circuit breaker (12) to panel with screws (10) and flat washers (11).
3. Insert pin (8) and spacers (9) through circuit breaker toggles to lock them together.
4. See tags and wiring diagram (fig. 4-4) and connect wire leads. Remove tags.
5. Check that grommets (14) are in place in shaft holes.
6. Slip back plate (7) in place and align holes in back plate with the three posts (6). Check that grommets (14) are still in place in shaft holes. Secure with three self-locking screws (5).
7. Install TEMPERATURE SELECTOR knob (4) and tighten setscrew (3).
8. Slip cover (2) in place and secure with four screws (1).

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install control module (para 4-21).



**4-26. CONTROL MODULE WIRING HARNESS.**

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

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

**Equipment Condition**

Remove control module (para 4-21).

**Materials/Parts**

Control Module Wiring Harness  
Self-locking Screws (3)  
Self-locking Nuts (8)

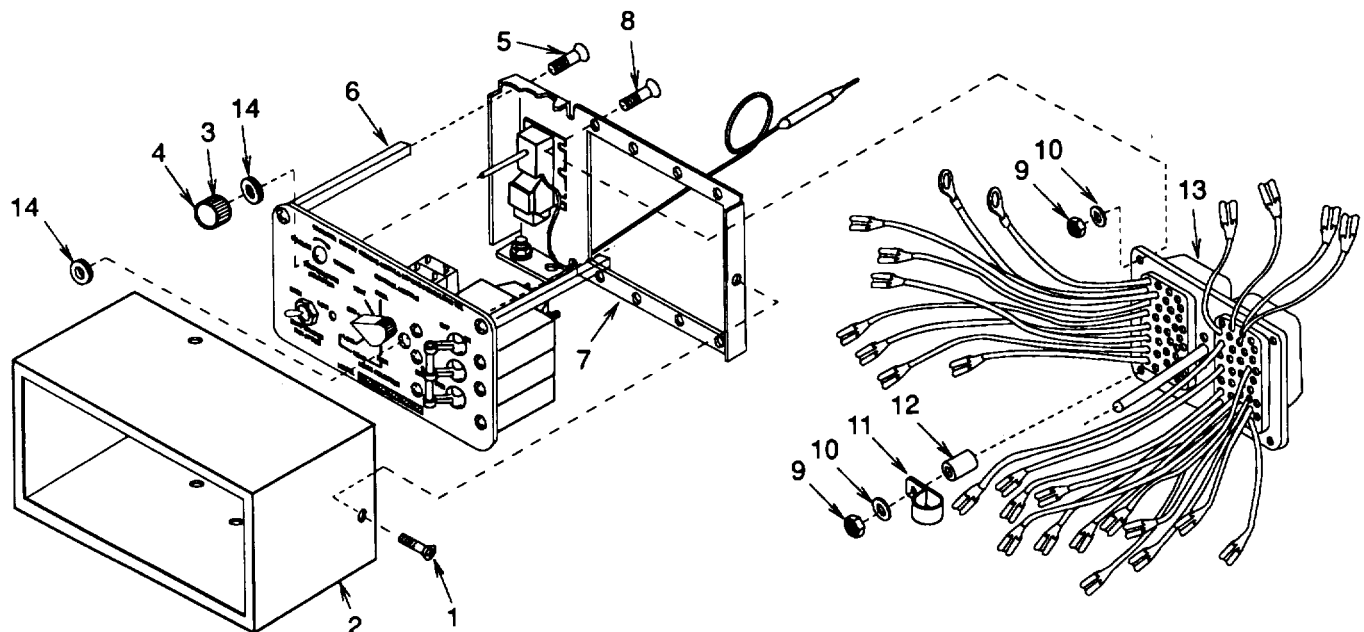


Figure 4-21. Control Module Wiring Harness

**INSPECTION**

1. Remove four screws (1) and pull the cover (2) off.
2. Inspect connector for loose, damaged or missing pins. Replace if defective.
3. Check individual wires for loose solder connections, loose terminal lugs, cut or frayed insulation, cut or broken wires.

#### **4-26. CONTROL MODULE WIRING HARNESS. - continued**

##### **REMOVAL**

1. Loosen setscrew (3) in TEMPERATURE SELECTOR knob (4). Remove knob.
2. Remove three self-locking screws (5) from the posts (6) and slip the back plate (7) off.
3. Tag and disconnect wires from components and ground stud.
4. Remove seven screws (8), self-locking nuts (9), and flat washers (10).
5. Remove screw (8), self-locking nut (9), flat washer (10), clamp (11), and spacer (12). Pull connector (13) from back plate.

##### **TESTING**

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

##### **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.

##### **REPLACEMENT**

Replace harness assembly if connector is damaged.

##### **INSTALLATION**

1. Slip connector (13) into back plate and secure with seven screws (8), nuts (9) and flat washers (10).
2. Install spacer (12) and clamp (11). Secure with screw (8), flat washer (10), and self-locking nut (9).
3. See tags and wiring diagram (fig, 4-4) and connect wire leads. Remove tags.
4. Check that grommets (14) are in place in shaft holes.
5. Slip back plate (7) in place and align holes in back plate with the three posts (6). Check that grommets (14) are still in place in shaft holes. Secure with three self-locking screws (5).
6. Install TEMPERATURE SELECTOR knob (4) and tighten setscrew (3).
7. Slip cover (2) in place and secure with four screws (1).

##### **NOTE**

FOLLOW-ON MAINTENANCE:  
Install control module (para 4-21).

**4-27. JUNCTION BOX.**

This task covers:      a. Removal      b. Inspection      c. Repair      d. Replacement      e. Installation

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

**Equipment Condition**

Remove control module (para 4-21).  
Remove top front panel (para 4-11).

**Materials/Parts**

Lock Washers (7)

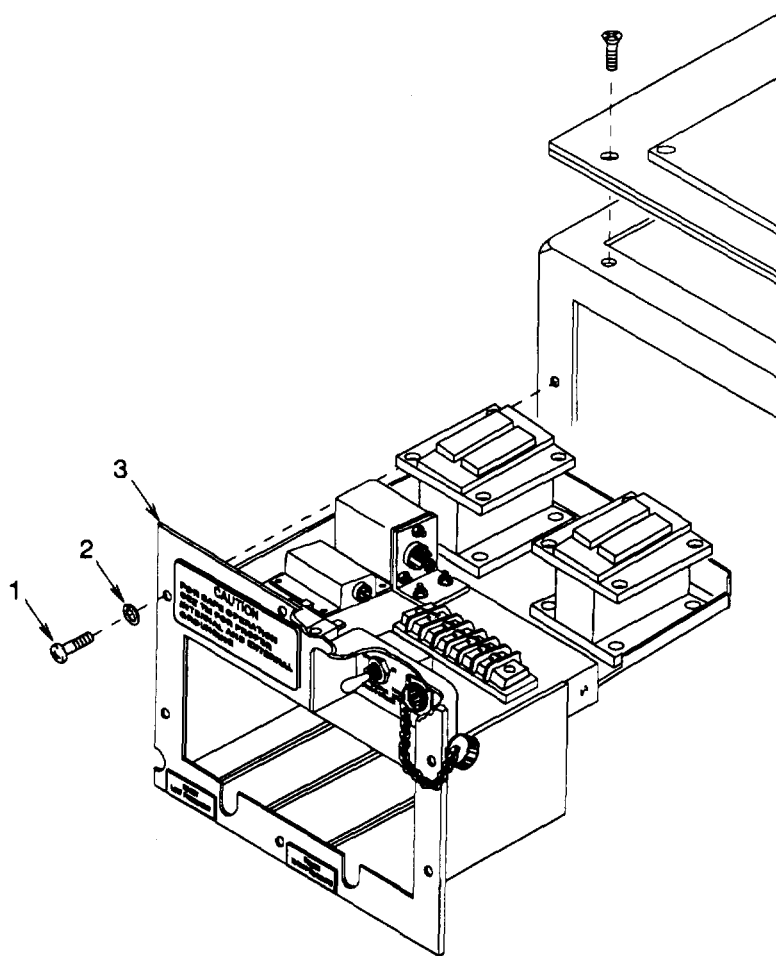


Figure 4-22. Junction Box

#### **4-27. JUNCTION BOX. - continued**

##### **REMOVAL**

1. Remove seven screws (1) and lock washers (2) and carefully slide junction box (3) out of unit.



The junction box should be supported on a stand or table to avoid damage to wires or connections.

##### **NOTE**

Most maintenance, testing, and inspection of the junction box and individual components can be done at this stage. If the complete junction box is to be replaced or removed proceed to step (2).

2. Tag and disconnect individual wires and connectors of junction box harness from unit.
3. Remove junction box.

##### **INSPECTION**

1. Inspect for missing or loose attaching hardware, damaged parts and excessive corrosion. Tighten loose hardware and clean or repair parts as indicated.
2. See paragraphs 4-28 through 4-33.

##### **REPAIR**

Replace missing hardware and damaged parts.

##### **REPLACEMENT**

If the junction box is damaged beyond repair, remove components (para 4-28 through 4-33) and replace with a new junction box.

##### **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 (3) into place and secure with seven screws (1) and lock washers (2).

##### **NOTE**

FOLLOW-ON MAINTENANCE:  
Install control module (para 4-21).  
Install top front panel (para 4-11).

**4-28. JUNCTION BOX WIRING HARNESS.**

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

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

**Equipment Condition**

Remove top panels (para 4-11).  
Remove junction box (para 4-27).

**Materials/Parts**

Junction Box Wiring Harness  
Gasket

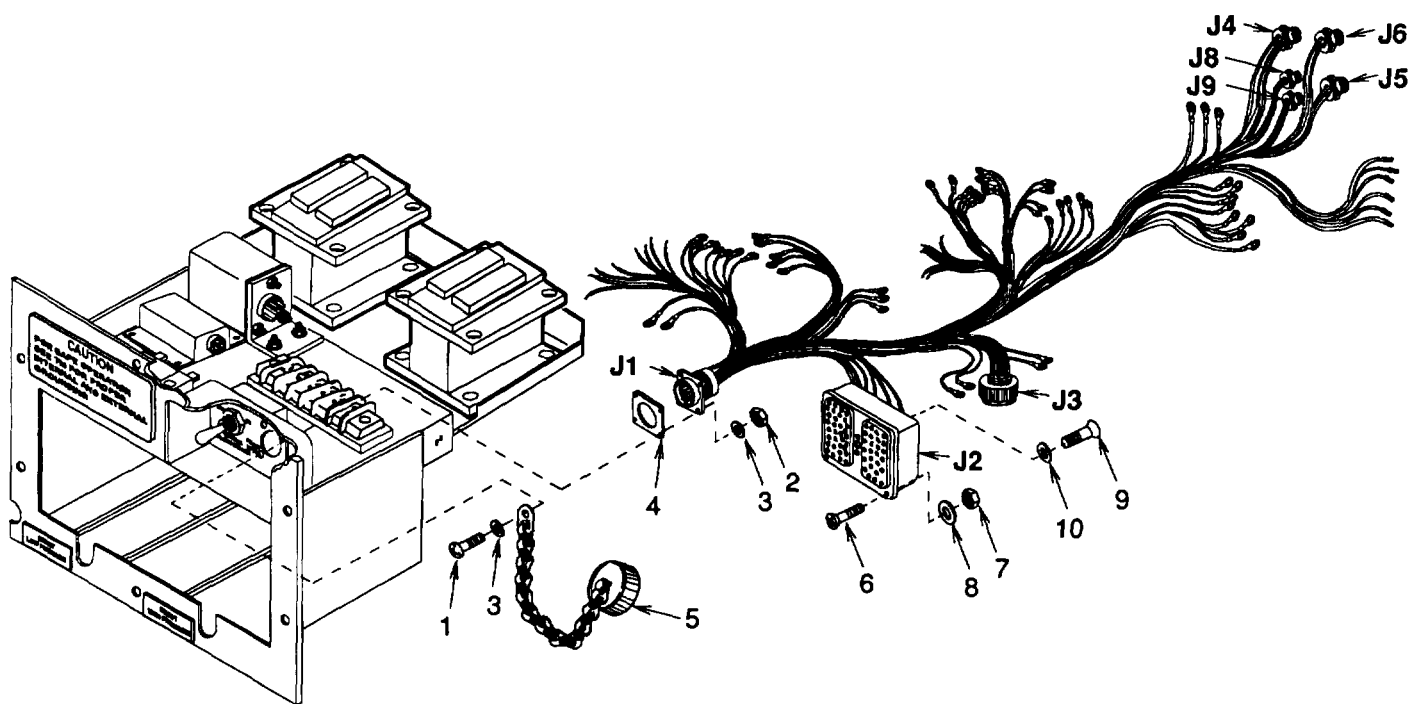


Figure 4-23. Junction Box Wiring Harness

**INSPECTION**

1. Inspect connectors for loose, damaged or missing pins. Replace if defective.
2. Check individual wires for loose solder connections, loose terminal lugs, cut or frayed insulation, cut or broken wires.

#### **4-28. JUNCTION BOX WIRING HARNESS. - continued**

##### **REMOVAL**

1. Tag and disconnect individual wires.
2. Remove nuts and J3 through J6, J8, and J9 connectors from unit.
3. Remove four screws (1) and nuts (2), and eight flat washers (3), gasket (4), and cap and chain (5) from J1 connector.
4. Remove eight screws (6), lock nuts (7), and flat washers (8), and one screw (9) and lock washer (10) from J2 connector.

##### **TESTING**

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

##### **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.
3. Replace individual wires, terminals, or connectors if defective.

##### **REPLACEMENT**

If harness is damaged beyond repair or connector J2 is damaged, replace junction box wiring harness.

##### **INSTALLATION**

1. Install J2 connector with one screw (9) and lock washer (10), and eight screws (6), lock nuts (7), and flat washers (8).
2. Install J1 connector, gasket (4), and cap and chain (5) with four screws (1) and nuts (2), and eight flat washers (3).
3. Install J3 through J6, J8, and J9 connectors. Secure with nuts.
4. See wiring diagram figure 4-4 and tags and connect the wire leads and connectors. Remove tags.

##### **NOTE**

##### **FOLLOW-ON MAINTENANCE:**

Install junction box (para 4-27).

Install top panels (para 4-11).

# **4-29. TIME DELAY RELAY (K1).**

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

## **INITIAL SETUP**

### **Tools**

Refrigeration Unit Service Tool Kit  
Appendix B, item 1  
Power Supply  
Appendix B, item 6

### **Materials/Parts**

Time Delay Relay  
Self-locking Nuts (2)

### **Equipment Condition**

Remove junction box (para 4-27).

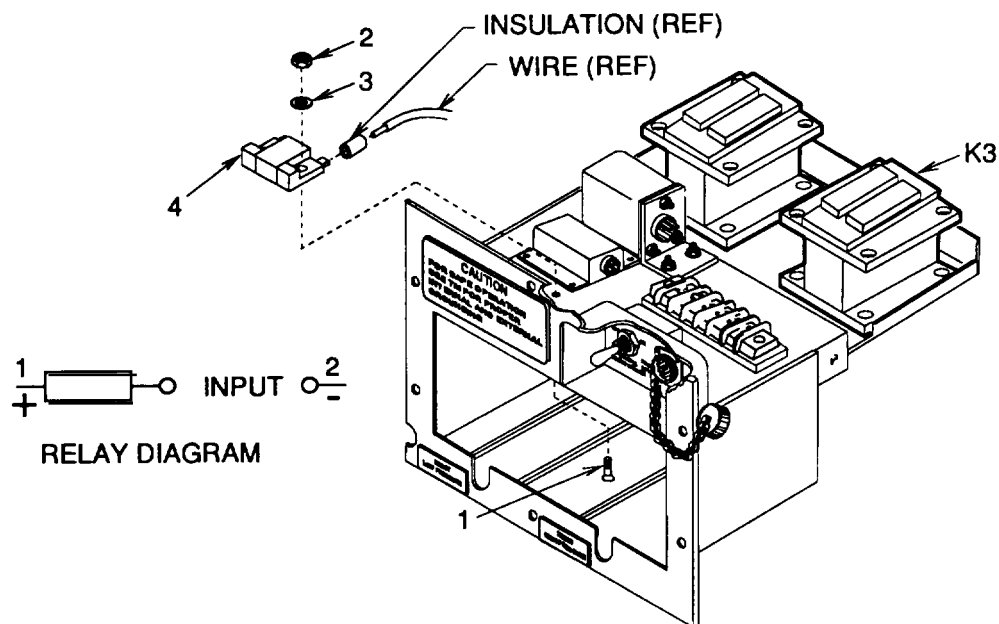


Figure 4-24. Time Delay Relay K1

## **TESTING**

1. Connect multimeter to terminal A1 and A2 of relay K3.
2. Apply +28VDC to terminal 6 of TB1 and -28VDC to terminal X2 of K3.
3. Multimeter must show continuity across terminals A1 and A2 within  $30 \pm 3$  seconds after applying the 28 VDC.
4. Remove the 28VDC. The multimeter must show that contacts are open.

**4-29. TIME DELAY RELAY (K1). - continued**

INSPECTION

Check relay for general condition and loose, broken, or missing terminals.

REMOVAL

1. Tag and disconnect wires to relay. (See para 4-20.)
2. Remove two screws (1), self-locking nuts (2), and flat washers (3).
3. Pull relay (4) from junction box.

REPLACEMENT

Replace individual relays if defective.

INSTALLATION

1. Mount relay using two screws (1), self-locking nuts (2), and flat washers (3).
2. See figure 4-4 wiring diagram and tags and connect leads. (See para 4-20.)

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install junction box (para 4-27).

**4-30. PHASE SEQUENCE RELAY K5, 3 phase units only.**

This task covers:      a. Testing      b. Replacement

INITIAL SETUP

Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

Equipment Condition

Remove return air louver (para 4-13).

Materials/Parts

Phase Sequence Relay  
Self-locking Nuts (4)



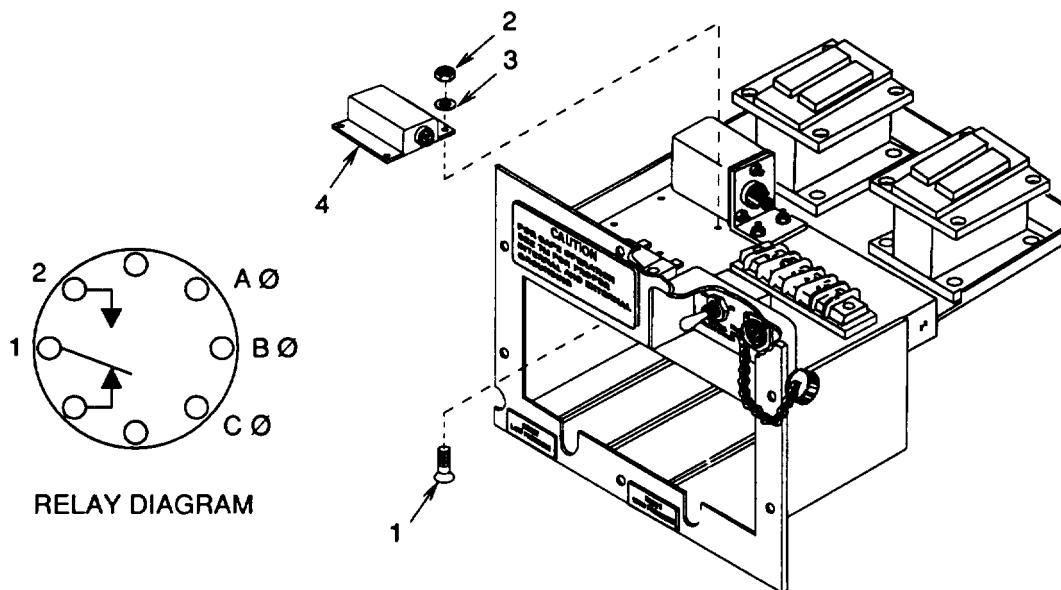
**4-30. PHASE SEQUENCE RELAY K5, 3 phase units only. - continued**


Figure 4-25. Phase Sequence Relay K5

**NOTE**

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).

**TESTING**

1. Check that power connections are properly connected.
2. Move circuit breakers CB1 and CB2 to on position.
3. Momentarily turn mode selector switch to VENT position then back to OFF.
4. To check correct input phasing, see that blower is rotating counterclockwise facing shaft end, if not, reverse two input leads at power source and re-check. (See para 4-5.)
5. To test phase sequence relay, turn mode selector switch to COOL position and see that condenser fan is on, if not, replace phase sequence relay.

**4-30. PHASE SEQUENCE RELAY K5, 3 phase units only. - continued**

**REPLACEMENT**

- 1. Remove junction box. (See para 4-27.)
- 2. Tag and disconnect wires from relay. (See para 4-20.)
- 3. Remove relay K4 from mounting bracket. (See para 4-32.)
- 4. Remove four screws (1), self-locking nuts (2), and flat washers (3).
- 5. Pull relay (4) from junction box.
- 6. Mount relay using four screws (1), self-locking nuts (2), and flat washers (3).
- 7. Secure relay K4 to mounting bracket. (See para 4-32.)
- 8. See figure 4-4wiring diagram and tags and connect leads. Remove tags. (See para 4-20.)

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install junction box (para 4-27).  
Install return air louver (para 4-13).

**4-31. RELAYS K2 and K3.**

This task covers:      a. Inspection      b. Testing      c. Replacement

**INITIAL SETUP**

Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1  
Power Supply  
Appendix B, item 6

Equipment Condition

Remove junction box (para 4-27).

Materials/Parts

Relay

# 4-31. RELAYS K2 and K3. - continued

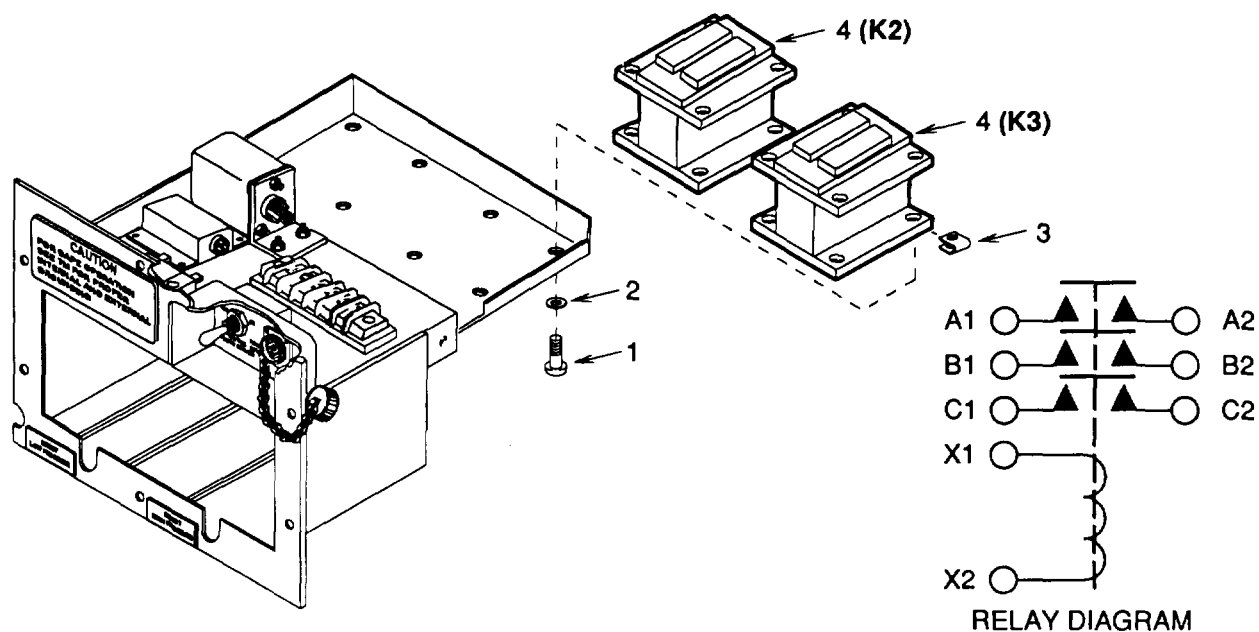


Figure 4-26. Relay K2 and K3

## INSPECTION

Check relays for general condition, evidence of overheating, and loose, broken, or missing terminals.

## TESTING

1. Apply 28VDC to terminals X1 (positive) and X2 (negative).
2. Check continuity across terminals A1 and A2, B1 and B2, and C1 and C2. The multimeter must show that contacts are closed.
3. Remove power. Multimeter must show that contacts are open.
4. Replace relay if defective.

4-31. RELAYS K2 and K3. - continued

REPLACEMENT

- 1. Tag and disconnect wires from relay.
- 2. Remove four screws (1), flat washers (2), and clips (3).
- 3. Pull relay (4) from junction box.
- 4. Mount relay using four screws (1), flat washers (2), and clips (3).
- 5. See figure 4-4 wiring diagram and tags and connect leads.

NOTE

FOLLOW-ON MAINTENANCE:  
Install junction box (para 4-27).

4-32. RELAY K4.

This task covers:      a. Inspection      b. Testing      c. Replacement

INITIAL SETUP

Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1  
Power Supply  
Appendix B, item 6

Equipment Condition

Remove junction box (para 4-27).

Materials/Parts

Relay  
Self-locking Nuts (3)

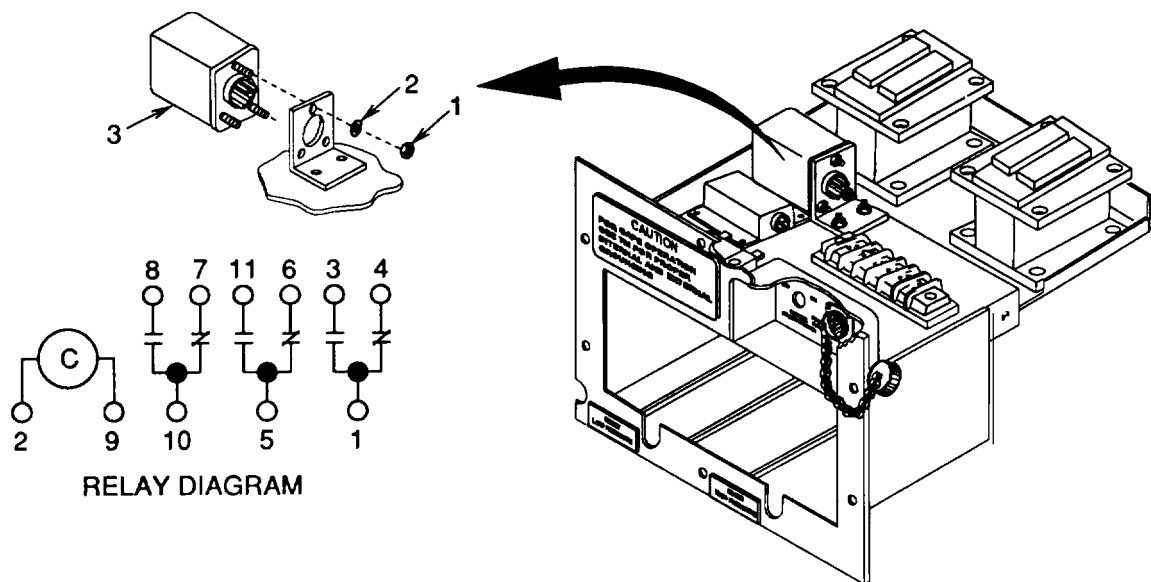
**4-32. RELAY K4. - continued**

Figure 4-27. Relay K4

**INSPECTION**

Check relay for general condition, evidence of overheating, and loose, broken, or missing terminals.

**TESTING**

1. Apply +28VDC to terminal TB1-6 and -28VDC to terminal TB1-4.

**NOTE**

Terminals 10 and 8 are not used in single phase units.

2. Check continuity across terminals 1 and 3, 5 and 11, and 10 and 8.
3. 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.
4. 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.

**4-32. RELAY K4. - continued**

**REPLACEMENT**

- 1. Tag and disconnect wires from relay. (See para 4-20.)
- 2. Remove three self-locking nuts (1) and flat washers (2).
- 3. Pull relay (3) from junction box.
- 4. Mount relay using three self-locking nuts (1) and flat washers (2).
- 5. See figure 4-4 wiring diagram and tags and connect leads. Remove tags. (See para 4-20.)

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install junction box (para 4-27).

**4-33. CONTROL CIRCUIT BREAKER CB2.**

This task covers:      a. Inspection      b. Testing      c. Replacement

**INITIAL SETUP**

Tools	Equipment Condition
Refrigeration Unit Service Tool Kit Appendix B, item 1	Remove top front panel (para 4-11).
Materials/Parts	
Control Circuit Breaker	
Lock Washer	
Lock Washers (2)	

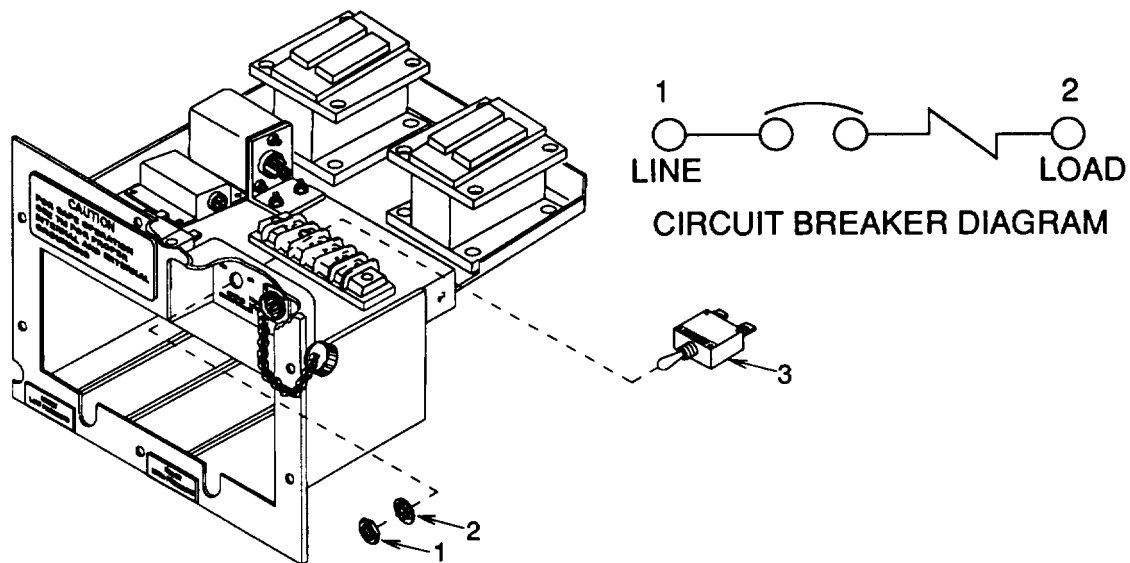
**4-33. CONTROL CIRCUIT BREAKER CB2. - continued**

Figure 4-28. Control Circuit Breaker CB2

**INSPECTION**

Check circuit breaker for general condition and loose, broken, or missing terminals.

**TESTING**

1. Check that there is continuity between the two terminals 1 and 2 with the circuit breaker in the ON position.
2. Check that there is no continuity between terminals with the circuit breaker in the OFF position.

**REPLACEMENT**

1. Remove attaching nut (1) and lock washer (2) from front of panel.
2. Slip circuit breaker (3) from back of panel.
3. Tag and disconnect leads.
4. See the wiring diagram figure 4-4 and tags and connect the wire leads. Remove tags.
5. Slip circuit breaker (3) into hole in panel.
6. Secure with nut (1) and lock washer (2).

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install top front panel (para 4-11).

#### 4-34. MISCELLANEOUS CABLES, HARNESSSES, AND TERMINAL BOARDS.

This task covers:      a. Inspection      b. Testing      c. Repair      d. Replacement      e. Installation

## INITIAL SETUP

## Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

## Materials/Parts

## Tie Down Straps

Equipment	Condition
Excavator	Good
Truck	Fair
Generator	Excellent
Drill	Fair
Saw	Good
Compressor	Excellent
Welding Machine	Fair
Grinder	Good
Hammer	Excellent
Screwdriver	Fair
Wrench	Good
Shovel	Excellent
Pickaxe	Fair
Level	Good
Square	Excellent
Plumb Line	Fair
String Line	Good
Shim	Excellent
Brick	Fair
Mortar	Good
Concrete	Excellent
Rebar	Fair
Formwork	Good
Support	Excellent
Foundation	Fair
Wall	Good
Floor	Excellent
Roof	Fair
Window	Good
Door	Excellent
Stair	Fair
Elevator	Good
Escalator	Excellent
Handrail	Fair
Lighting	Good
Ventilation	Excellent
Heating	Fair
Cooling	Good
Water Supply	Excellent
Sewerage	Fair
Drainage	Good
Landscaping	Excellent
Site Cleanup	Fair
Final Inspection	Good
Project Completion	Excellent

Remove top panels (para 4-11).  
Remove junction box (para 4-27).

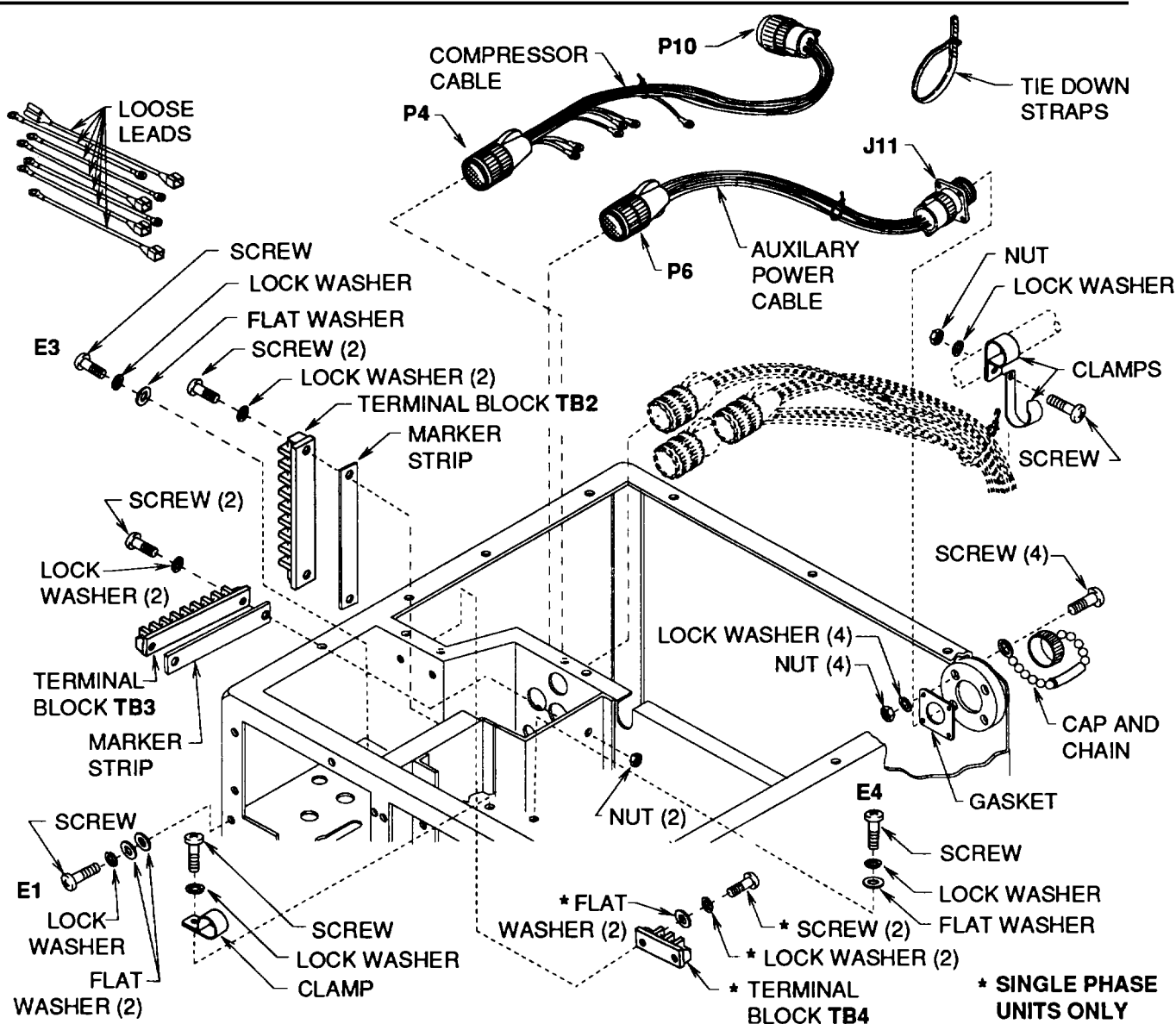


Figure 4-29. Miscellaneous Cables, Harnesses, and Terminal Boards



**4-34. MISCELLANEOUS CABLES, HARNESSSES, AND TERMINAL BOARDS. - continued**

**INSPECTION**

1. Check terminals on terminal boards that they are tight and free of corrosion.
2. Disconnect connectors and check for loose, damaged, or missing pins.
3. Check individual wires for loose solder connections, cut or frayed insulation and cut or broken wires

**TESTING**

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

**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.

**REPLACEMENT**

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

**INSTALLATION**

Connect all disconnected connectors.

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install junction box (para 4-27).  
Install top panels (para 4-11).

**4-35. COMPRESSOR START RELAY K5, single phase units only.**

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

**INITIAL SETUP**

<u>Tools</u>	Equipment	Condition
Refrigeration Unit Service Tool Kit Appendix B, item 1		Remove top panels (para 4-11).
Materials/Parts		
Compressor Start Relay Lock Washer		

**4-35. COMPRESSOR START RELAY K5, single phase units only. - continued**

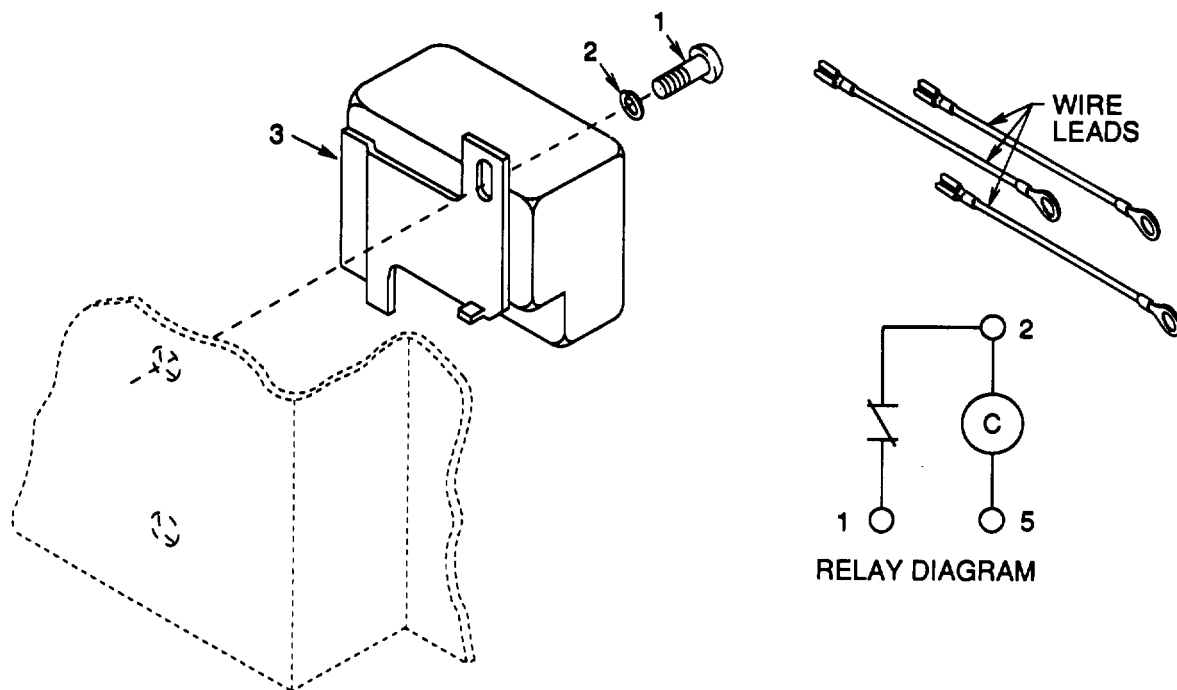


Figure 4-30. Compressor Start Relay K5 Single Phase Units Only

**NOTE**

Compressor start relay is installed on all units. The relay is connected to the start capacitor only on units using Welco compressors.

**REMOVAL**

1. Remove screw (1) and lock washer (2) from mounting tab and remove relay (3) from unit.
2. Tag and disconnect leads.

**INSPECTION**

inspect for cracks, bent or missing mounting tab, bent or missing terminals, dents or other obvious defects. Replace if damaged or defective.

**TESTING**

Cheek terminals 1 to 5, 2 to 5, and 1 to 2 for continuity. if continuity does not exist, or if there is a short circuit, replace compressor start relay.

**REPLACEMENT**

Replace compressor start relay if defective.

**4-35. COMPRESSOR START RELAY K5, single phase units only. - continued****INSTALLATION**

1. Secure compressor start relay (3) with screw (1) and lock washer (2).
2. See the wiring diagram figure 4-4 and tags and connect the wire leads. Remove tags.

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install top panels (para 4-11).

**4-36. CAPACITORS C2 AND C3, single phase units only.**

This task covers:    a. Inspection    b. Testing    c. Replacement

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

**Materials/Parts**

Capacitor  
Capacitor

**Equipment Condition**

Remove top rear panel (para 4-11).  
General Safety Instructions

**WARNING**

Ground all capacitors before touching.

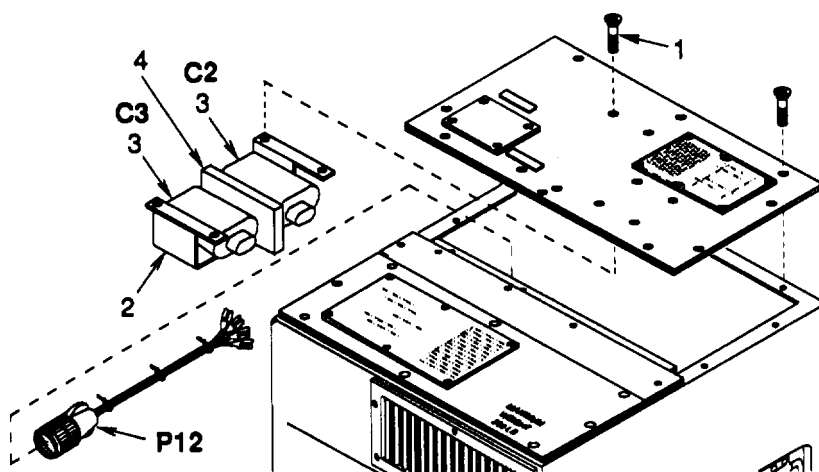


Figure 4-31. Capacitors C2 and C3 Single Phase Units Only

**4-36. CAPACITORS C2 AND C3, single phase units only. - continued**

**WARNING**

Ground all capacitors before touching.

**INSPECTION**

Check capacitors for general condition and loose, broken, or damaged terminals.

