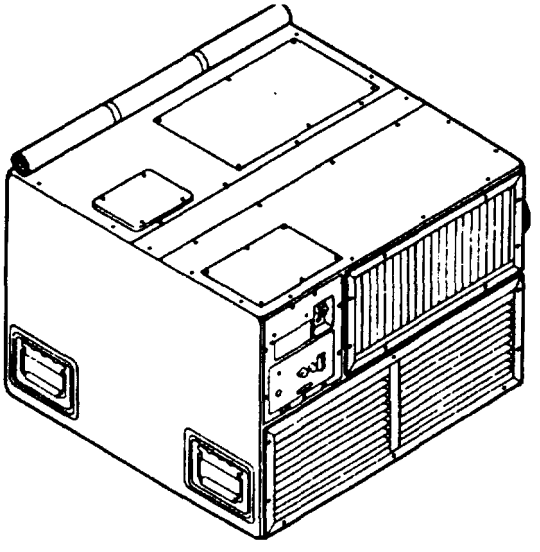
ARMY TM 9-4120-367-14
MARINE CORPS TM 07592 B-14/1

TECHNICAL MANUAL

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

AIR CONDITIONER, HORIZONTAL, COMPACT, 18,000 BTU/HR COOLING

MODEL	POWER	NSN
F18H	230V, Single Phase, 50/60 Hz	4120-00-411-3729 (EIC:VSJ)
F18H-3	208V, 3 Phase, 50/60 Hz	4120-01476-1753 (EIC:VUA)
K1F-18H-4	208V, 3 Phase, 400 Hz	4120-01-177-5990 (EIC:VWU)
F18H-3A	208V, 3 Phase, 50/60 Hz	4120-01-1224626 (EIC:VOU)
F18H-4A	208V, 3 Phase, 400 Hz	4120-01-1224627 (EIC:VUP)
MHP-204-08	208V, 3 Phase, 400 Hz	4120-01-286-8854 (EIC:VW4)



• This manual supersedes TM 5-4120-367-14, dated 24 Nov 80.

HEADQUARTERS, DEPARTMENTS OF THE ARMY AND THE MARINE CORPS

31 AUGUST 1993

CHANGE

NO. 1

HEADQUARTERS,
DEPARTMENT OF THE ARMY
AND HEADQUARTERS, U.S. MARINE CORPS
WASHINGTON, D.C., 15 July 1995

Operator's, Unit, Direct Support and General Support Maintenance Manual For AIR CONDITIONER, HORIZONTAL, COMPACT 18,000 BTU/HR COOLING

MODEL	POWER	NSN
F18H	230V, Single Phase, 50/60 Hz	4120-00-411-3729 (EIC:VSJ)
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F18H-3A	208V, 3 Phase, 50/60 Hz	4120-01-122-0626 (EIC:VUO)
F18H-4A	208V, 3 Phase, 400 Hz	4120-01-122-0627 (EIC:VUP)
MHP-20-4-08	208V, 3 Phase, 400Hz	4120-01-286-8854 (EIC:VW4)

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TM 9-4120-367-14/TM 07592B-14/1, 31 August 1993, is changed as follows:

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

Remove pages	Insert pages
i and ii	i and ii
3-11 and 3-12	3-11 and 3-12

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

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DISTRIBUTION:

To be distributed in accordance with DA Form 12-25-E, block no. 6150, requirements for TM 9-4120-367-14.

WARNING

HIGH VOLTAGE is used in the operation of this equipment.

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

Always disconnect the air conditioner from power source before performing maintenance on this equipment.

Do not operate the air conditioner without louvers, top covers, and guard in place and tightly secured.

WARNING

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

For Artificial Respiration, refer to FM 21-11.

WARNING

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

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

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

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

WARNING

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

When the technician is aided by operators, he must warn them about dangerous areas.

Whenever possible, the power supply to the equipment must be shut off before beginning work on the equipment.

Take particular care to ground every capacitor likely to hold a dangerous potential.

When working inside the equipment, after the power has been turned off, always ground every part before touching.

WARNING

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

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

WARNING

The burning of polyurethane foams is dangerous. Due to the chemical composition of a polyurethane foam, toxic fumes are released when it is burned or heated.

If it is burned or heated indoors, such as during a welding operation in its proximity. precaustions should be taken to adequately ventilate the area.

An exhaust system equivalent to that of a paint spray booth should be used.

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

Individuals who have chronic or recurrent respiratory conditions, including allergies and asthma, should not be employed in this type of environment.

WARNING

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

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

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

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

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

Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 59°C).

TECHNICAL MANUAL
No. 9-4120-367-14

HEADQUARTERS
DEPARTMENTS OF THE
ARMY AND MARINE CORPS

WASHINGTON D.C., 31 August 1993

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

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MHP-20-4-06	208V, 3 Phase, 400 Hz	4120-01-286-8854 (EIC:VW4)

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 directly to: Commander, US Army Aviation and Troop Command, ATTN: AMSAT-I-MP, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. You may also submit your recommended changes by E-mail directly to <daf2028@st-louis-emh7.army.mil>. A reply will be furnished directly to you.

Marine Corps users submit NAVMC Form 10772 directly to: Commander, Code 850, Marine Corps Logistics Bases, 814 Radford Blvd., Albany, GA 31704-1128.

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CHAPTER 1

INTRODUCTION

Section I. GENERAL INFORMATION

1.1 SCOPE.

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

1.1.2 Model Numbers and Equipment Names. Keco Models, F18H, F18H-3, and K1F-18H-4, F18H-3A and F18H-4A, and Airtacs Model, MHP-20-4-08, 18,000 BTU/hr Cooling, air conditioners.

NOTE

Unless otherwise noted the FMH-3A and F18H-4A identical to the F18H-3 and K1F-18H-4, respectively.

1.1.3 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 for circulating the conditioned air to provide heating and cooling of equipment or of personnel within the air conditioned area.

1.2 MAINTENANCE FORMS. RECORDS AND REPORTS. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DAPAM738-750. The Army Maintenance Management System (TAMMS).

Maintenance forms and records used by the Marine Corps personnel are prescribed in TM 4700-15/1.

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

1.4 PREPARATION FOR STORAGE OF SHIPMENT.

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

1.4.2 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 (MWOs) should be applied.

1.4.3 Storage Site Selection. Inside storage is preferred for items selected for administrative storage. If inside storage is not available, trusks, vans, conex containers or other containers may be used.

1.5 HAND RECEIPT MANUAL. Hand receipts for the End Item/Components of End Item (COEI), Basic Issue Items (BII), and Additional Authorization List (AAL) items are published in a Hand Receipt Manual. The Hand Receipt Manual's numerical designation is the same as the related Technical Manual with the letters HR added to the number. These manuals are published to aid in property accountability and are available through

Commander
US Army Adjutant General Publication Center
ATTN: AGDL-OD
2800 Eastern Blvd.
Baltimore, MD 21220

Not applicable to the Marine Corps. Refer to SL-1-3.

1.6 REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIRS). If your air conditioner needs improvement, let us know. Send us an EIR. You, the user, are the only who can tell us what you do not like about your equipped. Let us know why you do not like the design. Tell us why a procedure is hard to perform. Put it on an SF 368 (Quality Deficiency Report). Mail it to us at

Commander
US Army Aviation and Troop Command
ATTN: AMSAT-I-MDO
4300 Goodfellow Blvd.
St. Louis, MO 63120-1798. We will sead you a reply.

Marine Corps -by NAVMC Form 10772 directy to
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Code 850
Marine Corps Logistics Bases
814 Radford Blvd.
Albany, GA 31704-1128

Section II. EQUIPMENT DESCRIPTION AND DATA

1.7 EQUIPMENT CHARACTERISTICS, CAPABILITIES AND FEATURES.

1.7.1 Characteristics. The Keco Air Conditioner.

a. Cools air to a shelter,

b. Heats air to a shelter, and

c. Ventilates or circulates air in a shelter.

1.7.2 Capabilities and Features of Model F18H.

a. Cooling capacity on COOL, BTU/hour 18,000

b. Heating capacity on HIGH HEAT. BTU/hour 14,300

c. Heating capacity on LOW HEAT, BTU/hour. 7,500

d. Power Requirements:
- Voltage 230
- Phases . . . . . Single
- Frequency, Hertz 50/60
- Amperes, phase (maximum):
  - Cooling 23
  - Heating 40
- Watts, running (maximun):
  - Cooling 5,200
  - Heating. 4,400

e. Refrigerant type R-22

f. Amount of charge, pounds . . . . . 5-5 lbs (2.5 kg)

1.7.3 Capabilities and Features of Model F18H-3.

a. Cooling capacity on COOL, BTU/hour 18,000

b. Heating capacity on HIGH HEAT, BTU/hour 14,300

c. Heating on LOW HEAT, BTU/hour 7,500

d. Power Requipments:
Voltage 208
Phases 3
Frequency, Hertz 50/60
Amperes, each phase (maximum):
Cooling 16
Heating 15
Watts, running (maximum):
Cooling 5,000
Heating 4,400

e. Refrigerant type R-22

f. Amount of change, pounds . . . . . 5.5 lbs (2.5 kg)

1.7.4 Capabilities and Features of Models K1F-18H-4 and MHP-20-4-08.

a. Cooling capacity on COOL, BTU/hour 18,000

b. Heating capacity on HIGH HEAT, BTU/hour 14,300

c. Heating capacity on LOW HEAT, BTU/hour 7,500

d. Power Requirements:
Voltage 208
Phases 3
Frequency, Hertz 400
Amperes,each phase (maximum):
Cooling 26.4
Heating 15
Watts, running (maximum):
Cooling 6,500
Heating 5,200

e. Refrigerant type R-22

f. Amount of change, pounds . . . . . 5.5 lbs (2.5 kg

1.7.5 Operating Tempertures. The air conditioners are capable of functioning as follows.

a. Start, operate, and cycle on cooling mode up to plus 120°F(49°C) ambient temperature, with air up to plus 120°F (49°C) entering the evaporator and condenser.

b. Operate on cooling mode without forming frost or ice on the evaporator at 55°F (12°C) ambient temperature, with air at plus 67°F (19°C) dry bulb and plus57°F (14°C) wet bulb entering the evaporator.

c. Operate on the heating mode in ambient temperatures as low as minus 50°F (10°C) and as high as plus 80°F (26°C).

d. Start and operate on coding mode at 0°F (-18°C) ambient temperature, with air at plus 70°F (21°C) entering the evaporator.

1.7.6 Evaporator Airflow. With MODE SELECTOR set at VENT and the FAN SPEED set at HIGH, the evaportator air flow will be as follows:

Model	SCFM	m^3/m
F18H	590	16.5
F18H-3	590	16.5
F18H-4	640	17.9

1.8 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.

1.8.1 Condenser Section (See figure 1-2.).

a. **Equalizing Solenoid Valve.** This solenoid valve causes discharge and suction pressures to equalize whenever compressor is not operating.

b. **Liquid Line Solenoid Valve.** This solenoid valve controls flow of liquid refrigerant to the evaporator coil.

c. **Quench Expansion Valve.** This valve controls expansion of liquid refrigerant to gas in the suction line when the suction line super heat rises above 31 to 33°F (-1 to +1°C).

d. **Drier/Filter (Dehydrator).** A drier/filter (dehydrator) is a device used to remove water or water vapor from the refrigerant.

e **Receiver.** The receiver is a storage tank for liquid refrigerant.

f. **Condenser Coil.** It is constructed of interconnected parallel tubes which are retained in a series of multiple, closely spaced fins. Hot compressed gas is air cooled to a liquid in this coil.

g. **Compressor.** It consists of a reciprocating compressor driven by an electric motor, hermeticall sealed into a steel container with a lifetime charge of oil. A crankcase heater surrounds the lower part of the container. The heater is thermostatically controlled to prevent migratiom of liquid refrigerant into the crankcase where it would become mixed with the oil.

h. **Pressure Regulator Valves.** The pressure regulator valves are part of the hot gas bypass circuit and open when the compressor suction pressure drops below a preset level of 68 psig (4.78 kg/cm^2).

i. **Relief Valve.** The relief valve opens when the discharge line pressure rises above 540 psig (37.97 kg/cm^2).

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

k. **Charging Valve.** The charging valves provide connection ports so that refrigerant can be put into the system. They also provide poets for checking system operating pressures.

l. **Condenser Fan and Motor.** This fan and motor draws outside air over and through the condenser coil in order to remove the heat from the hot gas entering the condenser coil.

m. **Input Power Receptacle (alternate location).** Connection for power supply.

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

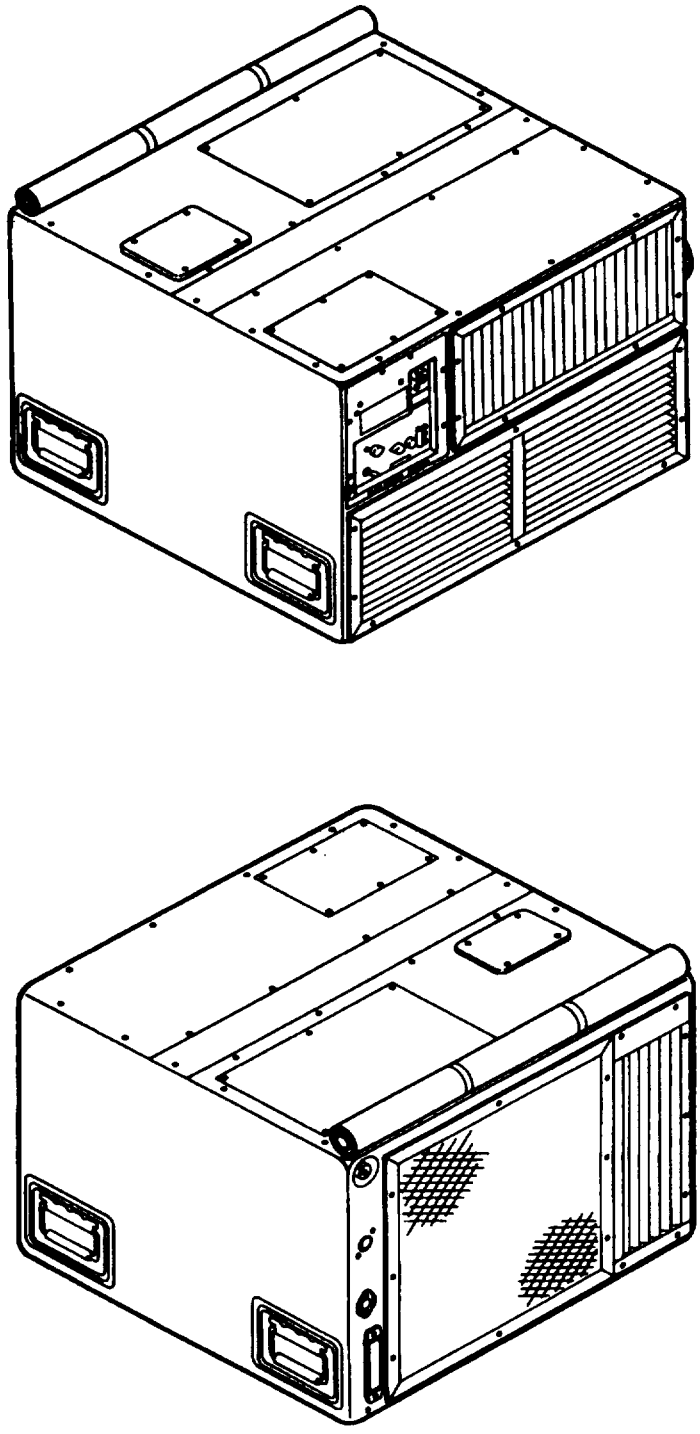


Figure 1-1. Air Conditioner, 3/4 Views

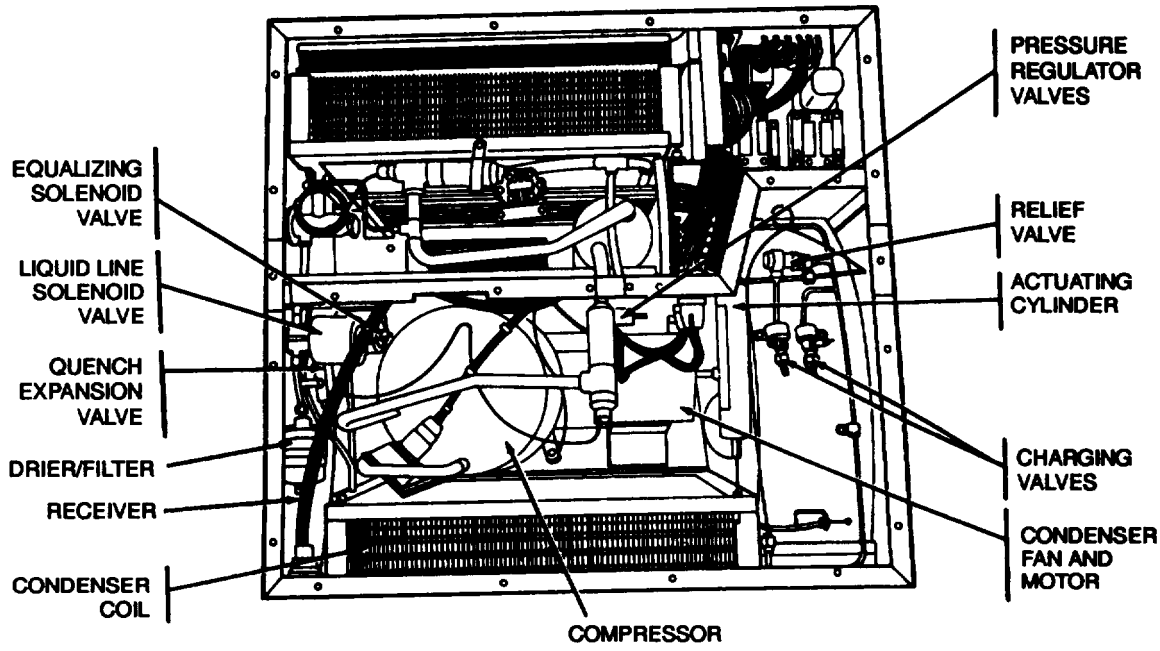


Figure 1-2. Air Conditioner, Condenser Section (Sheet 1 of 2)

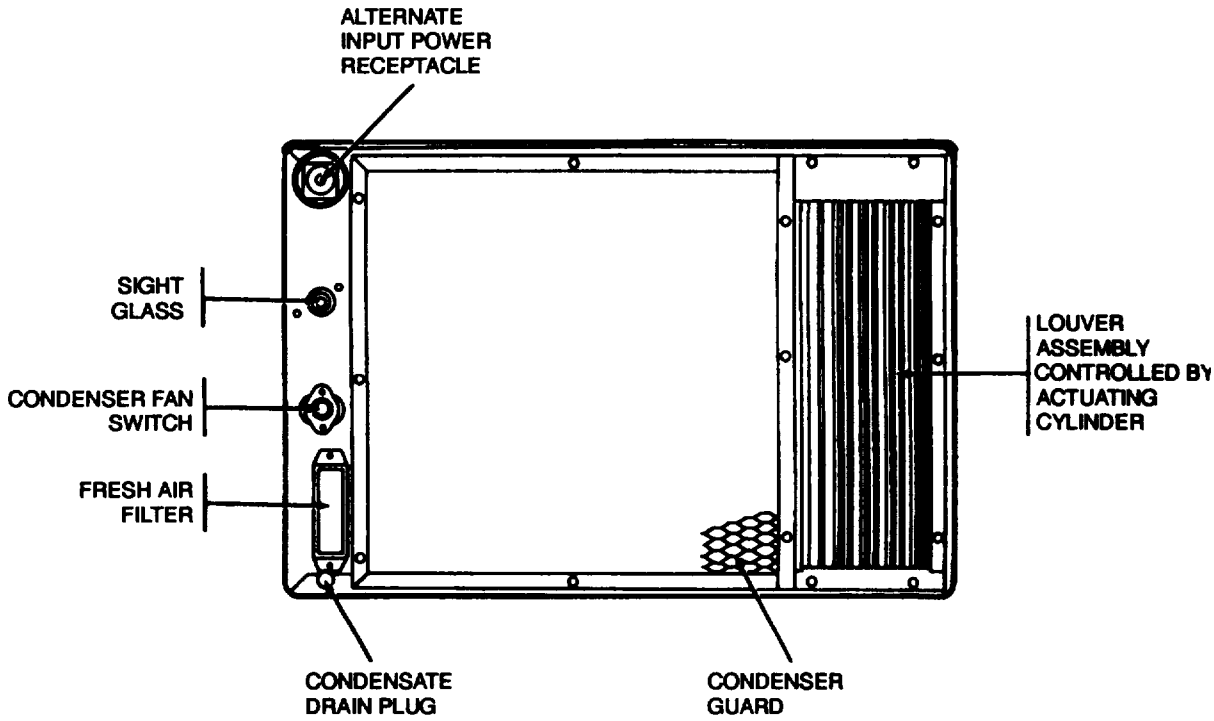


Figure 1-2. Air Conditioner, Condenser Section (Sheet 2 of 2)

Color	Moisture Content
Green	None
Chartreuse	Slight
Yellow	Replace Drier/ Filter and Refrigerant

o. **Condensate Drain Plug.** Drain connection for water collected below evaporator coil.

p. **Condenser Fan Switch.** Controls fan speed. At temperatures above 100° F (38°C), closes to allow high speed; below 100°F (38°C), opens to allow only low speed operation.

q. **Fresh Air Filter.** This filter cleans outside air drawn into the shelter.

NOTE

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

r. **Louver Assembly.** Automatically controlled by actuating cylinder.

1.8.2 Evaporator Section (See figure 1-3.)

a. **Evaporator Expansion Valve.** This valve controls the amount of liquid refrigerant to the evaporator.

b. **Distributor.** This distributor divides expanding refrigerant to three circuits of the evaporator coil.

c. **Evaporator Coil.** The evaporator coil converts the liquid refrigerant into gas to cool the air.

d. **Mist Eliminator.** The purpose of the mist eliminator is to trap droplets of condensed water which have formed on the evaporator coil, so that they will not be blown into the air conditioned space.

e. **Accumulator.** The accumulator is a tank that holds the liquid refrigerant which might be mixed with the gas leaving the evaporator coil preventing liquid refrigerant from entering the compressor.

f. **Input Power Receptacle (alternate location).** Connection for power supply.

g. **Ground Connection.** The ground connection is an exteranl point where shelter or van electrical ground is connected to the air conditioner.

h. **Low Pressure Switch.** This switch opens when suction line pressure drops to 10 to 20 psig (.703 to 1.406 l@ cm2). This switch must be hand re-set after the pressure rises above 40 psig (2.812 kg/cm2).

i. **High Pressure Switch.** The high pressure switch opens when the discharge line pressure rises to 435 to 455 psig (30.58 to 31.99kg/cm2) to stop the compressor. This switch must be hand reset after the line pressure drops to 320 psig (22.50 kg/cm2).

j. **Evaporator Blower and Motor.** The evaporator blower and motor blows the shelter air over the evaporator coil to give up heat to the refrigerant (cool mode) or draws in the fresh air or shelter air for ventilation.

k. **Air Filter.** The air filter removes dirt and dust from the air that is to be conditioned (not illustrated, located behind air intake grill).

1.8.3 Heating Section (See figure 1-4.).

a. **Heating Elements.** The heating elements heat the air before it passes through the evaporator coil.

b. **Thermostatic Switch (overheat safety).** The thermostatic switch opens the heating circuit at 145°F to 150°F (63°C to 66°C and closes at 100°F to 120°F (38°C to 49°C).

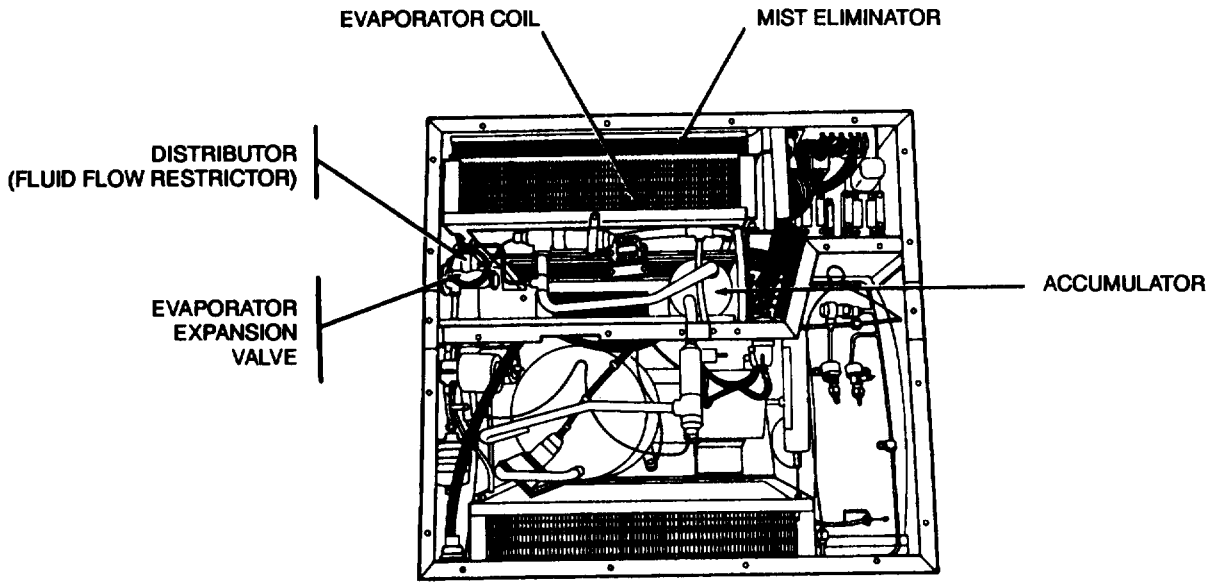


Figure 1-3. Air Conditioner, Evaporator Section (Sheet 1 of 2)

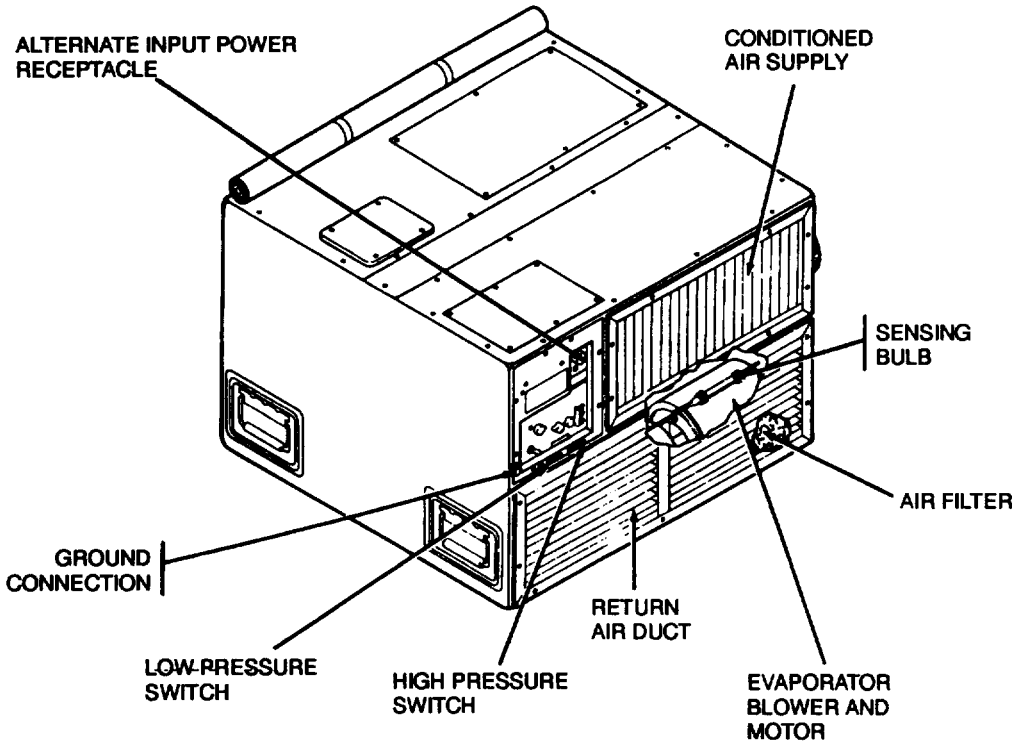


Figure 1-3. Air Conditioner, Evaporator Section (Sheet 2 of 2)

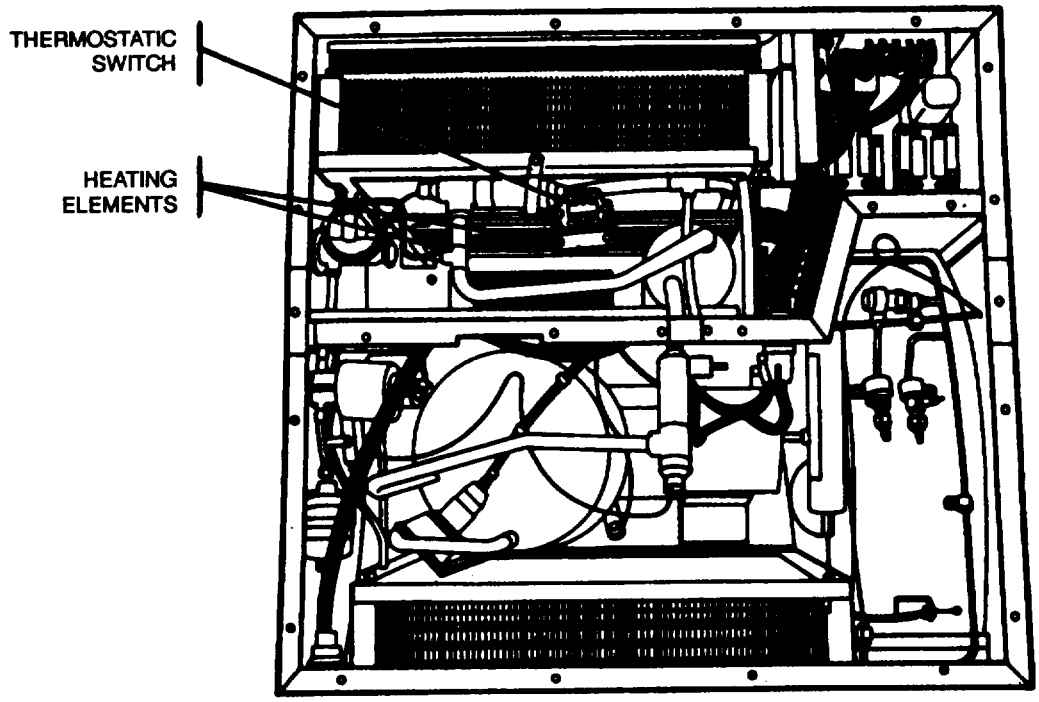


Figure 1-4. Air Conditioner, Top View, Top Covers Removed, Heating Section

1.9 DIFFERENCE BETWEEN MODELS. Unless otherwise specified, all data for the F18H-3 and K1F-18H4 will also apply to the F18H-3A and K1F-18H-4A, respectively. K1F-18H4A also has the same specifications as MHP-20-4-08.

	F18H	F18H-3	K1F-18H-4
Power Supply			
Voltage	230	208	208
Phases	Single	3	3
Frequency, Hertz	50/60	50/60	400
*Amperes			
Cooling	23	16	26.4
Heating	20	12	15
*Watts			
Cooling	5,200	5,000	6,500
Heating	4,400	4,400	5,200

* Conditions: 120 °F (49°C) ambient, with 90 °F (32.2°C) dry bulb, 75°F (23.9°C) wet bulb air to evaporator.

NOTE

The compressor, condenser fan motor and the evaporator blower motor are different. They are not interchangeable because they have different windings for the different required power supplies.

NOTE

The information contained in this manual is applicable to all models except for differences noted. Differences in procedure will be detailed at the point where they occur.

1.10 EQUIPMENT DATA.

1.10.1 Types of Conditioning Available.

a. High Vent Mode. Maximum air ventilation and filtering;

b. Low Vent Mode. Low velocity air ventilation and filtering;

c. High Cool Mode. Maximum cooling, filtering, and dehumidification;

d. Low Cool Mode. Low velocity cooling, filtering and dehumidification;

e. High Heat Mode. High velocity heating; and

f. Low Heat Mode. Low velocity heating.

1.10.2 Cooling Capacity (High Cool Mode). 18,000 Btu/hr at 90°F(32.2°C) dry bulb, 75°F (23.9°C) wet bulb air to evaporator. and 120°F (49°C) ambient air conditions.

1.10.3 Heating Capacity (High Heat Mode). 14,300 BTU/hr in an ambient of -50°F to +80°F (-45.5° to 29.4°C).

1.10.4 Conditioned Air Flow (Maximum). Refer to paragraph 1.7.

1.10.5 Electrical Power Requirements. Refer to paragraph 1.7.

1.10.6 Refrigerant (R-22). 5.5 pounds (2.5 kg).

1.10.7 Physical Characteristics.

a. Dimensions.

(1) 30 inches (76.2 cm) wide

(2) 28 inches (71.12 cm) deep

(3) 20 inches (50.8 cm) high

b. Weight.

(1) F18H-278 pounds (126.l kg)

(2) F18H-3-270 pounds (122.5 kg)

(3) K1F-18H-4 - 265 pounds (120.2 kg)

1.10.8 Evaporator and Condenser Fan Motor Rating.

	F18H	F18H-3	K1F-18H-4
Voltage	230	208	208
Hertz	50/60	50/60	400
Phase	1	3	3
RPM			
High	3,450	3,450	3,750
Low	1,725	1,725	1,800
Amperes			
High	3.5	2.3	6.0
Low	1.2	0.9	3.0
HP			
High	.73	.73	1.1
Low	.12	.12	.27
Duty	Continuous	Continuous	Continuous
Thermal protector	248°F (120 °C)	248°F (120°C)	302 °F (150°C)
Rotation (facing shaft end)	Counterclockwise	Counterclockwise	Counterclockwise

1.10.9 Compressor Motor Rating.

	F18H	F18H-3	K1F-18H-4
Voltage	230	208	208
Hertz	50/60	50/60	400
Phase	Single	3	3
Thermal protector	Internal	Internal	Internal

1.10.10 Switch Setting.

a. Low Pressure Cutout. Open at 10 to20 psig (.703 to 1.406 kg/cm2). Hand reset when pressure rises to 40 psig (2.812 kg/cm^2).

b. High Pressure Cutout. Open at 435 to 455 psig (30.58 to 31.99 kg/cm^2). Hand reset when pressure decreases to 320 psig (22.50 kg/cm^2).

Section III. PRINCIPLES OF OPERATION

1.11 REFRIGERATION CYCLE.

1.11.1 The Refrigerant Cycle. The refrigeration system removes heat from a given area. See figure 1-5. for a schematic of the refrigeration cycle.

a. The compressor (1A) takes cold, low pressure refrigerant gas and compresses it to a high temperature, high pressure gas. This gas flows thiough the metal tubing to the split condenser coil (3A) and receiver (4).

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

c. The liquid sight glass (5) indicates the presence of moisture and the quantity of refrigerant in the system.

d. The drier/filter dehydrator (6) removes any moisture (water vapor) or dirt that may be carried by the liquid refrigerant.

e. 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.

f. The expansion valve (8) controls the amount and pressure of liquid refrigerant to the evaporator coil (10). The expansion valve (8) senses the temperature and pressure of the refrigerant as it leaves the evaporator coil. By use of the feeler bulb in the bulb well (11) and ''external equalizer line,'' the valve constantly adjusts the flow of liquid refrigerant to the evaporator coil (10).

g. As the high pressure liquid refrigerant leaves the expansion valve (8), it enters the evaperator coil (10). As the liquid enters the coil, due to the size difference between the coil and the tubing, the pressure is suddenly decreased. As the pressure decreases, the liquid refrigerant “flashes” to a gas. The evaporator 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 the air from the conditioned spaces comes in contact with the evaporator coil (10), the air is cooled.

h. The accumulator (12) holds any liquid refrigerant which did not change to a gas in the evaporator. Heat in the evaporator section will boil this liquid to a gas before entering the compressor.

i. To prevent compresser damage during start-up, the solenoid valve (19) is normally open to equalize pressure on both sides of the compressor.

1.11.2 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 (10).

a. When the temperature selector on the control panel senses that cooling conditions have reached the set point, it closes the solenoid valve (7) to shut off refrigerant flow to the evaporator coil (10).

b. As the compressor suction pressure starts to drop, the pressure regulators (20) open to allow flow of hot gas from the compressor.

c. The quench valve (18) 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 (18) opens to allow liquid refrigerant to mix with the hot gas.

Item No.	Nomenclature
1A.	Compressor
1B.	Suction line filter
3A.	Coil, condenser with angle
3B.	Subcooler
4.	Receiver, liquid refrigerant
5.	Indicator, sight, liquid
6.	Dehydrator, desiccant, refrigerant
7.	Solenoid valve, with leads
8.	Valve, expansion (primary)
9.	Restrictor, fluid flow
10.	Coil, evaporator with angle
11.	Bulb well
12.	Accumulator
14.	Valve, charging, with cap
15.	Valve, pressure relief
16.	Cylinder assembly, actuating, linear
17.	Switch, pressure (high)
18.	Valve, expansion (quench)
19.	Solenoid valve, with leads
20.	Regulator, fluid pressure
21.	Switch, pressure (low)

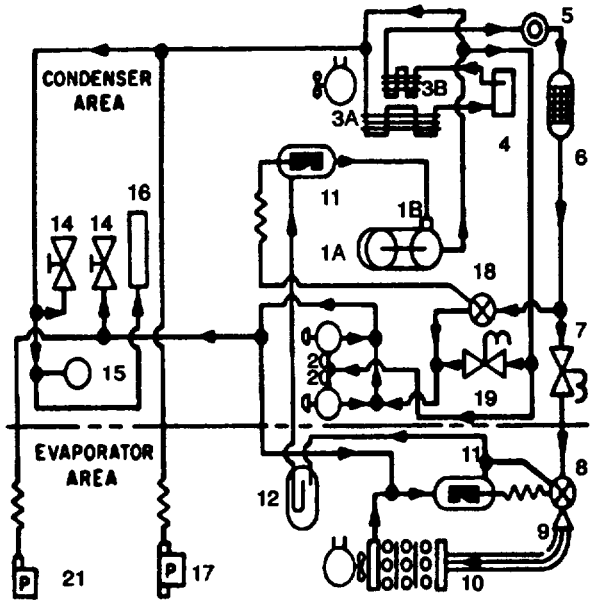


Figure 1-5. Refrigerant Flow Diagram

1.12 HEATING.

1.12.1 When the MODE SELECTOR is set for HIGH HEAT, six heating elements, located behind the evaporator coil are energized. These elements are protected from overheating by a thermal cutout switch. Three of the elements are controlled by the TEMPERATURE SELECTOR, and the remaining three are on all of the time. When set for LOW, only the three thermostatically controlled elements are energized.

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

1.13 LIST OF ACRONYMS AND ABBREVIATIONS.

AC	Alternating Current
C	Centigrade
CBR	Chemical-Biological-Radiological
cm^2	centimeter squared
DC	Direct Current
F	Fahrenheit
hp	horse power
HPCO	High Pressure cut-out
kg	kilogram
lbs	pounds
LPCO	Low Pressure cut-out
psi	pounds square inch
psig	pounds square inch gauge
rpm	revolutions per minute
reqd.	required
Vdc	Volts direct current

CHAPTER 2

OPERATING INSTRUCTIONS

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

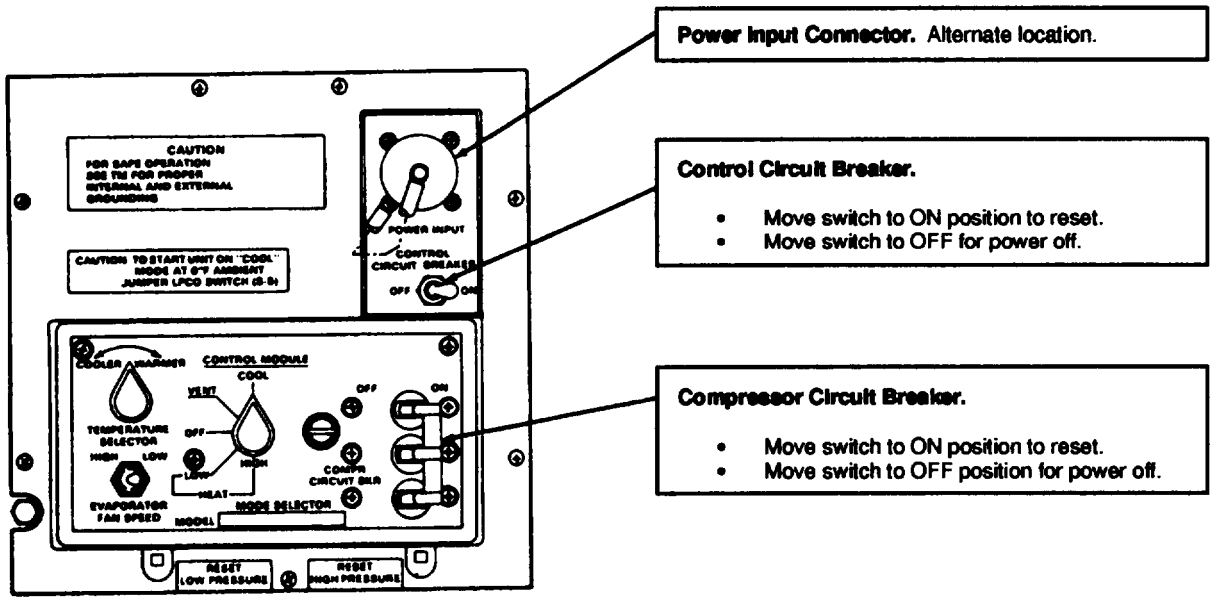
CAUTION

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

2.1 CONTROLS AND INDICATORS

CAUTION

To start unit on "cool" mode at 0°F ambient outside temperature, jumper the LPCO switch (S-5). Reference paragraph 3-8.



CAUTION

For safe operation see Chapter 3 for proper internal and external grounding.

Mode Selector Switch.

- Turn switch for COOL for cooling.
- Turn switch to VENT for vent.
- Turn switch to LOW HEAT or HIGH HEAT for heating.
- Turn switch to OFF to shut unit down.

Temperature Selector Switch.

- Turn knob to adjust level of cooling or heating.
  - * Clockwise for warmer, approx. 90 °F (32.2 °C);
  - * Counterclockwise for cooler, approx. 60 °F (15.5 °C).

Evaporator Fan Speed (not used on MHP-20-4-08).

- Turn switch to LOW for low speed.
- Turn switch to HIGH for high speed.

External Ground Connection.

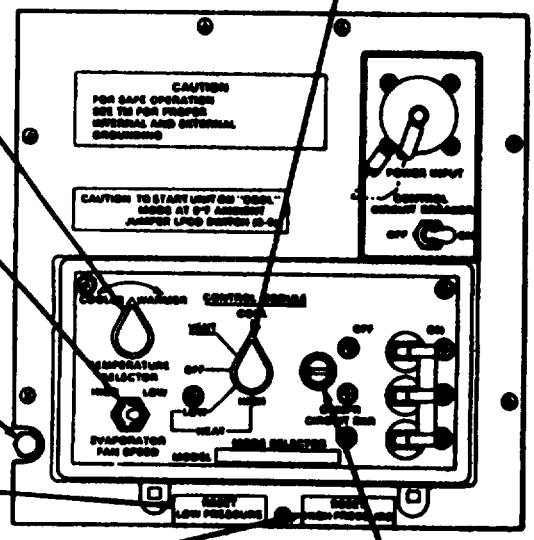
- Connect to shelter or van internal ground.

Low Pressure Cutout Switch.

- Push to reset.

High Pressure Cutout Switch.

- Push to reset.



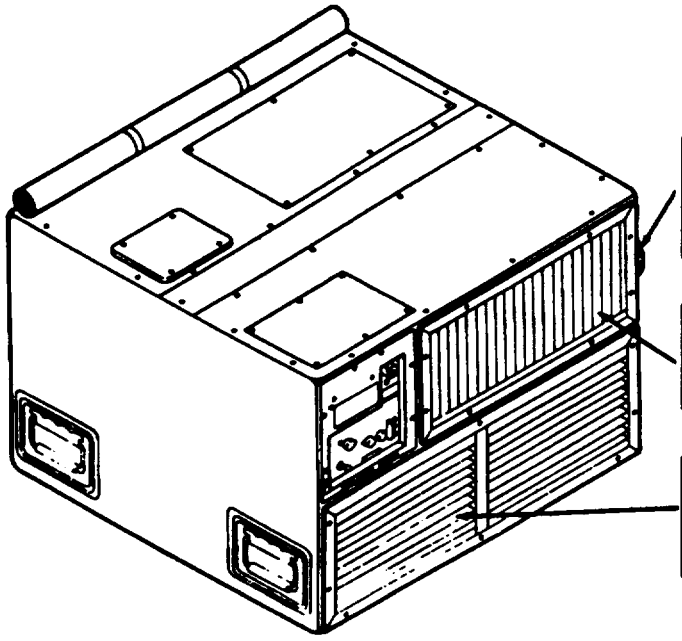
Control Module Connector Knob.*

- (Maintenance Only) DO NOT TURN.

NOTE

The control range of the Temperature Selector switch is 60 to 90 °F (15.5 to 32.2 °C).

* The connector knob was supplied on units prior to 1983. This knob is not supplied on F18H-3A or F18H-4A units and is not required on existing F18H, F18H-3, K1F-18H-4, or MHP-20-4-08 units. Use screwdriver slot in end of shaft.



Fresh Air Inlet Vent Control.

- Rotate downward to open vent.
- Rotate upward to close vent.

Air Outlet Louvers.

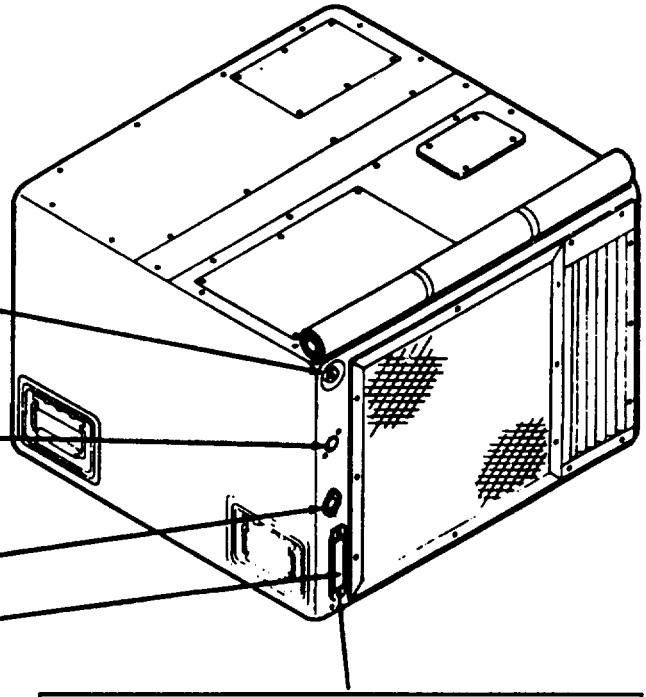
- Individually moveable.

Inlet Louver Tabs.

- Move TABS upward to open louvers.
- Move TABS downward to close louvers.

NOTE

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



Power Input Connector. Main location.

Liquid Sight Indicator.

- Milky or cloudy fluid or bubbles indicate insufficient charge or contaminated refrigerant system.

Condenser Fan Switch.

Fresh Air Inlet.

Condensate Drain.

NOTE

The air conditioner can be equipped for operation in chemical-biological-radiological (CBR) environment by connecting filtering equipment to the rectangular covered opening at the lower left side of the rear surface of the unit.

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

2.2 OPERATOR MAINTENANCE. The operator is required to perform preventive maintenance checks and services. Maintenance by operator/crew is limited to operating the air conditioner in COOL, LOW HEAT, HIGH HEAT, and VENT modes. Refer any malfunction to Unit Maintenance.

NOTE

Perform weekly as well as before PMCSs if:

(1) You are the assigned operator and have not operated the item since the last weekly PMCS.

(2) You are operating the item for the first time.

NOTE

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

Table 2-1. Operator/Crew Preventive Maintenance Checks and Services

Item No.	Interval	Item To Check/Service	Procedure	Not Fully Mission Capable If:
			NOTE All checks and services may be made while the air conditioner is on the shelter.	
1	Before	All Outside Covers and Information Plates	a. Check for major dents and cracks.	a. Cracks are present.
			b. Check that no screws are missing.	b. Screws are missing.
			c. Check that covers and gaskets are sealed against air leaks.	c. Air leaks are present.
2	Before	Fabric Cover	a. Check for mildew, tears or worn edges.	
			b. Check condition of snaps.	
3	Before	Return Air Intake	a. Check return air intake is clear.	a. Return air intake is blocked.
			b. Check for clean filter.	b. Filter is dirty.

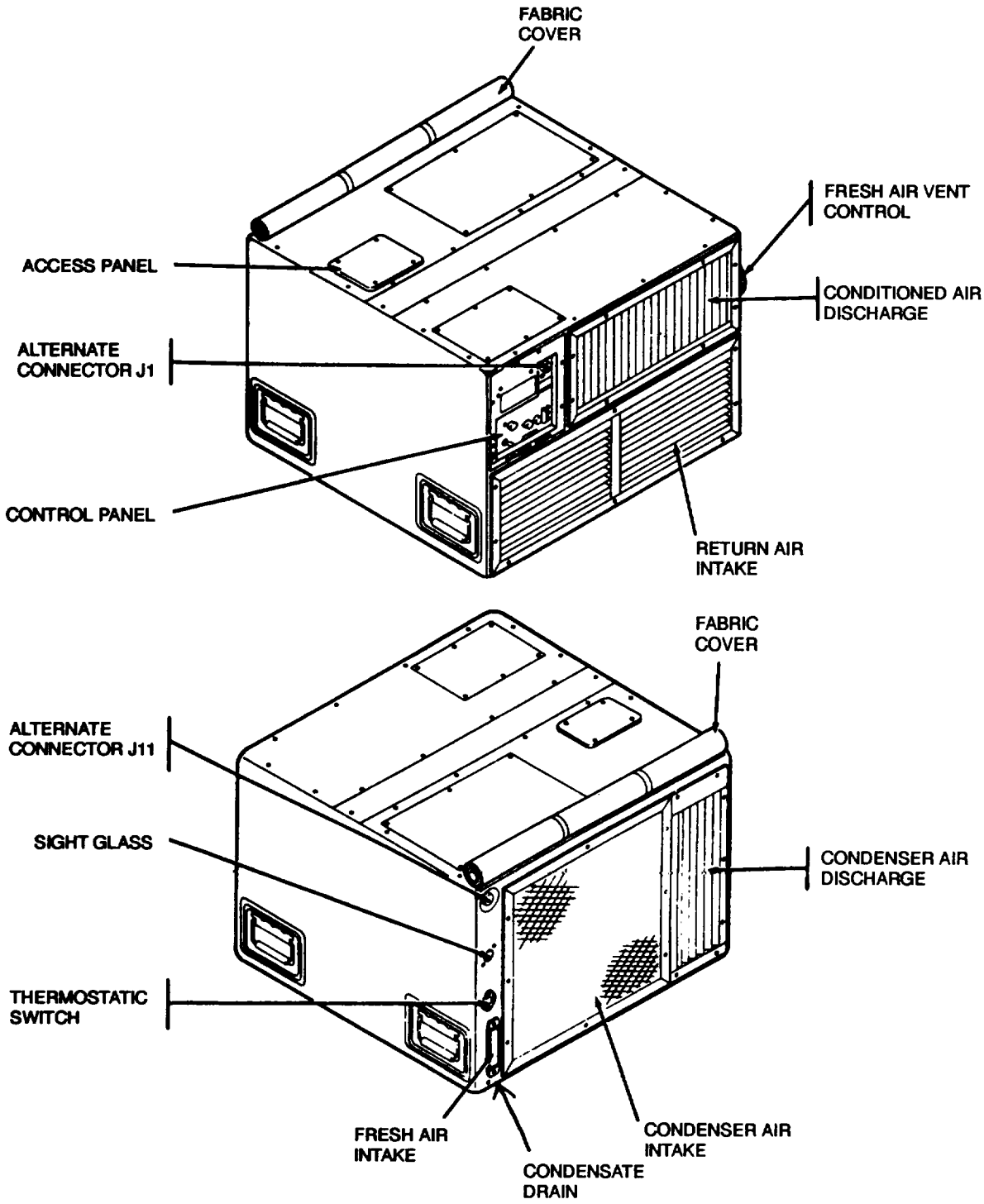
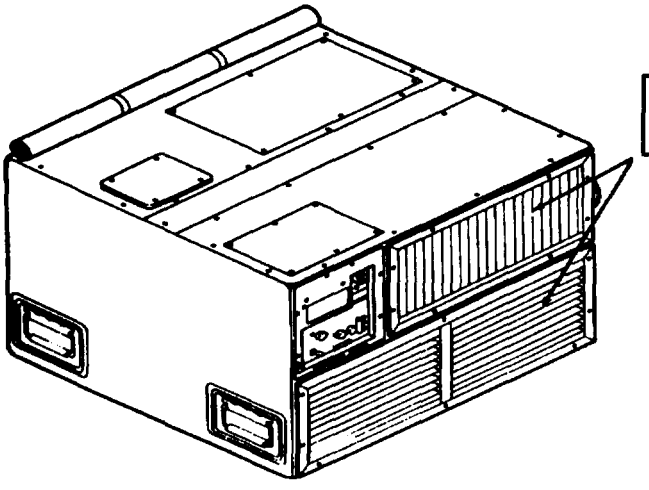

FABRIC COVER
FRESH AIR VENT CONTROL
ACCESS PANEL
CONDITIONED AIR DISCHARGE
ALTERNATE CONNECTOR J1
CONTROL PANEL
RETURN AIR INTAKE
FABRIC COVER
ALTERNATE CONNECTOR J11
SIGHT GLASS
CONDENSER AIR DISCHARGE
THERMOSTATIC SWITCH
FRESH AIR INTAKE
CONDENSER AIR INTAKE
CONDENSATE DRAIN

TABLE 2-1. Operator/Crew Preventive Maintenance Checks and Services - Continued

Item No.	Interval	Item To Check/Service	Procedure	Not Fully Mission Capable If:
4	Before	Condenser Air Intake, Discharge and Fresh Air Filter	a. Check that condenser air discharge is clear.	a Condenser air discharge is blocked.
			b. Check that there are no fumes or heat within 10 ft. of unit.	b. Fumes or heat are within 10 ft. of unit.
			c. Check that condenser air intake is clear and guard is not damaged.	c. Condenser air intake is blocked or guard is damaged.
			d. Check fresh air filter for damage or blockage.	d. Fresh air filter is damaged or blocked.
5	Before	Return Air Intake Filter and Fresh Air Vent Control	a. Inspect fresh air vent control for proper operation.	a. Fresh air vent control operates improperly.
			b. Inspect return air intake filter.	b. Filter is dirty.
6	During	Fresh Air Intake	Check for blockage.	
7	During	Condensate Drain	Check water dripping.	Water drip anywhere besides through drain.
8	During	Sight Glass	a. Check after air conditioner has run (cool mode) 15 min.	
			b. Check Moisture Indicator. Center should be clear without bubbles. Colors indicate: • Green - no moisture • Chartreuse - moisture • Yellow - replace drier/filter and refrigerant	Bubbles are present or "yellow" appears.
9	During	Air Conditioner Unit	During starting and operation, check for unusual noise and rough running. Check for excessive vibration, lack of power, or any indication of a failing or defective component. If suspected, notify unit maintenance.	

Section III. OPERATION UNDER USUAL CONDITIONS

2.3 BEFORE OPERATION.



1. Check all air intake and discharge openings. They should be clear.

NOTE

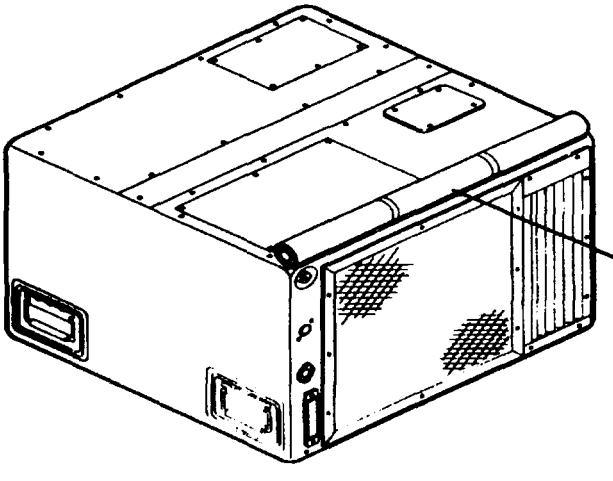
When possible...the shelter circuit breaker (provides power to air conditioner) should be ON at least 6 hours before operating the unit in the cool mode. This allows the crankcase heater to raise the compressor oil temperature to normal operating range.

NOTE

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

NOTE

Under all but extreme weather conditions, it is desirable to introduce about 10 percent of fresh air into the system. This will create a slight positive pressure, and will help to eliminate the musty odors associated with stale air.



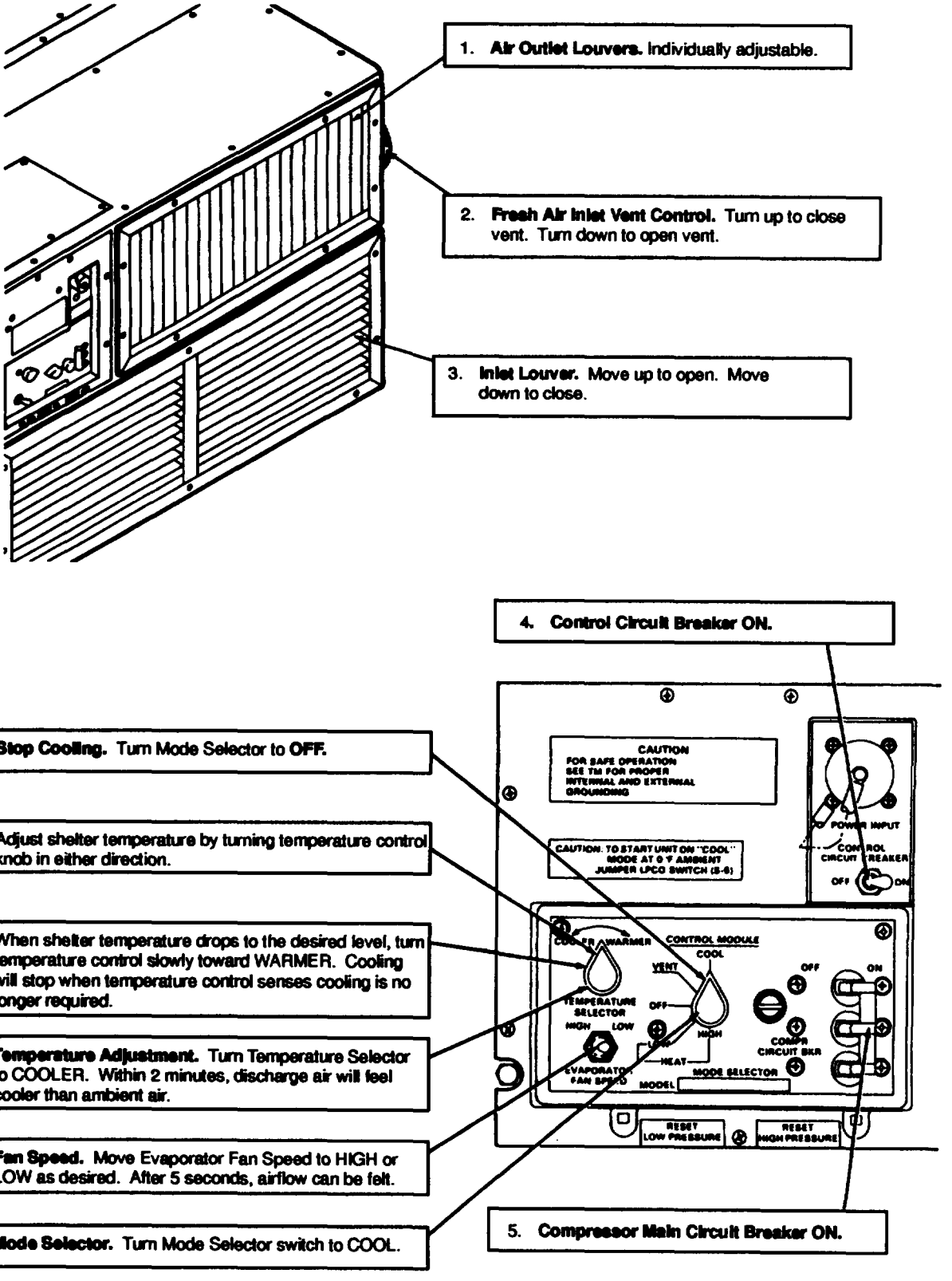
2. Condenser cover must be rolled up and tied on top of the air conditioner.

Table 2-2. Operating Settings

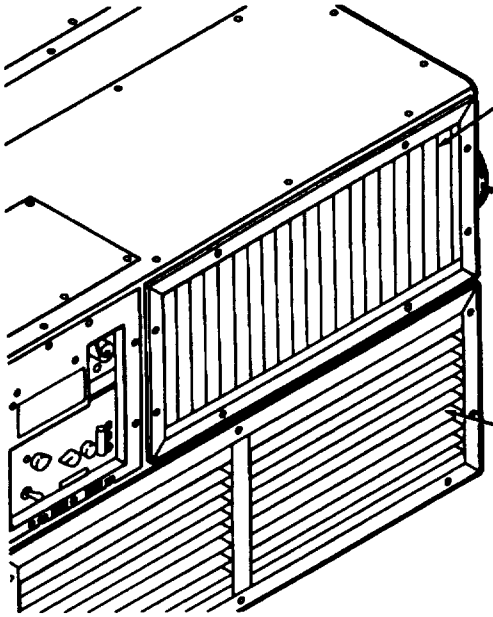
Mode	Mode Selector	Temperature Selector	Fresh Air Damper	Evaporator Intake Grille	*Fabric Cover
Cooling-100% recirculated air	COOL	Desired temperature	Closed	Open	Rolled
Cooling-with fresh makeup air	COOL	Desired temperature	Partially or fully open	Partial or fully closed	Rolled
Cooling-with fresh makeup air through CBR filter	COOL	Desired temperature	Fully open	Partially or fully open[1]	Rolled
Heating-100% recirculated air	LO HEAT or HI HEAT	Desired temperature	Closed	Open	Optional
Heating-with fresh makeup air	LO HEAT or HI HEAT	Desired temperature	Partially or fully open	Partially or fully closed	Rolled
Heating-with fresh makeup air through CBR filter	LO HEAT or HI HEAT	Desired temperature	Fully open	Partially or fully open[1]	Rolled
Ventilation-maximum outdoor air	VENTILATE	Any setting	Open	Closed	Rolled

[1] Partial closing of the evaporator intake grille causes a greater portion of the total airflow to be drawn from the outside.

2.4 COOLING OPERATION.



2.5 LOW HEAT OPERATION.



1. **Air Outlet Louvers.** Individually adjustable.

2. **Fresh Air Inlet Vent Control.** Turn up to close vent. Turn down to open vent.

NOTE

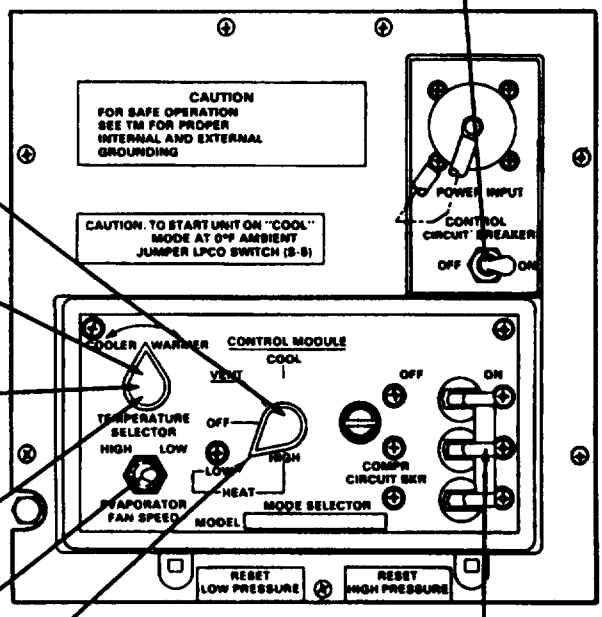
In low heat, air is circulated only in the evaporator section. The condenser blower will not operate.

3. **Inlet Louver.** Move up to open. Move down to close.

CAUTION

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

4. **Control Circuit Breaker ON.**



5. **Compressor Main Circuit Breaker ON.**

6. **Mode Selector.** Turn selector switch to LOW heat. After 5 seconds, airflow can be felt.

7. **Fan Speed.** Move Evaporator Fan Speed switch to HIGH or LOW.

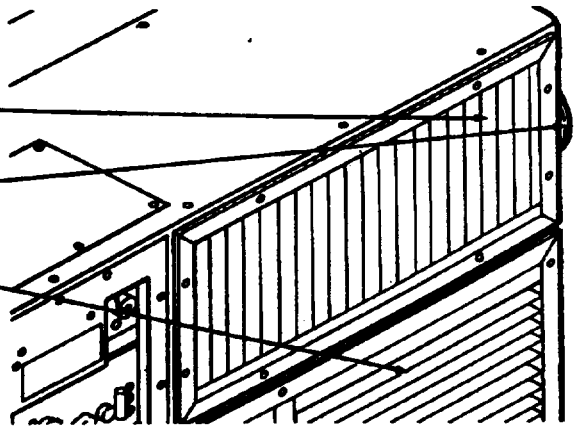
8. **Temperature Adjustment.** Turn temperature control to WARMER. After 2 minutes, discharge air will feel warmer than ambient air.

9. When shelter temperature rises to the desired level, turn temperature control slowly toward COOLER. Heating will stop when temperature control senses heating is no longer required.

10. Adjust shelter temperature by turning temperature control knob in either direction.

11. **To Stop Heating.** Move Mode Selector to VENT for 5 minutes. After 5-minute vent operation, move switch to OFF.

2.6 HIGH HEAT OPERATION.



1. **Air Outlet Louvers.** Individually adjustable.
2. **Fresh Air Inlet Vent Control.** Turn up to close vent. Turn down to open vent.
3. **Inlet Louver.** Move up to open. Move down to close.

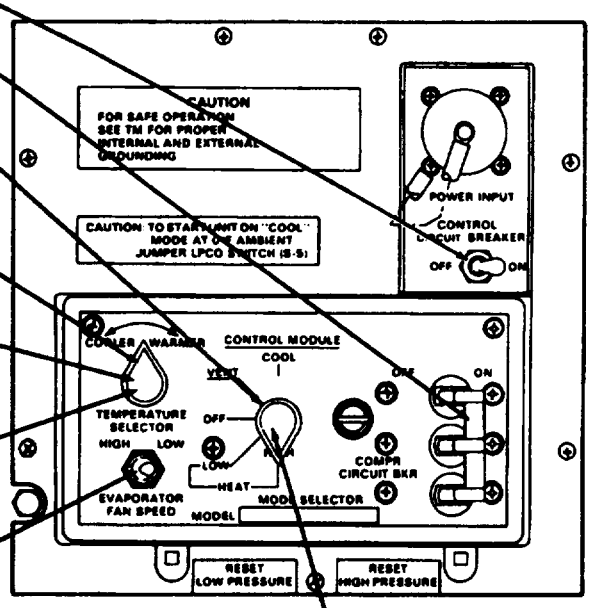
NOTE

The temperature control operates one bank of heating elements. In high heat, a second bank of elements is continuously on.

NOTE

In high heat, air is circulated only in the evaporator section. The condenser blower will not operate.

4. **Control Circuit Breaker ON.**
5. **Compressor Main Circuit Breaker ON.**
6. **Mode Selector.** Turn selector switch to HIGH heat. After 5 seconds, airflow can be felt.
7. Turn temperature control to WARMER. After 2 minutes, discharge air will feel warmer than ambient air.
8. When shelter temperature rises to the desired level, turn temperature control slowly toward **COOLER.** Heating will stop when temperature control senses heating is no longer required.
9. Adjust shelter temperature by turning temperature control knob in either direction.
10. **Fan Speed.** Move Evaporator Fan Speed switch to **HIGH** or **LOW.**



NOTE

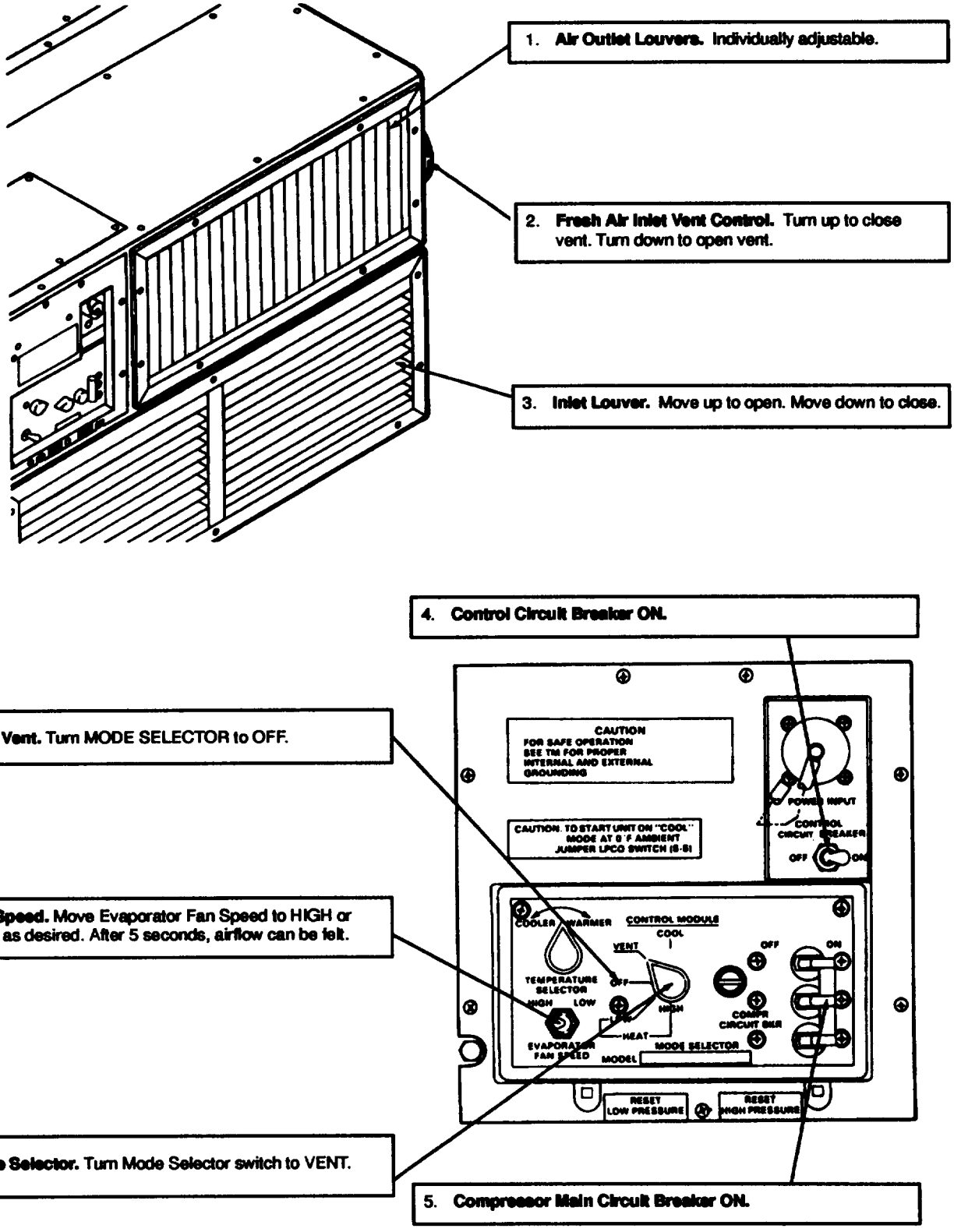
Use **high heat** when **low heat** fails to raise the shelter temperature.

CAUTION

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

11. **To Stop Heating.** Move Mode Selector to VENT for 5 minutes. After 5-minute vent operation, move switch to OFF.

2.7 VENTILATING OPERATION.



Section IV. OPERATION UNDER UNUSUAL CONDITIONS

NOTE

The air conditioner can be equipped for operation in chemical-biological-radiological (CBR) environment by connecting filtering equipment to the rectangular covered opening at the lower left side of the rear surface of the unit.

2.8 OPERATION IN EXTREME COLD. This task covers operation in extreme cold.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
None

Equipment Descriptions:
Power ON; installed in shelter

Special Environmental Conditions:
Below 0°F (-18 °C)

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Operator

Location/Item	Action	Remarks
General	The air conditioner is designed to operate on the heating cycle in ambient temperatures as low as minus50° F (-45.5 °C) and on cooling cycle with 0° F (-18 °C) air entering the condenser and 70° F (21 °C) air entering the evaporator. **CAUTION** Do not disturb wiring during cold weather, unless absolutely necessary. Cold temperatures make wiring and insulation brittle and easy to break.	
Before Operation	a. Before starting on cooling cycle, be sure cover is rolled from condenser air intake and discharge. b. Clear all ice and snow from openings. c. Be sure all dampers are in operating condition. d. To start unit on COOL mode at 0°F (-18°C) ambient (min. operating temp.) jumper LPCO switch. Refer to paragraph 3.7.	
After Operation	Install cover over condenser air intake and discharge openings.	

INITIAL SETUP

Applicable Configurations:
All

Special Environmental Conditions:
Above 120 °F (49 °C)

Test Equipment:
None

General Safety Instructions:
See WARNING page

Special Tools:
None

References:
None

Materials/Parts:
None

Troubleshooting References:
None

Equipment Descriptions:
Power ON; installed in shelter

Personnel Required:
Operator

NOTE

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

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

2.9.2 Protection.

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.

NOTE

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

2.9.3 Cleaning. Clean outside grilles, coils, filters and mist eliminator more frequently.

2.10 OPERATION IN DUSTY OR SANDY AREAS. This task covers operation in dusty or sandy areas.

INITIAL SETUP

Applicable Configurations:
All

Special Environmental Conditions:
Extremely dusty or sandy

Test Equipment:
None

General Safety Instructions:
See WARNING page

Special Tools:
None

References:
None

Materials/Parts:
None

Troubleshooting References:
None

Equipment Descriptions:
Power ON; installed in shelter

Personnel Required:
Operator

NOTE

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

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

CAUTION

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

2.10.2 Protection.

a. Shield the air conditioner from dust as much as possible.

b. Take advantage of any natural barriers which offer protection.

c. Limit the amount of dusty or sandy outside air introduced through the fresh air damper.

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

2.10.3 Cleaning.

a. Keep the air conditioner as clean as possible.

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

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

2.11 OPERATION UNDER RAINY OR HUMID CONDITIONS. This task covers operation under rainy or humid conditions.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
None

Equipment Descriptions:
Power ON; installed in shelter

Special Environmental Conditions:
Heavy Rain

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Operator

Location/Item	Action	Remarks
	WARNING Make sure power is disconnected from air conditioner before touching any wiring or other electrical pints.	
Cover Equipment	Take special precautions to keep equipment dry. If installed outdoors, cover the equipment with a waterproof cover when it is not in use.	
Keep Dry	Remove cover during the dry periods. Take all necessary precautions to keep electric components free from moisture.	

2.12 OPERATION IN SALT WATER AREAS. This task covers operation in salt water areas.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
None

Equipment Descriptions:
Power ON; installed in shelter

Special Environmental Conditions:
Salt water spray

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Operator

Location/Item	Action	Remarks
	WARNING Disconnect power source prior to washing the air conditioner.	
Wash	a. Wash the exterior and condenser section of the unit, particularly condenser air discharge louver control mechanism. Refer to paragraph 5.26. b. Be careful not to damage electrical system with water. c. Special attention must be given to prevent rust and corrosion.	
Painting	a. Paint all exposed areas where paint has cracked, peeled or blistered. b. Coat all exposed areas of polished metal with a light coat of grease.	

CHAPTER 3

OPERATOR MAINTENANCE

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

3.1 COMMON TOOLS AND EQUIPMENT.

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

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

Description	National Stock Number
Brush, Bristle	7520-00-223-8000
Brush, Wire	7920-00-282-9246
Bucket	7240-00-137-1609
Heat Gun	4940-01-042-4855
Multimeter	6625-00-553-0142
Nitrogen Regulator	6685-00-449-7484
Pliers, Long Round Nose	5120-00-268-3579
Recovery and Recycling Unit, Refrigerant	4310-01-338-2707
Rubber Gloves	8415-00-266-8677
Safety Goggles	4240-00-052-3776
Screwdriver, Cross Tip, No. 2, l-inch Long Blade	5120-00-227-7293
Screwdriver, Offset, Cross Tip, No. 1	5120-00-256-9014

3.2 SPECIAL TOOLS, TMDE AND SUPPORT EQUIPMENT. No special tools, TMDE, or support equipment is required.

3.3 REPAIR PARTS. Repair parts are listed and illustrated in Repair Parts and Special Tools List (RPSTL), TM 9-4120-367-24P.

Section II. SERVICE UPON RECEIPT

3.4 UNPACKING. This task covers unpacking and inspection.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
None

Equipment Descriptions:
Assembled; ready for installation

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Unit Maintenance (2 reqd.)

Location/Item	Action	Remarks
Container Air Conditioner		
Unpacking	a. Cut steel strapping.	
	b. Remove plastic wrap.	
	c. Lay unit on side with help of assistant.	
	d. Remove four mounting bolts.	Keep bolts for permanent mounting.
Inspection	a. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on DD Form 6, Packaging Improvement Report.	
	b. Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.	
	c. Check to see whether the equipment has been modified.	
	d. Report any modifications.	

3.4 UNPACKING. - Contined

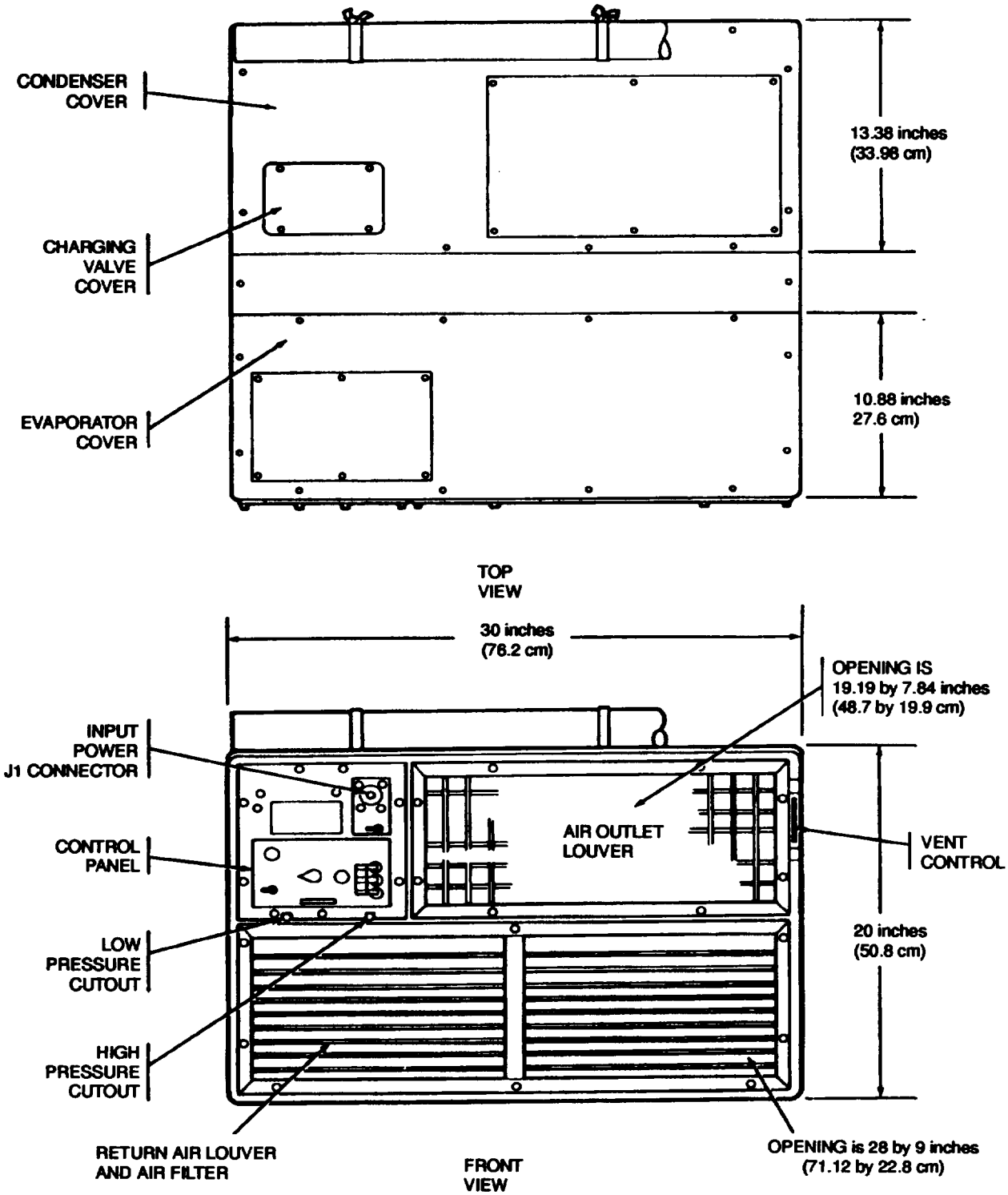
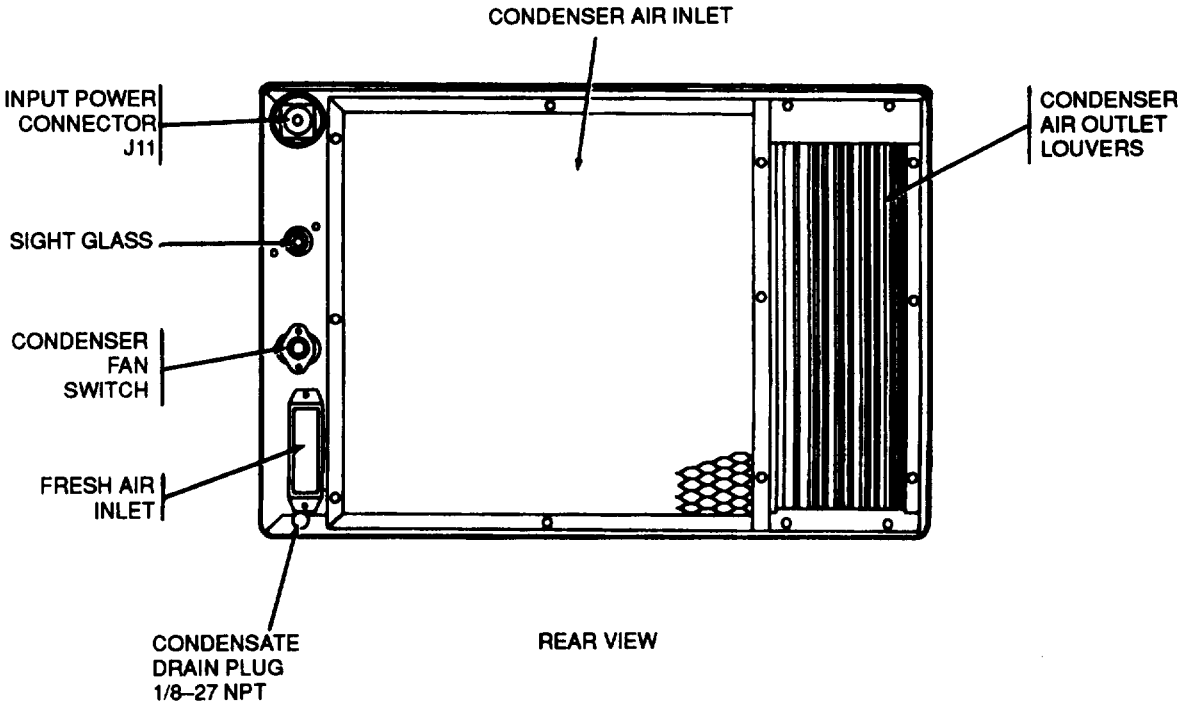


Figure 3-1. Installation Dimensions (Sheet 1 of 2)

3.4 UNPACKIING. - Continued



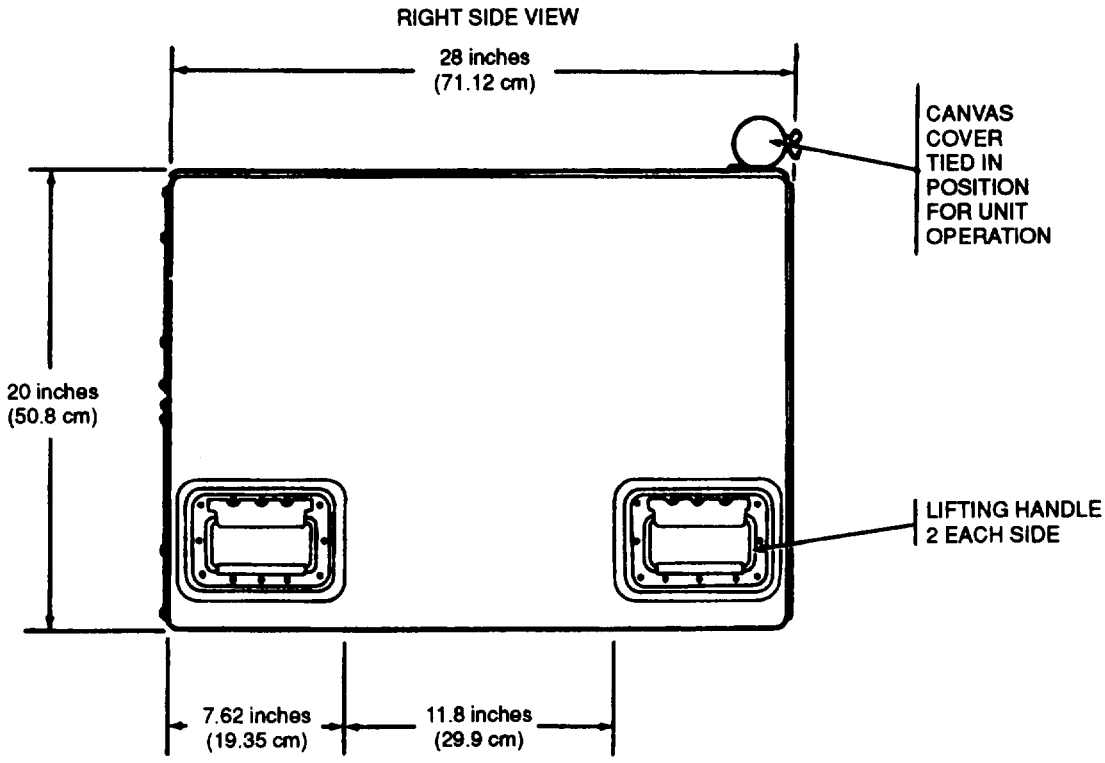


Figure 3-1. Installation Dimensions (Sheet 2 of 2)

3.5 INSTALLATION OR REMOVAL. This task covers installation, check of installation and removal.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
Hoist or Wrecker Sling

Materials/Parts:
Foam Insulating Material
Pressure Sensitive Tape
#10 AWG Ground Wire
Mounting Bracket
Shrims Material

Personnel Required:
Unit Maintenance (2 reqd.)

Special Environmental Conditions:
None

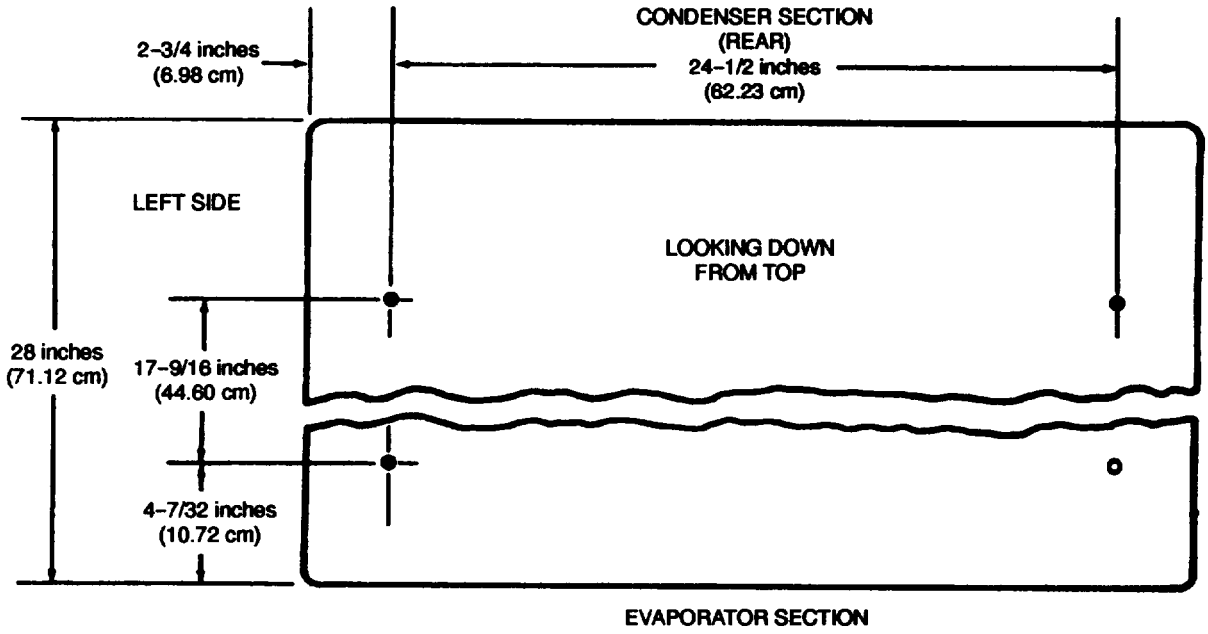
General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Location/Item	Action	Remarks
Shelter Air Conditioner		
	a. Select a support which allows slight slope. No more than 5 degrees front to rear (evaporator to condenser).	Evaporator higher than condenser to allow flow of condensate water.
	b. See Figure 3-1 for dimensions and location of mounting hardware.	Mounting hardware supplied with unit.
	c. Leave approximately 24 inches (60.8 cm) for maintenance.	More space is desirable.
	d. Check that there will bean unobstructed flow of outside air to and from condenser coil.	Keep all sources of heat at least 10 feet (30.4 m) from condenser coil.
	e. Check that no source of dangerous or objectionable fumes will be within 10 feet (30.4 m) of the fresh air intake.	

3.5 INSTALLATION OR REMOVAL. - Continued.



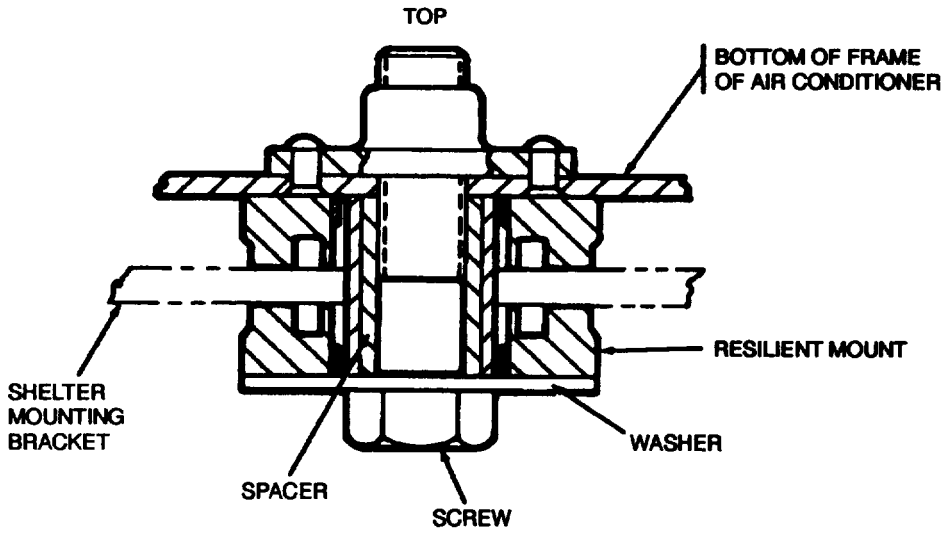


Figure 3-2. Mounting Hole Location

3.5 INSTALLATION OR REMOVAL. - Continued

Table 3-1. AC Power Supply Requirements

Model	Voltage	Phase	Hertz
F18H	230	Single	50/60
F18H-3	208	3	50/60
F18H-4	208	3	400
MHP-20-4-08	208	3	400

Table 3-2. J1 and J11 Wiring

Model	J11	Connector J1	Schematic *
F18H	Figure 3-3	Figure 3-4	FO-1
F18H-3	Figure 3-5	Figure 3-6	FO-2
F18H-4	Figure 3-5	Figure 3-6	FO-3
MHP-20-4-08	Figure 3-7	Figure 3-8	FO-9

* Foldout located at back of manual.

NOTE

Two input power connectors are provided on the air conditioner. Connector J1 is located on the evaporator section above the control module. Connector J11 is located on the condenser section right above the sight glass. Wiring at the terminal boards TB3 must be connected to the connector which is to used for input power.

NOTE

It may be necessary to isolate neutral from ground in the air conditioner to prevent electrical interference. It will be necessary to remove the air conditioner from the installed position to remove the jumper. If possible, determine the possibilities of electrical interference before installing the air conditioner.

3.5 INSTALLATION OR REMOVAL - Continued

Table 3-3. Connector Pin Wiring, Model F18H

Pin	Internal Wiring Connection J1 and J11
A	Positive
B	Neutral
C	Blank not used
D	Ground
E	Blank not used

Table 3-4. Phase Rotation Models F18H-3 and F18H-4

Pin	Internal Wiring Connection J1 and J11
A	Phase A
B	Phase B
C	Phase C
D	Ground
E	Blank not used

Location/Item	Action	Remarks
Installation	a. Refer to table 3-1 for electric power supply requirements.	There are three models, each with a different requirement.
	b. Determine which input power connector is to be used.	Rewire unit at terminal boards TB3 and TB4, if necessary.
	WARNING Do not wire connection J1 and J11 for use at the same time, nor apply power source to connectors J1 and J11 at the same time. You could have unknown HOT connector, radio interference, or you could place two separate power supplies in opposition to each other.	
	c. Remove all three top covers.	See tables 3-2, 3-3, and 3-4.

3.5 INSTALLATION OR REMOVAL. - Continued

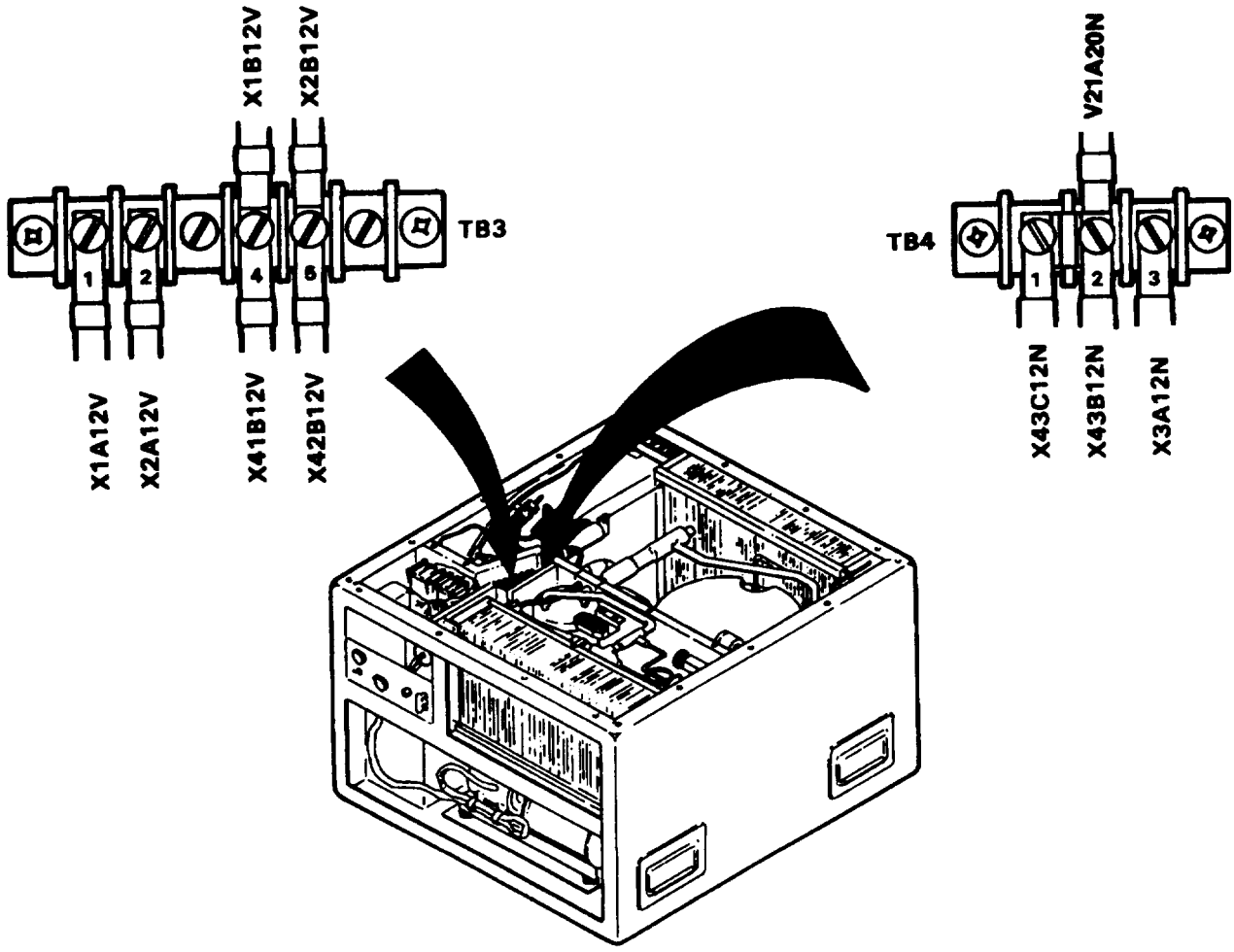


Figure 3-3. Connector J11 Wired at Terminal Board TB3 (Single Phase)

Location/Item	Action	Remarks
	OR	
Connector J11, Single Phase, Terminal Board TB3	a. Leads X1B12V and X2B12V must be connected to terminal board TB3, terminals 4 and 5.	Power supply connected to connector J11, single phase.
	AND	
Connector J11, Single Phase,, Terminal Board TB4	b. Wire X43B12N must be connected to terminal 2; wire X3A12N, connected to terminal 3.	(Figure FO-1) Replace all removed covers.

3.5 INSTALLATION OR REMOVAL.- Continued

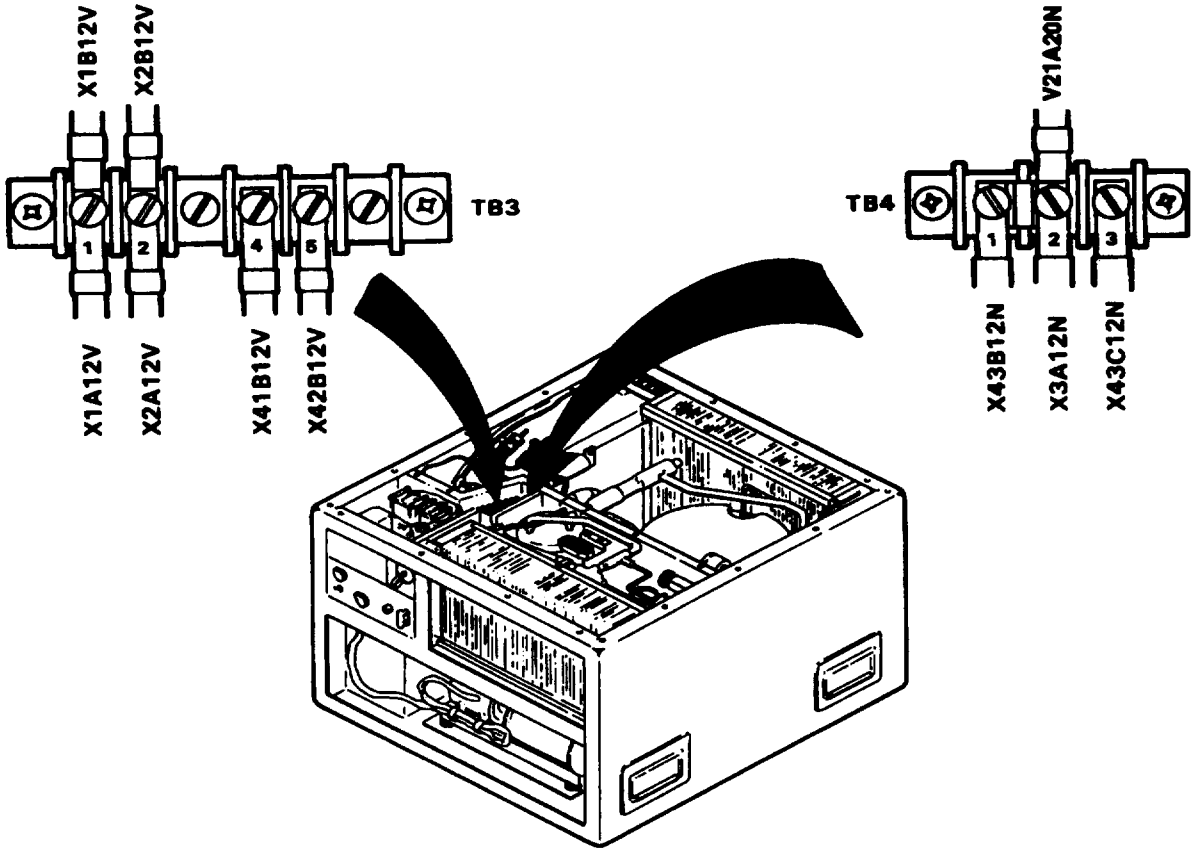
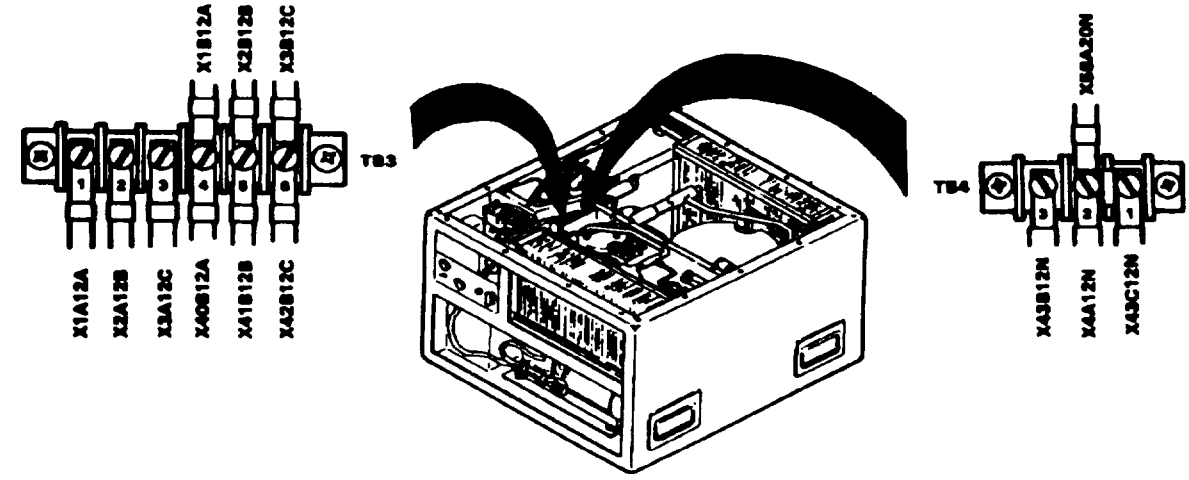


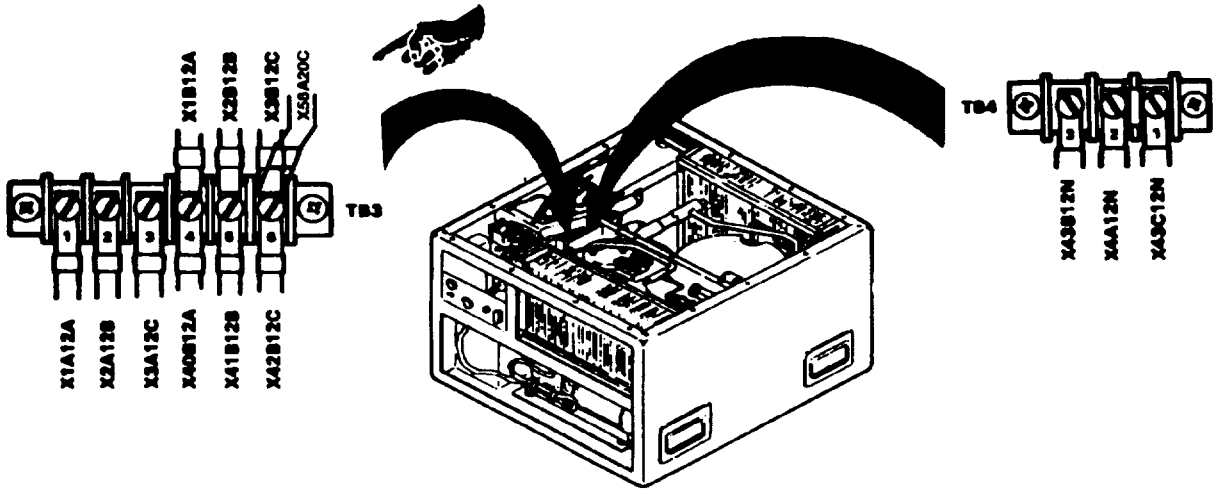
Figure 3-4. Connector J1 Wired at Termlnal Board TB3 (Single Phase)

Location/Item	Action	Remarks
	OR	
Connector J1, Single Phase, Terminal Board TB3	a Leads X1B12V and X2B12V must be connected to terminal board TB3, terminals 1 and 2.	Power supply connected to connector J1, single phase.
	AND	
Connector J1, Single Phase, Terminal Board TB4	b. Wire X3A12N must be oonnected to terminal 2; wire X43B12N, connected to terminal 3.	(Figure FO-1) Replaoe all removed covers.

3.5 INSTALLATION OR REMOVAL. - Continued



F18H-3 and F18H-4

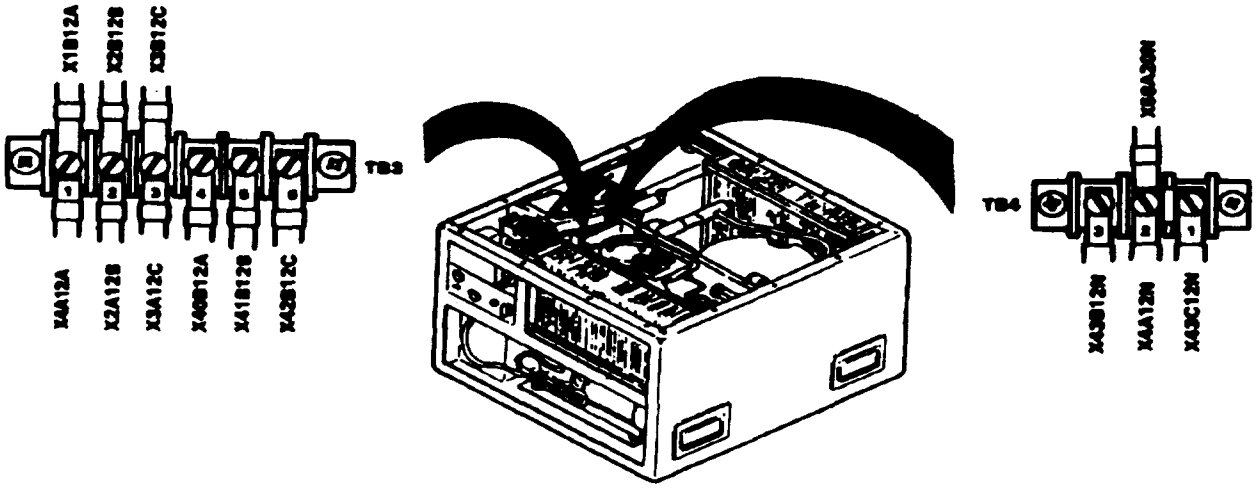


F18H-3A and F18H-4A

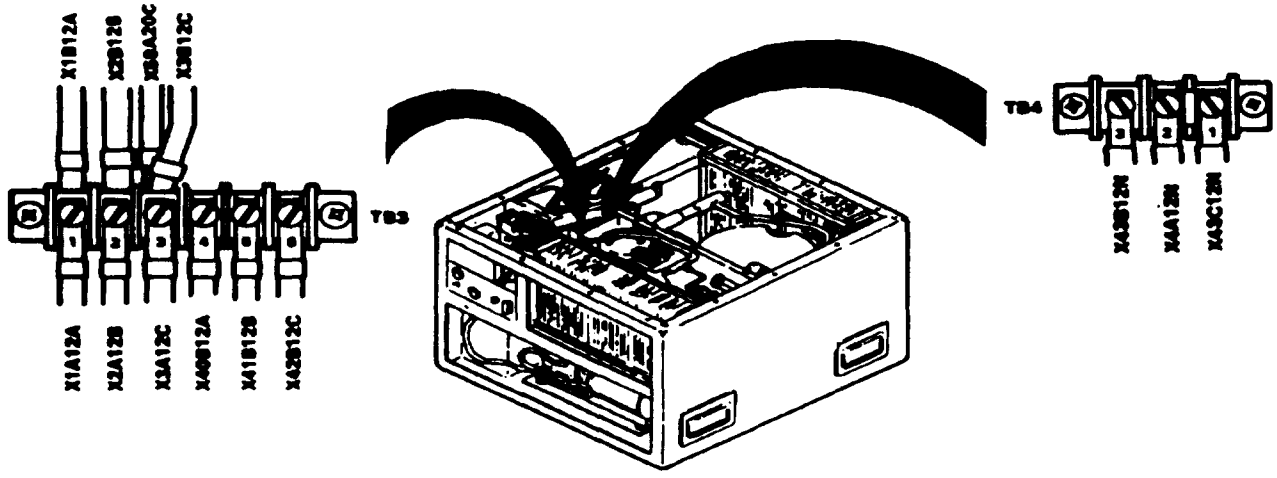
Figure 3-5. Connector J11 Wired at Terminal Board TB3 (Three Phase)

Location/Item	Action	Remarks
	OR	
Connector J11, 3-Phase, Terminal Board TB3	a. Leads X1B12A, X2B12B, and X3B12C must be connected to terminal board TB3, terminals 4, 5, and 6. Lead X58A20C must be connected to terminal board TB3 terminal 6.	Power supply connected to connector J11, 3-phase.
	AND	
Connector J11, 3-Phase, Terminal Board TB4	b. Wire X43B12N must be connected to terminal 2; wire X4A12N, connected to terminal 3.	Figure FO-1) Replace all removed covers.

3.5 INSTALLATION OR REMOVAL. - Continued



F18H-3 and F18H-4



F18H-3A and F18H-4A

Figure 3-6. Connector J11 Wired at Terminal Board TB3 (Three Phase)

Location/Item	Action	Remarks
	OR	
Connector J1, 3-Phase, Terminal Board TB3	a. Leads X1B12A, X2B12B, and X3B12C must be connected to terminal board TB3, terminals 1, 2, and 3.	Power supply connected to connector J11, 3-phase.
	AND	
Connector J1, 3-Phase, Terminal Board TB4	b. Wire X4A12N must be connected to terminal 2; wire X43B12N, connected to terminal 3.	Figure FO-2 or Figure FO-3.

*U.S. GOVERNMENT PRINTING OFFICE:1995-655-121/20220

3.5 INSTALLATION OR REMOVAL. - Continued

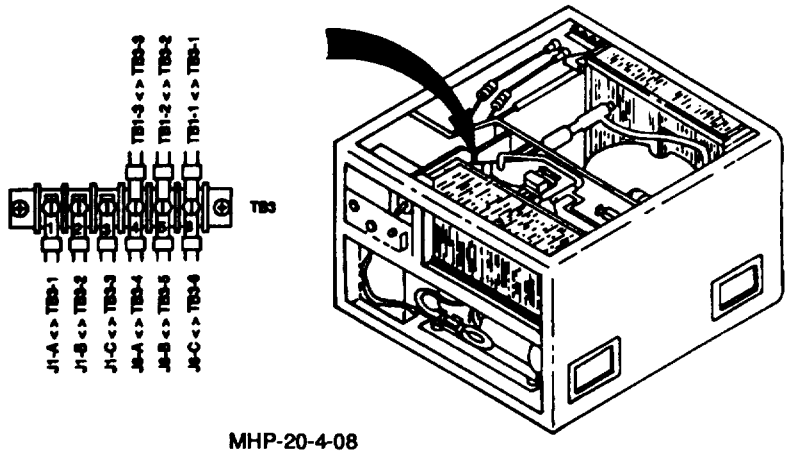


Figure 3-7. Connector J11 (Through J6) Wired at Termlnal Board TB3 (Three Phase)

Location/Item	Action	Remarks
Connector J11, 3-Phase, Terminal Board TB3	Leads TB1-3 <> TB3-3, TB1-2 <> TB3-2, and TB1-1 <> TB3-1 must be connected to terminal board TB3, terminals 4,5, and 6.	Power supply connected to connector J11, 3-phase.

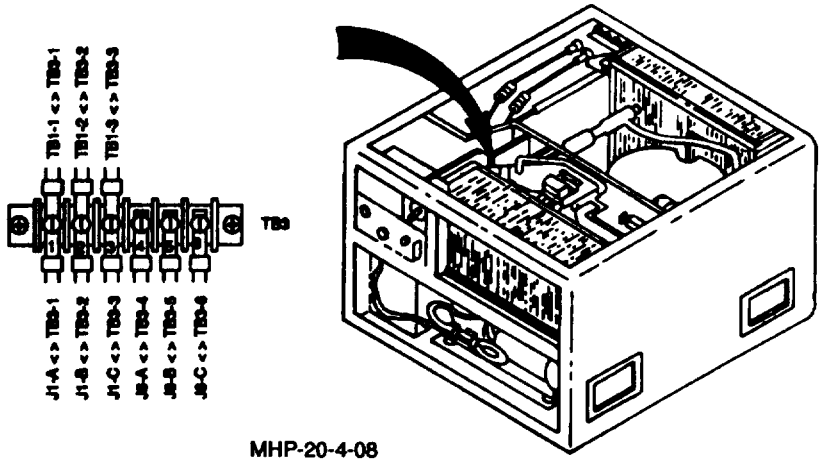


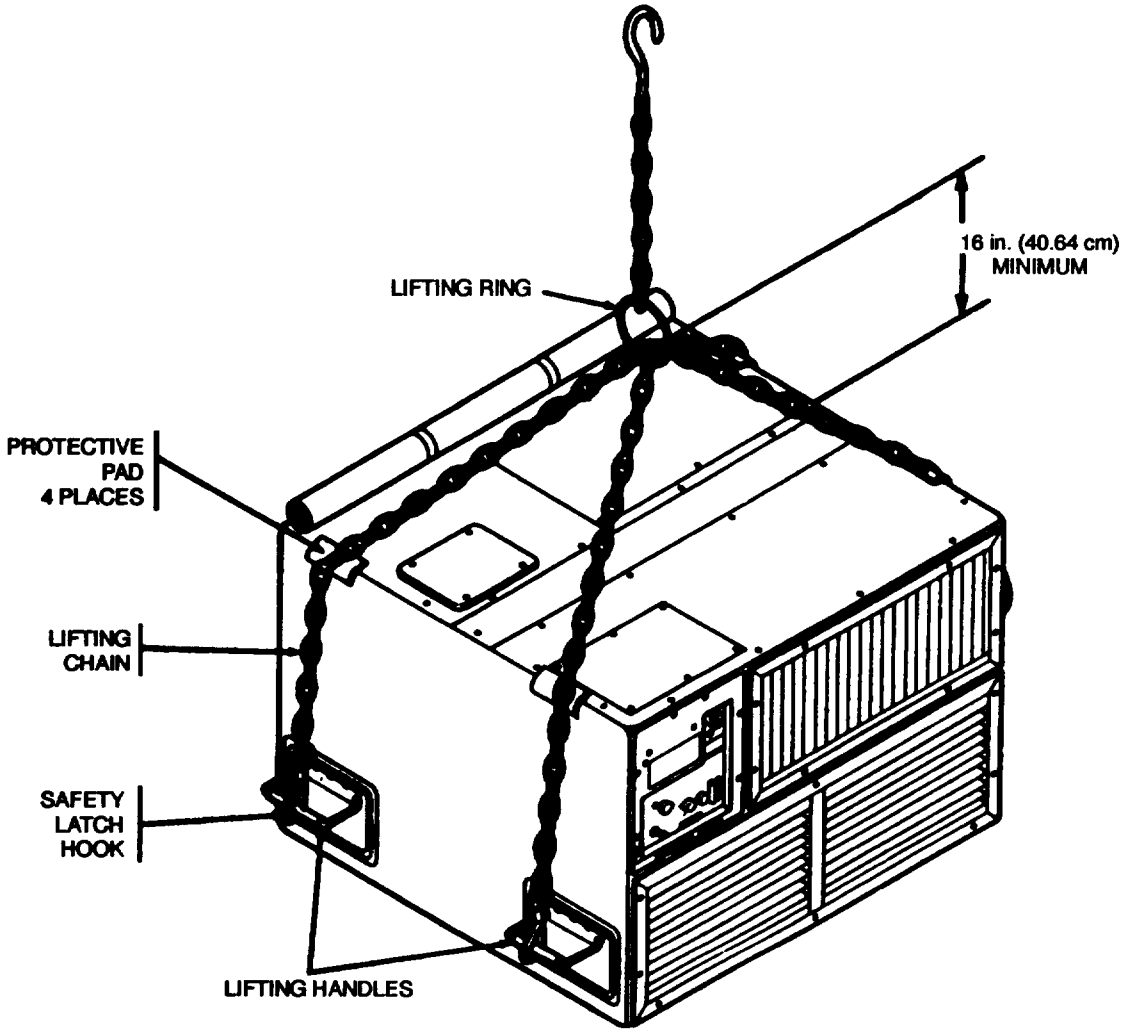
Figure 3-8. Connector J1 Wired at Terminal Board TB3 (Three Phase)

Location/Item	Action	Remarks
Connector J1, 3-Phase, Terminal Board TB3	Leads TB1 -30 TB3-3, TB1-2<> TB3-2, and TB1-1 <> TB3-1 must be connected to terminal board TB3, terminals 1,2, and 3.	Power supply connected to connector J11, 3-phase.

3.5 INSTALLATION OR REMOVAL. - Continued.

Looation/Item	Action	Remarks
	NOTE Check on possibilities of removing jumper on terminal board TB4 at this time.	
	WARNING Use care in lifting. Air conditioner weighs 256 lbs. (116.1 kg)	
Shelter Air Conditioner		
Installation in Shelter	a. Lift air conditioner to top of the mounting brackets.	Each side has two lifting handles.
	b. Use lifting sling if possible. See figure 3-9.	
	c. Locate evaporator section inside shelter. Leave space to remove cover from top of evaporator section.	Use care, unit is not mounted or secure and could shift.
	d. Level unit on bracket, side to side. Shim as necessary.	
	e. Level unit on bracket, front to back. Shim as necessary.	No more than 5°. Condenser lower than evaporator.
	f. Bolt unit to brackets (four places).	Hardware supplied with unit.
	g. Fill in and seal area around air conditioner to prevent loss of conditioned air.	Ffexible plastic foam and pressure sensitive tape may be used.
	WARNING For safe operation, user must connect #10 AWG ground wire to the external ground connection. Make certain that the shelter is properly grounded.	
	h. Connect #10 AWG ground wire from the shelter ground to air conditioner ground stud.	Ground is located below and to the side of control panel.

3.5 INSTALLATION OR REMOVAL. - Continued



GROSS WEIGHT F18H - 278 lbs (126.1 kg)
F18H-3 - 270 lbs (122.5 kg)
F18H-4 - 265 lbs (120.2 kg)
MHP-20-4-08 - 265 lbs (120.2 kg)

Figure 3-9. Lifting, Using Slings

3.5 INSTALLATION OR REMOVAL. - Continued

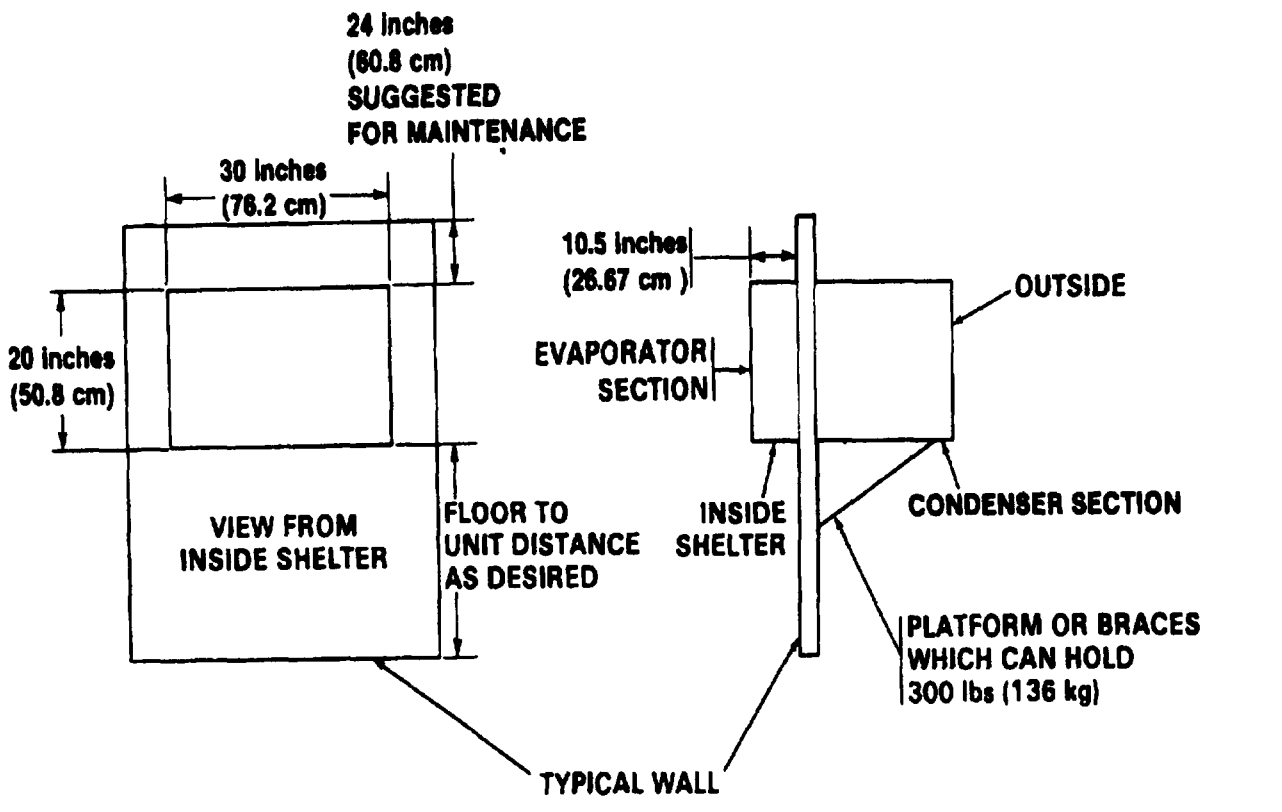


Figure 3-10. Wall Space Required

Location/Item	Action	Remarks
Shelter Air Conditioner		
Drain Line	Remove drain plug. Connect condensate drain line.	Rear of unit, below fresh air intake 1/8 -27 NPT.
Check Power Supply	a. Connect incoming power supply.	
	(1) Model F18H; check wirring to connector pins of J1 or J11 mating connector.	Table 3-3. Correct at power supply or Main Circuit Breaker.
	OR	
	(2) Models F18H-3 and F18H4; check phase rotation to connector pins of J1 or J11 mating connector.	Table 3-4. Correct at power supply or Main Circuit Breaker.

3.5 INSTALLATION OR REMOVAL. - Continued

Location/Item	Action	Remarks
Cheok Power Supply - Continued	**WARNING** Power supply circuit breaker must be OFF. Installation must be checked prior to turning ON power.	
	b. Connect mating power supply connector to J1 or J11.	
Installation Check	a. Check installation.	Unit ready for operation Checkout. Paragraph 3.6.
	b. Perform steps in paragraph 3.6 before placing unit in operation.	
Removal	a. Remove power at Main Circuit Breaker.	**WARNING** High voltage can kill.
	b. Disconnect power cable at air conditioner.	
	c. Remove insulating material from area around air conditioner.	
	d. Connect sling to lifting handles (4).	
	e. Position hoist (wrecker) next to shelter in order to lift air conditioner.	**WARNING** Air conditioner weighs 256 pounds (116.1 kg).
	f. Connect sling to two handles (one either side) on condenser section.	
	CAUTION The maintenance personnel MUST be visible to hoist or wrecker operator and in a position to guide air conditioner away from shelter.	