**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.

**TESTING**

1. Tag and disconnect leads.
2. Using a multimeter set to read high resistance, place meter leads on terminals of capacitor.
3. If capacitor is good, multimeter needle should move rapidly toward low end of scale then slowly return to infinity. The capacitor is internally short circuited if needle moves to zero and stays there. The capacitor has an open circuit if the needle does not move. Replace if capacitor indicates short circuit, open circuit, or has other damage.
4. See the wiring diagram figure 4-4 and tags and connect the wire leads. Remove tags.

**REPLACEMENT**

1. Using a screwdriver with an insulated handle, discharge capacitor.
2. Loosen four screws (1) securing strap (2) holding evaporator run and condenser run capacitors (C2 and C3) (3) to top rear panel. Do not remove strap.
3. Remove capacitors by sliding out from under strap. Retain insulator pad (4) from between capacitors.
4. Tag and disconnect leads.
5. Place capacitors (3) and insulation pad (4) into strap (2).
6. See the wiring diagram figure 4-4 and tags and connect the wire leads. Remove tags.
7. Tighten four screws (1) securing strap (2) holding capacitors (3).

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install top rear panel (para 4-11).

**4-37. COMPRESSOR START CAPACITOR C5, single phase units only.**

This task covers:    a. Inspection    b. Testing    c. Replacement

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

**Materials/Parts**

Capacitor

**Equipment Condition**

Remove top rear panel (para 4-11).

General Safety Instructions

**WARNING**

Ground all capacitors before touching.

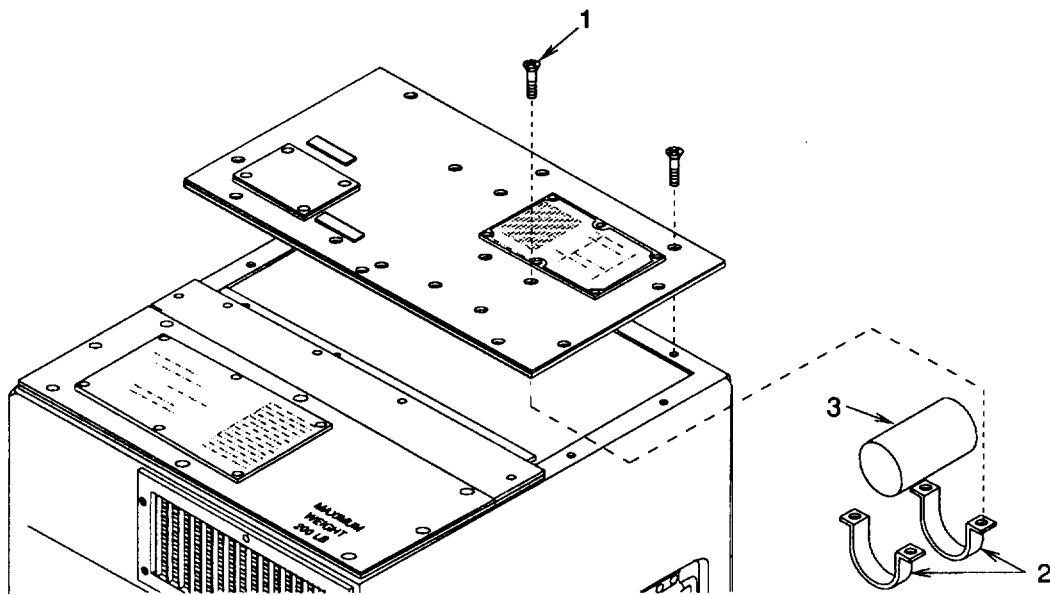


Figure 4-32. Compressor Start Capacitor C5, Single Phase Units Only

**4-37. COMPRESSOR START CAPACITOR C5, single phase units only. - continued**

**NOTE**

Compressor start capacitor is installed on all units. The capacitor is connected to the start relay only on units using Welco compressors.

**WARNING**

Ground all capacitors before touching.

**INSPECTION**

Check capacitor for general condition and loose, broken, or damaged terminals.

**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.

**TESTING**

1. Tag and disconnect leads.
2. Using a multimeter set to read high resistance, place meter leads on terminals of capacitor.
3. If capacitor is good, multimeter needle should move rapidly toward low end of scale then slowly return toward infinity, stopping at value of attached bleed resistor. The capacitor is internally short circuited if needle moves to zero and stays there. The capacitor has an open circuit if the needle only indicates value of attached bleed resistor. Replace if capacitor indicates short circuit, open circuit, or has other damage.
4. See the wiring diagram figure 4-4 and tags and connect the wire leads. Remove tags.

**REPLACEMENT**

1. Using a screwdriver with an insulated handle, discharge capacitor.
2. Loosen four screws (1) securing two straps (2) holding compressor start capacitor (C5) (3) to top rear panel. Do not remove straps.
3. Remove capacitor (3) by sliding out from under straps.
4. Tag and disconnect leads.
5. Place capacitors (3) into straps (2).
6. See the wiring diagram figure 4-4 and tags and connect the wire leads. Remove tags.
7. Tighten four screws (1) securing straps (2) holding capacitor (3).

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install top rear panel (para 4-11).

#### 4-38. COMPRESSOR RUN CAPACITOR C4, single phase units only.

This task covers: a. Inspection b. Testing c. Replacement

##### INITIAL SETUP

###### Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

###### Materials/Parts

Capacitor

###### Equipment Condition

Remove top rear panel (para 4-11).

General Safety Instructions

##### WARNING

Ground all capacitors before touching.

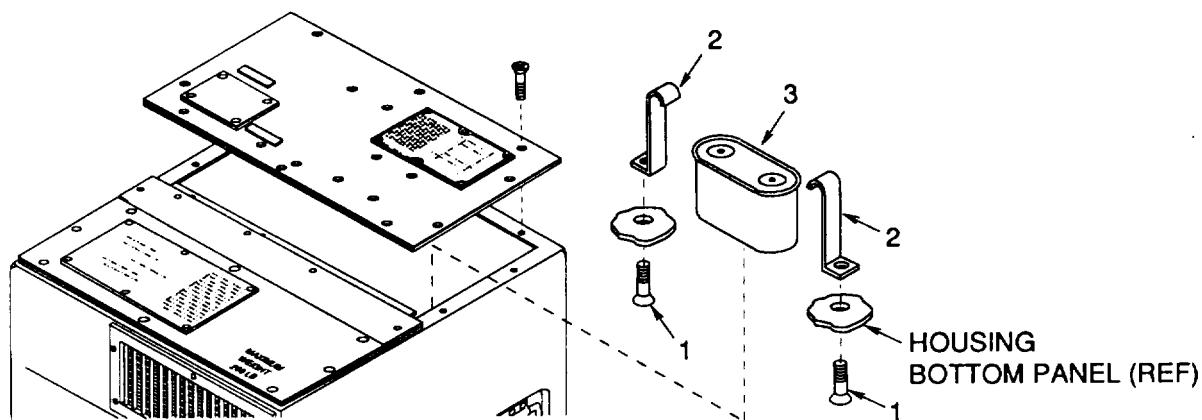


Figure 4-33. Compressor Run Capacitor C4, Single Phase Units Only

##### WARNING

Ground all capacitors before touching.

##### INSPECTION

Check capacitors for general condition and loose, broken, or damaged terminals.

##### 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.

**4-38. COMPRESSOR RUN CAPACITOR C4, single phase units only. - continued**

**TESTING**

1. Using a screwdriver with an insulated handle, discharge capacitor.
2. Tag and disconnect leads.
3. Using a multimeter set to read high resistance, place meter leads on terminals of capacitor.
4. If capacitor is good, multimeter needle should move rapidly toward low end of scale then slowly return to infinity. The capacitor is internally short circuited if needle moves to zero and stays there. The capacitor has an open circuit if the needle does not move. Replace if capacitor indicates short circuit, open circuit, or has other damage.
5. See the wiring diagram figure 4-4 and tags and connect the wire leads. Remove tags.

**REPLACEMENT**

1. Using a screwdriver with an insulated handle, discharge capacitor.
2. Position unit on blocks. Loosen two screws (1) securing straps (2) holding compressor run capacitor (C4) (3) to bottom housing panel. Do not remove straps.
3. Remove capacitor (3) by sliding out from under straps.
4. Tag and disconnect leads.
5. Place capacitors (3) into strap (2).
6. See the wiring diagram figure 4-4 and tags and connect the wire leads. Remove tags.
7. Tighten two screws (1) securing straps (2) holding capacitor (3) to bottom housing panel.

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install top rear panel (para 4-11).



# **4-39. RECTIFIER CR1 AND CAPACITORS (C1 and C2 for 3 phase units) or (C1 and C6 for single phase units).**

This task covers: a. Inspection b. Testing c. Replacement

## **INITIAL SETUP**

### **Tools**

Refrigeration Unit Service Tool Kit  
Appendix B, item 1  
Crimping Tool Kit  
Appendix B, item 2

### **Equipment Condition**

Remove top front panel (para 4-11).  
Remove junction box (para 4-27).

### **Materials/Parts**

Rectifier  
Capacitor  
Capacitor

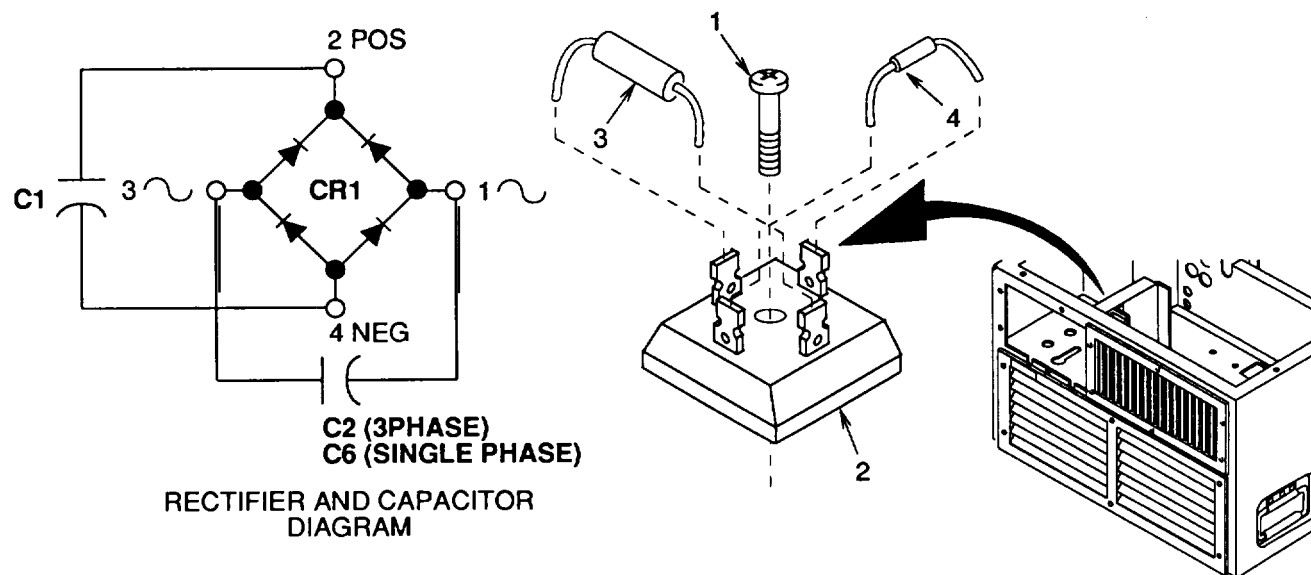


Figure 4-34. Rectifier CR1 and Capacitors (C1 and C2 for 3 Phase Units), (C1 and C6 for Single Phase Units)

## **INSPECTION**

Check rectifier and capacitors for general condition and loose, broken or missing terminals.

<b>4-39. RECTIFIER CR1 AND CAPACITORS (C1 and C2 for 3 phase units) or (C1 and C6 for single phase units). - continued</b>
--

### TESTING

Rectifier CR1.

- a. Tag and disconnect wire 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 and capacitors C1 and (C2 for 3 phase units) or (C6 for single phase units).
- g. See wiring diagram figure 4-4 and tags and connect the wire leads. Remove tags.

### REPLACEMENT

1. Tag and disconnect wire leads.
2. Remove screw (1) and pull rectifier (2) from unit.
3. Cut terminals from wire leads and capacitors C1 and (C2 for 3 phase units) or (C6 for single phase units).
4. Remove capacitors (3 and 4).

#### **NOTE**

When rectifier CR1 is replaced capacitors C1 and (C2 for 3 phase units) or (C6 for single phase units) should also be replaced.

5. See wiring diagram figure 4-4 and tags and attach capacitors (3 and 4) and wire leads to terminals.
6. See the wiring diagram figure 4-4 and tags and connect the terminals to rectifier (2). Remove tags.
7. Install rectifier (2) using screw (1).

#### **NOTE**

FOLLOW-ON MAINTENANCE:  
Install junction box (para 4-27).  
Install top front panel (para4-11).

**4-40. TRANSFORMER T1.**

This task covers:    a. Inspection    b. Testing    c. Replacement

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

**Equipment Condition**

Remove top front panel (para 4-11).  
Remove junction box (para 4-27).

**Materials/Parts**

Transformer  
Insulation Sleeving  
Lock Washers (4)

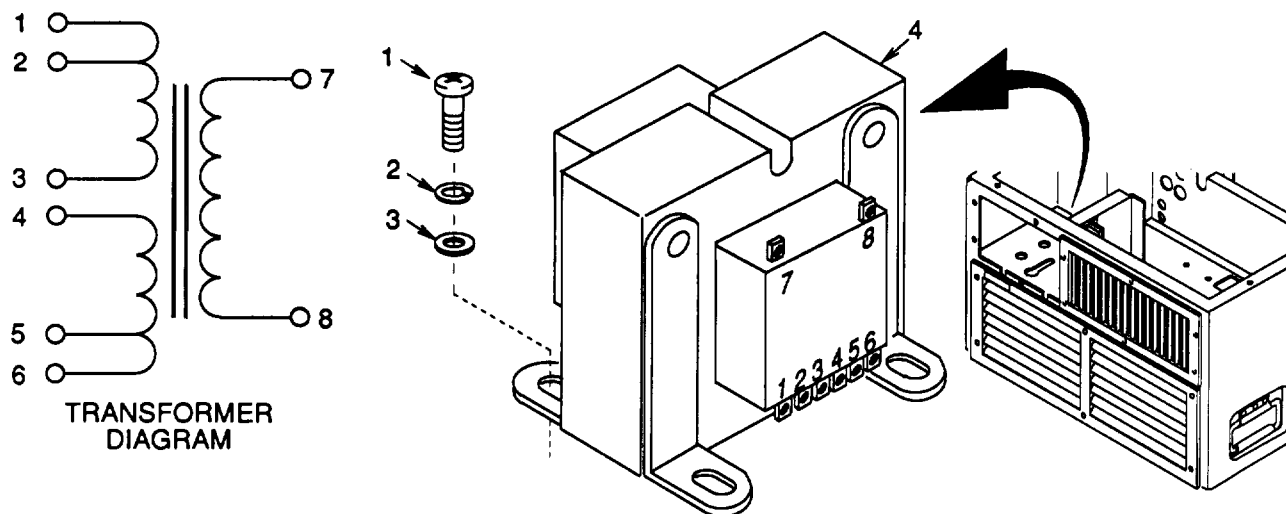


Figure 4-35. Transformer T1

#### **4-40. TRANSFORMER T1. - continued**

##### **INSPECTION**

Check transformer for general condition, signs of overheating, and loose, missing, or broken terminals.

##### **TESTING**

1. Remove four screws (1), lock washers (2), and flat washers (3) and pull transformer (4) from unit.
2. On 3 phase units only. Tag and disconnect leads from terminals 2 and 7. 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. (See para 4-20.)
3. On single phase units only. Tag and disconnect leads from terminals 1 and 7. Check for continuity across the primary winding pin 1 to pin 3 and pin 4 to pin 6 and across the secondary winding pin 7 to pin 8. If either winding is open, replace transformer. (See para 4-20.)
4. Check for shorts between one terminal of each winding and transformer case and also between one primary terminal and one secondary terminal using a multimeter on high ohms setting. Replace transformer if a short is indicated.
5. See wiring diagram figure 4-4 and tags and connect all wire leads. Remove tags. (See para 4-20.)
6. Attach transformer (4) to unit with four screws (1), lock washers (2), and flat washers (3).

##### **REPLACEMENT**

1. Remove four screws (1), lock washers (2), and flat washers (3) and pull transformer (4) from unit.
2. Tag and disconnect wire leads. (See para 4-20.)
3. See wiring diagram figure 4-4 and tags and connect all wire leads to new transformer. Remove tags. (See para 4-20.)
4. Attach transformer (4) to unit with four screws (1), lock washers (2), and flat washers (3).

##### **NOTE**

FOLLOW-ON MAINTENANCE:  
Install junction box (para 4-27).  
Install top front panel (para 4-11).

**4-41. EVAPORATOR FAN, MOTOR, AND HOUSING.**

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

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
 Appendix B, item 1

**Materials/Parts**

Evaporator Fan Motor  
 Evaporator Fan Impeller  
 Evaporator Centrifugal Housing  
 Evaporator Fan Inlet Ring  
 Self-locking Nuts (20)  
 Lock Washers (18)  
 Resilient Mounts (2)  
 Resilient Mounts (2)  
 Insulation  
 Appendix F, fig. F-25 (part B)  
 Rags  
 Appendix E, item 13  
 Adhesive Remover  
 Appendix E, item 16  
 Adhesive  
 Appendix E, item 2

**Equipment Condition**

Remove condensate drain tubing (para 4-19).

**General Safety Instructions****WARNING**

Adhesive remover is flammable and the vapors can be explosive. Repeated or prolonged skin contact or inhalation of vapors can be toxic. Use in a well ventilated area, wear gloves, and keep away from sparks or flame.

**CLEANING**

Wipe all dust or dirt from fan, motor, and housing.

**INSPECTION**

1. Check that all parts are in place and in good condition.
2. Inspect fan for damaged or bent blades and the motor for signs of overheating. Check all mounting hardware for tightness.
3. Disconnect P3 motor connector plug and check for loose, damaged, or missing pins.
4. Inspect fan housing for damage and missing or defective hardware.

**TESTING**

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, check continuity at P3 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.

**4-41. EVAPORATOR FAN, MOTOR, AND HOUSING. - continued**

3. Check continuity at P3 from pin G to pins A, B, C, D, E, and F. Continuity should not exist. If continuity exists, replace motor.

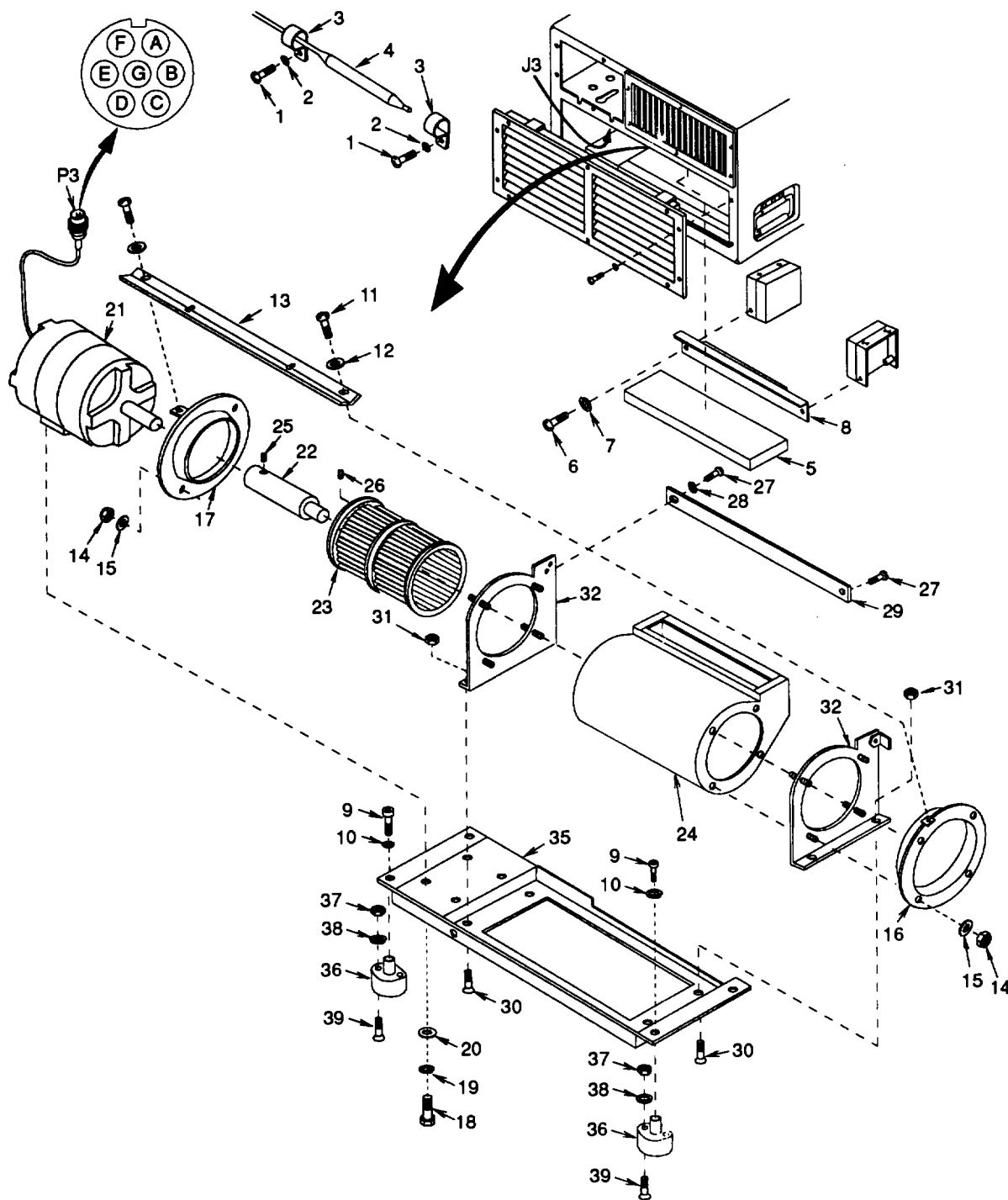


Figure 4-36. Evaporator Fan, Motor, and Housing

**4-41. EVAPORATOR FAN, MOTOR, AND HOUSING. - continued****REMOVAL**

1. Remove two screws (1), lock washers (2), and clamps (3) and remove the TEMPERATURE SELECTOR remote sensing bulb (4) from top of fan housing.
2. Remove insulation (5).
3. Remove two screws (6), lock washers (7), and fan bracket (8).
4. Remove four cap screws (9) and lock washers (10) holding four corners of base to resilient mounts.
5. If connector J3 interferes with assembly removal, loosen nut and push connector up out of the way.
6. Lift fan, motor, and base assembly out of unit.

**DISASSEMBLY**

1. Remove two screws (11), lock washers (12), and fan strap (13).
2. Remove eight self-locking nuts (14) flat washers (15), fan inlet (16), and centrifugal housing (17).
3. Remove four cap screws (18), lock washers (19), and flat washers (20) and pull motor (21), shaft extension (22), and fan impeller (23) out of housing (24).
4. Loosen setscrew (25) in shaft extension (22) and pull from motor (21). Remove centrifugal housing (17).
5. Loosen set screw (26) in fan impeller (23) and pull from shaft extension (22).
6. Remove two screws (27), flat washers (28), and fan strap (29).
7. Remove four screws (30), self-locking nuts (31), fan flanges (32 and 33), and fan housing (34) from base (35).
8. Check condition of resilient mounts (36). If damage is detected remove defective mount by lifting and blocking air conditioner and removing two self-locking nuts (37), flat washers (38), and screws (39) from bottom side of cabinet. Remove resilient mounts

**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.

**REPLACEMENT**

Replace any defective components found during inspection and test.

**ASSEMBLY**

1. If resilient mounts (36) were removed, Attach new mounts (36) to unit with two screws (39), flat washers (38), and self locking nuts (37).
2. Align pins in fan flanges (32 and 33) with holes in fan housing (34) and attach fan flanges to the base (35) with four screws (30) and self-locking nuts (31).
3. Attach fan strap (29) with two screws (27) and flat washers (28).

**4-41. EVAPORATOR FAN, MOTOR, AND HOUSING. - continued**

**NOTE**

The hub must be turned so that it is mounted toward the motor. The direction of rotation is counterclockwise facing the motor shaft.

4. Attach fan impeller (23) to shaft (22) and tighten set screw (26).
5. Slip shaft extension (22) and centrifugal housing (17) onto the motor (21) shaft and tighten setscrew (25).
6. Carefully slip fan impeller (23) and motor (21) assembly into housing (24).
7. Attach motor (21) to the base (35) with four cap screws (18), lock washers (19), and flat washers (20).
8. Attach fan inlet (16) and centrifugal housing (17) with eight flat washers (15) and self-locking nuts (14).

**INSTALLATION**

1. Place fan and motor assembly in unit and install four cap screws (9) and lock washers (10) to secure base (35) to the resilient mounts(36).
2. Install fan bracket (8) with two screws (6) and lock washers (7).
3. Slip TEMPERATURE SELECTOR remote sensing bulb (4) into clamps (3) and secure with two screws (1) and lock washers (2).
4. Tighten connector J3 nut if loosened.
5. Connect P3 motor connector.
6. Remove as much old insulation material from unit as possible by pulling or scraping it away from metal surface.

**WARNING**

Adhesive remover is flammable and the vapors can be explosive. Repeated or prolonged skin contact or inhalation of vapors can be toxic. Use in a well ventilated area, wear gloves, and keep away from sparks or flame.

7. Soften and remove old adhesive and material residue, using adhesive remover and a stiff brush.
8. Coat mating surfaces of metal and material with adhesive. Let both surfaces air dry until adhesive is tacky but will not stick to fingers.
9. Starting with an end, carefully attach material to metal. Press into firm contact all over.

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install condensate drain tubing (para 4-19).



**4-42. HEATER THERMOSTAT S6.**

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

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

**Equipment Condition**

Remove top front panel (para 4-11).

**Materials/Parts**

Heater Thermostat  
Lock Washers (2)

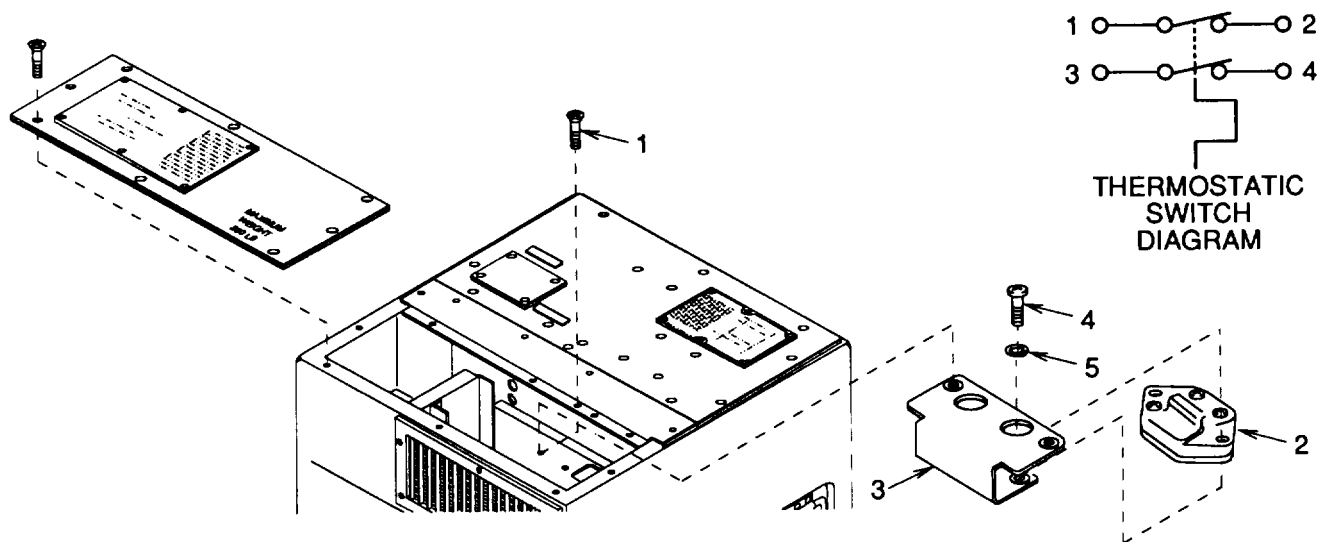


Figure 4-37. Heater Thermostat S6

**REMOVAL**

1. Remove two screws (1) and slip heater thermostat (2) and bracket (3) forward.
2. Remove two screws (4) and lock washers (5) and pull thermostat (2) from bracket (3).
3. Tag and disconnect leads.

**INSPECTION**

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

**4-42. HEATER THERMOSTAT S6. - continued**

TESTING

- 1. Check continuity on terminals 1 and 2 of the thermostat. Continuity should be indicated.
- 2. Check continuity on terminals 3 and 4. Continuity should be indicated.

REPLACEMENT

Replace heater thermostat if defective.

INSTALLATION

- 1. See tags and wiring diagram figure 4-4 and connect leads. Remove tags.
- 2. Attach thermostat (2) to bracket (3) with two screws (4) and lock washers (5).
- 3. Attach thermostat (2) and bracket (3) assembly to flange of the top center panel with two screws (1).

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install top front panel (para 4-11).

**4-43. HEATER ELEMENTS (HR1-HR6 3 phase units) and (HR1-HR4 single phase units).**

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

INITIAL SETUP

Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

Equipment Condition

Remove top panels (para 4-11).  
Remove junction box (para 4-27).

Materials/Parts

Heater Element  
Lock Washers (6)  
Rags  
Appendix E, item 13

**4-43. HEATER ELEMENTS (HR1-HR6 3 phase units) and (HR1-HR4 single phase units). - continued**

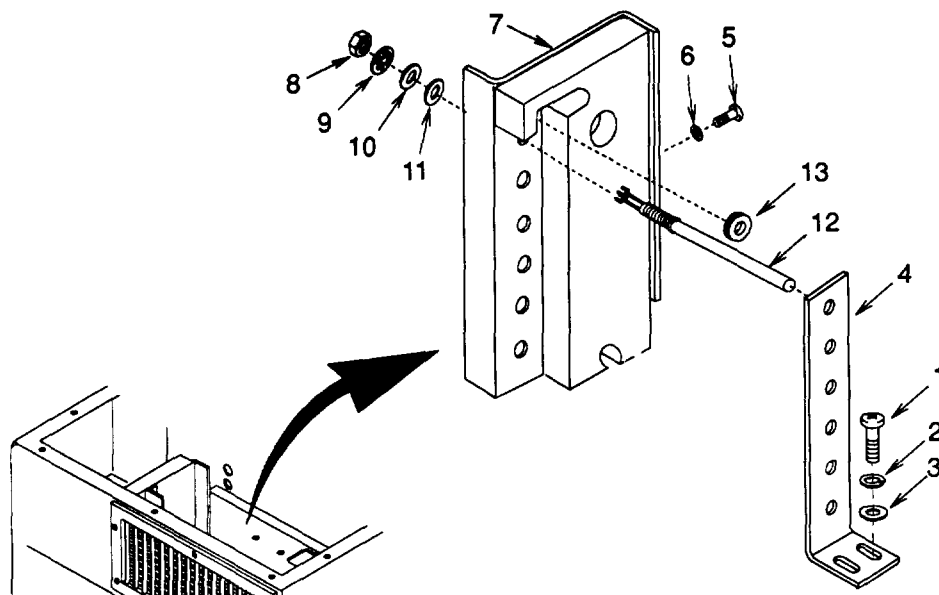


Figure 4-38. Heater Elements

**INSPECTION**

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

**TESTING**

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

**REMOVAL**

1. Tag and disconnect leads from terminal board TB2.
2. Remove two screws (1), lock washers (2), and flat washers (3) and remove heater support (4).
3. Remove three screws (5) and lock washer (6) from heater mounting bracket (7).
4. Slip bracket up enough to gain access to top heater.
5. Remove retaining nut (8), lock washer (9), flat washer (10), and insulating washer (11) and slip heater (12) out of bracket.
6. Remove remaining heaters using same methods as (4) and (5) above.

**CLEANING**

Use a clean dry cloth to wipe dust and dirt from heaters. Do not use solvent or detergent.

**4-43. HEATER ELEMENTS (HR1-HR6 3 phase units) and (HR1-HR4 single phase units). - continued**

**REPLACEMENT**

Replace any defective heater elements.

**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.
3. Slip heater through the bracket hole and secure with nut (8), lock washer (9), flat washer (10), and insulating washer (11) provided with heater (12).
4. Install remaining heaters one at a time. Slide mounting bracket down progressively as each heater is installed.
5. Place heater support (4) in the unit and slip ends of heaters through support holes.
6. Install three screws (5) and lock washers (6) in heater mounting bracket (7).
7. Install screw (1), lock washer (2), and flat washer (3) in heater support (4).
8. See tags and wiring diagram figure 4-4 and connect heater leads at terminal board TB2. Remove tags.

**NOTE**

FOLLOW-ON MAINTENANCE:  
 Install junction box (para 4-27).  
 Install top panels (para 4-11)

**4-44. CONDENSER FAN, MOTOR, AND HOUSING.**

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

**INITIAL SETUP**

Tools	Equipment    Condition
Refrigeration Unit Service Tool Kit Appendix B, item 1	Remove louver and cable assembly (para 4-17). Remove compressor start relay K5 (para 4-35).

**Materials/Parts**

Condenser Fan Motor  
 Condenser Fan Impeller  
 Condenser Fan Housing  
 Condenser Fan Inlet Ring  
 Lock Washers (4)  
 Lock Washers (4)  
 Tie Down Straps

**4-44. CONDENSER FAN, MOTOR, AND HOUSING - continued****INSPECTION**

1. Check motor rotational freedom by spinning fan. If there is any stiffness or binding, notify supervisor.
2. Check motor bearings for shaft end play. If there is excessive end play, notify supervisor.
3. Check impeller fan for dents, bent or loose fan blades, and that hub is securely attached. Replace if damaged.
4. Check fan inlet ring for dents or any distortion that would cause interference with impeller fan. Replace if damaged.

**TESTING**

1. Use a continuity tester to check continuity of field coils between motor connector P5 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.

**REMOVAL**

1. Remove four cap screws (1) and washers (2) from top of motor mounting plate (3).
2. Cut plastic tie down straps to free motor cable.
3. Unscrew P4, P5, P6, P8, and P9 connectors and push aside.
4. Loosen two setscrews (4) on motor shaft extension (5) at motor end. Slide shaft extension (5) and fan (6) from motor shaft.
5. Carefully lift motor (7) and mounting plate (3) up and out of unit.
6. Remove motor shaft extension (5) from fan (6) by loosening setscrew (8) on fan hub.
7. If motor is to be replaced, remove four cap screws (9), lock washers (10), eight flat washers (11), mounting plate (3), four bushings (12), and grommets (13).



Use care not to break refrigeration tubing.

8. Remove three screws (14), lock washers (15), flat washers (16), and loop clamps (17) that secure two charging valves (18), and pressure relief valve (19), to condenser fan housing (20).
9. Remove screw (21) and lock washer (22) securing clamp and tubing (23) to fan housing (20).

4-44. CONDENSER FAN, MOTOR, AND HOUSING. - continued

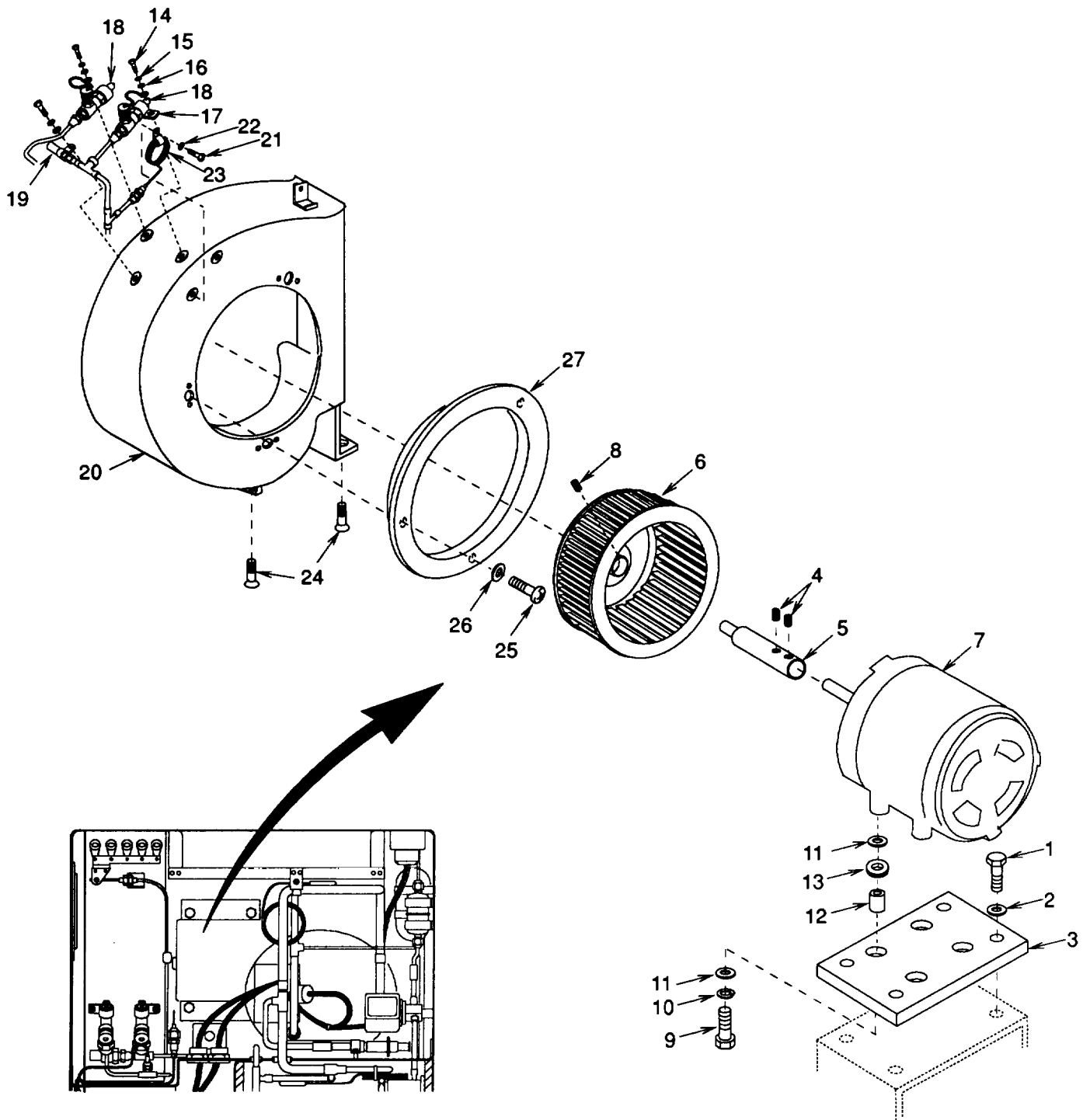


Figure 4-39. Condenser Fan, Motor, and Housing

**4-44. CONDENSER FAN, MOTOR, AND HOUSING. - continued**

10. Remove five screws (24) attaching condenser fan housing (20) to unit. Screws are accessible from underneath the unit.
11. Carefully remove condenser fan housing (20) (with fan (6) inside) by rotating housing 90° counterclockwise and pulling straight out.
12. Remove three screws (25) and flat washers (26), and fan inlet ring (27).
13. Remove impeller fan (6) from condenser fan housing (20).

**REPLACEMENT**

Replace all defective components found during inspection and test.

**INSTALLATION**

1. Place impeller fan (6) in condenser fan housing (20).
2. Install fan inlet ring (27) and secure with three screws (25) and flat washers (26).
3. Carefully place condenser fan housing (20) in unit by rotating housing 90° counterclockwise and sliding into place.
4. Secure condenser fan housing (20) to unit with five attaching screws (24).



Use care not to break refrigeration tubing.

5. Secure clamp and tubing (23) to fan housing (20) with screw (21) and lock washer (22).
6. Secure two charging valves (18), and pressure relief valve (19), to condenser fan housing (20) with three loop clamps (17), screws (14), flat washers (16), and lock washers (15).
7. Slide motor shaft extension (5) into hub of fan impeller (6) and secure with setscrew (8).

**NOTE**

After bringing motor mounting bolts up snug, tighten one full turn on each of the four bolts to compress grommets.

8. Insert four bushings (12) and grommets (13) into four motor mounting holes and attach motor (7) to mounting plate (3) with eight flat washers (11), four lock washers (10), and four cap screws (9).
9. Carefully place motor (7) and mounting plate (3) down into unit and align holes in motor mounting plate with those in unit.
10. Install four cap screws (1) and washers (2) in motor mounting plate (3) but do not tighten them all the way.
11. Slide motor shaft extension (5) onto motor shaft and secure with two setscrews (4).
12. Spin fan by hand and check for equal clearance between the fan inlet ring (27) and outer edges of fan (6). Adjust mounting plate (3) as necessary.

#### 4-44. CONDENSER FAN, MOTOR, AND HOUSING. - continued

13. Tighten cap screws (1) in motor mounting plate (3) and check that fan (6) rotates freely and has adequate clearance to fan inlet ring (27).
14. Connect P4, P5, P6, P8, and P9 connector plugs.
15. Secure cable and harnesses with new plastic tie down straps or lacing cord.

#### NOTE

FOLLOW-ON MAINTENANCE:  
Install compressor start relay K5 (para 4-35).  
Install louver and cable assembly (para 4-17).

#### 4-45. EVAPORATOR COIL.

This task covers: a. Inspection b. Cleaning

#### INITIAL SETUP

##### Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1  
Scrub Brush  
Appendix B, item 2  
Safety Glasses  
Appendix B, item 2

##### Equipment Condition

Remove supply air louver (para 4-14).  
Remove mist eliminator (para 4-16).

General Safety Instructions

#### WARNING

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

Do not use steam to clean coil.

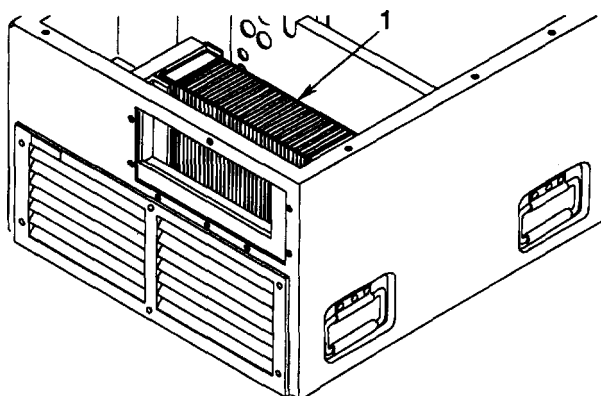


Figure 4-40. Evaporator Coil



**4-45. EVAPORATOR COIL. - continued****INSPECTION**

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 airflow. 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<sup>2</sup>).

Do not use steam to clean coil.

**CLEANING**

Clean coil (1) with a soft bristled brush, and use compressed air at 30 psi (2.1 kg/cm<sup>2</sup>) 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 notify your supervisor.

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install mist eliminator (para 4-16).  
Install supply air louver (para 4-14).

**4-46. SOLENOID VALVE (COIL).**

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

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

**Materials/Parts**

Solenoid Valve Coil  
Tie Down Straps

**Equipment Condition**

Remove top rear panel (para 4-11).