3.5 INSTALLATION OR REMOVAL. - Continued

Location/Item	Action	Remarks
Removal - Continued	g. Connect sling to hoist or wrecker.	
	h. Remove mounting bolts	
	i. Push air conditioner out of the conditioned area using the sling and hoist to hold and steady air conditioner.	Only push to point where sling can be hooked to front two handles.
	j. Attach sling to the front two handles.	
	k. Lift air conditioner from the mounting bracket and place on truck, tmansport trailer, or on the ground.	
	l. Remove sling.	

3. 6 PRELIMINARY SERVICING AND ADJUSTMENT OF EQUIPMENT. This task covers rechecking the installation and operationion of unit.

INITIAL SETUP

Applicable Configurations:

Test Equipment:
NONE

Special Tcols:
None

Materisls/Parts:
None

PersonnelRequired:
Unit Mantenace

Special Environmetal Coditions:
NOSE

General Safty Instructions:
See WARNING PAGE

References:
None

Troubleshooting References:
None

Location/Item	Action	Remarks
Shelter Air Conditioner	a. Check that fabric cover is rolled up end secure.	
	b. check that airflow to and from condenser is free of anything that will block airflow.	
	c. Keep ALL sources of heat et least 10 feet (30.4 m) from condenser coil.	
	d. Keep ALL sources of dangerous or objectionable fumes at least 10 feet (30.4 m) from fresh air intake.	Automobile or truck exhaust, refuse container fuel containers, etc.
	e. Check electrical connections.	
	f. See Chapter 2, Sections I and Ill.	
	g. Operate Unit	
	(1) Cool, high and low	
	(2) Heat, high and low	
	(3) Vent, high and low	
	(4) Fresh air open	

3.6 PREMIMINARY SERVICING AND ADJUSTMENT. - Continued

Location/Item	Action	Remarks
Shelter Air Conditioner - Continued	(5) Fresh air dosed h. Check if air conditioner electrically interferes with other shelter electrical equipment. i. Refer to paragraph 3.7 for neutral removal procedure.	Ground can be isolated from neutral.

3.7 REMOVAL NEUTRAL JUMPER (GROUND ISOLATION). This task covers removal of neutral jumper.

INITIAL SETUP

Applicable Cmfigurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
None

Equipment Descriptions:
Power OFF; renoved from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting Refrences:
None

Personnel Required:
Refrigeration Specialist

Location/Item	Action	Remarks
Removal	a. Disconnect power supply.	**WARNING** High voltage can kill.
	b. If unit is installed, it must be removed for this procedure.	Paragraph 3.5
	c Remove all three top covers.	
	d. Remove jurnper from terminal board TB4, terminals 1 and 2.	

3.7 REMOVAL NEUTRAL JUMPER (GROUND ISOLATION). - Continued

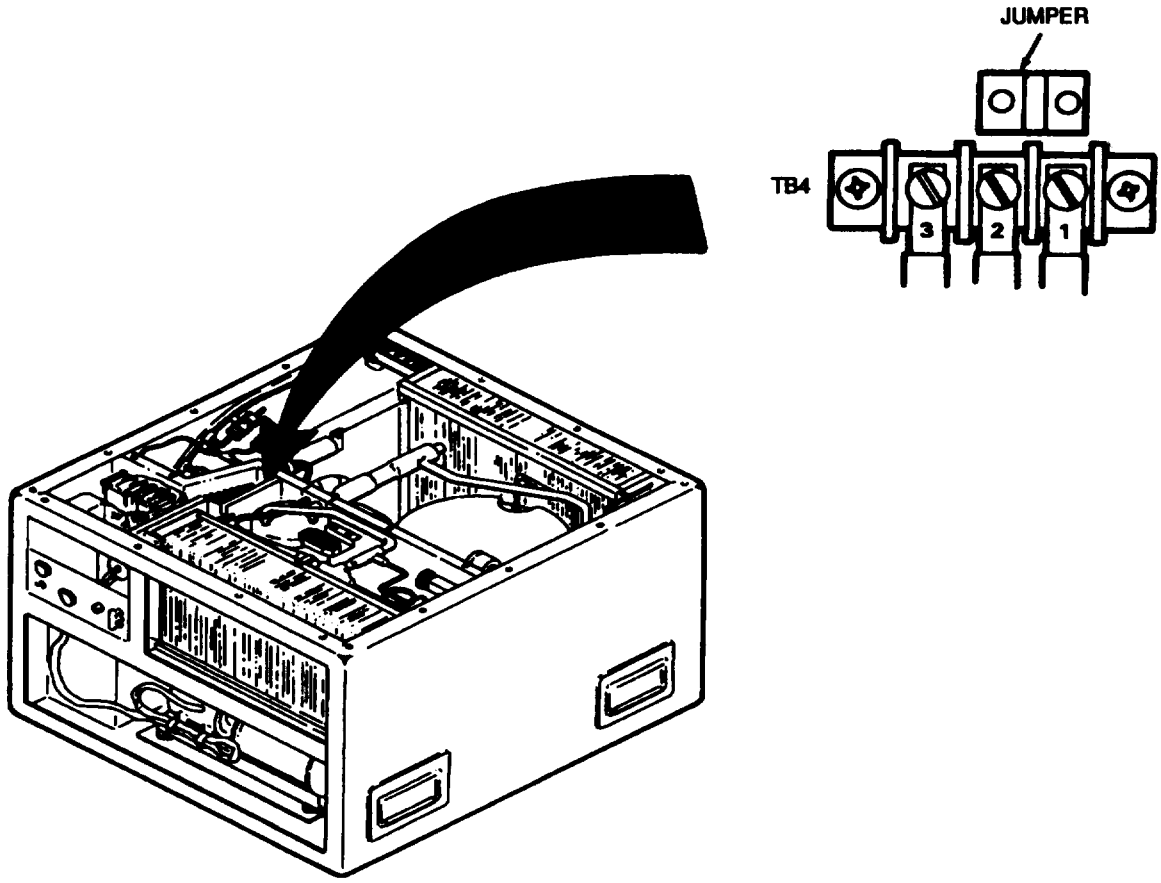


Figure 3-11. Neutral Jumper Removal

Location/Item	Action	Remarks
Removal - Continued	e. Place tag on air conditioner to indicate that NEUTRAL jumper has been removed. f. Replace top covers. g. Install air conditioner. h. Doublecheck that unit is grounded.	Paragraph 3.5

3.8 LOW PRESSURE CUTOOUT JUMPER. This task covers jump;er across Low pressure Cutout (LPCO).

INITIAL SETUP

Applicable Configurations as:

Test Equipment
None

Special Tools:
None

Materials/Parts:
None

Personnel Required:
Utilities Equipment Repairer

Special Evironmentall Conditions:
None

General Safely Instructions:
See WARNING page

References
None

Troubleshooting References:
None

3.8 LOWER PRESSURE CUTOUT JUMPER. - Continued

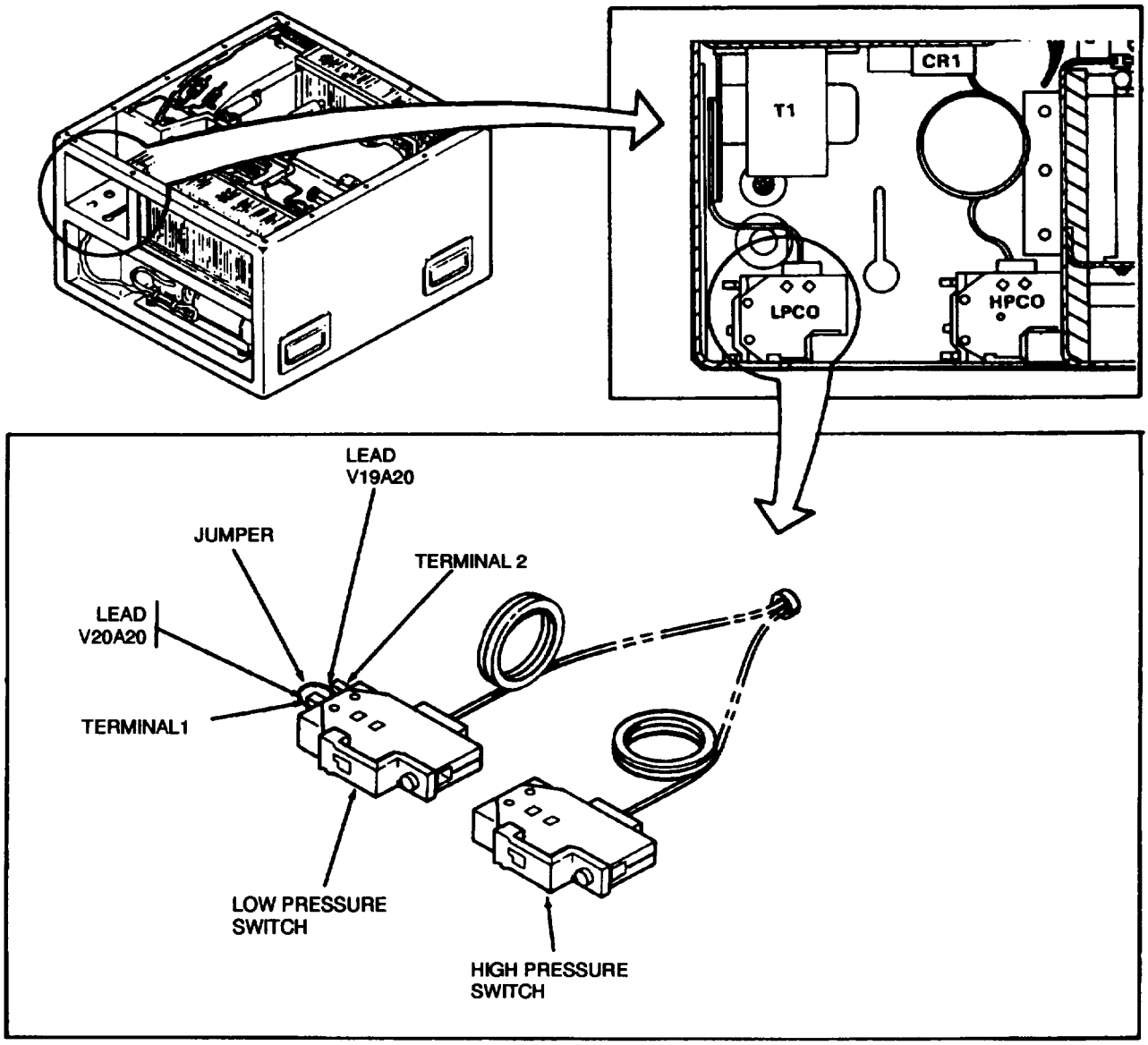


Figure 3-12. Jumper Across LPCO

3.8 LOW PERSSURE CUTOUT JUMPER. - Continued

Location/Item	Action	Remarks
LPCO Jumper	a. Disconnect power supply to air conditioner.	**WARNING** Shut off power before beginning any maintenance. High voltage can kill.
	b. Remove cover from top of evaporator section.	
	c. Remove screws and pull control panel from frame. Use care to avoid breaking or kinking the sensing line.	Sensing line is copper tube connected between TEMPERATURE SELECTOR and SENSING BULB which is behind the return air louver.
	d. Place jumper between terminals 1 and 2 of low pressure contact.	Check that jumper will not short out against frame of control panel.
	e. Fabricate CAUTION tag to place on control panel to show that low pressure cutout has been bypassed.	**CAUTION** Air conditioner low pressure cutout has been bypassed. Compressor will not shut off under low suction pressure conditions.
	f. Push control panel back into frame. Use care to avoid breaking or kinking sensing line and the LPCO jumper.	
	g. Replace top cover.	
	h. Connect power supply.	
	i. Remove jumper when outside temperature increases to 40°F (5 °C).	

CHAPTER 4

TROUBLESHOOTING

4.1 TROUBLESHOOTING.

4.1.1 This section contains troubleshooting information for locating and correcting moat of the operating troubles which may develop in the air conditioner.

NOTE

This is a combined troubleshooting covering Unit, Direct and General Suppmt Maintenance. Refer to the Maintenance Allocation Chart (MAC), Appendix B, for tasks authorized to your level of maintanece.

4.1.2 Before using the troubleshooting guides, perform an operating check. Impossible, isolate the problem to either equipment failure or control failure.

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

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

Be careful not to contact high voltage connections. Keep one hand away from the equipment reduce the hazard of current flowing through vital organs of the body. Do not be misled by the term ''low voltage." Potentials as low as 50 volts may cause death under adverse conditions.

NOTE

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

Table 4-1. Operational Status

Component	Cool		Vent		Heat	
	High	Low	High	Low	High	Low
Compressor	On	On	Off	Off	Off	Off
Condenser Fan Motor	On HIGH or LOW	On HIGH or LOW	Off	Off	Off	Off
Evaporator Fan Motor	On HIGH	On LOW	On HIGH	On LOW	On HIGH	On LOW
Solenoid Valve L1[1]	On	On	Off	Off	Off	
Solenoid Valve L2[1]	On/Off	On/Off	Off	Off	Off	Off
Heaters, 1st Stage	Off	Off	Off	Off	On	Off
Heaters, 2nd Stage	Off	Off	Off	Off	On/Off	On/Off

[1]Solenoid valves are normally open. When unit is de-energized, valves are open. L1 would be open or de-energized during cooling; L2 would be closed or energized during cooling.

Table 4-2. Troubleshooting Symptom Index

Primary Symptom	Secondary Symptoms/Conditions				Troubleshooting Procedures Paragraph
	Compressor	Evaporator Blower	Condenser Blower	Heaters	
Air Conditioner Fails To Start In Any Mode	X	X	X	X	4.2
Evaporator Blower Fails To Start	Starts	X	Starts	Heat	4.3
Compressor Fails To Start	X	Starts	X Starts	NA	4.4
Condenser Fan Fails To Start	Starts X	Starts	X	NA	4.5
Little Or No Cooling Action	Starts	Starts	Starts	NA	4.6
Cooling Action Stops After Operating For Short Time	X	X	X	NA	4.7

Table 4-2. Troubleshooting Symptom Index - Continued

Primary Symptom	Secondary Symptoms/Conditions				Troubleshooting Procedures Paragraph
	Compressor	Evaporator Blower	Condenser Blower	Heaters	
Little Or No Heating In Low Heat Mode	NA	Starts	NA	X Some Heat X No Heat	4.8
Little Or No Additional Heating In High Heat	NA	Starts	NA	X Some additional heat X No additional heat	4.9
Temperature Selector Effective	Starts	Starts	Starts		4.10
Unusual Noise Or Vibration	Starts	Starts	Starts	Starts	4.11
Unit Runs In COOL, But Discharge Air Is Warm	Starts	Starts	Starts	NA	4.12
Frosted Evaporator Coil	Starts	Starts	Starts	NA	4.13
Excessive Head Pressure	Starts and Stops	Starts	Starts	NA	4.14
Low Head Pressure	Starts	Starts	Starts	NA	4.15
Excessive Suction Pressure	Starts	Starts	Starts	NA	4.16
Low Suction Pressure	Starts and Stops	Starts	Starts	NA	4.17

Table 4-3. Electrical Components Tests

No.	Procedure
1	Circuit Breakers CB1 and CB2. Check continuity of the two circuit breakers. Tag and disconnect leads from circuit breaker. Using a multimeter, check continuity of each pair of terminals. Replace defective circuit breaker. There is a double throw switch on circuit breaker CB1. See paragraphs 5.14 and 5.15.

Table 4-3. Electrical Components Tests - Continued

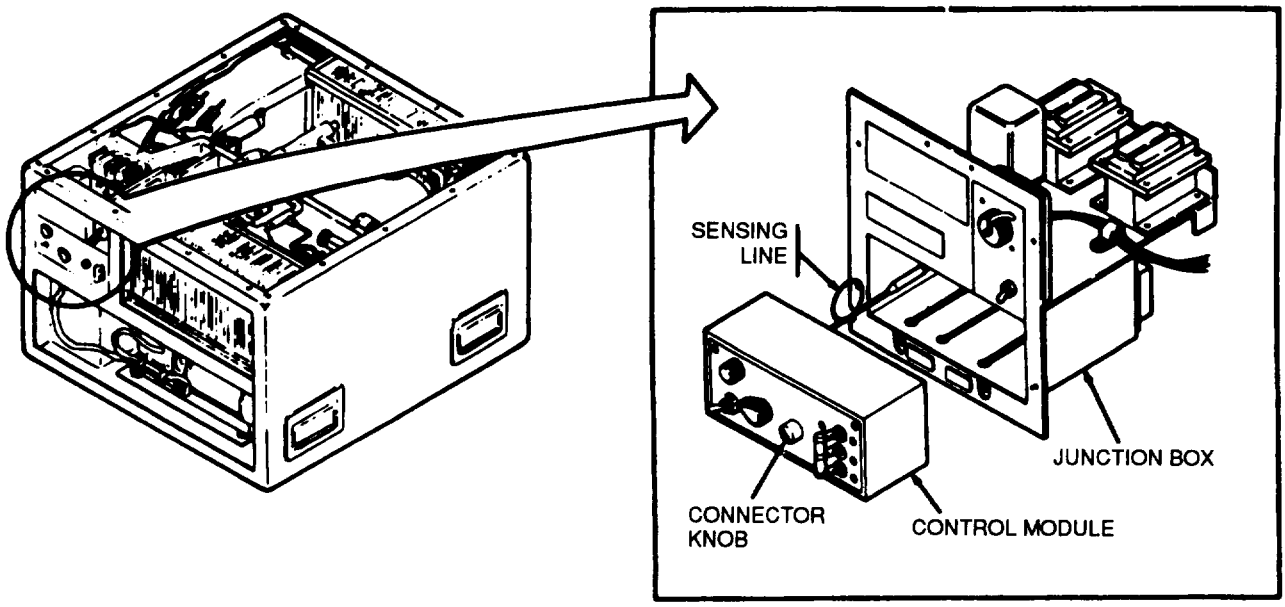
No.	Procedure
2	Time Delay Relay K1. Apply 28 volts DC to terminals 2 and 5: positive to terminal 2 and negative to terminal 5. Check across terminals 2 and 3 to see that contact is made within 30 ± 3 seconds of energizing the coil. Replace defective relay. See paragraph 5.9.
3	Relay K2 and K3. Test each relay in the same manner. Apply 28 volts DC to terminals X1 and X2: positive to X1 and negative to X2. Check continuity of pairs: A1 - A2, B1 - B2, and C1 - C2. Replace defective relay. See paragraph 5.10.
4	Relay K4. Relay K4 is an 11 pin continuous duty, three pole, double throw, 24 volt DC coil relay. When the coil is activated by thermostatic switch S7, contacts 1 - 3, 5 - 11, and 10 - 8 open and terminals 1 - 4, 5 - 6, and 10 - 7 close. See paragraph 5.8. **NOTE** Pins 5 - 6 and 5 - 11 are not used in single-phase unit model F18H. Apply 28 volts DC to terminals 2 and 9: positive to terminal 2 and negative to terminal 9. Check continuity. Terminals (contacts) 1 - 3, 5 - 11, and 10 - 8 should be closed; 1 - 4, 5 - 6, and 10 - 7 should be open. Remove the power. Terminals 1 - 4, 5 - 6, and 10 -7 should be closed; 1 - 3, 5 - 11, and 10 - 8 should be open. Replace defective relay.
5	Transformer T1. Apply 115 volts AC, 120 watts, to input terminals 1 and 2 (F18H, F18H-3, or F18H-4) or 2 and 5 (F18H-3A, F18H-4A, or MHP-20-4-08). Voltage at output terminals 3 and 4 (F18H, F18H-3, or F18H-4) or 7 and 8 (F18H-3A, F18H-4A, or MHP-20-4-08) should be 28 to 30 volts AC, 4 amps. Remove power from transformer. Replace defective transformer. See paragraph 5.7.
6	Rectifier CR1. Apply 28 - 30 volts AC to rectifier terminals 1 and 3. Output at terminals 4 and 2 should be 26 to 30 volts DC. Terminal 4 is negative and terminal 2 is positive. Replace faulty rectifier. See paragraph 5.6.
7	Mode Selector Switch S1. Check continuity of selector switch in all positions. See table 4-4 or table 4-5. See paragraph 5.11.
8	Temperature Selector S3. Remove the return air louver and air filter. Carefully remove the sensing bulb from the damped position. Place the sensor bulb in a container of warm water 85°F to 100°F (30° to 40°C). Turn knob from the extreme WARMER to extreme COOLER position. Continuity should be indicated. See paragraph 5.12. Place the sensor bulb in a container of cold water 40° to 65°F (5° to 18°C). Turn the knob from the extreme COOLER to the extreme WARMER position. Continuity should be indicated.
9	Fan Speed Switch S2 (all models except MHP-20-4-08). Check continuity in both positions. Continuity should be indicated. See paragraph 5.13.

Table 4-3. Electrical Components Tests - Continued

No.	Procedure
10	Motors B2 and B3. Disconnect power from the unit. Spin the fan/blower. Listen for bearing noise. If bearing noise is evident, turn shaft slowly backward and forward to check for roughness. Use multimeter and check that no continuity exists between each pin and motor frame. Replace defective motor. See paragraph 6.29.
11	Relay K5. (Single phase only.) Apply 230 volts single phase, 60 Hertz to terminals 1 and 5. Contact which is across 1 and 2 should open at voltage rise between 180 to 190 volts. Remove voltage. Contact should dose upon voltage drop between 115 and 55 volts. Rating of relay is 5180 ohms. See paragraph 5.18.
12	Condenser Fan Switch S7. Tape the bulb of a thermometer or junction of a thermocouple to the sensing part of the switch. Disconnect plug P7 and connect multimeter to the connector. Gradually apply heat and observe both the thermometer and multimeter. Contact shall be open until temperature reaches 100°F (38°C) and above, at which time contact should close. Allow temperature to drop. Contact should open at below 100°F (38°C). Remove meter and connect plug. See paragraph 5.27.
13	Hester Thermostat S6. Visually inspect the heater thermostat for crack in the housing, missing pieces or other damage. Replace. See paragraph 5.28. a. Using a multimeter, check continuity of the wire leads attached to terminals 1 and 2, and 3 and 4 of the heater thermostat. Continuity should be indicated. b. Tape the bulb of a thermometer or junction of a thermocouple to the body of the heater thermostat, and leave the continuity tester connected to terminals 1 and 2. Gradually apply heat, and observe both the thermometer and the continuity tester. Continuity should drop out at 194° ± 9°F (90° ± 5°C). While still continuing to watch the thermometer end the continuity tester, let the heater thermostat cool. Continuity should be re-established at 142° ± 17°F (61° ± 9°C). c. Repeat Step b. with the meter connected to terminals 3 and 4. d. If the heater thermostat does not meet temperature and continuity requirements, replace it.
14	Heater HR1 through HR6. The six steel sheathed resistance heating elements are located immediately behind the evaporator coil and extend all the way across the width of the evaporator. Three of the elements are energized when the selector switch is set at LOW HEAT, and all six elements are energized when the selector switch is set at HIGH HEAT. The temperature control thermostat controls only the elements energized by the LOW HEAT setting. All six elements are protected against overheating by a thermal overload protector (heater thermostat). See paragraph 5.29.

Table 4-3. Electrical Components Tests - Continued

No.	Procedure
14 - Continued	**WARNING** Hot heaters can cause severe burns. a. Visually inspect each heating element for damage, deformation, damaged terminal threads, cracked or broken sheath, or burnt-out spots. b. If damaged, replace. c. Using an ohmmeter, multimeter or other continuity tester, check continuity of each heating element. Replace elements that do not indicate continuity.



NOTE

Sensing line connects TEMPERATURE SELECTOR to sensing bulb which is located behind return air louver.

NOTE

The connector knob was supplied on units prior to 1983. This knob is not supplied on F18H-3A or F18H-4A units and is not required on existing F18H, F18H-3 or F18H-4 units. Use screwdriver slot in end of shaft.

Figure 4-1. Junction Box and Control Panel Removal

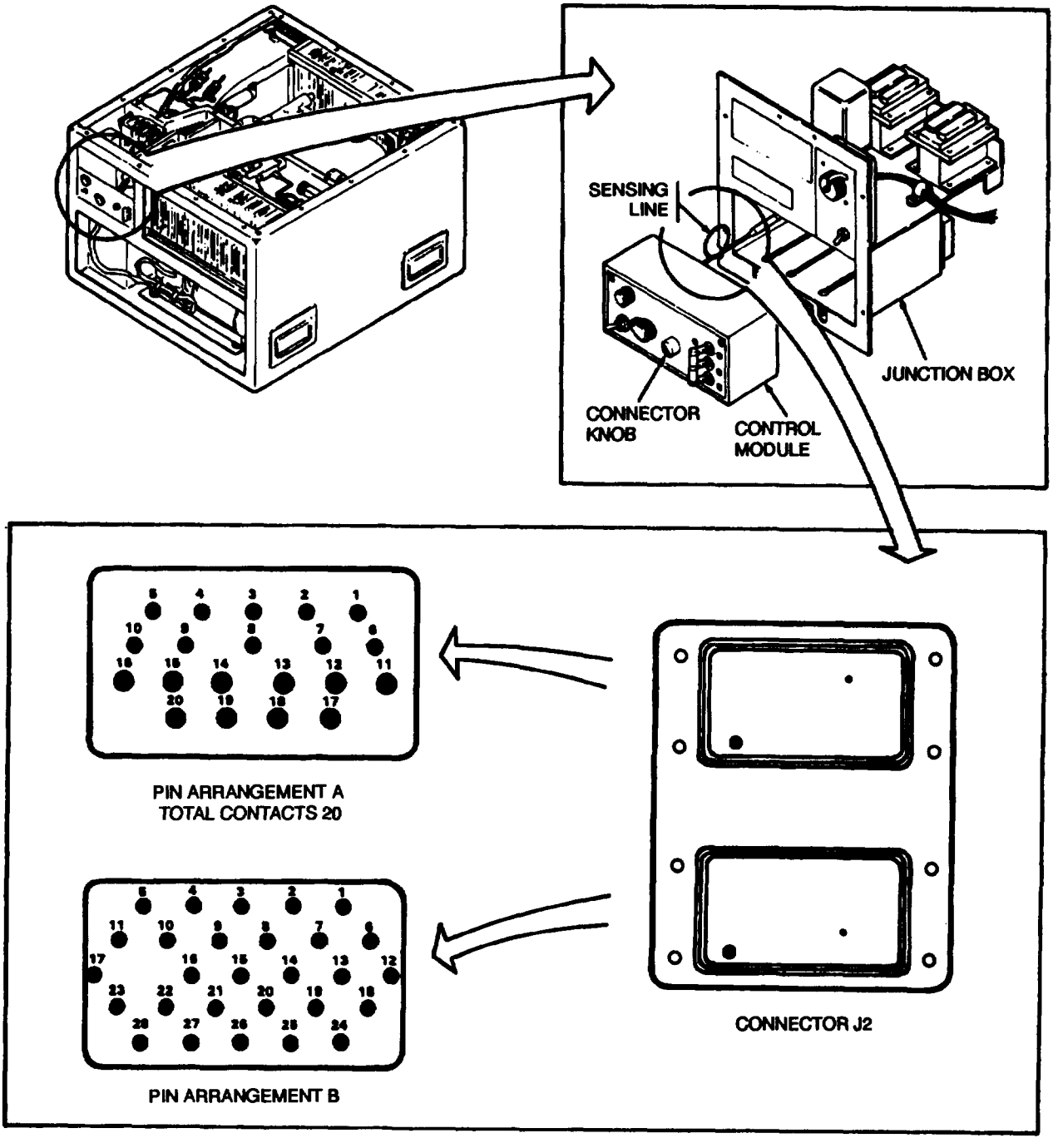


Figure 4-2. Terminal Location, Connector J2

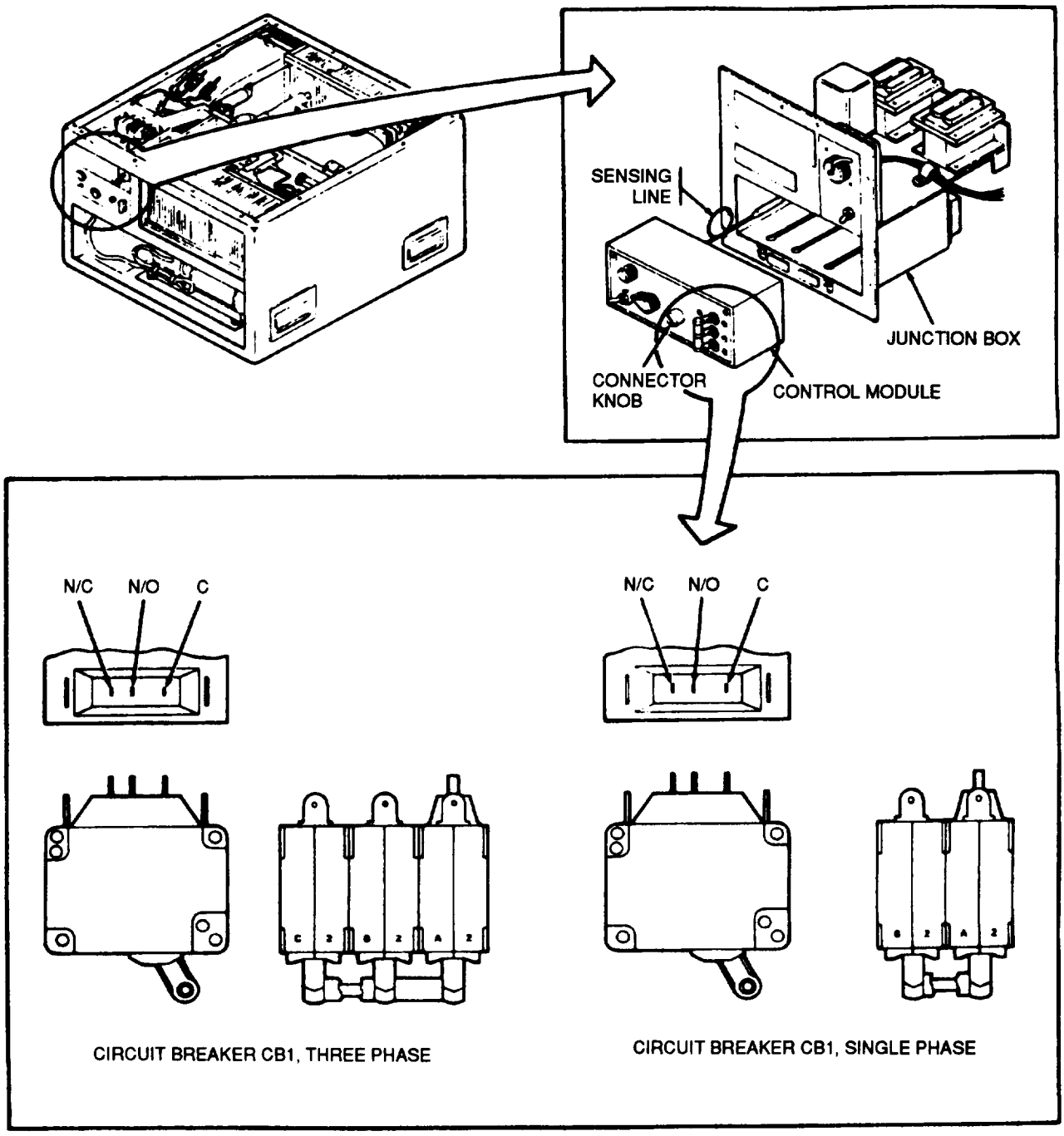
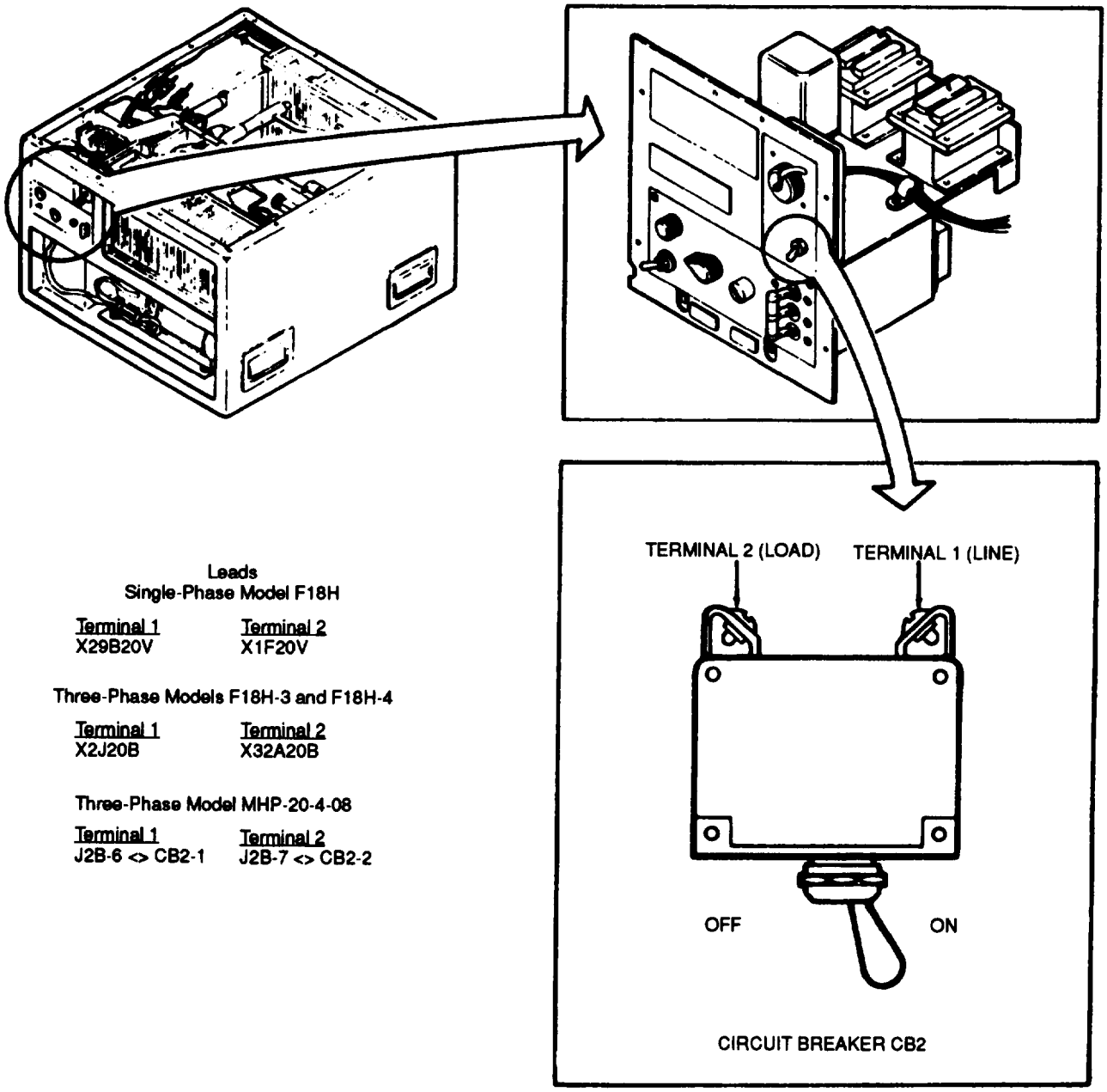


Figure 4-3. Terminal Location, Circuit Breaker CB1



Leads

Single-Phase Model F18H

Terminal 1	Terminal 2
X29B20V	X1F20V

Three-Phase Models F18H-3 and F18H-4

Terminal 1	Terminal 2
X2J20B	X32A20B

Three-Phase Model MHP-20-4-08

Terminal 1	Terminal 2
J2B-6 <> CB2-1	J2B-7 <> CB2-2

Figure 4-4. Terminal Location, Circuit Breaker CB2

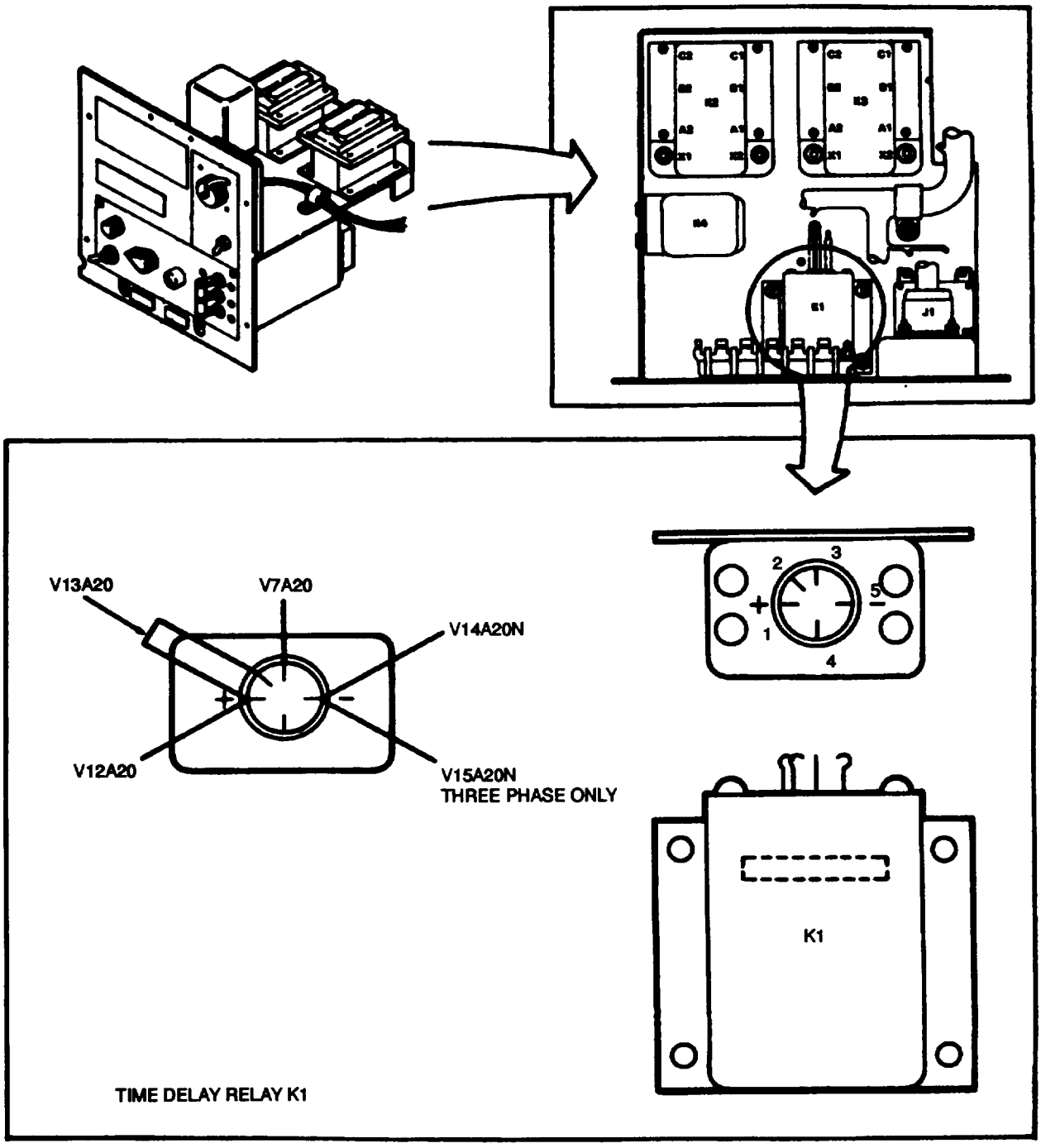


Figure 4-5. Terminal Location, Relay K1

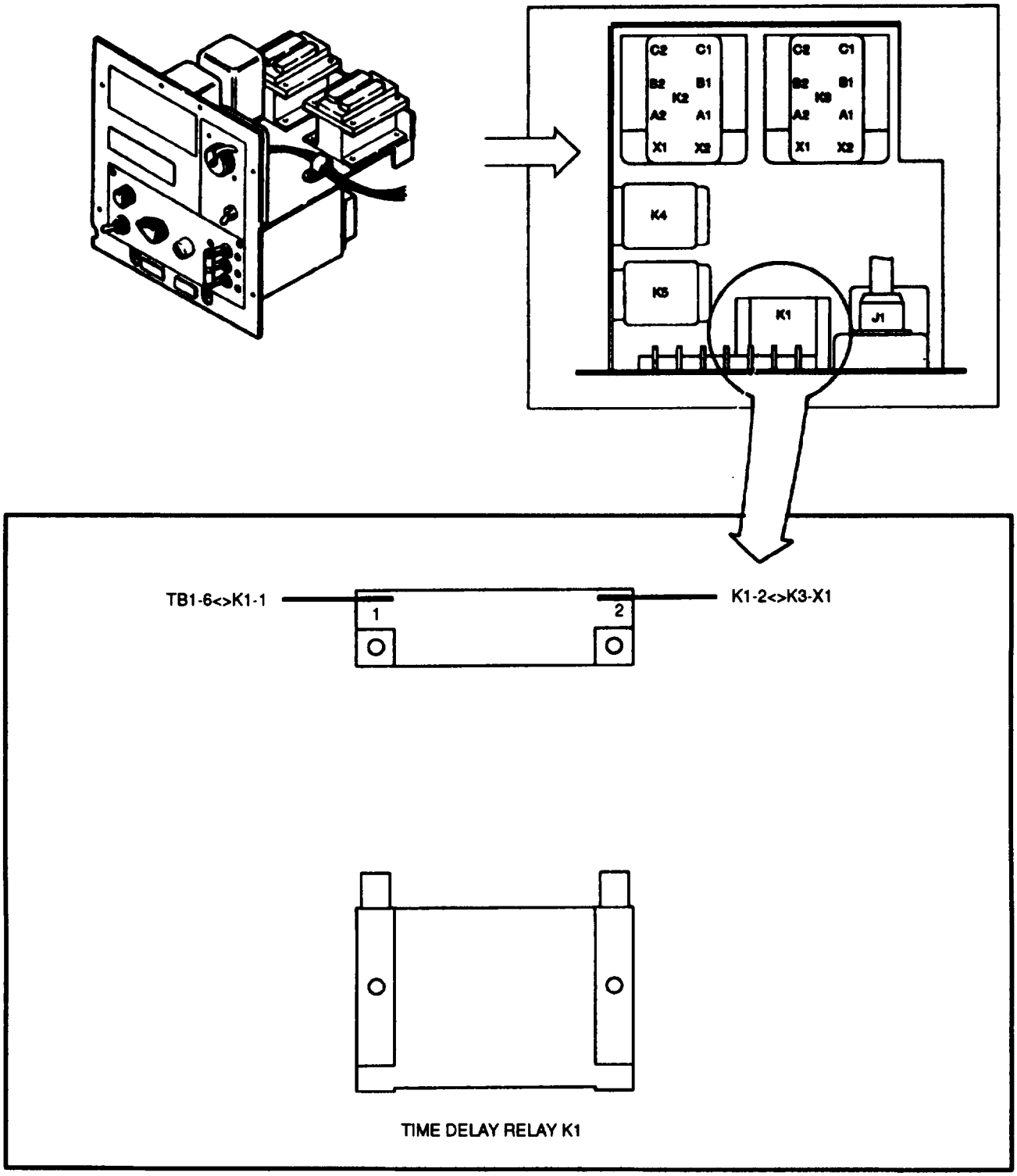
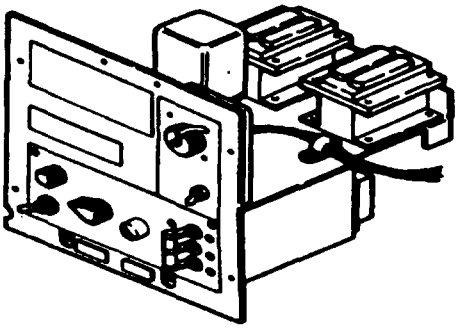


Figure 4-6. Terminal Location, Relay K1 (Model MHP-20-4-08)



RELAY K2

Model F18H

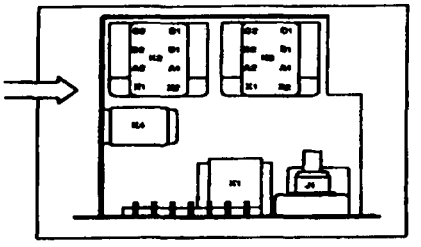
Wire No.	Terminal No.
X1E16V	A1
X2E16V	B1
Blank	C1
V3A20	X1
X32A16V	A2
X17B16V, X31A16V	B2
Blank	C2
V15A20N, V17A20N, and V16A20N	X2

Models F18H-3 & K1F-18H-4

Wire No.	Terminal No.
X1E16A	A1
X2J20B, X2E16B	B1
X3E16C	C1
V3A20	X1
X39A16A	A2
X60A16B	B2
X59A16C	C2
V15A20N, V16A20N, and V17A20N	X2

Model MHP-20-4-06

Wire No.	Terminal No.
K4-1<>K2-A1, TB1-1<>K2-A1	A1
TB1-2<>K2-B1, K4-5<>K2-B1	B1
TB1-3<>K2-C1, K4-10<>K2-C1	C1
J2B-5<>K2-X1	X1
K2-A2<>TB2-6	A2
K2-B2<>TB2-5	B2
K2-C2<>TB2-4	C2
K2-X2<>K3-X2, K2-X2<>K4-9	X2



RELAY K3

Models F18H-3 & K1F-18H-4

Wire No.	Terminal No.
X20C16B, X20B12A	A1
X22B12B, X2C16B	B1
X24B12C	C1
V7A20, V8A20	X1
X21A12A	A2
X23A12B	B2
X25A12C	C2
V10A20N, V17A20N, and V18A20N	X2

Model F18H

Wire No.	Terminal No.
X19C16X, X19B12V	A1
X23B12V, X23C16Y	B1
Blank	C1
V8A20, V7A20	X1
X20A12V, X21A12V	A2
X24A12V,	B2
Blank	C2
V10A20N, V17A20N, and X18A20N	X2

Model MHP-20-4-06

Wire No.	Terminal No.
J2A-14<>K3-A1, K3-A1<>J4-F	A1
J2A-15<>K3-B1, K3-B1<>J4-G	B1
J2A-16<>K3-C1	C1
K1-2<>K3-X1, K3-X1<>J9-B	X1
K3-A2<>J4-A	A2
K3-B2<>J4-B	B2
K3-C2<>J4-C	C2
K3-X2<>J8-B, K3-X2<>J9-A, and K2-X2<>K3-X2	X2

Figure 4-7. Terminal Location, Relays K2 and K3

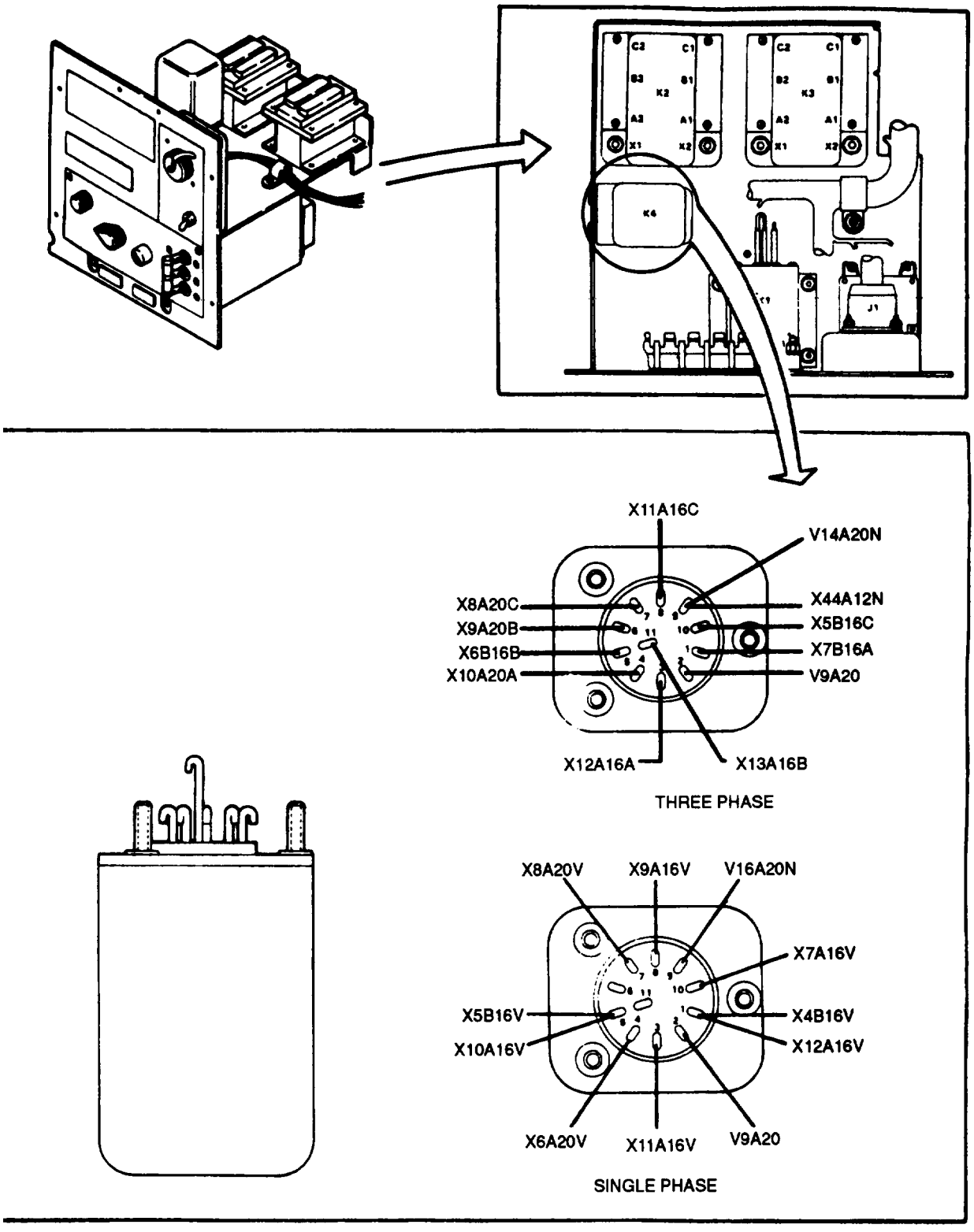
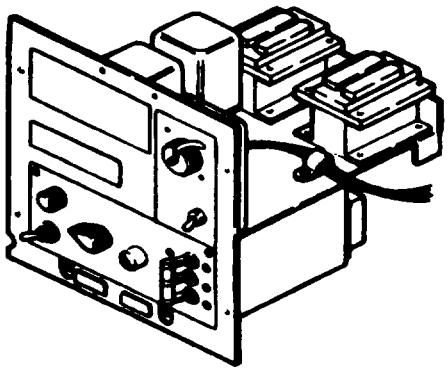
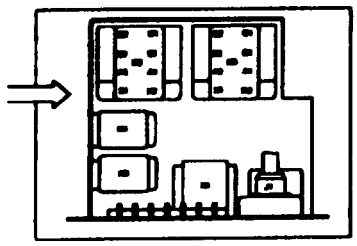


Figure 4-8. Terminal Location, Relay K4





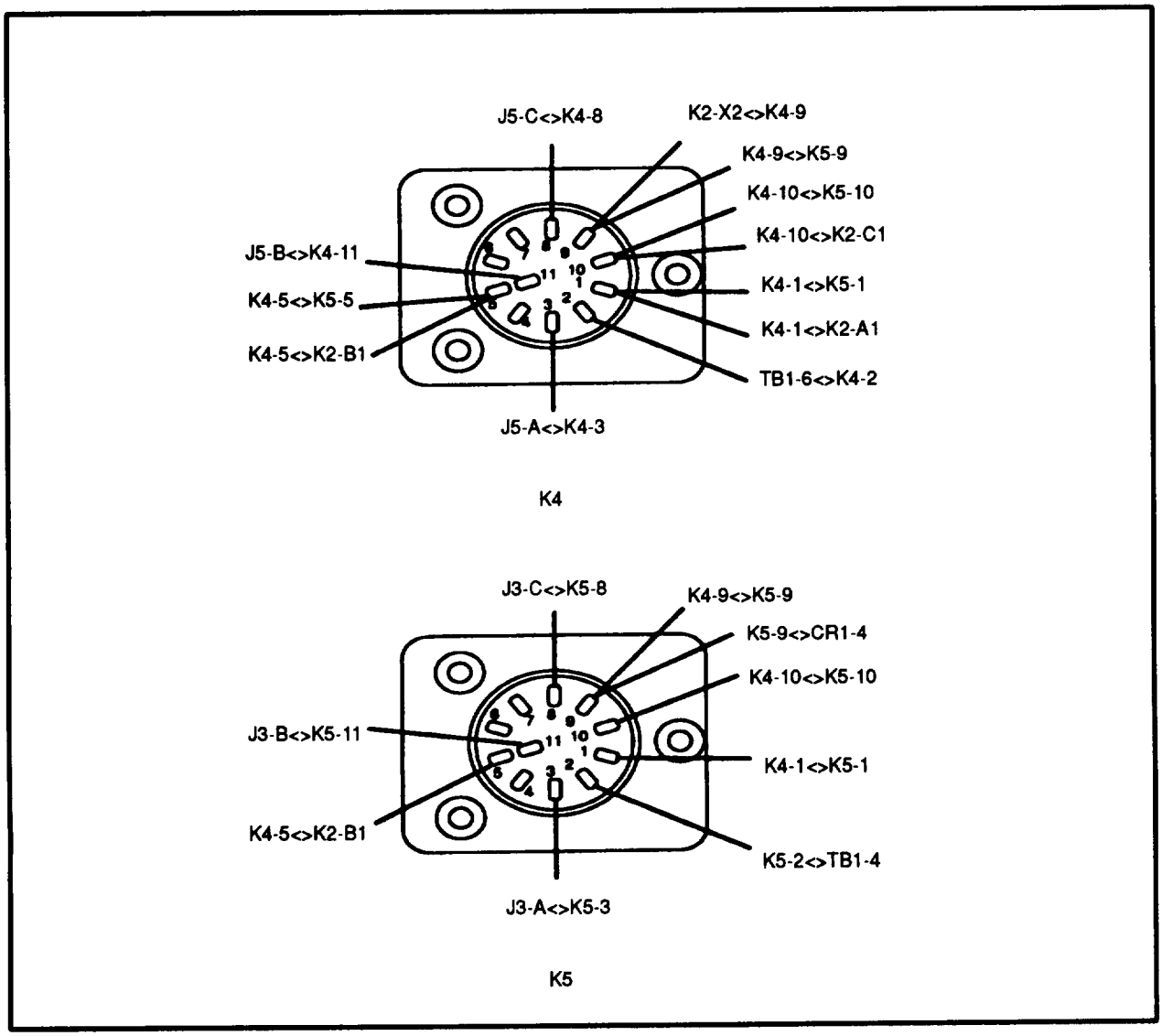


Figure 4-9. Terminal Location, Relays K4 and K5 (Model MHP-20-4-08 Only)

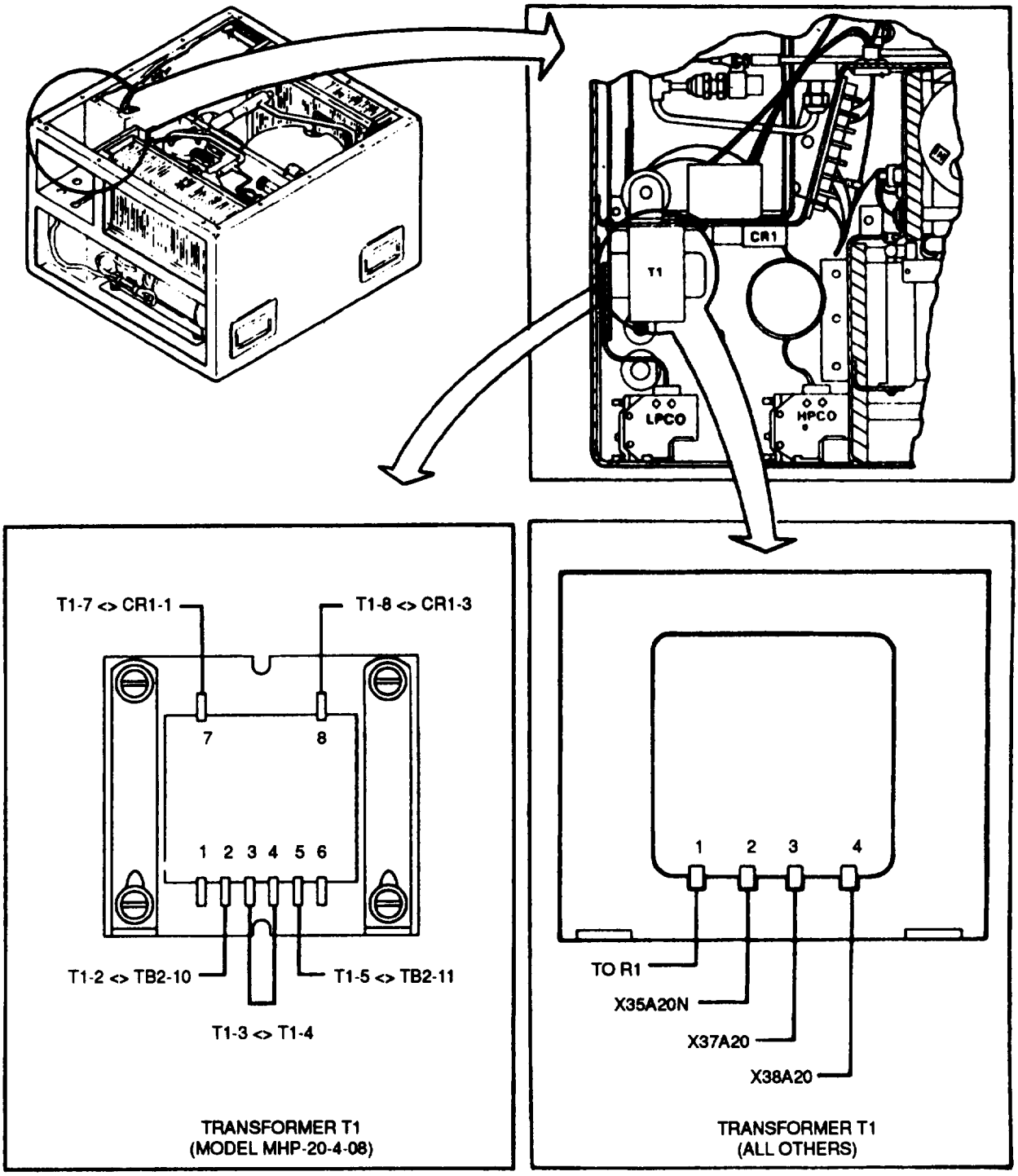


Figure 4-10. Terminal Location, Transformer T1

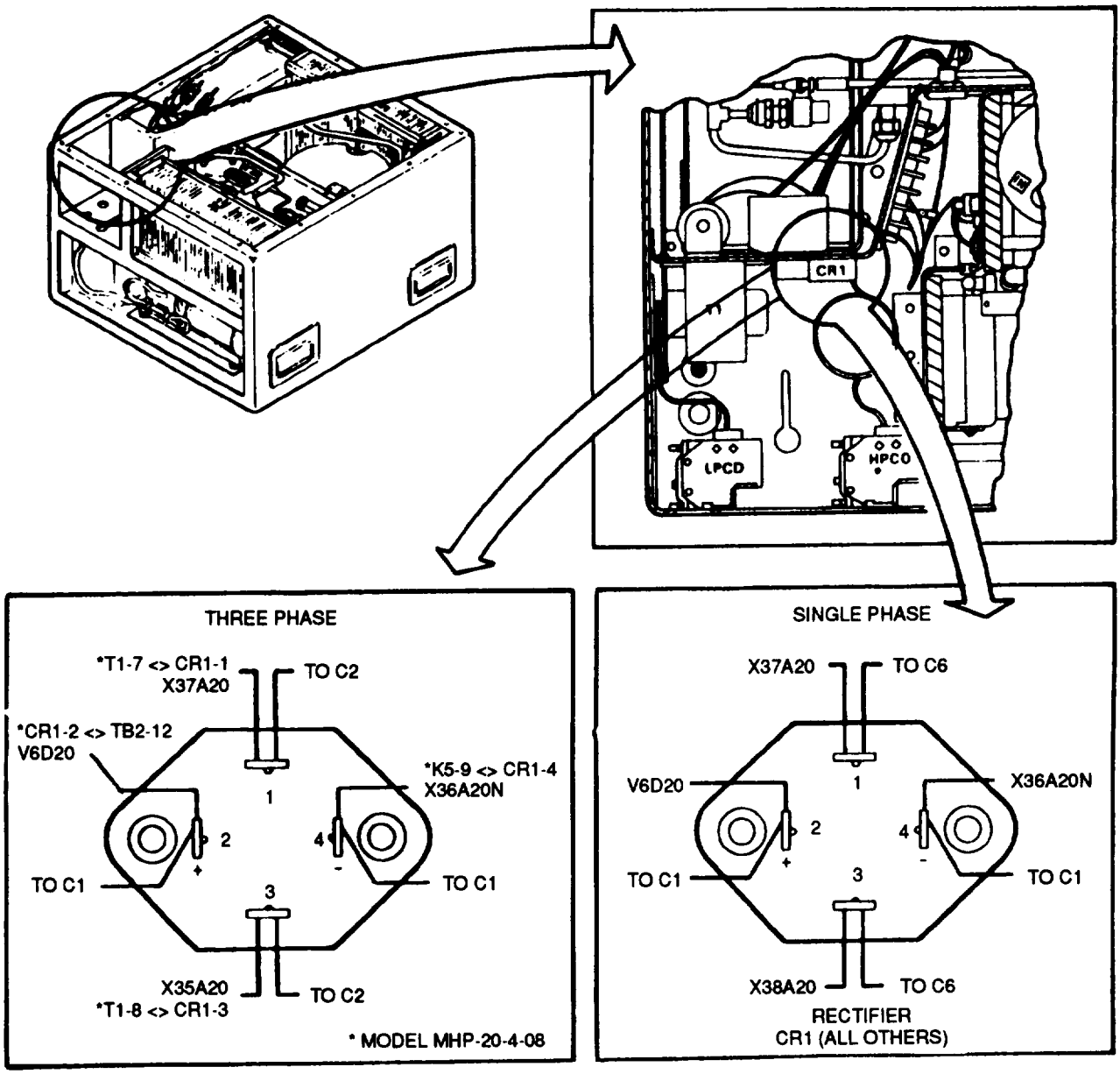


Figure 4-11. Terminal Location, Rectifier CR1

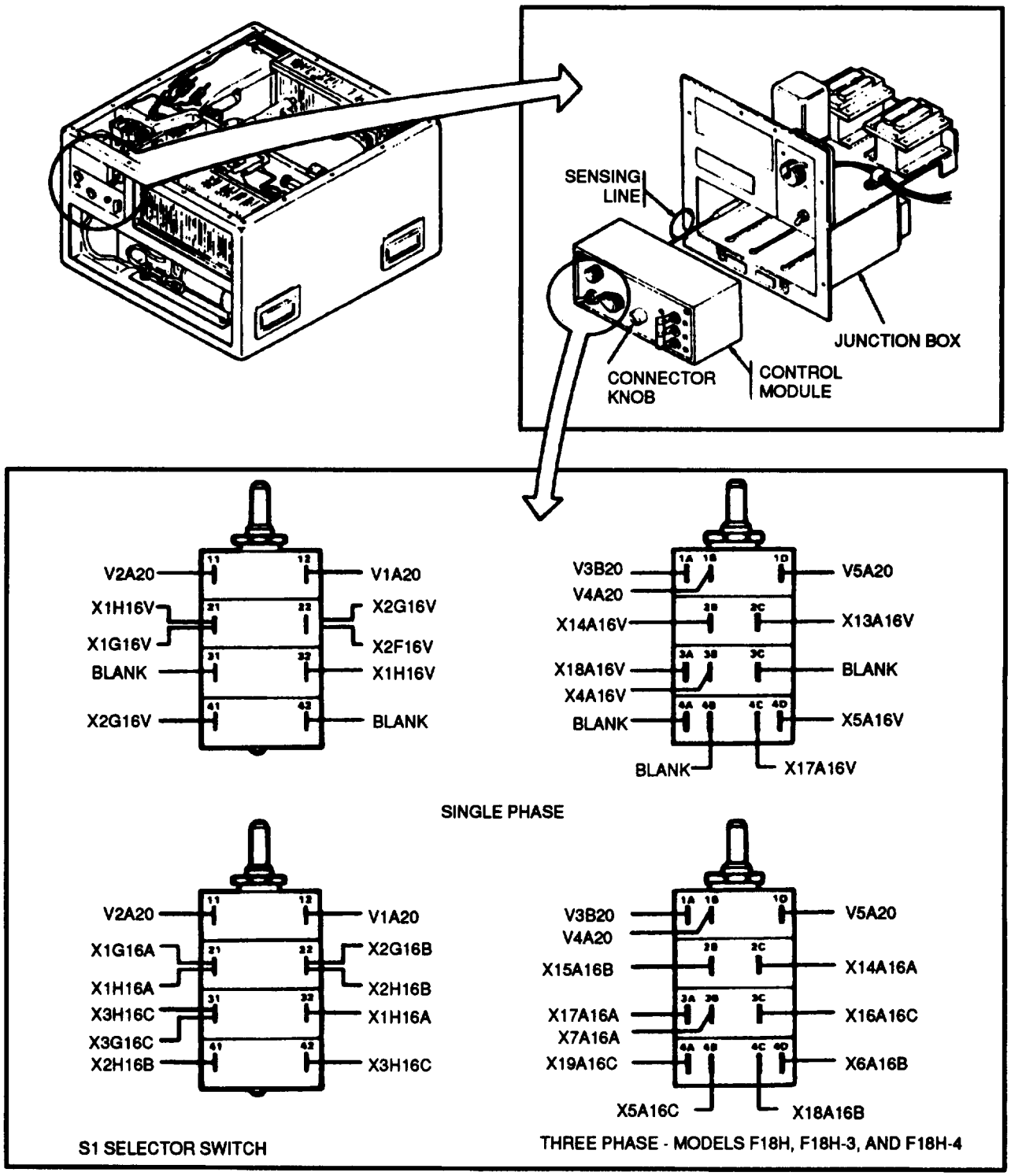


Figure 4-12. Terminal Location, Mode Selector Switch S1

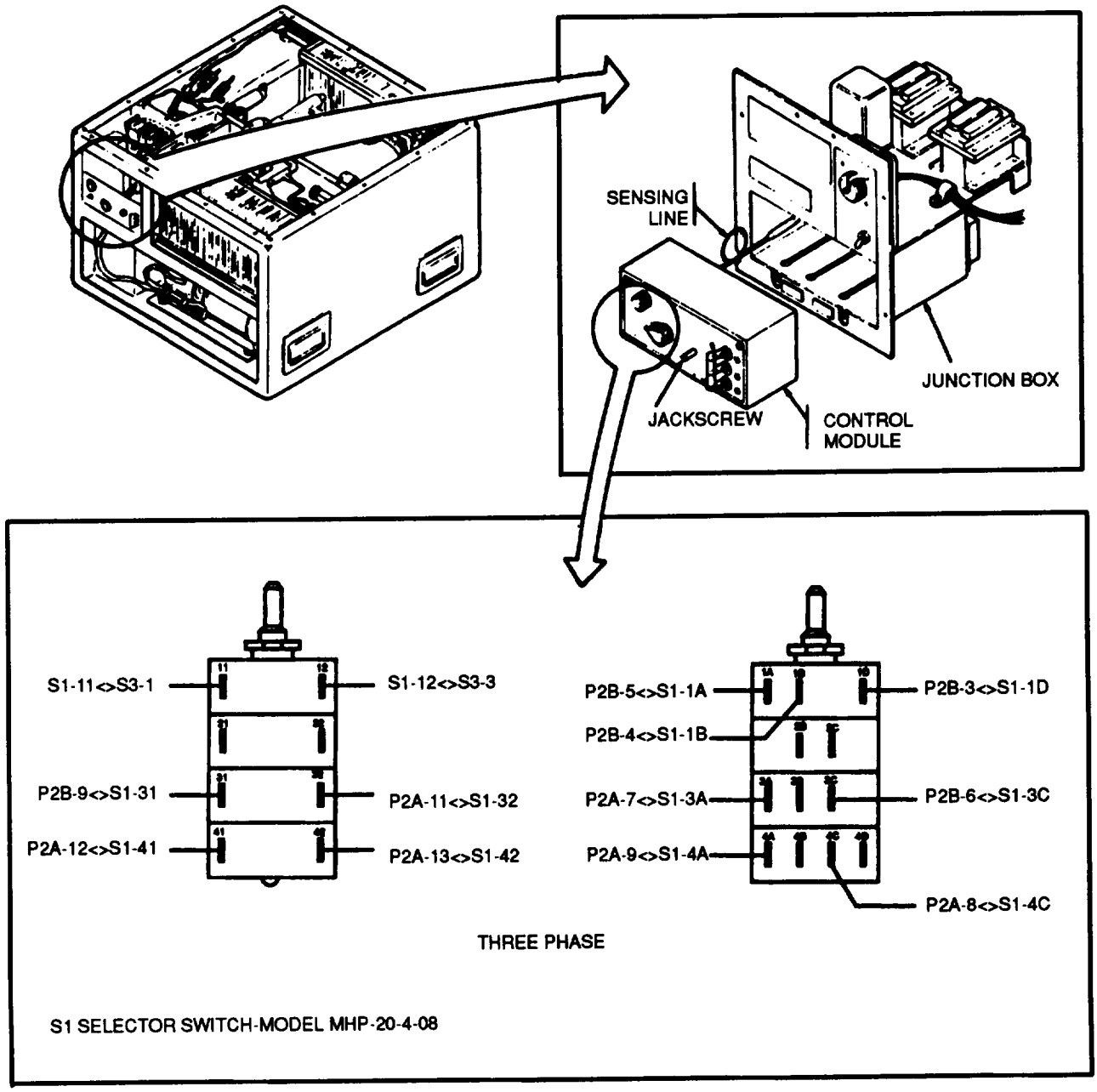


Figure 4-13. Terminal Location, Mode Selector Switch S1

Table 4-4. Model F18H Mode Switch Positions (Single Phase)