General Safety Instructions

**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.

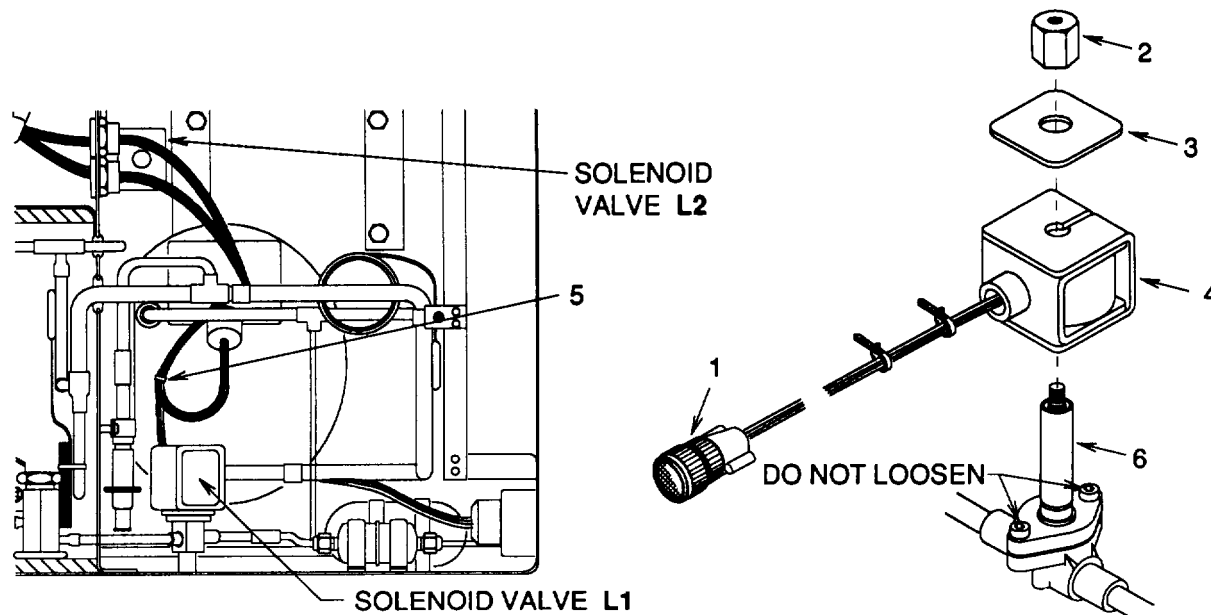
**4-46. SOLENOID VALVE (COIL). - continued**

Figure 4-41. Solenoid Valve (Coil)

**NOTE**

The following basic instructions apply to both the by-pass solenoid L1 and the pressure equalizer solenoid L2.

**TESTING**

1. Disconnect the solenoid valve connector plug (1). (P8 for L1 solenoid and P9 for L2 solenoid.)
2. Check for continuity between pins A and B in connector plug (1). If continuity is not found, the coil (4) is open and must be replaced.
3. Check for continuity between each pin in connector plug (1) and coil (4) casing. If continuity is found the coil is grounded and should be replaced.
4. If continuity checks are satisfactory, apply 28 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, Notify supervisor.

**REPAIR**

The only authorized repair to solenoid valve is coil replacement. The coil can be replaced without opening the refrigeration pressure system.

#### **4-46. SOLENOID VALVE (COIL). - continued**

#### **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.

#### **REMOVAL**

1. Remove top nut (2), coil (4), data plate (3), and connector plug (1).
2. Cut plastic tie down straps (5) as necessary to remove solenoid valve cable.
3. Remove connector plug (1) from coil (4) leads. (See para 4-20.)

#### **INSTALLATION**

1. Attach connector plug (1) to coil (4) leads. (See para 4-20.)
2. Place coil assembly (4) and data plate (3) onto valve body (6) and secure with nut (2).
3. Reconnect connector plug (1).
4. Secure wires to existing harnesses with new plastic tie down straps (5).

#### **NOTE**

FOLLOW-ON MAINTENANCE:  
Install top rear panel (para 4-11)

#### **4-47. LOW PRESSURE CUTOUT SWITCH (LPCO) BYPASS.**

This task covers: Installation

#### **INITIAL SETUP**

##### **Tools**

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

##### **Equipment Condition**

Remove junction box (para 4-27).

#### **NOTE**

If unit is to be operated in COOL mode at or below 0°F (-17.8°C) ambient the low pressure cutout (LPCO) switch (S5) must be jumpered.

**4-47. LOW PRESSURE CUTOUT SWITCH (LPCO) BYPASS. - continued**

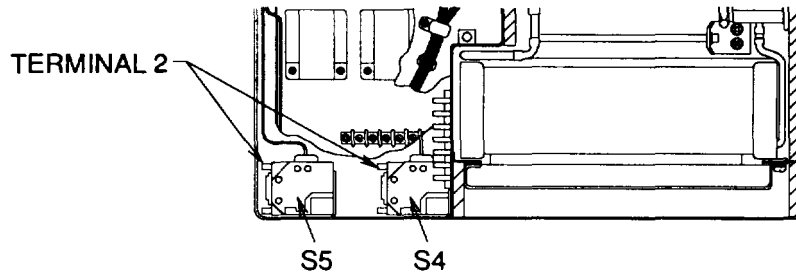


Figure 4-42. Bypass LPCO Switch

**INSTALLATION**

1. Tag and disconnect wire lead from low pressure cutout switch (S5) terminal 2.
2. Tag and disconnect wire lead from high pressure cutout switch (S4) terminal 2.
3. Connect wire lead disconnected in step 1 above to high pressure cutout switch (S4) terminal 2.
4. Connect wire lead disconnected in step 2 above to low pressure cutout switch (S5) terminal 2.
5. Remove tags.
6. Fabricate CAUTION tag (shown below) and 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 to permit operation in cool mode at temperatures below 0°F (-17.8°C).

Compressor will not shut off under low suction pressure conditions.

Rewire the pressure cutout switches (S4 and S5) per wiring diagram when outside air temperature increases to 40°F (5°C).

CAUTION TAG EXAMPLE

**NOTE**

**FOLLOW-ON MAINTENANCE:**  
Install junction box (para 4-27).

**4-48. CONDENSER COIL.**

This task covers:    a. Inspection        b. Cleaning

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
 Appendix B, item 1  
 Safety Glasses  
 Appendix B, item 2  
 Scrub Brush  
 Appendix B, item 2

**Equipment Condition**

Remove top rear panel (para 4-11).  
 Remove condenser air inlet guard (para 4-12).

**General Safety Instructions****WARNING**

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

Do not use steam to clean coil.

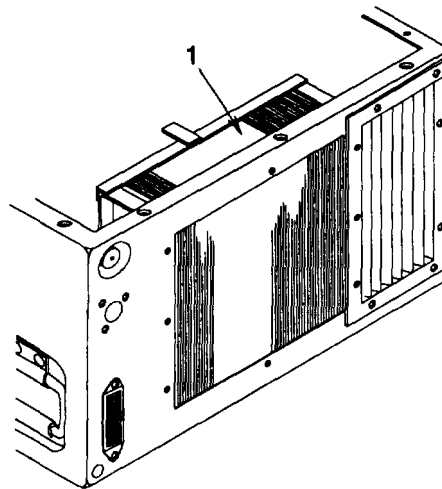


Figure 4-43. Condenser Coil

**NOTE**

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

**INSPECTION**

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 airflow. Straighten all damaged fins with a plastic fin comb.

#### 4-48. CONDENSER COIL. - continued

### WARNING

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

Do not use steam to clean coil.

### CLEANING

Clean coil (1) with a soft bristled brush and use compressed air at 30 psi (2.1 kg/cm<sup>2</sup>) 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 notify your supervisor.

### NOTE

FOLLOW-ON MAINTENANCE:  
Install condenser air inlet guard (para 4-1 2)  
Install top rear panel (para 4-11)

#### 4-49. CONNECTORS (INSTALLATION).

This task covers: a. Inspection b. Replacement

### INITIAL SETUP

#### Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

#### Equipment Condition

Disconnect power at power source.

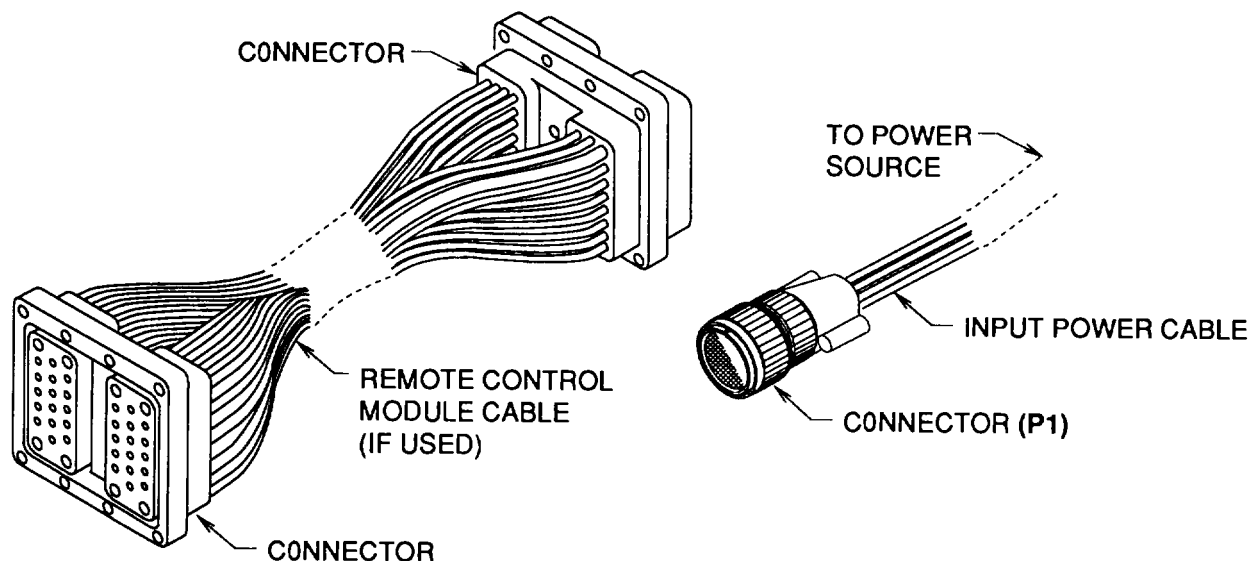


Figure 4-44. Connectors (Installation)

**4-49. CONNECTORS (INSTALLATION). - continued****NOTE**

There are three connectors supplied with each air conditioner.

The input power cable connector (P1) 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.

The other two remote control module cable connectors are used when the control module is to be installed remote from the air conditioner. (See para 4-5.)

**INSPECTION**

Check for loose, missing, or damaged pins and cut, or broken wires on connector or any other damage.

**REPLACEMENT**

Replace damaged wires or connectors and connectors with missing, loose, or damaged pins.

**NOTE**

FOLLOW-ON MAINTENANCE:  
Connect power at power source.

**4-50. INSTALLATION HARDWARE.**

This task covers:    a. Inspection    b. Replacement

**INITIAL SETUP**

Tools

Equipment    Condition

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

Disconnect power at power source.

**NOTE**

Each unit is supplied with mounting hardware for the four base attachment points.

**Inspection**

Inspect hardware to be sure it is tight, properly installed, and in good condition.

**REPLACEMENT**

Replace missing, damaged, or defective parts.

**NOTE**

FOLLOW-ON MAINTENANCE:  
Connect power at power source.

**4-50. INSTALLATION HARDWARE. - continued**

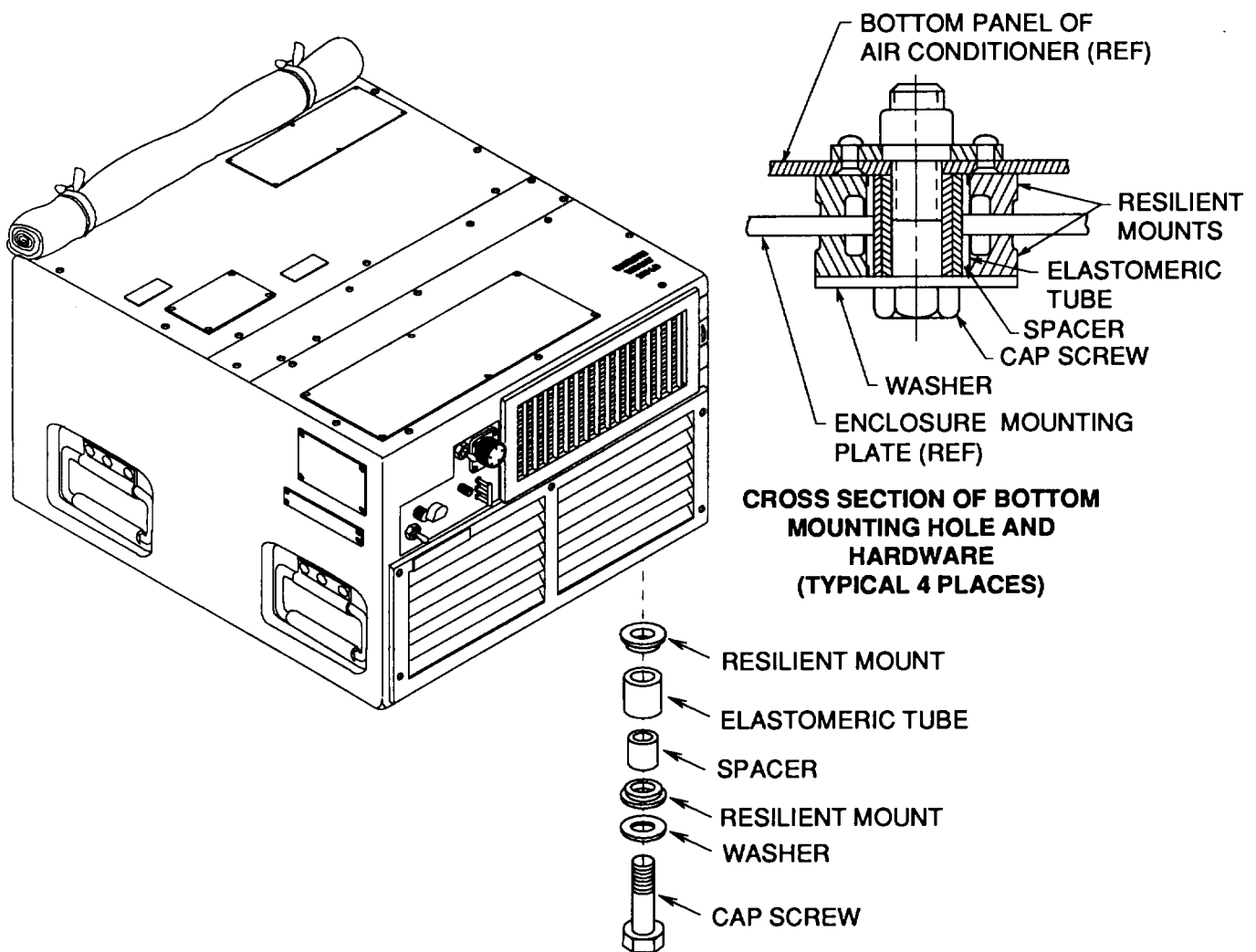


Figure 4-45. Installation Hardware



**Section VII PREPARATION FOR STORAGE OR SHIPMENT****4-51. PREPARATION FOR STORAGE.**

Before placing equipment in administrative storage, current maintenance services and Equipment Serviceable Criteria (ESC) evaluations should be completed, shortcomings and deficiencies should be corrected, and all Modification Work Orders (MWO's) should be applied.

- a. Storage Site Selection. Inside storage is preferred for items selected for administrative storage. If inside storage is not available, trucks, vans, conex containers and other containers may be used.
- b. Administrative Storage of Equipment. Placement of equipment in administrative storage should be for short periods of time when a shortage of maintenance effort exists. Items should be in mission readiness within 24 hours or within the time factors as determined by the directing authority. During the storage period appropriate maintenance records will be kept.
  - (1) Unroll fabric cover.
  - (2) Snap cover in place.
- c. 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.
- d. 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

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

### **5-1. GENERAL.**

- a. For authorized common tools and equipment refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.
- b. Test, measurement, and diagnostic equipment (TMDE) and support equipment include electrical test equipment, standard pressure and vacuum gauges, vacuum pumps, and charging manifolds found as standard equipment in any direct support refrigeration shop.
- c. Repair parts are listed and illustrated in TM9-4120-400-24P. 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.

## 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.

## SYMPTOM INDEX

Trouble	Malfunction No.
<b>AIR CONDITIONER</b>	
Insufficient Cooling . . . . .	3
Noisy During Operation . . . . .	7
Operates Continuously On Cooling Cycle . . . . .	5
<b>COMPRESSOR</b>	
Will Not Start. . . . .	1
Short Cycles. . . . .	2
<b>Refrigerant System</b>	
Contaminated. . . . .	6
Continuously Losing Refrigerant. . . . .	4

Table 5-1. TROUBLESHOOTING

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
-------------	--------------------	-------------------

**1. COMPRESSOR WILL NOT START.****NOTE**

Be sure and check Item 5, Steps 1 through 10, Table 4-2 Troubleshooting for unit maintenance before proceeding with Step 1.

Step 1. 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 5-28 and 5-29.)

Step 2. Check that the compressor motor thermal cutoff switch is operational. (See para 5-35.)

Replace compressor if thermal cutoff switch is defective.

Step 3. Inspect and check compressor for burnout. (See para 5-35.)

Replace burned out compressor.

**2. COMPRESSOR SHORT CYCLES.**

Step 1. 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 5-28.)
- 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.

Table 5-1. TROUBLESHOOTING - continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
-------------	--------------------	-------------------

**2. COMPRESSOR SHORT CYCLES. - continued**

Step 2. Check head pressure (low pressure side). (See para 5-19.)

Add refrigerant if low. (See para 5-16.)

Step 3. Check quench valve. (See para 5-23.)

Replace if defective.

Step 4. Check compressor motor internal overload switch. (See para 5-35.)

Replace compressor if motor internal overload switch is defective.

Step 5. Check solenoid valves L1 and L2. (See para 5-24 and 5-25.)

Replace or replace if defective.

**3. INSUFFICIENT COOLING.****NOTE**

Frost on the evaporator coil is usually caused by an obstruction to air flow or dirty coils, filter, or mist eliminator.

Step 1. Check actuating cylinder to make sure condenser discharge louvers are opening. (See para 5-27.)

Replace if defective.

Step 2. 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 5-20.)

Step 3. Check for refrigerant leaks. (See para 5-14.)

Repair or change defective part.

Step 4. Check solenoid valves L1 and L2. (See para 5-24 and 5-25.)

Repair or replace if defective.

Step 5. Check pressure regulator valve. (See para 5-26.)

Replace if defective.

Step 6. Check expansion valve for proper operation. (See para 5-22.)

Replace if defective.

Table 5-1. TROUBLESHOOTING - continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<b>3. INSUFFICIENT COOLING. - continued</b>		
	Step 7. Check quench valve for proper operation. (See para 5-23.)	Replace if defective.
<b>4. REFRIGERANT SYSTEM CONTINUOUSLY LOSING REFRIGERANT</b>		
	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 5-31.)	Replace if defective.
<b>5. UNIT OPERATES CONTINUOUSLY ON COOLING CYCLE.</b>		
	Check solenoid valve L1. (See para 5-24.)	Replace if defective.
<b>6. REFRIGERANT IS CONTAMINATED.</b>		
	Sight glass appears yellow instead of green after compressor has run for at least one hour.	Replace dehydrator. (See para 5-20.)
<b>7. AIR CONDITIONER NOISY DURING OPERATION.</b>		
	Step 1. Check expansion valve. (See para 5-22.)	Replace if defective.
	Step 2. Check quench valve. (See para 5-23.)	Replace if defective.
	Step 3. Check compressor for internal noise and loose mounting. (See para 5-35.)	a. Repair loose mounting. b. Replace compressor if defective.

## Section III MAINTENANCE PROCEDURES

**5-3. GENERAL.****WARNING**

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

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. TOP PANELS.**

This task covers:      a. Repair      b. Replacement

**INITIAL SETUP**

## Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

## Materials/Parts

Adhesive Remover  
Appendix E, item 16  
Adhesive  
Appendix E, item 2  
Insulation/Gasket  
Appendix F

## Equipment Condition

Remove top panels (para 4-11).

General Safety Instructions

**WARNING**

Adhesive remover is flammable and the vapors can be explosive. Repeated or prolonged skin contact or inhalation of vapors can be toxic. Use in a well ventilated area, wear gloves, and keep away from sparks or flame.

**NOTE**

The only authorized repairs for these panels are replacement of gaskets, insulation and information plates.

Use only gasket material, insulation material, or nameplates identified in TM9-4120-400-24P.

**REPAIR**

1. Remove as much old gasket or insulation material as possible by pulling or scraping it away from the metal surface.

**5-4. TOP PANELS. - continued****WARNING**

Adhesive remover is flammable and the vapors can be explosive. Repeated or prolonged skin contact or inhalation of vapors can be toxic. Use in a well ventilated area, wear gloves, and keep away from sparks or flame.

2. Soften and remove old adhesive and material residue, using adhesive remover and a stiff brush.
3. Fabricate gaskets/insulation in accordance with dimensions provided in Appendix F.
4. Coat mating surfaces of metal and material with adhesive. Let both surfaces air dry until adhesive is tacky but will not stick to fingers.
5. Starting with an end, carefully attach material 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.

**REPLACEMENT**

Replace panels that are badly dented, bent, or punctured.

**5-5. FRESH AIR DAMPER AND ACTUATOR.**


---

This task covers:      a. Removal      b. Replacement      c. Installation      d. Adjustment

---

**INITIAL SETUP**

Tools	Equipment Condition
Refrigeration Unit Service Tool Kit Appendix B, item 1	Remove return air louver (para 4-13). Remove supply air louver (para 4-14). Remove mist eliminator (para 4-16). Remove compressor (para 5-34).
Materials/Parts	
Self-locking Nuts (2) Lock Washer Lock Washers (3) Spring Washers (2) Push On Nut	

---



**5-5. FRESH AIR DAMPER AND ACTUATOR. - continued**

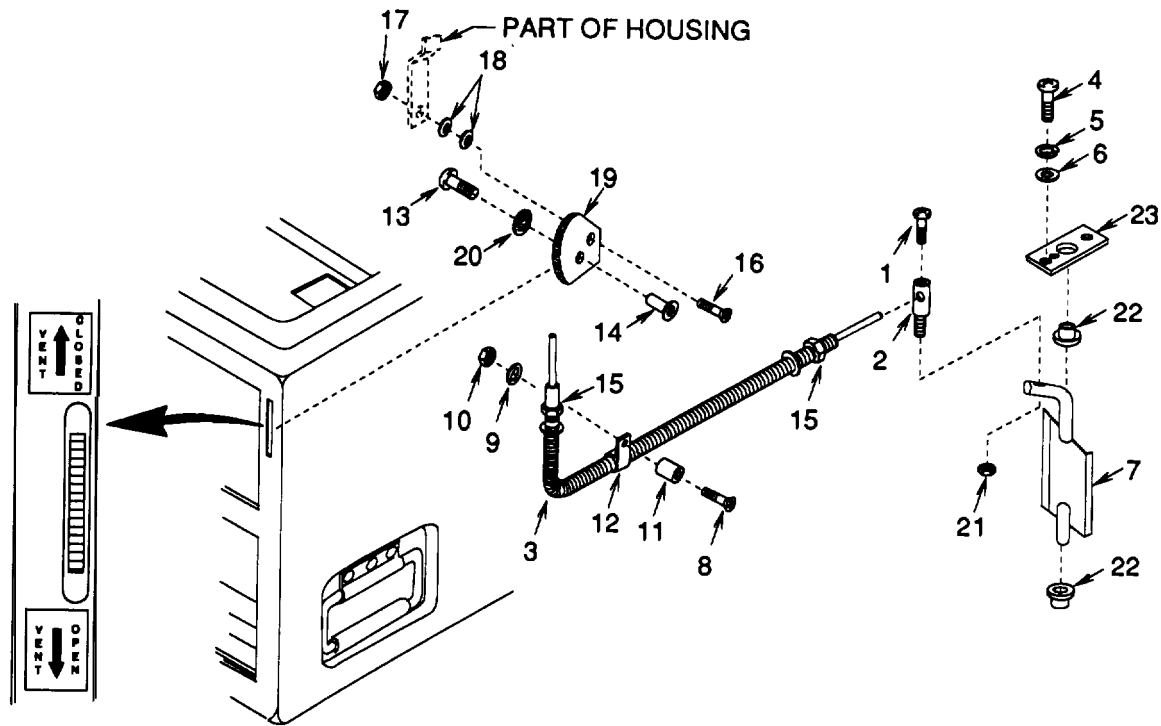


Figure 5-1. Fresh Air Damper and Actuator

**REMOVAL**

1. Loosen screw (1) on mechanical post (2) and disconnect push-pull control cable (3).
2. Remove two screws (4), lock washers (5), and flat washers (6) and lift damper (7) from air conditioner.
3. Remove screw (8), lock washer (9), nut (10), spacer (11) and loop clamp (12).
4. Loosen screw (13) in actuator plate blind nut (14) to free end of push-pull control cable (3).
5. Remove outer nuts (15) from both ends of push-pull control cable (3) and remove cable from unit.
6. Remove screw (16), self-locking nut (17), two spring washers (18) and actuator plate (19).
7. Remove screw (13), push on nut (20), and blind nut (14) from actuator plate (19).
8. Remove self-locking nut (21), screw (1), mechanical post (2), two sleeve bearings (22), and cover (23) from damper (7).

**REPLACEMENT**

Replace all worn or damaged parts.

**5-5. FRESH AIR DAMPER AND ACTUATOR. - continued****INSTALLATION**

1. Insert blind nut (14) into actuator plate (19) and secure with push on nut (20).
2. Install screw (13) into blind nut (14). Do not tighten.
3. Attach two sleeve bearings (22), cover (23), mechanical post (2), and self-locking nut (21) to damper (7).
4. Install screw (1) into mechanical post (2). Do not tighten.
5. Install actuator plate (19) with screw (16), two spring washers (18), and self-locking nut (17).
6. Install damper (7) in opening of housing.
7. Secure damper cover (23) to housing with two screws (4), lock washers (5), and flat washers (6).
8. Install one nut (15) seven turns onto each end of push-pull control cable (3).
9. Install ends of cable through openings in housing.
10. Install outer nuts (15) on push-pull control cable (34) and tighten.
11. Insert cable (3) ends into mechanical post (2) and blind nut (14).
12. Install loop clamp (12), spacer (11), screw (8), nut (10), and washer (9).

**NOTE**

Be sure equal lengths of push-pull control cable (3) extend from ends.

13. Put actuator plate (19) in center position and tighten screw (13).
14. Put damper (7) in center position and tighten screw (1).

**ADJUSTMENT**

1. Loosen screw (13) on blind nut (14) to release push- pull control cable end.
2. Move move push-pull cable (3) in and out and determine the center between the two extreme stop points.
3. Move actuator plate (19) so that it is also centered on the curved portion of the plate.
4. Tighten screw (13) on blind nut (14).
5. Check actuator plate (19) for smooth operation.

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install compressor (para 5-34).  
Install mist eliminator (para 4-16).  
Install supply air louver (para 4-14).  
Install return air louver (para 4-13).

## 5-6. SCREENS, GUARDS, AND LOUVERS.

This task covers:      a. Repair      b. Replacement

### INITIAL SETUP

#### Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

#### Equipment Condition

Remove rear screens and guards (para 4-12).  
Remove return air louver and air filter (para 4-13).  
Remove supply air louver (para 4-14).

#### Materials/Parts

Adhesive Remover  
Appendix E, item 16  
Adhesive  
Appendix E, item 2  
Gasket  
Appendix F

#### General Safety Instructions

#### WARNING

Adhesive remover is flammable and the vapors can be explosive. Repeated or prolonged skin contact or inhalation of vapors can be toxic. Use in a well ventilated area, wear gloves, and keep away from sparks or flame.

### NOTE

The only authorized repairs are replacement of gaskets and the straightening of bent blades.

### REPAIR

1. Remove as much old gasket material as possible by pulling or scraping it away from the metal surface.

#### WARNING

Adhesive remover is flammable and the vapors can be explosive. Repeated or prolonged skin contact or inhalation of vapors can be toxic. Use in a well ventilated area, wear gloves, and keep away from sparks or flame.

2. Soften and remove old adhesive and gasket residue, using adhesive remover and a stiff brush.
3. Fabricate gaskets in accordance with dimensions provided in Appendix F.
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 metal. Press into firm contact all over.
6. Minor dents and bent edges can be straightened using common sheet metal repair procedures.
7. Straighten slightly bent louver blades by hand.
8. Should touch up or refinishing be necessary, see TM 43-0139.

**5-6. SCREENS, GUARDS, AND LOUVERS. - continued****REPLACEMENT**

Replace screens, guards, or louvers that are badly dented or bent and screens that are punctured or torn.

**NOTE****FOLLOW-ON MAINTENANCE:**

Install rear screens and guards (para 4-12).  
 Install return air louver and air filter (para 4-13).  
 Install supply air louver (para 4-14).

**5-7. EVAPORATOR FAN MOTOR REPAIR.**

This task covers:           Repair

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
 Appendix B, item 1

**Materials/Parts**

Oil  
 Appendix E, item 17

**REPAIR****NOTE**

Check name plate on motor for manufacturer and model number and use repair instructions below which pertain to the motor in your air conditioner.

1. Motor Assembly, IMC Magnetics Corp., 3 Phase Motor, Model FBT 4625-3 and Single Phase Motor, Model BC45201.

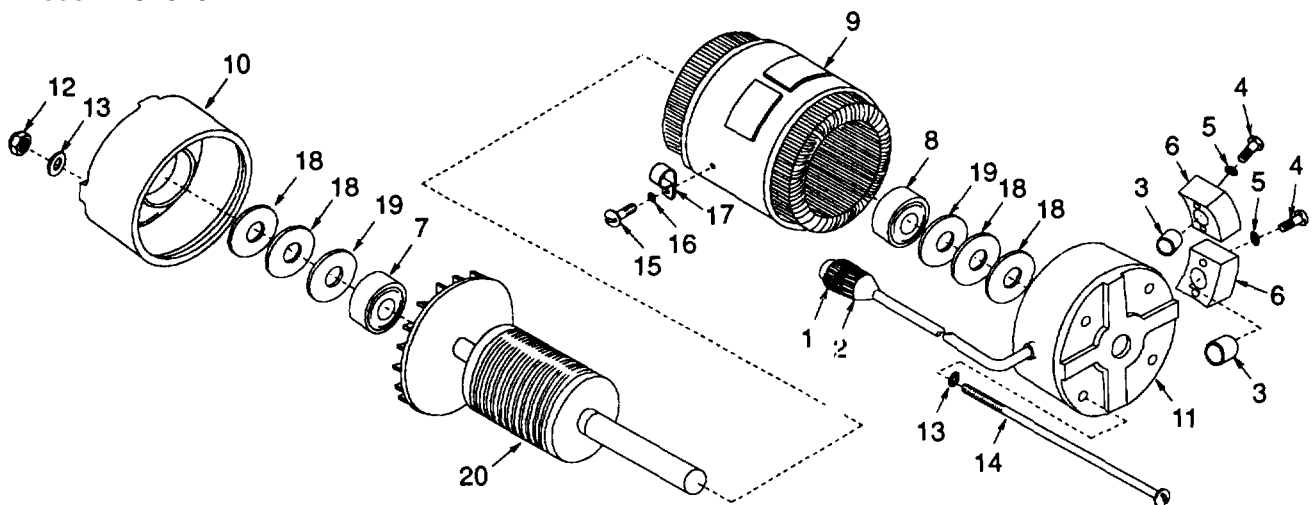


Figure 5-2. Motor Assembly, IMC Model FBT 4625-3 (3 phase) and Model BC4520-1 (single phase)

**5-7. EVAPORATOR FAN MOTOR REPAIR. - continued**

a. To replace connector (1):

- (1) Loosen cable clamp (2).
- (2) Tag and unsolder leads.
- (3) Remove old connector (1).
- (4) See wiring diagram figure 4-4 and tags and solder leads to new connector (1). Remove tags.
- (5) Secure cable clamp (2).

b. To replace overload (thermal) protectors (3):

- (1) Remove two screws (4) and lock washers (5) from thermal overload protector housing (6).
- (2) Remove housing (6).
- (3) Tag and disconnect leads to overload protector (3).
- (4) Remove old overload protector (3).
- (5) See tags and connect leads to new overload protector (3). Remove tags.
- (6) Install overload protector housing (6) with two screws (4) and lock washers (5).

c. To replace bearings (7 and 8):

- (1) Match-mark stator (9) and both end bells (10 and 11) to ease reassembly.
- (2) Remove four locknuts (12), eight flat washers (13), and four through bolts (14) from motor.
- (3) Remove screw (15), lock washer (16), and loop clamp (17) from the side of stator.
- (4) Carefully separate rear end bell (10) from stator (9). Tap rear end bell away from stator. Tap opposite sides, top, and bottom in alternating sequence to break end bell loose.
- (5) Carefully separate front end bell (11) from stator (9) being careful to avoid damaging wires. Tap front end bell away from stator. Tap opposite sides, top, and bottom in alternating sequence to break end bell loose. Wires may be left in place if care is taken to avoid damaging them.
- (6) Press out or carefully drive bearings (7 and 8) out of end bells (10 and 11). Remove and retain shims (18) and thrust washer (19) for use at reassembly if they are not damaged.
- (7) Examine rotor (20), stator (9), and shaft for nicks, gouges, deformations, and signs of overheating. Replace motor if defective.
- (8) Coat shaft surfaces of rotor with oil and slide bearings (7 and 8) on shaft ends. They should seat against shoulders at inner ends of shaft.
- (9) Coat thrust washers (19) and shims (18) with oil and slide them over each end of shaft with the thrust washers (19) next to the bearings.
- (10) Coat bearing cavity of each end bell (10 and 11) 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.

**5-7. EVAPORATOR FAN MOTOR REPAIR. - continued**

- (11) Place a flat washer (13) on each through bolt (14) and insert through bolts through holes in both end bells. Place flat washers (13) and lock nuts (12) on through bolts, and tighten finger-tight.
- (12) Tap around both end bells (10 and 11) while tightening nuts (12) on through bolts (14). 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.
- (13) 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.
- (14) Secure cable to stator housing with loop clamp (17), screw (15), and lock washer (16).

2. Motor Assembly, Motor Appliance Corp., 3 Phase Motor, Model W0792.

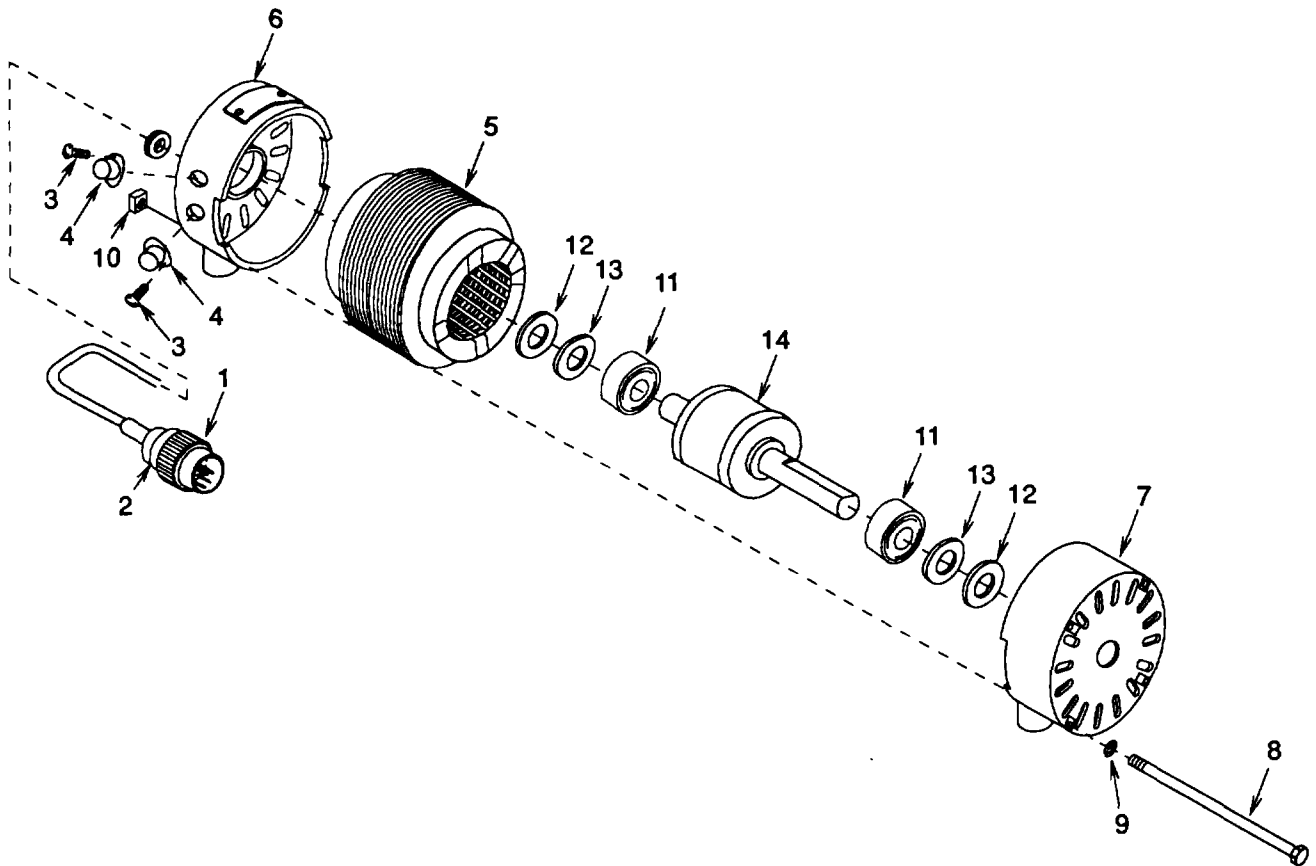


Figure 5-3. Motor Assembly, Motor Appliance Corp Model W0792 (3 phase)

- a. To replace connector (1):
  - (1) Loosen cable clamp (2).
  - (2) Tag and unsolder leads.
  - (3) Remove old connector (1).

**5-7. EVAPORATOR FAN MOTOR REPAIR. - continued**

(4) See wiring diagram figure 4-4 and tags and solder leads to new connector (1). Remove tags.

(5) Secure cable clamp (2).

b. To replace overload (thermal) protectors:

(1) Remove two screws (3) from overload protector (4).

(2) Tag and disconnect leads to overload protector (4).

(3) Remove old overload protector (4).

(4) See tags and connect leads to new overload protector (4). Remove tags.

(5) Install overload protector (4) with two screws (3).

c. To replace bearings:

(1) Match-mark stator (5) and both end bells (6 and 7) to ease reassembly.

(2) Remove four thru bolts (8), lock washers (9), and square nuts (10) from front motor.

(3) Carefully separate end bells (6 and 7) from stator (5) being careful to avoid damaging wires. Tap opposite sides, top and bottom in alternating sequence to break end bells loose. Wires may be left in place if care is taken to avoid damaging them.

(4) Press out or carefully drive bearings (11) out of end bells (6 and 7). Remove and retain spacers (12) and spring washers (13) from end bells (6 and 7) for use at reassembly if they are not damaged.

(5) Examine rotor (14), stator (5) and shafts for nicks, gouges, deformations and evidence of overheating. Replace motor if defective.

(6) Coat shaft surfaces of rotor (14) with oil and slide bearings(11) on shaft ends. They should seat against shoulders at the inner ends of shaft.

(7) Coat spacers (12) and spring washers (13) with oil and slide them over end of both shafts with spring washers (13) installed first.

(8) Coat bearing cavity of each end bell (6 and 7) with oil. Slide end bells 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 (5). Keep match-marks made at time of disassembly in alignment.

(9) Place four lock washers (9) on each thru bolt (8) and insert thru bolts through both end bells. Place square nuts (10) on each thru bolt and tighten finger tight.

(10) Tap around both end bells (6 and 7) while tightening screws. Tighten in alternating sequence until all screws (8) are equally tightened. Check for freedom of rotation by turning motor shaft by hand. There should be no drag or binding.

(11) 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.

# 5-7. EVAPORATOR FAN MOTOR REPAIR. - continued

3. Motor Assembly, Welco Industries Inc., 3 Phase Motor, Model M-4720-26A.

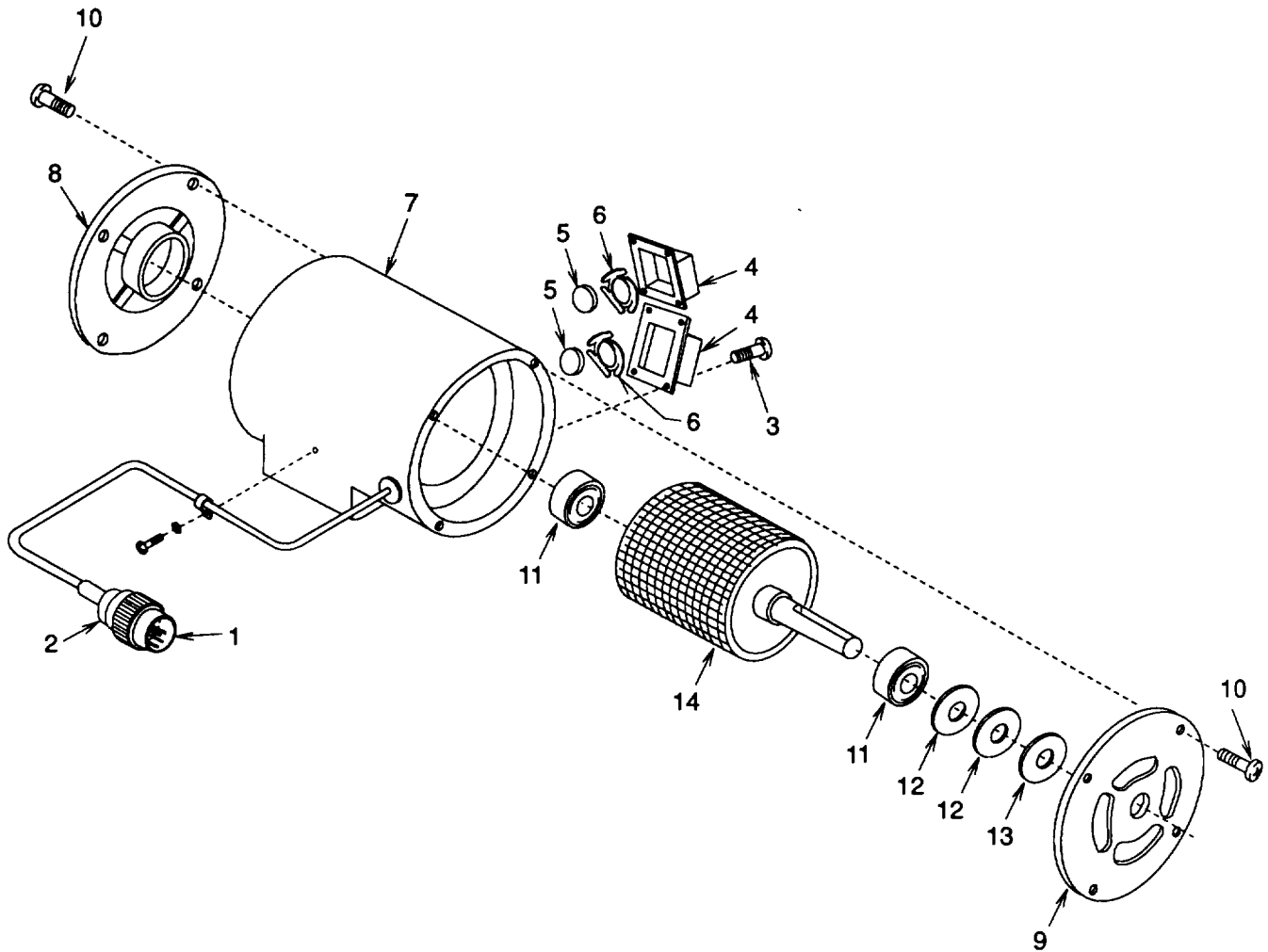


Figure 5-4. Motor Assembly, Welco Model M-4720-26A (3 phase)

a. To replace connector (1):

- (1) Loosen cable clamp (2).
- (2) Tag and unsolder leads.
- (3) Remove old connector (1).
- (4) See wiring diagram figure 4-4 and tags and solder leads to new connector (1). Remove tags.
- (5) Secure cable clamp (2).



**5-7. EVAPORATOR FAN MOTOR REPAIR. - continued**

b. To replace overload (thermal) protectors:

- (1) Remove four screws (3) from overload protector housing (4).
- (2) Remove overload protector housing (4).
- (3) Tag and disconnect leads to overload protector (5).
- (4) Remove old overload protector (5) and spring (6).
- (5) See tags and connect leads to new overload protector (5). Remove tags.
- (6) Install overload protector (5) and spring (6).
- (7) Install overload protector housing (4) with four screws (3).

c. To replace bearings:

- (1) Match-mark stator (7) and both front and rear brackets (8 and 9) to ease reassembly.
- (2) Remove four screws (10) each from front bracket (8) and rear bracket (9).
- (3) Carefully separate end brackets (8 and 9) from stator (7). Tap opposite sides, top and bottom in alternating sequence to break end brackets loose.
- (4) Press out or carefully drive bearings (11) out of end brackets. Remove and retain shims (12) and load spring (13) from rear bracket (9) (shaft end) for use at reassembly if they are not damaged.
- (5) Examine rotor (14), stator (7) and shafts for nicks, gouges, deformations and evidence of overheating. Replace motor if defective.
- (6) Coat shaft surfaces of rotor (14) with oil and slide bearings on shaft ends. They should seat against shoulders at the inner ends of shaft.
- (7) Coat shims (12) and load spring (13) with oil and slide them over end of rear shaft with load spring (13) installed last.
- (8) Coat bearing cavity of each end bracket (8 and 9) with oil. Slide end brackets 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 (7). Keep match-marks made at time of disassembly in alignment.
- (9) Place four screws (10) in each end bracket (8 and 9).
- (10) Tap around both end brackets (8 and 9) while tightening screws (10). 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,
- (11) 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.

**5-8. CONDENSER FAN MOTOR REPAIR.**

This task covers:      Repair

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

**Materials/Parts**

Oil  
Appendix E, item 17

**REPAIR****NOTE**

Check nameplate on motor for manufacturer and model number and use repair instructions below which pertain to the motor in your air conditioner.

1. Motor Assembly, Keco Industries, Inc., 3 phase motor, Model 13221 E9344-3K.

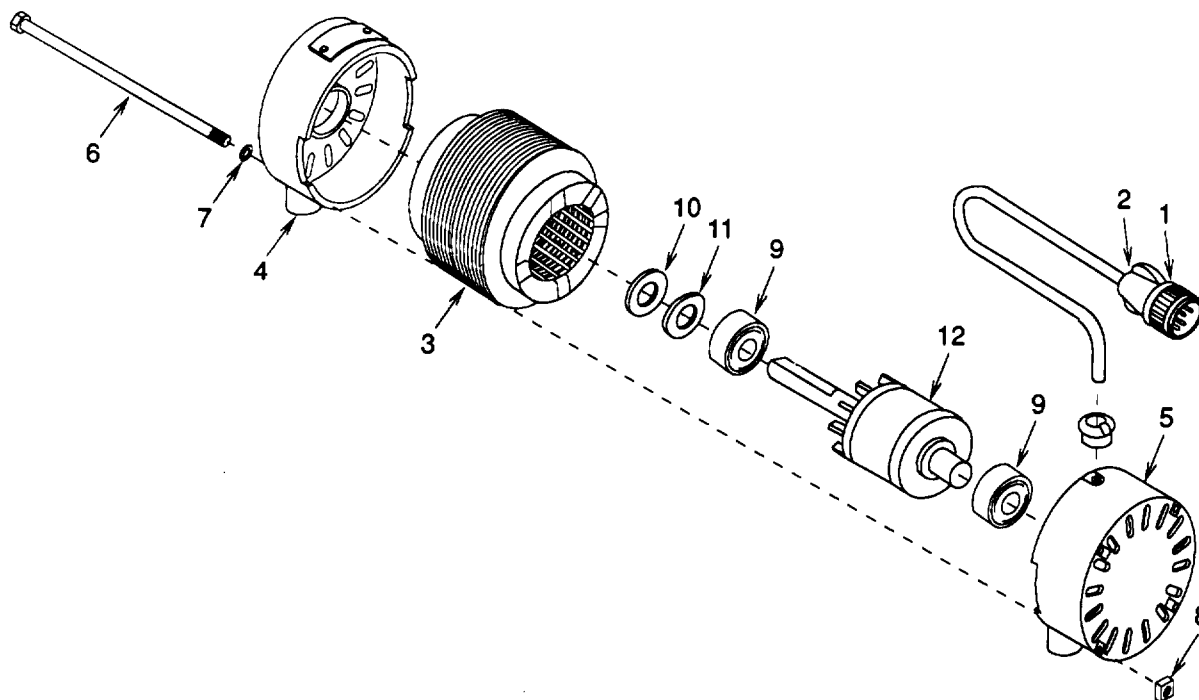


Figure 5-5. Condenser Fan Motor Assembly, Keco Industries, Inc., 3 Phase Motor, Model 13221 E9344-3K

## **5-8. CONDENSER FAN MOTOR REPAIR. - continued**

a. To replace connector (1):

- (1) Loosen cable clamp (2).
- (2) Tag and unsolder leads.
- (3) Remove old connector (1).
- (4) See wiring diagram figure 4-4 and tags and solder leads to new connector(1). Remove tags.
- (5) Secure cable clamp (2).

b. To replace bearings:

- (1) Match mark stator (3) and both end caps (4 and 5) to ease reassembly.
- (2) Remove four thru bolts (6), lock washers (7), and square nuts (8) from front end cap (4) and rear end cap (5).
- (3) Carefully separate end caps (4 and 5) from stator (3). Tap opposite sides, top and bottom in alternating sequence to break end caps loose.
- (4) Press out or carefully drive bearings (9) out of end caps (4 and 5). Retain washers (10) and load spring (11) from front end cap for use at reassembly, if they are not damaged.
- (5) Examine rotor (12), stator (3), and shafts for nicks, gouges, deformations, and evidence of overheating.
- (6) Dress high metal defects in shafts with a fine file or stone. If damage exceeds repairable limits, replace motor.
- (7) Coat shaft surfaces of rotor (12) with oil and slide bearings (9) on shaft ends. They should seat against shoulders at the inner ends of shaft.
- (8) Coat washers (10) and load spring (11) with oil and slide them over end of front shaft with load spring (11) installed first.
- (9) Coat bearing cavity of each end cap (4 and 5) with oil. Slide end cap carefully into position over shaft so that OD of bearing (9) enters ID of bearing cavity in end cap. Work end caps onto shaft until bore fits over end of stator (3). Keep match marks made at time of disassembly in alignment.
- (10) Place four thru bolts (6), lock washers (7), and square nuts (8) thru motor assembly. Finger tighten.
- (11) Tap around both end caps with a plastic or rawhide mallet while tightening thru bolts (6). Tighten in alternating sequence until all thru bolts are equally tightened. Check motor for freedom of rotation by turning motor shaft by hand. There should be no drag or binding.
- (12) 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 washers to adjust.

2. Motor Assembly, Howell Electric Motor Division of SFM Corp., Single Phase Motor, Model 70N4-4886.

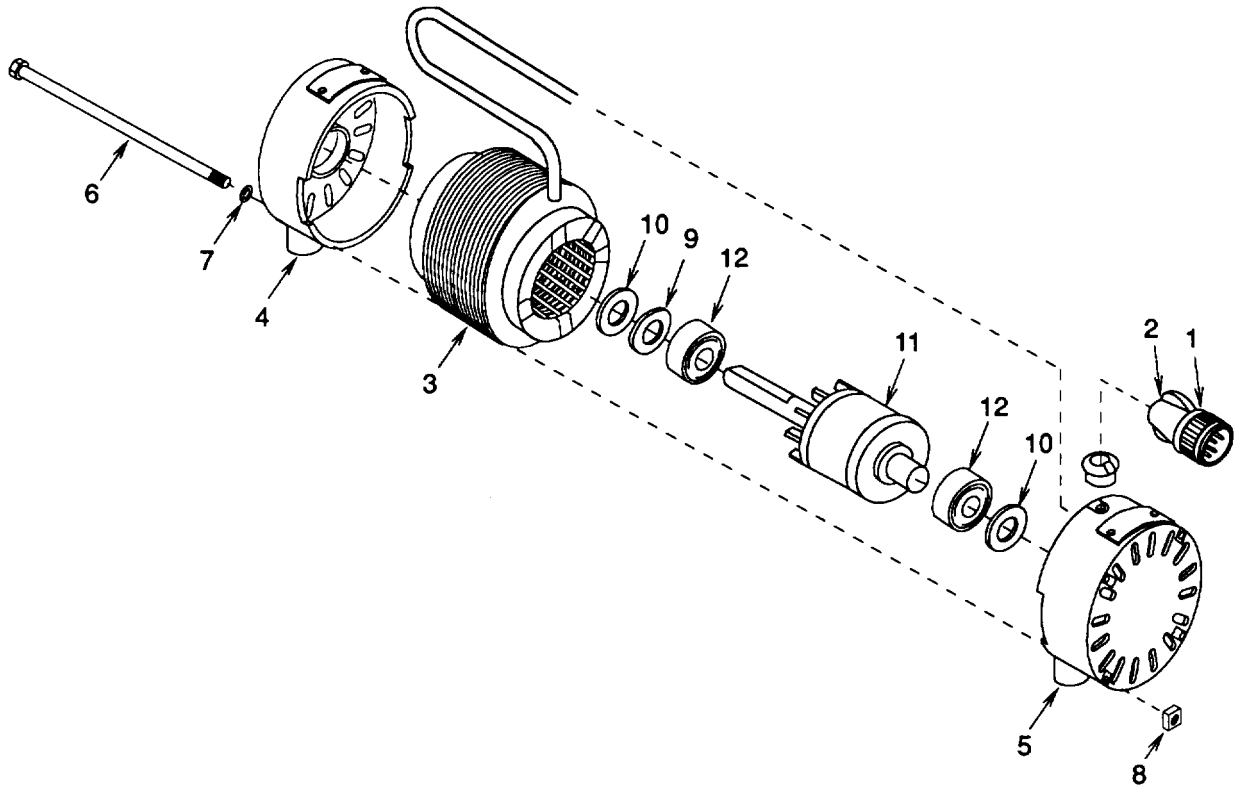
**5-8. CONDENSER FAN MOTOR REPAIR. - continued**

Figure 5-6. Condenser Fan Motor Assembly, Howell Electric Motor Division of SFM Corp., Single Phase Motor, Model 70N4-4886.

- a. To replace connector (1):
  - (1) Loosen cable clamp (2).
  - (2) Tag and unsolder leads.
  - (3) Remove old connector (1).
  - (4) See wiring diagram figure 4-4 and tags and solder leads to new connector (1). Remove tags.
  - (5) Secure cable clamp (2).
- b. To replace bearings:
  - (1) Match mark stator (3) and both end shields (4 and 5) to ease reassembly.
  - (2) Remove four thru bolts (6), lock washers (7), and square nuts (8) from end shields (4 and 5).
  - (3) Carefully separate end shields (4 and 5) from stator (3). Using a brass or plastic bar and hammer tap opposite sides, top and bottom in alternating sequence to break end shields loose.

## **5-8. CONDENSER FAN MOTOR REPAIR. - continued**



Remove the end shields carefully to avoid damaging wires. Wires maybe left in place if care is taken to avoid damaging them.

### **NOTE**

Be sure bad spring (9) and washers (10) are not lost during motor disassembly. Note their positions for use in reassembly.

- (4) Remove end shields (4 and 5).
- (5) Carefully slide rotor (11) out of stator (3) housing.
- (6) Press out or carefully drive bearings (12) out of end shields and stator housing. Retain load spring (9) and washers for use at reassembly, if not damaged.
- (7) Examine rotor (11), stator (3), and shafts for nicks, gouges, deformations, and evidence of overheating.
- (8) Dress high metal defects in shafts with a fine file or stone. If damage exceeds repairable limits, replace motor.
- (9) Coat shaft surfaces of rotor(11 ) with oil (MIL-L-2104, Grade 20) and slide bearings(12) on shaft ends. They should seat against shoulders at the inner ends of shaft.
- (10) Coat bearing cavity of end shields (4 and 5) and stator housing with oil and carefully slide rotor(11) into stator (3) until bearings (12) are seated.
- (11) Work end shields onto shaft until bore fits over end of stator. Keep the matchmark made during disassembly in alignment.
- (12) Place four thru bolts (6), lock washers (7), and square nuts (8) thru motor assembly. Finger tighten.
- (13) Tap around both end shields with a plastic or rawhide mallet while tightening thru bolts (6). Tighten in alternating sequence until all thru bolts are equally tightened. Check motor for freedom of rotation by turning motor shaft by hand. There should be no drag or binding.

### **3. Motor Assembly, IMC Magnetics Corp., Single Phase Motor, Model BC5320.**

#### **a. To replace connector (1):**

- (1) Loosen cable clamp (2).
- (2) Tag and unsolder leads.
- (3) Remove old connector (1).
- (4) See wiring diagram figure 4-4 and tags and solder leads to new connector (1). Remove tags.
- (5) Secure cable clamp (2).

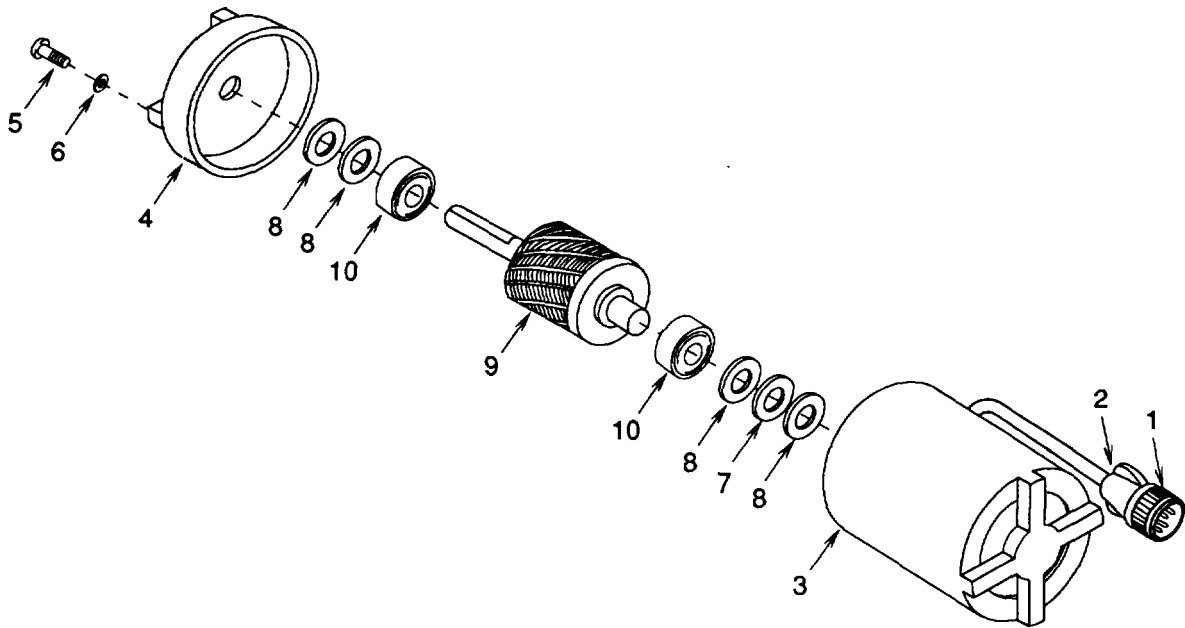
**5-8. CONDENSER FAN MOTOR REPAIR. - continued**

Figure 5-7. Condenser Fan Motor Assembly, IMC Magnetics Corp., Single Phase Motor, Model BC5320

b. To replace bearings:

- (1) Match mark stator (3) and end cap (4) to ease reassembly.
- (2) Remove four screws (5) and lock washers (6) from end cap.
- (3) Carefully separate end cap (4) from stator (3). Using a brass or plastic bar and hammer tap opposite sides, top, and bottom in alternating sequence to break end cap loose.

**CAUTION**

Remove end cap carefully to avoid damaging wires. Wires maybe left in place if care is taken to avoid damaging them.

**NOTE**

Be sure load spring and spacer washers are not lost during motor disassembly. Note their position for use in reassembly.

- (4) Remove end cap (4).
- (5) Carefully slide rotor (9) out of stator housing (3).
- (6) Press out or carefully drive bearings (10) out of end cap (4) and stator housing (3). Retain load spring (7) and spacer washers (8) for use at reassembly if not damaged.
- (7) Examine rotor (9), stator (3), and shafts for nicks, gouges, deformations, and evidence of overheating.
- (8) Dress high metal defects in shafts with a fine file or stone. If damage exceeds repairable limits, replace motor.

## 5-8. CONDENSER FAN MOTOR REPAIR. - continued

- (9) Coat shaft surfaces of rotor(9) with oil and slide bearings (10) on shaft ends. They should seat against shoulders at the inner ends of shaft.
- (10) Place spacer washer (8) and load spring (7) in same position as noted above
- (11) Coat the bearing cavity of end cap (4) and stator housing (3) with oil and carefully slide rotor into stator until bearing is seated.
- (12) Work end cap (4) onto shaft until bore fits over end of stator (3). Keep the matchmark made during disassembly in alignment.
- (13) Place four screws (5) and lock washers (6) through end cap (4) into stator housing.
- (14) Tap around end cap with a plastic or rawhide mallet while tightening screws (5). 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.

4. Motor Assembly, Welco Industries Inc., Model M4720-50.

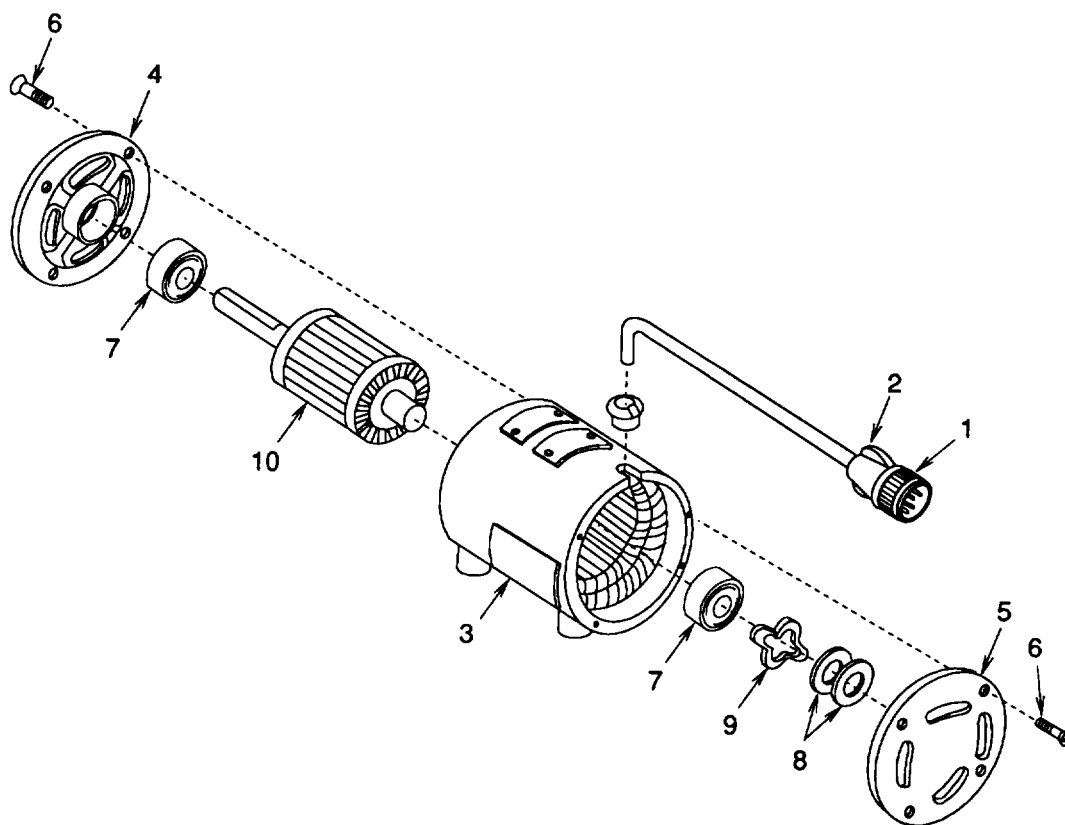


Figure 5-8. Condenser Fan Motor Assembly, Welco Model M-4720-50

**5-8. CONDENSER FAN MOTOR REPAIR. - continued**

## a. To replace connector (1):

- (1) Loosen cable clamp (2).
- (2) Tag and unsolder leads.
- (3) Remove old connector (1).
- (4) See wiring diagram figure 4-4 and tags and solder leads to new connector (1). Remove tags.
- (5) Secure cable clamp (2).

## b. To replace bearings:

- (1) Match mark stator (3) and both end brackets (4 and 5) to ease reassembly.
- (2) Remove four screws (6) each from front and rear brackets (4 and 5).
- (3) Carefully separate end brackets (4 and 5) from stator (3). Using a brass or plastic bar and hammer tap opposite sides, top and bottom in alternating sequence to break end brackets loose.
- (4) Remove end brackets (4 and 5).
- (5) Press out or carefully drive bearings (7) out of end brackets. Retain washers (8) and load spring (9) from front bracket for use at reassembly if they are not damaged.
- (6) Examine rotor, stator, and shafts for nicks, gouges, deformations, and evidence of overheating.
- (7) Dress high metal defects in shafts with a fine file or stone. If damage beyond repair, replace motor.
- (8) Coat shaft surfaces of rotor (10) with oil and slide bearings (7) on shaft ends. They should seat against shoulders at the inner ends of shaft.
- (9) Coat washers (8) and load spring (9) with oil and slide them over end of front shaft with load spring (9) installed first.
- (10) Coat bearing cavity of each end bracket (4 and 5) 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 (3). Keep match-marks made at time of disassembly in alignment.
- (11) Place four screws (6) in each end bracket (4 and 5).
- (12) Tap around both end brackets (4 and 5) with a plastic or rawhide mallet while tightening screws (6). 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.
- (13) 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. SERVICE MANIFOLD INSTALLATION.

This task covers: a. Installation b. Removal

### INITIAL SETUP

#### Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1  
Goggles  
Appendix B, item 2  
Gloves  
Appendix B, item 2

#### Equipment Condition

Disconnect power at power source.

General Safety Instructions

### WARNING

#### DANGEROUS CHEMICAL REFRIGERANT UNDER PRESSURE

is used in the operation of this equipment.

Use great care to avoid contact with liquid refrigerant or inhaling 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 surfaces. Heat causes the refrigerant to breakdown and form carbonyl chloride (phosgene), a highly toxic and corrosive gas.

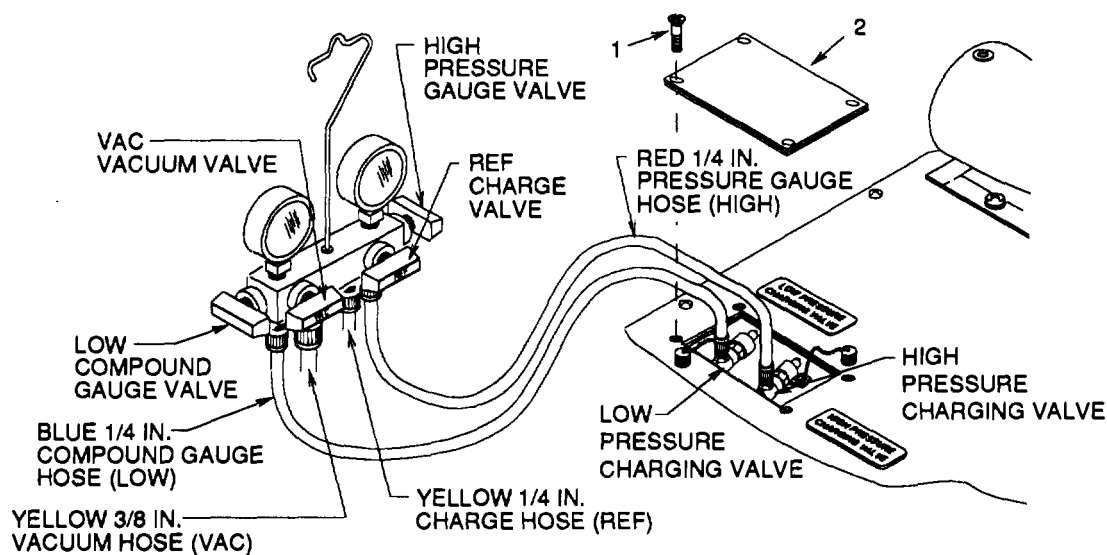


Figure 5-9. Service Manifold Installation

**WARNING****DANGEROUS CHEMICAL REFRIGERANT UNDER PRESSURE**

is used in the operation of this equipment.

Use great care to avoid contact with liquid refrigerant or inhaling 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 surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas.

**INSTALLATION**

1. Remove four screws (1) and access panel (2).
2. Check that HIGH and LOW PRESSURE CHARGING VALVES are closed.
3. Remove protective caps from HIGH and LOW PRESSURE CHARGING VALVES.
4. Connect the red (pressure gauge) hose to HIGH PRESSURE CHARGING VALVE and the blue (compound gauge) hose to LOW PRESSURE CHARGING VALVE.
5. Check that all four service manifold valves are closed.
6. Open HIGH and LOW PRESSURE CHARGING VALVES.
7. Loosen the red (pressure gauge) hose at service manifold and allow refrigerant to purge for 3-5 seconds.  
Tighten hose.
8. Loosen the blue (compound gauge) hose at service manifold and allow refrigerant to purge for 3-5 seconds.  
Tighten hose.

**REMOVAL**

1. Check that unit HIGH and LOW PRESSURE CHARGING VALVES are closed.
2. Open all four service manifold valves to bleed off pressure.
3. Remove hoses from HIGH and LOW PRESSURE CHARGING VALVES.
4. Close service manifold valves.
5. Install protective caps onto HIGH and LOW PRESSURE CHARGING VALVES.
6. Install access panel (2) and secure with four screws (1).

**NOTE**

FOLLOW-ON MAINTENANCE:  
Connect power at power source.

**5-10. DISCHARGING THE REFRIGERANT SYSTEM.**

This task covers: Discharging

**INITIAL SETUP**

Tools

Refrigeration Unit Service Tool Kit  
 Appendix B, item 1  
 Goggles  
 Appendix B, item 2  
 Gloves  
 Appendix B, item 2  
 Refrigerant Recovery and Recycle Unit  
 Appendix B, item 9

Equipment Condition

Install service manifold (para 5-9).

General Safety Instructions

**WARNING**

**DANGEROUS CHEMICAL REFRIGERANT UNDER PRESSURE**

is used in the operation of this equipment.

Use great care to avoid contact with liquid refrigerant or inhaling 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 surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas.

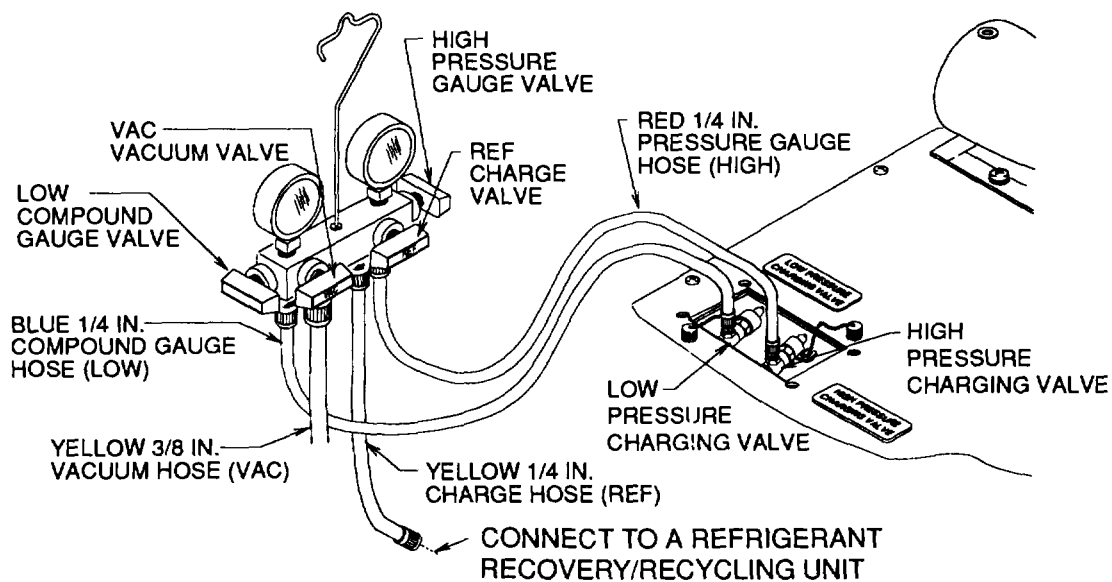


Figure 5-10. Discharging Refrigerant

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**5-10. DISCHARGING THE REFRIGERANT SYSTEM -continued**

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**DISCHARGING**

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

**NOTE**

Use great care to avoid contact with liquid refrigerant or inhaling 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 surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas.

**NOTE**

In accordance with Environmental Protection Agency regulations, refrigerants can not be discharged into the atmosphere. A refrigerant recovery/recycling unit must be used whenever discharging the refrigeration system.

1. Connect the yellow 1/4 inch (charge) hose to an approved refrigerant recovery/recycling unit.



Follow instructions for specific container or refrigerant recovery unit being used to avoid compressor oil loss. Loss of oil could result in compressor damage.

2. Open pressure gauge and compound gauge valves.

**NOTE**

Operation of the recovery/recycling unit must be by authorized personnel only.

3. Operate the recovery/recycling unit in accordance with the manufacturer's instructions.

**NOTE**

**FOLLOW-ON MAINTENANCE:**  
Remove service manifold (para 5-9).

## 5-11. PURGING THE REFRIGERANT SYSTEM.

This task covers: Purging

### INITIAL SETUP

#### Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1  
Goggles  
Appendix B, item 2  
Nitrogen Regulator  
Appendix B, item 7

#### Materials/Parts

Nitrogen  
Appendix E, item 8

#### Equipment Condition

Discharge refrigerant system (para 5-10).  
Install service manifold (para 5-9).

#### General Safety Instructions

#### WARNING

The pressure in a nitrogen cylinder can exceed 2000 psi. A nitrogen pressure regulator should be used at all times to avoid personal injury.

Nitrogen is an inert gas that can cause suffocation and must be discharged in a well ventilated area.

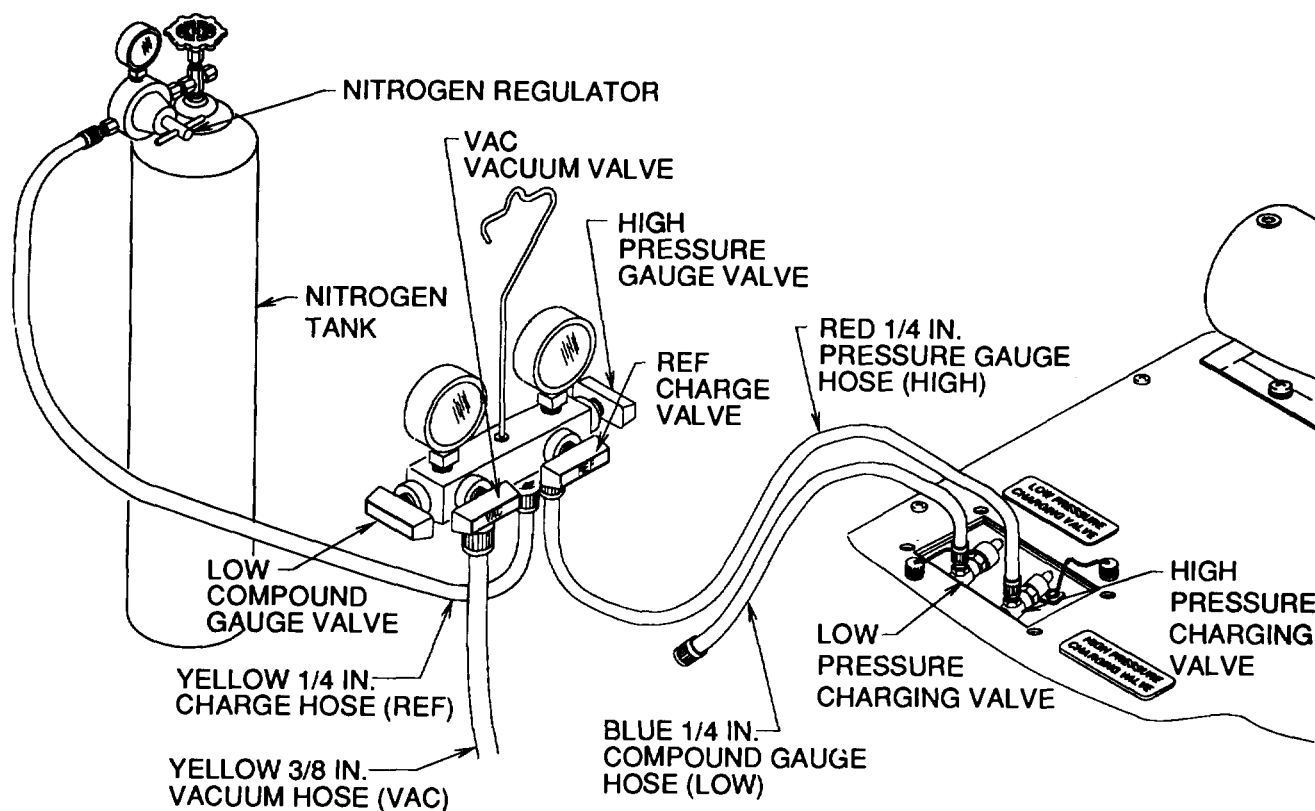


Figure 5-11. Nitrogen Tank Connection

**5-11. PURGING THE REFRIGERANT SYSTEM. - continued****WARNING**

The pressure in a nitrogen cylinder can exceed 2000 psi. A nitrogen pressure regulator should be used at all times to avoid personal injury.

Nitrogen is an inert gas that can cause suffocation and must be discharged in a well ventilated area.

1. Connect the yellow 1/4 inch (charge) hose to a nitrogen regulator and dry nitrogen cylinder.
2. Disconnect the blue (compound gauge) hose from the service manifold.
3. Be sure the service manifold compound gauge and vacuum valves are closed.
4. Be sure that unit high and low pressure charging valves are open.
5. Open the service manifold pressure gauge and charge valves.
6. Open the nitrogen cylinder valve and adjust the regulator so that approximately 1 - 2 cfm (0.028 - 0.057 m<sup>3</sup>/minute) of nitrogen flows through the system.
7. Check discharge from the blue hose attached to the LOW PRESSURE CHARGING VALVE to be sure that no oil is being forced out of the system.
8. When purging is completed, close nitrogen cylinder valve.
9. Disconnect the yellow 1/4 inch (charge) hose from nitrogen regulator.
10. Connect the blue (compound gauge) hose to service manifold.

**NOTE**

FOLLOW-ON MAINTENANCE:  
Remove service manifold (para 5-9).

**5-12. BRAZING/DEBRAZING PROCEDURES.**

This task covers:      a. Debrazing              b. Cleaning              c. Brazing

**INITIAL SETUP**

**Tools**

- Refrigeration Unit Service Tool Kit  
Appendix B, item 1
- Goggles  
Appendix B, item 2
- Gloves  
Appendix B, item 2

**Equipment Condition**

- Discharge refrigerant system (para 5-10).
- General Safety Instructions



**Materials/Parts**

- Brazing Alloy  
Appendix E, item (9 and 10)
- Brazing Flux  
Appendix E, item 11
- Abrasive Cloth  
Appendix E, item 12
- Rags  
Appendix E, item 13

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.

Never use a heating torch on any part that contains refrigerant. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. All refrigerant must be discharged from the system and the entire system must be purged with dry nitrogen before beginning any debrazing operation.

**DEBRAZING**

1. 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 m³/minute). (See para 5-11.)



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.

2. Protect insulation, wiring harnesses, and other components with appropriate shields.

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**5-12. BRAZING/DEBRAZING PROCEDURES. - continued**

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**WARNING**

Never use a heating torch on any part that contains refrigerant. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. All refrigerant must be discharged from the system and the entire system must be purged with dry nitrogen before beginning any debrazing operation.

**NOTE**

It may be easier to access a component by cutting or debrazing the copper lines in accessible areas and removing part of the interconnecting tubing with the component.

3. If debrazing a joint on a valve, disassemble the valve to the extent possible and wrap all but the joint with a wet cloth to act as a heat sink.
4. 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 is separated.

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**CLEANING**

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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.

---

**BRAZING**

---

1. 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<sup>3</sup>/minute). (See para 5-11.)

**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.

2. Protect insulation, wiring harnesses, and other components with appropriate shields.



**5-12. BRAZING/DEBRAZING PROCEDURES. - continued**

**WARNING**

Never use a heating torch on any part that contains refrigerant. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. All refrigerant must be discharged from the system and the entire system must be purged with dry nitrogen before beginning any debrazing operation.

**NOTE**

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.

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.

3. If brazing a joint on a valve, disassemble the valve to the extent possible and wrap all but the joint with a wet cloth to act as a heat sink.

**NOTE**

If interconnecting tubing was removed with a component, braze tubing to the new components before reinstallation.

5. Position component or assembly into place.
6. 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 brazing is completed.

**NOTE**

FOLLOW-ON MAINTENANCE:  
Remove service manifold (para 5-9).

**5-13. FLUSHING THE REFRIGERANT SYSTEM.**

This task covers:      a. Flushing      b. Purging

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
 Appendix B, item 1  
 Goggles  
 Appendix B, item 2  
 Gloves  
 Appendix B, item 2  
 Power Supply  
 Appendix B, item 6  
 Diaphragm Pump  
 Appendix B, item 8

**Materials/Parts**

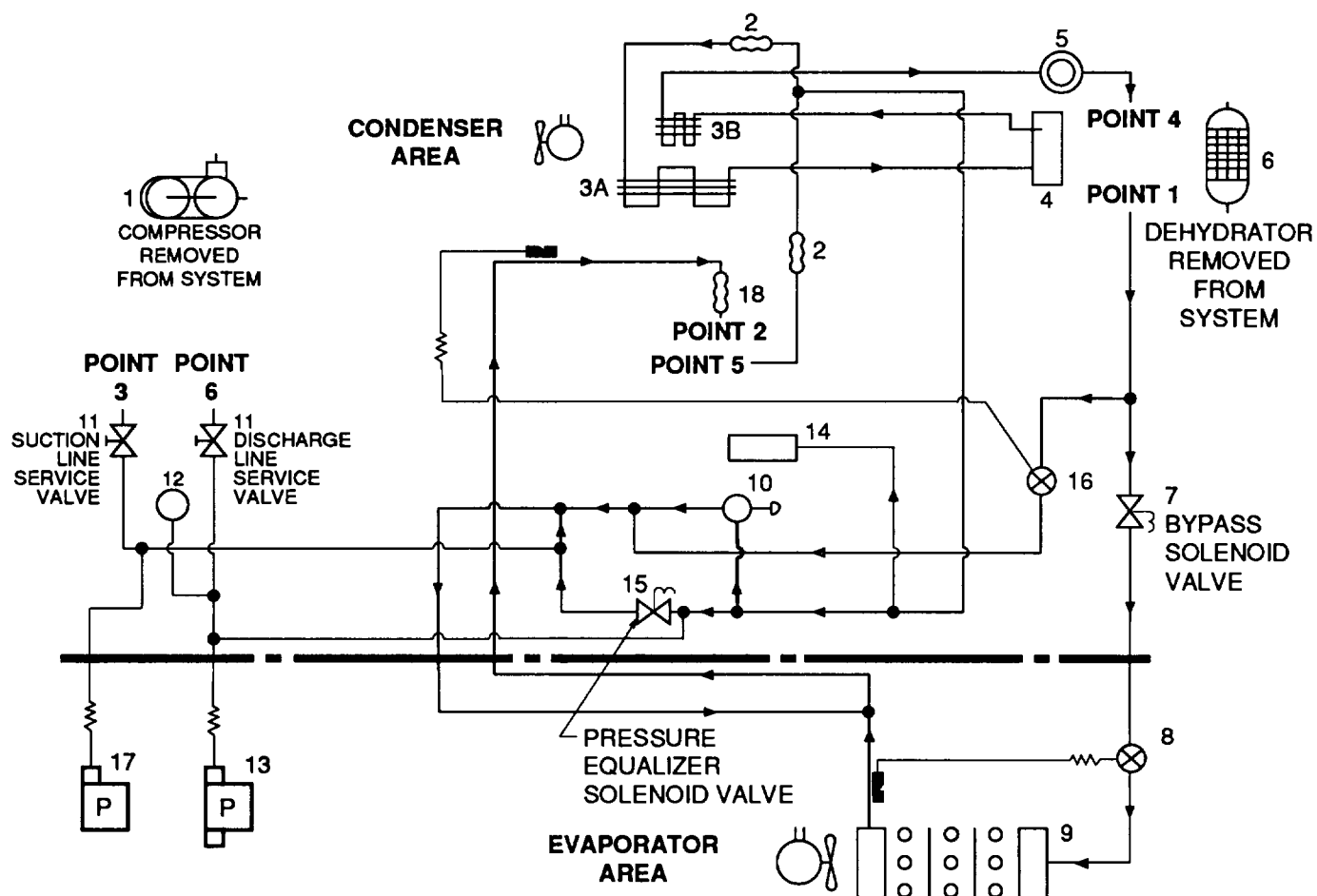
Refrigerant R-114  
 Appendix E, item 5  
 Equipment Condition  
 Remove compressor (para 5-35).

**FLUSHING**

When a hermetic motor burns out, the stator winding decomposes forming carbon, water and acid which contaminates refrigerant systems. These contaminants must be thoroughly removed from the system to prevent repeated motor failures.