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

Table 4-5. Medals F18H-3 and F18H-4 Mode Switch Positions (Three Phase)

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

Table 4-6. Model MHP-20-4-08 Mode Switch Positions (Three Phase)

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

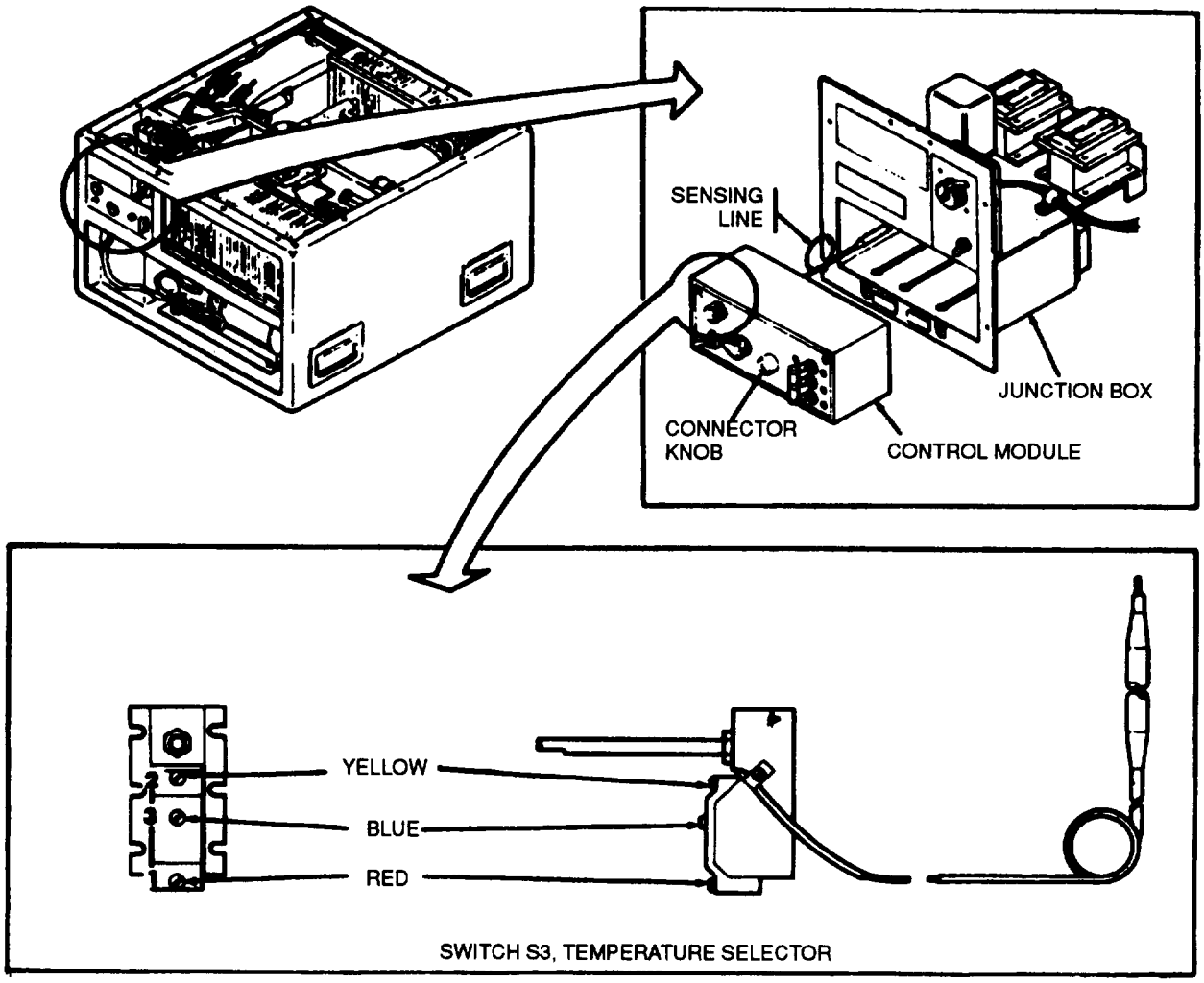


Figure 4-14. Terminal Location, Temperature Selector Switch S3

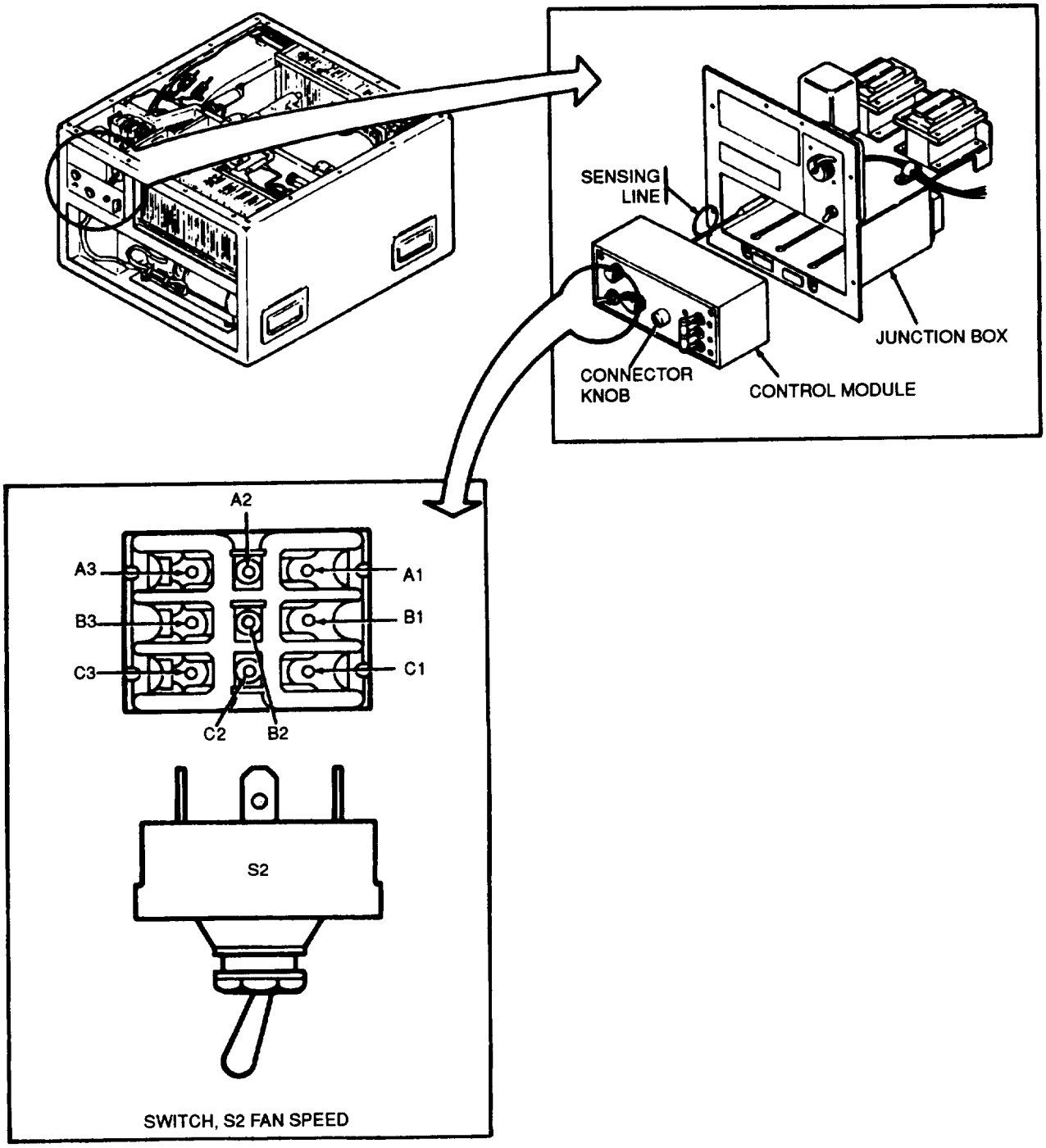


Figure 4-15. Terminal Location, Fan Speed Switch S2

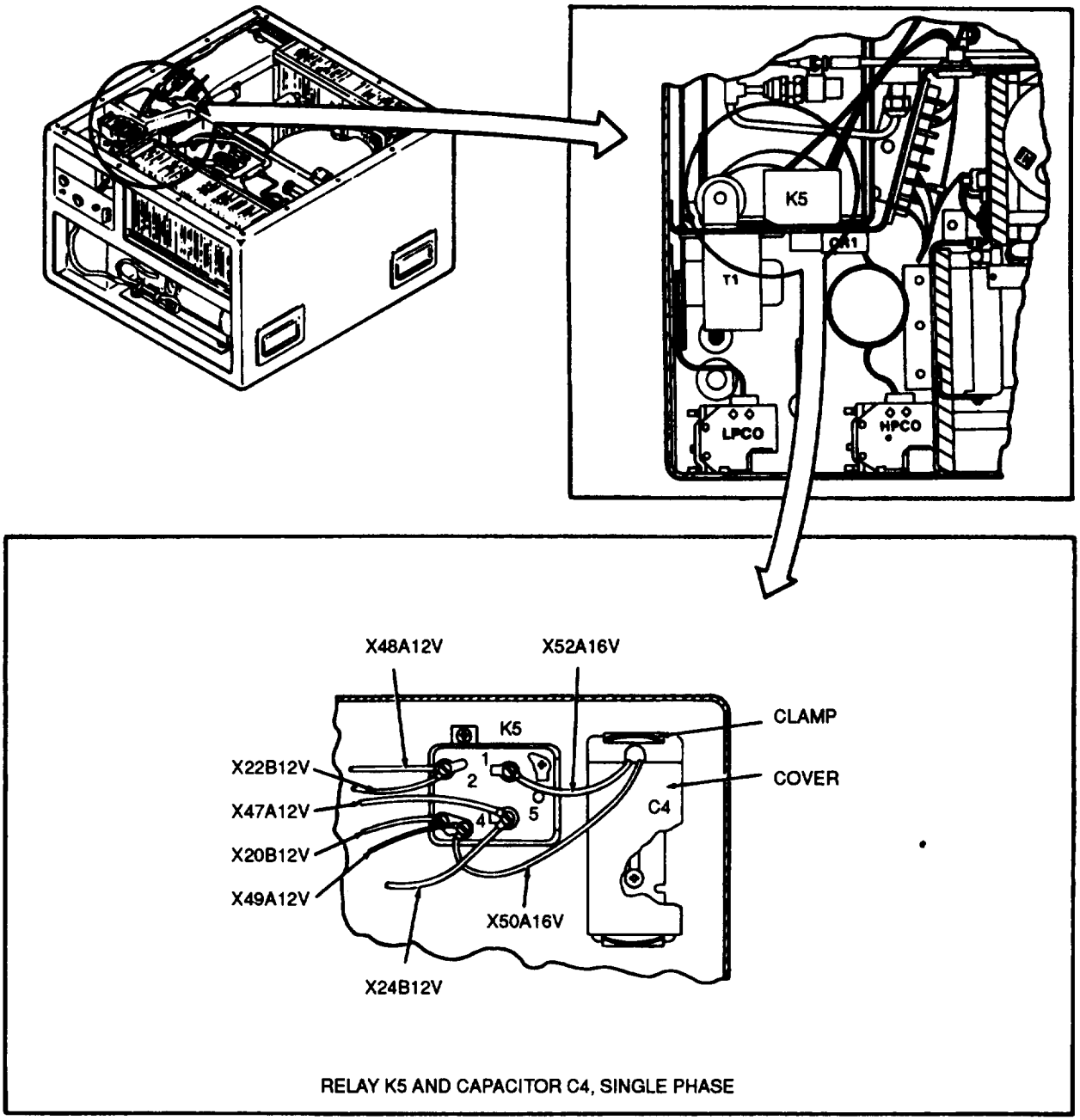


Figure 4-16. Terminal Location, Relay K5 and Capacitor C4 (Single Phase)

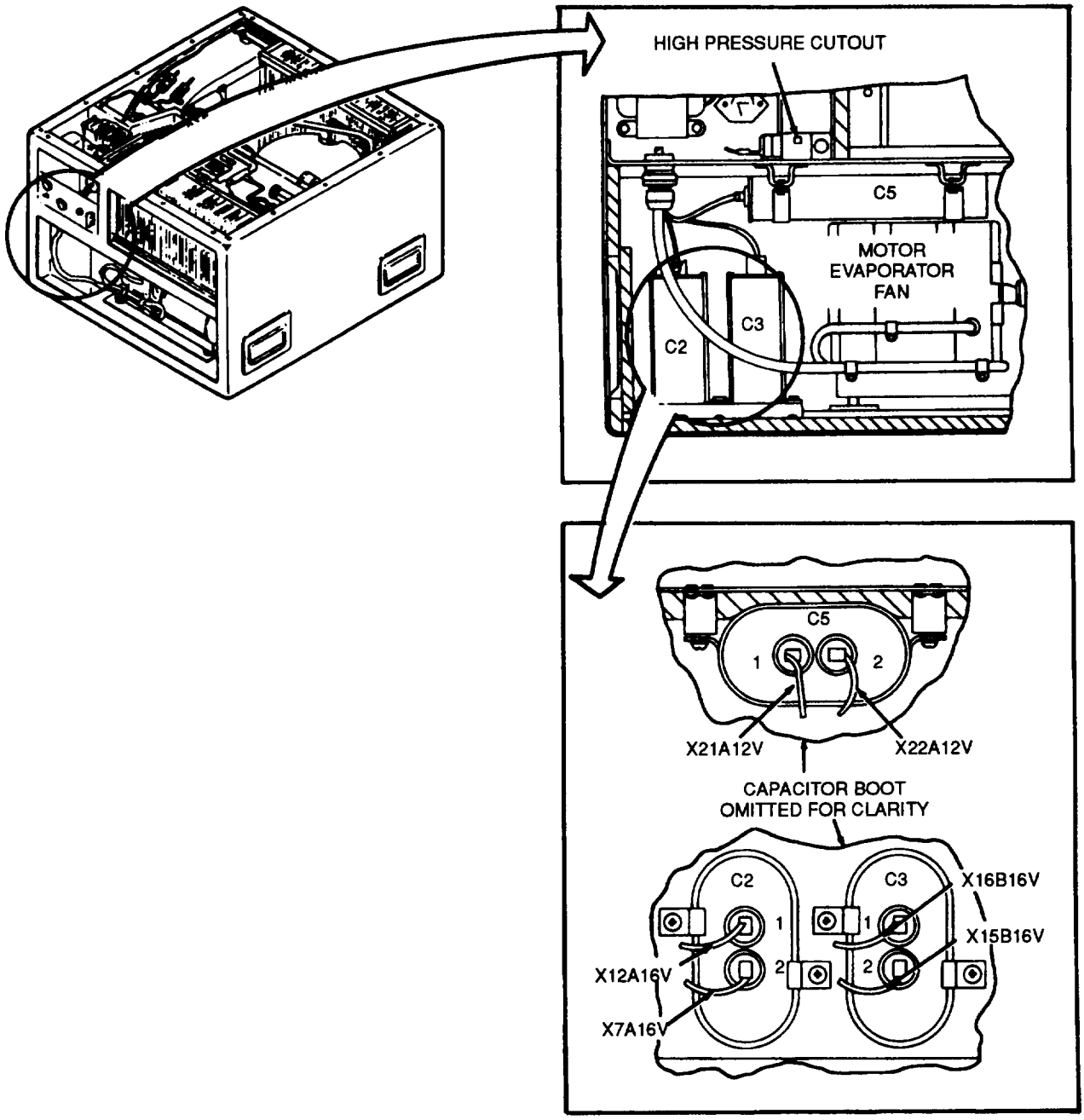


Figure 4-17. Terminal Location, Capacitors C2, C3, and C5 (Single Phase)

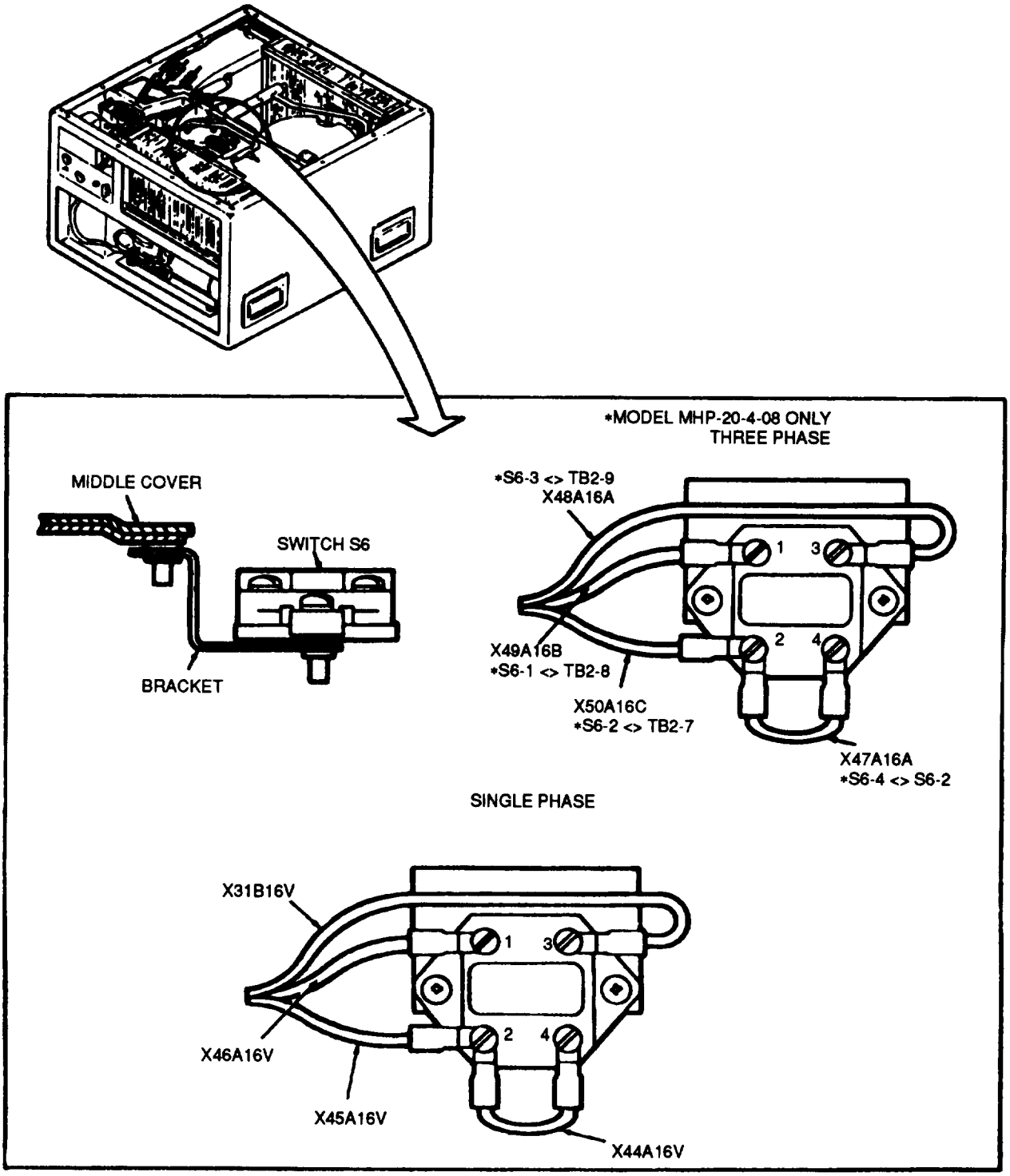


Figure 4-18. Terminal Location, Heater Thermostat S6 (Overheat Safety)

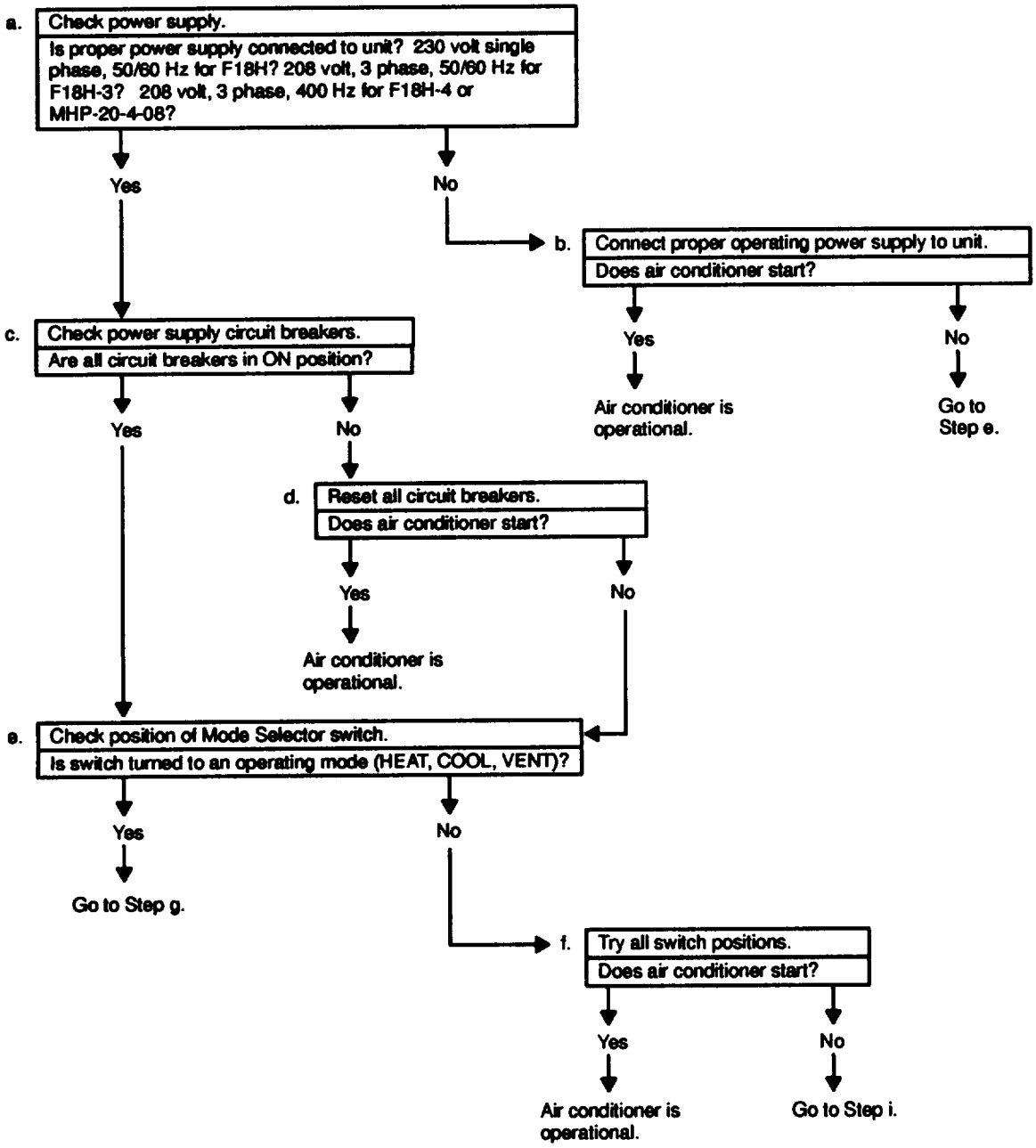
4.2 AIR CONDITIONER FAILS TO START IN ANY MODE.

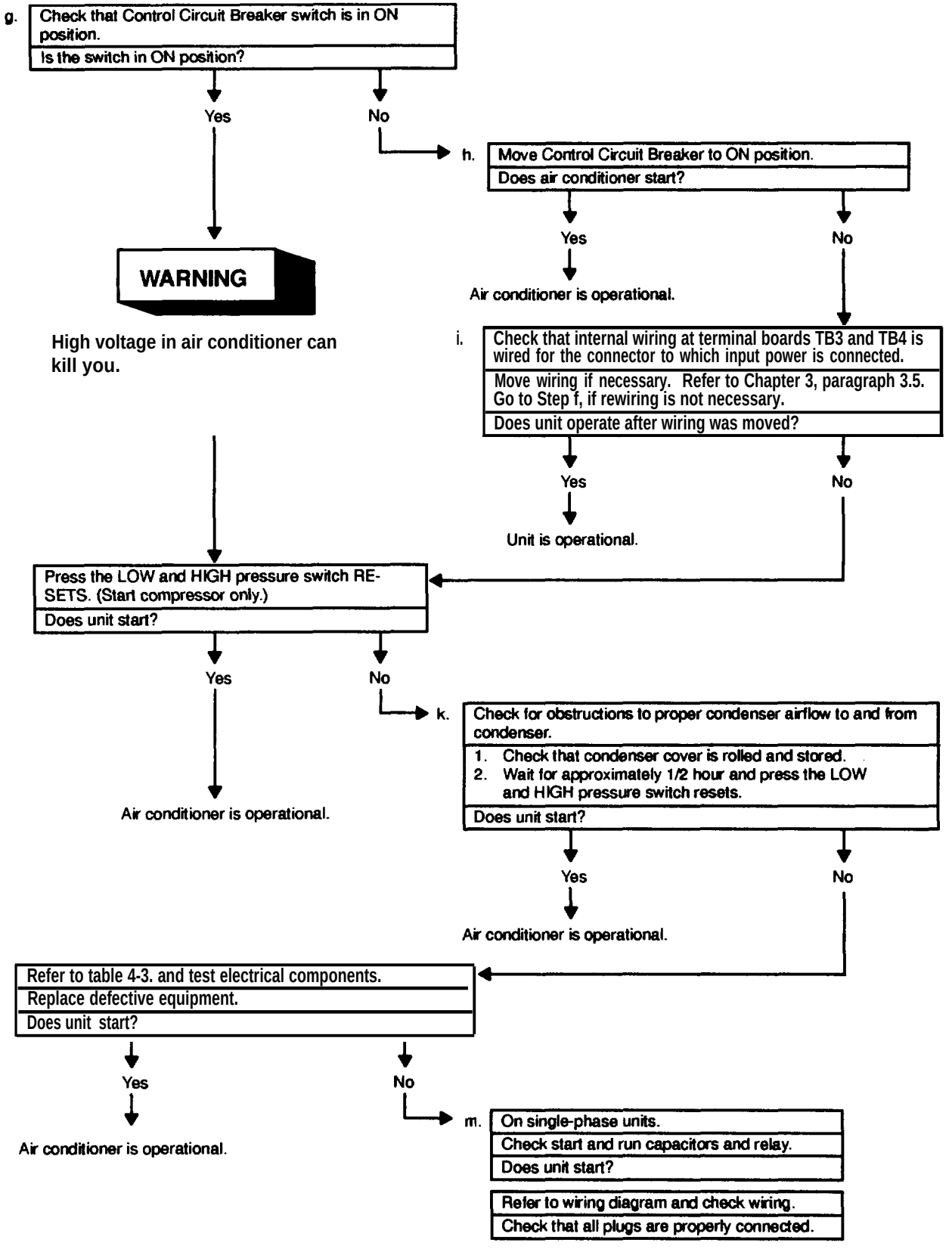
WARNING

High voltage in air conditioner can kill you.

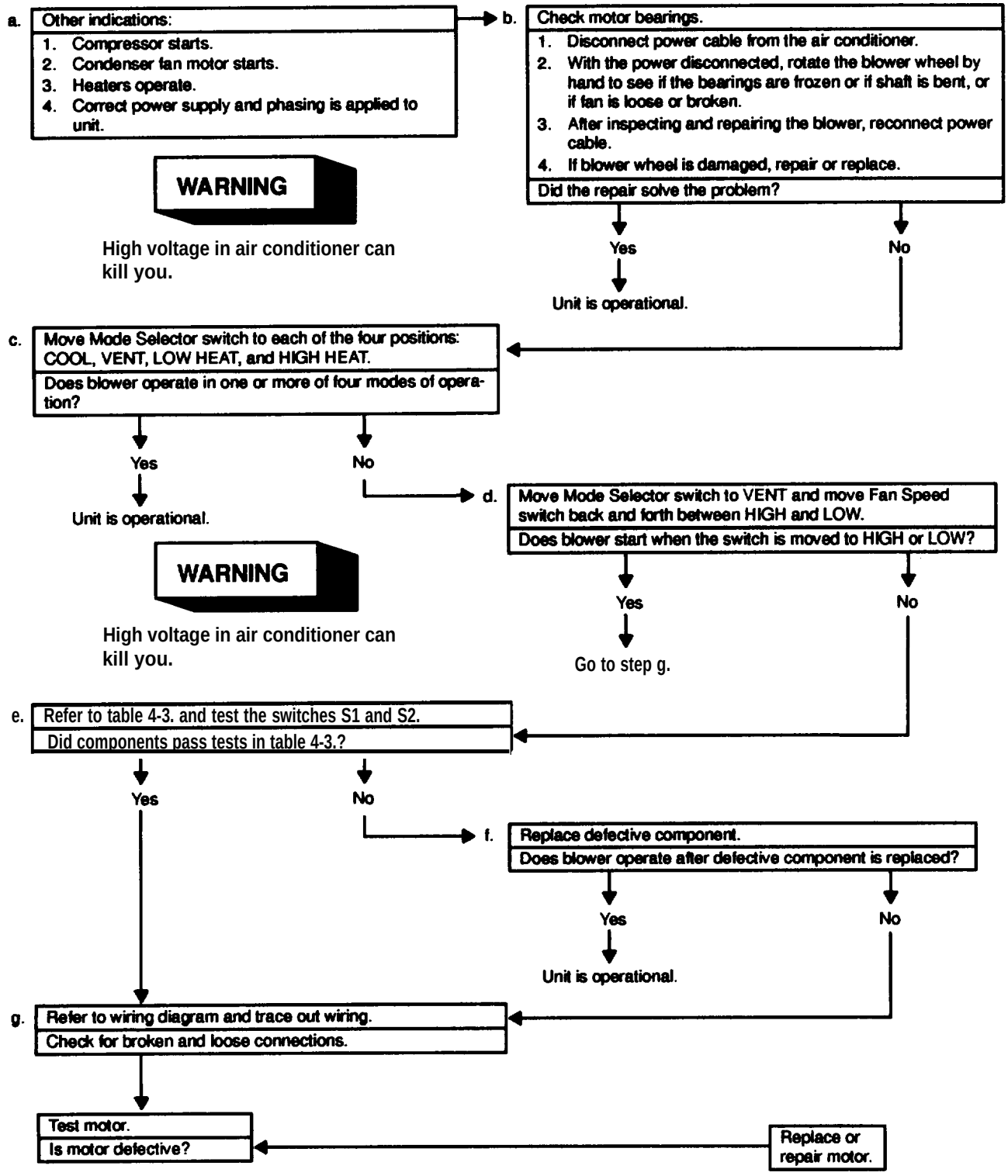
NOTE

Evaporator blower will operate in one speed without the control circuit.

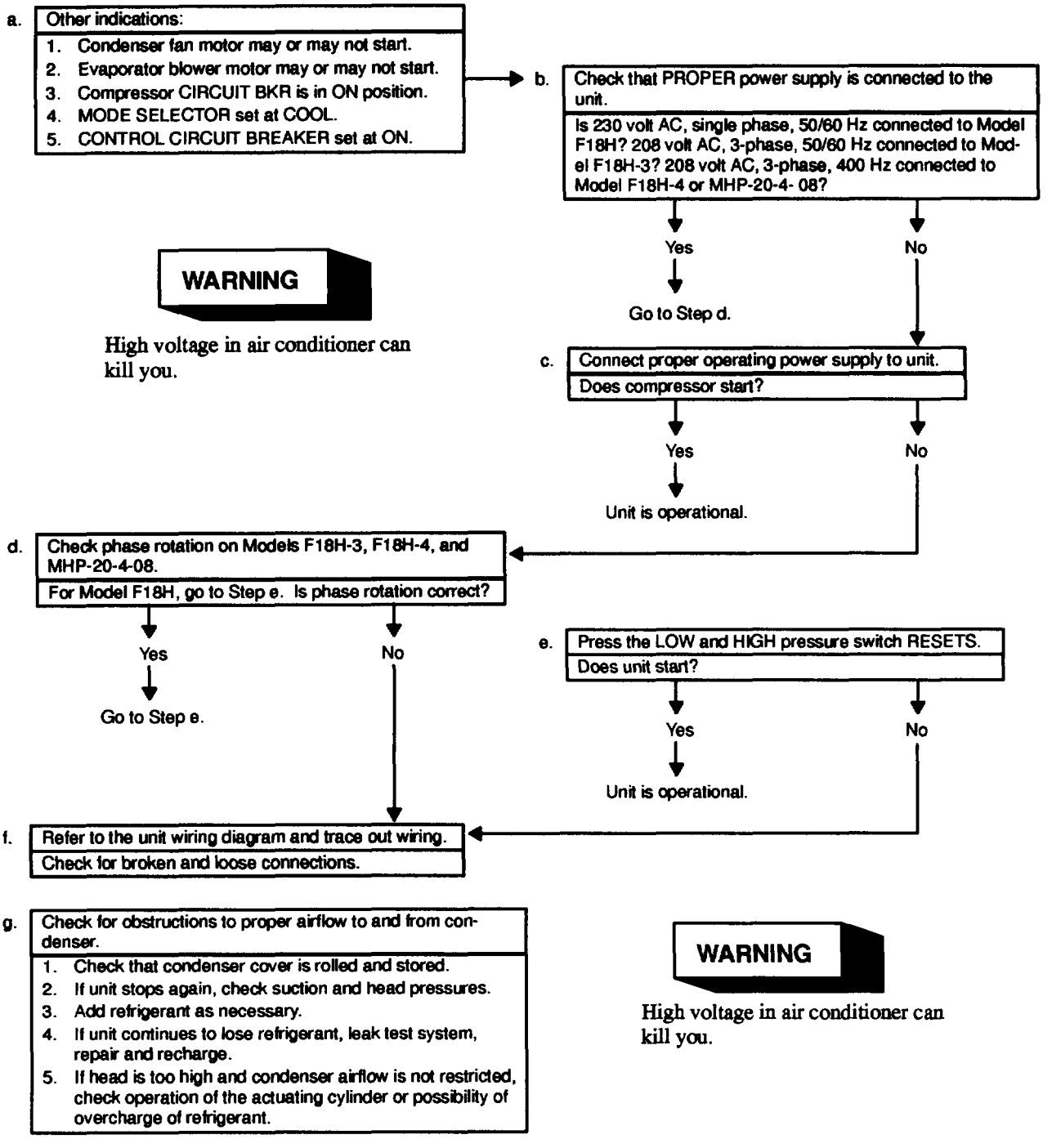



g.
Check that Control Circuit Breaker switch is in ON position.
Is the switch in ON position?
Yes
No
h.
Move Control Circuit Breaker to ON position.
Does air conditioner start?
Yes
No
Air conditioner is operational.
WARNING
High voltage in air conditioner can kill you.
i.
Check that internal wiring at terminal boards TB3 and TB4 is wired for the connector to which input power is connected.
Move wiring if necessary. Refer to Chapter 3, paragraph 3.5. Go to Step f, if rewiring is not necessary.
Does unit operate after wiring was moved?
Yes
No
Unit is operational.
Press the LOW and HIGH pressure switch RE-SETS. (Start compressor only.)
Does unit start?
Yes
No
Air conditioner is operational.
k.
Check for obstructions to proper condenser airflow to and from condenser.
1. Check that condenser cover is rolled and stored.
2. Wait for approximately 1/2 hour and press the LOW and HIGH pressure switch resets.
Does unit start?
Yes
No
Air conditioner is operational.
l.
Refer to table 4-3. and test electrical components.
Replace defective equipment.
Does unit start?
Yes
No
Air conditioner is operational.
m.
On single-phase units.
Check start and run capacitors and relay.
Does unit start?
Refer to wiring diagram and check wiring.
Check that all plugs are properly connected.

4.3 EVAPORATOR BLOWER FAILS TO START.



4.4 COMPRESSOR FAILS TO START.



4.5 CONDENSER FAN FAILS TO START.

a. Other indications:
1. Evaporator blower motor may or may not start.
2. Compressor CIRCUIT BKR is in ON position.
3. MODE SELECTOR set at COOL.
4. CONTROL CIRCUIT BREAKER set at ON.

b. Check bearings.
1. Disconnect power cable from the air conditioner.
2. With the power disconnected, rotate fan by hand to see if the fan is binding or loose on motor shaft.
3. Check to see if fan is rubbing and/or sticking against the fan inlet.
4. Repair as necessary.
5. Reconnect power cable.

Did this repair solve the problem?

Yes → Unit is operational.

No →

WARNING

High voltage in air conditioner can kill you.

c. Check selector switch.
Connect power cable and move Mode Selector switch to COOL.
Does compressor and evaporator blower operate?

Yes → Refer to paragraph 4.4, Steps b through e.

No →

d. Test the motor.
Is motor defective?

Yes → Replace motor.

No →

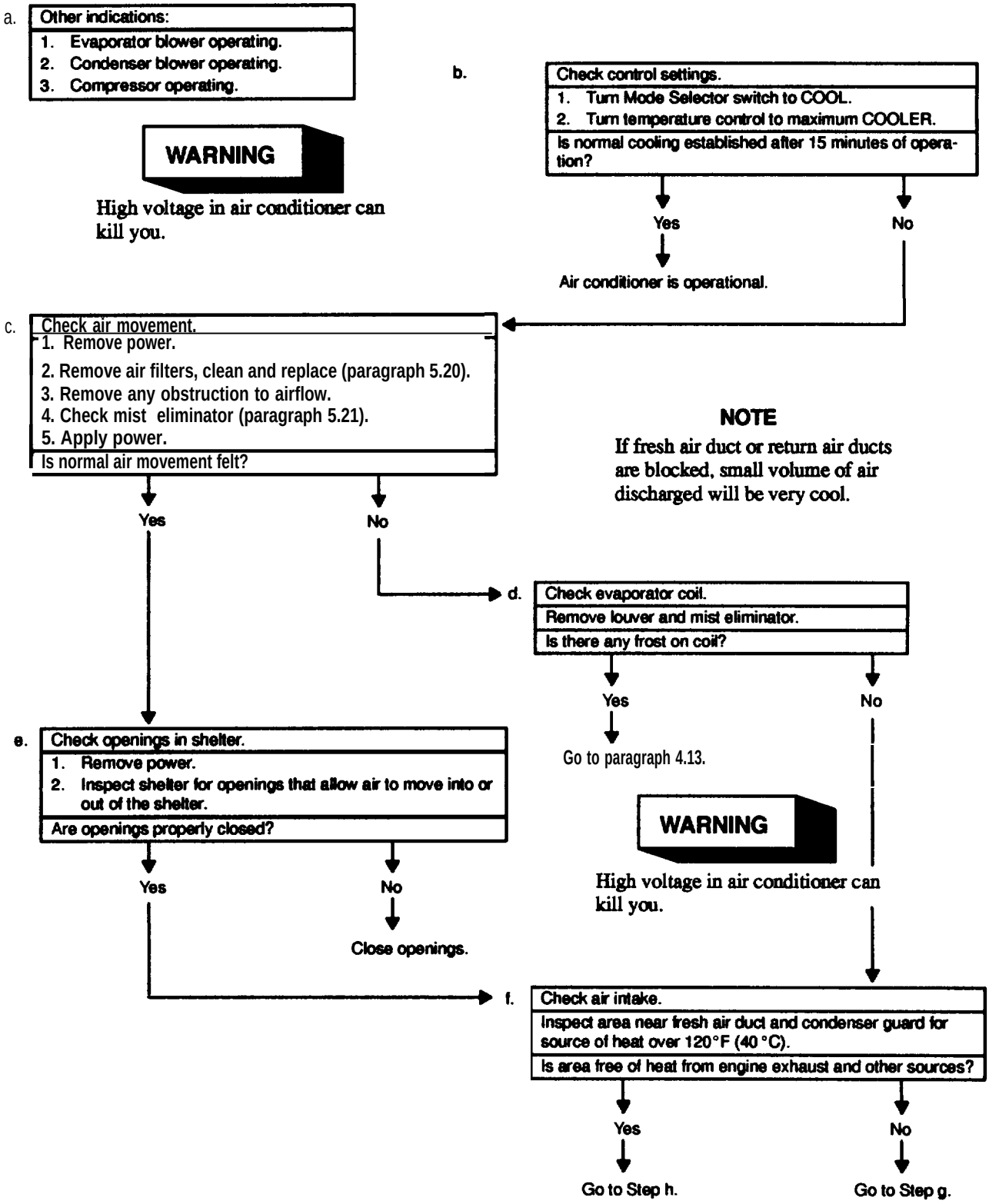
e. Refer to table 4-3. and test switch S1 and relay K4.
Is switch or relay defective?

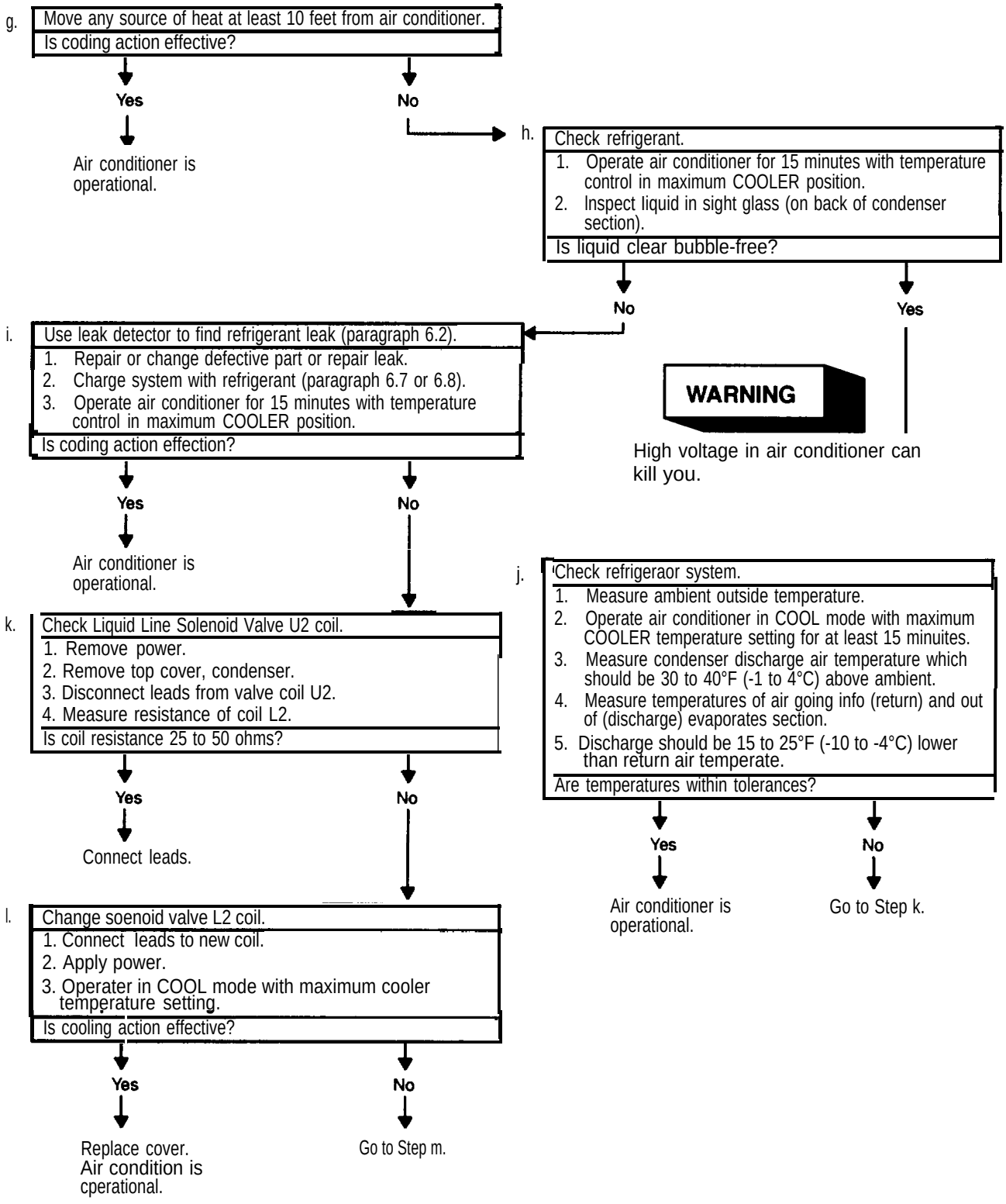
Yes → Replace defective component.

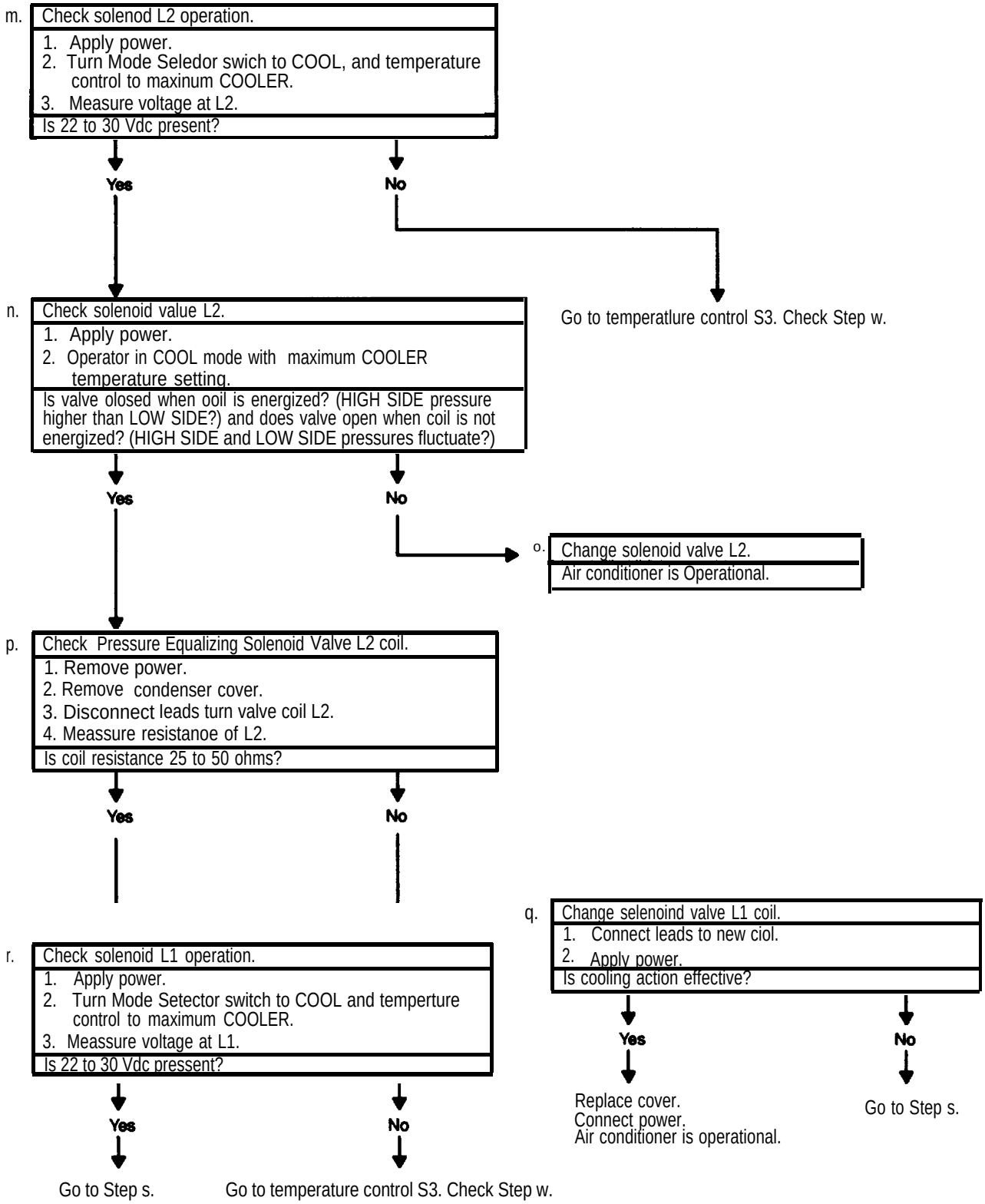
No →

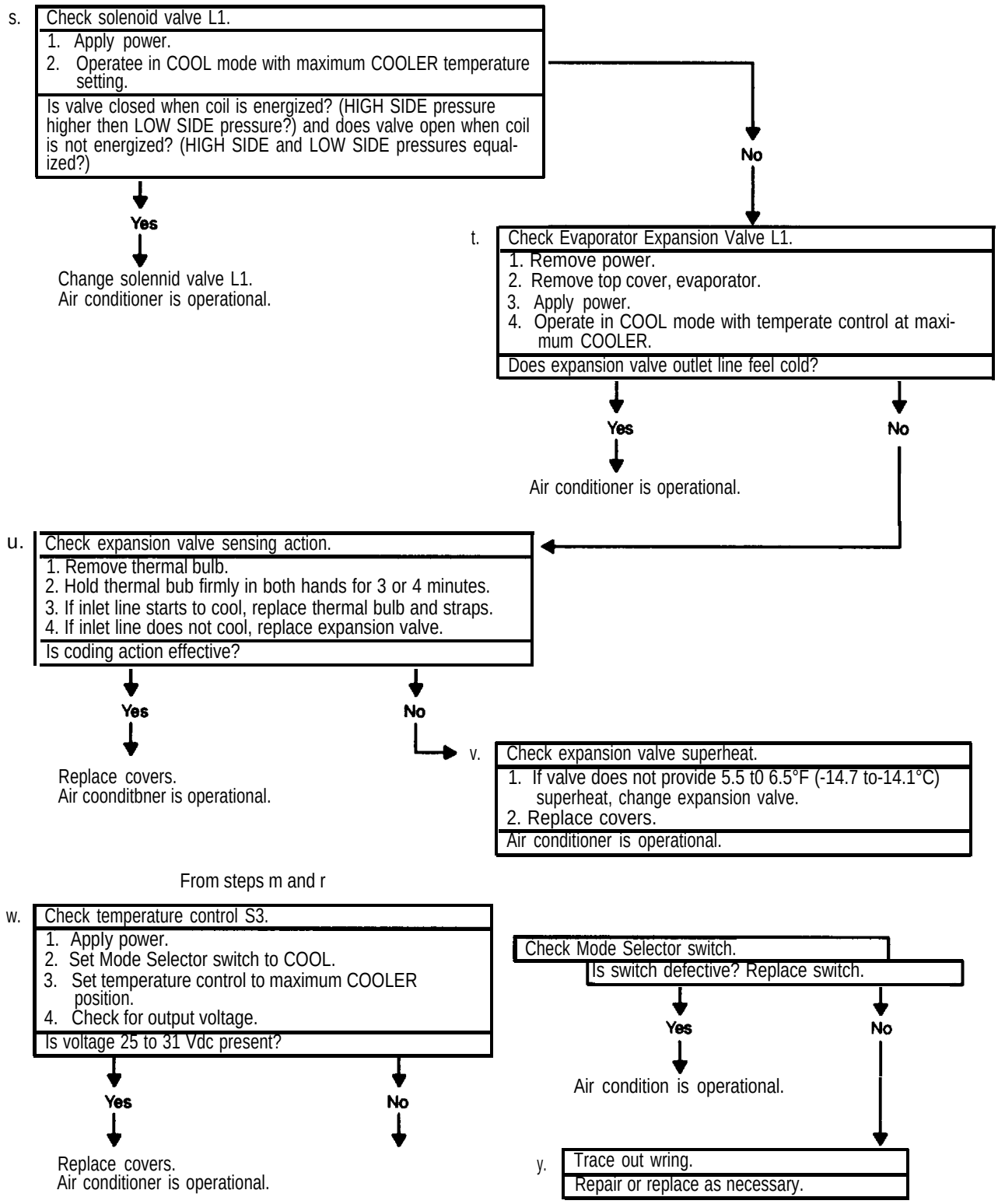
f. Refer to wiring diagram and trace out wiring.
Check for loose and broken connections. Repair as necessary.