Flush the refrigerant system with refrigerant solvent R-114. Flushing should be done under a pressure of 8 to 12 psig (.56 to .84 kg/cm<sup>2</sup>). Procedures for flushing the system are as follows:

- a. 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) and discharge line service valve (point 6) closed. Cap the tubing at points 4 and 5.
- b. Start the pump and flush the line for approximately 10 minutes then turn the pump off.
- c. Remove the recovery line from point 2 and cap the tubing at point 2.
- d. Connect the recovery line to the valve at point 3 and open the suction line service valve.
- e. Start the pump and flush the line for approximately 10 minutes, then turn the pump off.
- f. Disconnect the bypass solenoid valve plug P8 from receptacle J8.
- g. Energize the bypass solenoid valve by applying 28 volts dc across pins A and B of plug P8.
- h. Start the pump and flush the line for approximately 10 minutes, then turn the pump off.
- i. Switch the pump lines so that the discharge line is connected to the suction line service valve at point 3 and the recovery line is connected to the tubing at point 1.
- j. Start the pump and flush the line for approximately 10 minutes, then turn the pump off.

**5-13. FLUSHING THE REFRIGERANT SYSTEM. - continued**

FIND NO.	QTY	NOMENCLATURE
1	1	COMPRESSOR, RECIPROCATING
2	2	HOSE ASSEMBLY, 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	1	REGULATOR, FLUID PRESSURE
11	2	VALVE, SERVICE
12	1	VALVE, PRESSURE RELIEF
13	1	SWITCH, PRESSURE (HIGH)
14	1	CYLINDER ASSEMBLY, ACTUATING, LINEAR
15	1	SOLENOID VALVE WITH LEADS
16	1	VALVE, EXPANSION (QUENCH)
17	1	SWITCH, PRESSURE (LOW)
18	1	HOSE ASSEMBLY, METAL

Figure 5-12. Refrigerant Flow System with Dehydrator and Compressor Removed

**5-13. FLUSHING THE REFRIGERANT SYSTEM. - continued**

- k. Close the suction line service valve and move the discharge line from the valve at point 3 to the tubing at point 2.
- l. Start the pump and flush the line for approximately 10 minutes, then turn the pump off.
- m. De-energize the bypass solenoid valve by disconnecting the dc voltage source from pins A and B of plug P8.
- n. Start the pump and flush the line for approximately 10 minutes, then turn the pump off.
- o. Uncap the tubing at points 4 and 5.
- p. Disconnect the pump discharge line from the tubing at point 2 and connect it to the tubing at point 5.
- q. Disconnect the recovery line from the tubing at point 1 and connect it to the tubing at point 4.
- r. Cap the tubing at points 1 and 2.
- s. Start the pump and flush the line for approximately 10 minutes, then turn the pump off.
- t. Move the pump discharge line from the tubing at point 5 to the valve at point 6. Cap the tubing at point 5.
- u. Open the discharge line service valve (point 6).
- v. Start the pump and flush the line for approximately 10 minutes, then turn the pump off.
- w. 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.
- x. Start the pump and flush the line for approximately 10 minutes, then turn the pump off.
- y. 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.
- z. Disconnect the pressure equalizer solenoid valve plug P9 from receptacle J9.
- aa. Energize the pressure equalizer solenoid valve by applying 28 volts dc across pins A and B of plug P9.
- ab. Start the pump and flush the line for approximately 10 minutes, then turn the pump off.
- ac. Remove the cap from the tubing at point 5.
- ad. Remove the pump discharge line from tubing at point 2 and connect to the tubing at point 5.
- ae. 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.
- af. Start the pump and flush the line for approximately 10 minutes, then turn the pump off.
- ag. De-energize the pressure equalizer solenoid valve by removing the voltage source from pins A and B of plug P9.
- ah. Disconnect the discharge and recovery lines from the tubing and remove all caps from the tubing.

## **5-13. FLUSHING THE REFRIGERANT SYSTEM. - continued**

### **PURGING**

Purge the system with nitrogen at approximately 30 psig (2.11 kg/cm<sup>2</sup>) as follows:

- a. Make sure all caps are off the tubing ends and that the suction and discharge line service valves are open.
- b. 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.
- c. Energize the bypass solenoid valve by applying 28 volts dc across pins A and B of plug P8.
- d. Release nitrogen into the system for approximately 5 minutes or until moisture ceases to be discharged from the system.
- e. 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 no moisture is discharged from the system.
- f. 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.
- g. Energize the pressure equalizer solenoid valve by applying 28 volts dc across pins A and B of plug P9.
- h. Release nitrogen into the system for approximately 5 minutes or until moisture ceases to be discharged from the system.
- i. 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 no moisture is discharged from the system.
- j. 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.
- k. 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 no moisture is discharged from the system.
- l. 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 no moisture is discharged from the system.
- m. 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.
- n. Remove the nitrogen line from the valve at point 3.
- o. Close the suction line and discharge line service valves.
- p. Cap all open tubing until installation of new components.
- q. Reconnect plugs P8 and P9 to receptacles J8 and J9 respectively.

### **NOTE**

FOLLOW-ON MAINTENANCE:  
Install compressor (para 5-35).

**5-14. LEAK TESTING.**

This task covers:      Testing

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
 Appendix B, item 1  
 Goggles  
 Appendix B, item 2  
 Gloves  
 Appendix B, item 2  
 Nitrogen Regulator  
 Appendix B, item 7

**Materials/Parts**

Nitrogen  
 Appendix E, item 8  
 Refrigerant R-22  
 Appendix E, item 4

**Equipment Condition**

Remove top panels (para 4-11).  
 Install service manifold (para 5-9).

**General Safety Instructions****WARNING**

Never pressurize lines with oxygen, mixture with oil will cause an explosion.

The pressure in a nitrogen cylinder can exceed 2000 psi. A nitrogen pressure regulator should be used at all times to avoid personal injury.

Nitrogen is an inert gas that can cause suffocation and must be discharged in a well ventilated area.

**TESTING****NOTE**

Either a refrigerant gas leak detector or a strong solution of liquid detergent in water can be used to test for leaks.

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".

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.

**WARNING**

Never pressurize lines with oxygen, mixture with oil will cause an explosion.

The pressure in a nitrogen cylinder can exceed 2000 psi. A nitrogen pressure regulator should be used at all times to avoid personal injury.

Nitrogen is an inert gas that can cause suffocation and must be discharged in a well ventilated area.

## **5-14. LEAK TESTING. - continued**

1. To pressurize a system that has some refrigerant charge:
  - a. Connect the yellow 1/4 inch (charge) hose to a Refrigerant -22 cylinder.
  - b. Open the service manifold compound gauge, pressure gauge, and charge valves.
  - c. Check that service manifold vacuum valve is closed.
  - d. Open refrigerant cylinder valve and pressurize system to 100 psi (7.1 kg/cm<sup>2</sup>).
  - e. Test for leaks at all points of possible leakage using an electronic refrigerant gas leak detector or brushing on a soap solution while closely observing for bubbles to form.
  - f. If a leak is found, discharge and purge system, and repair leak. Retest for leaks. (See para 5-12.)
  - g. If a soap solution was used to test for leaks, thoroughly rinse test areas with fresh water.
  - h. If a leak was not found, check unit charge. (See para 5-16.)
2. To pressurize a system that has been discharged and purged:
  - a. Connect the yellow 1/4 inch (charge) hose to a cylinder of refrigerant R-22 set to deliver gas only.
  - b. Open the service manifold compound gauge, pressure gauge, and charge valves.
  - c. Check that service manifold vacuum valve is closed.
  - d. Open refrigerant cylinder valve and pressurize system to 40-50 psi (2.8 -3.5 kg/cm<sup>2</sup>).
  - e. Close service manifold valves and refrigerant cylinder valve.
  - f. Disconnect the yellow 1/4 inch (charge) hose from the refrigerant cylinder.
  - g. Connect the yellow 1/4 inch (charge) hose to a nitrogen regulator and dry nitrogen cylinder.
  - h. Open the service manifold compound gauge, pressure gauge, and charge valves.
  - i. Open nitrogen cylinder valve and pressurize system to 350 psi (24.7 kg/cm<sup>2</sup>).
  - j. Close service manifold valves and nitrogen cylinder valve.
  - k. Test for leaks at all points of possible leakage using an electronic refrigerant gas leak detector or brushing on a soap solution while closely observing for bubbles to form.
  - l. If a leak is found, discharge and purge system, and repair leak. Retest for leaks. (See para 5-12.)
  - m. If a soap solution was used to test for leaks, thoroughly rinse test areas with fresh water.
  - n. After performing leak tests, discharge and purge system before performing maintenance, or evacuating and charging system, as appropriate. (See para 5-10 and 5-11.)

### **NOTE**

FOLLOW-ON MAINTENANCE:  
Remove service manifold (para 5-9).  
Install top panels(para 4-11).

**5-15. EVACUATING THE REFRIGERANT SYSTEM.**

This task covers:      Evacuation

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
 Appendix B, item 1  
 Vacuum Pump  
 Appendix B, item 3

**Equipment Condition**

Install service manifold (para 5-9).

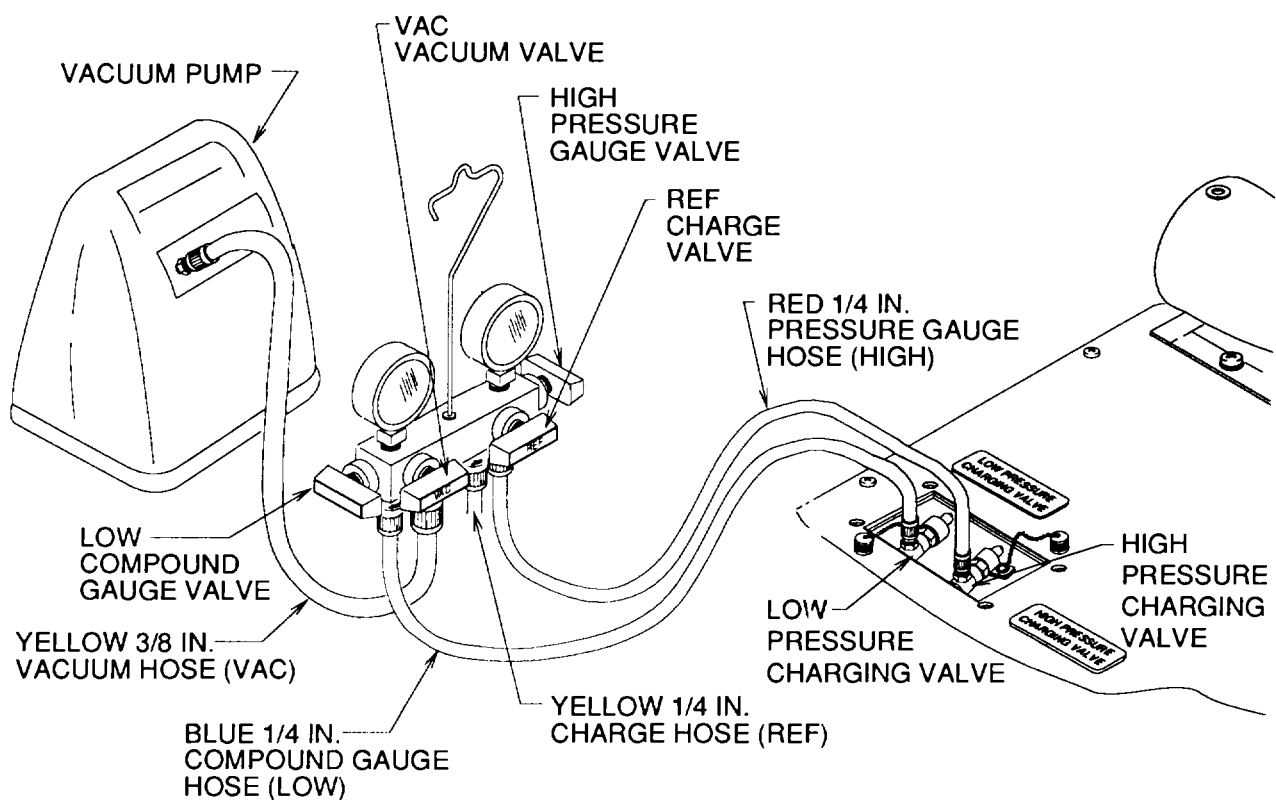


Figure 5-13. Evacuation of Refrigerant System

**EVACUATION**

1. Check that new dehydrator was installed. If not, install one. (See para 5-20.)
2. Check that service manifold charge valve is closed.
3. Check that unit HIGH and LOW PRESSURE CHARGING VALVES are open
4. Connect the yellow 3/8 inch hose to vacuum pump.



**5-15. EVACUATING THE REFRIGERANT SYSTEM. - continued**

5. Start vacuum pump.
6. Open service manifold high pressure gauge, compound gauge, and vacuum valves.
7. Run vacuum pump until at least 29 inches of mercury is measured on compound gauge.

**NOTE**

Inability to reach and hold 29 inches of mercury may indicate either a leak or a problem with the vacuum pump.

8. Continue running vacuum pump for one more hour, while observing the gauge. If gauge needle moves back and forth, you have a leak which must be located and corrected. (See para 5-14.)
9. Close unit HIGH and LOW PRESSURE CHARGING VALVES.
10. Close service manifold high pressure gauge, compound gauge, and vacuum valves.
11. Stop vacuum pump.
12. Disconnect the yellow 3/8 inch hose from vacuum pump.

**NOTE**

FOLLOW-ON MAINTENANCE:  
Charge the refrigerant system (para 5-16).

**5-16. CHARGING THE REFRIGERANT SYSTEM**

This task covers:      a. Full Charge      b. Partial Charge

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
 Appendix B, item 1  
 Goggles  
 Appendix B, item 2  
 Gloves  
 Appendix B, item 2

**Materials/Parts**

Refrigerant R-22  
 Appendix E, item 4

**Equipment Condition**

Evacuate the refrigerant system (para 5-15).

**General Safety Instructions****WARNING****DANGEROUS CHEMICAL REFRIGERANT UNDER PRESSURE**

is used in the operation of this equipment.

Use great care to avoid contact with liquid refrigerant or inhaling 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 surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas.

Never introduce high discharge pressure into a refrigerant cylinder. This can cause the cylinder to rupture and injure personnel.

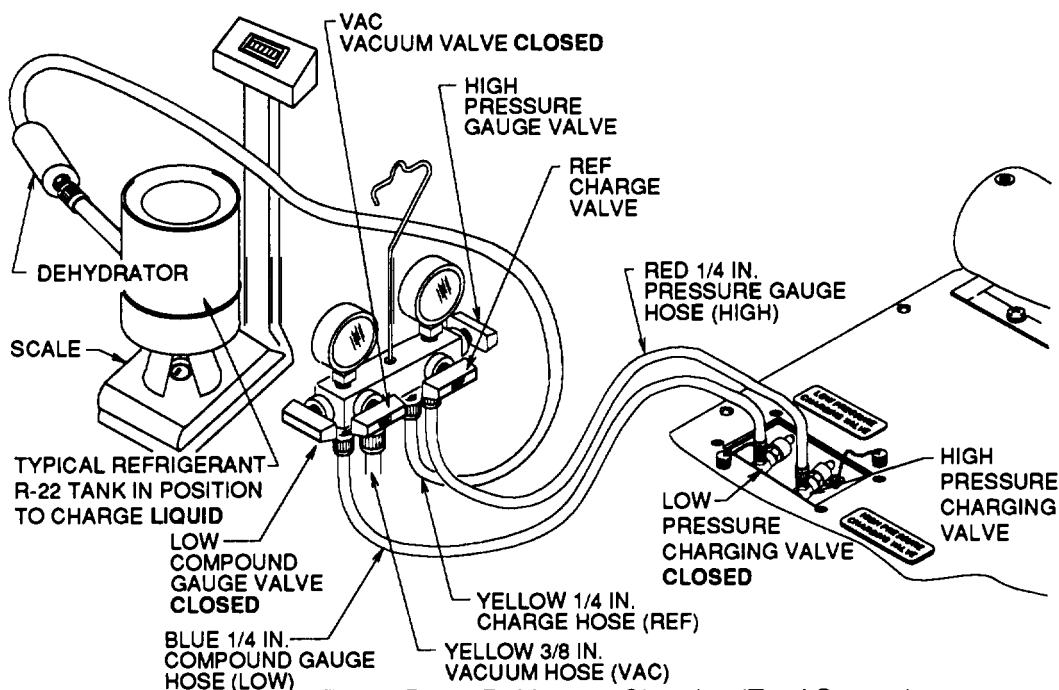


Figure 5-14. Refrigerant Charging (Total System)

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**5-16. CHARGING THE REFRIGERANT SYSTEM. - continued**

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FULL CHARGE

**WARNING**

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

Use great care to avoid contact with liquid refrigerant or inhaling 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 surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas.

**NOTE**

The charging operation should be done with all panels in place except for refrigerant charging valve access cover. Whenever available, use recycled refrigerant.

1. Connect the yellow 1/4 inch (charge) hose to a cylinder of Refrigerant-22 set to deliver gas only.
2. Loosen hose connections on the HIGH and LOW PRESSURE CHARGING VALVES slightly.
3. Check that vacuum and charge valves are closed.
4. Open pressure gauge and compound gauge valves.
5. Open refrigerant cylinder valve.
6. Open charge valve slightly to allow a small amount of refrigerant to purge air from hoses. Tighten hose connections on the HIGH and LOW PRESSURE CHARGING VALVES. Close charge valve.

**CAUTION**

Never introduce liquid refrigerant into the low pressure (suction) charging valve. This can cause damage to the compressor.

7. Close compound gauge valve.
8. Set refrigerant cylinder to deliver liquid only.
9. Place refrigerant cylinder on an accurate scale to measure and record weight.
10. Open HIGH and LOW PRESSURE CHARGING VALVES.
11. Open charge valve. Allow liquid refrigerant to enter system until drum weight has decreased by (2.2 pounds (1.0 kg) for F9000H-1SA or 2.4 pounds (1.09 kg) for F9000H-3SA) or until system pressure has equalized.
12. Close charge and pressure gauge valves.
13. Reset low pressure and high pressure cutout switches.

**5-16. CHARGING THE REFRIGERANT SYSTEM. - continued**

14. Connect power at power source.

15. Turn air conditioner on and operate in COOL mode with TEMPERATURE SELECTOR set at maximum COOLER position.

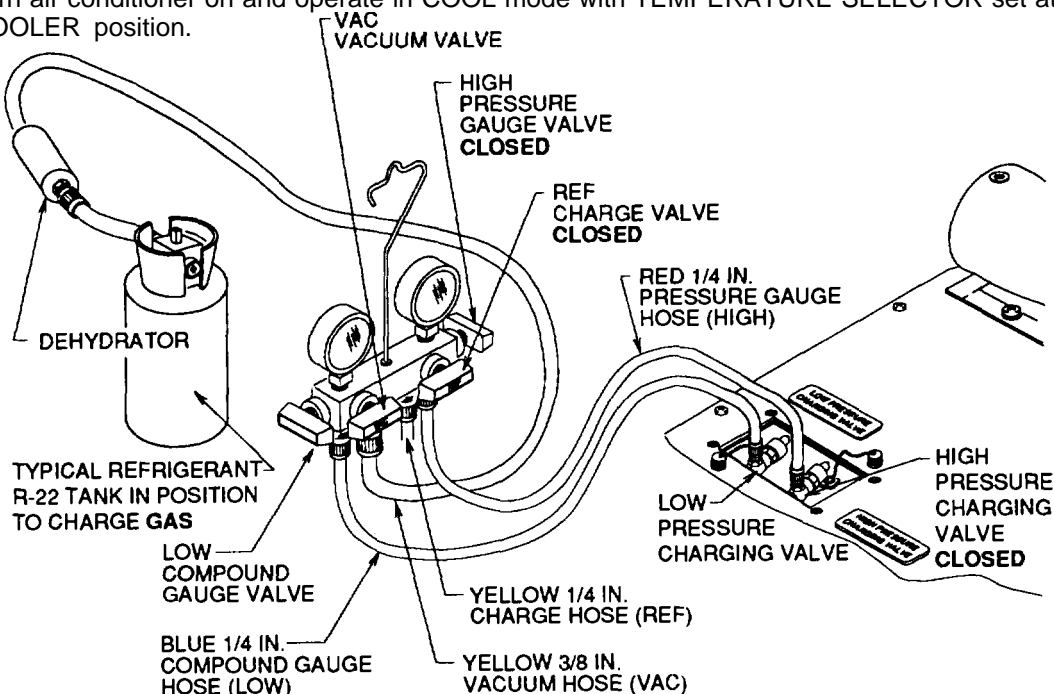


Figure 5-15. Refrigerant Charging (Partial System/Small Quantity Charge)

**NOTE**

If (2.2 pounds (1.0 kg) for F9000H-1SA or 2.4 pounds (1.09 kg) for F9000H-3SA) full charge was obtained, skip steps 16. through 20. If system pressure equalized prior to obtaining a full charge, proceed with step 16.

**CAUTION**

Never introduce liquid refrigerant into the low pressure (suction) charging valve. This can cause damage to the compressor.

16. Set refrigerant cylinder to deliver gas only.

**WARNING**

Never introduce high discharge pressure into a refrigerant cylinder. This can cause the cylinder to rupture and injure personnel.

17. Check that pressure gauge valve is closed.

18. Open compound gauge valve.

19. Open charge valve.

## **5-16. CHARGING THE REFRIGERANT SYSTEM. - continued**

20. Monitor weight of refrigerant cylinder as air conditioner compressor pulls additional refrigerant into system until full (2.2 pounds (1.0 kg) for F9000H-1SA or 2.4 pounds (1.09 kg) for F9000H-3SA) charge is obtained. When system is fully charged, immediately close charge valve and compound gauge valve.
21. Run air conditioner in COOL mode with TEMPERATURE SELECTOR set at maximum COOLER position for 15 minutes.
22. With unit running, 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.
23. If charge is still low, carefully add refrigerant.



Never introduce liquid refrigerant into the low pressure (suction) charging valve. This can cause damage to the compressor.

- a. Set refrigerant cylinder to deliver gas only.



Never introduce high discharge pressure into a refrigerant cylinder. This can cause the cylinder to rupture and injure personnel.

- b. Check that pressure gauge valve is closed.
  - c. Open compound gauge and charge valves.
  - d. Continue to charge until sight glass is clear and bubble-free.
  - e. Close compound gauge, charge, and refrigerant cylinder valves.
24. Turn MODE SELECTOR switch to OFF.

**5-16. CHARGING THE REFRIGERANT SYSTEM. - continued****PARTIAL CHARGE****WARNING**

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

Use great care to avoid contact with liquid refrigerant or inhaling 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 surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas.

**NOTE**

The charging operation should be done with all panels in place except for refrigerant charging valve access cover. Whenever available, use recycled refrigerant.

1. Connect the yellow 1/4 inch (charge) hose to a cylinder of Refrigerant-22 set to deliver gas only.
2. Loosen hose connections on the HIGH and LOW PRESSURE CHARGING VALVES slightly.
3. Check that vacuum and charge valves are closed.
4. Open pressure gauge and compound gauge valves.
5. Open refrigerant cylinder valve.
6. Open charge valve slightly to allow a small amount of refrigerant to purge air from hoses. Tighten hose connections on the HIGH and LOW PRESSURE CHARGING VALVES. Close charge valve.

**CAUTION**

Never introduce liquid refrigerant into the low pressure (suction) charging valve. This can cause damage to the compressor.

7. Close compound gauge valve.
8. Connect power at power source.
9. Turn air conditioner on and operate in COOL mode with TEMPERATURE SELECTOR set at maximum COOLER position.

**5-16. CHARGING THE REFRIGERANT SYSTEM. - continued**

10. With unit running, 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.

11. If charge is still low, carefully add refrigerant.



Never introduce liquid refrigerant into the low pressure (suction) charging valve. This can cause damage to the compressor.

- a. Set refrigerant cylinder to deliver gas only.



Never introduce high discharge pressure into a refrigerant cylinder. This can cause the cylinder to rupture and injure personnel.

- b. Check that pressure gauge valve is closed.
- c. Open compound gauge and charge valves.
- d. Continue to charge until sight glass is clear and bubble-free.
- e. Close compound gauge, charge, and refrigerant cylinder valves.

12. Turn MODE SELECTOR switch to OFF.

**NOTE**

FOLLOW-ON MAINTENANCE:  
Remove service manifold (para 5-9).

**5-17. REFRIGERATION SYSTEM TROUBLESHOOTING.**

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This task covers: Examination

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**INITIAL SETUP**

Equipment Condition

Unit operating in full cool.

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**EXAMINATION**

1. Check sight glass condition.

- a. 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. Correct as indicated.

**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. 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. Correct as indicated.

2. Check for decreased 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. Correct as indicated.

**NOTE**

FOLLOW-ON MAINTENANCE:  
Turn unit OFF.



5-18. OVERHEATING CHECKS.

---

This task covers: Examination

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INITIAL SETUP

Equipment Condition

Unit operating in full cool.

---

EXAMINATION

**NOTE**

Bubbles appearing in the sight glass or a reduction in cooling capacity is often caused by the refrigeration system being overheated. Adequate cooling of the hot, compressed, refrigerant vapor in the condenser is essential to the proper operation of the air conditioner.

Painting coils will cause overheating and reduce cooling capacity.

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**

FOLLOW-ON MAINTENANCE:  
Turn unit OFF.

**5-19. REFRIGERANT PRESSURE CHECK.**

This task covers:        Testing

**INITIAL SETUP**

Refrigeration Unit Service Tool Kit

Appendix B, item 1

Goggles

Appendix B, item 2

Gloves

Appendix B, item 2

Install service manifold (para 5-9).

**TESTING**

1. Check that unit HIGH and LOW PRESSURE CHARGING VALVES are open and all four service manifold valves are closed.
2. 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 as 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.)
3. Turn air conditioner on and operate in COOL mode with TEMPERATURE SELECTOR in full COOLER setting for five minutes.
4. With unit operating allow gages to stabilize. Take readings of the two gages.
  - a. If discharge and suction pressures are at, or near, the same value a pressure equalizer solenoid valve L2 or compressor failure is indicated.
  - b. If discharge pressure is low and suction pressure is normal, a low refrigerant charge is indicated. (See table 5-3.)
  - c. If discharge pressure is normal and suction pressure is either high or low, failure or maladjustment of the pressure regulator valve is indicated. (See table 5-3.)
  - d. If ice forms on evaporator coil, or evaporator coil does not cool, during operation, failure or malfunction of evaporator expansion valve is indicated.
  - e. If discharge pressure is high and suction pressure is normal, a malfunction of quench the valve is indicated. If discharge pressure is above 540 psig, pressure relief valve malfunction is also indicated.
5. When pressure tests are completed, turn unit off and proceed with any maintenance action indicated.

**NOTE**

FOLLOW-ON MAINTENANCE:  
Remove service manifold (para 5-9).

**Table 5-2. PRESSURE-TEMPERATURE RELATIONSHIP OF SATURATED REFRIGERANT-22**

Temperature		Pressure		Temperature		Pressure	
Deg F	Deg C	Psig	kg/cm <sup>2</sup>	Deg F	Deg C	Psig	kg/cm <sup>2</sup>
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				

**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. DEHYDRATOR (FILTER/DRIER).**

This task covers: Replacement

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

**Equipment Condition**

Remove top rear panel (para 4-11).  
Discharge refrigerant system (para 5-10).

**Materials/Parts**

Dehydrator

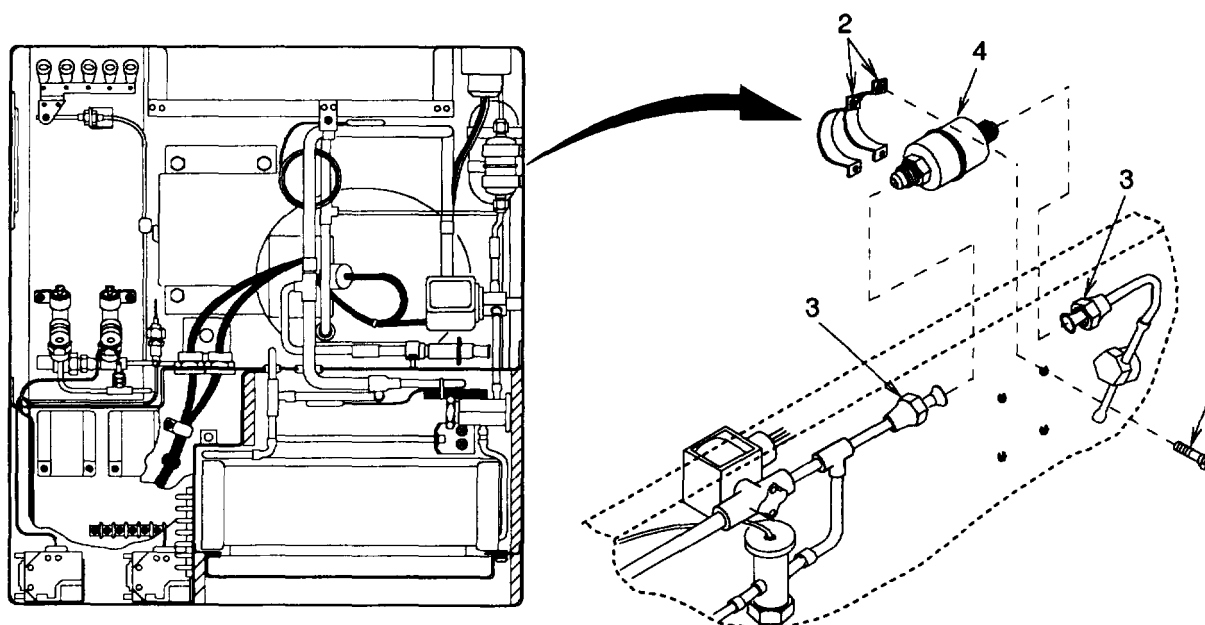


Figure 5-16. Dehydrator (Filter/Drier)

**REPLACEMENT**

1. Remove four screws (1) and two mounting clamps (2).
2. Disconnect two flare nuts (3) and remove dehydrator(4) from unit.



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.

## 5-20. DEHYDRATOR (FILTER/DRIER). - continued

3. Connect two flare nuts (3) to each end of dehydrator (4).
4. Install mounting clamps (2) with two screws (1).

### NOTE

FOLLOW-ON MAINTENANCE:  
 Leak test refrigerant system (para 5-14).  
 Evacuate refrigerant system (para 5-15).  
 Charge refrigerant system (para 5-16)  
 Install top rear panel (para 4-11).

## 5-21. EVAPORATOR COIL.

This task covers: Replacement

### INITIAL SETUP

#### Tools

Refrigeration Unit Service Tool Kit  
 Appendix B, item 1  
 Gloves  
 Appendix B, item 2

#### Materials/Parts

Evaporator Coil

#### Equipment Conditions

Remove top panels (para 4-11).  
 Remove supply air louver (para 4-14).  
 Remove mist eliminator (para 4-16).  
 Remove dehydrator (para 5-20).  
 Purge refrigerant system (para 5-11).

#### General Safety Instructions

### WARNING

When handling coils wear gloves to avoid cuts and reduce fin damage on the coil.

### REPLACEMENT

1. Remove two screws (1) securing solenoid valve (2).
2. Debraze tube connections at elbow (3) and expansion valve (4) (para 5-12). Take care that expansion valve is not damaged during debrazing operations.
3. Remove top two flat head screws (5) that attach coil (6) to housing. Remove side two flat head screws (7) and two each screws (8), lock washers (9), and flat washers (10) that attach the mist eliminator holder(11 ) and coil (6) to housing.
4. Lift mist eliminator holder(11) up and out of unit.

## 5-21. EVAPORATOR COIL. - continued

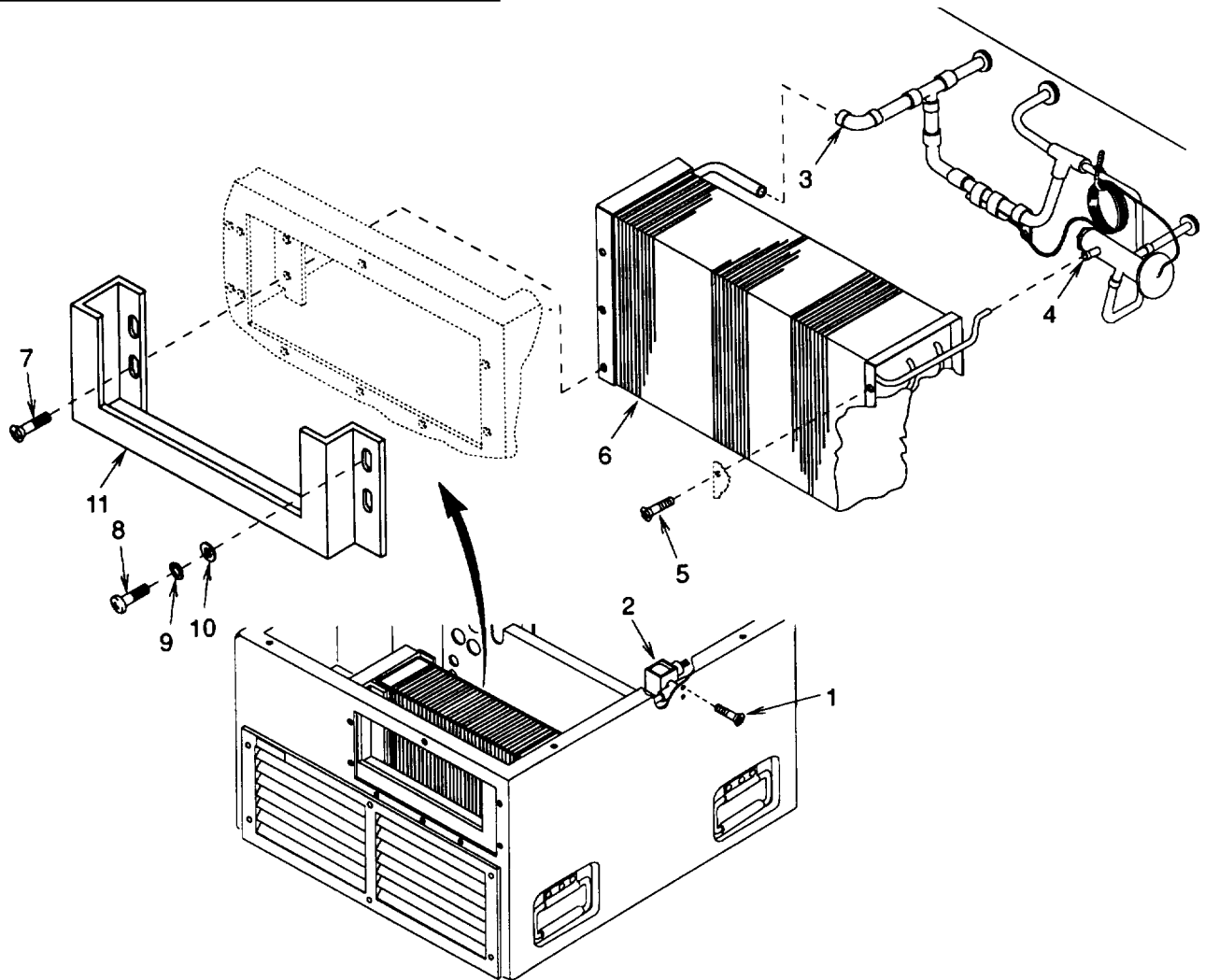


Figure 5-17. Evaporator Coil

**WARNING**

When handling coils wear gloves to avoid cuts and reduce fin damage on the coil.

5. Lift evaporator coil (6) up and out of unit.
6. Carefully position evaporator coil (6) in unit.
7. Position mist eliminator holder(11) in unit.
8. Secure mist eliminator holder(11) and evaporator coil (6) to housing with four flat head screws (5 and 7). Secure evaporator coil to housing with two each screws (8), lockwashers (9), and flat washers (10). The four holes in the mist eliminator holder match the bottom four holes in the coil.

**5-21. EVAPORATOR COIL. - continued**

- 9. Align tubing connections to elbow (3) and expansion valve (4). Braze joints (para 5-13). Take care that expansion valve is protected during brazing operation.
- 10. Secure solenoid valve (2) with two screws (1).

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install new dehydrator (para 5-20).  
Install mist eliminator (see para 4-16).  
Install supply air louver (see para 4-14).  
Install top panels (para 4-11).

**5-22. EXPANSION VALVE (PRIMARY). ]**

This task covers:     Replacement

**INITIAL SETUP**

Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

Equipment Condition

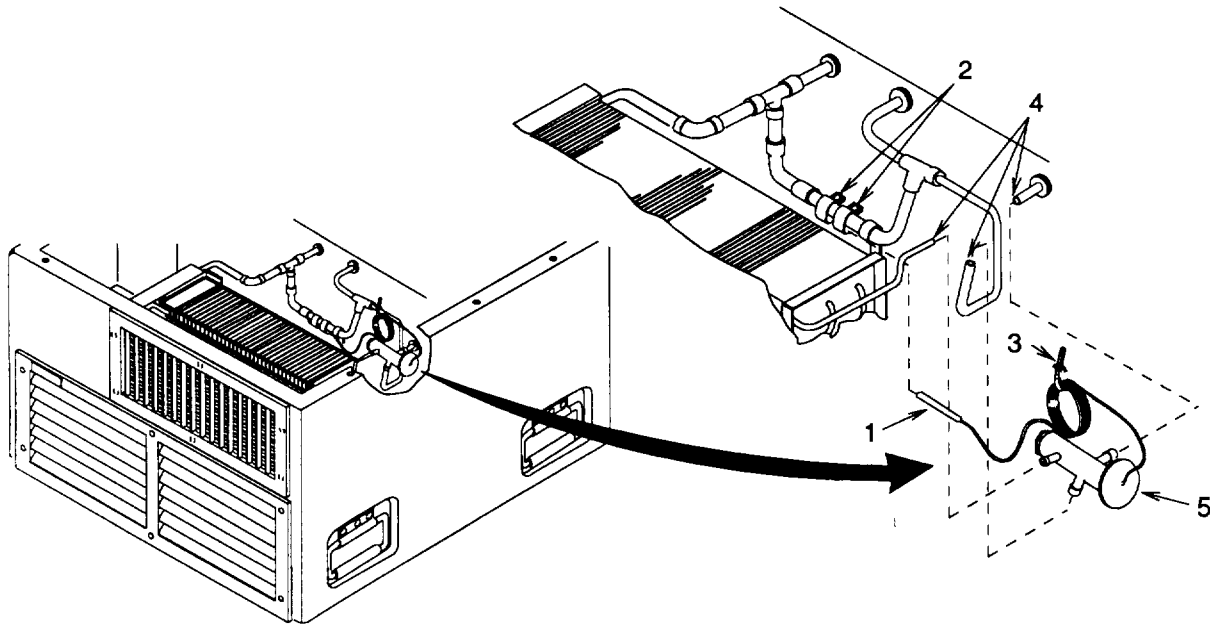
Remove top panels (para 4-11).  
Remove dehydrator (para 5-20).  
Purge refrigerant system (para 5-11),

**Materials/Parts**

Expansion Valve  
Tie Down Straps  
Insulation Tape  
Appendix E, item 18

**REPLACEMENT**

- 1. Unwrap insulation from thermal bulb (1).
- 2. Loosen hardware in thermal bulb clamps (2) and slip bulb (1) out of clamps.
- 3. Cut plastic tiedown strap (3) holding capillary tubing coil to tubing
- 4. Debraze three tube connections (4) to valve. (See para 5-12.)
- 5. Remove valve (5) from unit.
- 6. Place expansion valve (5) in unit and align tubing ends (4).
- 7. Braze joints. (See para 5-12.)
- 8. Install thermal bulb (1) in clamps (2) and tighten hardware.

**5-22. EXPANSION VALVE (PRIMARY). - continued****Figure 5-18. Expansion Valve (Primary)**

9. Rewrap insulation at thermal bulb (1).
10. Carefully coil capillary tubing and secure with a plastic tiedown strap (3).

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install new dehydrator (para 5-20).  
Install top front panel (para 4-11).



## 5-23. EXPANSION VALVE (QUENCH).

This task covers: Replacement

### INITIAL SETUP

#### Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

#### Materials/Parts

Expansion Valve  
Flush Bushing  
Self-locking Nuts (2)  
Tie Down Straps  
Insulation Tape  
Appendix E, item 1

#### Equipment Condition

Remove top panels (para 4-11).  
Remove dehydrator (para 5-20).  
Purge refrigerant system (para 5-11).

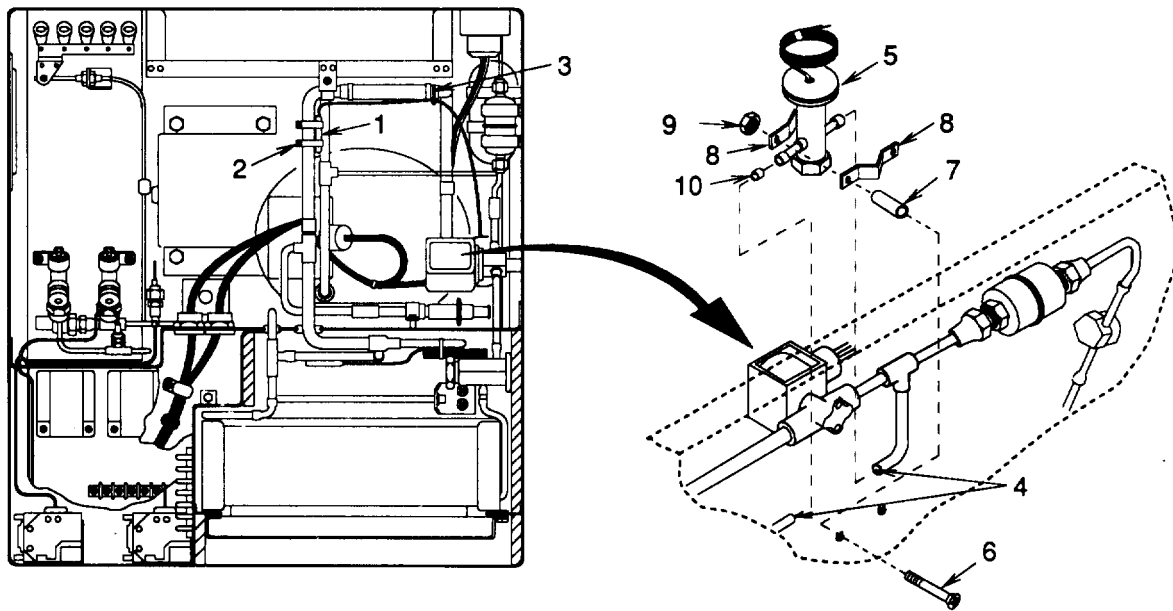


Figure 5-19. Expansion Valve (Quench)

**5-23. EXPANSION VALVE (QUENCH). - continued****REPLACEMENT**

1. Unwrap insulation from thermal bulb (1).
2. Loosen the hardware in clamps (2) that hold thermal bulb (1) in place and slip thermal bulb out of clamps.
3. Cut the plastic tiedown strap (3) from the capillary line.
4. Debraze two tube connections (4) to valve (5).
5. Remove two screws (6), post spacers (7), brackets (8), and self-locking nuts (9).
6. Remove valve (5) from the unit.
7. Install flush bushing (10) in valve (5).
8. Place expansion valve (5) in unit and align tubing ends (4).
9. Braze joints. (See para 5-12.)
10. Secure valve (5) to housing with two each screws (6), post spacers (7), brackets (8), and lock nuts (9).
11. Install sensing bulb (1) in clamps and tighten screw and nut.
12. Rewrap insulation at sensing bulb.
13. Coil excess capillary line of expansion valve (5) and secure with tiedown straps (3).

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install new dehydrator (para 5-20).  
Install top panels (para 4-11).

**5-24. SOLENOID VALVE L1.**

This task covers: Replacement

**INITIAL SETUP**

**Tools**

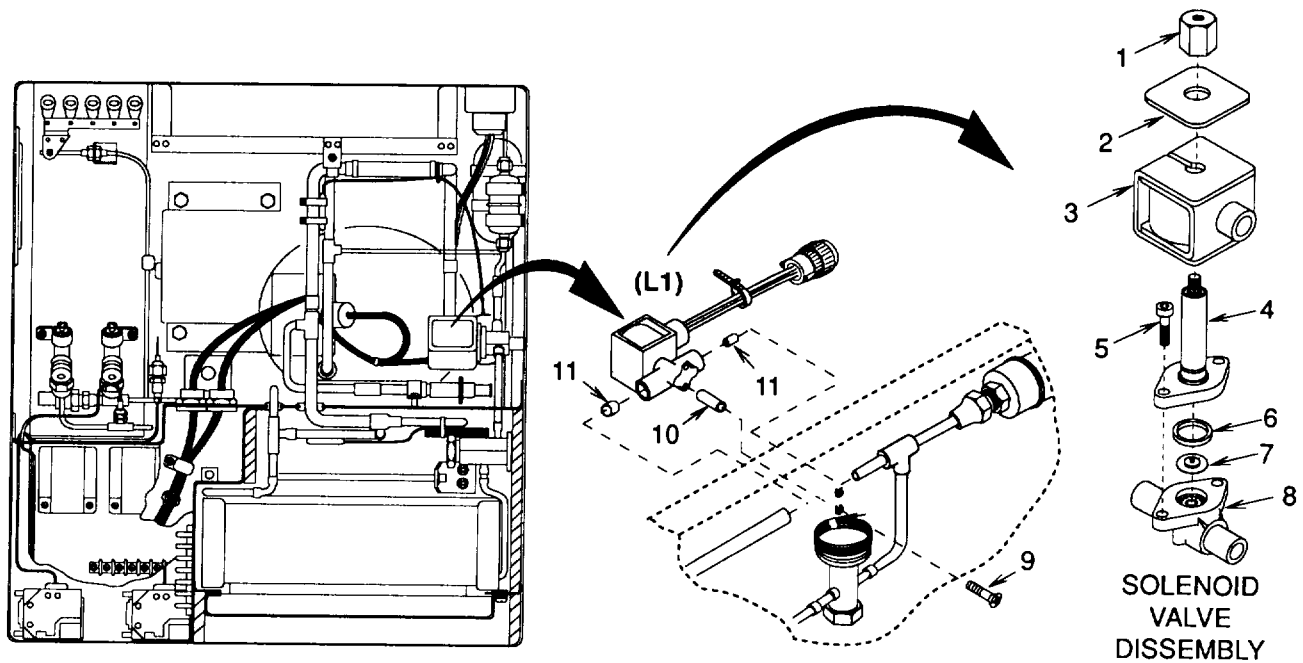
Refrigeration Unit Service Tool Kit  
Appendix B, item 1

**Materials/Parts**

Solenoid Valve  
Flush Bushings (2)

**Equipment Condition**

Remove top panels (para 4-11).  
Remove dehydrator (para 5-20).  
Purge refrigerant system (para 5-11).



**Figure 5-20. Solenoid Valve L1**

**REPLACEMENT**

1. Remove top nut (1), data plate (2), and coil (3) from tube and plunger assembly (4). Carefully lay coil (3) aside.
2. Remove two screws (5), tube and plunger assembly (4), O-ring (6), and diaphragm (7) from valve body (8).
3. Remove two screws (9) and spacers (10) that attach valve body (8) to the housing.
4. Debraze joints and remove valve body (8). (See para 5-12.)

**5-24. SOLENOID VALVE L1. - continued**

5. Remove two screws (5), tube and plunger assembly (4), O-ring (6), and diaphragm (7) from new valve body (8).
6. Install flush bushings (11) in valve body (8).
7. Braze tubing to valve body (8). (See para 5-12.)
8. Secure valve body (8) to housing with two screws (9) and spacers (10).
9. Install O-ring (6), diaphragm (7), and tube and plunger assembly (4). Secure to valve body (8) with two screws (5).
10. Install coil (3) and data plate (2), with attaching nut (1) on tube and plunger assembly (4).

**NOTE**

FOLLOW-ON MAINTENANCE:  
 Install new dehydrator (para 5-20).  
 Install top panels (para 4-11).

5-25. SOLENOID VALVE L2.

This task covers: Replacement

INITIAL SETUP

Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

Materials/Parts

Solenoid Valve  
Flush Bushings (2)  
Lock Washers (2)

Equipment Condition

Remove top panels (para 4-11).  
Remove condenser fan motor (para 4-44).  
Remove dehydrator (para 5-20).  
Purge refrigerant system (para 5-11).

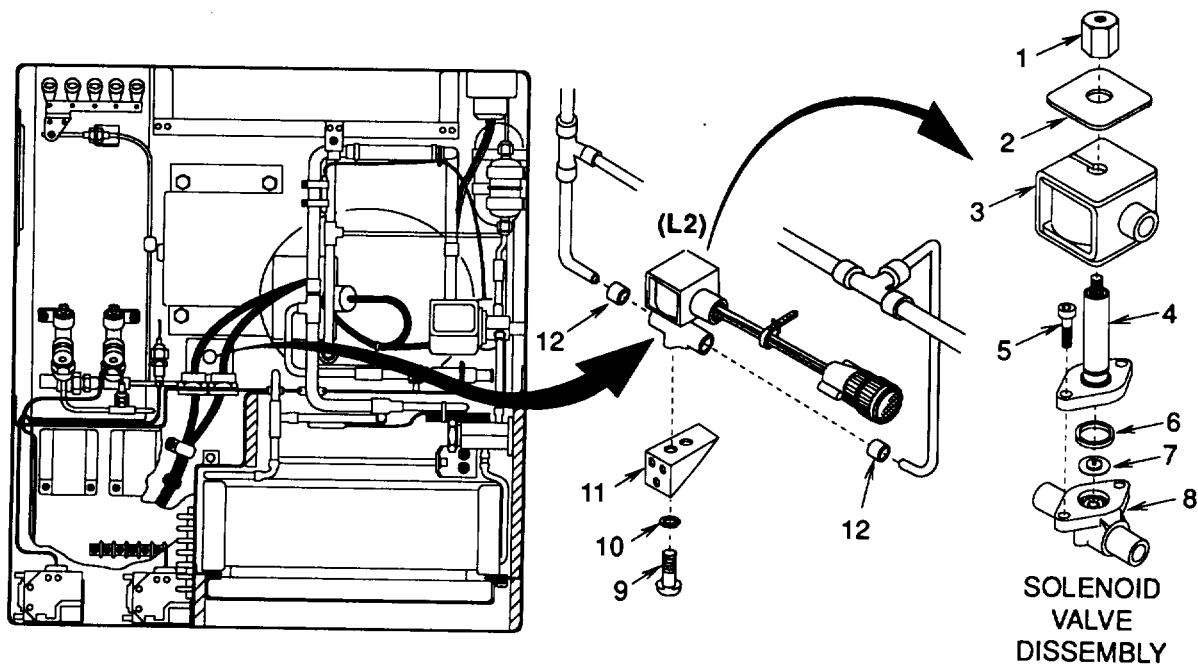


Figure 5-21. Solenoid Valve L2

**5-25. SOLENOID VALVE L2. - continued****REPLACEMENT**

1. Remove top nut (1), data plate (2), and coil (3) from tube and plunger assembly (4). Carefully lay coil (3) aside.
2. Remove two screws (5), tube and plunger assembly (4), O-ring (6), and diaphragm (7) from valve body (8).
3. Remove two screws (9) and lockwashers (10) that attach valve body (8) to bracket (11).
4. Debraze joints and remove valve body (8). (See para 5-12.)
5. Remove two screws (5), tube and plunger assembly (4), O-ring (6), and diaphragm (7) from new valve body (8).
6. Install flush bushings (12) in valve body (8).
7. Braze tubing to valve body (8). (See para 5-12.)
8. Secure valve body (8) to bracket (11) with two screws (9) and lockwashers (10).
9. Install O-ring (6), diaphragm (7), and tube and plunger assembly (4). Secure to valve body (8) with two screws (5).
10. Install coil (3) and data plate (2), with attaching nut (1) on tube and plunger assembly (4).

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install new dehydrator (para 5-20).  
Install condenser fan motor (para 4-44).  
Install top panels (para 4-11).

## 5-26. PRESSURE REGULATOR.

This task covers: Replacement

### INITIAL SETUP

#### Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

#### Materials/Parts

Pressure Regulator  
Lock Washer

#### Equipment Condition

Remove actuating cylinder (para 5-27).

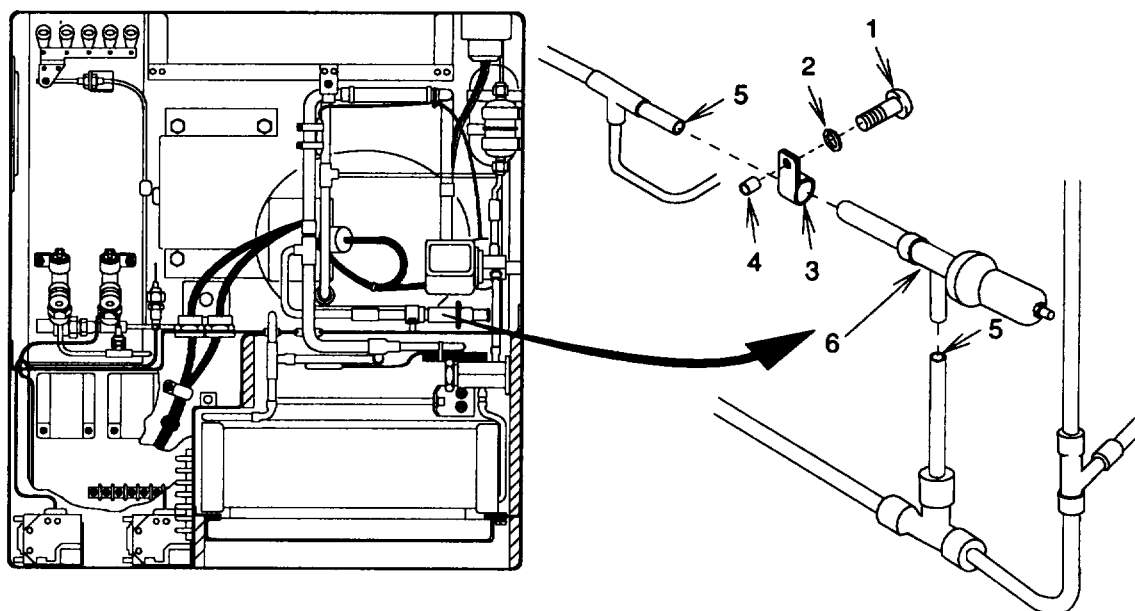


Figure 5-22. Pressure Regulator

### REPLACEMENT

1. Remove screw (1), lock washer (2), clamp (3), and post spacer(4).
2. Debraze two tube connections (5) and remove pressure regulator (6). (See para 5-12.)
3. Slip pressure regulator (6) in place.
4. Braze tubing to pressure regulator (6). (See para 5-12.)

**5-26. PRESSURE REGULATOR. - continued**

5. Secure pressure regulator (6) with screw (1), lock washer (2), clamp (3), and post spacer (4).

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install actuating cylinder (para 5-27).

**5-27. ACTUATING CYLINDER.**

This task covers:      Installation

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

**Equipment Condition**

Remove top panels (para 4-11).  
Remove dehydrator (para 5-20).

**Materials/Parts**

Actuating Cylinder  
Lock Washers (2)

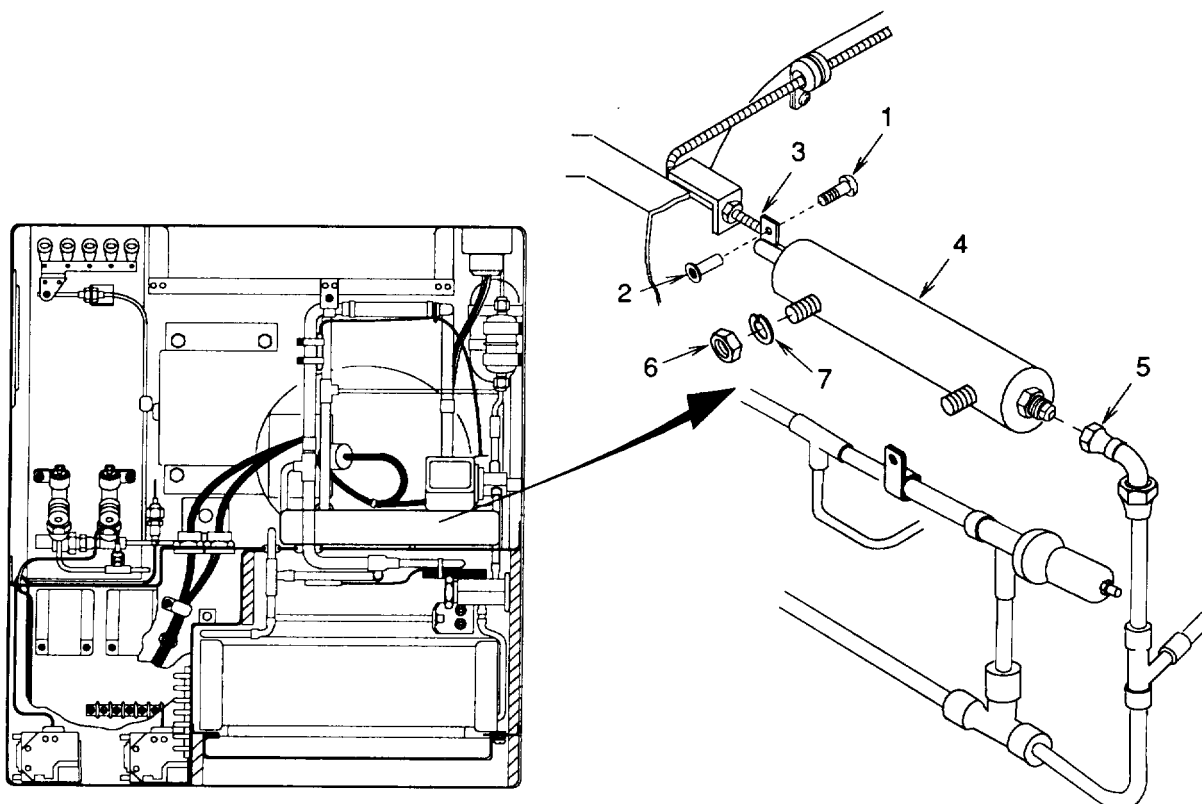


Figure 5-23. Actuating Cylinder



## 5-27. ACTUATING CYLINDER. - continued

### REPLACEMENT

1. Loosen screw (1) from mechanical post (2) and slip the push-pull cable (3) wire loose,
2. Disconnect actuator cylinder (4) from the flare nut (5) on elbow.
3. Remove two nuts (6) and lock washers (7) and slip actuator cylinder (4) out of the unit.
4. Align studs on actuating cylinder (4) with holes in bulkhead and secure with two each lock washers (7) and nuts (6).
5. Connect swivel elbow flare nut (5) to actuating cylinder (4).
6. Insert control cable (3) into mechanical post (2), Do not tighten screw (1).
7. Close condenser discharge air louvers and tighten screw(1).

### NOTE

FOLLOW-ON MAINTENANCE:  
Install new dehydrator (para 5-20),  
Install top panels (para 4-11).

## 5-28. HIGH PRESSURE SWITCH S4.

This task covers:      a. Inspection      b. Testing      c. Replacement

### INITIAL SETUP

#### Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

#### Equipment Condition

Remove junction box (para 4-27).  
Remove top panels (para 4-11).

#### Materials/Parts

High Pressure Switch S4  
Lock Washers (3)

### Inspection

Inspect pressure switch (1) and capillary line for visible signs of damage, Replace if damaged.

### Testing

Press reset button on the switch (1). Check for continuity between terminals 1 and 2. If there is continuity, the switch is properly closed. If no continuity is found press and release the reset button again. If there is still no continuity, switch must be replaced.

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**5-28. HIGH PRESSURE SWITCH S4. - continued**


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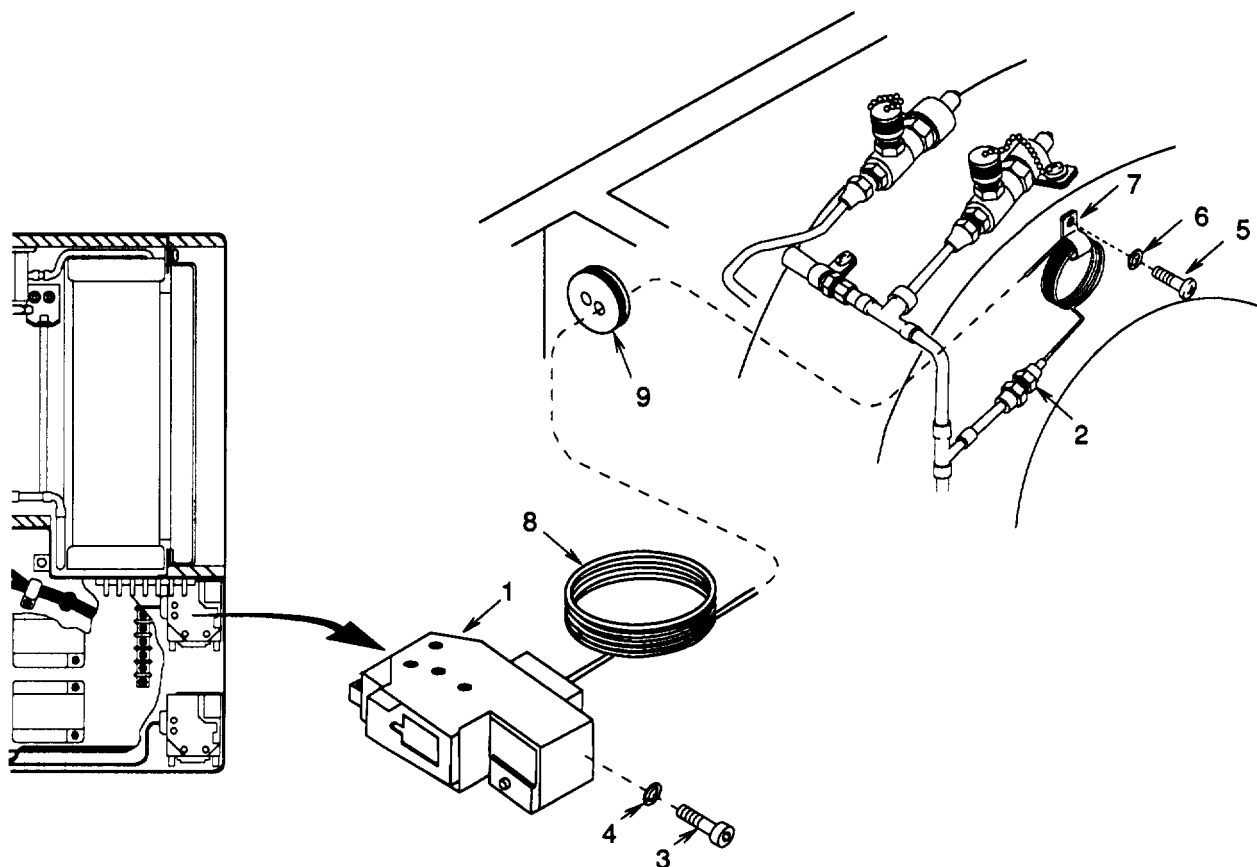


Figure 5-24. High Pressure Switch S4

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**REPLACEMENT**


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1. Remove supply air louver. (See para 4-14.)
2. Remove dehydrator. (See para 5-20.)
3. Tag and disconnect wire leads from high pressure switch (1).
4. Disconnect flare nut (2) at end of capillary line from switch (1).
5. Remove mist eliminator bracket. (See para 5-21.)
6. Remove two screws (3) and lock washers (4) from switch (1).
7. Remove screw (5), lock washer (6), and clamp (7) from capillary line (8).
8. Carefully remove capillary line (8) through grommet (9) and remove switch (1).
9. Insert capillary line (8) through grommet (9) hole in bulkhead.
10. Connect flare nut (2).

**5-28. HIGH PRESSURE SWITCH S4.- continued**

- 11. Secure switch (1) with two screws (3) and lock washers (4).
- 12. Carefully route capillary line (8) and position so it will not touch junction box.
- 13. Secure capillary line (8) with clamp (7), screw (5), and lock washer (6).
- 14. See tags and wiring diagram figure 4-4 and connect wire leads. Remove tags.

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install new dehydrator (para 5-20).  
Install mist eliminator bracket (para 5-21).  
Install junction box (para 4-27).  
Install supply air louver (para 4-14).  
Install top panels (para 4-11).

**5-29. LOW PRESSURE SWITCH S5.**

This task covers:    a. Inspection       b. Testing       c. Replacement

**INITIAL SETUP**

Tools	Equipment Condition
Refrigeration Unit Service Tool Kit Appendix B, item 1	Remove junction box (para 4-27). Remove top panels (para 4-11).

Materials/Parts

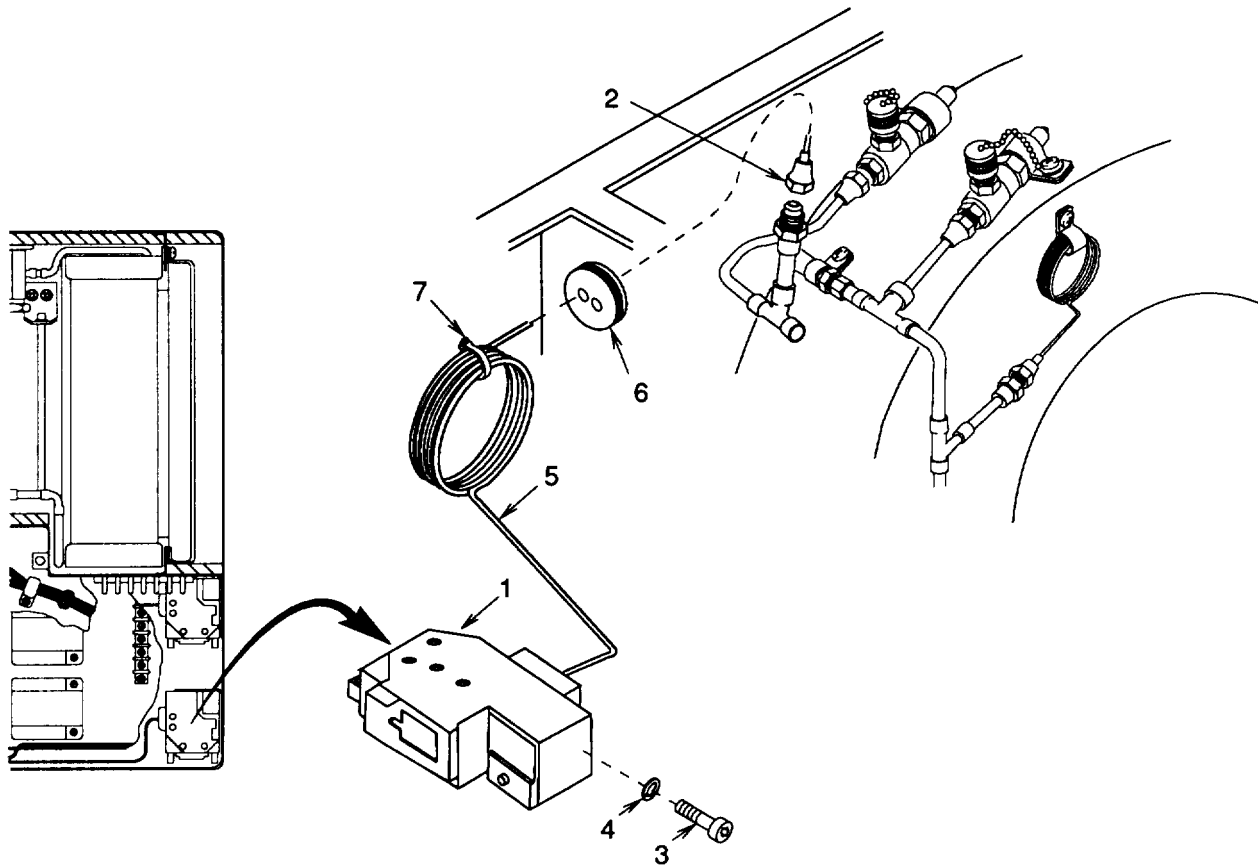
Low Pressure Switch S5  
Lock Washers (2)  
Tie Down Straps

**INSPECTION**

Inspect pressure switch (1) and capillary line for visible signs of damage. Replace if damaged.

**TESTING**

Press reset button on the switch (1). Check for continuity between terminals 1 and 2. If there is continuity, the switch is properly closed. If no continuity is found press and release the reset button again. If there is still no continuity, switch must be replaced.

**5-29. LOW PRESSURE SWITCH S5. - continued**

**Figure 5-25. Low Pressure Switch S5**
**REPLACEMENT**

1. Remove dehydrator. (See para 5-20.)
2. Tag and disconnect wire leads from low pressure switch (1).
3. Disconnect flare nut (2) at end of capillary line from switch(1).
4. Remove two screws (3) and lock washers (4) from switch (1).
5. Carefully remove capillary line (5) through grommet (6) and remove switch (1).
6. Insert capillary line (5) through grommet (6) hole in bulkhead.
7. Connect flare nut (2).
8. Secure switch (1) with two screws (3) and lock washers (4).
9. Carefully route capillary line (5) and position so it will not touch junction box.

## **5-29. LOW PRESSURE SWITCH S5. - continued**

- 10, Coil and secure excess capillary line (5) with tie down strap (7).
11. See tags and wiring diagram figure 4-4 and connect wire leads. Remove tags.

### **NOTE**

FOLLOW-ON MAINTENANCE:  
 Install new dehydrator (para 5-20).  
 Install junction box (para 4-27).  
 Install top panels (para 4-11).

## **5-30. SERVICE (CHARGING) VALVES.**

This task covers:      Replacement

### **INITIAL SETUP**

#### **T o o l s**

Refrigeration Unit Service Tool Kit  
 Appendix B, item 1

#### **E q u i p m e n t    C o n d i t i o n**

Remove top panels (para 4-11).  
 Remove dehydrator (para 5-20).

### **Materials/Parts**

Service Charging Valve  
 Lock Washer

### **REPLACEMENT**

1. Remove screw (1), lock washer (2), flat washer (3), cap and chain (4), and loop clamp (5) from the valve (6) to be replaced.
2. Disconnect flare nut (7) and remove valve (6).
3. Slip valve (6) in place and tighten flare nut (7).
4. Secure valve (6) and cap and chain (4) with loop clamp (5), screw (1), lock washer (2), and flat washer (3).

### **NOTE**

FOLLOW-ON MAINTENANCE:  
 Install new dehydrator (para 5-20).  
 Install top panels (para 4-11).

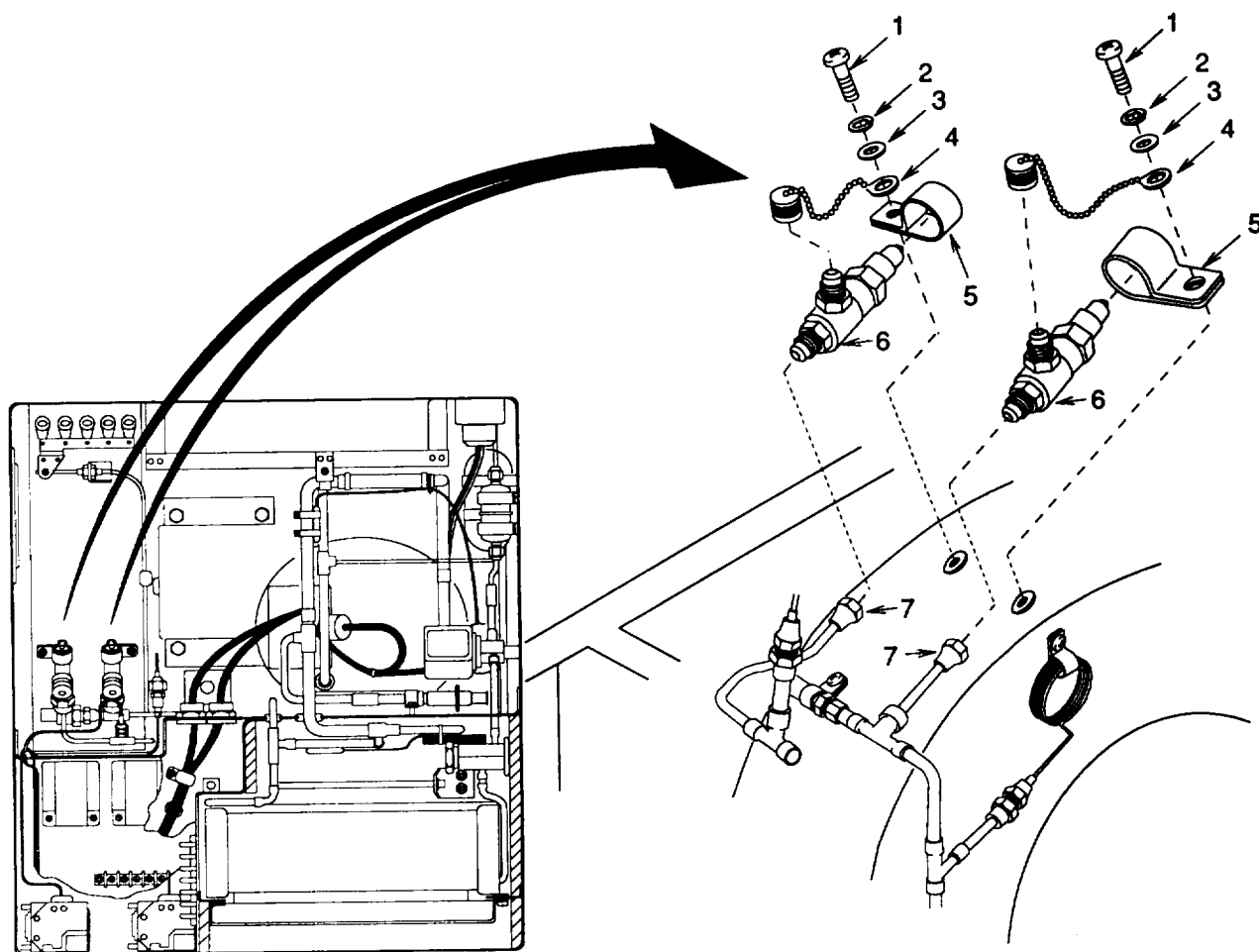
**5-30. SERVICE (CHARGING) VALVES. - continued**

Figure 5-26. Service (Charging) Valves

## 5-31. PRESSURE RELIEF VALVE.

This task covers: Replacement

### INITIAL SETUP

#### Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

#### Equipment Condition

Remove top panels (para 4-11).  
Remove dehydrator (para 5-20).

#### Materials/Parts

Pressure Relief Valve  
Lock Washers (2)

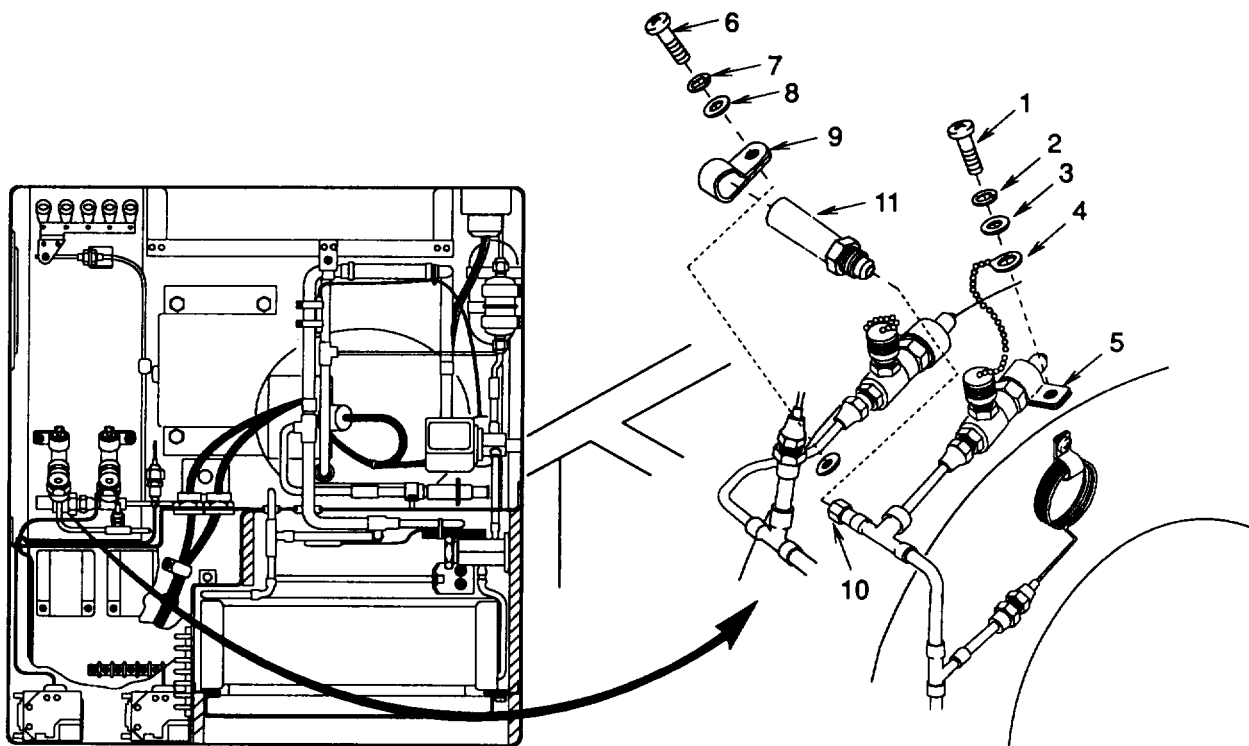


Figure 5-27. Pressure Relief Valve

### REPLACEMENT

1. Remove screw (1), lockwasher (2), flat washer (3), and chain (4) from clamp (5).
2. Remove screw (6), lockwasher (7), flat washer (8), and loop clamp (9).
3. Hold fitting (10) and remove valve (11).

### 5-31. PRESSURE RELIEF VALVE. - continued

4. Hold fitting (10) and install valve(11).
5. Secure valve (11) with clamp (9), screw(6), lock washer(7), and flat washer(8).
6. Install clamp (5) and chain (4) with screw (1), lock washer(2), and flat washer(3).

#### **NOTE**

FOLLOW-ON MAINTENANCE:  
Install new dehydrator (para 5-20).  
Install top panels (para 4-11).

### 5-32. CONDENSER COIL.

This task covers: Replacement

#### INITIAL SETUP

##### Tools

Refrigeration Unit Service Tool Kit  
Appendix B, item 1  
Gloves  
Appendix B, item 2

##### Equipment Condition

Remove dehydrator (para 5-20).  
Purge refrigerant system (para 5-11).  
Remove condenser air inlet guard (para 4-12).  
Remove connector J11 (para 4-34).

##### Materials/Parts

Condenser Coil  
Lock Washers (3)

##### General Safety Instructions

#### **WARNING**

When handling coils wear gloves to avoid cuts and reduce fin damage.

#### REPLACEMENT

1. Remove two screws (1) and lock washers (2) and mounting plate (3).
2. Remove four screws (4) and two clamps (5) from the receiver(6).
3. Remove screw (7), nut (8), lock washer (9), and clamp (10) from coil (11).
4. Debraze tube connection (12) on the coil (11). (See para 5-12.)

#### **WARNING**

When handling coils wear gloves to avoid cuts and reduce fin damage.

5. Carefully lift condenser coil (11), sight glass (13), and receiver (6) up and out of unit.



**5-32. CONDENSER COIL. - continued**

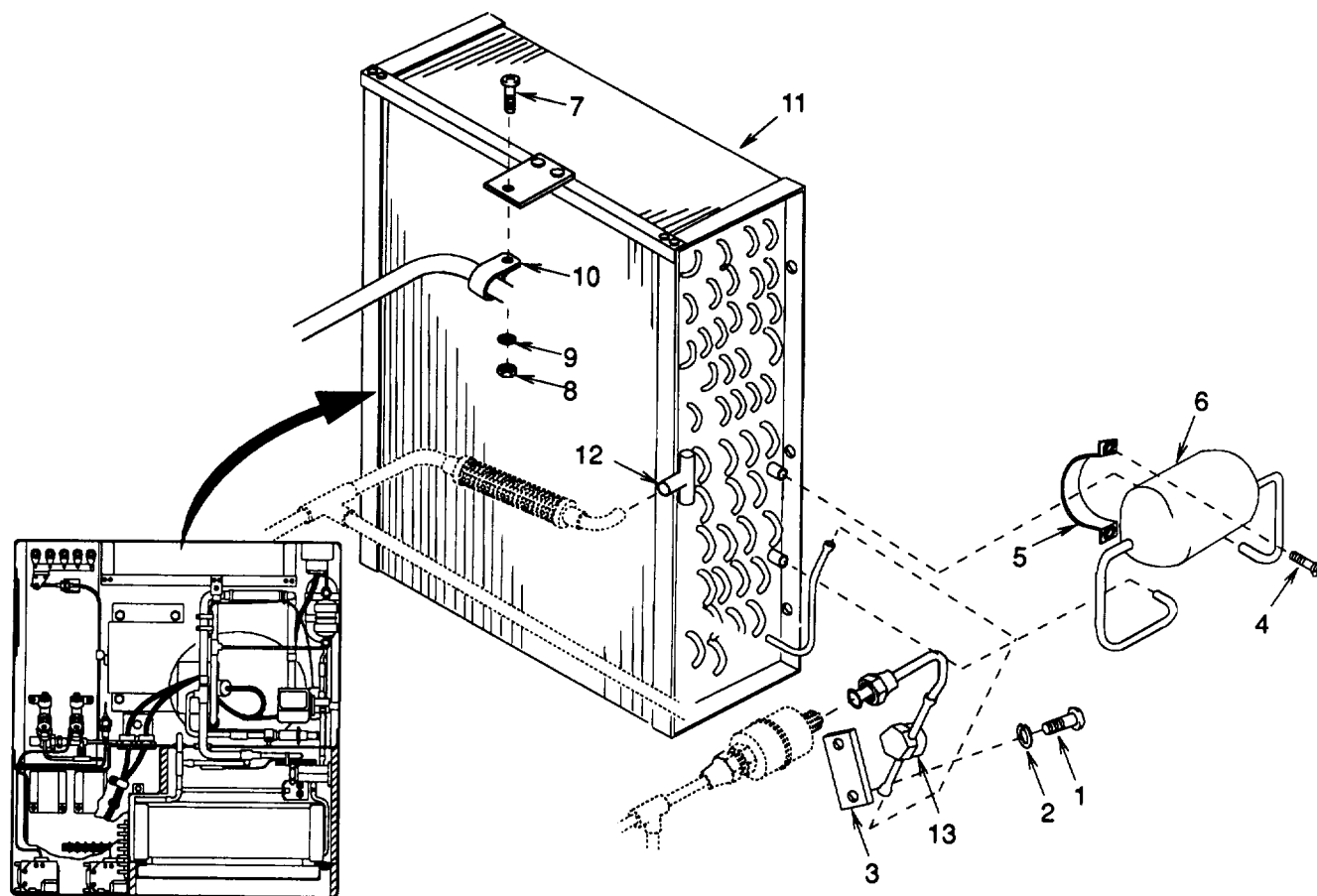


Figure 5-28. Condenser Coil

6. Remove (debraze) receiver (6). (See para 5-12.)
7. Braze receiver (6) to new coil. (See para 5-12.)
8. Remove (debraze) sight glass (13). (See para 5-12.)
9. Braze sight glass (13) to new coil. (See para 5-12.)

**WARNING**

When handling coils wear gloves to avoid cuts and reduce fin damage.

10. Carefully place coil (11) into position in unit.
11. Braze tube connections (12) to coil, (See para 5-12.)
12. Secure receiver (6) with two clamps (5) and screws (4).

**5-32. CONDENSER COIL. - continued.**

13. Secure sight glass (13) with mounting plate (3), two screws (1) and lockwashers (2).

14. Secure clamp (10) with screw (7), lock washer (9), and nut (8).

**NOTE**

FOLLOW-ON MAINTENANCE:  
 Install new dehydrator (para 5-20).  
 Install connector J11 (para 4-34).  
 Install condenser air inlet guard (para 4-12).

**5-33. LIQUID INDICATOR (SIGHT GLASS).**

This task covers: Replacement

**INITIAL SETUP****Tools**

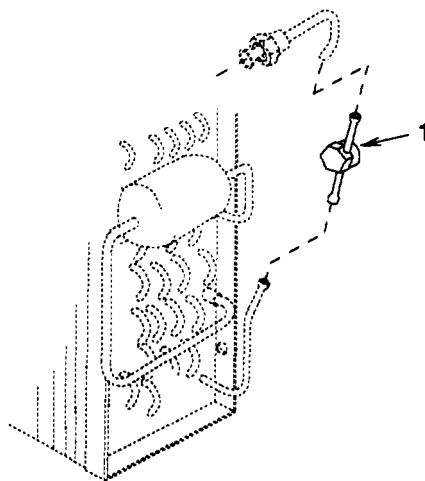
Refrigeration Unit Service Tool Kit  
 Appendix B, item 1

**Equipment Condition**

Remove condenser coil (para 5-32).

**Materials/Parts**

Liquid Indicator



**Figure 5-29. Liquid Indicator**

**REPLACEMENT**

1. Debraze and remove liquid indicator (1), (See para 5-12.)

**5-33. LIQUID INDICATOR (SIGHT GLASS). - continued**

2. Place liquid indicator (1) on tubing ends and braze. (See para 5-12.)

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install condenser coil (para 5-32).

**5-34. RECEIVER.**

This task covers:      Replacement

**INITIAL SETUP**

Tools

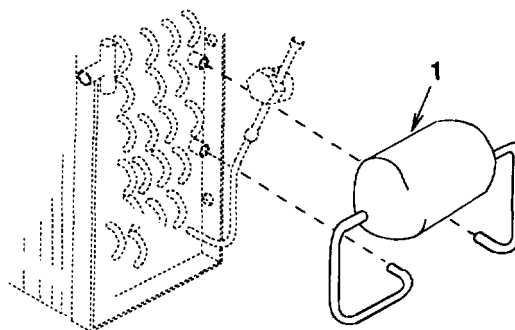
Refrigeration Unit Service Tool Kit  
Appendix B, item 1

Equipment Condition

Remove condenser coil (para 5-32).