4.6 LITTLE OR NO COOLING ACTION.

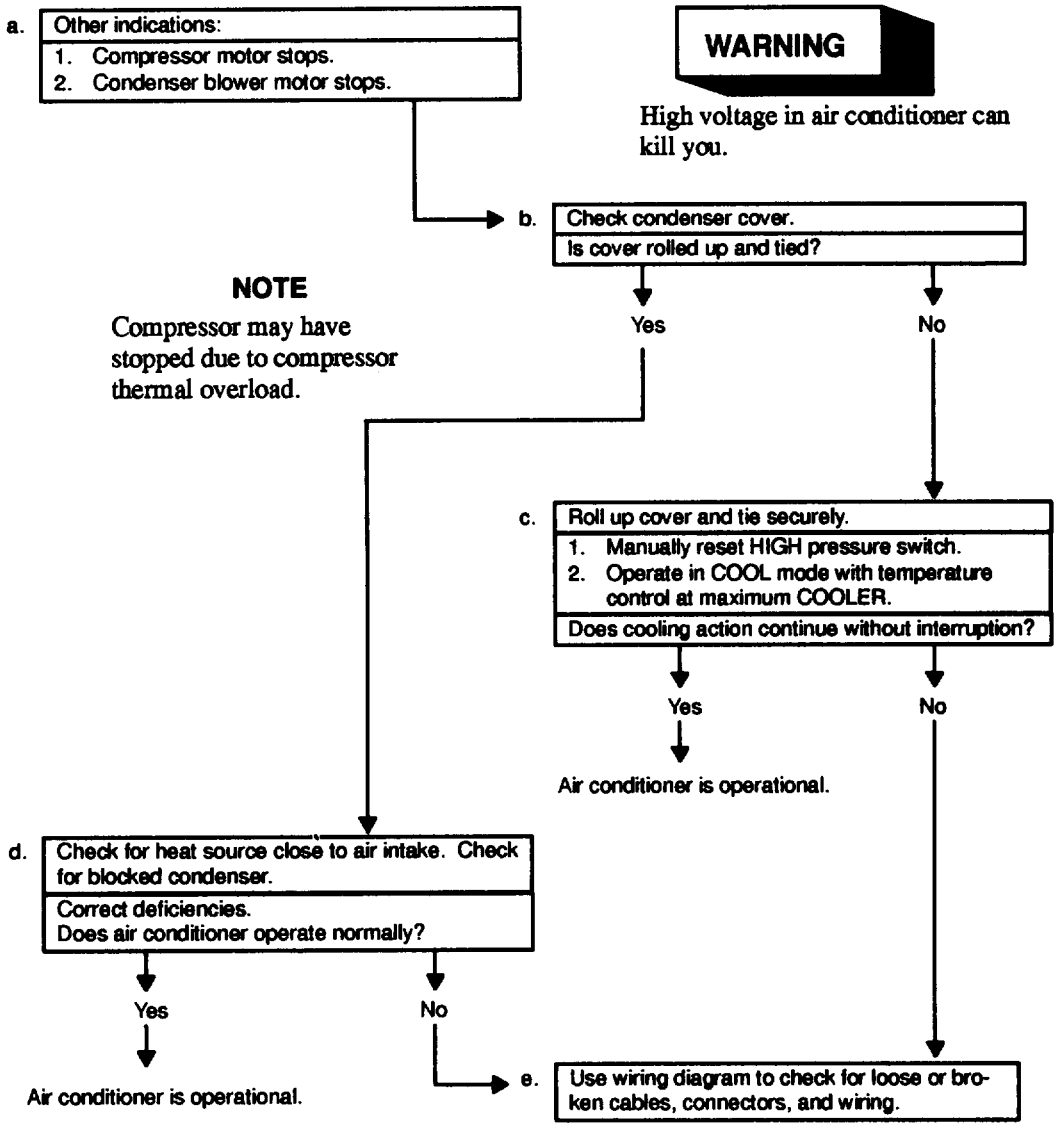



g.
Move any source of heat at least 10 feet from air conditioner.
Is coding action effective?
Yes
No
Air conditioner is operational.
h.
Check refrigerant.
1. Operate air conditioner for 15 minutes with temperature control in maximum COOLER position.
2. Inspect liquid in sight glass (on back of condenser section).
Is liquid clear bubble-free?
No
Yes
i.
Use leak detector to find refrigerant leak (paragraph 6.2).
1. Repair or change defective part or repair leak.
2. Charge system with refrigerant (paragraph 6.7 or 6.8).
3. Operate air conditioner for 15 minutes with temperature control in maximum COOLER position.
Is coding action effection?
Yes
No
Air conditioner is operational.
WARNING
High voltage in air conditioner can kill you.
j.
Check refrigeraor system.
1. Measure ambient outside temperature.
2. Operate air conditioner in COOL mode with maximum COOLER temperature setting for at least 15 minuites.
3. Measure condenser discharge air temperature which should be 30 to 40°F (-1 to 4°C) above ambient.
4. Measure temperatures of air going info (return) and out of (discharge) evaporates section.
5. Discharge should be 15 to 25°F (-10 to -4°C) lower than return air temperate.
Are temperatures within tolerances?
Yes
No
Air conditioner is operational.
Go to Step k.
k.
Check Liquid Line Solenoid Valve U2 coil.
1. Remove power.
2. Remove top cover, condenser.
3. Disconnect leads from valve coil U2.
4. Measure resistance of coil L2.
Is coil resistance 25 to 50 ohms?
Yes
No
Connect leads.
l.
Change soenoid valve L2 coil.
1. Connect leads to new coil.
2. Apply power.
3. Operater in COOL mode with maximum cooler temperature setting.
Is cooling action effective?
Yes
No
Replace cover.
Air condition is cperational.
Go to Step m.


m.
Check solenod L2 operation.
1. Apply power.
2. Turn Mode Seledor swich to COOL, and temperature control to maxinum COOLER.
3. Measure voltage at L2.
Is 22 to 30 Vdc present?
Yes
No
Go to temperatlure control S3. Check Step w.
n.
Check solenoid value L2.
1. Apply power.
2. Operator in COOL mode with maximum COOLER temperature setting.
Is valve olosed when ooil is energized? (HIGH SIDE pressure higher than LOW SIDE?) and does valve open when coil is not energized? (HIGH SIDE and LOW SIDE pressures fluctuate?)
Yes
No
o.
Change solenoid valve L2.
Air conditioner is Operational.
p.
Check Pressure Equalizing Solenoid Valve L2 coil.
1. Remove power.
2. Remove condenser cover.
3. Disconnect leads turn valve coil L2.
4. Meassure resistanoe of L2.
Is coil resistance 25 to 50 ohms?
Yes
No
q.
Change selenoind valve L1 coil.
1. Connect leads to new ciol.
2. Apply power.
Is cooling action effective?
Yes
No
Replace cover.
Connect power.
Air conditioner is operational.
Go to Step s.
r.
Check solenoid L1 operation.
1. Apply power.
2. Turn Mode Setector switch to COOL and temperture control to maximum COOLER.
3. Meassure voltage at L1.
Is 22 to 30 Vdc pressent?
Yes
No
Go to Step s.
Go to temperature control S3. Check Step w.


s.
Check solenoid valve L1.
1. Apply power.
2. Operatee in COOL mode with maximum COOLER temperature setting.
Is valve closed when coil is energized? (HIGH SIDE pressure higher then LOW SIDE pressure?) and does valve open when coil is not energized? (HIGH SIDE and LOW SIDE pressures equalized?)
Yes
Change solennid valve L1.
Air conditioner is operational.
No
t.
Check Evaporator Expansion Valve L1.
1. Remove power.
2. Remove top cover, evaporator.
3. Apply power.
4. Operate in COOL mode with temperate control at maximum COOLER.
Does expansion valve outlet line feel cold?
Yes
Air conditioner is operational.
No
u.
Check expansion valve sensing action.
1. Remove thermal bulb.
2. Hold thermal bub firmly in both hands for 3 or 4 minutes.
3. If inlet line starts to cool, replace thermal bulb and straps.
4. If inlet line does not cool, replace expansion valve.
Is coding action effective?
Yes
Replace covers.
Air coonditbner is operational.
No
v.
Check expansion valve superheat.
1. If valve does not provide 5.5 t0 6.5°F (-14.7 to-14.1°C) superheat, change expansion valve.
2. Replace covers.
Air conditioner is operational.
From steps m and r
w.
Check temperature control S3.
1. Apply power.
2. Set Mode Selector switch to COOL.
3. Set temperature control to maximum COOLER position.
4. Check for output voltage.
Is voltage 25 to 31 Vdc present?
Yes
Replace covers.
Air conditioner is operational.
No
Check Mode Selector switch.
Is switch defective? Replace switch.
Yes
Air condition is operational.
No
y.
Trace out wring.
Repair or replace as necessary.

4.7 COOLING ACTION STOPS AFTER OPERATING FOR SHORT TIME.



4.8 LITTLE OR NO HEATING IN LOW HEAT MODE.

a. Oter indications:
1. Evaporator blower is operating.
2. Proper power supply is supplied and property connected to unit.

WARNING

High voltage in air conditioner can kill you.

NOTE

This unit can operate in temperatures as low as -50°F (-45.5 °C). However, depending on shelter size, shelter heat loss, and amount of heat generated by equipment in the shelter, heat output LOW HEAT mode may or may not heat shelter to a comfortable level.

b. Check air movement in evaporator section.
1. Apply power.
2. Set Mode Selector switch to LOW HEAT.
3. Turn temperature control to maximum WARMER position.
4. Feel air ducts for air movement in and out of air conditioner.

Is air moving into return filter and out discharge opening?

Yes → No

c. Check reason for low airflow.
1. Turn Mode Selector switch to OFF.
2. Remove return air filter, dean and replace (paragraph 5.20).
3. Remove any obstruction to airflow.
4. Check mist eliminates (paragraph 5.21).

Is heating action effective?

Yes → Air conditioner is operational.

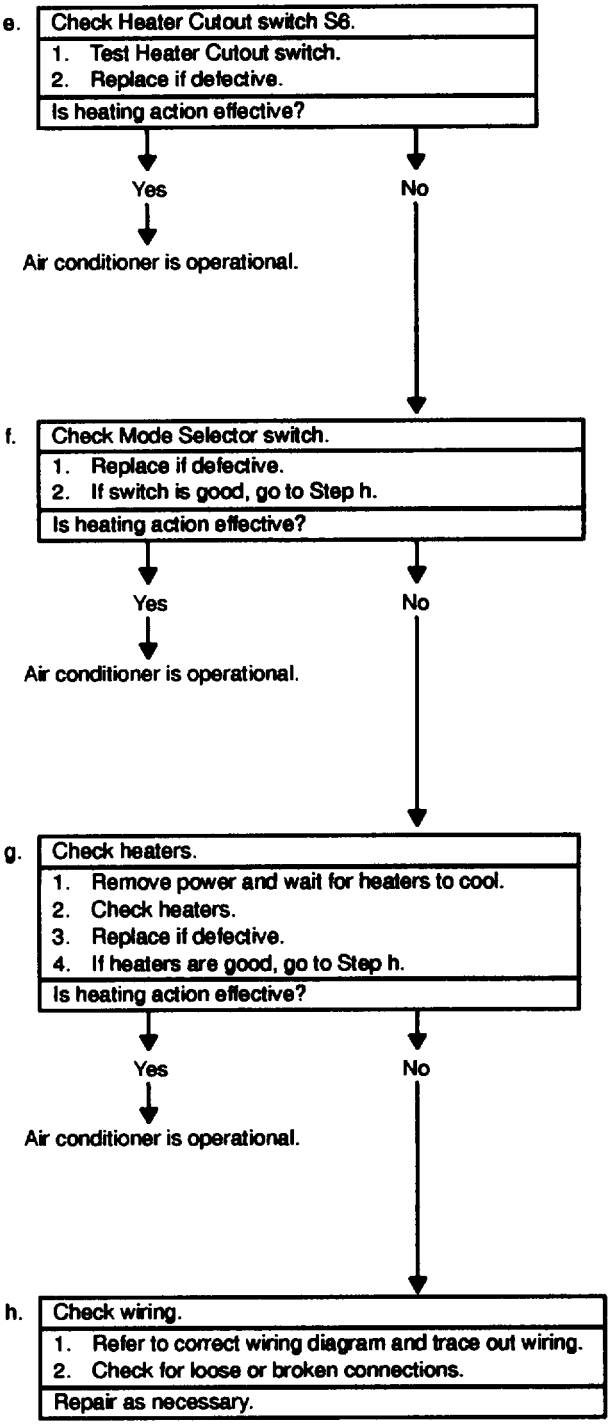
No

d. Compare discharge air temperature to return air temperature.
1. Turn Mode Selector switch to LOW HEAT and temperature control to maximum WARMER.
2. After operating for 5 minutes, measure return air temperature and discharge air temperature.

Is discharge air temperature at least 10°F (5.5°C) above return air temperature?

Yes → Go to Step g.

No → Go to Step e.


e.
Check Heater Cutout switch S6.
1. Test Heater Cutout switch.
2. Replace if defective.
Is heating action effective?
Yes
No
Air conditioner is operational.
f.
Check Mode Selector switch.
1. Replace if defective.
2. If switch is good, go to Step h.
Is heating action effective?
Yes
No
Air conditioner is operational.
g.
Check heaters.
1. Remove power and wait for heaters to cool.
2. Check heaters.
3. Replace if defective.
4. If heaters are good, go to Step h.
Is heating action effective?
Yes
No
Air conditioner is operational.
h.
Check wiring.
1. Refer to correct wiring diagram and trace out wiring.
2. Check for loose or broken connections.
Repair as necessary.

4.9 LITTLE OR NO ADDITIONAL HEATING IN HIGH HEAT.

a. Other indications:
1. Evaporator blower is operating.
2. Proper power supply is supplied and properly connected to unit.
3. Controls are set for HIGH HEAT.

b. Check that TEMPERATURE SELECTOR is set for the extreme WARMER position (clockwise as far as it will go).
Move to maximum WARMER. After operating for 5 minutes, check air temperature.
Is heating action effective?

Yes → Air conditioner is operational.

No

WARNING

High voltage in air conditioner can kill you.

NOTE

This unit can operate in temperatures as low as -50°F (-45.5°C). However, depending on excessive shelter heat loss, and extremely low amount of heat generated by equipment in the shelter, heat output may or may not heat shelter to a comfortable level.

c. Check openings in shelter.
1. Inspect shelter for openings that allow cold air to move into the shelter.
2. Seal all openings.
Are openings properly closed? Is heating action effective?

Yes → Air conditioner is operational.

No

d. Check air movement into and out of the air conditioner.
1. Check air filter.
2. Clean the filter.
3. Check for and remove obstructions to free airflow.
Is heating action effective?

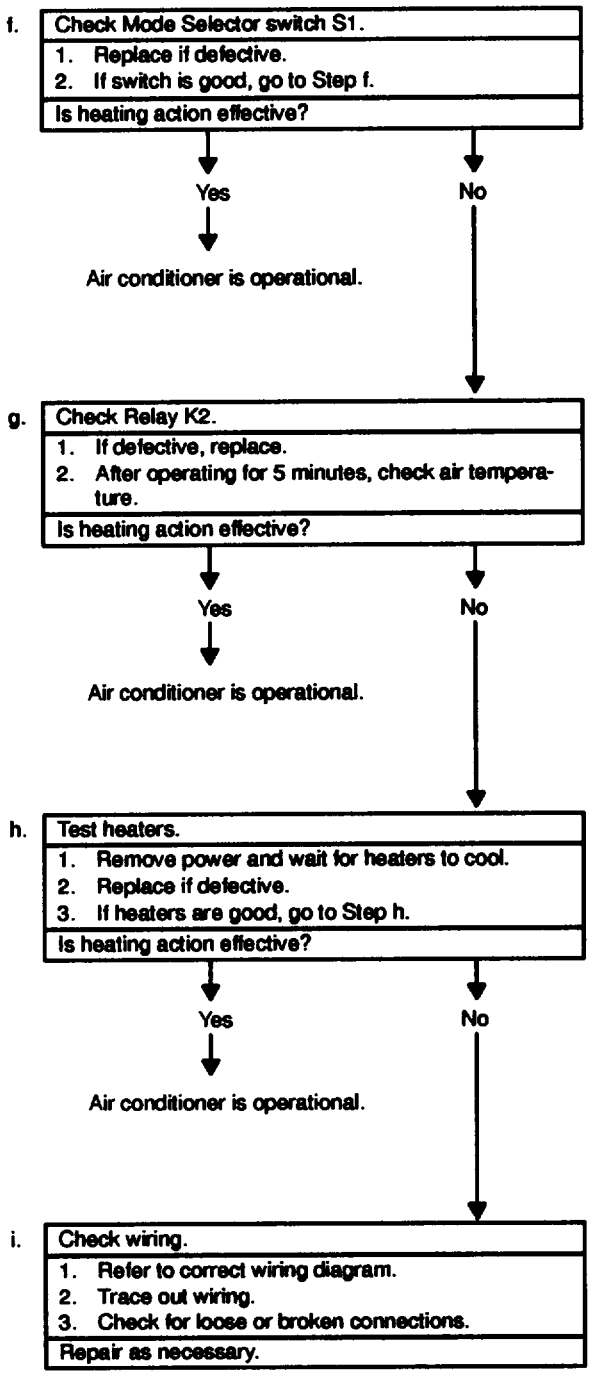
Yes → Air conditioner is operational.

No

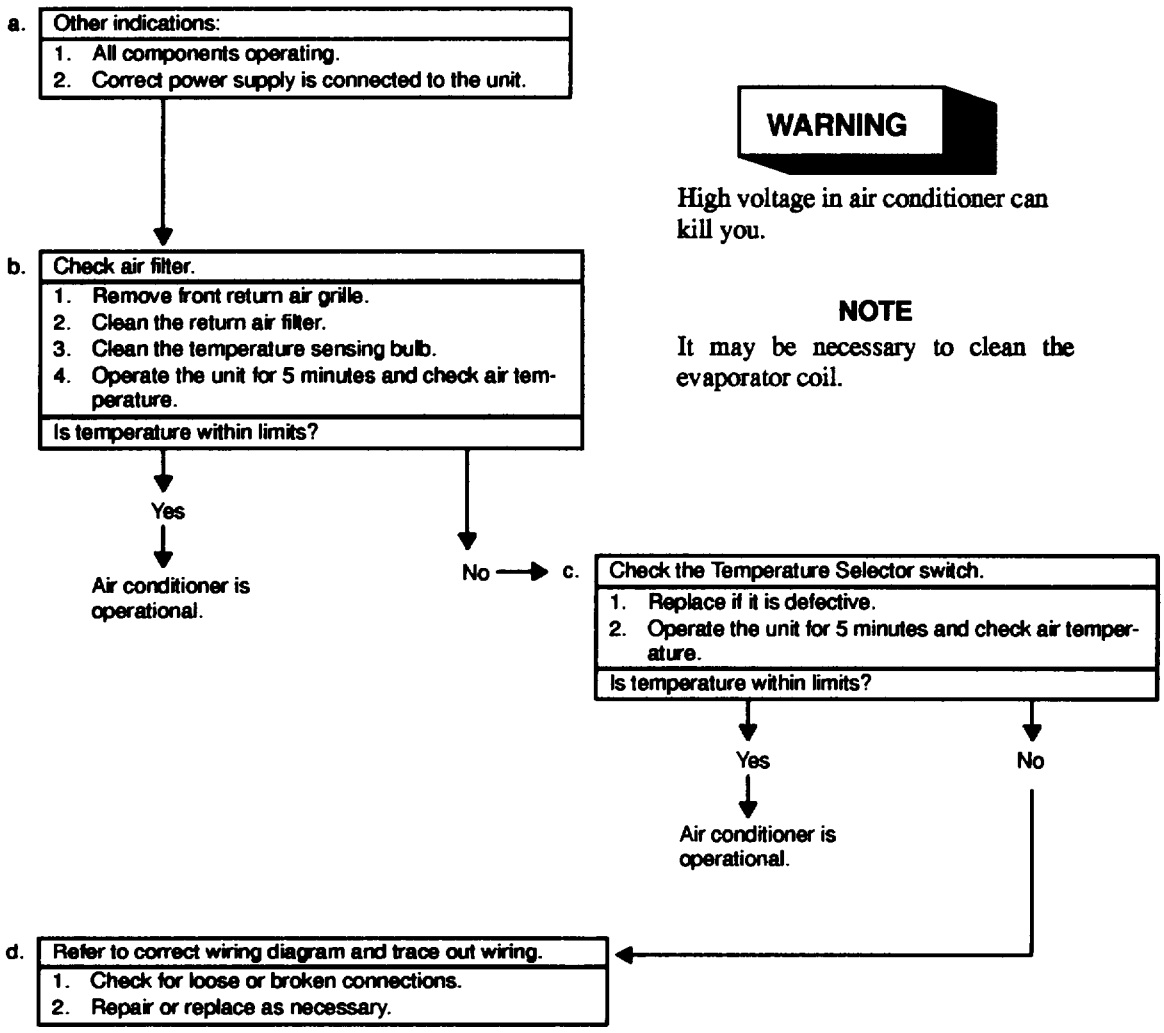
e. Check Heater Cutout switch S6.
1. Test the switch.
2. Replace if necessary.
3. After switch is replaced, operate unit for 5 minutes and check air temperature.
Is heating action effective?

Yes → Air conditioner is operational.

No → Go to Step f.


f.
Check Mode Selector switch S1.
1. Replace if defective.
2. If switch is good, go to Step f.
Is heating action effective?
Yes
No
Air conditioner is operational.
g.
Check Relay K2.
1. If defective, replace.
2. After operating for 5 minutes, check air temperature.
Is heating action effective?
Yes
No
Air conditioner is operational.
h.
Test heaters.
1. Remove power and wait for heaters to cool.
2. Replace if defective.
3. If heaters are good, go to Step h.
Is heating action effective?
Yes
No
Air conditioner is operational.
i.
Check wiring.
1. Refer to correct wiring diagram.
2. Trace out wiring.
3. Check for loose or broken connections.
Repair as necessary.

4.10 TEMPERATURE SELECTOR NOT EFFECTIVE.



WARNING

High voltage in air conditioner can kill you.

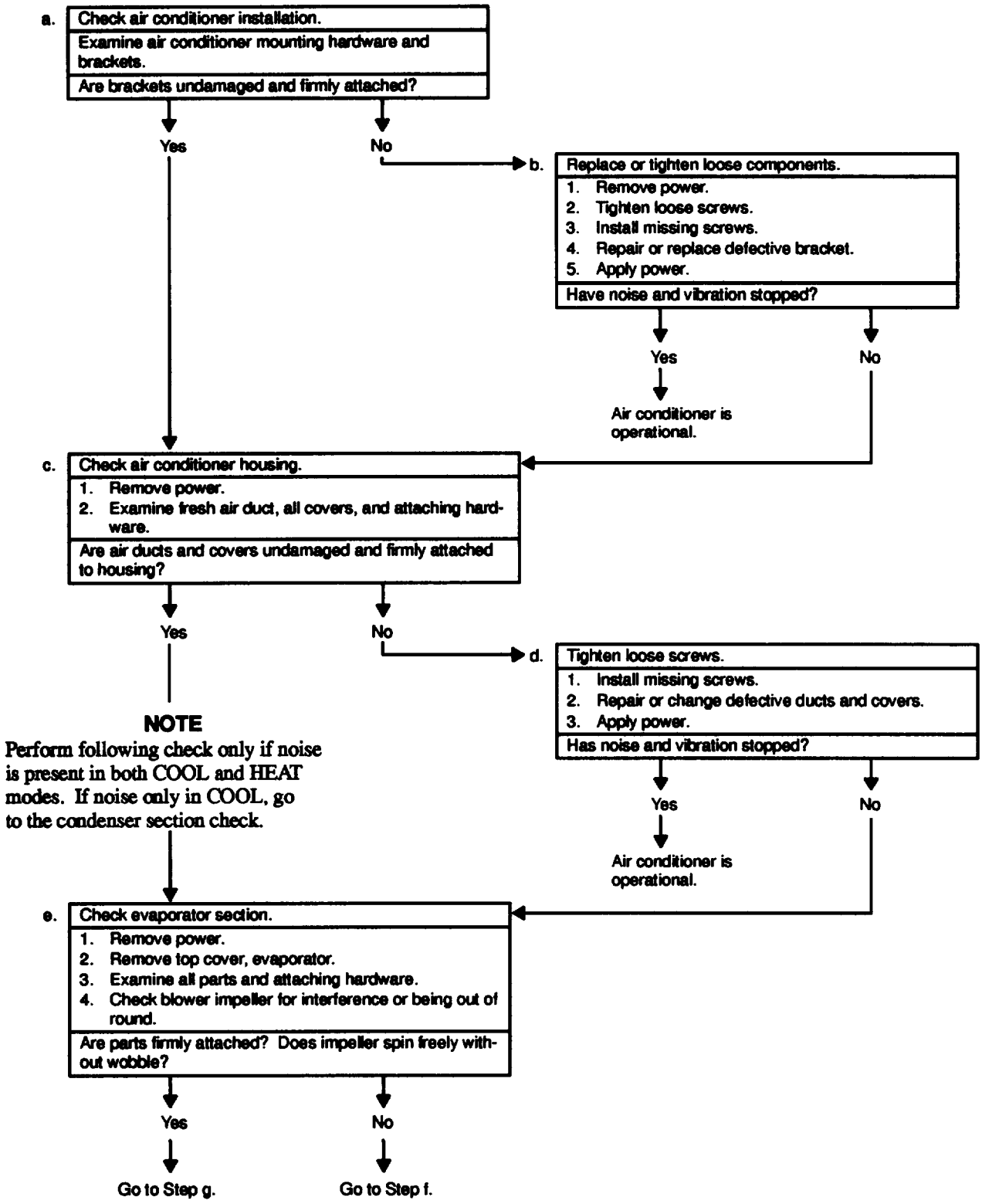
NOTE

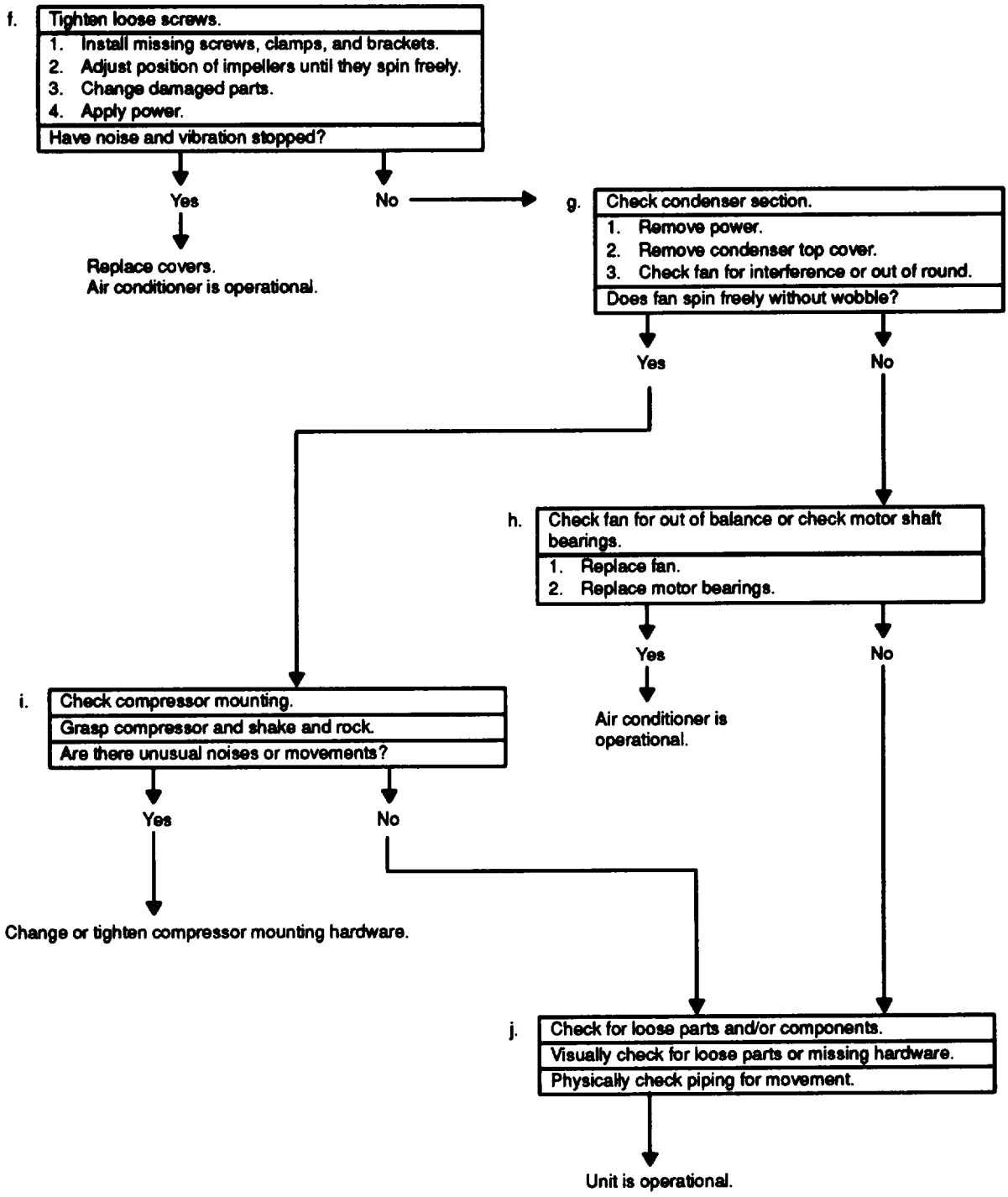
It may be necessary to clean the evaporator coil.

NOTE

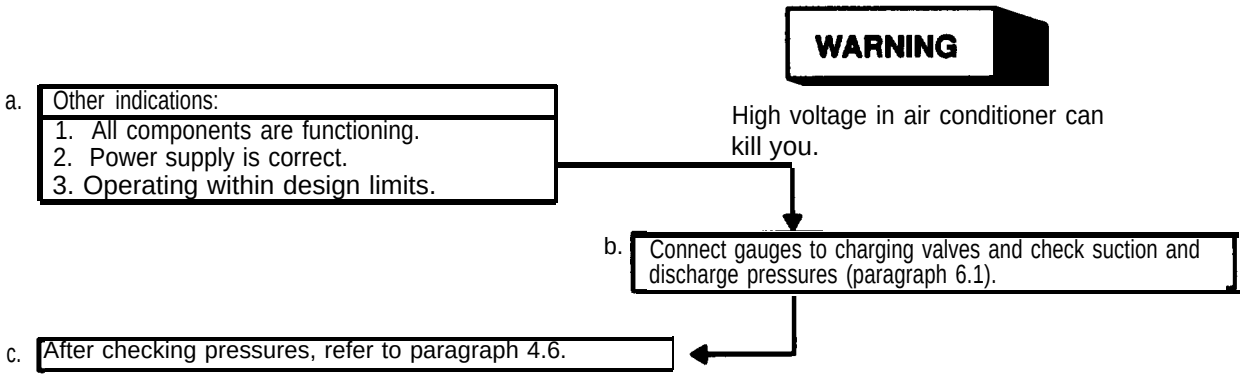
Due to weather extremes and shelter heating/cooling loads, it may require a longer time period to bring shelter temperature to desired comfort range.

4.11 UNUSUAL NOISE OR VIBRATION.




f.
Tighten loose screws.
1. Install missing screws, clamps, and brackets.
2. Adjust position of impellers until they spin freely.
3. Change damaged parts.
4. Apply power.
Have noise and vibration stopped?
Yes
No
Replace covers.
Air conditioner is operational.
g.
Check condenser section.
1. Remove power.
2. Remove condenser top cover.
3. Check fan for interference or out of round.
Does fan spin freely without wobble?
Yes
No
h.
Check fan for out of balance or check motor shaft bearings.
1. Replace fan.
2. Replace motor bearings.
Yes
No
Air conditioner is operational.
i.
Check compressor mounting.
Grasp compressor and shake and rock.
Are there unusual noises or movements?
Yes
No
Change or tighten compressor mounting hardware.
j.
Check for loose parts and/or components.
Visually check for loose parts or missing hardware.
Physically check piping for movement.
Unit is operational.

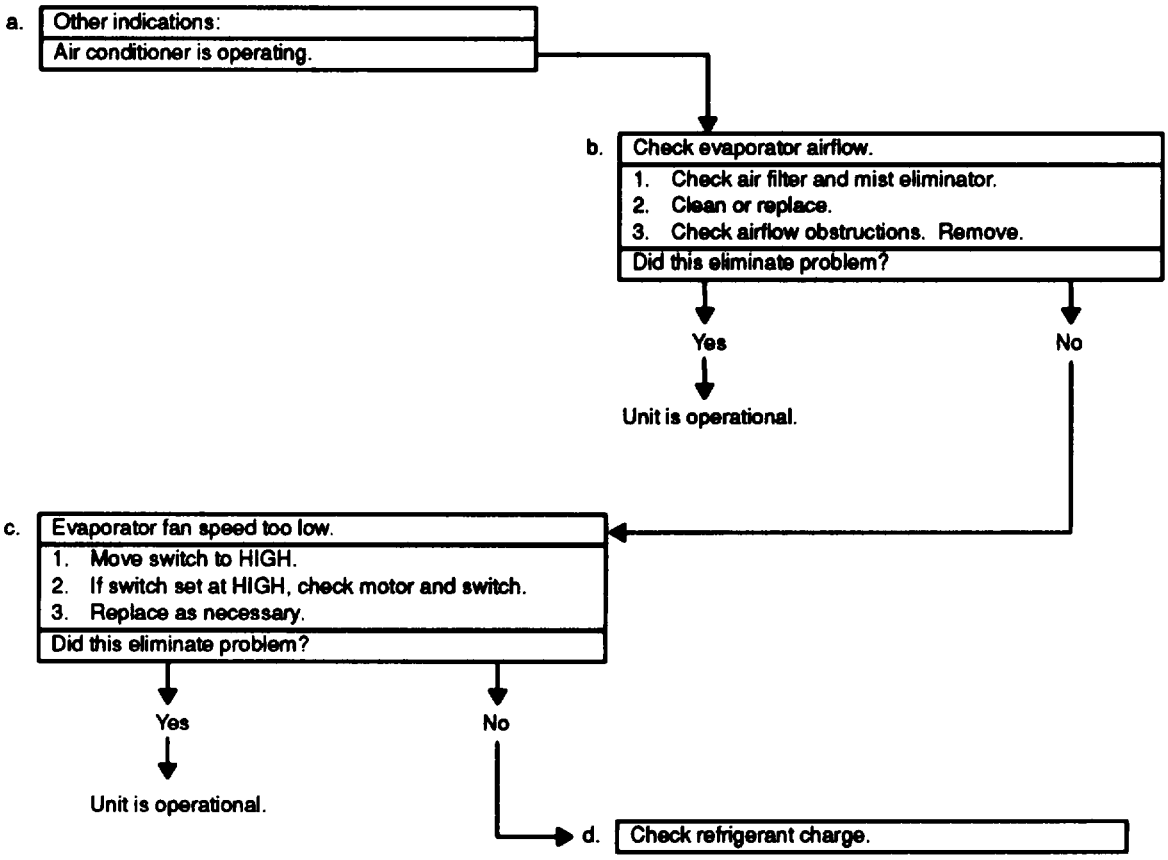
4.12 UNIT RUNS, BUT BISCHARGE AIR IS WARM.



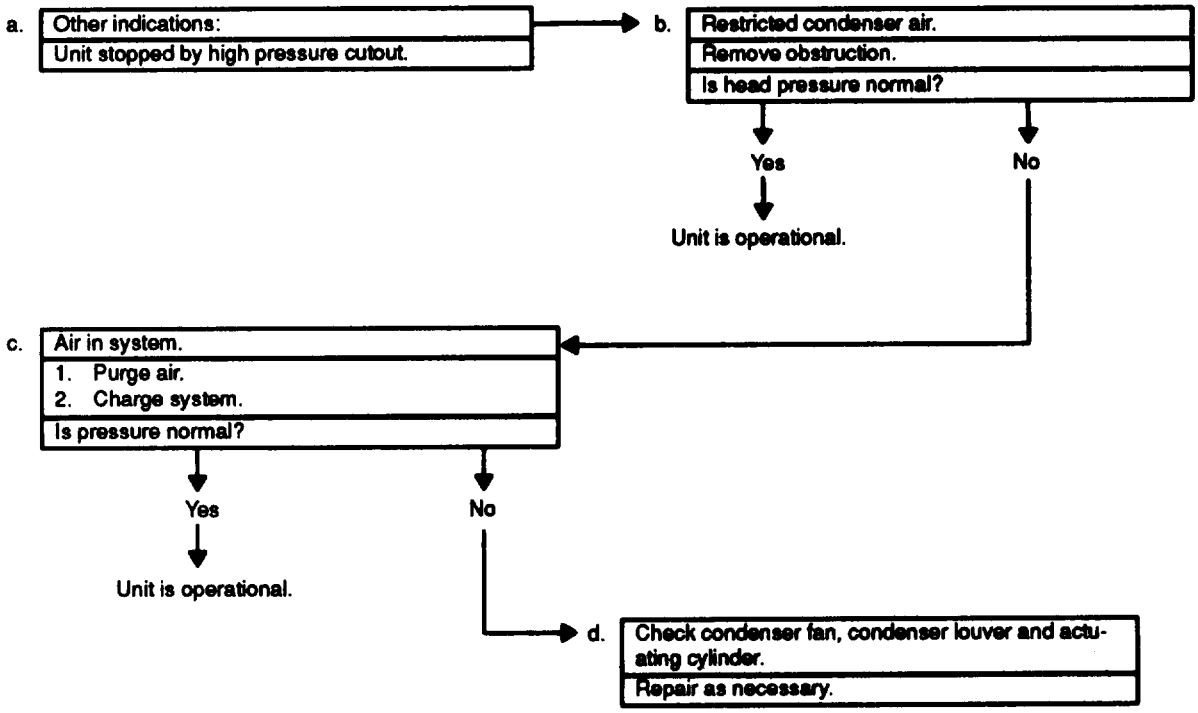
4.13 FROSTED EVAPORATOR COIL.

NOTE

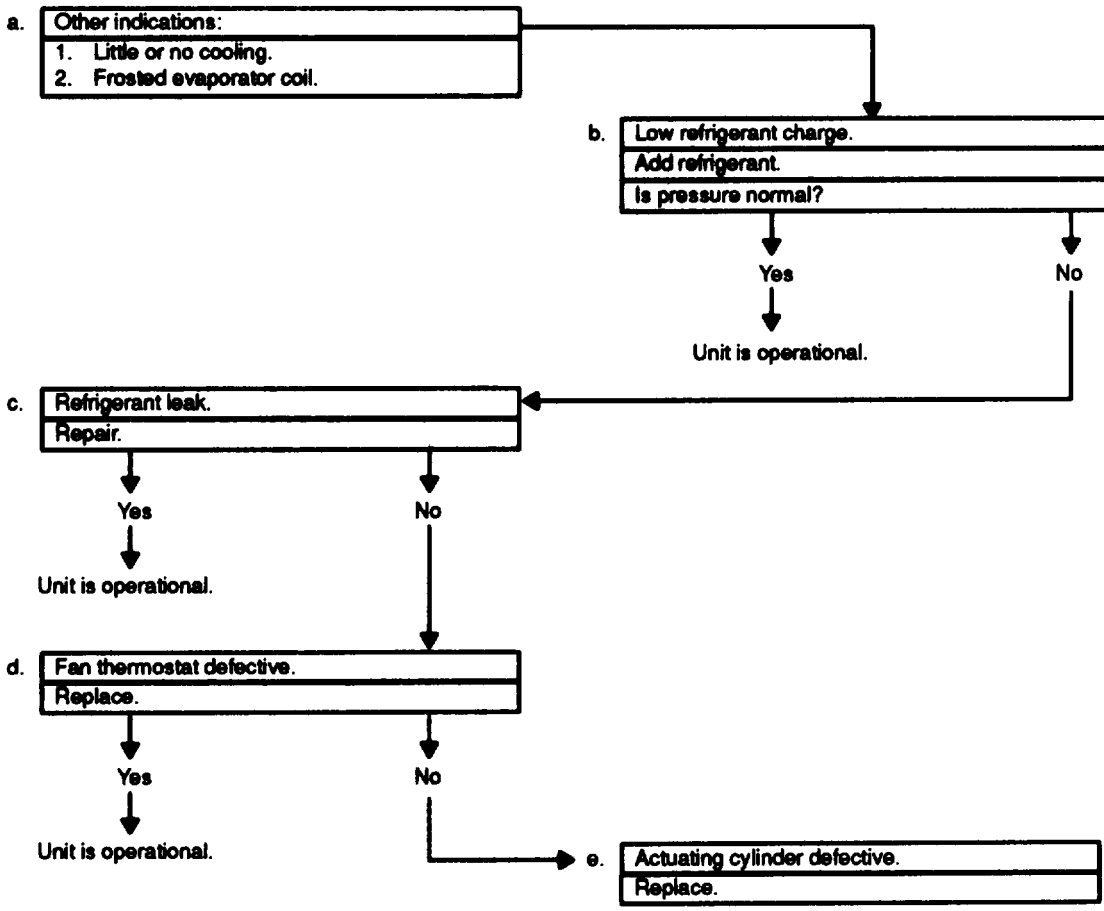
Stop operation and allow frost to melt before troubleshooting.



4.14 EXCESSIVE HEAD PRESSURE.



4.15 LOW HEAD PRESSURE.

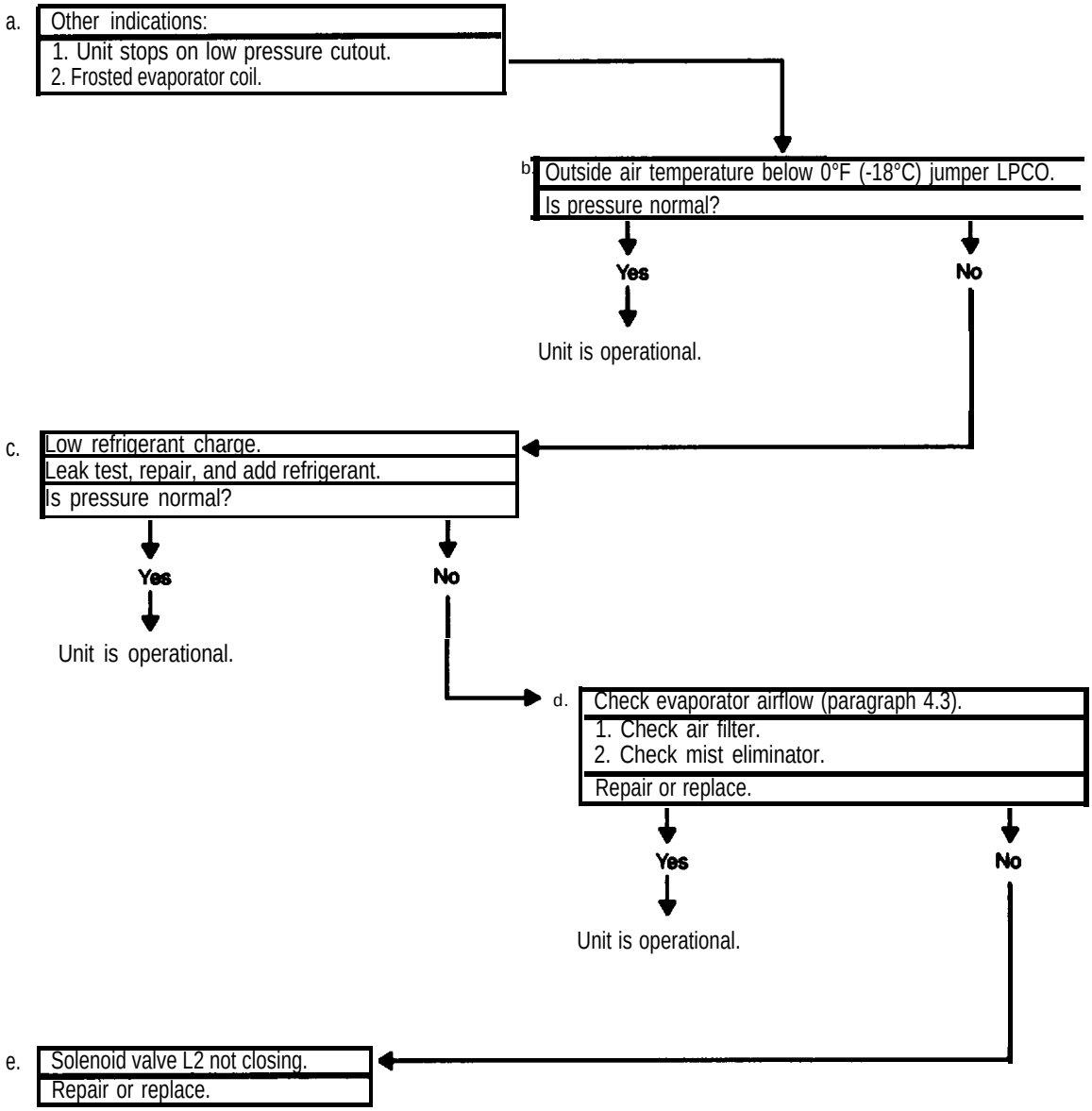


4.16 EXCESSIVE SUCTION PRESSURE.

a. Other indications:
High head pressure.

b. Same conditions as for excessive head pressure (paragraph 4.14).

4.17 LOW SUCTION PRESSURE.



CHAPTER 5

UNIT MAINTENANCE

5.1 GENERAL MAINTENANCE PROCEDURES. This task covers removal, testing, inspection, splicing wires, crimping terminals, insulating joints and soldering connections.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
Multimeter

Special Tools:
None

Materials/Parts:
Heat-shrink Tubing
Solder
Solvent P-D-680
Detergent
Cleaning Cloths

Equipment Descriptions:
Power OFF; installed in shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Unit Maintenance

Location/Item	Action	Remarks
Removal	a. The electrical circuits in the air conditioner are completed by individual wire leads or by wire leads laced or enclosed in wire ties to form a wiring harness. b. All of the wiring carries code numbers. c. When repairing or replacing the wiring harness or individual wires, refer to the wiring diagrams figures FO-1, FO-3, FO-5, FO-7, or FO-9. **WARNING** Disconnect air conditioner power supply before peforming maintenance work on electrical system.	**WARNING** High voltage can kill.

5.1 GENERAL MAINTENANCE PROCEDURES. - Continued

Location/Item	Action	Remarks
Removal - Continued	d. Preferred repair methods consist of replacing wires, terminals, connectors, etc., rather than splicing wires, bending ends to form terminals, and other makeshift procedures.	
	e. Determine the proper size and length of wire, terminal or connector to be used for replacement.	
Testing	a. Use a multimeter set on low ohm range to test for continuity.	
	b. Use multimeter set on high ohm range to test for sheds between the circuit in a component and the outside case of the component.	
	c. When testing electrial component, also look for visual damage and inspect all wiring in the area for damage or loose connections.	
	d. Test for continuity in leads or wiring harnesses by disconnecting each end.	
	e. Where wires terminate in an electrical connector, disconnect connector from corresponding receptacle connector or plug connector.	
	f. Touch the test probes of a multimeter set on low ohm range to ends of wire or to corresponding pin of connector.	
	g. If continuity is not indicated, repair or replace wire.	
Inspection	a. Inspect all wiring installations for cracked or frayed insulation material.	
	b. Pay particular attention to wires passing through holes in the frame or around sharp edges.	
	c. Repair or replace defective wiring.	
	d. Inspect electrical connectors and fittings for damage or broken conditions.	
	e. Replace defective connectors and fittings.	

5.1 GENERAL MAINTENANCE PROCEDURES. - Continued

Location/Item	Action	Remarks
Splicing Wires	a. To repair broken or cut wires that are othewise sound, the mating ends can be stripped and spliced.	
	b. A commercial butt splice can be crimped onto the ends to join them, or a wire splice can be made.	
	c. A wire splice is made by stripping one 1-1/4 inch of insolation from the wire ends, holding the ends parallel and facing opposite directions, then twisting each end around the other wire at least three turns.	
	d. Solder and apply insulation.	
Crimping Terminals	a. To install a terminal on end of a wire, strip 1/4 - 1/2 inch of insulation from the end of the wire.	
	b. Apply a 1-inch piece of heat-shrink tubing (if the terminals are of the uninsulated type), and insert wire-end into the shank of the terminal.	
	c. Crimp the shank.	
	d. Install heat-shrink tubing if necessary.	
Insulating Joints	a. The preferred method of insulating electrical joints is by the use of heat-shrink tubing.	
	b. To apply, cut a piece of heat-shrink tubing of suitable diameter to a 1-inch length for covering joints at terminals or connectors, or to a length about 1/2-inch longer than the joint to be insulated.	
	c. Slide the tubing over the wire before making the joint.	
	d. After the joint is rode, elide the tubing over the joint and shrink in place with moderate heat.	
Soldering Connections	a. Wire connections must be made mechanically sound before they are soldered.	
	b. Solder alone does not provide sufficient strength to prevent breakage.	
	c. Joining surfaces of connections to be soldered must be dean and bright.	

5.1 GENERAL MAINTENANCE PROCEDURES. - Continued

Location/Item	Action	Remarks
Soldering Connections - Continued	d. If a separate flux is used, it should conform to Specification, MIL-F-4995, Type 1, rosin-alcohol flux, and should be brushed onto the joint before soldering. e. If a flux-core solder is used, it should always be rosin-core electrical solder. f. If an uncored solder is used, it should be a led-tin solder conforming to Specification, QQ-S-571. g. Wires should always be heated to the point at which the solder will melt completely and flow into all parts of the joint. h. Excessive buildup of solder "gobs" on the joint should be avoided or removed.	
Preventive Maintenance Checks	Refer to table 5-1.	

5.1 GENERAL MAINTENANCE PROCEDURES. - Continued

Table 5-1. Unit Preventive Maintenance Checks and Services

Item No.	Interval	Item To Check/Service	Procedure	Not Fully Mission Capable If:
1	Quarterly	Air Filters	Check that filters are clean.	Filters are dirty.
2	Qualterly	Mist Eliminator	Check that eliminator is clean.	Eliminator is dirty.
3	Quarterly	Evaporator Coil	Check that coil is clean.	Coil is dirty.
4	Quarterly	Condenser Coil	Check that coil is clean.	Condenser coil is dirty.
5	Quarterly	Evaporator Motor	Cheek that motor is clean. Turn shaft to be sure bearings are not defective.	Motor is dirty. Bearings are defective.
6	Quarterly	Condenser Motor	Check that motor is clean. Turn shaft to be sure bearings are not defective.	Condenser motor is dirty. Bearings are defective.
7	Quarterly	Air Conditioner Unit	Lubricate all movable connections and linkage with SAE 20 oil. Check for loose, missing, or darnaged components.	Components are loose, missing or damaged.

NOTE: Quarterly = (250 Hours).

5.2 RADIO INTERFERENCE SUPPRESSION. This task covers general information.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
None

Equipment Descriptions:
Power OFF; installed in shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Refrigeration Specialist

Location/Item	Action	Remarks
General	a. Essentially suppression is attained by providing a low resistance path to ground for the stray currents. Methods used include grounding the frame with banding straps and using capacitors and resistors. b. The control module, junction box and etectrical system components are grounded to the housing. c. The housing is connected to a ground wire in the power supply. d. Capacitors are located across the rectifier terminals. e. Grommets are inserted in the heat support bracket to isolate heating elements from bracket to prevent metal to metal contact and scraping during expansion and contraction of heating elements. f. Power inlet cover chains are encased in shrink type tubing to prevent rattling of chain links.	

5.3 EMI CAPACITORS C2 AND C1. This task covers removal and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
Multimeter

Special Tools:
None

Materials/Parts:
Heat-shrink Tubing
Solder
Hot Air Dryer

Equipment Descriptions:
Power OFF; installed in shelter

Special Environment Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Refrigeration Specialist

Location/Item	Action	Remarks
Capacitor C1		
Removal	a. Disconnect power supply.	**WARNING** High voltage can kill.
	b. Remove evaporator section top cover.	
	c Remove screws and pull junction box from frame. Use care to avoid breaking the sensing line.	Sensing line connects TEMPERATURE SELECTOR to sensing bulb which is located behind return air louver.
	d. Tag and pull "quick disconnect" terminals from rectifier CR1, terminals 2 and 4.	
	e. Cut leads at terminals.	

5.3 EMI CAPACITORS C2 AND C1. - Continued

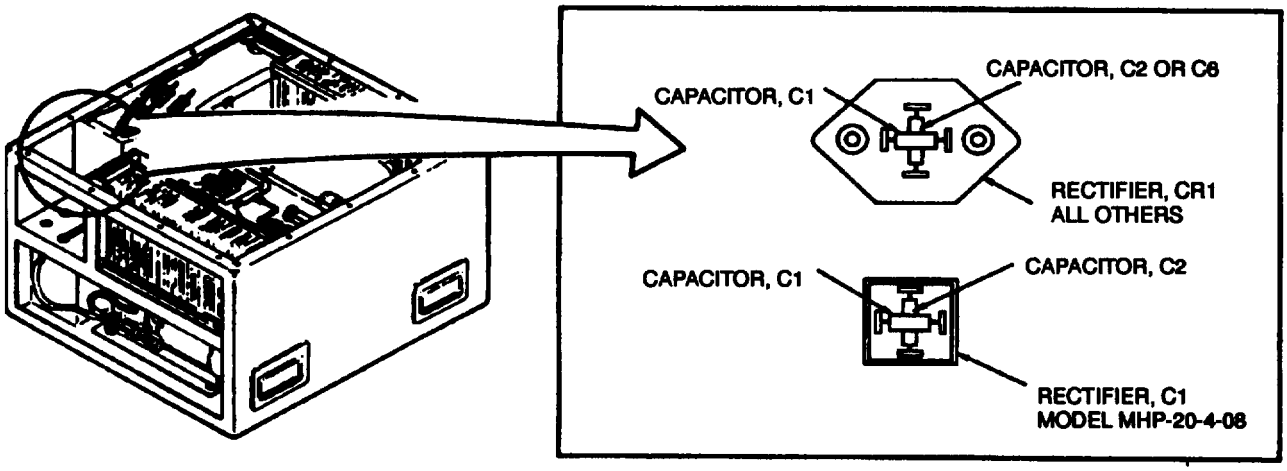


Figure 5-1. Capacitor C1

Location/Item	Action	Remarks
Installation	a. Slip heat-shrink tubing over capacitor leads and leads X36A20N and V6D20 (CR1-2<>TB2-12 and K5-9<>CR1-4 on model MHP-20-4-08).	Figures FO-1, FO-3, FO-5, FO-7, or FO-9.
	b. Join one capacitor lead and wire V6D20 (CR1-2<>TB2-12 on model MHP-20-4-08).	Attached to "+" terminal on MHP-20-4-08.
	c. Join capacitor lead and wire X36A20N (K5-9<>CR1-4 on model MHP-20-4-08).	Attached to "-" terminal on MHP-20-4-08.
	d. Solder "quick disconnect" terminals to the wires.	
	e. Heat shrink tubing over the solder joint.	Use hot air dryer.
	f. Push terminals onto rectifier CR1, terminals 2 and 4.	Wire V6D20 (CR1-2<>TB2-12) to terminal 2; X36A20N (K5-9<>CR1-4) to terminal 4.
	g. Attach remaining two wires to either of two AC terminals.	
	h. Replace junction box.	
	i. Replace top cover.	
	j. Connect power supply.	

5.4 CAPACITORS C2 (THREE-PHASE UNITS) AND C6 (SINGLE-PHASE UNIT).

Location/Item	Action	Remarks
Removal	a. Disconnect power supply.	**WARNING** High voltage can kill.
	b. Remove evaporator section top cover.	
	c. Tag and pull "quick disconnect" terminals from rectifier CR1, terminals 1 and 3.	
	d. Cut leads at terminals.	
Installation	a. Slip heat-shrink tubing over capacitor leads and leads X38A20N and X37A20.	Figures FO-1, FO-3, FO-5, or FO-7.
	b. Join one capacitor lead and wire X38A20.	
	c. Join second capacitor lead and wire X37A20.	
	d. Solder "quick disconnect" terminals to the wires.	
	e. Heat shrink tubing over the solder joint.	Use hot air dryer.
	f. Push terminals onto rectifier CR1, terminals 1 and 3.	Wire X38A20 to terminal 3; X37A20, to terminal 1.
	g. Replace junction box.	
	h. Replace top cover.	
	i. Connect power supply.	

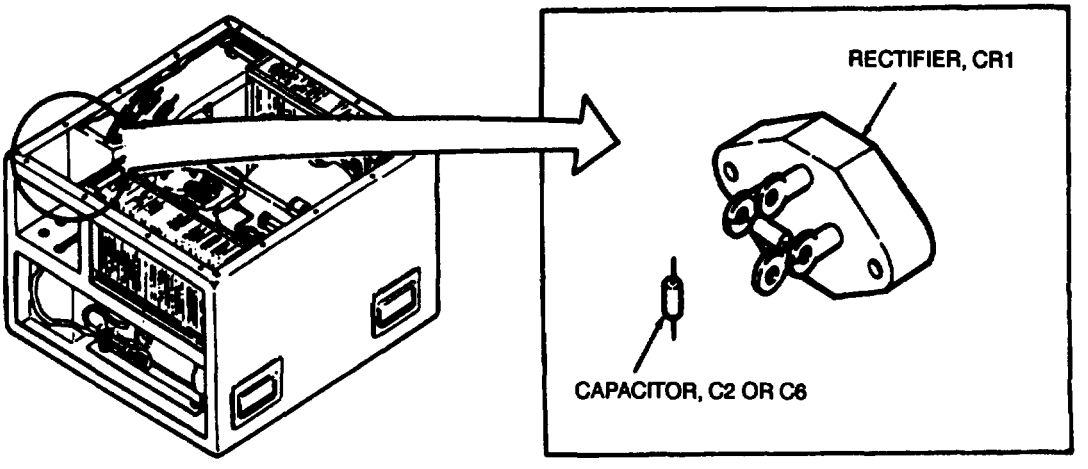


Figure 5-2. Capacitors C2 (Three-Phase Units) and C6 (SIngle Phase Unit)

5.5 RESISTOR R1. This task covers removal and installation.

INITIAL SETUP

Applicable Configurations:
All but Model MHP-20-4-08

Test Equipment:
Multimeter

Special Tools:
None

Materials/Parts:
Heat-shrink Tubing
Solder
Wire Ties
Hot Air Dryer

Equipment Descriptions:
Power OFF; installed in shelter

Special Environmintal Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Refrigeration Specialist

Location/Item	Action	Remarks
Removal	a. Disconnect power supply from unit.	**WARNING** High voltage can kill.
	b. Remove top cover from evaporator section.	
	c Remove screws and carefully pull junction box from frame. Use care to avoid breaking sensing line.	Sensing line connects TEMPERATURE SELECTOR to sensing bulb which is behind return air louver.
	d. Cut wire ties and pull resistor away from transformer.	Figure 5-3
	e. Tag and unsolder or cut leads at resistor.	

5.5. RESISTOR R1. - Continued

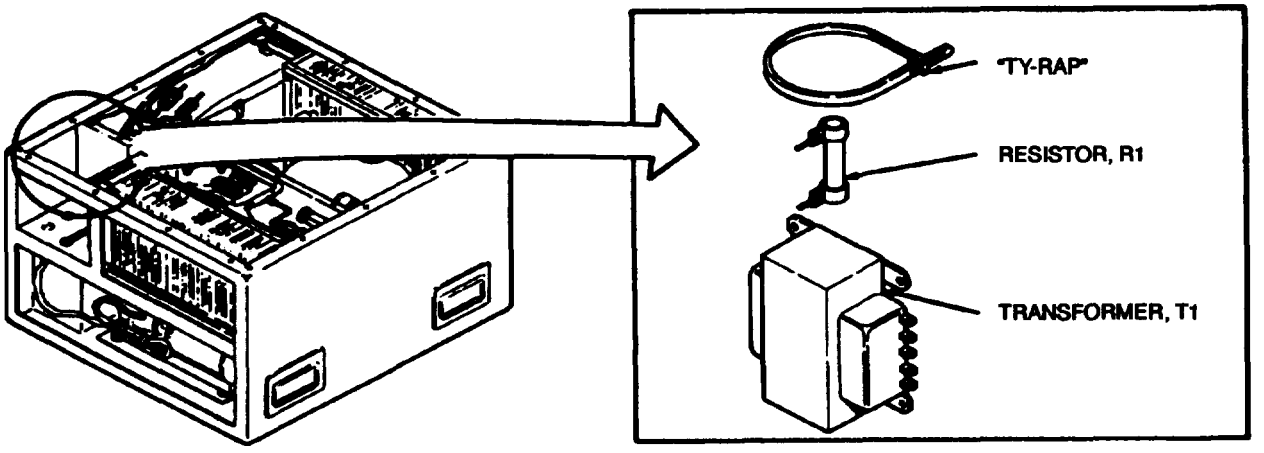


Figure 5-3. Resistor R1

Location/Item	Action	Remarks
Installation	a Slip heat-shrink tubing over resistor leads.	
	b. Use a commercial “butt splice" or solder wire X34A20V (F18H, F18H-3 and F18H-4) or X34A20B (F18H-3A and F18H-4A) to one of the resistor leads.	
	c. Solder loose end of resistor to terminal 1 of transformer T1 .	
	d. Heat shrink tubing over wire or solder connections.	Use hot air dryer.
	e. Secure resistor R1 to transform T1 using "Ty-rap."	
	f. Replace junction box.	
	g. Replace top cover.	
	h. Conned power supply.	

5.6 RECTIFIER CR1. This task covers removal, testing and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipmment:
Multimeter

Special Tools:
None

Materials/Parts:
None

Equipment Descriptions:
Power OFF; installed in shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Refrigeration Specialist

Location/Item	Action	Remarks
Removal	a. Disconnect power supply.	**WARNING** High voltage can kill.
	b. Remove top cover from evaporator section.	
	c. Remove screws and pull junction box from frame. Use care to avoid breaking sensing line.	Sensing line connects TEMPERATURE SELECTOR to sensing line bulb which is behind return air louver.
	d. Tag and pull the four “quick disconnect" terminals from the rectifier.	
	e. Remove capactors C1 and C2 or C6.	
	f. Remove two screws and pull rectifier from frame.	

5.6 RECTIFIER CR1. - Continued

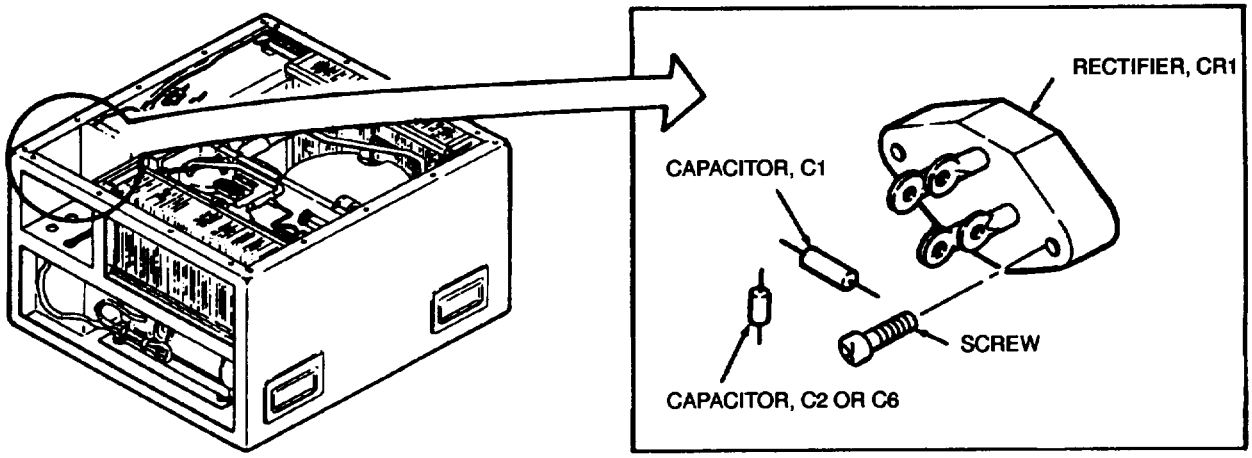


Figure 5-4. Rectifier CR1

Location/Item	Action	Remarks
Installation	a. Bolt rectifier CR1 to frame using two screws. b. Connect “quick disconnect” terminals. Terminal Connection (Models F18H, F18H-3 & F18H-4) Wire No. / Terminal No. X37A20 — 1 V6D20 — 2 X38A20 — 3 X36A20N — 4 Terminal Connection (Model MHP-20-4-08) Wire No. / Terminal No. T1-7<>CR1-1 — 1 (AC) CR1-2<>TB2-12 — 2 (+) T1-8<>CR1-3 — 3 (AC) K5-9<>CR1-4 — 4 (-) c. Replace capacitors C1 and C2 or C6. d. Install junction box. e. Replace top cover. f. Connect power supply.	Terminal 1 at top.

5.7 TRANSFORMER T1. This task covers removal, testing and installation.

INITIAL SETUP

Applicable Configurations:
All but Model MHP-20-4-08

Test Equipment:
Multimeter

Special Tools:
None

Materials/Parts:
Heat-shrink Tubing
Hot Air Dryer

Equipment Descriptions:
Power OFF; installed in shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Refrigeration Specialist

Location/Item	Action	Remarks
Transformer T1		
Removal	a. Disconnect power supply from unit.	**WARNING** High voltage can kill.
	b. Remove top cover from evaporator section.	
	c. Remove screws and carefully pull junction box from frame. Use care to avoid breaking sensing line.	Sensing line connects TEMPERATURE SELECTOR to sensing line bulb which is behind return air louver.
	d. Remove resistor.	Paragraph 5.5
	e. Remove four screws and pull transformer away from frame.	
	f. Tag and unsolder or cut the leads at the transformer.	