Materials/Parts

Receiver



**Figure 5-30. Receiver**

**REPLACEMENT**

1. Debraze and remove receiver(1). (See para 5-12.)
2. Place receiver (1) on tubing ends and braze. (See para 5-12.)

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install condenser coil (para 5-32).

**5-35. COMPRESSOR.**

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

**INITIAL SETUP****Tools**

Refrigeration Unit Service Tool Kit  
Appendix B, item 1

**Materials/Parts**

Compressor  
Thermal Overload Switch  
Crankcase Heater  
Connector J10  
Self-locking Nut  
Tie Down Straps

**Equipment Condition**

Remove top rear panel (para 4-11).

General Safety Instructions

**WARNING**

If compressor is being removed due to burnout, use care when lifting to avoid touching compressor sludge. Acid in sludge can cause burns.

**Personnel Required**

Two

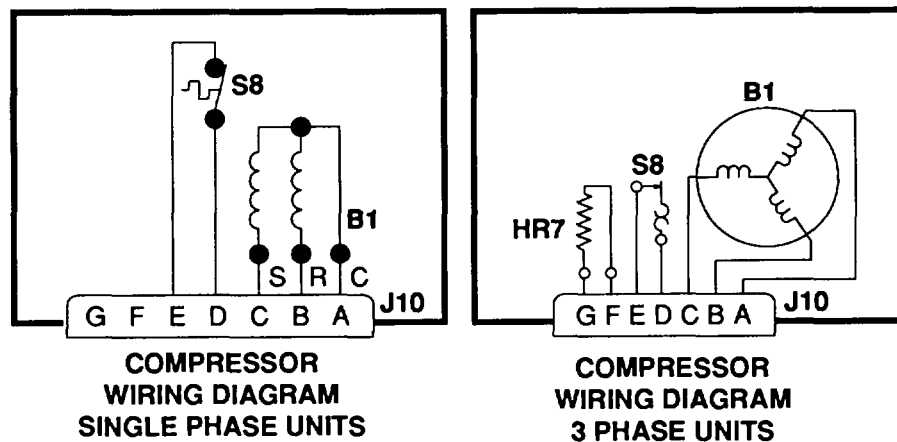
**TESTING**

Figure 5-31 Compressor Testing

1. Disconnect wiring harness P10 from J10.
2. (On 3 phase models only.) With multimeter set on lowest OHMS scale, 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.
3. 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. On three phase units, replace compressor. On single phase units, replace overload protector.

**5-35 COMPRESSOR. - continued**

4. 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.
5. Check continuity between pins A, B, and C and the compressor body. No continuity should exist. If continuity exists the compressor motor is bad. Replace compressor.
6. Inspect J10 connector for loose, broken, or otherwise damaged pins or connector threads. Replace if damaged.

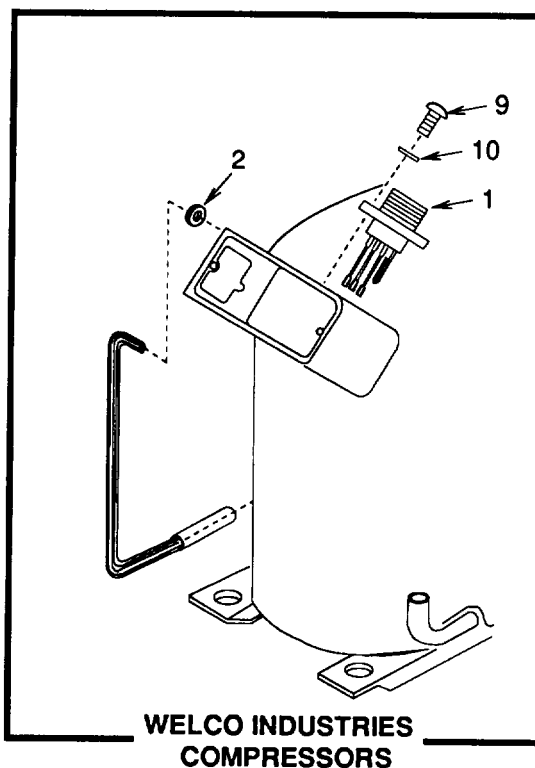
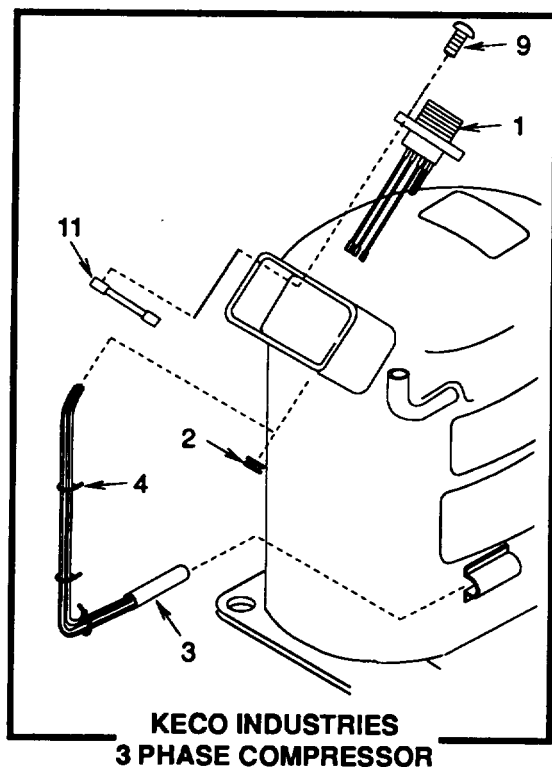
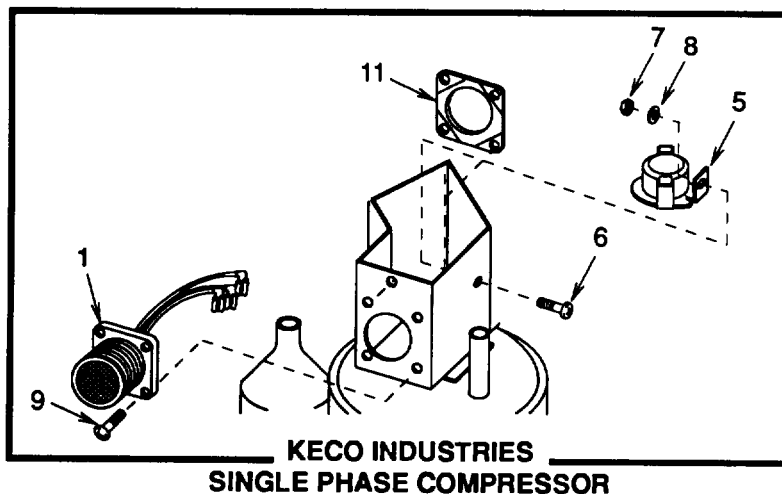
**REPAIR**

Figure 5-32. Compressor Repair

**5-35. COMPRESSOR. - continued**

1. Crankcase heater, (3 phase only).
  - a. Disconnect heater leads from pins F and G of J10(1). Pull leads through grommet (2). (See para 4-20.)
  - b. Pull heater (3) from mounting clip.
  - c. Place new heater (3) in mounting clip.
  - d. Run heater wires through grommet (2).
  - e. Connect heater leads to J10 pins F and G. (See para 4-20.)
  - f. Secure heater wires with tie down straps (4).
2. Cutout switch (S8) (Keco single phase units only).
  - a. Remove screw (6), self-locking nut (7), flat washer (8), and switch (5).
  - b. Tag and disconnect terminals from switch (5).
  - c. Using tags and wiring diagram figure 4-4 connect terminal lugs to switch (5).
  - d. Place switch (5) in junction box and secure with screw (6), self-locking nut (7), and flat washer(8).
3. Connector (J10).
  - a. Remove four screws (9), lock washers (10) (Welco only), nut plate (11) (Keco only), and connector (1) with leads.
  - b. Tag and unsolder leads. (See para 4-20.)
  - c. Using tags and wiring diagram figure 4-4 solder leads to new connector. Remove tags. (See para 4-20.)
  - d. Secure connector (1) with four screws (9), lockwashers (10) (Welco only), and nut plate (11) (Keco only).

**REMOVAL**

1. Remove dehydrator. (See para 5-20.)
2. Purge refrigerant system. (See para 5-11.)
3. Debraze compressor tubes.(See para 5-12.)
4. Lift and support air conditioner to gain access to underside of housing.
5. Loosen four access panel screws (1) in bottom of unit and swing access panels (2) out of the way.
6. Remove four self locking nuts (3), eight flat washers (4), eight shims (5), and four screws (6).

**WARNING**

If compressor is being removed due to burnout, use care when lifting to avoid touching compressor sludge. Acid in sludge can cause burns.

7. Carefully lift compressor (7) from unit.

**5-35. COMPRESSOR. - continued**

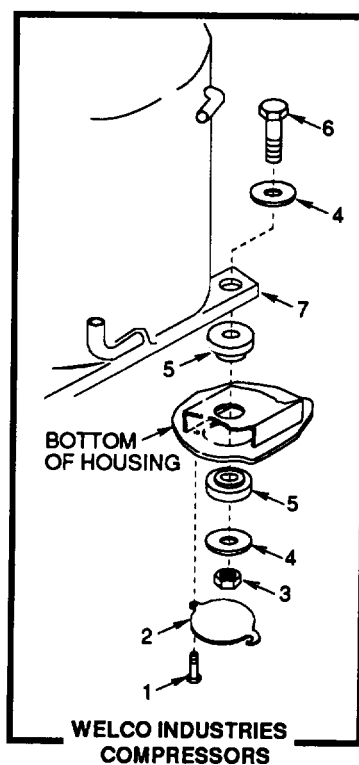
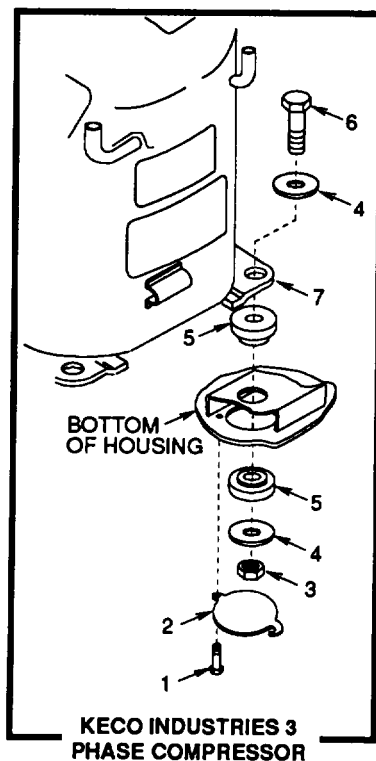
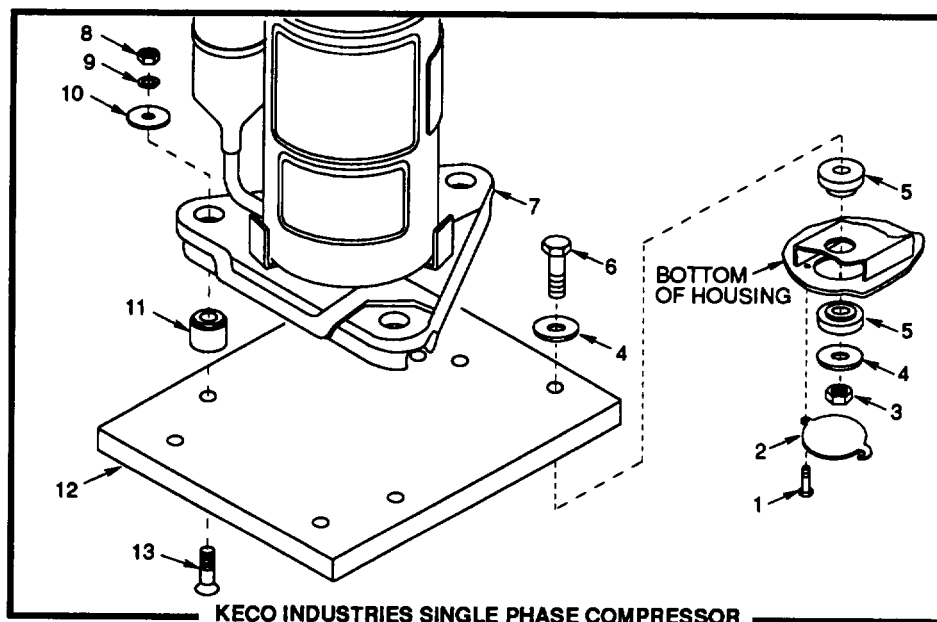


Figure 5-33. Compressor Removal/Installation

**5-35. COMPRESSOR. - continued]**

8. (Single phase unit.) Remove three nuts (8), lock washers (9), flat washers (10), spacers (11), plate (12), and screws (13).
9. Check compressor to see if a motor burnout is indicated.
  - a. Tip compressor toward discharge port and drain a small quantity of oil into a clear glass container.
  - b. If oil is clean and clear, and does not have a burnt acid smell, the compressor did not fail because of motor burnout. Install new compressor.
  - c. If oil is black, contains sludge, and has a burnt acid odor, the compressor failed because of motor burnout. Before installing new compressor, flush refrigerant system. (See para 5-13.)

**INSTALLATION**

The compressor is supplied with a complete charge of oil. Take care that oil is not lost when handling and installing compressor.

1. (Single phase unit.) Install three screws (13), plate (12), three spacers (n), flat washers (10), lockwashers (9), and nuts (8).
2. If any refrigeration piping was disconnected and removed with the compressor, transfer the piping to the replacement compressor.
3. Place four shims (5) into unit on mounting channels.
4. Carefully set compressor (7) down onto shims (5).
5. Install four flat washers (4) and screws (6).
6. Lift and support air conditioner to gain access to underside of housing.
7. Install four shims (5), flat washers (4) and self-locking nuts (3).
8. Swing four access panels (2) into place and tighten screws (1).
9. Braze tube connections. (See para 5-12.)
10. Connect P10 connector.
11. Replace dehydrator. (See para 5-20.)

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install top rear panel (para 4-11).



**5-36. TUBING AND FITTINGS.**

---

This task covers:        Replacement

---

**INITIAL SETUP**

Tools	Equipment Condition
Refrigeration Unit Service Tool Kit Appendix B, item 1	Remove top panels (para 4-11). Remove dehydrator (para 5-20). Purge refrigerant system (para 5-11).

---

**REPLACEMENT**

Replace tubing and fittings only with equal material, grade, size, length, and shape as the item removed.  
(See para 5-12.)

**NOTE**

FOLLOW-ON MAINTENANCE:  
Install new dehydrator (para 5-20).

CHAPTER 6  
GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

**6-1. GENERAL.**

The only items restricted to general support maintenance level by the Maintenance Allocation Chart (MAC) are the repair or 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 unit and direct support maintenance for rehabilitation or overhaul of an air conditioner.

**6-2. HOUSING.**

This task covers:      a. Repair      b. Replacement

**INITIAL SETUP**

**T o o l s**

Refrigeration Unit Service Tool Kit  
Appendix B, item 1  
Torch Set  
Appendix B, item 2

Equipment Condition  
Disconnect power at power source.  
General Safety Instructions

**Materials/Parts**

Insulation/Gasket  
Appendix F  
Adhesive Remover  
Appendix E, item 16  
Adhesive  
Appendix E, item 2



Adhesive remover is flammable and the vapors can be explosive. Repeated or prolonged skin contact or inhalation of vapors can be toxic. Use in a well ventilated area, wear gloves, and keep away from sparks or flame.

**NOTE**

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.

**REPAIR**

1. Disassemble unit as necessary and make repair as indicated.
2. Minor dents and bent edges can be straightened using common sheet metal repair procedures.
3. Should touch up or refinishing be necessary, see TM 43-0139.

**6-2. HOUSING. - continued**

**NOTE**

Housing replacement requires total unit disassembly. Normally if the unit is damaged to this extent it should be replaced.

If housing replacement is attempted see individual installation instructions of components for reinstallation of items removed.

**REPLACEMENT**

Gasket and insulation replacement.

- a. Use only gaskets, insulation, or name plates identified in TM9-4120-400-24P.
- b. Remove as much old gasket or insulation material from unit as possible by pulling or scraping it away from metal surface.

**WARNING**

Adhesive remover is flammable and the vapors can be explosive. Repeated or prolonged skin contact or inhalation of vapors can be toxic. Use in a well ventilated area, wear gloves, and keep away from sparks or flame.

- c. Soften and remove old adhesive and material residue, using adhesive remover and a stiff brush.
- d. Coat mating surfaces of metal and material with adhesive. Let both surfaces air dry until adhesive is tacky but will not stick to fingers.
- e. Starting with an end, carefully attach material to metal. Press into firm contact all over.

**NOTE**

FOLLOW-ON MAINTENANCE:  
Connect power at power source.

## 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 |
| • Equipment Inspection and Maintenance Worksheet      | DA 2404 |
| • Quality Deficiency Report                           | SF 368  |

#### **A-3. TECHNICAL MANUALS.**

- |  |                   |
|--|-------------------|
| Painting Instructions for Field Use  | TM 43-0139        |
| • Unit, Direct Support, and General Support Maintenance<br>Repair Parts and Special Tools List | TM 9-4120-400-24P |
| • Procedures for Destruction of Equipment to Prevent Enemy Use                                 | TM 750-244-3      |

#### **A-4. MISCELLANEOUS PUBLICATIONS.**

- |   |                     |
|---|---------------------|
| • The Army Maintenance Management System (TAMMS)                              | DA Pamphlet 738-750 |
| • Warranty Program for Air Conditioners,<br>Horizontal, Compact, 9,000 BTU/HR | TB9-4120-400-24     |
| • Environmental Control of Small Shelters                                     | MIL-HDBK-116        |

## 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.
- 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 instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.
- g. 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<sup>1</sup>, including fault location/troubleshooting<sup>2</sup>, removal/installation, and disassembly/assembly<sup>3</sup> procedures, and maintenance actions<sup>4</sup> 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 service/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.....Unit  
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.

<sup>1</sup>Services - inspect, test, service, adjust, aline, calibrate, and/or replace.  
<sup>2</sup>Fault locate/troubleshoot - The process of investigating and detecting the cause Of equipment malfunctioning; the act of isolating a fault within a system or unit under test (UUT).  
<sup>3</sup>Disassemble/assemble - encompasses the step-by-step taking apart (or breakdown) of a spare/functional group coded item to the level of its least componency identified as maintenance significant (i.e., assigned an SMR code) for the category of maintenance under consideration.  
<sup>4</sup>Actions - welding, grinding, riveting, straightening, facing, remachinery, and/or resurfacing.

f. Column 6. Remarks. Column 6 contains a note number which shall correspond to the notes contained in Section IV.

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

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 manufacturers part number.

<b>B-5. EXPLANATION OF COLUMNS IN REMARKS, SECTION IV.</b>
--

a. Column 1. Reference Code. The code recorded in column 6, Section II.

b. Column 2. Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

## Section II

## MAINTENANCE ALLOCATION CHART

(1) Group No.	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category				(5) Tools & Equip.	( 6 ) Remarks
			Unit					
			C	O	F	H		
01	HOUSING COVERS, PANELS, GRILLES, SCREENS AND INFORMATION PLATES							
	Cover, Fabric	Inspect Service Replace	0.1	0.5 1.0				
	Panels	Inspect Service Repair Replace	0.1	0.5	2.0 1.0			a
	Screens and Guards	Inspect Service Replace	0.1 0.2	0.5	0.5			b
	Louvers	Inspect Adjust Service Replace	0.1 0.1	0.2 0.1	1.0			
	Information Plates	Inspect Replace	0.1	0.5				
02	AIR CIRCULATING AND CONDENSATE DRAIN SYSTEM							
	Air Filter	Inspect Service Replace	0.1	0.2 1.0 1.0				
	Mist Eliminator	Inspect Service Replace		0.5 1.0 1.0				
	Condenser Air Discharge Louver and Linkage	Inspect Service Adjust Replace		0.5 1.0 1.0 1.0				
	Fresh Air Damper and Actuator	Inspect Service Adjust Replace	0.1	0.5 0.5 0.5 2.0	0.5 2.0			



## MAINTENANCE ALLOCATION CHART - Continued

(1) Group No.	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category				(5) Tools & Equip.	(6) Remarks
			Unit					
			C	O	F	H		
03	Condensate Traps and Drain Tubes	Inspect Service Replace	0.1	0.5 0.5 1.0				
	ELECTRICAL							
	Control Module	Repair Replace		3.0 0.5				c
	Temperature Control Thermostat)	Inspect Test Replace	0.1	0.1 1.0 1.0				
	EVAPORATOR FAN SPEED Switch	Inspect Test Replace	0.1	0.1 0.5 1.0				
	MODE SELECTOR Switch	Inspect Test Replace	0.1	0.1 0.5 1.0				
	COMPR (compressor) CIRCUIT BKR (breaker)	Inspect Test Replace		0.1 0.5 1.0				
	Control Module Wiring Harness	Inspect Test Repair Replace		0.5 1.0 1.0 2.0				
	Junction Box	Inspect Repair Replace		1.0 2.0 2.0				c
	Junction Box Wiring Harness	Inspect Test Repair Replace		0.5 1.0 1.0 12.0				
	Relays	Inspect Test Replace		0.2 1.0 1.5				
	Control Circuit Breaker	Inspect Test Replace		0.1 0.5 1.0				

## MAINTENANCE ALLOCATION CHART - Continued

(1) Group No.	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category				(5) Tools & Equip.	(6) Remarks
			C	Unit				
					F	H		
04	Unit Wiring Harness	Inspect Test Repair Replace	1.0 2.0 1.0 4.0					
	Compressor Start Relay	Inspect Test Replace	0.1 0.2 0.5					
	Capacitors	Inspect Test Replace	0.1 0.2 0.5					
	Rectifier	Inspect Test Replace	0.1 0.5 1.0					
	Transformer	Inspect Test Replace	0.1 0.5 1.0					
	EVAPORATOR FAN MOTOR AND HEATER							
	Fan and Housing	Inspect Service Replace	0.5 1.0 2.0					
	Motor	Inspect Test Repair Replace	0.5 0.5  3.0	2.0			d	
	Heater Thermostat	Inspect Test Replace	0.1 1.0 0.5					
	Heater Elements	Inspect Test Replace	0.1 0.5 2.0					
	05	CONDENSER FAN, AND MOTOR						
	Fan and Housing	Inspect Service Replace	0.5 0.5 1.0					

## MAINTENANCE ALLOCATION CHART - Continued

(1) Group No.	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category				(5) Tools & Equip.	(6) Remarks
			Unit					
			C	O	F	H		
06	Motor	Inspect Test Repair Replace		0.5 0.5 3.0	2.0			d
	REFRIGERATION SYSTEM							
	Dehydrator	Inspect Replace			0.1 3.0			
	Evaporator Coil	Inspect Service Replace		0.5 1.0	8.0			
	Expansion Valves	Replace			8.0			
	Solenoid Valves	Test Repair Replace		0.5 1.0	8.0			e
	Pressure Regulator	Replace			8.0			
	Actuating Cylinder	Adjust Replace			1.0 8.0			
	Pressure Switches	Inspect Test Replace			0.1 0.5 8.0			
	Service Valves	Replace			8.0			
	Pressure Relief Valve	Replace			8.0			
	Condenser Coil	Inspect Service Replace		0.5 1.0	8.0			
	Liquid Indicator	Inspect Replace	0.5		8.0			
	Receiver	Replace			8.0			
	Compressor	Test Repair Replace		0.5	0.5 1.0 12.0			f
	Tubing and Fittings	Replace			8.0			

MAINTENANCE ALLOCATION CHART - Continued

(1) Group No.	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category				(5) Tools & Equip.	(6) Remarks
			Unit					
			c	o	F	H		
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	O-F-H	Tool kit, service, refrigeration Unit (SC 5180-90-CL-N18)	5180-00-597-1474	
2	O-F-H	Shop Equipment, Auto Organizational #1 Common	4910-00-754-0654	
3	F-H	Pump, Vacuum	4310-00-289-5967	
4	O-F-H	Heat Gun	4940-01-042-4855	
5	O-F-H	Screwdriver, Offset, Cross Tip No. 1	5120-00-256-9014	
6	O-F-H	Power Supply, 28 Volt dc	6130-01-143-5947	
7	F-H	Nitrogen Regulator	6680-00-503-1327	
8	F-H	Pump, Diaphragm	4320-00-588-3590	
9	F-H	Recovery and Recycle Unit, Refrigerant	4130-01-338-2707	

**Section IV REMARKS**  
**MAINTENANCE ALLOCATION CHART**

Reference Code	Remarks
a	Replace gasket insulation and information plates.
b	Straighten bent blades.
c	Replace components.
d	Replace bearings, thermal overloads or connector.
e	Replace solenoid valve coil only.
f	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 1. Active time listed for maintenance task functions are with the air conditioner in off-equipment position.

## APPENDIX C

## COMPONENTS OF END ITEM (COEI) AND BASIC ISSUE ITEMS (BII) 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 item, 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.

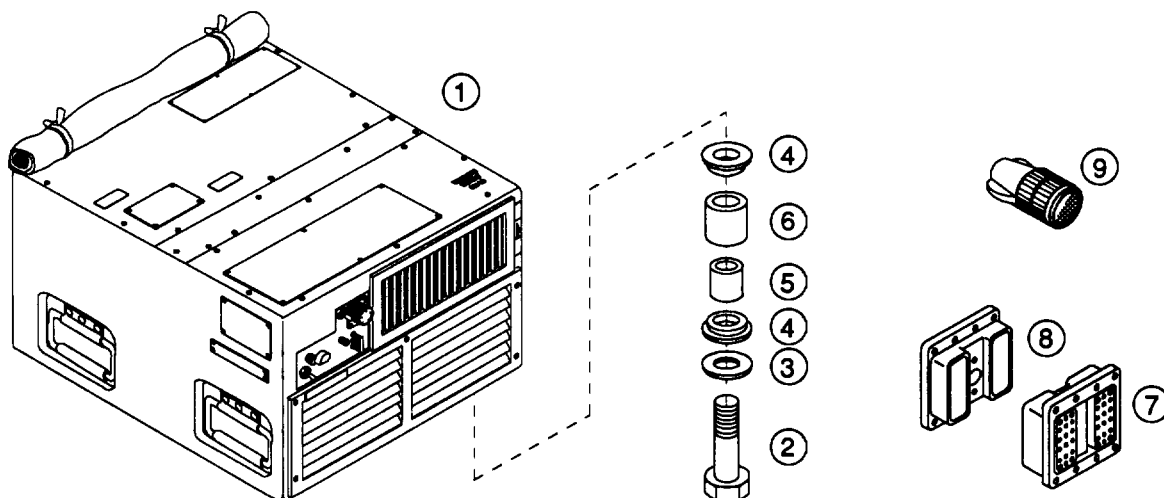
c. Column (3) - Description. Indicates the Federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the CAGE (in parentheses) followed by the part number. If item needed differs for different models of this equipment, the model is shown under the "Usable On" heading in this column. These codes are identified as:

Code	Used On
EXT	Model F9000H-3SA Air Conditioner, 208 volt, 3 phase, 50/60 hertz
EXX	Model F9000H-1SA Air Conditioner, 115 volt, single phase, 50/60 hertz

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 CAGE and Part Number	Usable On Code	(4) U/M	(5) Qty Rqr
1	4120-01-330-6542	Air Conditioner (97403) 13225E8455	EXT	EA	1
1	4120-01-326-4370	Air Conditioner (97403) 13225E8450	EXX	EA	1
2	5305-00-269-2807	Screw, Cap, Hex Head (96906) MS90726-64		EA	4
3	5310-00-566-9504	Washer (97403) 13216E6138-2		EA	4
4	5340-01-042-5759	Mount Resilient (97403) 13216E6137		EA	8
5	5365-01-044-6408	Spacer (97403) 13216E6152		EA	4
6	4720-01-038-2334	Tube Elastomeric (97403) 13216E6153		EA	4
7	5935-00-482-2390	Connector, Receptacle Electrical (97403) 13216E6177		EA	1
8	5935-00-482-2388	Connector, Plug Electrical (97403) 13216E6209-1		EA	1
9	5935-00-725-4153	Connector, Plug Electrical (96906) MS3106R18-11S		EA	1

## Section III BASIC ISSUE ITEMS

(1) Illus. Number	(2) National Stock Number	(3) Description CAGE and Part Number	Usable On Code	(4) U/M	(5) Qty Rqr
		Department of the Army Technical Manual; Operator's, Unit, Direct Support, and General Support Maintenance Manual TM9-4120-400-14		EA	1
		Warranty Program for Air Conditioner Horizontal Compact 9000 BTU/HR TB9-4120-400-24		EA	1



## APPENDIX D

## ADDITIONAL AUTHORIZATION LIST (AAL) ITEMS

## 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 CAGE AND PART NUMBER	USABLE ON CODE	(3) U/M	(4) QTY RQR

## APPENDIX E

## EXPENDABLE/DURABLE SUPPLIES AND MATERIALS (EDSML) 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- Unit Maintenance  
F - Direct Support Maintenance  
H - General Support Maintenance

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

d. Column 4, Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Commercial And Government Entity (CAGE) 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	6850-00-281-1985	Dry Cleaning Solvent A-A-511 (58536)	gl
4	F	6850-00-837-9927	Monochlorodifluoromethane, Technical: w/cylinder 22 lb (Refrigerant-22) BB-F-1421, type 22 (81348)	cy
5	F	6830-00-782-6512	Dichlorotetrafluoroethane Technical: w/cylinder (Refrigerant-1 14) BB-F-1421, Type 114-(81348)	cy
6	O	3439-01-045-7940	Flux, Solder, Liquid, Rosin Base MIL-F-14256	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, 1, 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	9150-01-340-3804	Silicon Spray, P/N AS193 (61014)	oz

Section II EXPENDABLE SUPPLIES AND MATERIALS LIST - continued

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
15	O	7930-00-764-5066	Detergent, Dishwasher	oz
16	O	6510-01-016-8772	Adhesive Remover	oz
17	F	9150-00-189-6727	Oil, MIL-L-2104, Grade 10 (81349)	qt
18	F	5640-00-580-6276	Insulation Tape	roll

## APPENDIX F

## ILLUSTRATED LIST OF MANUFACTURED ITEMS

## Section I INTRODUCTION

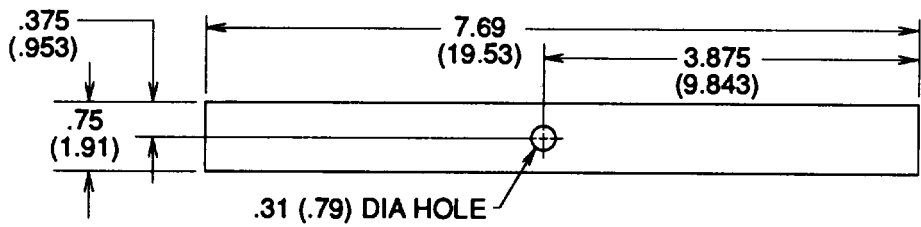
**SCOPE.**

- a. This appendix includes complete instructions for making items authorized to be manufactured or fabricated at unit, direct support, and general support maintenance.
- b. A part number index in alphanumeric order is provided for cross-referencing the part number of the item to be manufactured to the figure which covers fabrication criteria.
- c. All bulk materials needed for manufacture of an item are listed by part number or specification number in a tabular list on the illustration.

## Manufactured Items Part Number Index

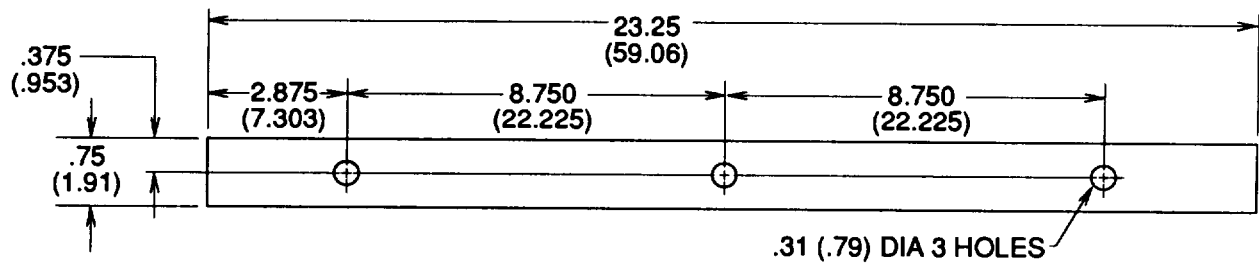
Part Number	Figure Number	Part Number	Figure Number
13216E5880/2	F-1 1	13225E8451/28	F-31
13216E5880/3	F-13	13225E8451/40	F-24
13216E5881/3	F-3	13225E8451/41	F-18
13216E5881/5	F-1	13225E8451/42	F-23
13216E5881/6	F-2	13225E8451/43	F-34
13216E5881/8	F-3	13225E8451/44	F-26
13216E5895/3	F-19	13225E8451/45	F-18
13216E5896/2	F-18	13225E8451/46	F-28
13216E5899/3	F-20	13225E8451/47	F-27
13216E6116-2/3	F-1 8	13225E8451/48	F-30
13216E6151-1	F-15	13225E8451/49	F-18
13216E6151-4	F-15	13225E8451/50	F-21
13216E6151-5	F-15	13225E8451/51	F-33
13220E1352/3	F-12	13225E8451/52	F-33
13225E8422/3	F-8	13225E8451/53	F-25
13225E8422/4	F-9	13225E8451/61	F-22
13225E8422/5	F-10	13225E8451/62	F-3
13225E8423/2	F-3	13225E8451/64	F-29
13225E8423/4	F-4	13225E8455/223	F-14
13225E8450/251	F-16	13225E8458/3	F-5
13225E8450/283	F-17	13225E8458/4	F-6
13225E8451/25	F-31	13225E8458/5	F-7

Section II MANUFACTURED ITEMS ILLUSTRATIONS



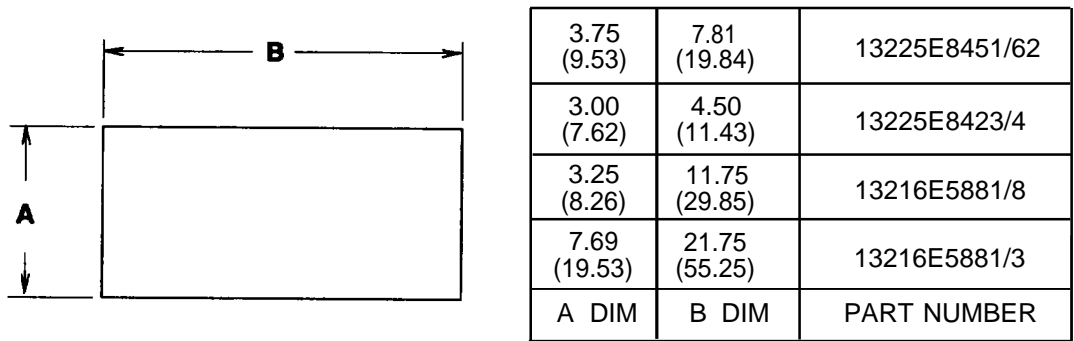
NOTE  
1. FABRICATE FROM NSN 9320-00-814-4583 STOCK

Figure F-1. Rubber, Cellular (Gasket), Part Number 13216E5881/5



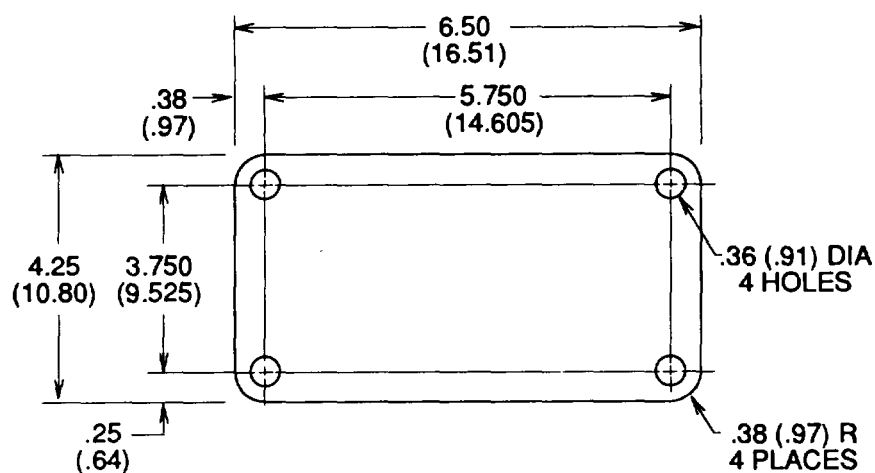
NOTE  
1. FABRICATE FROM NSN 9320-00-814-4583 STOCK

Figure F-2. Rubber, Cellular (Gasket), Part Number 13216E5881/6



NOTE  
1. FABRICATE FROM AMS3570/SH-1/4THK FLEXIBLE  
POLYURETHANE FOAM, OPEN CELL, MEDIUM  
FLEXIBILITY, 2.5 LB PER CU FT, .25 (.64) STK

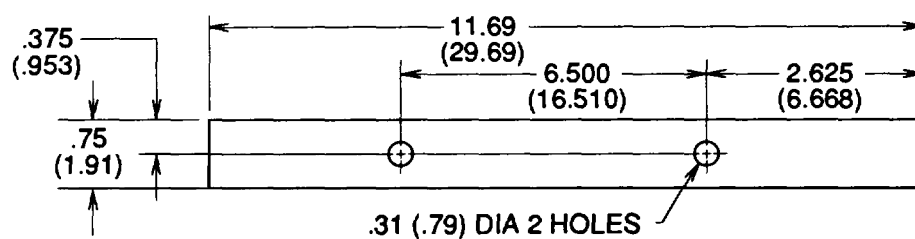
Figure F-3. Foam, Flexible (Insulation)



NOTE

1. FABRICATE FROM NSN 9320-01-N80-1132 STOCK

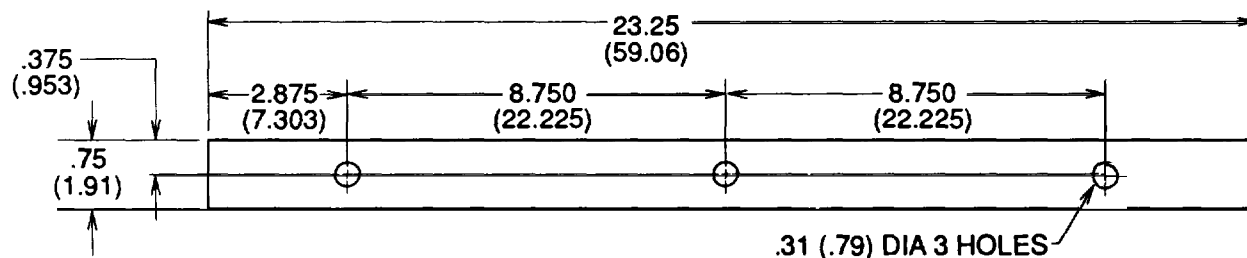
Figure F-4. Rubber, Cellular (Gasket), Part Number 13225E8423/4



NOTE

1. FABRICATE FROM NSN 9320-01-N80-1132 STOCK

Figure F-5. Rubber, Cellular (Gasket), Part Number 13225E8458/3



NOTE

1. FABRICATE FROM NSN 9320-01-N80-1132 STOCK

Figure F-6. Rubber, Cellular (Gasket), Part Number 13225E8458/4

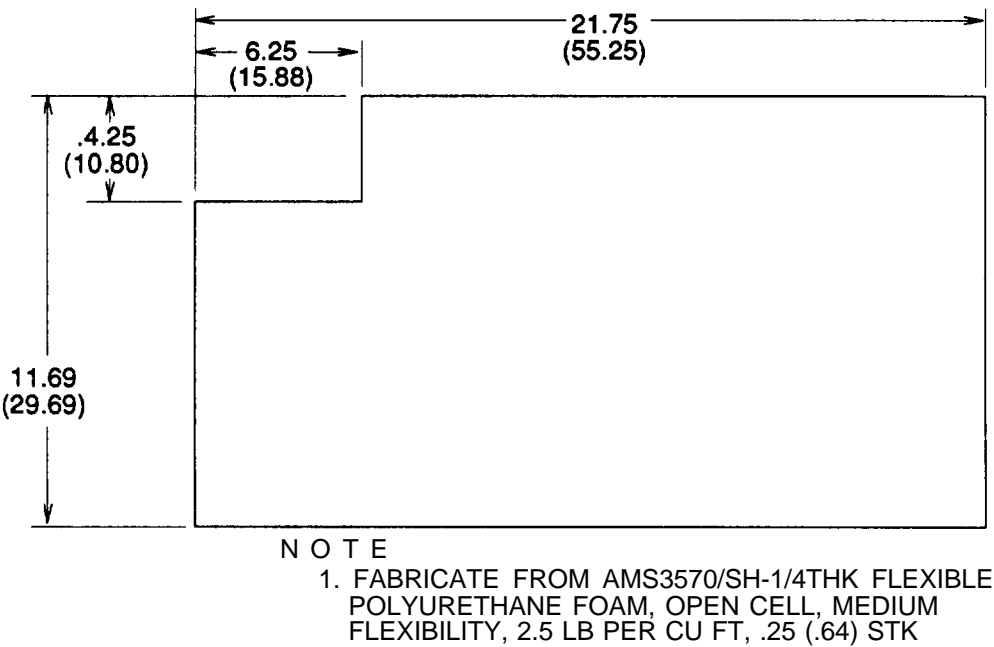


Figure F-7. Foam, Flexible (Insulation), Part Number 13225E8458/5

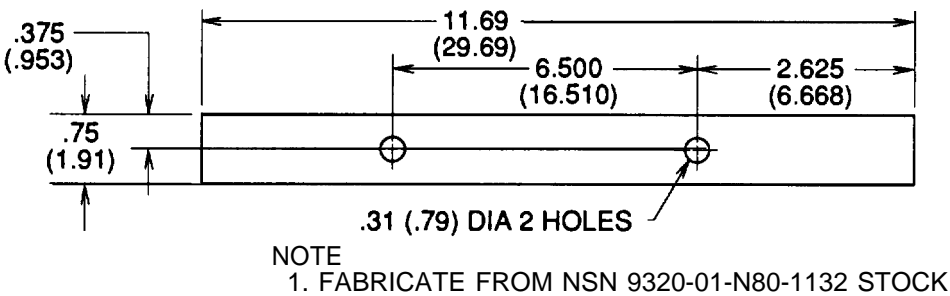


Figure F-8. Rubber, Cellular (Gasket), Part Number 13225E8422/3

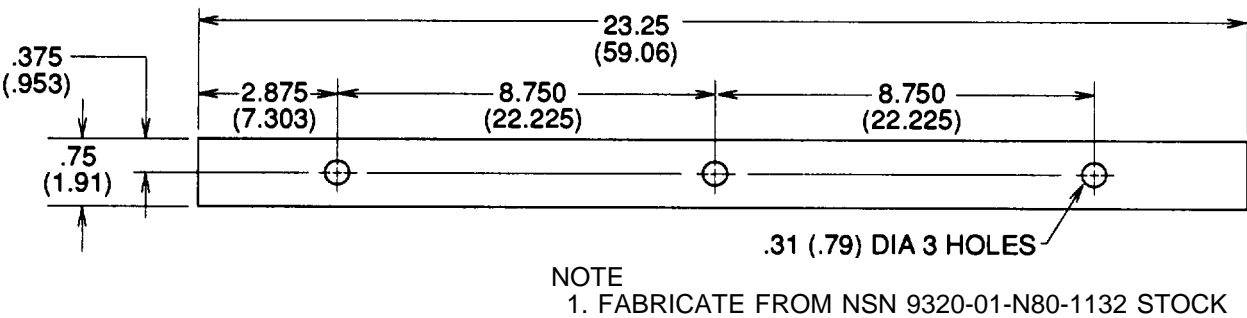
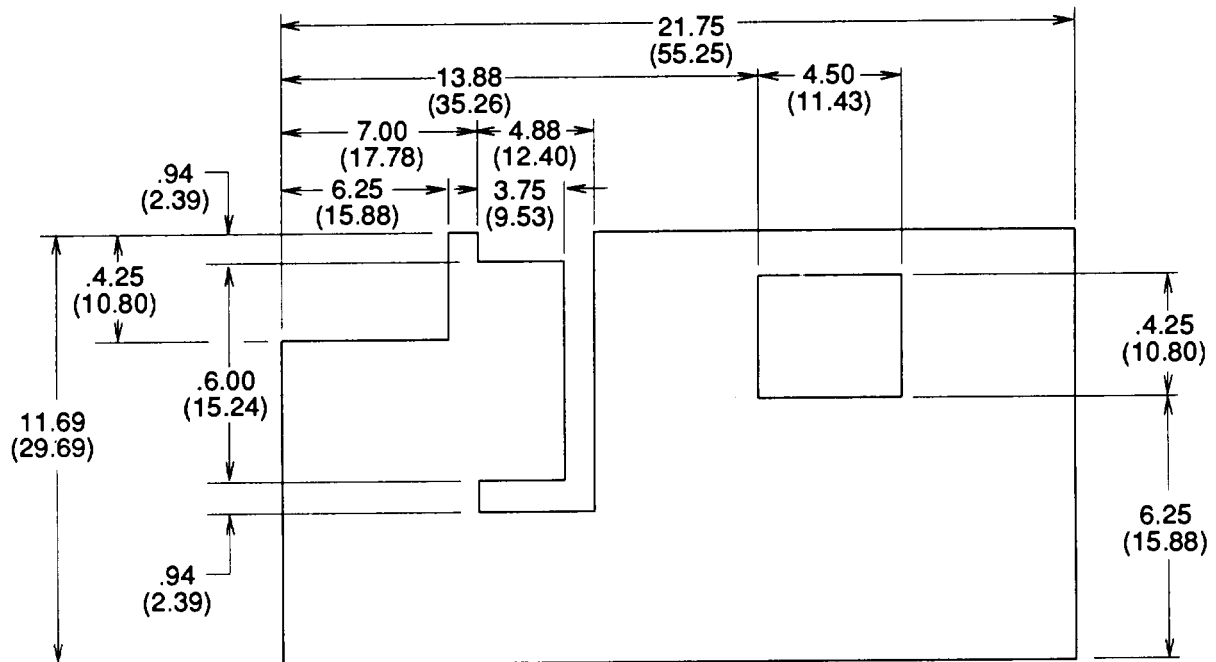


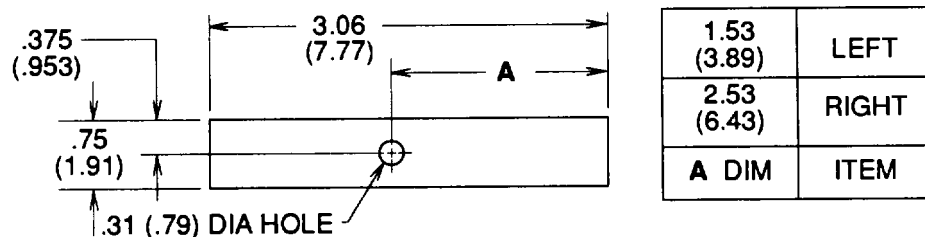
Figure F-9. Rubber, Cellular (Gasket), Part Number 13225E8422/4



NOTE

1. FABRICATE FROM AMS3570/SH-1/4THK FLEXIBLE POLYURETHANE FOAM, OPEN CELL, MEDIUM FLEXIBILITY, 2.5 LB PER CU FT, .25 (.64) STK

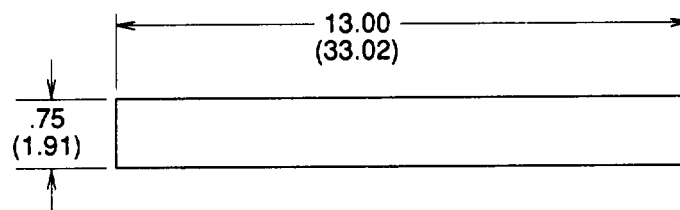
Figure F-10. Foam, Flexible (Insulation), Part Number 13225E8422/5



NOTE

1. FABRICATE FROM NSN 9320-01-N80-1132 STOCK

Figure F-11. Rubber, Cellular (Gasket), Part Number 13216E5880/2



NOTE

1. FABRICATE FROM NSN 9320-00-814-4583 STOCK

Figure F-12. Rubber, Cellular (Gasket), Part Number 13220E1352/3



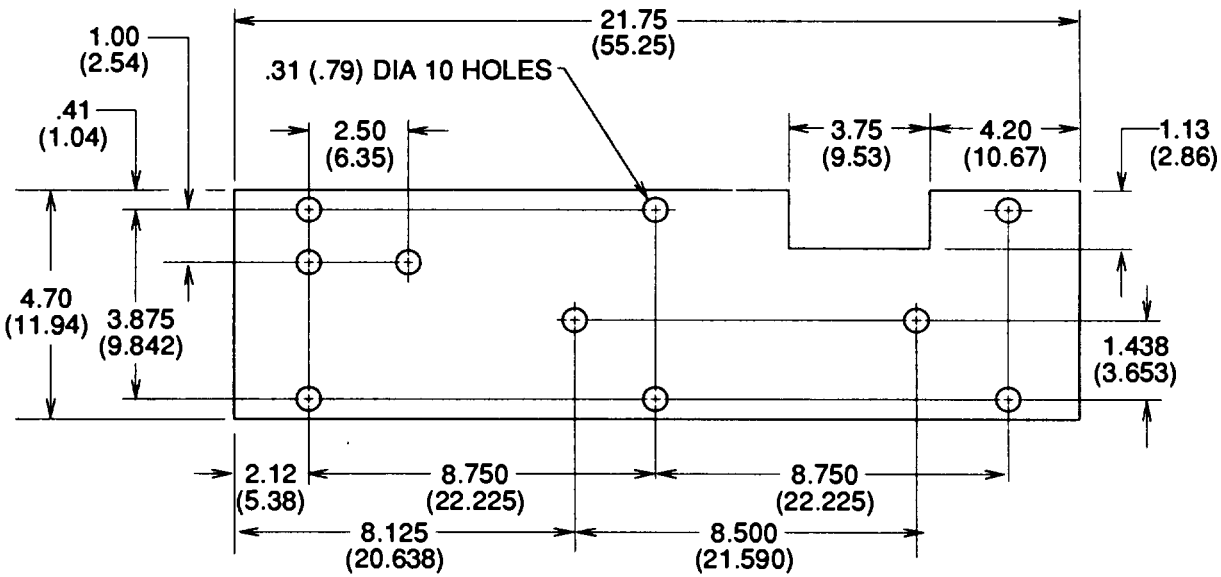


Figure F-13. Foam, Flexible (Insulation), Part Number 13216E5880/3

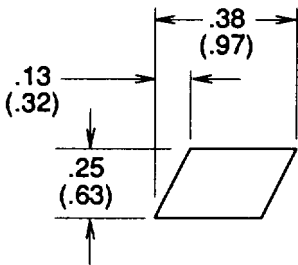
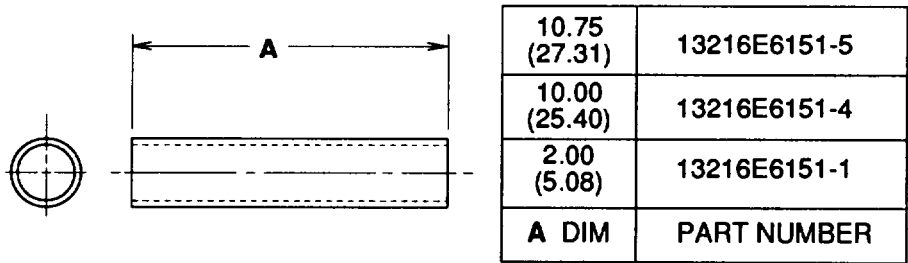
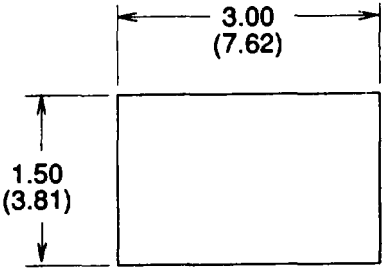


Figure F-14. Rubber, Cellular (Gasket), Part Number 13225E8455/223



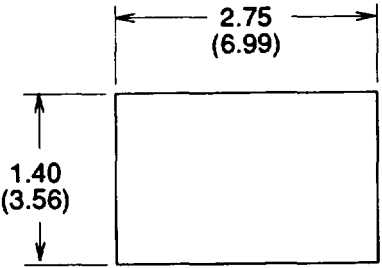
NOTE  
1. FABRICATE FROM NSN 9330-01-214-8452

Figure F-15. Tubing, Nonmetallic



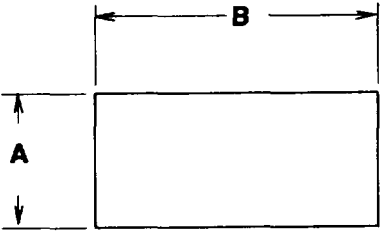
**NOTE**  
1. FABRICATE FROM NSN 5640-00-237-4781 STK

**Figure F-16. Foam, Flexible (Insulation), Part Number 13225E8450/251**



**NOTE**  
1. FABRICATE FROM ASTM-D-2000M2EC510A14 .25 THK STK

**Figure F-17. Rubber Sheet, Part Number 13225E8450/283**



1.00 (2.54)	1.00 (2.54)	13225E8451/49
8.02 (20.37)	9.41 (23.90)	13225E8451/45
8.02 (20.37)	8.12 (20.62)	13225E8451/41
1.13 (2.87)	3.50 (8.89)	13216E6116-2/3
1.13 (2.87)	6.69 (16.99)	13216E5896/2
A DIM	B DIM	PART NUMBER

**NOTE**  
1. FABRICATE FROM AMS3570/SH-1/2THK FLEXIBLE  
POLYURETHANE FOAM, OPEN CELL, MEDIUM  
FLEXIBILITY, 2.5 LB PER CU FT, .50 (1.27) STK

**Figure F-18. Foam, Flexible (Insulation)**

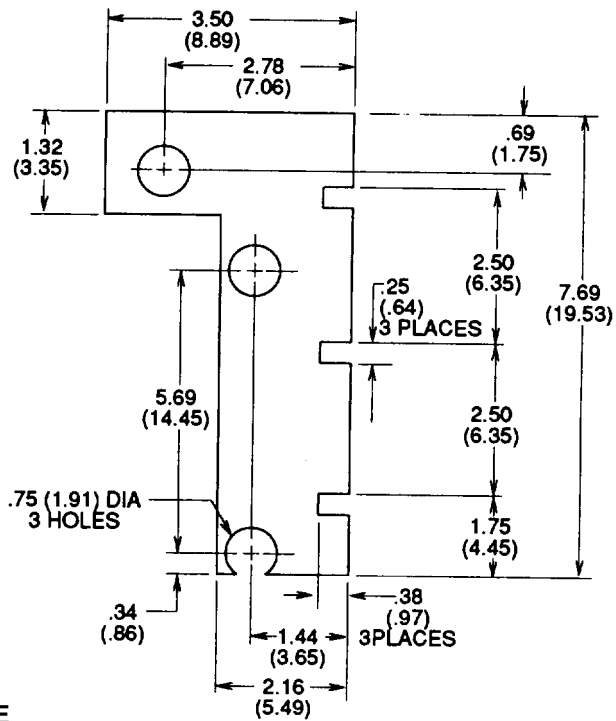


Figure F-19. Foam, Flexible (Insulation), Part Number 13216E5895/3

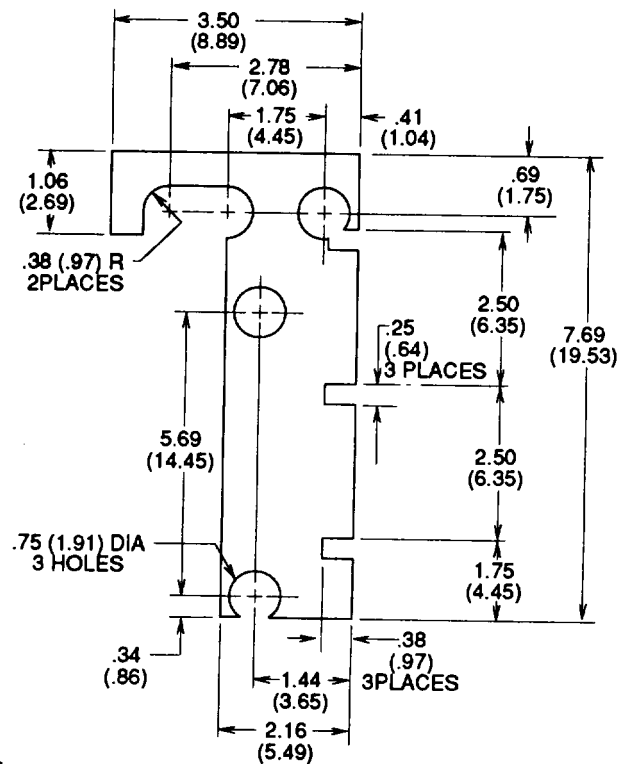
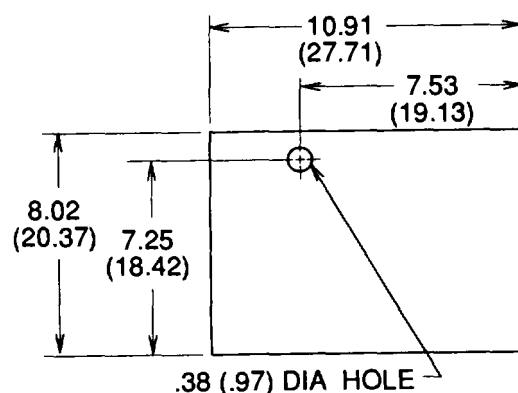


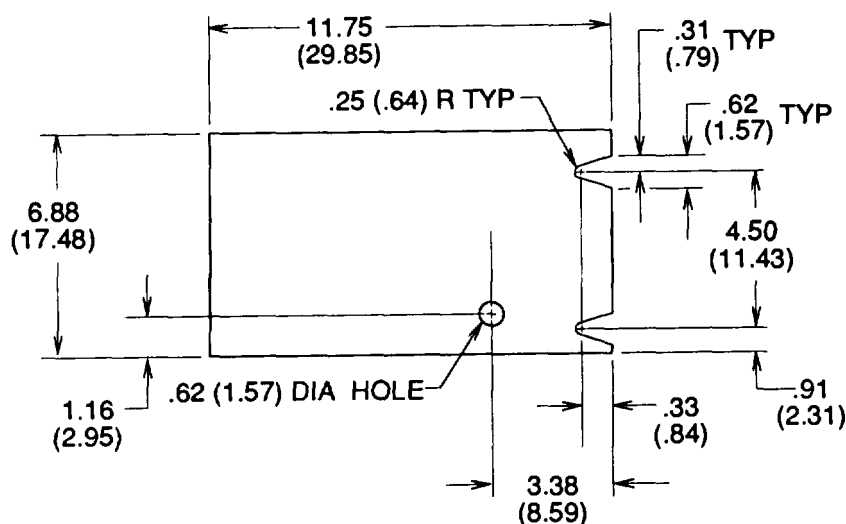
Figure F-20. Foam, Flexible (Insulation), Part Number 13216E5899/3



## NOTE

1. FABRICATE FROM AMS3570/SH-1/2THK FLEXIBLE POLYURETHANE FOAM, OPEN CELL, MEDIUM FLEXIBILITY, 2.5 LB PER CU FT, .50 (1.27) STK

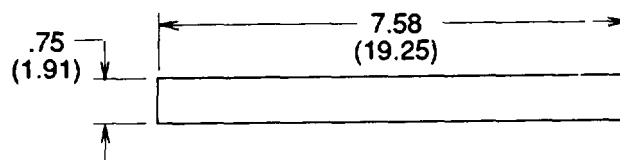
Figure F-21. Foam, Flexible (Insulation), Part Number 13225E8451/50



## NOTE

1. FABRICATE FROM AMS3570/SH-1/2THK FLEXIBLE POLYURETHANE FOAM, OPEN CELL, MEDIUM FLEXIBILITY, 2.5 LB PER CU FT, .50 (1.27) STK

Figure F-22. Foam, Flexible (Insulation), Part Number 13225E8451/61



## NOTE

1. FABRICATE FROM NSN 5640-00-198-7255 STK

Figure F-23. Foam, Flexible (Insulation), Part Number 13225E8451/42

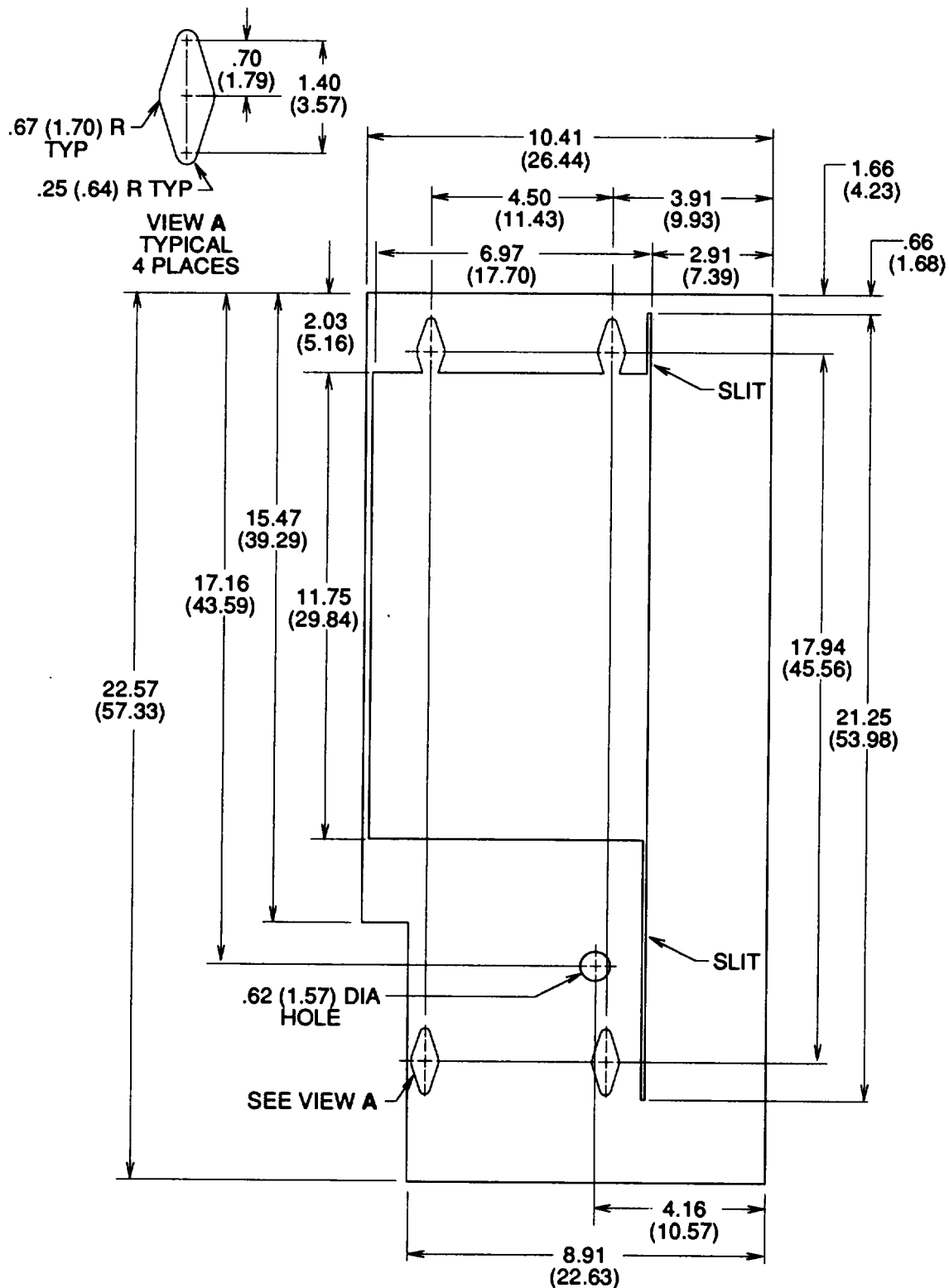
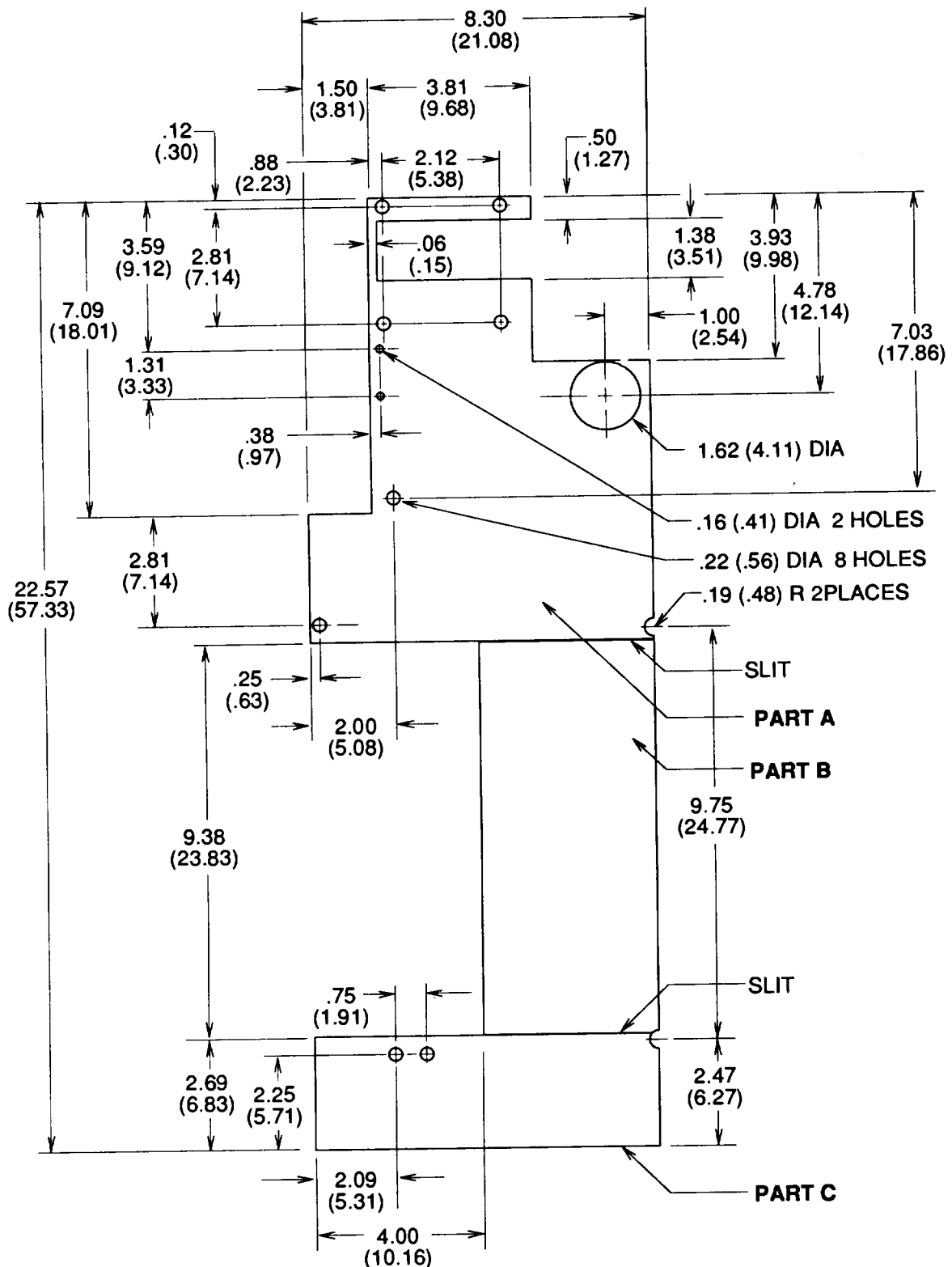


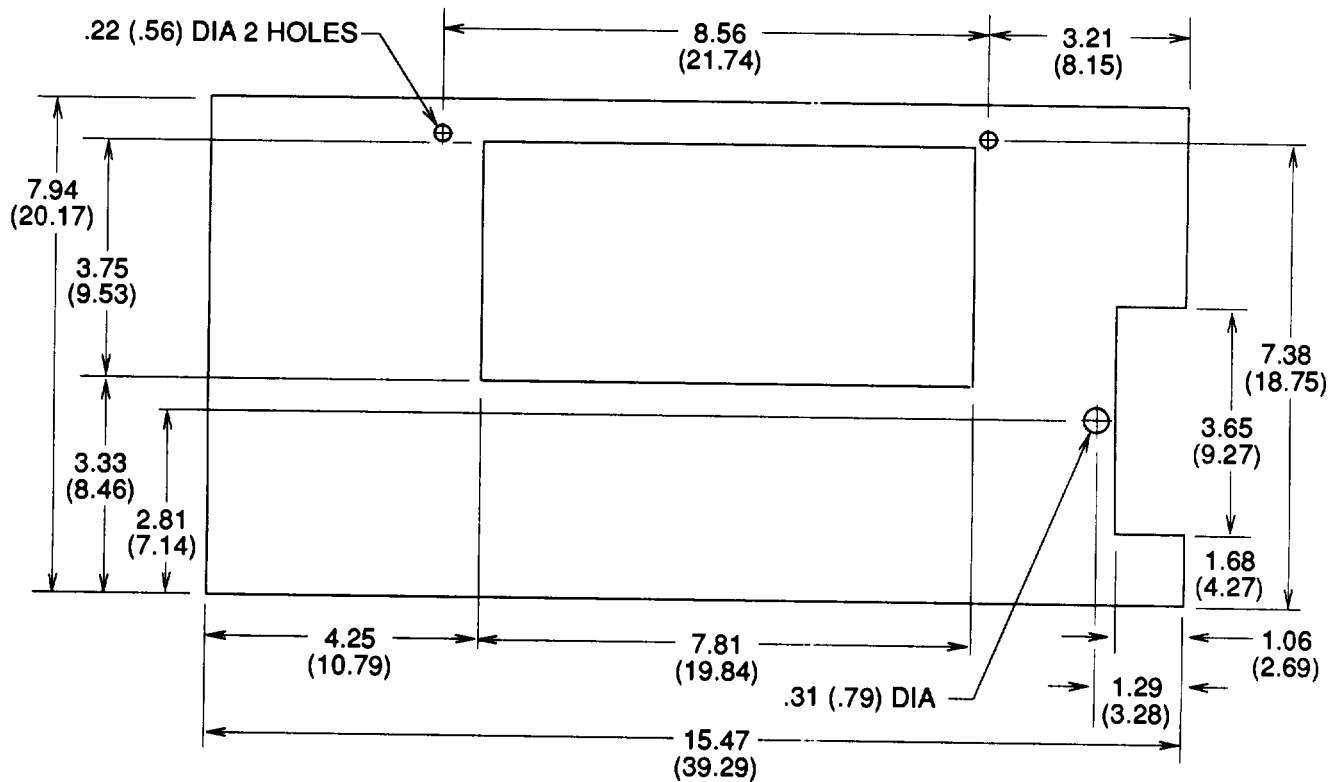
Figure F-24. Foam, Flexible (Insulation), Part Number 13225E8451/40



**NOTE**

1. FABRICATE FROM AMS3570/SH-1/2THK FLEXIBLE POLYURETHANE FOAM, OPEN CELL, MEDIUM FLEXIBILITY, 2.5 LB PER CU FT, .50 (1.27) STK

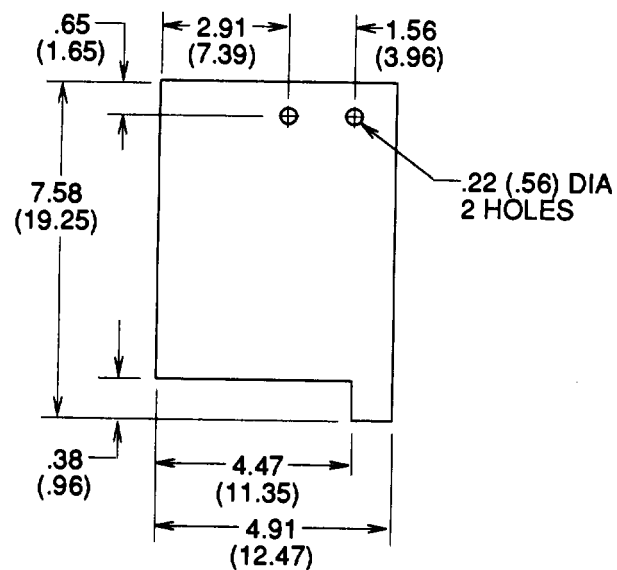
Figure F-25. Foam, Flexible (Insulation), Part Number 13225E8451/53



### NOTE

1. FABRICATE FROM AMS3570/SH-1/2THK FLEXIBLE  
POLYURETHANE FOAM, OPEN CELL, MEDIUM  
FLEXIBILITY, 2.5 LB PER CU FT, .50 (1.27) STK

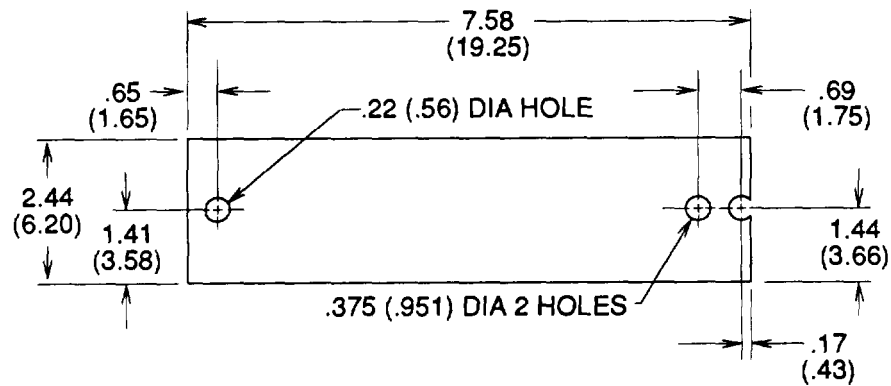
**Figure F-26. Foam, Flexible (Installation), Part Number 13225E8451/44**



## NOTE

1. FABRICATE FROM NSN 5640-00-237-4780 STK

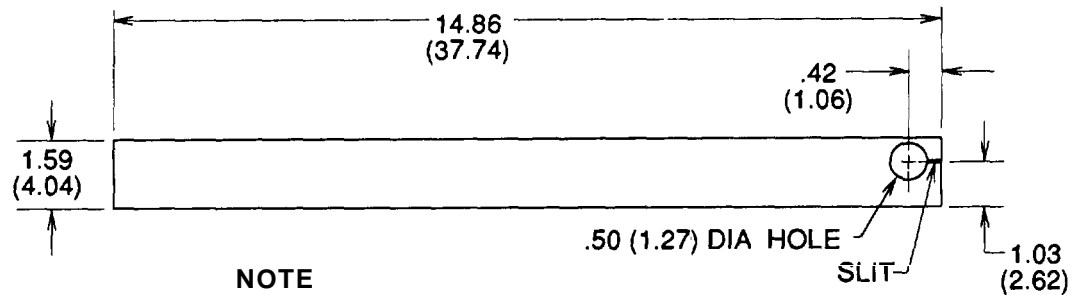
**Figure F-27. Foam, Flexible (Insulation), Part Number 13225E8451/47**



**NOTE**

1. FABRICATE FROM NSN 5640-00-237-4780 STOCK

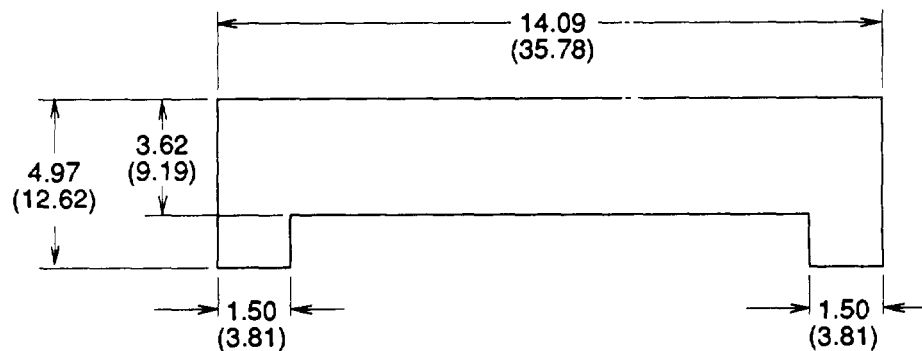
Figure F-28. Plastic Foam (Gasket), Part Number 13225E8451/46



**NOTE**

1. FABRICATE FROM NSN 5640-00-198-7255 STOCK

Figure F-29. Insulation, Part Number 13225E8451/64

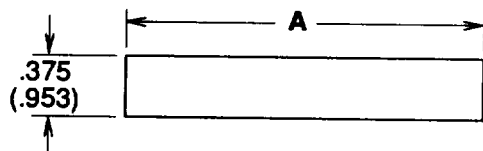


**NOTE**

1. FABRICATE FROM NSN 5640-00-198-7255 STOCK

Figure F-30. Insulation, Part Number 13225E8451/48



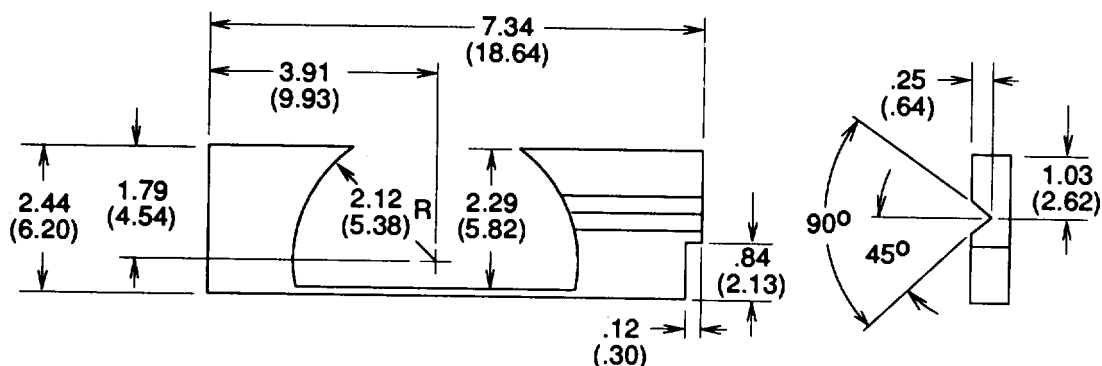


14.09 (35.79)	13225E8451/28
5.34 (13.56)	13225E8451/25
A DIM	PART NUMBER

**NOTE**

1. FABRICATE FROM 9320-01-N80-1131 STK

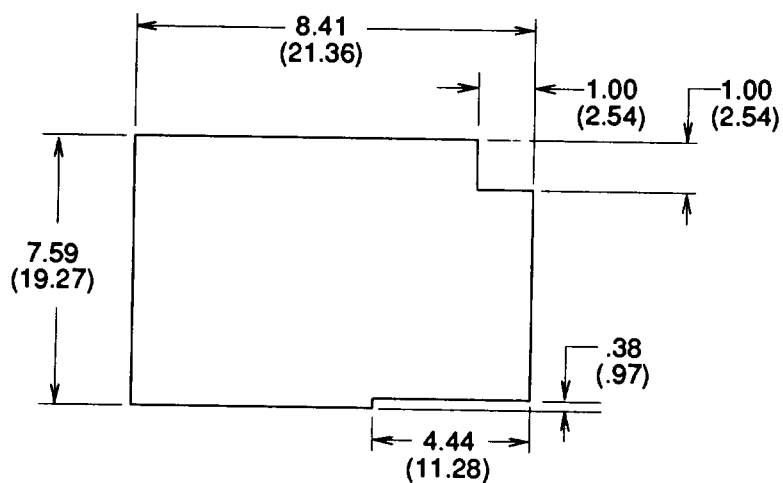
Figure F-31. Rubber, Cellular (Gasket)



**NOTE**

1. FABRICATE FROM 5640-00-237-4781 STK

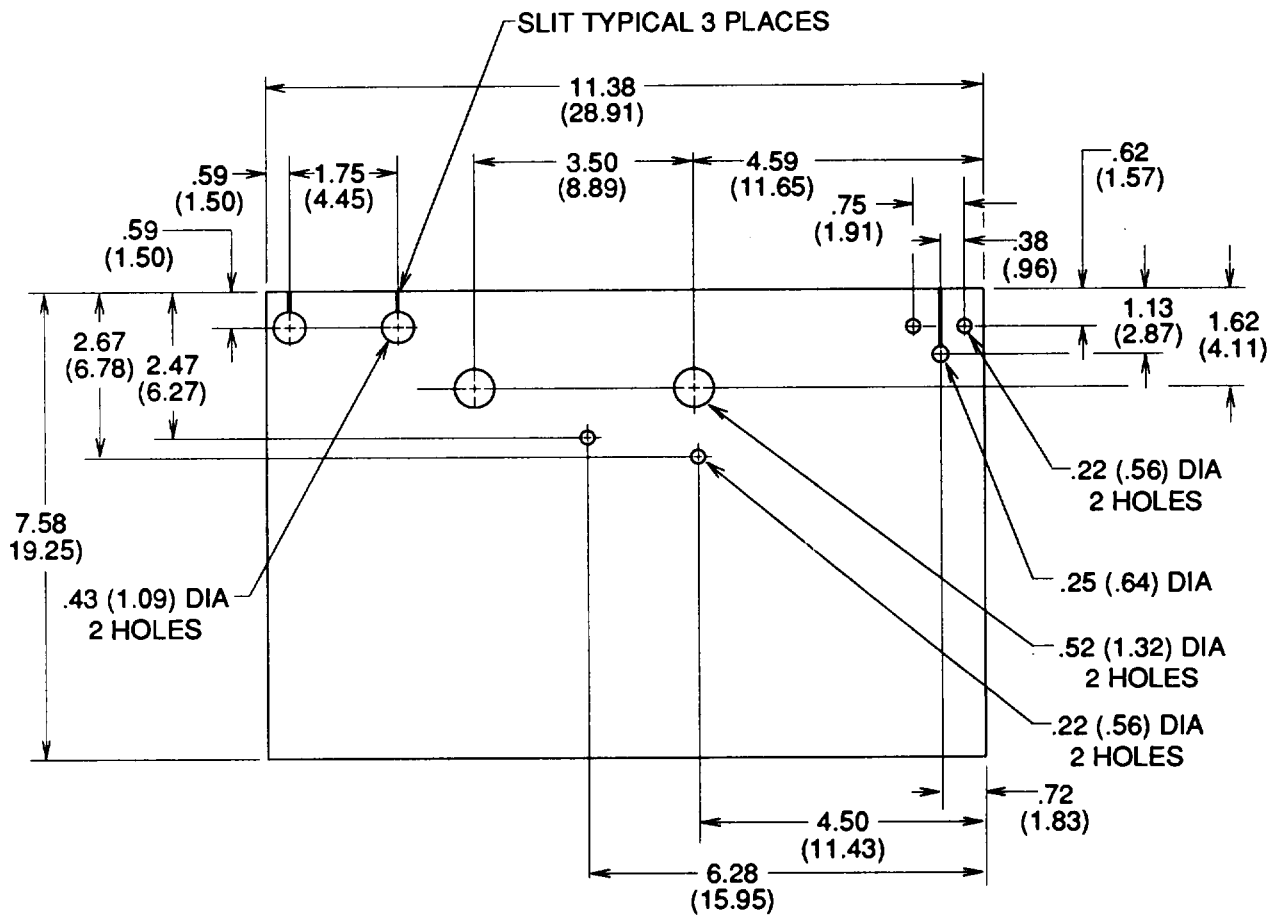
Figure F-32. Plastic Foam (Insulation), Part Number 13225E8451/52



**NOTE**

1. FABRICATE FROM 5640-00-237-4781 STK

Figure F-33. Plastic Foam (Insulation), Part Number 13225E8451/51



## NOTE

1. FABRICATE FROM AMS3570/SH-1/2THK FLEXIBLE POLYURETHANE FOAM, OPEN CELL, MEDIUM FLEXIBILITY, 2.5 LB PER CU FT, .50 (1.27) STK

Figure F-34. Foam, Flexible (Insulation), Part Number 13225E8451/43

## GLOSSARY

## Section I ABBREVIATIONS

AAL	Additional Authorized List
AWG	American Wire Gauge
BII	Basic Issue Items
BKR	Breaker
BTU	British Thermal Unit
C	Centigrade
CAGE	Commercial And Government Entity
cfm	Cubic Feet per Minute
cm	Centimeter
c m <sup>2</sup>	Square Centimeter
COEIL	Components of End Item List
COMPR	Compressor
CTA	Common Table of Allowances
EIR	Equipment Improvements Recommendations
F	Fahrenheit
Fig	Figure
HR	Hour
JTA	Joint Table of Allowances
kg	Kilogram
LB	Pounds
LPCO	Low Pressure Cutout Switch
m <sup>3</sup>	Cubic Meter
MAC	Maintenance Allocation Chart
MTOE	Modified Table of Organization and Equipment
NBC	Nuclear Biological and Chemical
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
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

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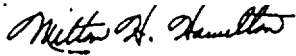
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COA, 3d ENGINEER BN  
FT. LEANARDWOOD, MA 63108

DATE SENT

PUBLICATION NUMBER

TM 9-4120-400-14

PUBLICATION DATE

1 JULY 1992

PUBLICATION TITLE

AIR CONDITIONER HORIZONTAL COMPACT

BE EXACT PIN-POINT WHERE IT IS

PAGE NO	PARA- GRAPH	FIGURE NO	TABLE NO
6	2-1 a		
B1		4-3	
125	line 20		

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

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

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

I ordered a gasket, item 19 on figure B-16 by NSN 2 910-00-762-3001. 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

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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 decigrams = .035 ounce  
 1 dekagram = 10 grams = .35 ounce  
 1 hectogram = 10 dekagrams = 3.52 ounces  
 1 kilogram = 10 hectograms = 2.2 pounds  
 1 quintal = 100 kilograms = 220.46 pounds  
 1 metric ton = 10 quintals = 1.1 short tons

## Liquid Measure

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

## Square Measure

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

## Cubic Measure

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

# Approximate Conversion Factors

To change	To	Multiply by	To change	To	Multiply by
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

# Temperature (Exact)

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

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