5.7. TRANSFORMER T1. - Continued

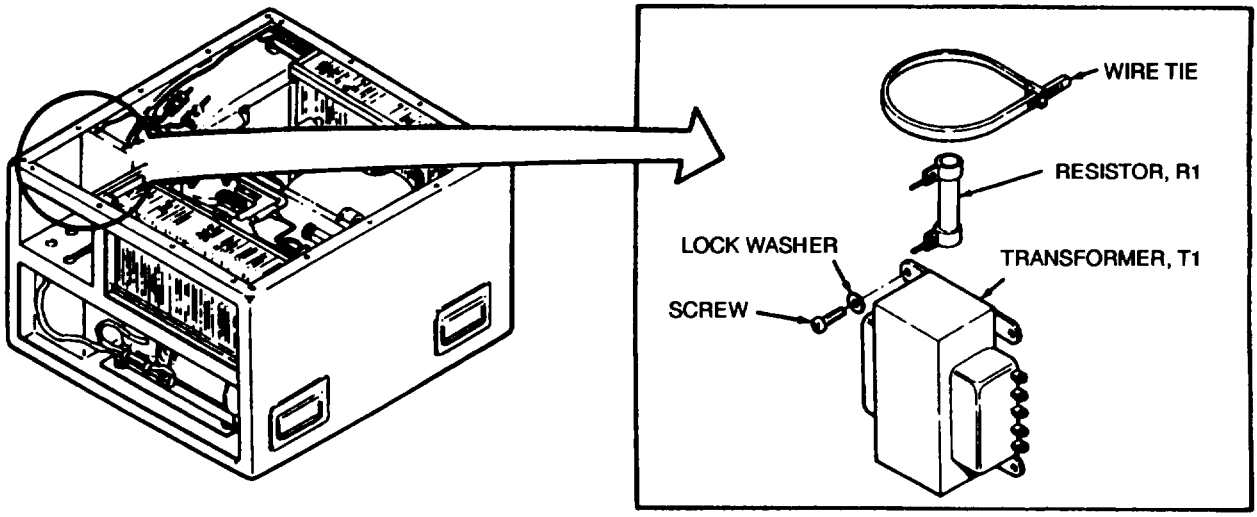


Figure 5-5. Transformer T1

Location/Item	Action	Remarks
Testing	a. Tag and disconnect leads and check for continuity across the primary winding and then across the secondary winding. If either winding is open, replace the transformer. b. Check for shorts between one terminal and transformer case and also between one primary termial and one secondary terminal using multimeter on high ohms setting. Replace transformer if a short is indicated.	
Installation	a. Slip heat-shrink tubing over the leads. b. Solder leads to transformer. Terminal Connection (Models F18H, F18H-3 & F18H-4) **Wire No.** / **Terminal No.** Resistor R1 — 1 X35A20N — 2 X37A20 — 3 X38A20 — 4	

5.7. TRANSFORMER T1. - Continued

Location/Item	Action	Remarks
Installation - Continued	Terminal Connection (Models F18H-3A & F18H-4A) **Wire No.** — **Terminal No.** Resistor R1 — 2 X61A16V — 3 X61A16V — 4 X35A20C — 5 X37A20 — 7 X38A20 — 8 Terminal Connection (Model MHP-20-4-08) **Wire No.** — **Terminal No.** T1-2<>TB2-10 — 2 T1-3<>T1-4 — 3 T1-3<>T1-4 — 4 T1-5<>TB2-11 — 5 T1-7<>CR1-1 — 7 T1-8<>CR1-3 — 8	
	c. Heal shrink tubing over the solder connections.	Use hot air dryer.
	d. Install resistor.	Paragraph 5.5
	e. Side transformer into place.	
	f. Install screws.	
	g. Replace junction box.	
	h. Replace top cover.	
	i. Connect power supply.	

5.8 RELAYS K4 (AND K5 ON MODEL MHP-20-4-08.). This task covers removal, testing and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
Multimeter
Stop watch
28 Vdc power supply

Special Tools:
None

Material/Parts:
Heat-shrink Tubing
Solder
Solvent P-D-680)
Detergent
Cleaning Cloths

Equipment Descriptions:
Power OFF; installed in shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Unit Maintenance

NOTE

Removal and testing proccedures apply to both relays K4 and K5.

Location/Item	Action	Remarks
Removal	a. Disconnect power supply.	**WARNING** High voltage can kill.
	b. Remove screws, and carefully pull junction box from the frame. Use care to avoid breaking the sensing line.	Sensing line connects TEMPERATURE SELECTOR to sensing bulb which is behind return air louver.
	c. Remove two screws from the side of the junction box frame.	Bracket and relay can be lifted from frame.
	d. Remove three nuts and washers.	Relay can be lifted from brackets.
	e. Tag and unsolder or cut leads at relay.	

5.8 RELAYS K4 (AND K5 ON MODEL MHP-20-4-08). - Continued

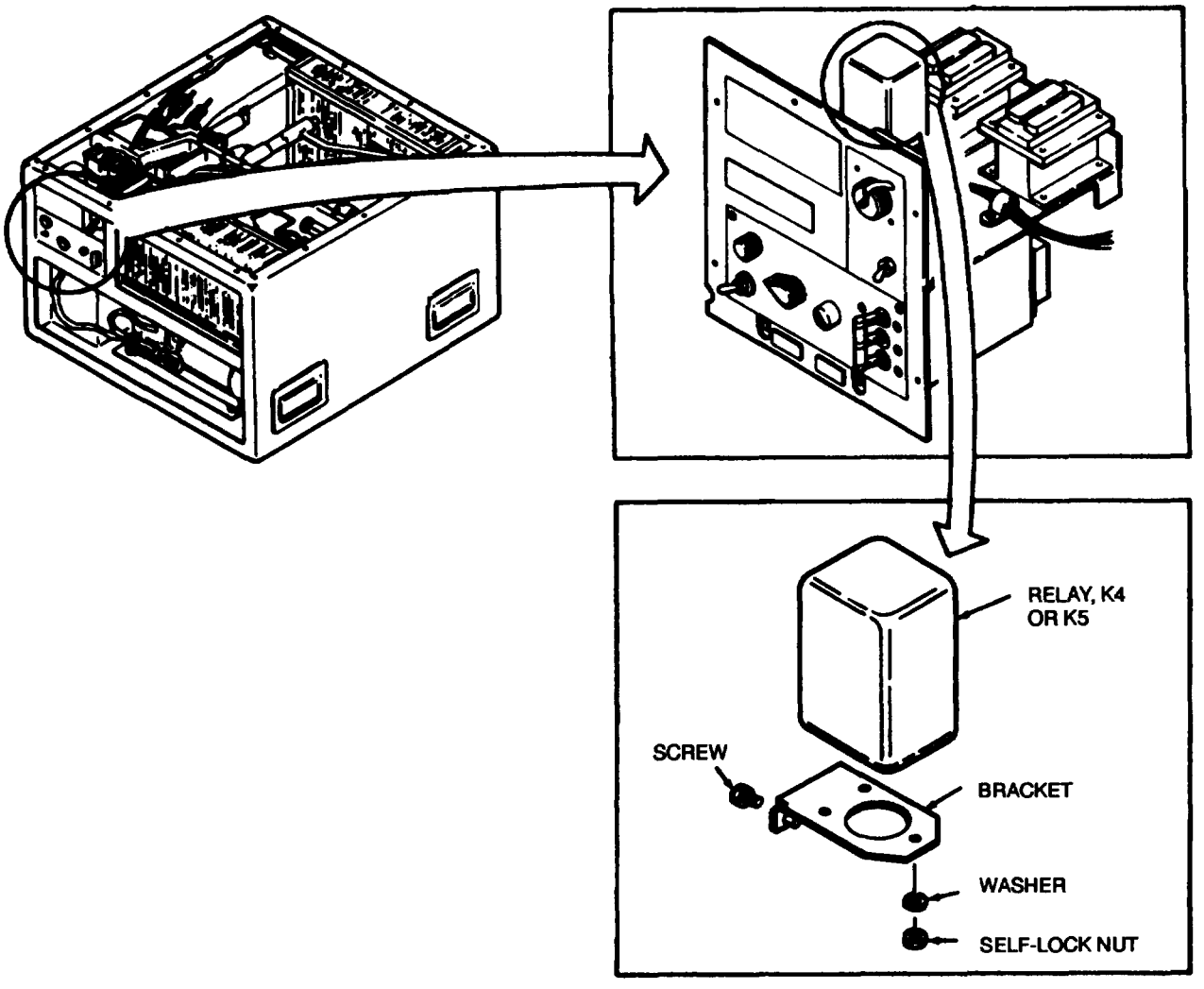


Figure 5-6. Relays, K4 and K5

Location/Item	Action	Remarks
Testing	a. Apply 28 Vdc to terminals 2 and 9: 2 is positive; 9 is negative. b. Check continuity across terminals 1 and 3,5 and 11, and 10 and 8. c. Read multimeter. It should indicate that terminals 1 and 3,5 and 6, and 10 and 7 are open. Terminals 1 and 4, 5 and 11, and 10 and 8 are closed.	**NOTE** Terminals 5,6, and 11 are not used for Model F18H single phase.

5.8 RELAYS K4 (AND K5 ON MODEL MHP-20-4-08). - Continued

Location/Item	Action	Remarks
Testing - Continued	d. Remove 28 Vdc power. Multimeter should indicate that terminals 1 and 4, 5 and 6, and 10 and 7 are dosed and that terminals 1 and 3, 5 and 11, and 10 and 8 are open.	
Installation	a. Side heat-shrink tubing over the leads.	
	b. Group the leads and pull them through bracket.	
	c. Solder leads to relay. See figures FO-1, FO-3, FO-5, FO-7, or FO-9.	**NOTE** Terminals 5, 6, and 11 are not used for Model F18H.

K4 - Single-Phase Model F18H

Wire No.	Terminal No.
X4B16V, X12A16V	1
V9A20	2
X11A16V	3
X6A20V	4
X5B16V, X10A16V	5
Blank	6
X8A20V	7
X9A16V	8
V1SA20N	9
X7A16V	10
Blank	11

K4 - 3-Phase Models F18H-3 & F18H-4

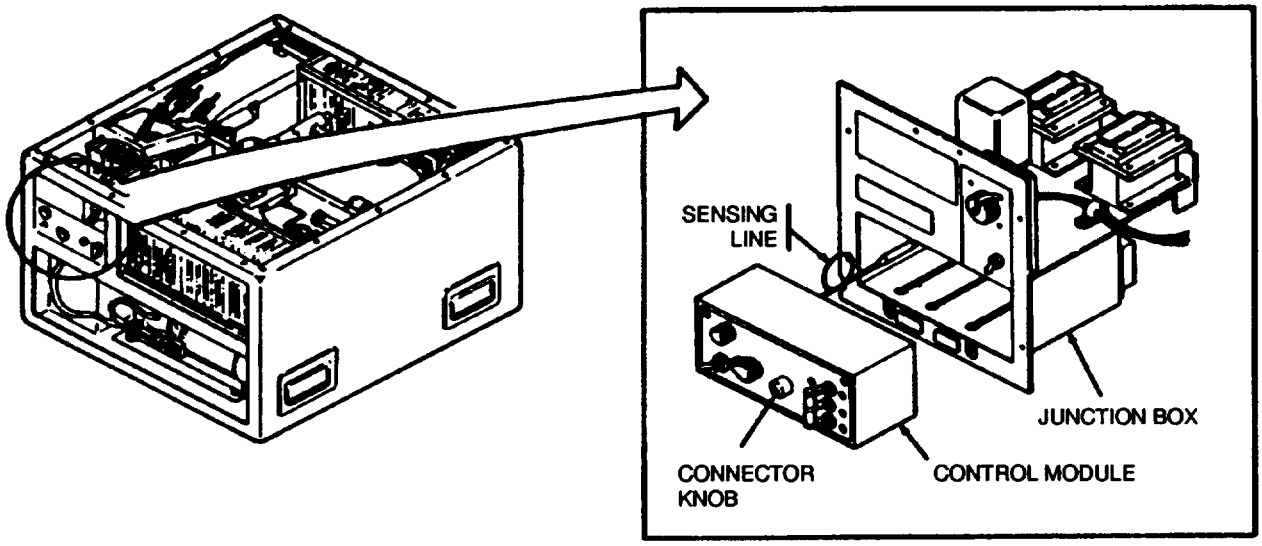
Wire No.	Terminal No.
X7B16A	1
V9A20	2
X12A16A	3
X10A20A	4
X6B16B	5
X9A20B	6
X8A20C	7
X11A16C	8
V14A20N, X44A12N	9
X5B16C	10
X13A16B	11

5.8 RELAYS K4 (AND K5 ON MODEL MHP-20-4-08) - Continued

Location/Item	Action	Remarks
Installation - Continued	K4 - 3-Phase Model MHP-20-4-08 **Wire No.** / **Terminal No.** K4-1<>K2-A1, K4-1<>K5-1 — 1 TB1-6<>K4-2 — 2 J5-A<>K4-3 — 3 Blank — 4 K4-5<>K5-5, K4-5<>K2-B1 — 5 Blank — 6 Blank — 7 J5-C<>K4-8 — 8 K4-9<>K5-9, K2-X2<>K4-9 — 9 K4-10<>K5-10, K4-10<>K2-C1 — 10 J5-B<>K4-11 — 11 K5 - 3-Phase Model MHP-20-4-08 **Wire No.** / **Terminal No.** K4-1<>K5-1 — 1 K5-2-<>TB1-4 — 2 J3-A<>K5-3 — 3 Blank — 4 K4-5<>K5-5 — 5 Blank — 6 Blank — 7 J3-C<>K5-8 — 8 K5-9<>CR1-4, K4-9<>K5-9 — 9 K4-10<>K-5-10 — 10 J3-B<>K5-11 — 11 d. Use hot air dryer to heat-shrink tubing on or over the solder connections. e. Push relay down into bracket and install the three nuts and washers. f. Attach relay and bracket to junction box frame. g. Replace junction box. h. Connect power supply.	

NOTE: Removal and testing procedure apply to both relays K4 and K5.

5.8 RELAYS K4 (AND K5 ON MODEL MHP-20-4-08). - Continued



NOTE

Removal and testing procedures apply to both relays K4 and K5.

NOTE

Sensing line connects TEMPERATURE SELECTOR to sensing bulb which is behind return air louver.

Figure 5-7. Control Module Removal

5.9 RELAY K1. This task covers removal, testing and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
Multimeter
28 Vdc Power Supply Or 24 Vdc Battery

Special Tools:
None

Materials/Parts:
Heat-shrink Tubing
Solder
Hot Air Dryer

Equipment Descriptions:
Power OFF; installed in shelter

Special Environmental Conditions:
None

General Safety Installations:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Refrigeration Specialist

Location/Item	Action	Remarks
Relay K1		
Removal	a. Disconnect power supply from the air conditioner.	**WARNING** High voltage can kill.
	b. Remove screws and carefully pull the junction box from the frame. Use care to avoid breaking the sensing line.	Sensing line connects TEMPERATURE SELECTOR to sensing bulb which is behind return air louver.
	c. Use screwdriver to turn control module connector knob to the left until it is free of the frame (about live complete turns).	

5.9 RELAY K1. - Continued

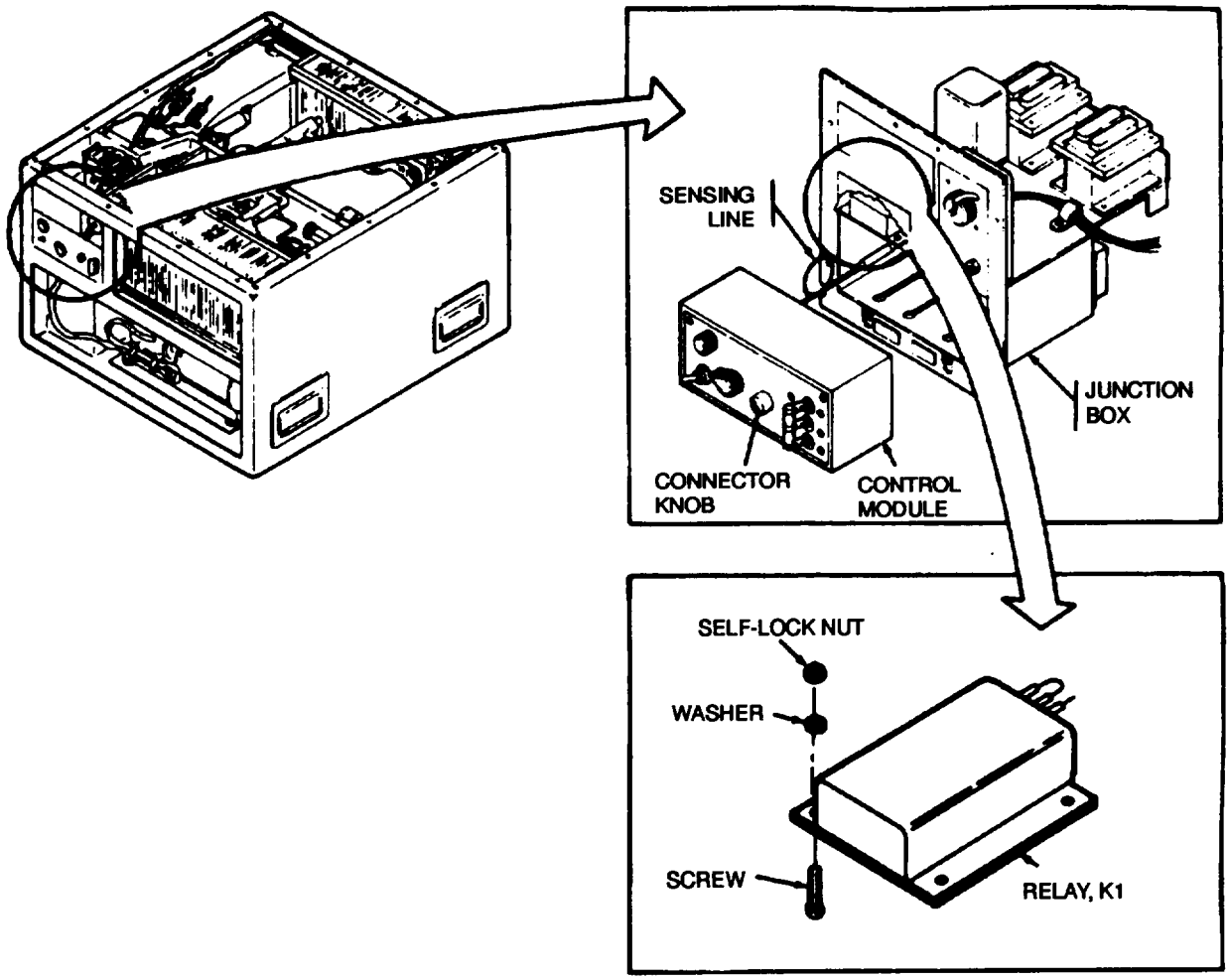


Figure 5-8. Relay K1

5.9 RELAY K1. - Continued

Location/Item	Action	Remarks
Removal - Continued	d. Carefully pull control module from the junction box. Use care to avoid breaking the sensing line.	
	e. Remove four screws from top of junction box.	Keep screws, washers, and nuts for installation.
	f. Cut wire ties.	
	g. Unsolder or cut leads at relay terminals.	
Testing	a. Connect multimeter to terminals 2 and 3.	
	b. Apply 28 Vdc to terminals 1 and 5: Terminal 1 is positive; terminal 5 is negative.	Multimeter must show continuity across terminals 2 and 3 within 30 +/- 3 seconds of applying voltage.
Installation	a. Slide heat-shrink tubing over leads in control panel.	
	b. Solder leads to relay.	Make sure lead location will not interfere with installation.
	Terminal Connection (Models F18H, F18H-3, and F18H-4) **Wire No.** — **Terminal No.** V12A20, V13A20 — 1 V13A20 — 2 V7A20 — 3 V14A20N, V15A20N (Three Phase Only) — 5	
	Terminal Connection (Model MHP-20-4-08 **Wire No.** — **Terminal No.** TB1-6<>K1-1 — 1 K1-2<>K3-X1 — 2	
	c. Hot air dry heat-shrink tubing over the solder connections.	Use hot air dryer.
	d. Push screws up through the four mounting holes.	Figure 5-6
	e. Slip relay over the four screws and tighten the screws and nuts.	
	f. Install control module.	
	g. Install junction box.	
	h. Connect power supply.	

5.10 RELAYS K2 AND K3. This task covers removal, testing and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
Multimeter
28 Vdc Power Supply

Special Tools:
None

Materials/Parts:
None

Equipment Descriptions:
Power OFF; installed in shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Refrigeration Specialist

Location/Item	Action	Remarks
Relay K2 or K3		
Removal	a. Disconnect power supply.	**WARNING** High voltage can kill.
	b. Remove screws and carefully pull junction box from frame. Use care to avoid breaking the sensing line.	Sensing line connects TEMPERATURE SELECTOR to sensing bulb which is behind return air louver.
	c. Remove terminal cover from relay.	Do not discard if relay is not being replaced.
	d. Tag and remove all leads from relay.	
	e. Remove four screws, washers and nuts to lift relay from frame.	Save hardware for reuse.

5.10 RELAYS K2 AND K3. - Continued

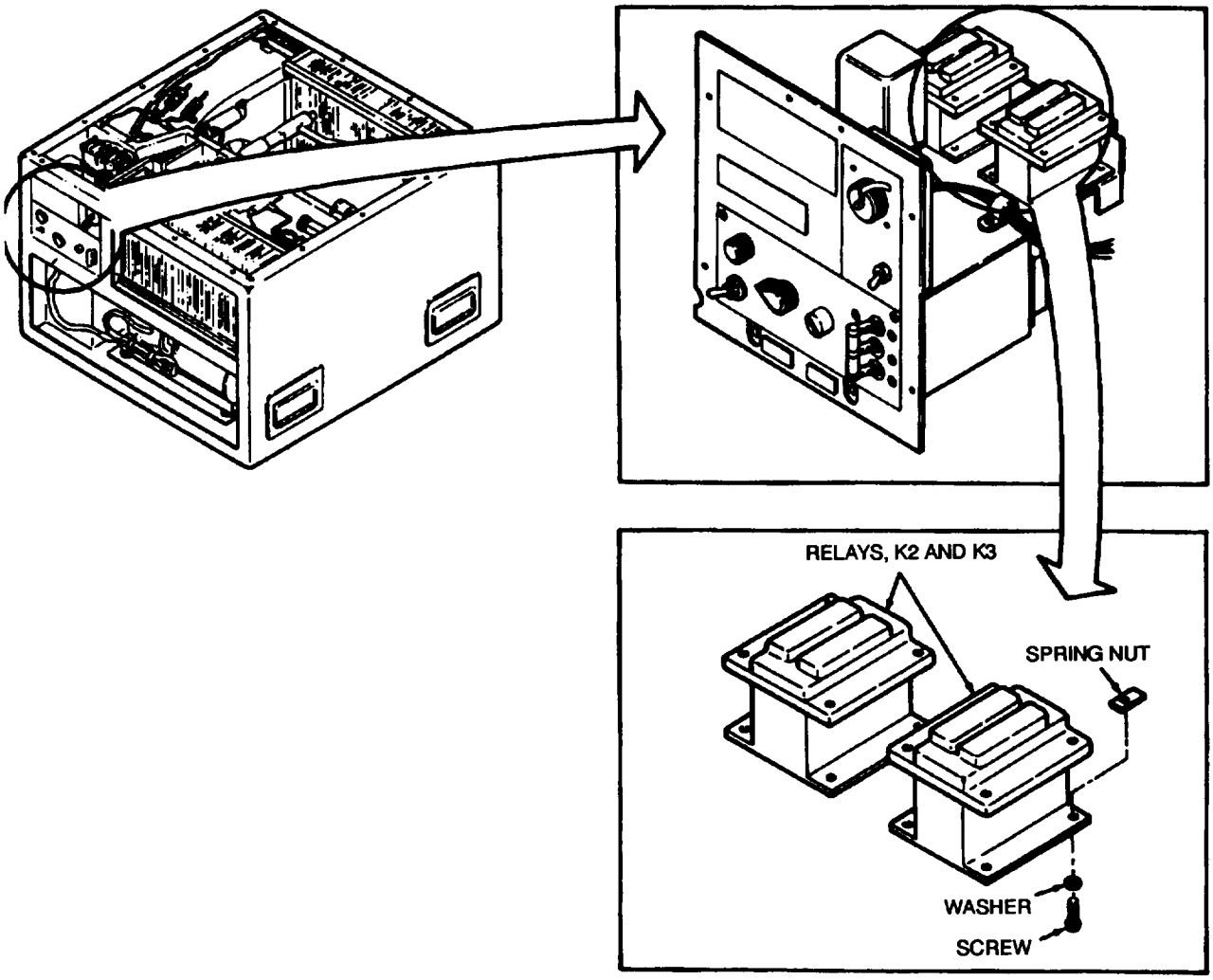


Figure 5-9. Relays K2 and K3

5.10 RELAYS K2 AND K3. - Continued

Location/Item	Action	Remarks
Testing	a. Apply 28 Vdc to terminals X1 and X2: X1 is positive; X2 is negative.	
	b. Check continuity across terminals A1 and A2, B1 and B2, and C1 and C2.	The multimeter must show that contacts are closed.
	c. Remove power.	Multimeter must show that contacts are open.
Installation	a. Attach relay to control panel frame.	Use the removed hardware.
	b. Remove terminal cover to attach leads to new relays.	

Model F18H Relay K2

Wire No.	Terminal No.
X1E16V	A1
X2E16V	B1
Blank	C1
V3A20	X1
X32A16V	A2
X17B16V, X31A16V	B2
Blank	C2
V15A20N, V17A20N and V16A20N	X2

Model F18H Relay K3

Wire No.	Terminal No.
X19C16Y X19B12V	A1
X23B12V, X23C16Y	B1
Blank	C1
V8A20, V7A20	X1
X20A12V, X21A12V	A2
X24A12V	B2
Blank	C2
V10A20N, V17A20N, and V18A20N	X2

5.10 RELAYS K2 AND K3. - Continued

Location/Item	Action	Remarks
Installation - Continued	Models F18H & K1F-18H-4 Relay K2 **Wire No.** — **Terminal No.** X1E16A — A1 X2J20B, X2E16B — B1 X3E16C — C1 V3A20 — X1 X39A16A — A2 X60A16B — B2 X59A16C — C2 V15A20N, V16A20N and V17A20N — X2 Models F18H-3 & K1F-18H-4 Relay K3 **Wire No.** — **Terminal No.** X20C16B, X20B12A — A1 X22B12B, X22C16B — B1 X24B12C — C1 V7A20, V8A20 — X1 X21A12A — A2 X23A12B — B2 X25A12C — C2 V10A20N, V17A20N, and V18A20N — X2	

5.10 RELAYS K2 AND K3. - Continued

Location/Item	Action	Remarks
Installation - Continued	Model MHP-20-4-08 Relay K2 **Wire No.** — **Terminal No.** K4-1<>K2-A1, TB1-1<>K2-A1 — A1 TB1-2<>K2-B1, K4-5<>K2-B1 — B1 TB1-3<>K2-C1 K4-10<>K2-C1 — C1 J2B-5<>K2-X1 — X1 K2-A2<>TB2-6 — A2 K2-B2<>TB2-5 — B2 K2-C2<>TB2-4 — C2 K2-X2<>K3-X2, K2-X2<>K4-9 — X2 Model MHP-20-4-08 Relay K3 **Wire No.** — **Terminal No.** J2A-14<>K3-A1, K3-A1<>J4-F — A1 J2A-15<>K3-B1, K3-B1<>J4-G — B1 J2A-16<>K3-C1 — C1 K1-2<>K3-X1, K3-X1<>J9-B — X1 K3-A2<>J4-A — A2 K3-B2<>J4-B — B2 K3-C2<>J4-C — C2 K3-X2<>J8-B, K3-X2<>J9-A, and K2-X2<>K3-X2 — X2 c. Replace terminal cover. d. Replace junction box. e. Connect power supply.	

5.10 RELAYS K2 AND K3. - Continued

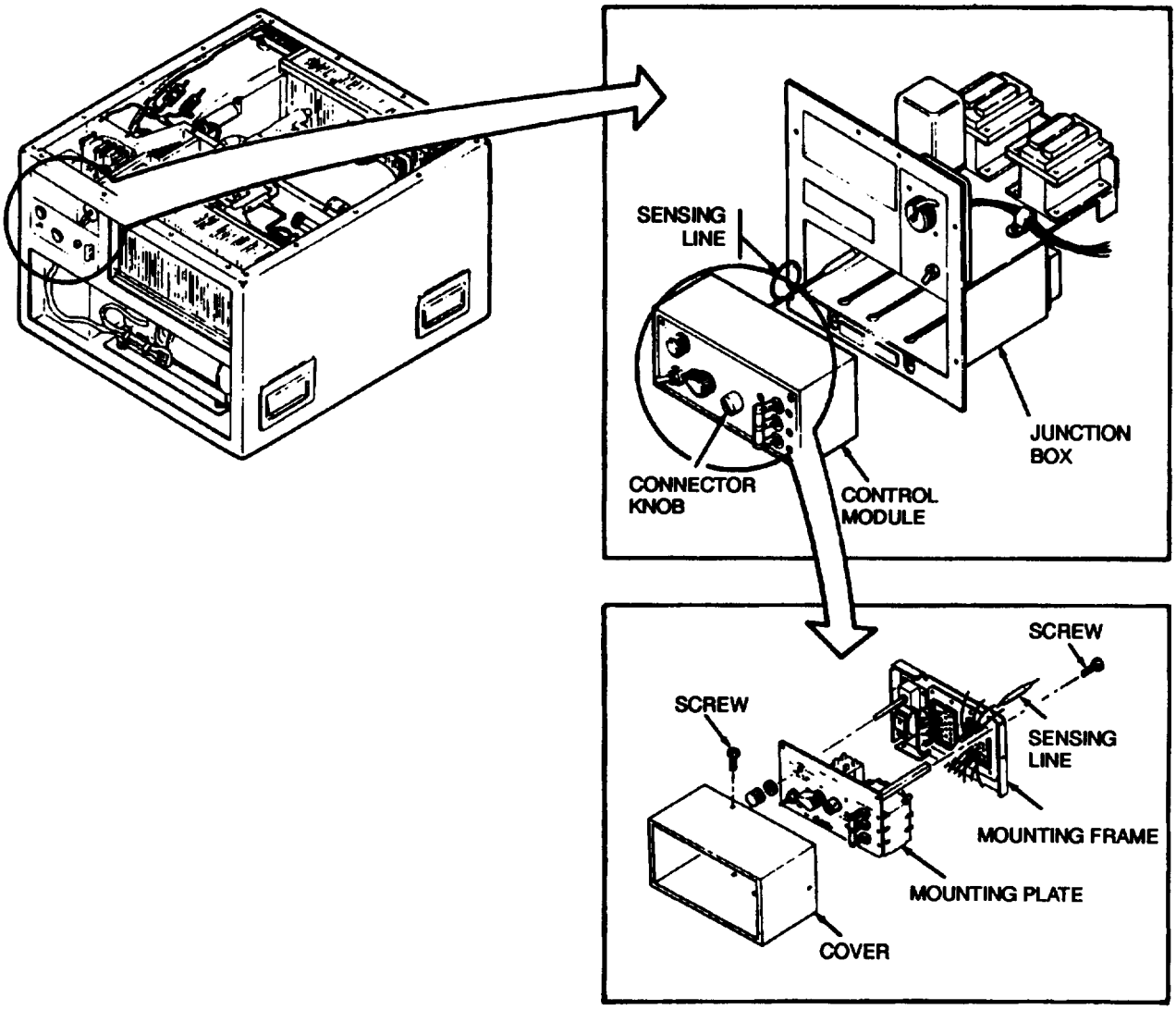


Figure 5-10. Control Module

5.11 MODE SWITCH S1. This task covers removal, testing and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
Multimeter

Special Tools:
None

Materials/Parts:
None

Equipment Descriptions:
Power OFF; installed in shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting Referemces:
None

Personnel Required:
Electrician

Location/Item	Action	Remarks
Mode Switch Removal	a. Disconnect power supply.	**WARNING** High voltage can kill.
	b. Use a screwdriver to turn the connector knob to the left until it is free (about five complete turns).	
	c. Carefully pull the control module from the junction box. Use care to avoid breaking sensing line.	Sensing line connects TEMPERATURE SELECTOR to sensing bulb which is behind return air louver.
	d. Remove four screws and pull cover from control module frame.	Figure 5-10

5.11 MODE SWITCH S1. - Continued

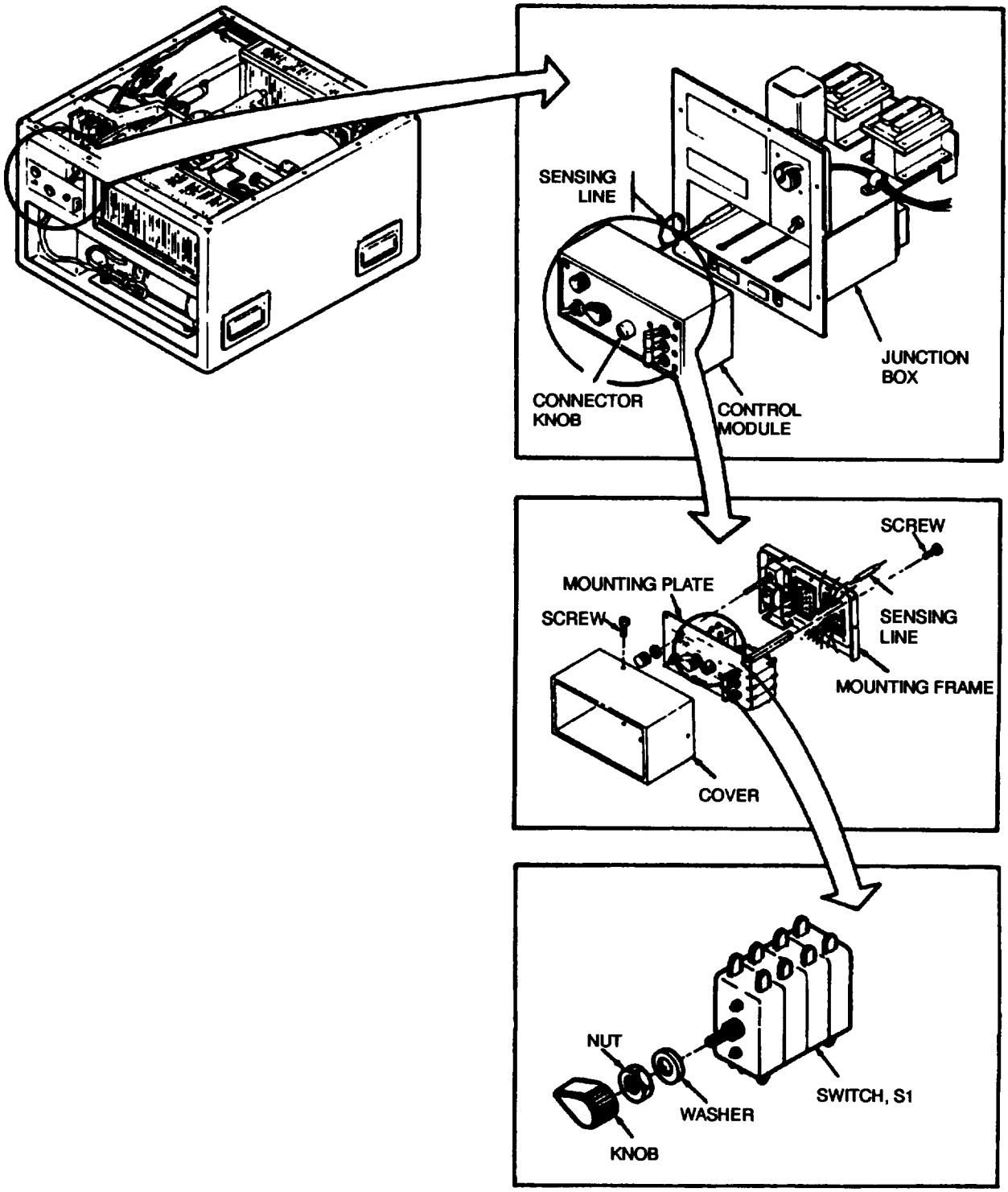
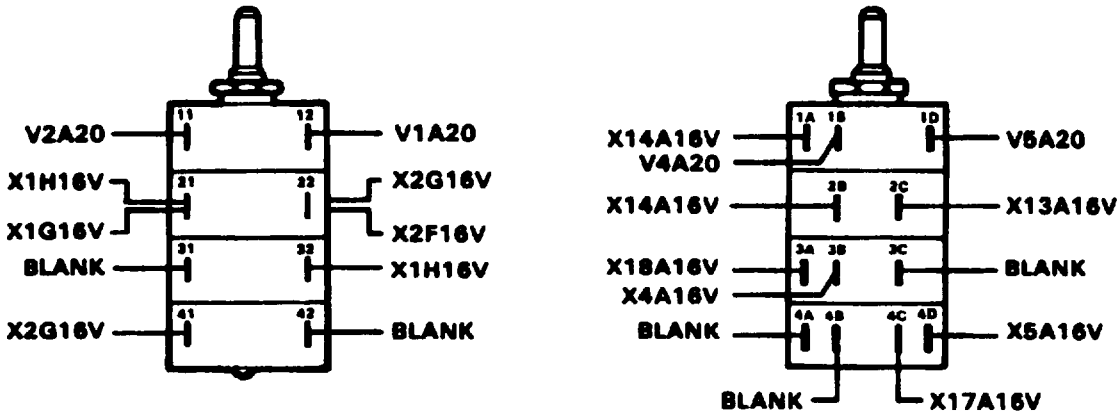
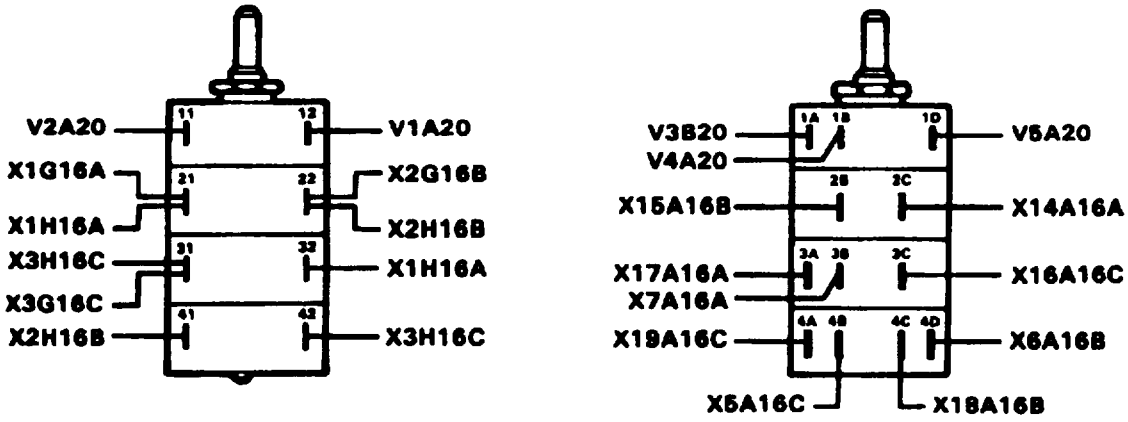


Figure 5-11. Switch S1

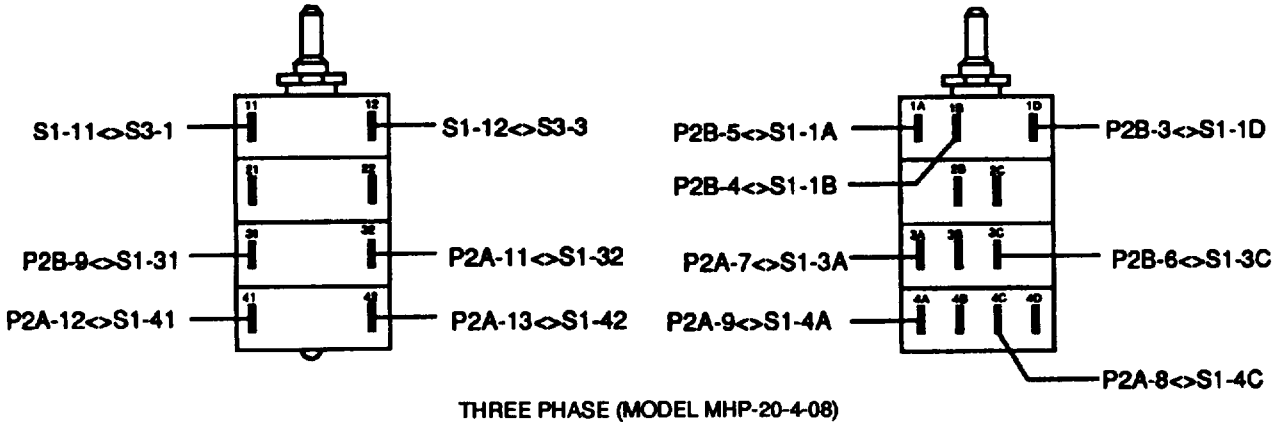
5.11 MODE SWITCH S1. - Continued



SINGLE PHASE



THREE PHASE (MODELS F18H, F18H-3, AND F18H-4)



THREE PHASE (MODEL MHP-20-4-08)

Figure 5-12. Selector Switch Wire Termination

5.11 MODE SWITCH S1. - Continued

Location/Item	Action	Remarks
Removal - Continued	e. Separate the mounting plate from the mounting frame assembly.	
	f. Loosen setscrew in knob to pull knob from switch shaft.	
	g. Remove switch nut and washer.	Discard nut and washer. New nut and washer included with new switch.
	h. Tag and pull “quick disconnects” from switch.	
Testing	See table 4-3, Step 7.	
Installation	a. Push "quick disconnect" terminals onto switch terminals.	
	b. Slip switch into the mounting plate.	
	c. Install switch nut and washer.	Supplied with switch.
	d. Assemble control module.	
	e. Slide control module into juntion box.	
	f. Turn connector knob to the right (about five full turns).	
	g. Connect power supply.	

5.12 TEMPERATURE SWITCH S3. This task covers removal, testing and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
Multimeter

Special Tools:
None

Materials/Parts:
None

Equipment Descriptions:
Power OFF; installed in shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Refrigeration Specialist

Location/Item	Action	Remarks
Temperature Switch		
Removal	a. Disconnect power supply from air conditioner.	**WARNING** High voltage can kill.
	b. Turn connector knob to the left (about five full turns) until it is free.	
	c. Carefully pull the control module from the junction box. Use care to avoid breaking sensing line.	Sensing line connects TEMPERATURE SELECTOR to sensing bulb.
	d. Remove four screws in order to pull cover from control module frame.	
	e. Remove four screws to separate mounting plate from mounting frame.	

5.12 TEMPERATURE SWITCH S3. - Continued

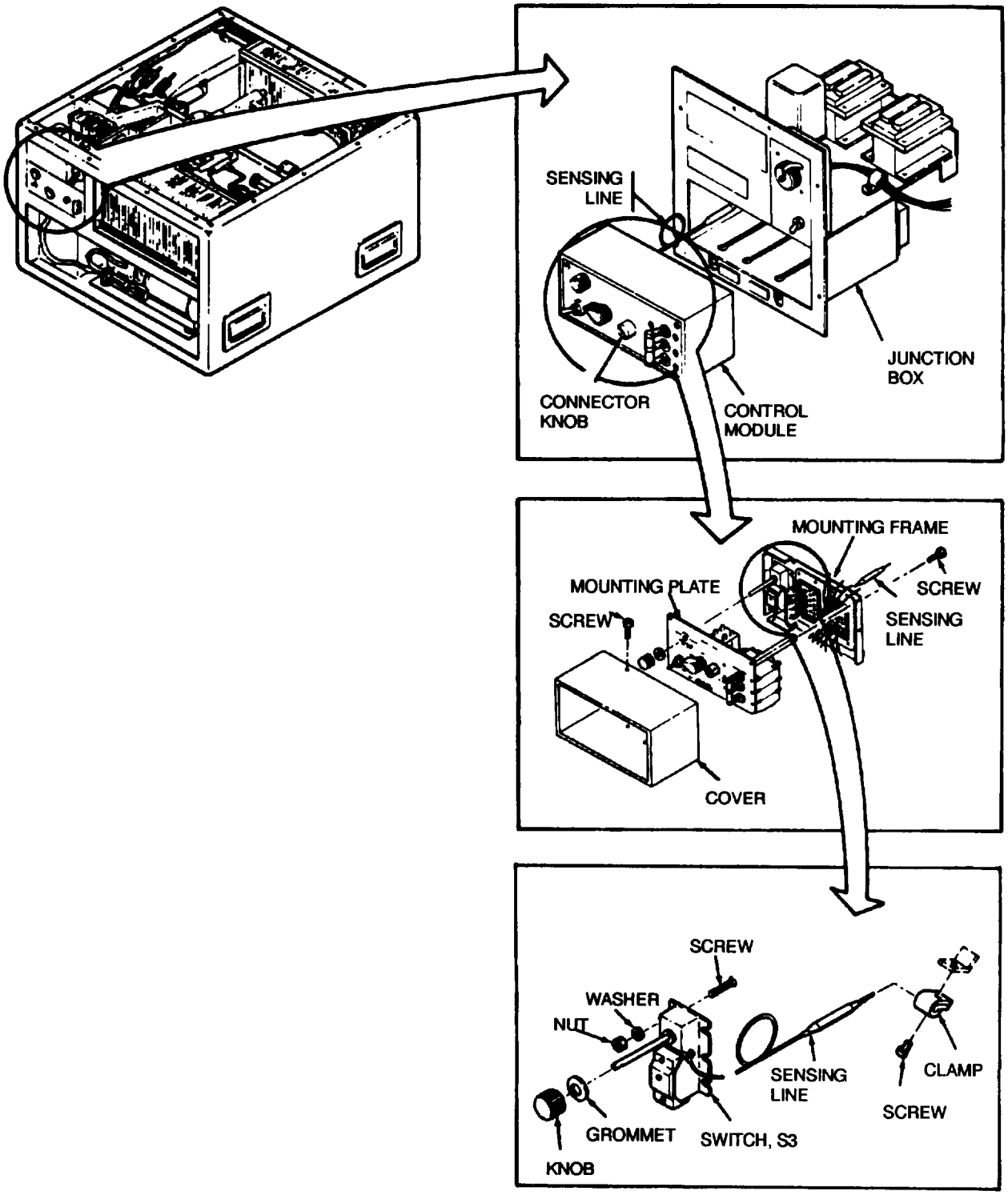


Figure 5-13. Temperature Selector Switch S3

5.12 TEMPERATURE SWITCH S3. - Continued

Location/Item	Action	Remarks
Removal - Continued	f. Loosen setscrew in knob to pull knob from switch shaft.	
	g. Remove return air louver and filter.	Paragraph 5.20
	h. Remove top cover from evaporator section.	
	i. Pull control module from frame.	
	j. Remove tube clamps to remove sensing bulb from evaporator blower housing.	Keep clamps and hardware for installation.
	k. Carefully work tube and bulb from frame.	
	l. Remove four screws to pull switch from mounting frame.	Keep screws, washers, and nuts for installation.
	m. Pull "quick disconnect" terminals from switch.	
Testing	See table 4-3, Step 8.	
Installation	a. See wiring diagram figures FO-1, FO-3, FO-5, FO-7, or FO-9.	Figure FO-1 for F18H, figure FO-3 for F18H-3, figure FO-5 for K1F-18H-4, figure FO-7 for F18H-3A and F18H-4A, and figure FO-9 for MHP-20-4-08.
	b. Push “quick disconnects" onto switch.	

Single Phase

Wire No.	Terminal No.
V1A20	1
V2A20, V6A20	2

Three Phase (F18H-3A and K1F-18H-4)

Wire No.	Terminal No.
V1A20	2
V2A20, V6A20	1

Three Phase (F18H-3 and F-18H-4A)

Wire No.	Terminal No.
V1A20	3 Blue
V2A20, V6A20	1 Red

5.12 TEMPERATURE SWITCH S3. - Continued

Location/Item	Action	Remarks
Installation - Continued	Three Phase (MHP-20-4-08) **Wire No.** — **Terminal No.** P2B-10<>S3-1, — 1 S1-11<>S3-1 S1-12<>S3-3 — 3 c. Carefully work sensing bulb through junction box and control/electrical section to the evaporator blower housing. d. Clamp sensing bulb to the evaporator blower housing bracket. e. Secure switch to mounting frame. f. Assemble control module. g. Install louver, filter, and top panel. h. Install control module in junction box. i. Install junction box. j. Connect power supply.	

5.13 EVAPORATOR FAN SWITCH S2. This task covers removal, testing and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
Multimeter

Special Tools:
None

Materials/Parts:
None

Equipment Descriptions:
Power OFF; installed in shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Refrigeration Specialist

Location/Item	Action	Remarks
Removal	a. Disconnect power supply from air conditioner.	**WARNING** High voltage can kill.
	b. Turn connector knob to the left (about five full turns) until it is free.	

5.13 EVAPORATOR FAN SWITCH S2. - Continued

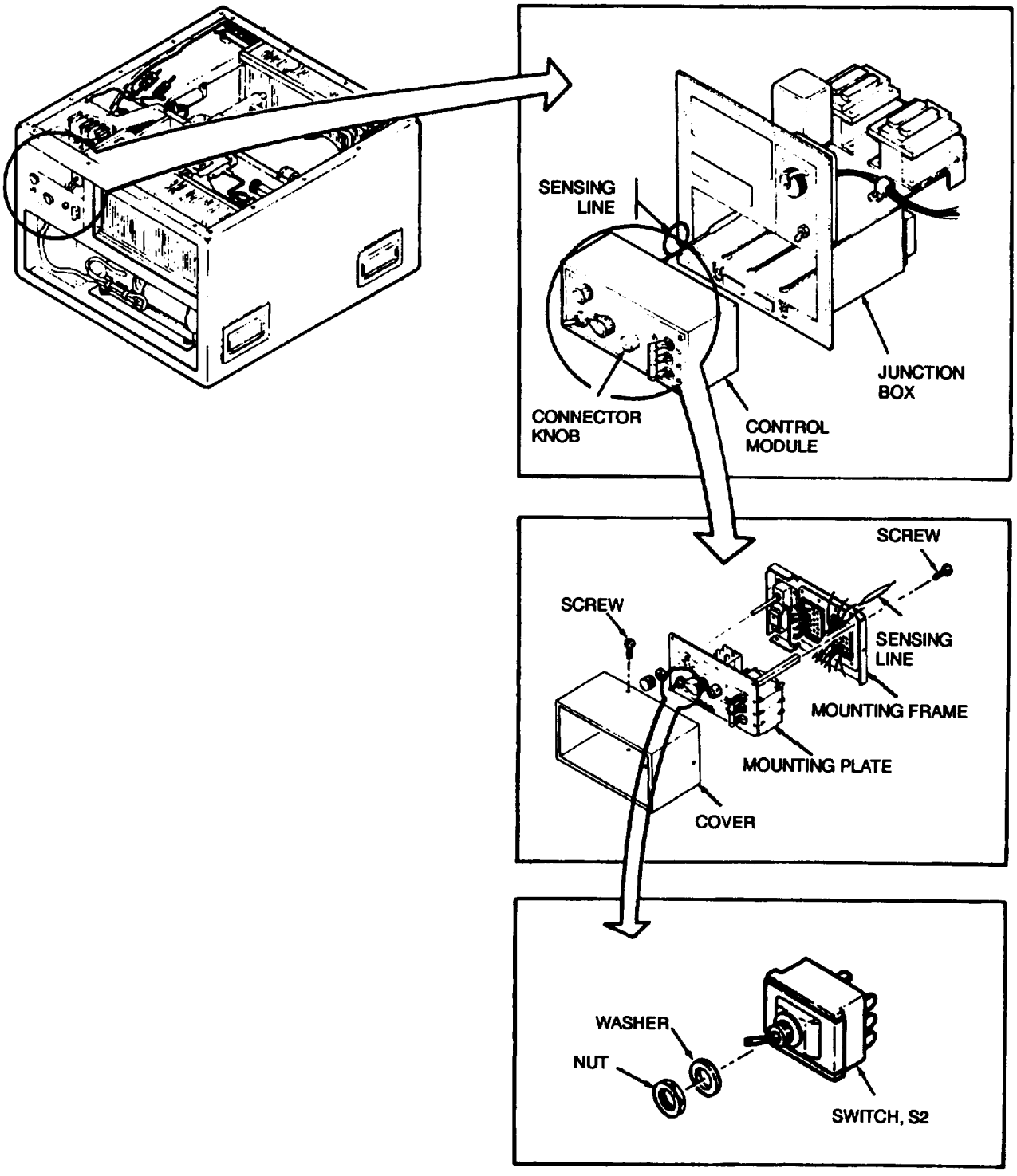


Figure 5-14. Fan Speed Switch S2

5.13 EVAPORATOR FAN SWITCH S2. - Continued

Location/Item	Action	Remarks
Removal - Continued	c. Carefully pull the control module from the junction box. Use care to avoid breaking sensing line.	Sensing line connects TEMPERATURE SELECTOR to sensing bulb.
	d. Remove four screws in order to pull cover from mounting frame.	
	e. Remove four screws to separate mounting plate from mounting frame.	
	f. Remove switch, nut and washer to pull switch from mounting plate.	If switch is to be replaced, discard nut and washer (supplied with new switch).
	g. Tag and pull "quick disconnects" from switch terminals.	
Testing	Check continuity in both positions. Continuity should be indicated.	
Installation	a. See figures FO-1, FO-3, FO-5, or FO-7.	Figure FO-1 for F18H, figure FO-3 for F18H-3, figure FO-5 or K1F-18H-4, figure FO-7 for F18H-3A and F18H-4A.
	b. Push "quick disconnect" terminals onto switch.	

Single Phase (Mcdel F18H)

Wire No.	Terminal No.
X25A16V	A1
X26A16V	B1
Blank	C1
X13A16V, X15A16V	A2
X16A16V	B2
Blank	C2
X27A20V	A3
X28A20V	B3
Blank	C3

5.13 EVAPORATOR FAN SWITCH S2. - Continued

Location/Item	Action	Remarks
Installation - Continued	Three Phase (Models F18H-3 and K1F-18H-4) **Wire No.** — **Terminal No.** X26A16A — A1 X28A16B — B1 X27A17C — C1 X14A16A — A2 X15A16B — B2 X16A16C — C2 X29A18A — A3 X31A18B — B3 X30A18C — C3 c. Slide switch into mounting plate assembly. d. Thread nut and washer onto switch shaft. e. Assemble control module. f. Install control module into junction box. g. Tighten connector knob. h. Connect power supply.	

5.14 CONTROL CIRCUIT BREAKER CB2. This task covers removal, testing and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
Multimeter

Special Tools:
None

Materials/Parts
None

Equipment Descriptions:
Power OFF; installed in shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Refrigeration Specialist

Location/Item	Action	Remarks
Cicuit Breaker CB2		
Removal	a. Disconnect power supply from air conditioner.	**WARNING** High voltage can kill.
	b. Remove screws to pull junction box from frame. Use care to avoid breaking sensing line.	Sensing line connects TEMPERATURE SELECTOR to sensing bulb.
	c. Remove nut from circuit breaker shaft.	If circuit breaker is to be replaced, discard nut (supplied with new circuit breaker).
	d. Pull circuit breaker away from junction box.	
	e. Remove circuit breaker terminal screws to lift wires from ciruit breaker. Tag removed wires.	

5.14 CONTROL CIRCUIT BREAKER CB2. - Continued

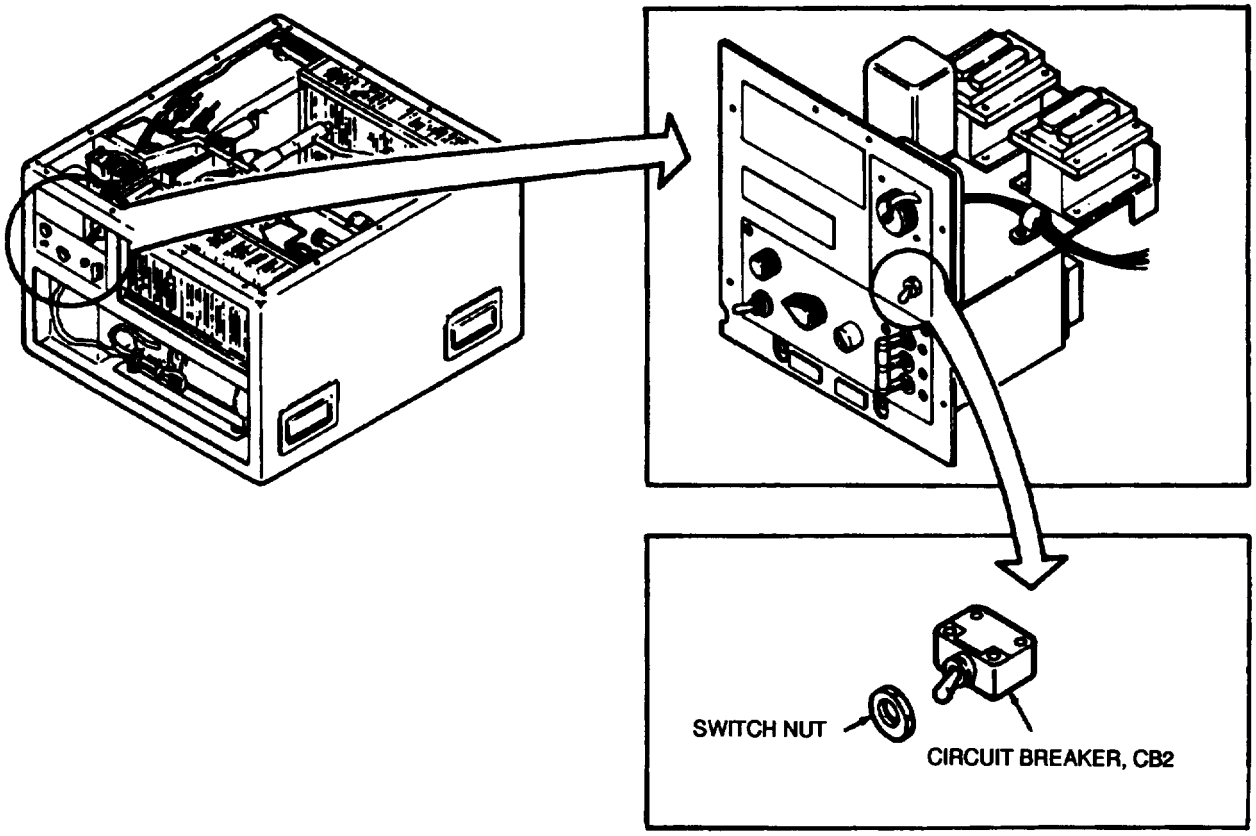


Figure 5-15. Circuit Breaker CB2

5.14 CONTROL CIRCUIT BREAKER CB2. - Continued

Location/Item	Action	Remarks
Testing	See table 4-3, Step 1.	
Installation	a. Install wires. Terminal Connections Single-Phase Model F18H **Wire No.** — **Terminal No.** X29B20V — 1 X1F20V — 2 3-Phase Models F18H-3 and F18H-4 **Wire No.** — **Terminal No.** X2J20B — 1 X32A20B — 2 3-Phase Model MHP-20-4-08 **Wire No.** — **Terminal No.** J2B-6<>CB2-1 — 1 (Line) J2B-7<>CB2-2 — 2 (Load)	
	b. Install circuit breaker in junction box.	Locating dimple provided for correct installation.
	c Thread nut onto circuit breaker shaft.	
	d. Install junction box.	
	e. Connect power supply.	

5.15 CIRCUIT BREAKER CB1. This task covers removal, testing and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
Multimeter

Special Tools:
None

Materials/Parts:
None

Equipment Descriptions:
Power OFF; installed in shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Refrigeration Specialist

Location/Item	Action	Remarks
Circuit Breaker CB1		
Removal	a. Disconnect power supply.	**WARNING** High voltage can kill.
	b. Drive out handle shaft and spacers.	If circuit breaker is to be replaced, discard (supplied with new circuit breaker).
	c. Turn connector knob to the left (about five full turns) until it is free.	
	d. Pull control module from juntion box. Use care to avoid breaking sensing line.	Sensing line connects TEMPERATURE SELECTOR to sensing bulb.

5.15 CIRCUIT BREAKER CB1. - Continued

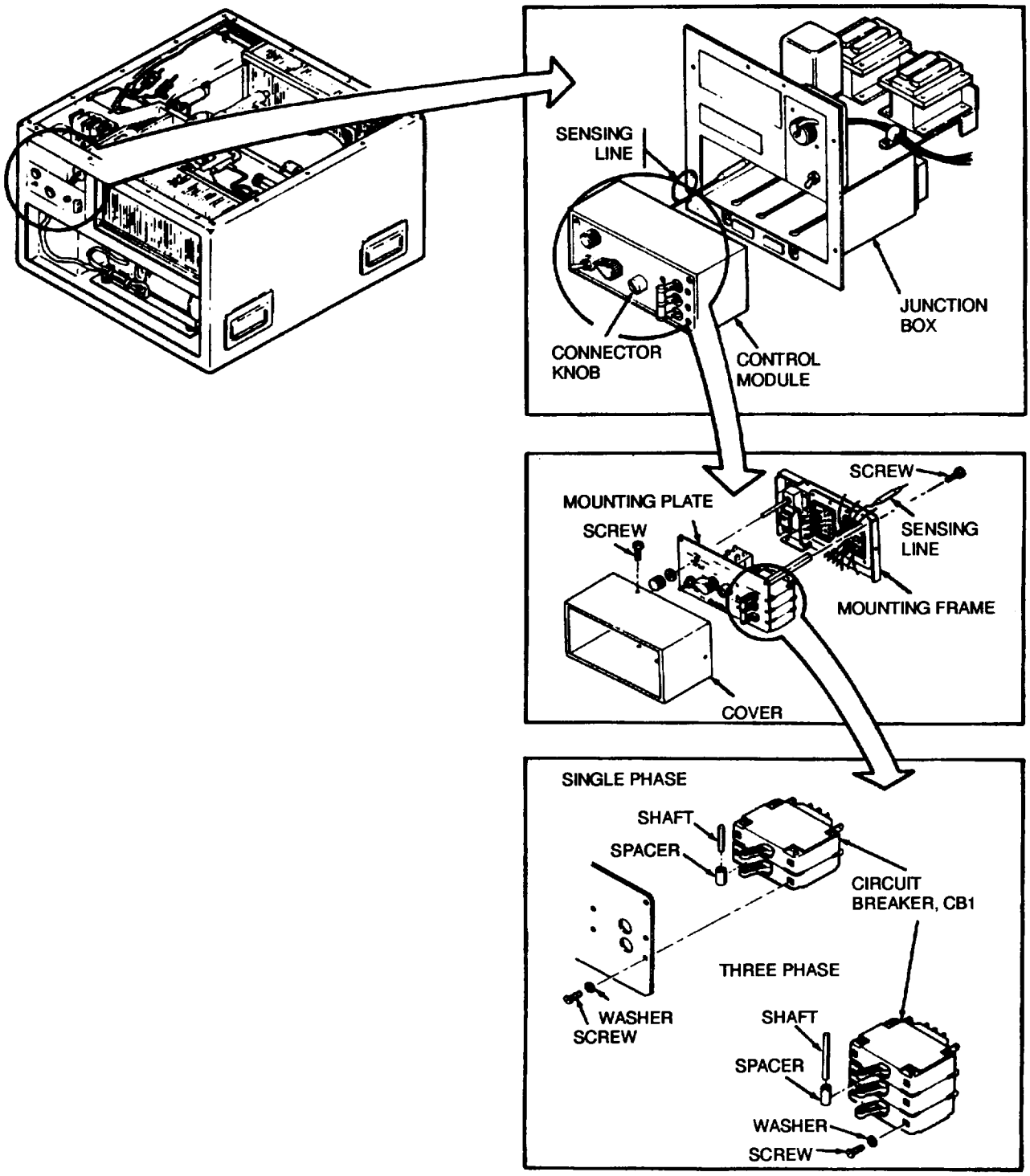


Figure 5-16. Circuit Breaker CB1

5.15 CIRCUIT BREAKER CB1. - Continued

Location/Item	Action	Remarks
Removal Continued	e. Remove four screws to pull cover from control module. f. Remove four screws to separate mounting frame assembly. g. Tag and pull "quick disconnect" terminals from circuit breaker. h. Remove four screws (single-phase) or six screws (3-phase) to pull circuit breaker from mounting plate.	
Testing	See table 4-3, Step 1.	
Installation	a. See wiring diagram figure FO-1, FO-3, FO-5, FO-7 or FO-9. b. Push "quick disconnect" terminals onto circuit breaker.	

Single Phase
Model F18H

Wire No.	Terminal No.
X30A20V	NO
X29A20V	C
X1D12V	A1
X2D12V	B1
X19A12V	A2
X23A12V	B2

Three Phase
F18H-3 & F-18H-4

Wire No.	Terminal No.
X57A20B	NO
X33B20B	C
X1D12A	A1
X2D12B	B1
X3D12C	C1
X20A12A	A2
X22A12B	B2
X24A12C	C2

5.15 CIRCUIT BREAKER CB1. - Continued

Location/Item	Action	Remarks
Installation - Continued	Three Phase MHP-20-4-08 **Wire No.** / **Terminal No.** P2B-8<>CB1-NO — NO P2B-7<>CB1-C — C P2A-11<>CB1-A1 — A1 P2A-12<>CB1-B1 — B1 P2A-13<>CB1-C1 — C1 P2A-14<>CB1-A2 — A2 P2A-15<>CB1-B2 — B2 P2A-18<>CB1-C2 — C2	
	c. Drive out shaft and handle spacers.	Save for Step e.
	d. Secure circuit breaker to mounting frame. Four screws (single phase); six screws (three phase).	Terminals A1, B1, C1 to outside of frame.
	e. Install handle spacers and shaft.	Removed in Step c.
	f. Assemble control module.	
	g. Install control module into junction box.	
	h. Connect power supply.	

5.16 CONNECTOR P2. This task covers removal and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
Multimeter

Special Tools:
None

Materials/Parts:
Heat-shrink Tubing
Solder
Cleaning Cloths
Hot Air Dryer

Equipment Descriptions:
Power OFF; installed in shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

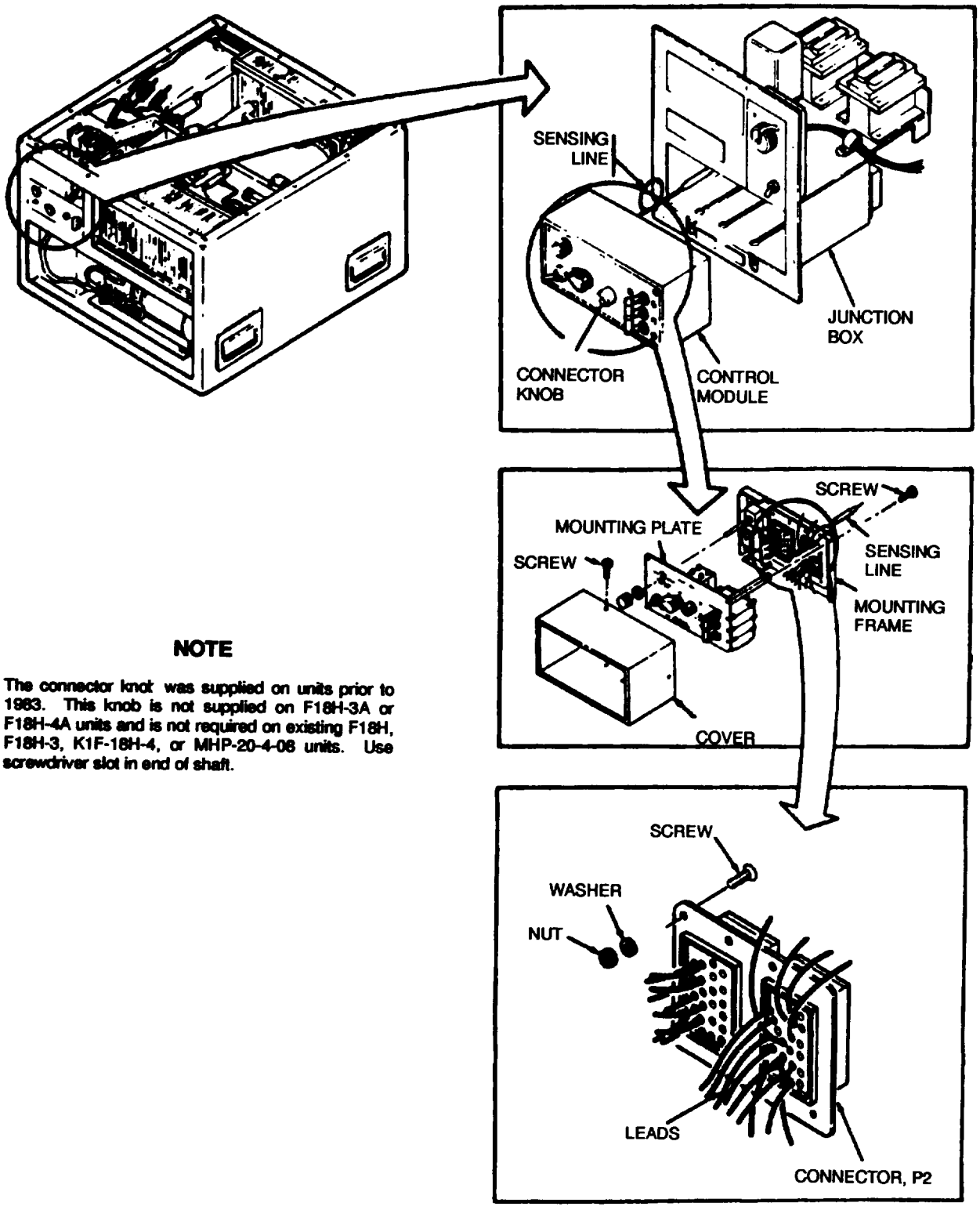
References:
None

Troubleshooting References:
None

Personnel Required:
Refrigeration Specialist

Location/Item	Action	Remarks
Connector P2		
Removal	a. Disconnect power supply from air conditioner.	**WARNING** High voltage can kill.
		NOTE Connector is “two gang“ connector. figures FO-1, FO-3, FO-5, FO-7 and FO-9 label as P2A and P2B.
	b. Turn connector knob to the left (about five full turns) until it is free.	

5.16 CONNECTOR P2. - Continued



NOTE

The connector knot was supplied on units prior to 1983. This knob is not supplied on F18H-3A or F18H-4A units and is not required on existing F18H, F18H-3, K1F-18H-4, or MHP-20-4-06 units. Use screwdriver slot in end of shaft.

Figure 5-17. Connector P2

5.16 CONNECTOR P2. - Continued

Location/Item	Action	Remarks
Removal - Continued	c. Pull control module from junction box. Use care to avoid breaking sensing line.	Sensing line connects TEMPERATURE SELECTOR to sensing bulb.
	d. Remove four screws to pull cover from control module frame.	
	e. Remove four screws to separate mounting plate assembly from mounting frame assembly.	
	Remove screws, washers and nuts to separate connector from mounting frame assembly.	
	g. Tag and unsolder wires from connector.	
Installation	a. Slide heat-shrink tubing over wires.	
	b. Solder wires to connector. See figures FO-1, FO-3, FO-5, FO-7, or FO-9.	Figure FO-1 for F18H, figure FO-3 for F18H-3, figure FO-3 or K1F-18H-4, figure FO-7 for F18H-3A and F18H-4A, and figure FO-9 for MHP-20-4-08.

Single-Phase Model F18H

Wire No.	P2A Terminal
X25A16V	1
X26A16V	2
X14A16V	3
X27A20V	4
X28A20V	5
X16A16V	6
X15A16V	7
X17A16V	8
X18A16V	9
X1D12V, X1G16V	11
X2D12V, X2F16V	12
Blank	13
X19A12V	14
X23A12V	15
Blank	16

5.16 CONNECTOR P2. - Continued

Location/Item	Action	Remarks
Installation - Continued	Single-Phase Model F-18H **Wire No.** — **P2B Terminal** X4A16V — 1 X5A16V — 2 V5A20 — 3 V4A20 — 4 V3B20 — 5 Blank — 6 X29A20V — 7 X30A20V — 8 V6A20 — 10 X3DI6N — 11 3-Phase Models F18H-3 & K1F-18H-4 **Wire No.** — **P2A Terminal** X26A16A — 1 X28A16B — 2 X27A16C — 3 X29A18A — 4 X31A18B — 5 X20A18C — 6 X17A16A — 7 X18A16B — 8 X19A16C — 9 X1D12A, X1G16A — 11 X2D12B, X2G16B — 12 X3D12C, X3G16C — 13 X20A12A — 14 X22A12B — 15 X24A12C — 16	

5.16 CONNECTOR P2. - Continued

Location/Item	Action	Remarks
Installation - Continued	3-Phase Models F18H-3 & K1F-18H-4 **Wire No.** — **P2B Terminal** X5A16C — 1 X6A16B — 2 V5A20 — 3 V4A20 — 4 V3B20 — 5 X7A16A — 6 X33B20B — 7 X57A20B — 8 V6A20 — 10 X4D16N — 11 3-Phase Model MHP-20-4-08 **Wire No.** — **P2A Terminal** P2A-7<>S1-3A — 7 P2A-8<>S1-4C — 8 P2A-9<>S1-4A — 9 P2A-11<>S1-32, P2A-11<>CB1-A1 — 11 P2A-12<>S1-41, P2A-12<>CB1-B1 — 12 P2A-13<>S1-42, P2A-13<>CB1-C1 — 13 P2A-14<>CB1-A2 — 14 P2A-15<>CB1-B2 — 15 P2A-16<>CB1-C2 — 16 3-Phase Model MHP-20-4-08 **Wire No.** — **P2B Terminal** P2B-3<>S1-10 — 3 P2B-4<>S1-1B — 4 P2B-5<>S1-1A — 5 P2B-6<>S1-3C — 6 P2B-7<>CB1-C — 7 P2B-8<>CB1-NO — 8 P2B-9<>S1-31 — 9 P2B-10<>S3-1 — 10 P2B-11<>E1 — 11 c. Heat shrink tubing over soldered connections. d. Slide connector into mounting plate assembly. e. Secure to mounting plate assembly.	

5.16 CONNECTOR P2. - Continued

Location/Item	Action	Remarks
Installation - Continued	f. Assemble control module. g. Install control module. h. Connect power supply.	

5.17 CAPACITORS (SINGLE PHASE) C2, C3, C5. This task covers removal and installation.

INITIAL SETUP

Applicable Configurations:
Model F18H, Single Phase

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Grounding Rod

Equipment Descriptions:
Power OFF; installed in shelter

Special Environment Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Refrigeration Specialist

Location/Item	Action	Remarks
Removal	a. Disconnect power supply from air conditioner.	**WARNING** High voltage can kill.
	b. Remove evaporator air inlet and filter.	
	c Ground the capacitors to discharge electrical charge.	Use grounding rod.
	d. Tag and pull "quick disconnect" terminal from capacitor.	
	e. Remove screws, washers, and straps.	Capacitor can be pulled from frame.

5.17 CAPACITORS (SINGLE PHASE) C2, C3, C5. - Continued

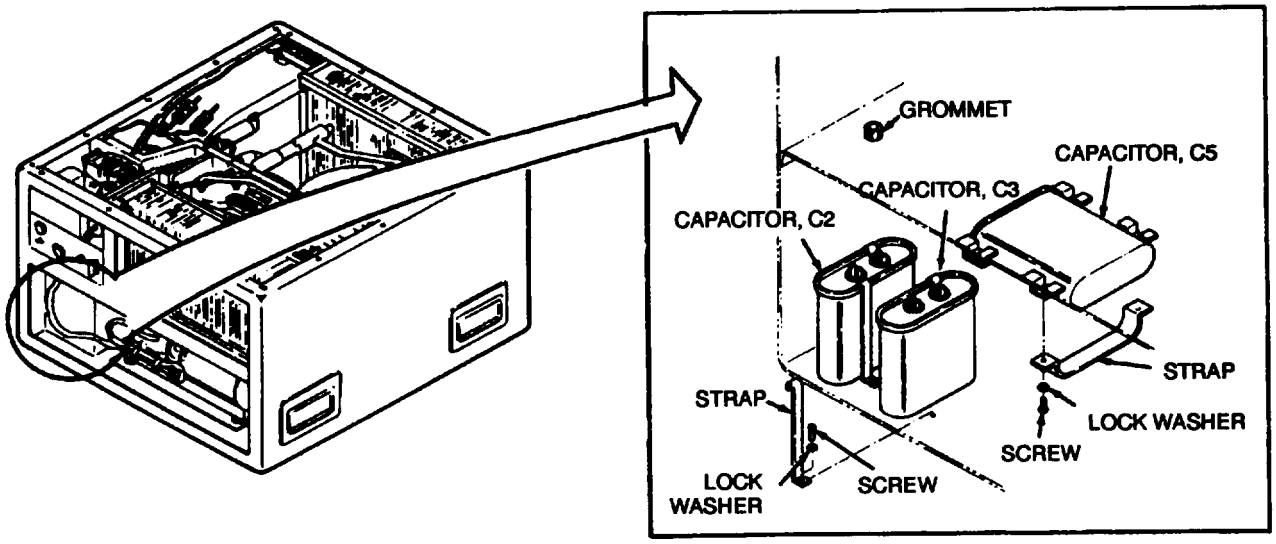


Figure 5-18. Capacitors C2, C3, and C5 (Single Phase)

Location/Item	Action	Remarks
Installation	a. See wiring diagram figure FO-1. b. Push "quick disconnect" terminals onto capacitor terminals. Capacitor C2 Wire No. X12A16V → Terminal No. 1 Wire No. X7A16V → Terminal No. 2 Capacitor C3 Wire No. X16B16V → Terminal No. 1 Wire No. X15B16V → Terminal No. 2 Capacitor C5 Wire No. X21A12V → Terminal No. 1 Wire No. X22A12V → Terminal No. 2 c. Secure capacitor in place. d. Replace air filter and louver. e. Connect power supply.	

5.18 RELAY K5 (SINGLE PHASE). This task covers removal, testing and installation.

INITIAL SETUP

Applicable Configurations:
Model F18H, Single Phase

Test Equipment:
Multimeter

Special Tools:
None

Materials/Parts:
None

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Refrigeration Specialist

Location/Item	Action	Remarks
Relay K5	**NOTE** Air conditioner will have to be removed from installed position to replace Relay K5.	
Removal	a. Disconnect power supply.	**WARNING** High voltage can kill.
	b. Remove air conditioner from installed position.	Paragraph 3.5
	c Remove all three top covers.	
	d. Tag and pull "quick disconnect" terminals from relay.	
	e. Remove screws and washer to lift relay from frame.	We hardware for installation.

5.18 RELAY K5 (SINGLE PHASE). - Continued

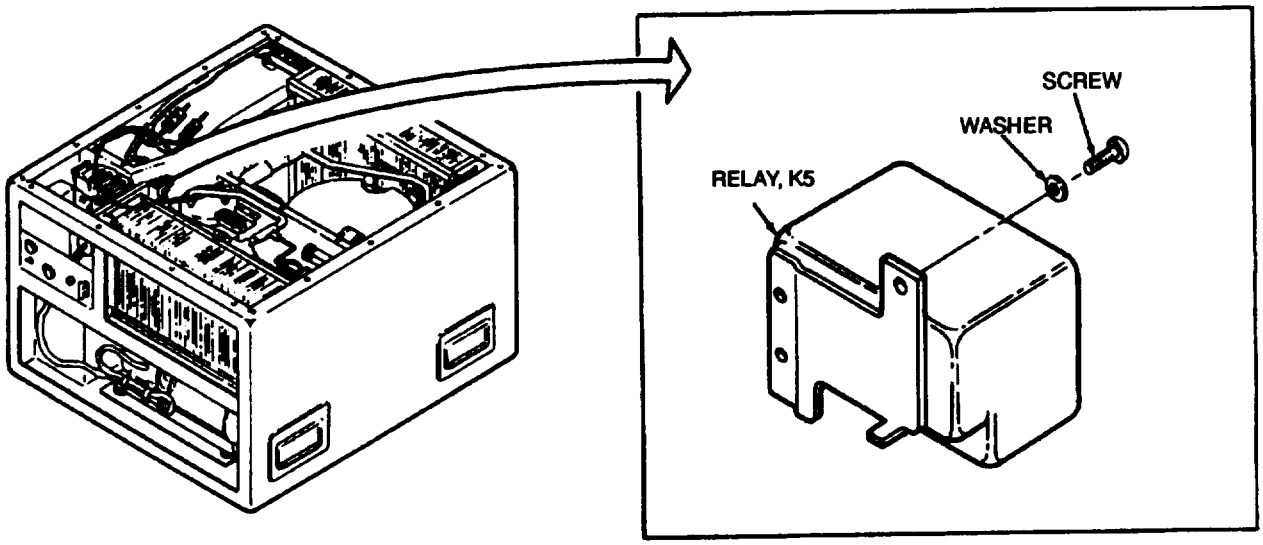


Figure 5-19. Relay K5 (Single Phase)

Location/Item	Action	Remarks
Testing	See table 4-3, Step 11.	
Installation	a. Bolt relay to frame using removed screws and washers.	
	b. Push "quick disconnect" terminals onto relay terminals.	
	Terminal Connections Wire No. / Terminal No. X52A16V — 1 X22B12V, X48A12V — 2 X20B12V, X49A12V — 4 X50A16V, X24B12V, X47A12V — 5	
	c. Replace top three covers.	
	d. Install air conditioner.	Paragraph 3.5

5.19 CAPACITOR C4 (SINGLE PHASE). This task covers removal and installation.

INITIAL SETUP

Applicable Configurations:
Model F18H, Single Phase

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Grounding Rod

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Refrigeration Specialist

Location/Item	Action	Remarks
Capacitor C4	**NOTE** Air conditioner will have to be removed from installed position to replace Capacitor C4.	
Removal	a. Disconnect power supply.	**WARNING** High voltage can kill.
	b. Remove air conditioner from installed position.	Paragraph 3.5
	c. Remove all three top covers.	
	d. Pry cap from capacitor.	
	e. Ground capacitor to discharge electrical charge.	Use grounding rod.
	f. Tag and pull “quick disconnect” terminals from capacitor.	
	g. Pull capacitor from retainer.	

5.19 CAPACITOR C4 (SINGLE PHASE). - Continued

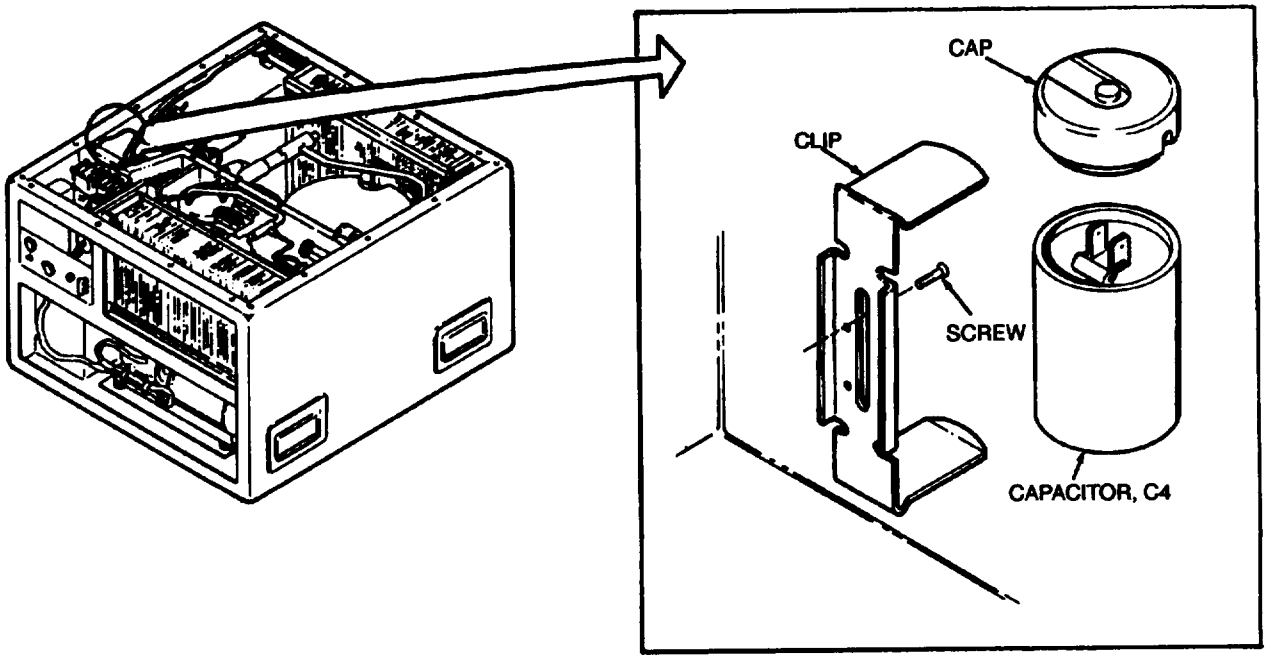


Figure 5-20. Capacitor C4 (Single Phase)

Location/Item	Action	Remarks
Installation	e. Push terminals onto capacitor. Terminal Connections Wire No. — Terminal No. X50A16V — 1 X52A16V — 2 b. Install cap. c. Snap capacitor into retainer. d. Replace top three covers. e. Install air conditioner.	Paragraph 3.5

5.20 AIR FILTER. This task covers removal, cleaning, inspection and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equiment:
Multimeter

Special Tools:
None

Materials/Parts:
SAE 30 Oil
Solvent P-D-680
Detergent Solution
Cleaning Cloths
Container to hold solvent and air filter

Equipment Descriptions:
Power OFF; installed in shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Unit Maintenance

Location/Item	Action	Remarks
	NOTE The air filter consists of a shredded aluminum foil maze held between screens in an aluminum channel frame. The filter can be cleaned and re-used repeatedly. Airflow markings (arrows) printed on the frame make it easy to replace the filter in the correct position every time.	
Removal	a. Remove return air louver.	
Cleaning	b. Pull filter to side, out and away from louver.	

5.20 AIR FILTER. - Continued

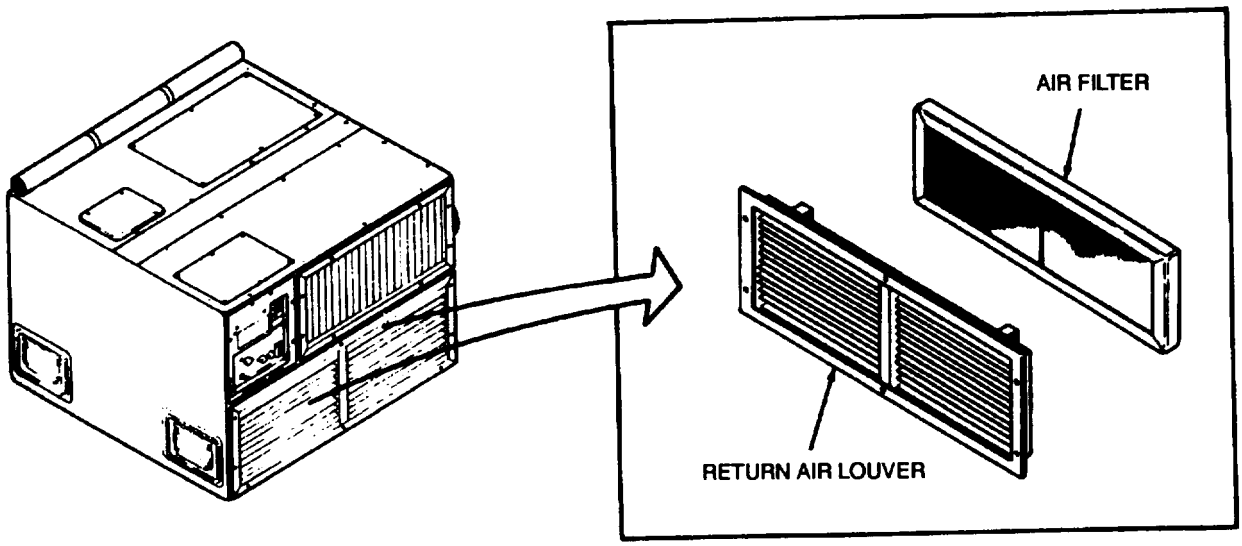


Figure 5-21. Return Air Filter

Location/Item	Action	Remarks
Cleaning Continued	**WARNING** Dry cleaning solvent (Federal specification P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 59°C). a. Immerse the filter in detergent solution or dry cleaning solvent (Federal Specification P-D-680). b. Agitate until dirt is removed, using a soft brush if necessary to loosen caked on dirt. c. Rinse in clear water or clean dry cleaning solvent. d. Drain, then hold filter horizontal and tap each edge on bench or floor to dislodge droplets.	

5.20 AIR FILTER. - Continued

Location/Item	Action	Remarks
Inspection	a Inspect the filter for damage such as perforations or punctures in the screen and aluminum foil maze that could permit passage of unfiltered air. b. Inspect for areas of packed or crushed maze material that would obstruct airflow through the filter. c. Check for deformation of the frame, and straighten if possible without crushing maze material. d. Replace filter if crushed, punctured, badly deformed, or broken.	
Installation	a Spray a very light coat of SAE oil on air intake side of air filter. b. Drain filter for 8 hours. c. Wipe off excess oil. **NOTE** Airflow arrows on filter point inward toward fan intake. d. Slide filter into brackets on return air louver. e. Install return air louver.	

5.21 MIST ELIMNATOR. This task covers removal, cleaning, inspection and installation.

INITAL SETUP

Applicable Configuration:
All

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Solvent P-D-680
Detergent
Cleaning Cloths
Container to hold solvent and mist eliminator

Equipment Descriptions:
Power OFF; installed in shelter

References:
None

Troubleshooting References:
None

Personnel Required:
Unit Maintenance

Location/Item	Action	Remarks
	NOTE The purpose of the mist eliminator is to trap droplets of condensate water formed on the evaporator coil so that droplets will not be blown into the air conditioned space.	
Removal	a. Remove evaporator top cover. b. Remove air outlet louver. c. Pry or lift mist eliminator at outer ends of bottom part of frame.	

5.21 MIST ELIMINATOR. - Continued

Location/Item	Action	Remarks
Cleaning - Continued	**WARNING** **DRY CLEANING SOLVENT (Federal Specification P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 59°C).**	
	a. Immerse in detergent solution or dry cleaning solvent (Federal Specification P-D-680). **b. Agitate until dirt is removed, using a soft brush if necessary to loosen caked dirt.** **c. Rinse in clear water or clean dry cleaning solvent.** **d. Drain, then hold horizontal and tap each edge on bench or floor to dislodge droplets.**	
Inspection	**a. Inspect for damage such as perforations or punctures in the screen and aluminum.** **b. Inspect for areas of packed or crushed material that would obstruct airflow.** **c. Check for deformation of the frame, and straighten if possible without crushing aluminum.** **d. Replace if crushed, punctured, badly deformed, or broken.**	
Installation	e. **Replace rubber insulation strip which is across top of mist eliminator, if it is torn, partly missing,missing, or damaged.** a. **TOP mark must be up and airflow arrows must point outward away from coil.** b. **Slide mist eliminator downward between the side channels.** c. **Replace air outlet louver.** d. **Replace evaporator top cover.**	

5.21 MIST ELIMNATOR. - Continued

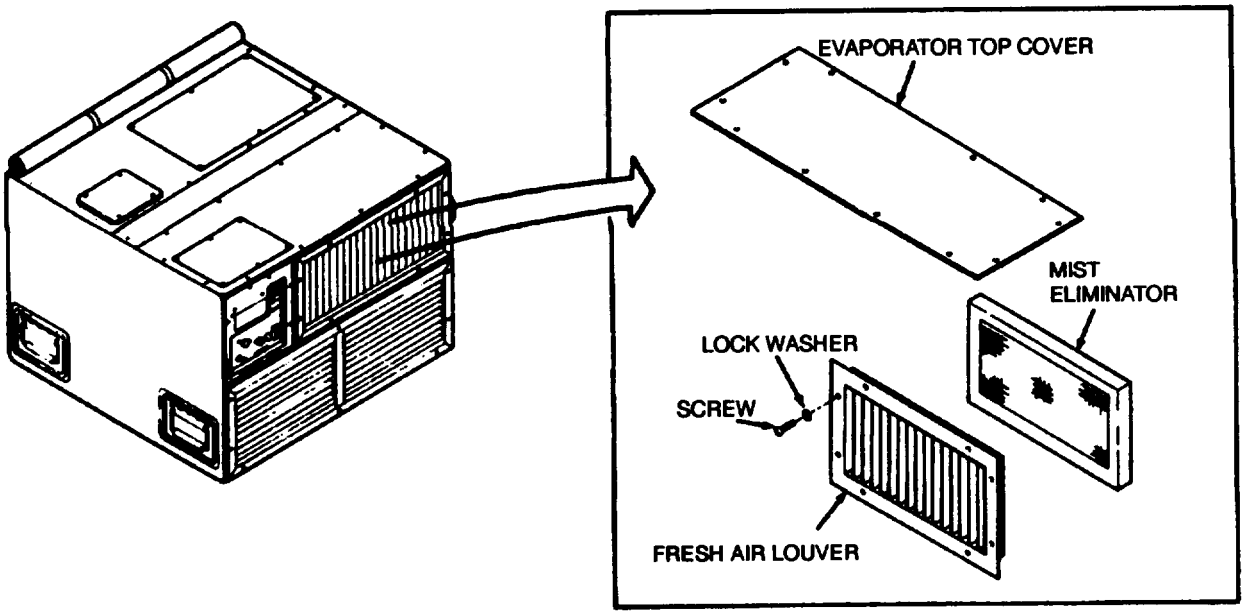


Figure 5-22. Mist Eliminator

5.21 MIST ELIMINATOR. - Continued

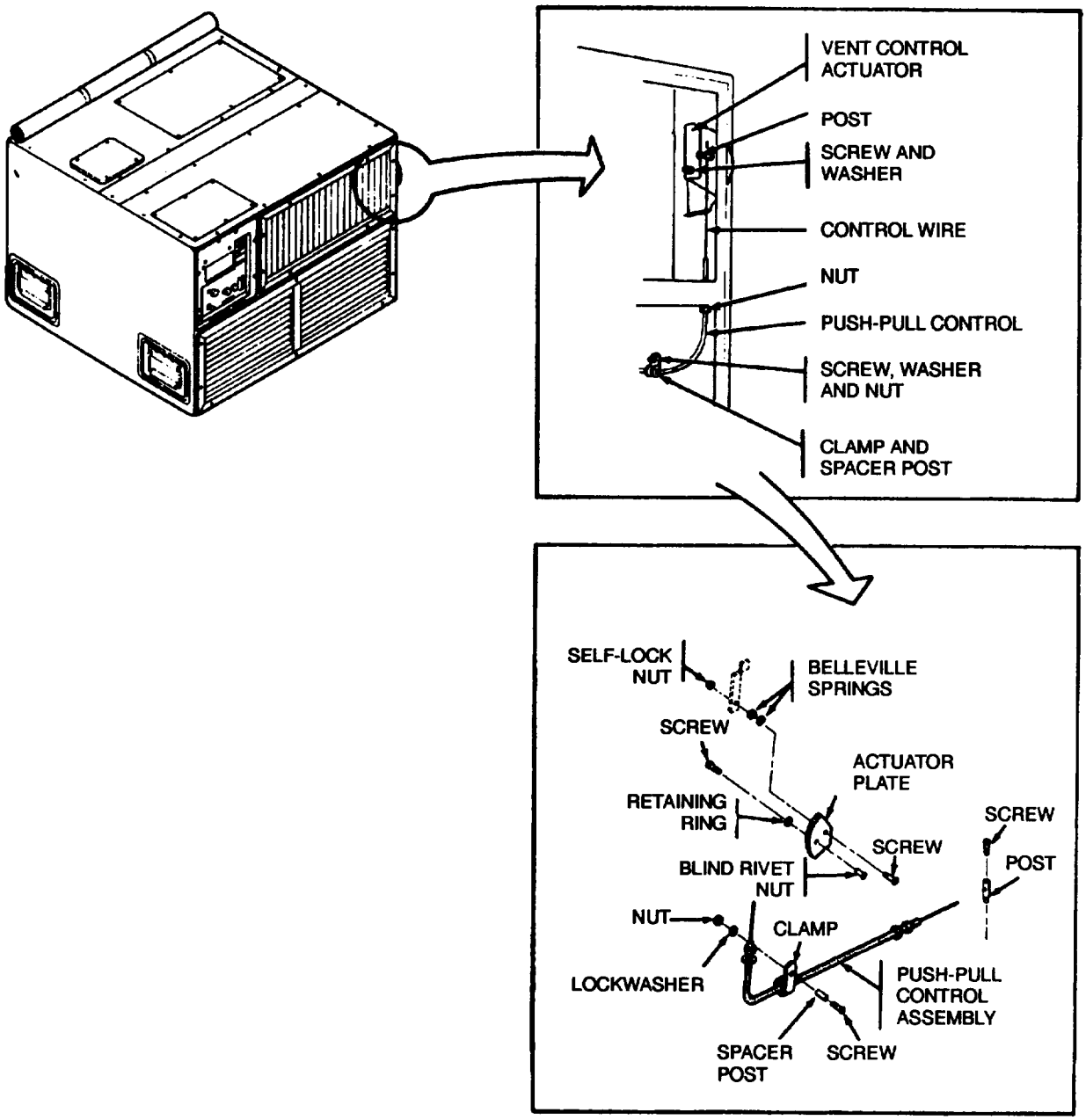


Figure 5-23. Fresh Air Damper Adjustment

5.22 FRESH AIR DAMPER. This task covers adjustment, removal, cleaning, inspection and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tests:
None

Materials/Parts:
Cleaning Cloths
Cable Lubricant

Equipment Descriptions:
Power OFF; installed in shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Unit Maintenance

Location/Item	Action	Remarks
Adjustment	**NOTE** Damper opens and closes fresh air inlet passage. It is opened and closed by a push-pull type control. Unit was designed for use with CBR.	
	a. Loosen screw on mechanical post.	**NOTE** The wire core of a push-pull control is attached to actuator and to rod on top of damper by a mechanical post.
	b. Set actuator or damper rod and tighten screw.	
	c. Control should be adjusted for center position between open and closed.	

5.22 FRESH AIR DAMPER. - Continued

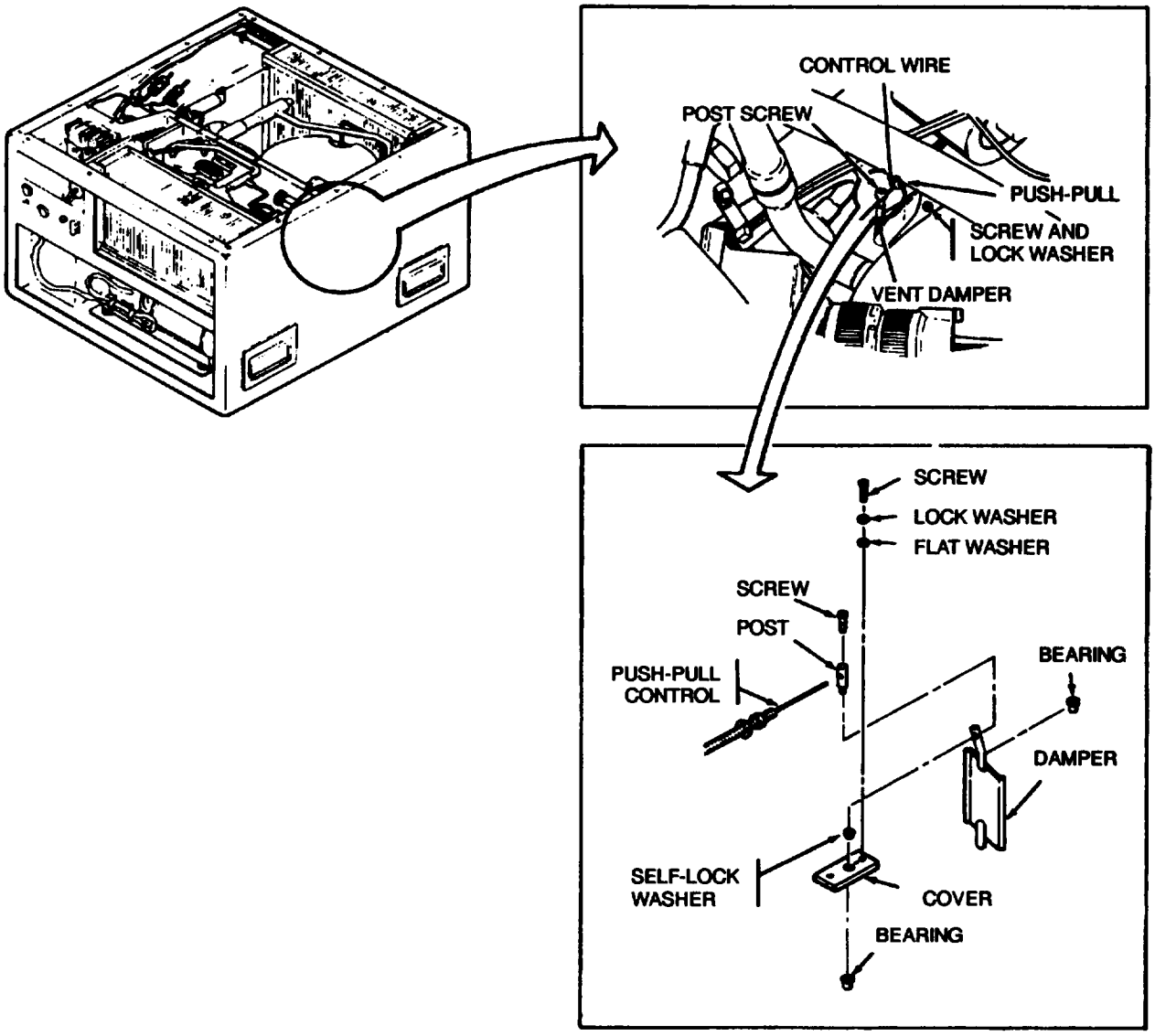


Figure 5-24. Vent Damper

Location/Item	Action	Remarks
Adjustment - Continued	d. Actuator should be in centered position and rod on top of damper should be parallel with front of housing. e. Check operation. The control should move smoothly between the open and closed position.	

5.22 FRESH AIR DAMPER. - Continued

Location/Item	Action	Remarks
Removal	a. Remove condenser top cover.	
	b. Loosen screw on mechanical post and disconnect push-pull control.	
	c. Remove two screws and lockwashers and lift vent damper from air conditioner.	
	d. Remove both evaporator louvers.	
	e. Remove screw, washer, nut, spacer and loop clamp.	
	f. Loosen screw and mechanical post to free end of control wire core.	
	g. Remove outer nuts from both ends of control outer casing and remove push-pull control.	
	h. Remove screw, nut, two spring washers and actuator.	
Cleaning	a. Wipe off all loose dirt with dry cloth.	
	b. Wipe off any buildup of “caked” on dirt.	
Inspection	a. Inspect push-pull control for smooth operation of core in casing.	
	b. Inspect vent damper for bent or broken condition.	
	c. Inspect for loose or damaged rubber seal or damper. Cement loose rubber or replace as required.	
Installation	a. Vent Control Actuator. Install actuator, screw, two spring washers and nut.	
	b. Vent Damper. Install vent damper in opening in housing.	
	c. Secure vent damper cover to housing with two screws and lockwashers.	
	d. Push-Pull Control. With one nut on each end of outer casing of push-pull control, install ends of control through opening in housing.	
	e. Install outer nuts and insert ends of wire core into mechanical posts of damper and actuator.	

5.22 FRESH AIR DAMPER. - Continued

Location/Item	Action	Remarks
Installation - Continued	f. Tighten outer nuts on casing. g. Install clamp, spacer, screw, nut and washer. h. Refer to paragraph 5.22, ADJUSTMENT, to adjust the control. i. Install housing covers. j. Install evaporator inlet and outlet louvers.	

5.23 FRESH AIR SCREEN. This task covers removal, cleaning, inspection and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Solvent P-D-680
Detergent
Solution
Cleaning Cloths
Container to hold solvent and screen

Equipment Descriptions:
Power OFF; installed in shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Unit Maintenance

Location/Item	Action	Remarks
	NOTE The fresh air screen, mounted on the rear wall of the housing, covers the fresh air inlet opening to prevent airborne matter from entering the air conditioner. This unit was designed for use with CBR.	
Removal	a. Remove screws and lockwashers.	
	b. Pull screen from unit.	
Cleaning	**WARNING** Dry cleaning solvent (Federal Specification P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100 °F to 138 °F (38 °C to 59 °C).	
	a. Immerse the screen in detergent solution or dry cleaning solvent (Federal Specification P-D-680).	

5.23 FRESH AIR SCREEN. - Continued

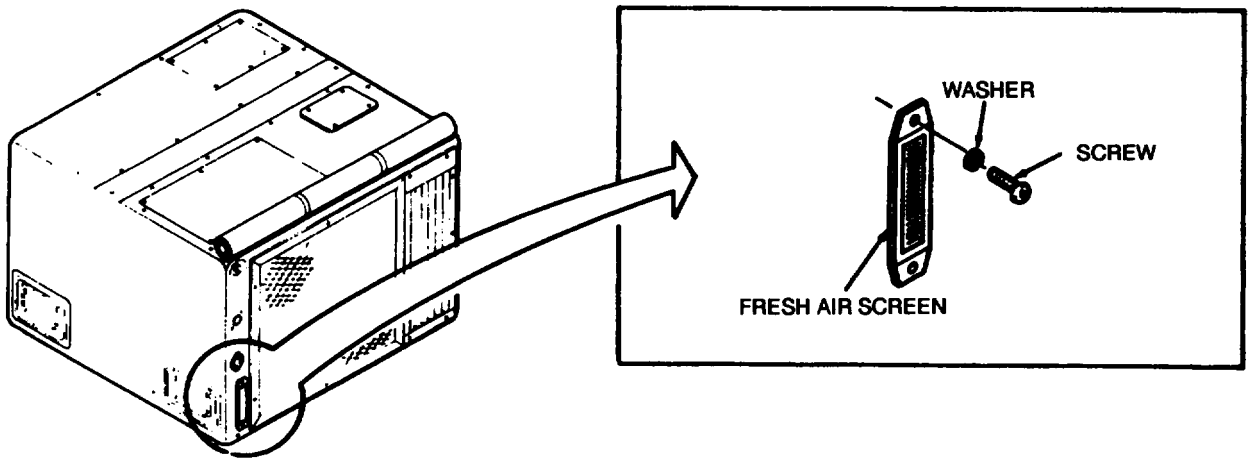


Figure 5-25. Fresh Air Screen

Location/Item	Action	Remarks
Cleaning - Continued	b. Agitate until dirt is removed, using a soft brush if necessary to loosen caked-on dirt.	
	c. Rinse in clear water or clean dry cleaning solvent.	
	d. Drain, then hold horizontal and tap each edge on bench or floor to dislodge droplets.	
Inspection	a. Inspect for damage such as perforations or punctures.	
	b. Inspect for areas of packed or crushed material that would obstruct airflow.	
	c. Check for deformation of the frame and straighten.	
	d. Replace if crushed, punctured, badly deformed, or broken.	
Installation	Bolt screen to frame using two screws and washers.	

5.24 CONDENSATE LINES. This task covers flow test, cleaning, removal and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
One Pint Container
Fresh Water
Brush or Soft Wire

Equipment Descriptions:
Power OFF; installed in shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Unit Maintenance

Location/Item	Action	Remarks
Flow Test	a. Remove mist eliminator.	Paragraph 5.21
	b. Remove air filter.	Paragraph 5.20
	c. Loosen mount bolts.	
	d. Place a 3/4-inch board under one side of the air conditioner to tilt it slightly.	
	e. Pour about one pint (one-half liter) of water into the lower end of the drip pan below the evaporator coil.	
	f. Verify that the water flow out of the drip pan through the drain tube.	
	g. Tilt the air conditioner the opposite direction, and repeat the flow test on the other side.	
	h. Water should drain freely through both tubes. If it does not, remove and repair or replace the drain tube.	
	i. Tighten mounting bolts.	

5.24 CONDENSATE LINES. - Continued

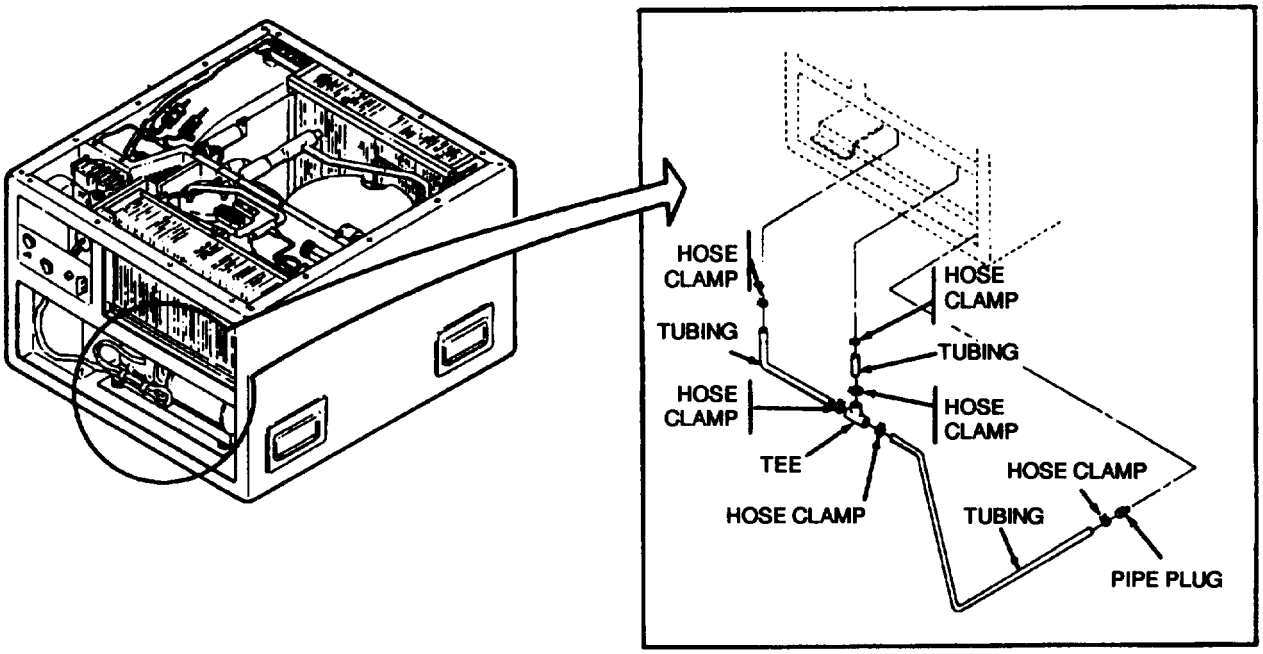


Figure 5-26. Condensate Lines

Location/Item	Action	Remarks
Inspection	a. Inspect for split or deteriorated condition.	
	b. Inspect for cracks or breaks.	
Cleaning	a. Flush out tubing using fresh clean water.	
	b. Use a small diameter brush or a piece of soft wire to clean tubing. If necessary remove tubing in order to clean.	
Removal	a. Remove hose clamps.	
	b. Pull tubing from unit.	
Installation	a. Slide hose clamp onto tubing.	
	b. Push tubing into place.	
	c Tighten hose clamp.	

5.25 EVAPORATOR COIL CLEANING. This task covers cleanin.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Vacuum cleaner
Brush
Safety Glasses
Compressed Air and Compressed Air Line

Equipment Descriptions:
Power OFF; installed in shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Unit Maintenance

Location/Item	Action	Remarks
Cleaning	**WARNING** Do not use steam to clean the coil. Live hot steam will splash and could cause burns. The high heat could cause high system pressure. Wear safety glasses or goggles when cleaning the coil. Dirt can be blown into your eyes. **NOTE** At the same time evaporator coil is cleaned, the condenser coil should be cleaned. a. Disconnect the power supply. b. Remove the top cover. c. Remove the mist eliminator. d. Remove the conditioned air outlet louver.	Paragraph 5.21

5.25 EVAPORATOR COIL CLEANING. - Continued

Location/Item	Action	Remarks
Cleaning - Continued	e. Cover the evaporator blower to prevent dirt from entering the blower and motor.	
	f. Clean the front and back surfaces using a soft bristle brush.	
	WARNING Use compressed air at 30 psi (1.36 kg) or less. Hold compressed air nozzle at least 6 to 8 inches away from coil to keep the compressed air from damaging the coil or fins.	
	g. Use a vacuum cleaner and compressed air, if necessasry, to clean the area between the fins.	
	h. Clean the air filter.	Paragraph 5.20
	i. Clean the mist eliminator.	Paragraph 5.21
	j. Clean the condensate lines.	Paragraph 5.24
	k. Clean the evaporator blower. Use a vacuum cleaner.	
	l. Replace the top cover, mist eliminator, air filter and louvers.	
	m. Connect the power supply.	

5.26 CONDENSER COIL CLEANING. This task covers cleaning.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Brush
Safety Glasses
Compressed Air and Air Lines
Vacuum Cleaner

Equipment Descriptions:
Power OFF; installed in shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Refrigeration Specialist

Location/Item	Action	Remarks
Cleaning	**WARNING** Do not use steam to clean the coil. Live hot steam will splash and could cause serious burns. Also, pressure could be too high and could cause coil damage. Wear safety glasses or goggles when cleaning the coil. Dirt can be blown into your eyes. **NOTE** At the same time condenser coil is cleaned, the evaporator coil should be cleaned. a. Disconnect the power supply. b. Remove the condenser section top cover. c. Cover the condenser fan, motor and compressor. d. Remove the condenser guard.	

5.26 CONDENSER COIL CLEANING. - Continued

Location/Item	Action	Remarks
Cleaning - Continued	e. Clean the front and back surfaces using a soft bristle brush. **WARNING** Use compressed air at 30 psi (1.36 kg) or less. Hold compressed air nozzle at least 6 to 8 inches away from coil to keep the compressed air from damaging the coils or fins. f. Use a vacuum cleaner and, if necessary, compressed air to clean the area between the fins. g. Use a vacuum cleaner to clean the condenser motor, fan and compressor. h. Replace all covers. i. Connect power supply.	

5-27 CONDENSER FAN SWITCH S7. This task covers removal, testing and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Heat-shrink Tubing
Solder
Ty Rap
Hot Air Dryer

Equipment Description:
Power OFF; installed in shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Refrigeration Specialist

Location/Item	Action	Remarks
Removal	a. Disconnect power supply.	**WARNING** High voltage can kill.
	b. Remove condenser section top cover.	
	c Cut "ty-rap" from plug P7 wires.	
	d. Disconnect plug P7.	
	e. Remove two screws and washers.	
	f. Pull switch away from frame.	
	g. Unsolder or cut wires at switch.	
Testing	See table 4-3.	

5.27 CONDENSER FAN SWITCH S7 - Continued

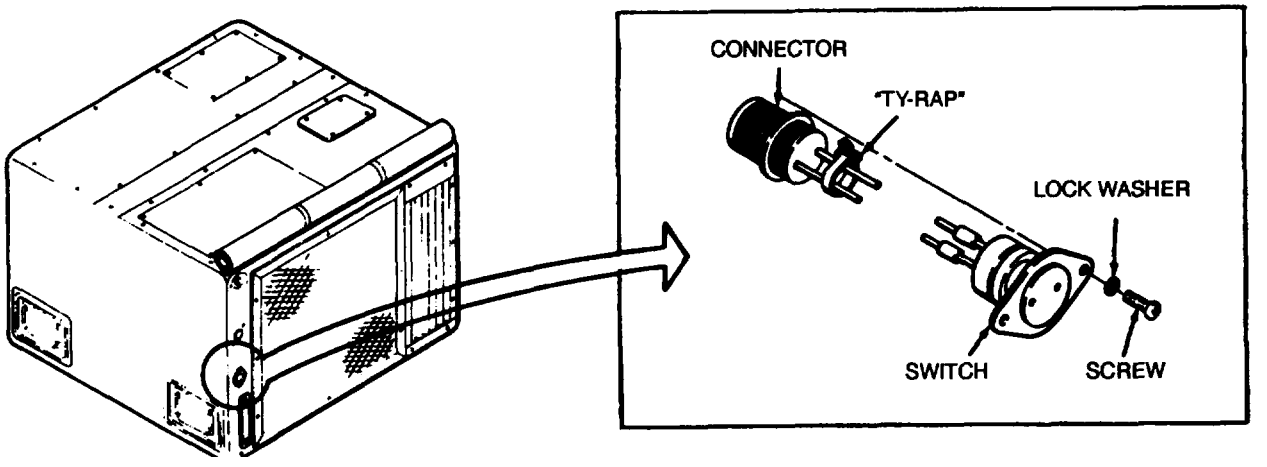


Figure 5-27. Fan Switch

Location/Item	Action	Remarks
Installation	a. Slip heat-shrink tubing over the two leads. Wire No. / Switch Terminal No. / Plug Terminal V9B20 / 2 / A V5D20 / 1 / B b. Pull tubing over solder joint. c. Hot air dry tubing. d. Push switch into frame. e. Secure with two screws and washers. f. Connect plug P7. g. Secure wires to cable with “ty-rap.” h. Replace top cover. i. Connect power supply.	

5.28 HEATER THERMOSTATE (OVERHEAT SAFETY). This task covers removal, testing and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment
None

Special Tools:
None

Materials/Parts:
None

Equipment Descriptions:
Power OFF; installed in shelter

Special Environmental Conditions:
None

General Safety Instnuctions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Unit Maintenance (2)

Location/Item	Action	Remarks
	WARNING Allow heaters to cool before attempting removal or testing of heater thermostat.	
Removal	a. Remove power supply. b. Remove evaporator section top cover. c. Remove thermostat from bracket. d. Tag and remove wires from switch.	
Testing	Refer to table 4-3, Step 12.	
Installation	a. Attach thermostat to bracket. b. Connect wires. Single-Phase Model F18H **Wire No.** — **Terminal No.** X46A16V — 1 X44A16V, X45A16V — 2 X31B16V — 3 X44A16V — 4	

5.28 HEATER THERMOSTATE (OVERHEAT SAFETY). - Continued

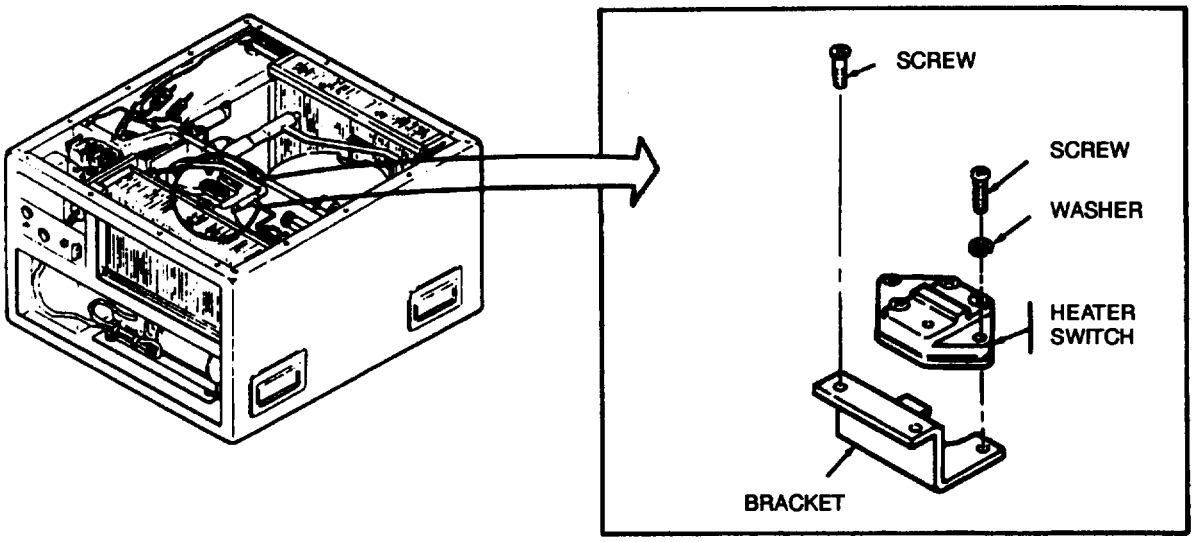


Figure 5-28. Heater Thermostat

Location/Item	Action		Remarks
Installation - Continued	3-Phase Models F18H-3 & F18H-4		
	Wire No.	**Terminal No.**	
	X49A16B	1	
	X50A16C, X47A16A	2	
	X48A16A	3	
	X47A16A	4	
	3-Phase Model MHP-20-4-08		
	Wire No.	**Terminal No.**	
	S6-1<>TB2-8	1	
	S6-2<>TB2-7, S6-4<>S6-2	2	
	S6-3<>TB2-9	3	
	S6-4<>S6-2	4	
	c. If thermostat bracket was loosened or removed, reattach to center cover.		
	d. Install cover.		
	e. Install air conditioner.		Paragraph 3.5

5.29 HEATER. This task covers removal, cleaning, testing and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
Multimeter

Special Tools:
None

Materials/Parts:
Cleaning Cloths

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

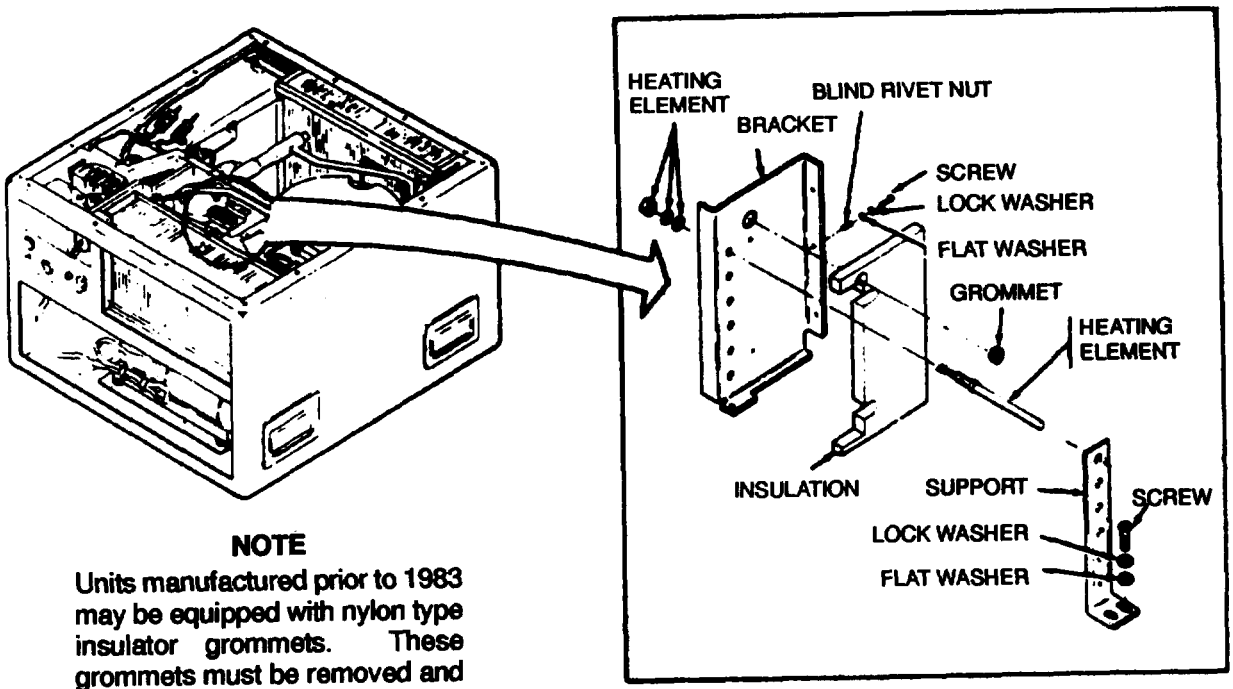
References:
None

Troubleshooting References:
None

Personnel Required:
Unit Maintenance (2)

Location/Item	Action	Remarks
	WARNING High voltage can kill.	
	WARNING Allow heater to cool before handling; severe bums can result from touching hot heater.	**NOTE** Model F18H has six 230-volt heaters; Models F18H-3, F18H-4, and MHP-20-4-08 have six 120-volt heaters.
Removal	a. Remove power supply.	
	b. Remove air conditioner from shelter.	Paragraph 3.5
	c. Remove all three top covers.	
	d. Remove heater thermostat from middle cover.	Do not remove leads.
	e. Remove heater support.	
	f. Remove four screws.	
	g. Remove nut from top heater. Allow it to slide onto heater terminal.	
	h. Pull top heater from heater bracket.	Heater lead will only allow slight movement of heater.

5.29 HEATER. - Continued



NOTE

Units manufactured prior to 1983 may be equipped with nylon type insulator grommets. These grommets must be removed and heater end support should be replaced with new part (97403) 13226E5916.

Figure 5-29. Heater

Location/Item	Action	Remarks
Removal - Continued	Pull heater bracket up and out of air conditioner until top heater lead can be tagged. Remove lead from terminal board.	Use caution, second heater from top will prevent movement of bracket when heater touches refrigerant piping.
	Remove each of remaining five heaters in same manner as first was removed.	
Cleaning	**WARNING** Allow heaters to cool before handling.	
	CAUTION Do not use solvent or detergent to dean heater. Either one could damage heater.	

5.29 HEATER. - Continued

<table>
<tr><th>Location/Item</th><th>Action</th><th>Remarks</th></tr>
<tr><td>Cleaning
- Continued</td><td>Use clean dry cloth to wipe dust or dirt off heater.</td><td>NOTE
It is not necessary to remove heaters for cleaning.</td></tr>
<tr><td>Testing</td><td>Refer to table 4-3, Step 14.</td><td></td></tr>
<tr><td>Installation</td><td>a. Position heater bracket into frame so that heaters can be installed, one at a time.
Single-phase Model F18H
Wire No. — Heater — TB2
X46D16V — HR1-1 — 5
X18C16V — HR1-2 — 1
X46E16V — HR3-1 — 5
X18F16V — HR3-2 — 2
X46B16V — HR5-1 — 7
X18E16V — HR5-2 — 2
X45D16V — HR2-1 — 8
X32D16V — HR2-2 — 3
X45E16V — HR4-1 — 6
X32E16V — HR4-2 — 3
X46B16V — HR6-1 — 8
X32B16V — HR6-2 — 4
3 Phase Models F18H-3 & F18H-4
Wire No. — Heater — TB2
X52A16C — HR1-1 — 7
X19C16C — HR1-2 — 1
X54A16B — HR3-1 — 8
X18C16B — HR3-2 — 2
X56A16A — HR5-1 — 9
X17C16A — HR5-2 — 3
X55A16C — HR2-1 — 7
X59B16C — HR2-2 — 4
X53A16B — HR4-1 — 8
X60B16B — HR4-2 — 5
X51A16A — HR6-1 — 9
X39B16A — HR6-2 — 6</td><td></td></tr>
</table>

5.29 HEATER. - Continued

Location/Item	Action	Remarks
Installation - Continued	3-Phase Model MHP-20-4-03 **Wire No.** **Heater** **TB2** HR1-1<>TB2-7 HR1-1 7 HR1-2<>TB2-1 HR1-2 1 HR2-1<>TB2-7 HR2-1 7 HR2-2<>TB2-4 HR2-2 4 HR3-1<>TB2-8 HR3-1 8 HR3-2<>TB2-2 HR3-2 2 HR4-1<>TB2-8 HR4-1 8 HR4-2<>TB2-5 HR4-2 5 HR5-1<>TB2-9 HR5-1 9 HR5-2<>TB2-3 HR5-2 3 HR6-1<>TB2-9 HR6-1 9 HR6-2<>TB2-6 HR6-2 6 b. Install one heater at a time and slide bracket down after each heater is installed. c. Slip nut lockwasher, and insulating washer over heater leads before leads are connected to terminal board TB2. d. Insert heaters in bracket and support. e. Install and tighten bracket. f. Replace heater thermostat. g. Replace top covers. h. Install air conditioner.	Paragraph 5.28

CHAPTER 6

DIRECT AND GENERAL SUPPORT MAINTENANCE

6.1 PRESSURE TEST. This task covers pressure test refrigerant system.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Charging Manifold
Safety Glasses

Equipment Descriptions:
Power OFF; installed in shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

Location/Item	Action	Remarks
Condenser Section Charging Valves		
Set-Up	a. Remove charging valve access panel. b. Connect charging manifold to suction and high (head) pressure gauges. c. Make sure middle hose is capped or plugged.	

6.1 PRESSURE TEST. - Continued

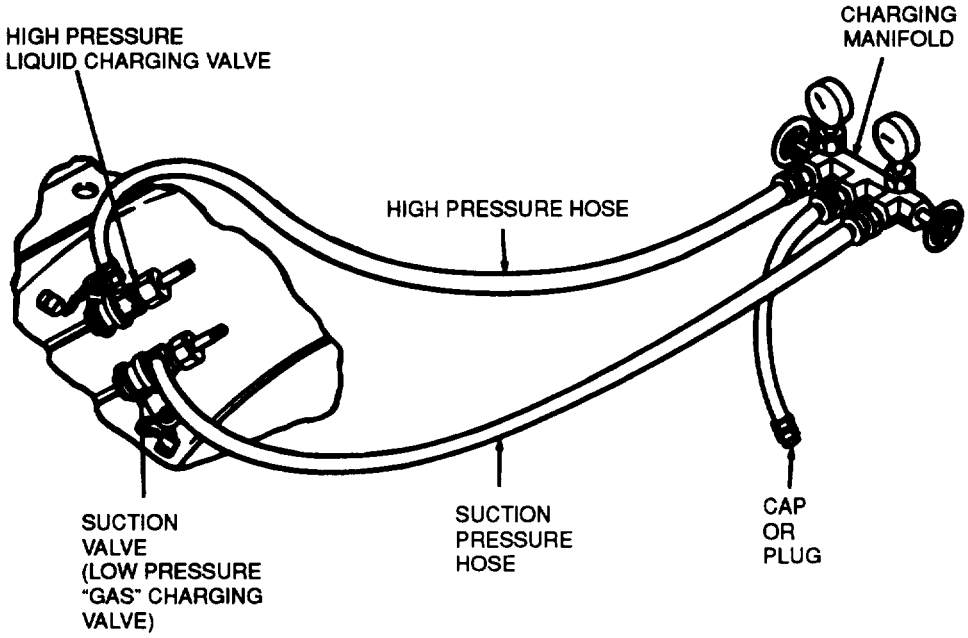


Figure 6-1. Pressure Test

Location/Item	Action	Remarks
Set Up - Continued	d. Make sure that the fresh air damper is completely closed and that the evaporator air intake and discharge grilles are fully open. e. Hang an accurate thermometer directly in front of the evaporator air intake grille to register "dry bulb return air to unit" temperature. f. Hang an accurate thermometer directly in front of the condenser coil guard, making sure that the thermometer is shaded from direct sunlight, to record "outdoor ambient temperature." g. If indoor ambient temperature is too low, provide a space heater to raise the "dry bulb return air to unit" temperature to 80°F (27°C).	

6.1 PRESSURE TEST. - Continued

Location/Item	Action	Remarks
Procedure	a. Turn the MODE switch to COOL, and the TEMPERATURE SELECTOR switch to maximum COOLER. b. Slowly open the charging valves to which pressure gauges have been connected. c. Let the air conditioner operate for at least 15 minutes in the COOLING mode, so that all parts of the system are stabilized. d. Record the temperatures indicated by both thermometers and the pressure indicated by both pressure gauges. e. Compare the readings obtained from pressure testing with the normal ranges shown in table 6-1.	
Analysis of Discrepancies	a. If actual pressure-temperature relationships differ from those shown in table 6-1, take appropriate action. (1) If pressures are too low, see table 6-3 and table 6-4. (2) If pressures are too high, see table 6-2. (3) If discharge pressure is extremely high and suction pressure is extremely low, blockage may exist in the refrigeration system. Troubleshoot, correct the trouble, recharge if necessary, and repeat the pressure test.	
Completion	a. After pressure testing has been successfully completed, close the suction and discharge service valves. b. Drain the pressure from the charging manifold and hose very slowly by cracking the hose on the suction and discharge service valves. c. Remove thermometers and charging manifold from the unit.	

6.1 PRESSURE TEST. - Continued

Table 6-1. Normal Temperature - Pressure Relationships

95°F (35°C) dry bulb return air to unit					
Outdoor Ambient Temperature	50°F (10°C)	75°F (24°C)	100°F (38°C)	11°F (43.5°C)	125°F (52°C)
Gauge Pressures Suction (psig) (kg/cm^2)	56-60 3.93-4.22	56-65 3.93-4.57	65-75 4.57-5.27	70-80 4.92-5.62	75-90 5.27-6.33
Discharge (psig) (kg/cm^2)	135-155 9.50-10.90	185-205 13.00-14.41	275-295 19.33-20.74	375-380 26.36-26.72	400-420 28.12-29.53
80°F (27°C) dry bulb return air to unit					
Outdoor Ambient Temperature		50°F (10°C)	75°F (24°C)	100°F (38°C)	125°F (52°C)
Gauge Pressures Suction (psig) (kg/cm^2)		56 min. 3.93 min.	56 min. 3.93 min.	56-65 3.93-4.57	65-75 4.57-5.27
Discharge (psig) (kg/cm^2)		130-150 9.14-10.55	180-200 12.65-14.06	270-290 18.98-20.39	290-410 20.39-28.82

NOTE: Dry bulb temperatures are measured with an ordinary thermometer.

Table 6-2. Excessive Head and Suction Pressure

Possible Cause	Remedy
1. Unit overcharged.	1. Purge excess refrigerant.
2. Restricted condenser air.	2. Check for free airflow. a. Check condenser louver adjustment. b. Check for any restrictions to airflow. c. Check operation actuating cylinder. d. Condenser fan or motor needs repair or replacement.
3. Air in system. **NOTE** It maybe necessary to release entire charge and then recharge system.	3. Check for leaks on suction side. Release refrigerant, and check operation.

6.1 PRESSURE TEST. - Continued

Table 6-3. Low Head Pressure

Possible Cause	Remedy
1. Low refrigerant charge.	1. Completely charge, then leak test, repair, and recharge to 5.5 lbs (2.5 kg).
2. Restriction in liquid line.	2. Locate and repair.
3. Charging valve leaking.	3. Replace.
4. Fan thermostat defective.	4. Replace.
5. Actuating cylinder defective.	5. Replace.

Table 6-4. Low Suction Pressure

Possible Cause	Remedy
1. Low refrigerant charge.	1. Completely charge, then leak test, repair and recharge to 5.5 lbs (2.5 kg).
2. Restriction in expansion valve.	2. Repair or replace.
3. Low evaporator airflow.	3. Restriction, dirty filter, dirty mist eliminator, motor or blower.
4. Outdoor ambient at or near 0°F (-18°C).	4. It will be necessary to jumper LPCO to operate at this outdoor temperature.

6.2 LEAK TEST. This task covers leak test of refrigerant system.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
Electronic Leak Detector

Special Tools:
None

Materials/Parts:
Safety Glasses
Detergent Solution
Cleaning Cloths
Tools (Paragraph 3.1)
Thermal Gloves
Charging Manifold
Nitrogen Cylinder

Equipment Descriptions:
Power OFF; installed in or removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
Operating Instructions for Leak Detector

Troubleshooting References:
None

Personnel Required:
Direct Support

Location/Item	Action	Remarks
Tubing, Joints, Components	**NOTE** Requires system to be pressurized with nitrogen or proper charge of R-22.	
Soap Solution	a. Remove condenser and evaporator top covers.	
	WARNING Disconnect power.	

6.2 LEAK TEST. - Continued

Location/Item	Action	Remarks
Soap Solution - Continued	b. Using extreme care to avoid touching fan, blower, or electrical components, brush soap or detergent solution on all possible points of leakage. c. Follow definite sequence to avoid missing any points that should be tested. d. Watch for bubbles. e. Mark point at which leak is found. f. Wipe solution from all joints.	
Leak Tester	**WARNING** Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin-or-eye-contact is possible. Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas. **WARNING** Disconnect power. **CAUTION** The electronic leak detector is sensitive to the presence of refrigerant gas in the atmosphere. When refrigerant gas is present in the atmosphere of the work area, false indications can result. Use in a well-ventilated but draft-free area. a. Position refrigerant drum so that only refrigerant gas will be used and connect to center hose of charging manifold. b. Remove caps from both charging valves and loosely connect hose from charging manifold to valves. Purge air from lines and tighten hoses or valves.	

6.2 LEAK TEST. - Continued

Location/Item	Action	Remarks
Leak Tester - Continued	c. Open both charging valves and allow refrigerant to flow into system until gauges indicate 50 psig (3.5 kg/cm^2). d. Close both charging valves, charging manifold valves and refrigerant drum valve. e. Disconnect refrigerant cylinder. f. Connect nitrogen regulator (paragraph 3.1) to nitrogen cylinder. g. Connect nitrogen regulator to center connection on charging manifold. h. Open nitrogen regulator valve slowly. i. Open discharge service valve and suction service valve. Do not turn on air conditioner. j. Slowly open both valves on charging manifold and charge system to 350 psig (22 kg/cm^2). k. Close all valves. **NOTE** Tester must be calibrated for a pure refrigerant leak rate of 0.1 ounce (2.84 g) per year. l. Turn on electronic leak detector and slowly pass probe around all points in the system where a leak could exist. m. Depending upon the type of detector used, a leak will be indicated by an audible signal, a light, or by meter deflections. n. When a leak is found, mark the leak point. o. Disconnect hose between charging manifold and nitrogen regulator.	

6.2 LEAK TEST. - Continued

Location/Item	Action	Remarks
Leak Tester - Continued	**NOTE** In accordance with the Environmental Protection Agency regulations, refrigerants cannot be purged into the atmosphere. A refrigerant recovery/recycling unit must be used whenever discharging the refrigerant system. Operation of the recovery/recycling unit must be by AUTHORIZED PERSONNEL ONLY.	
	p. To discharge system, connect and operate recovery/recycling unit in accordance with manufacturer's instructions.	Paragraph 6.4

6.3 REPAIR. This task covers general information needed by a technician to repair this unit.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Brazing Flux
Brazing Alloy
Charging Manifold
Safety Glasses
Brazing And Soldering Set
Solvent P-D-680
Detergent Solution
Cleaning Cloths
Refrigerant R-22
Nitrogen (Cylinder)
Tools (Paragraph 3.1)
Abrasive Cloth
Scale
Thermal Gloves

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

Location/Item	Action	Remarks
	NOTE The following instructions are provided for use by refrigeration shops furnished with only the most basic equipment. If more sophisticated equipment, such as two-valve or four-valve service manifolds is available, it should be used by making appropriate modifications to these instructions.	

6.3 REPAIR. - Continued

Location/Item	Action	Remarks
Opening System	a. When the refrigeration system must undergo maintenance that requires the system to be opened for removal of parts, the system must first be discharged and purged. **NOTE** In accordance with the Environmental Protection Agency regulations, refrigerants cannot be purged into the atmosphere. A refrigerant recovery/recycling unit must be used whenever discharging the refrigerant system. Operation of the recovery/recycling unit must be by AUTHORIZED PERSONNEL ONLY.	Paragraphs 6.4 and 6.5
	b. After the repair has been made and all soldering completed, the system must be charged and tested for leaks.	Paragraphs 6.7 or 6.8 and 6.2
Removal of Parts	a. If maybe necessary to remove some tub ing and fittings with a part that is to be replaced. b. The tubing and fittings can then be removed from the defective part and installed in the new part. c. Care should be exercised in opening joints or resoldering to prevent damage to other parts of the air conditioner. **NOTE** If soldering is necessary on any part of the system, a constant purge of dry nitrogen must be fed through the system being soldered to prevent scale formation within the system.	

6.3 REPAIR. - Continued

Location/Item	Action	Remarks
Brazing	a. Braze copper to copper joints with silver solder, Grade Ill, IV or VI specifications, QQ-B-654, and copper to brass or copper to steel with Grade IV or VI specifications, QQ-B-654, per MIL-B-7883.	
	b. Solder melting point is 1160°F (626°C).	
	c. All brazed or soldered joints shall be made with an atmosphere of nitrogen to prevent internal oxidation.	
Insulation and Gaskets	a. Replace damaged insulation and gaskets.	
	b. Cement loose insulation.	
Hardware	a. Replace any damaged screws, washers, lockwashers or nuts.	
	b. Use screws of correct length to hold parts securely.	
	c. In some applications, screws that are too long may bottom before the head is tight against the part it is to hold or may cause damage to the threads or other parts.	
Debrazing	a. With dry nitrogen flowing through the system, debraze tubing connections at any fitting near the compressor that will permit convenient removal.	
	b. Tubing and fittings attached to the compressor, after their removal, can be transferred to the replacement compressor before installation in the air conditioner.	
Shims	a. Be sure to remove all shims where used.	
	b. Keep shims together and identify them as to location.	
Repairing Damaged Threads	a. Damaged threads should be repaired by use of a thread restorer or by chasing in a lathe.	
	b. Internal threads should be repaired with a tap of the correct size.	
	c. If threads cannot be satisfactorily repaired, replace the part.	

6.3 REPAIR. - Continued

Location/Item	Action	Remarks
Repair of Damaged Machined and Polished Surfaces	a. Smooth rough spots, scores, burrs, galling, and gouges from damaged machined and polished surfaces so that part will efficiently perform its normal function. b. The finish of the repaired part is to approximate that of the original finish. c. In performing any of these operations, critical dimensions must not be altered.	
Removal of Rust or Corrosion	a. Remove corrosion from all parts of material. b. To remove rust or corrosion, use wire brush, abrasive cloth, sand blast, vapor blast equipment, or rust remover, except highly polished surfaces. c. On these surfaces, buffing or the use of crocus cloth is recommended.	
Tubes and Fittings	a. Check tubes and fittings for cracked or split condition. b. Check tubing for kinks. c. Replace defective fittings. d. Replace damaged tubing with tubing of same size. e. Take care in making bends in tubing to prevent kinking of tubing. f. All tubing and fittings must be completely clean on inside prior to installation.	

6.4 RELEASING REFRIGERANT. This task covers the procedure for releasing refrigerant.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Charging Manifold
Safety Glasses
Cleaning Cloths
Tools (Paragraph 3.1)
Thermal Gloves
Container

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

Location/Item	Action	Remarks
Discharge	**WARNING** Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin-or-eye-contact is possible. Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to breakdown and form carbonyl chloride (phosgene), a highly toxic and corrosive gas.	

6.4 RELEASING REFRIGERANT. - Continued

Location/Item	Action	Remarks
Discharge - Continued	**WARNING** Avoid contact with refrigerant being discharged from compressor burnout. Acid in refrigerant can cause burns. **NOTE** In accordance with the Environmental Protection Agency regulations, refrigerants cannot be purged into the atmosphere. A refrigerant recovery/recycling unit must be used whenever discharging the refrigerant system. Operation of the recovery/recycling unit must be by AUTHORIZED PERSONNEL ONLY. a. Connect and operate recovery/recycling unit in accordance with manufacturer's instructions.	

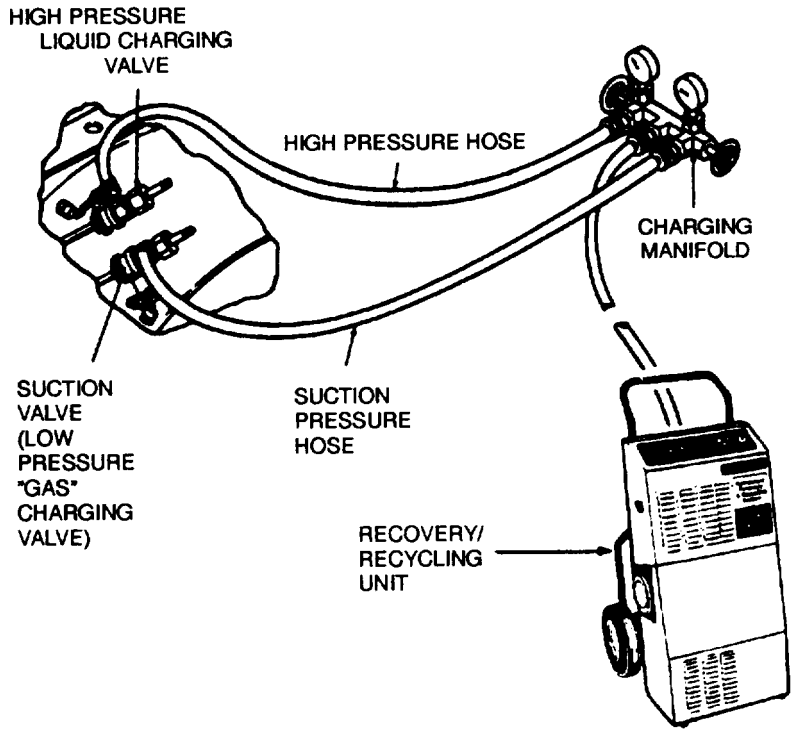


Figure 6-2. Releasing Refrigerant

6.5 NITROGEN PURGE. This task covers the nitrogern purge procedure.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Charging Manifold
Safety Glasses
Nitrogen (Cylinder)
Tools (Paragraph 3.1)
Thermal Gloves

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

Location/Item	Action	Remarks
	NOTE In accordance with the Environmental Protection Agency regulations, refrigerants cannot be purged into the atmosphere. A refrigerant recovery/recycling unit must be used whenever discharging the refrigerant system. Operation of the recovery/recycling unit must be by AUTHORIZED PERSONNEL ONLY.	
Purge	a. Release refrigerant charge in accordance with paragraph 6.4. b. Attach middle hose from charging manifold to dry nitrogen cylinder valve. c. Connect hose from charging manifold low side to suction charging valve. d. Open both charging valves.	Paragraph 6.4

6.5 NITROGEN PURGE. - Continued

Location/Item	Action	Remarks
Purge - Continued	**CAUTION** Nitrogen pressure in the system should not exceed 10 pounds. e. Open cylinder valve and allow dry nitrogen to flow through system until all moisture is forced out (not less than 5 minutes). f. Close cylinder valve. g. Close both charging valves. h. Disconnect all hoses.	

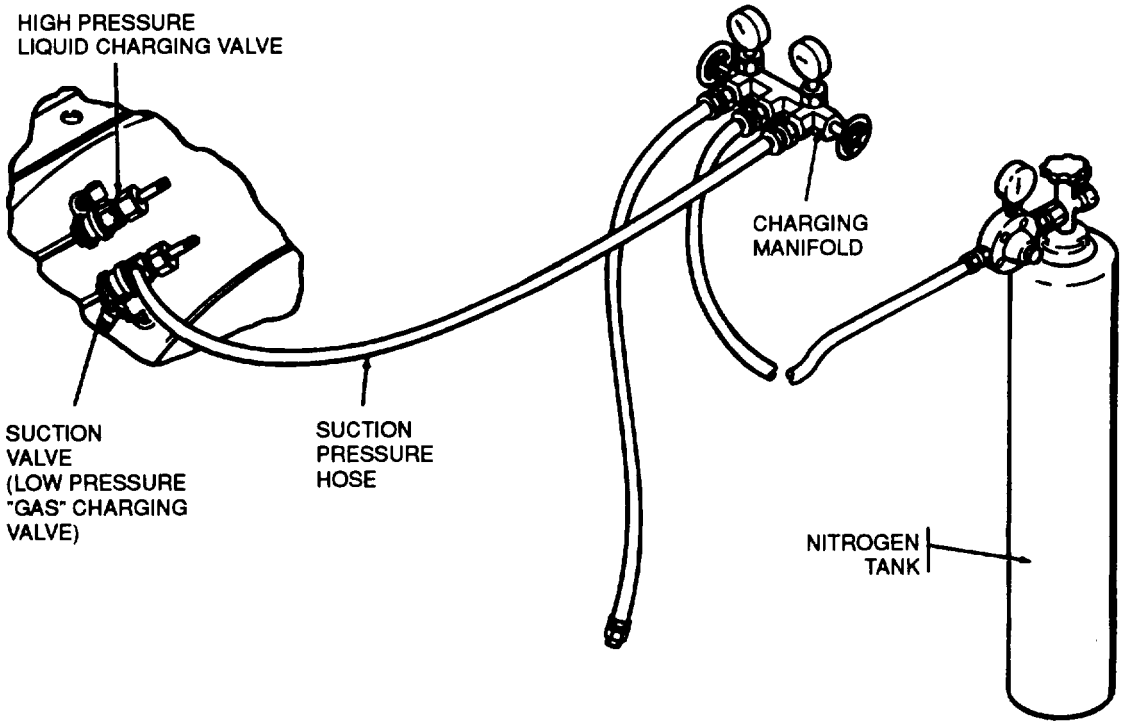


Figure 6-3. Nitrogen Tank Connection

6.6 EVACUATION. This task covers connecting a vacuum pump to remove all contamination from the refrigerant piping.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Charging Manifold
Safety Glasses
Tools (Paragraph 3.1)
Vacuum Pump

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

Location/Item	Action	Remarks
Vacuum Pump	a. Leak test system.	Paragraph 6.1
	b. Install new filter/dryer.	Paragraph 6.15
	c. Close charging manifold valves.	
	d. Remove caps from charging valves.	
	e. Attach manifold hoses to the charging valves.	
	f. Attach middle hose to a vacuum pump.	
	g. Start vacuum pump.	
	h. Open manifold valves.	

6.6 EVACUATION. - Continued

Location/Item	Action	Remarks
Vacuum Pump - Continued	i. Open both charging valves. j. Run the vacuum pump until at least 29 inches of mercury, measured on the vacuum pump gauge, is reached. **NOTE** Inability to reach 29 inches of mercury may indicate a leak or problem with the pump. k. Continue running the pump for one more hour, observing the vacuum pump gauge. If the gauge needle moves back and forth, there is a refrigerant leak which must be located and corrected. l. Close manifold valves. m. Close both charging valves. n. Stop vacuum pump.	

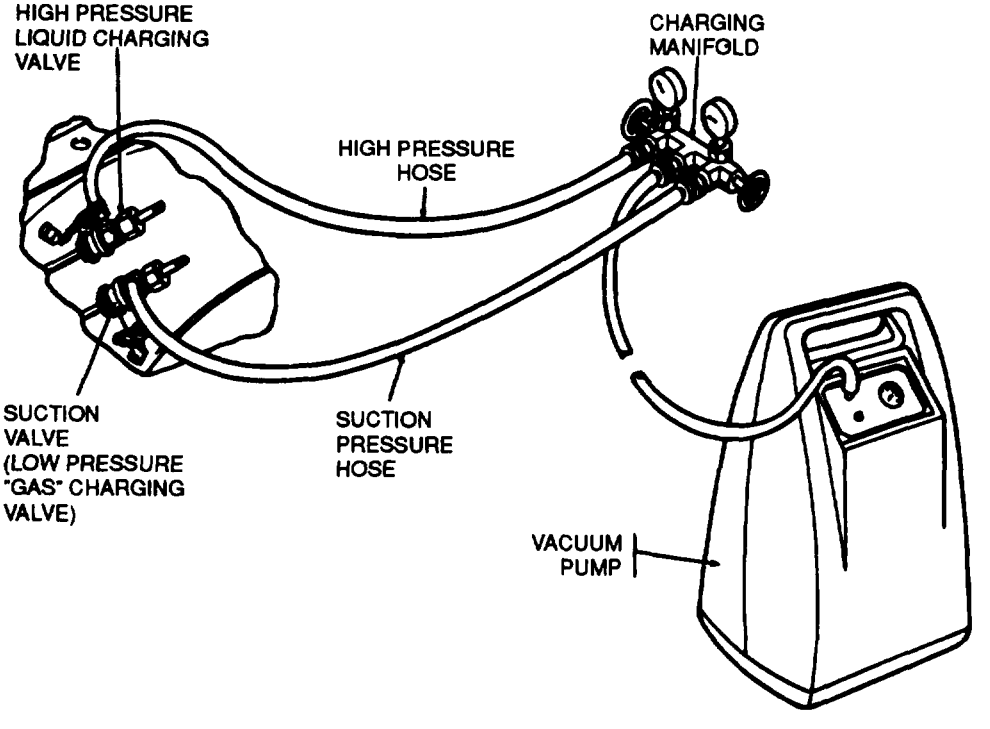


Figure 6-4. Evacuating System

6.7 REFRIGERANT CHARGEING WITH GAS. This task covers procedures to add refrigerant gas to a system which is low on refrigerant.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
Multimeter

Special Tools:
None

Materials/Parts:
Charging Manifold
Safety Glasses
Cleaning Cloths
Refrigerant R-22
Tools (Paragraph 3.1)
Thermal Gloves

Equipment Descriptions:
Power OFF; installed in or removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

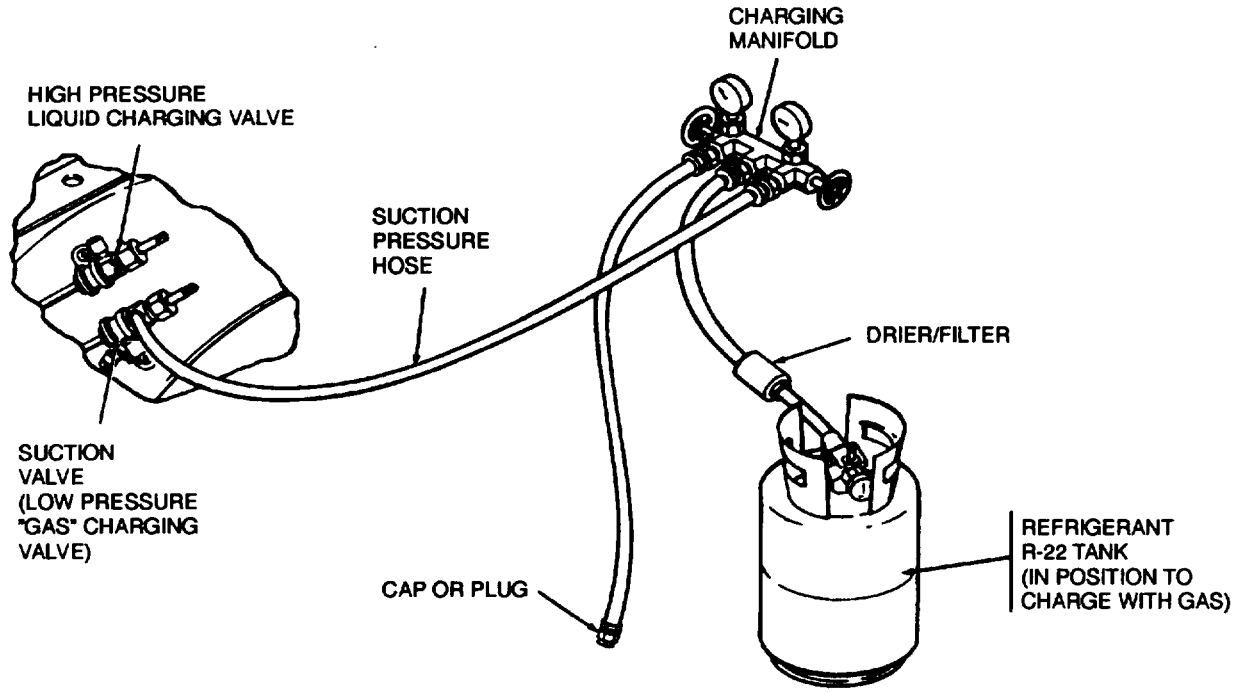
References:
None

Troubleshooting References:
None

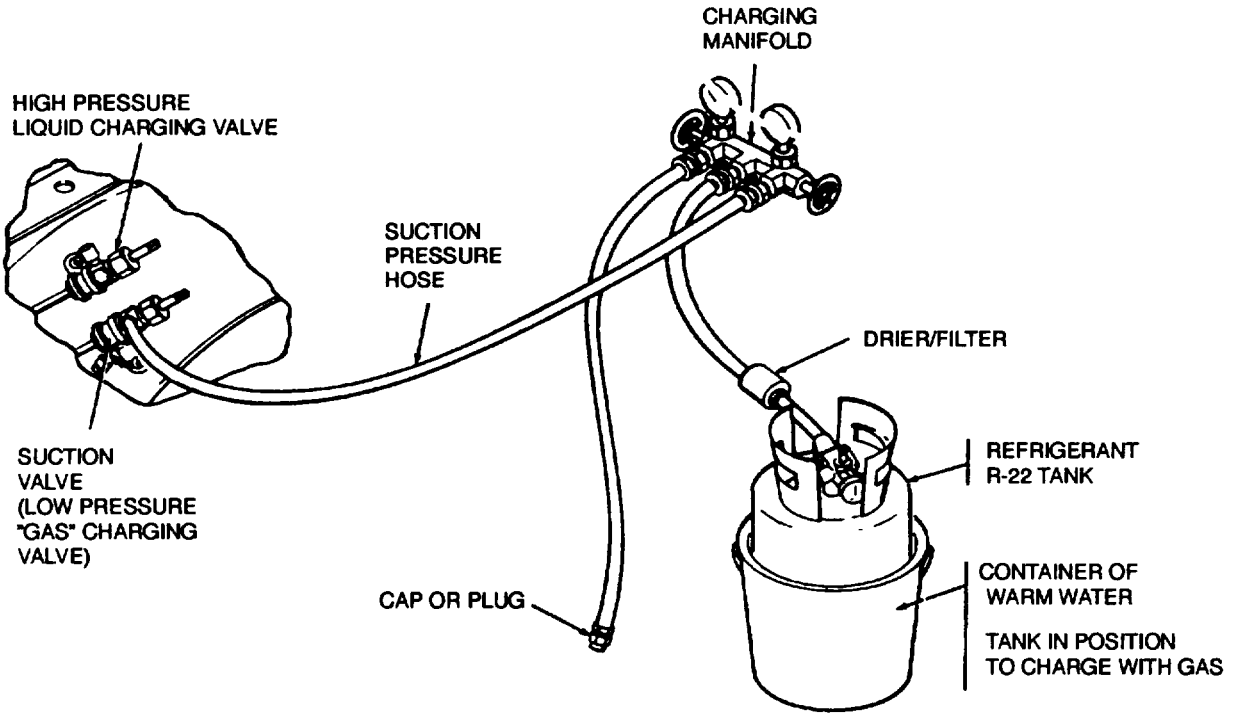
Personnel Required:
Direct Support

Location/Item	Action	Remarks
Charging	**WARNING** Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin-or-eye-contact is possible. Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to breakdown and form carbonyl chloride (phosgene), a highly toxic and corrosive gas.	

6.7 REFRIGERANT CHARGING WITH GAS. - Continued



ADDING GAS TO SYSTEM



ADDING GAS TO SYSTEM (COLD DAY)

Figure 6-5. Refrigerant Charging, Gas

6.7 REFRIGERANT CHARGING WITH GAS. - Continued

Location/Item	Action	Remarks
Charging - Continued	**CAUTION** Do not attempt to charge liquid refrigerant into the suction line. The compressor would be damaged. **CAUTION** If compressor knocking or pounding is heard when charging with gas, shut down at once and release some refrigerant. **NOTE** Two kinds of refrigerant drums are in general use. One is equipped with a single shutoff valve and must be inverted when charging liquid refrigerant. The other is equipped with a vapor valve and a liquid valve, which makes it possible to charge either liquid or vapor when the drum is upright. **NOTE** Whenever available, use recycled refrigerant for charging the refrigeration system. a. Place refrigerant drum in upright position. **CAUTION** When adding refrigerant, use extreme care to avoid adding refrigerant to the system too fast which would cause slugging at the compressor. b. Remove cap from low pressure (suction side) charging valve and loosely connect charging line to valve. Purge air from line.	

6.7 REFRIGERANT CHARGING WITH GAS. - Continued

Location/Item	Action	Remarks
Charging - Continued	c. Open refrigerant drum valve slightly to purge air from charging line. Tighten connection at charging valve. Close refrigerant drum valve. d. With the air conditioner operating slowly, admit gas to system. e. Close valves and carefully loosen the charging line to release trapped pressure. Disconnect charging line and install charging valve cap. Operate air conditioner in cooling mode for 15 minutes. f. Check liquid sight indicator. If indicator regularly shows bubbles, repeat Steps b. through e., adding refrigerant until indicator is clear. **NOTE** On cold days it may be necessary to place refrigerant drum in container of warm water not over 120°F (48.9°C).	

6.8 REFRIGERANT CHARGING WITH LIQUID. This task covers procedures to add liquid refrigerant to a discharged system.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
All

Special Tools:
None

Materials/Parts:
Charging Manifold
Safety Glasses
Cleaning Cloths
Refrigerant R-22 (5.5 Lbs, 2.5 Kg)
Tools (Paragraph 3.1)
Thermal Gloves

Equipment Descriptions:
Power OFF: removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

Location/Item	Action	Remarks
Charging	**WARNING** Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin-or-eye-contact is possible. Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas.	

6.8 REFRIGERANT CHARGING WITH LIQUID. - Continued

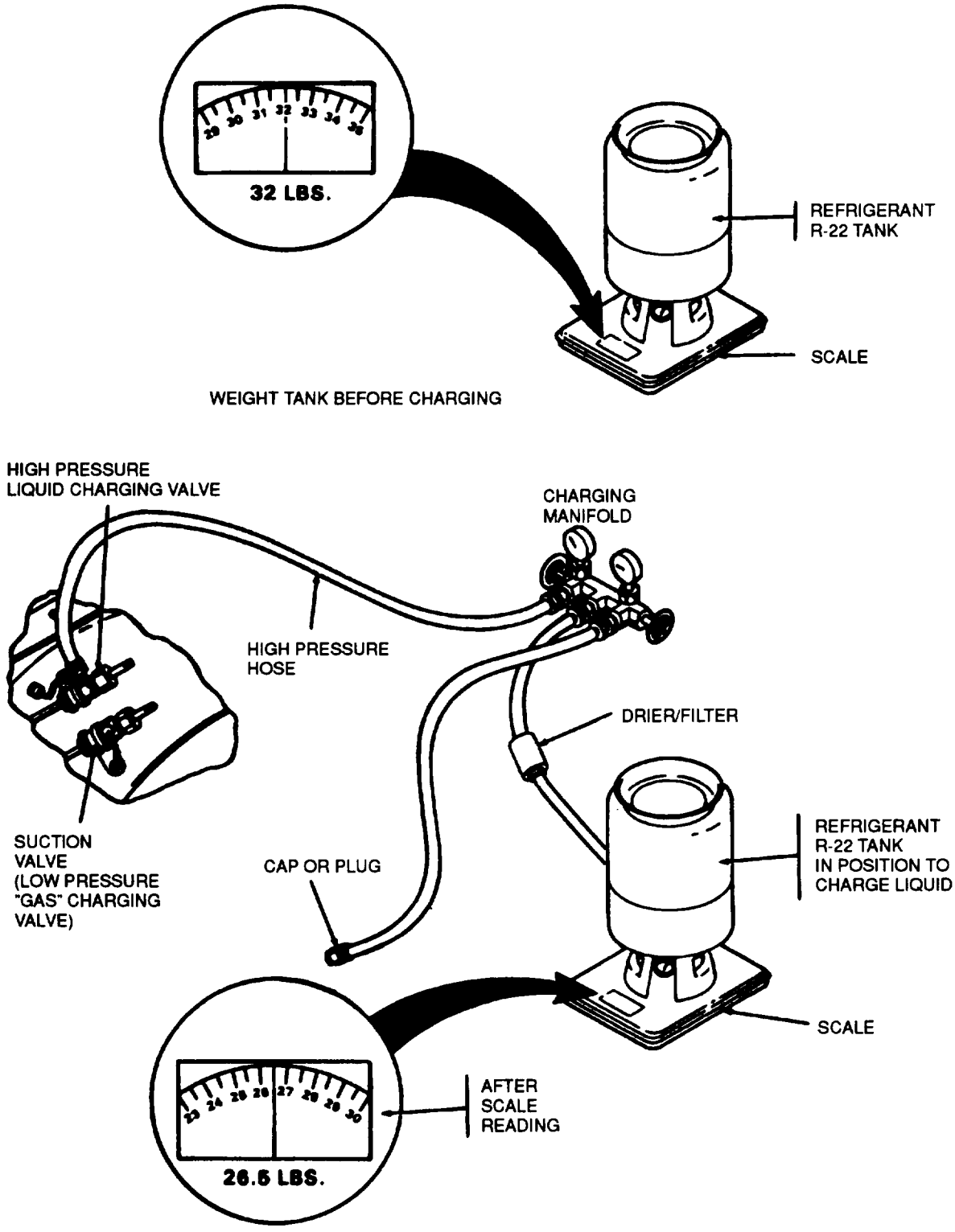


Figure 6-6. Refrigerant Charging, Liquid

6.8 REFRIGERANT CHARGING WITH LIQUID. - Continued

Location/Item	Action	Remarks
Charging - Continued	**NOTE** Two kinds of refrigerant drums are in general use. One is equipped with a single shutoff valve and must be inverted when charging liquid refrigerant. The other is equipped with a vapor valve and a liquid valve, which makes it possible to charge either liquid or vapor when the drum is upright. **NOTE** Whenever the refrigerant system has been opened, a new filter-drier must be installed before re-charging. **NOTE** Whenever available, use recycled refrigerant for charging the refrigeration system. a. Evacuate the system. b. Use only R-22 refrigerant. c. Set drum with valve down on scale. d. Record the weight. e. Subtract 5.5 Ibs (2.5 kg) and mark dial face at that point. f. Connect charging manifold to drum. g. Connect charging manifold to high (head) pressure valve. h. Open refrigerant tank valve slightly and loosen hose fitting for a few seconds at manifold to purge hose. i. Tighten fitting at the manifold. j. Open high side valve. k. Open tank valve until tank weight has decreased by 5.5 Ibs (2.5 kg).	Paragraph 6.6

6.8 REFRIGERANT CHARGING WITH LIQUID. - Continued

Location/Item	Action	Remarks
Charging - Continued	l. Immediately close HIGH SIDE service valve, manifold valve and refrigerant tank valve. m. Run the air conditioner in COOL mode with temperature control in extreme COOLER position for 15 minutes. n. Check liquid sight indicator. If system is short of refrigerant, gas bubbles will appear regularly in the indicator. o. If refrigerant system is undercharged, add additional refrigerant (see paragraph 6.7').	

6.9 COMPRESSOR. This task covers safety measures. diagnosing compressor motor burnout, and cleaning after burnout.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
Acid Test Kit

Special Tools:
None

Materials/Parts:
Brazing Flux
Brazing Alloy
Charging Manifold
Safety Glasses
Brazing and Soldering Set
Solvent P-D-680
Detergent Solution
Cleaning Cloths
Refrigerant R-22
Nitrogen (Cylinder)
Tools (Paragraph 3.1)
Abrasive Cloth
Scale
Rubber Gloves
Drier/Filter (2)

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

6.9 COMPRESSOR. - Continued

Location/Item	Action	Remarks
Charging	a. Serviceman should be aware of acid burns. b. When testing for odor, release a small amount of gas and smell it cautiously to avoid inhalation of toxic decomposed products. c. When discharging gas or liquid refrigerant from a burnout, avoid eye-or-skin-contact with the product. d. If the entire charge is to be removed, it should be discharged outside any enclosure. **NOTE** In accordance with the Environmental Protection Agency regulations, refrigerants cannot be discharged into the atmosphere. A refrigerant recovery and recycling unit must be used whenever discharging the refrigerant system. e. Connect and operate recovery/recylcling unit in accordance with manufacturer's instructions. Operation of the recovery/recycling unit must be by AUTHORIZED PERSONNEL ONLY. Wear rubber gloves to avoid acid burns when handling sludge from a burned out compressor. **WARNING** Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged from any container under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or safety glasses in any situation where skin-or-eye-contact is possible. Prevent contact of refrigerant gas with flame or hot metal surfaces. Heat causes the refrigerant to breakdown and form carbonyl chloride (phosgene), a highly toxic and corrosive gas.	Paragraph 6.4

6.9 COMPRESSOR. - Continued

Location/Item	Action	Remarks
Charging - Continued	**CAUTION** The electronic leak detector is sensitive to the presence of refrigerant gas in the atmosphere. When refrigerant gas is present in the atmosphere of the work area, false indications can result. Use in a well-ventilated but draft-free area.	
Diagnosing Compressor Motor Burnout	a. Simple failure, without motor burnout, does not require extensive cleaning of entire refrigerant system that burnout requires. b. Motor burnout indicates other problems have contributed to the failure. c. These problems must be corrected or avoided to prevent repetition of the burnout. d. A compressor motor that fails to start maybe due to improper voltage, a faulted motor thermal switch (S8), a malfunction of the compressor start relay, or a compressor mechanical fault. e. Make certain that a burnout has occurred by doing the following: (1) Check for proper voltage. (2) Remove power connector from unit. (3) Check S8 for full continuity between pins D and E on motor plug P-4. (4) Check power at compressor connector by jumping pins D and E. (5) Remove the compressor leads at the compressor side of the start relay. (6) Close the disconnect switch to energize the control circuit. (7) Check for voltage on all lines at both the line and load side of the compressor relay K3.	

6.9 COMPRESSOR. - Continued

Location/Item	Action	Remarks
Diagnosing Compressor Motor Burnout - Continued	**NOTE** Before checking the compressor motor, make sure the compressor and crankcase heater are cool to the touch. Otherwise, a false indication may be obtained due to internal motor protectors being open.	
	(8) Check the compressor motor to see if it is electrically grounded or open.	
	(9) A 500-volt megger or an ohmmeter can be used for making the test.	
	(10) Megger reading is at least 5 megohms.	
	After removal of a bad compressor from the refrigeration system, remove all external tubing and tip the compressor toward the discharge port to drain a small quantity of oil into a clear glass container.	
	g. If the oil is clean and clear, and does not have an acrid smell, the compressor did not fail because of motor burnout.	
	h. If the oil is black, contains sludge and has an acrid odor, the compressor failed because of motor burnout.	
	If a burnout has occurred, the refrigeration system must be cleaned to prevent residual contaminants from causing repeated burnouts.	
Cleanup Procedures	a. System must be cleaned thoroughly to remove all contaminants.	If not, a repeat burnout will occur.
	b. Discharge refrigerant from system.	Paragraph 6.4. Wear rubber gloves.
	c. Nitrogen purge both high and low sides of system.	Paragraph 6.5
	d. Remove and install new drier/filter.	Paragraph 6.15
	e. Install new drier/filter in suction line.	Use same drier/filter as used in system.
	f. Install “pressure tap” (valve) between bulbwell and suction line drier/filter.	

6.9 COMPRESSOR. - Continued

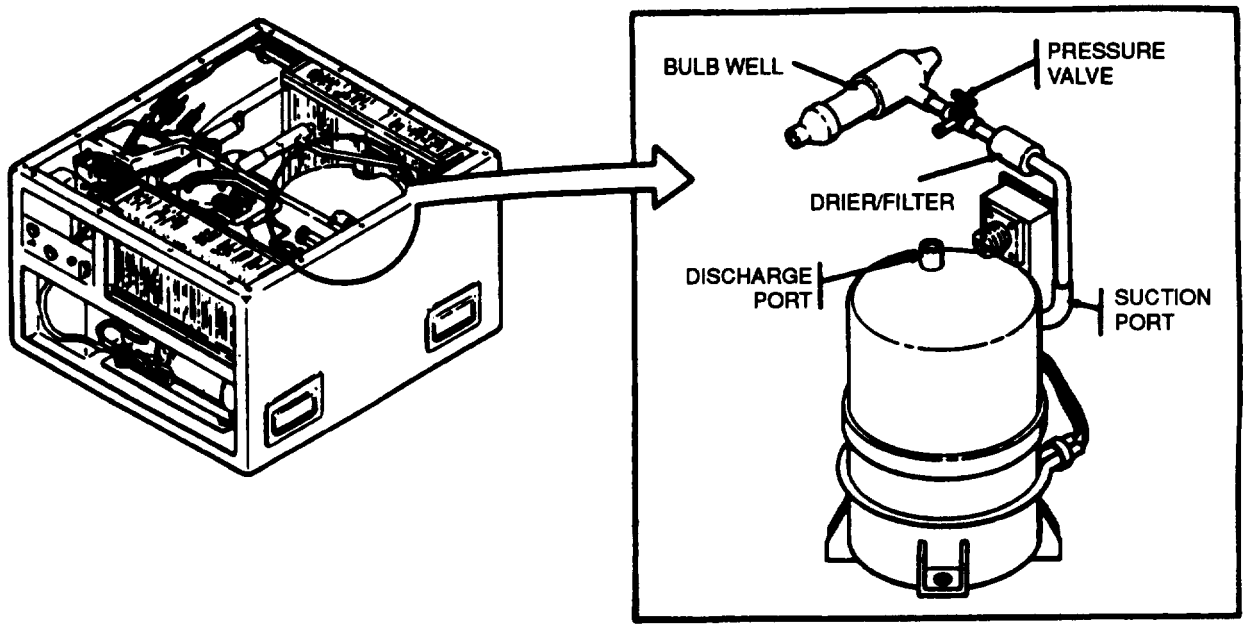


Figure 6-7. Compressor Burnout Cleanup

Location/Item	Action	Remarks
Cleanup Procedures - Continued	g. Check the expansion valve and clean or replace it.	Paragraph 6.17
	h. Replace sight glass.	Paragraph 6.14
	i. Remove the burned out compressor and install the replacement.	Paragraph 6.9
	j. Evacuate the system.	Paragraph 6.6
	k. Recharge the system and put in operation.	Paragraph 6.8
	l. Check pressure drop across the new suction drier after 1 hour of operation. Change, if necessary, and evacuate system.	Between new valve and low side charging valve, no more than 3 psig difference is permitted.
	m. After 8 to 24 hours of operation, change suction drier/filter. Check odor and color of oil. Evacuate system.	
	n. After 14 days of operation, check color acidity of oil. If required, change drier/filter. Before clean up is completed, it is essential that oil is clean and no acid is present.	

6.9 COMPRESSOR. - Continued

Location/Item	Action	Remarks
Removal	a. Disconnect power supply.	**WARNING** High voltage can kill.
	b. Remove top covers.	
	WARNING Avoid contact with refrigerant. Acid burns could result from contact with refrigerant.	
	c. Discharge refrigerant system.	Paragraph 6.4
	WARNING It maybe necessary to wait for crankcase heater to cool. Heater can cause severe burns.	
	d. Disconnect electrical connector.	
	e. Unsolder or, if necessary, cut tubing at the compressor.	
	f. Loosen two screws in each of four access covers on bottom of air conditioner.	
	g. Move four access covers to one side.	
	h. Remove four sets of screws, washers, bushings, and nuts.	Save for installation. Inspect bushing and washers. It may be necessary to order new for installation.
	WARNING If compressor is being removed due to burnout, use care when lifting to avoid touching compressor sludge. Acid in sludge can cause burns.	
	i. Lift compressor from air conditioner.	

6.9 COMPRESSOR. - Continued

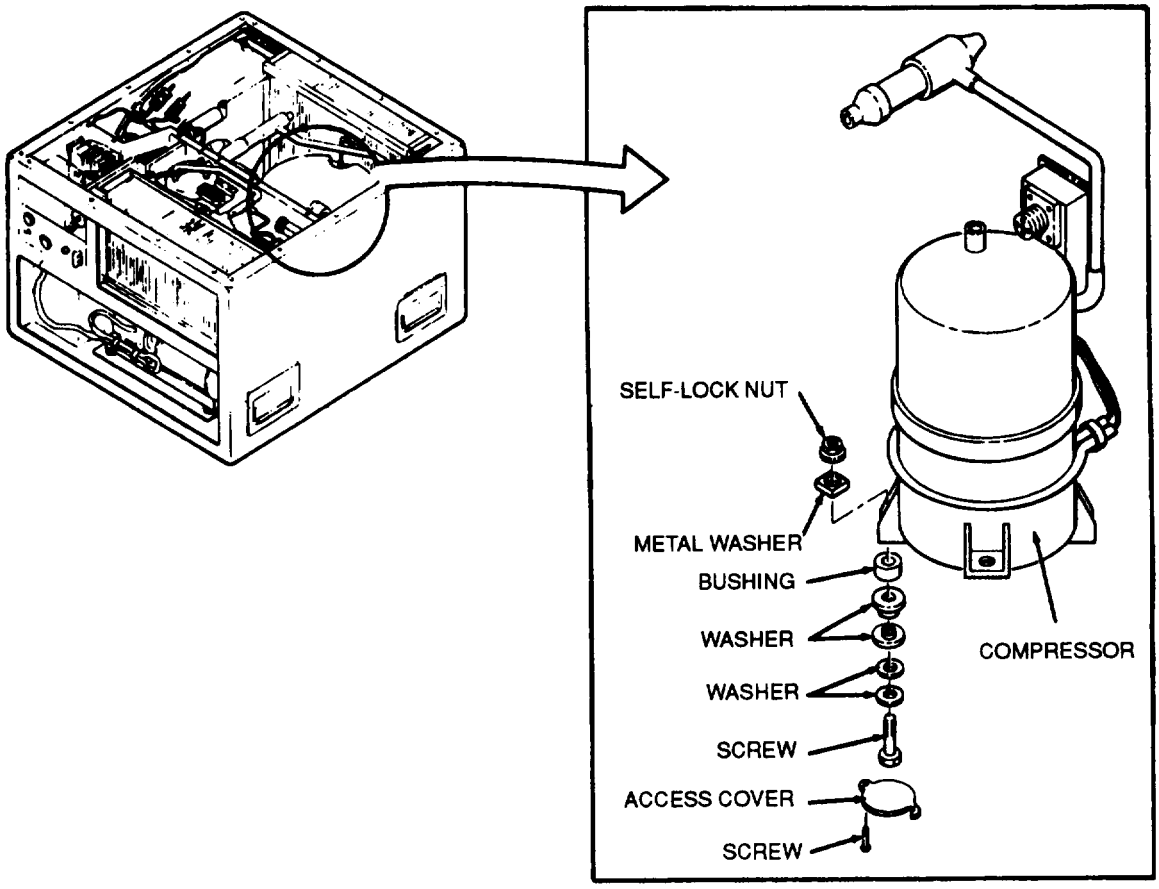


Figure 6-8. Compressor Replacement

Location/Item	Action	Remarks
Installation	CAUTION If compressor is being replaced due to motor burnout, decontaminate system.	Failure to follow caution will result in failure of new compressor.
	a. Nitrogen purge both high and low sides of system.	Paragraph 6.5
	b. Perform previous “Cleanup Procedures” located in this paragraph.	For burnout only.
	c. Inspect removed washers and bushings; use new if they are deformed or worn.	

6.9 COMPRESSOR. - Continued

Location/Item	Action	Remarks
Installation - Continued	d. Install four mounting screws, flat washers, and washers and bushings. **CAUTION** Compressor solder tube connections are factory sealed to prevent moisture or dirt contamination of compressor. Do not remove plugs until compressor is to be connected to refrigerant tubing. **NOTE** If refrigeration piping was disconnected with the compressor being replaced, transfer the piping to the replacement compressor before installing it in the air conditioner. e. Discard plastic plugs from compressor solder connections. f. Lift compressor and slowly lower down onto the four sets of mounting hardware. g. Secure compressor in place using washers and self-locking nuts. h. Solder refrigerant tubing to compressor. See paragraph 6.3. **CAUTION** Do not use new compressor to draw vacuum on system. i. Evacuate the system. j. Connect compressor electrical connector. k. Charge system with 5.5 lbs (2.5 kg) of refrigerant R-22. l. Replace covers. m. Connect power supply.	**NOTE** Dry nitrogen is always used to purge the refrigeration system before brazing or debrazing connections, in order to prevent internal oxidation and scaling. Paragraph 6.6 Paragraph 6.8

6.10 COMPRESSOR CRANKCASE HEATER. This task covers removal and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Cleaning Cloths
Tools (Paragraph 3.1)

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

Location/Item	Action	Remarks
Removal	a. Discharge refrigerant.	Paragraph 6.4
	b. Disconnect power supply.	**WARNING** High voltage can kill.
	c. Remove all three top covers.	
	CAUTION Check that compressor and heater are cool. Either or both can cause severe burns.	
	d. Remove the retaining spring from the ends of the crankcase heating element. Remove compressor junction box cover.	
	NOTE One lead is spliced to compressor switch S9, and the other lead is connected to the compressor connector.	
	e. Tag and unsolder wire lead from heating element.	

6.10 COMPRESSOR CRANKCASE HEATER. - Continued

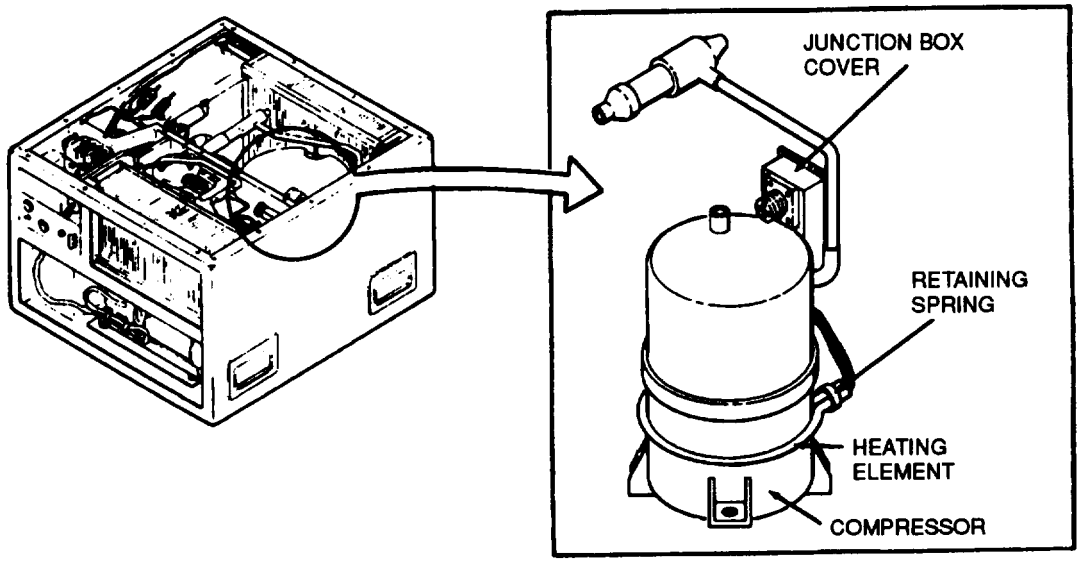


Figure 6-9. Crankcase Heater

Location/Item	Action	Remarks
Removal - Continued	f. Spring the ends of the heating element apart slightly so that the heating element can be maneuvered around and over the top of the compressor housing to remove it.	
Installation	a. Maneuver the crankcase heating element over the top of the compressor and down to the lower part of the compressor housing.	
	b. Do not spread the ends of the heating element any more than necessary.	
	c. Install retaining spring over both ends of the heating element to hold it in position.	
	d. Lead electrical wires from heating element into the compressor junction box.	
	e. Slide a 1-inch length of heat-shrink tubing over leads.	
	f. Solder wire junctions.	
	g. Use hot air dryer to shrink the tubing.	
	h. Install cover on junction box.	
	i. Connect power supply.	

6.11 CONDENSER COIL. This task covers cleaning, removal and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Brazing Flux
Brazing Alloy
Charging Manifold
Safety Glasses
Brazing and Soldering Set
Solvent P-D-680
Detergent Solution
Cleaning Cloths
Nitrogen (Cylinder)
Refrigerant R-22
Tools (Paragraph 3.1)
Abrasive Cloth
Scale
Gloves

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

6.11 CONDENSER COIL. - Continued

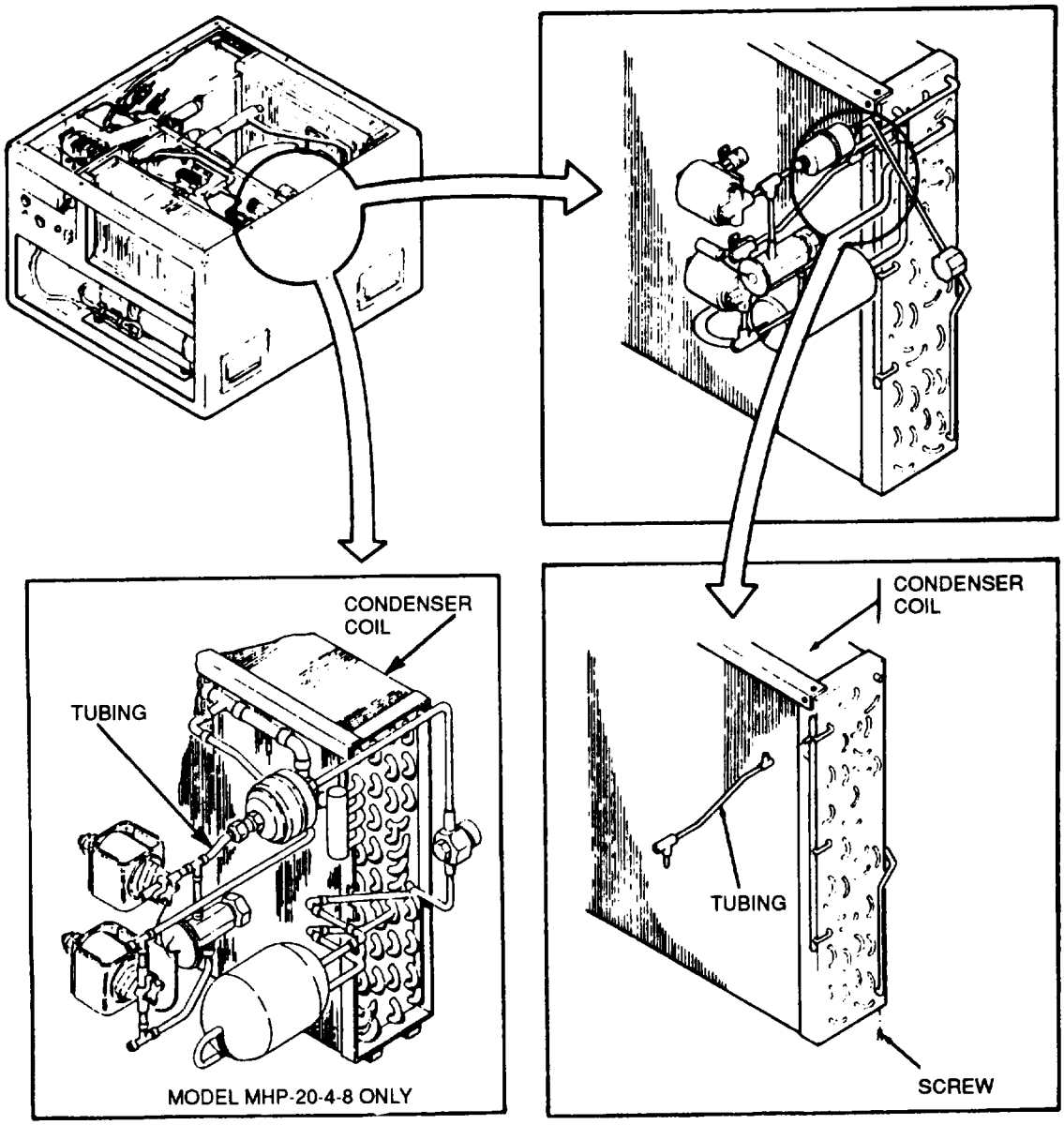


Figure 6-10. Condenser Coil

Location/Item	Action	Remarks
Cleaning	Refer to paragraph 5.26.	
Removal	a. Discharge refrigerant.	Paragraph 6.4
	b. Remove the top covers.	

6.11 CONDENSER COIL. - Continued

Location/Item	Action	Remarks
Removal - Continued	c. Remove compressor.	Paragraph 6.9
	d. Unsolder tubing at joint near condenser.	Paragraph 6.3
	e. Remove actuator control.	Paragraph 6.22
	f. Remove condenser guard.	
	g. Remove four screws that secure coil to frame.	
	NOTE Sight glass must be removed with condenser coil (see paragraph 6.13).	
	h. Lift coil from the frame.	
Installation	a. Install new drier/filter (dehydrator).	Paragraph 6.14
	b. Install spring nuts on bottom of coil.	
	c. Position coil in air conditioner.	
	d. Install four screws to secure coil.	
	e. Install condenser guard.	
	f. Install and adjust louver control.	Paragraph 6.23
	g. Solder tubing connections.	Paragraph 6.3
	h. Nitrogen purge system.	Paragraph 6.5
	i. Leak test and evacuate.	Paragraphs 6.2 and 6.6
	j. Charge system with liquid refrigerant.	Paragraph 6.8
	k. Replace top covers.	

6.12 RECEIVER. This task covers removal and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Brazing Flux
Brazing Alloy
Charging Manifold
Safety Glasses
Brazing and Soldering Set
Solvent P-D-680
Detergent Solution
Cleaning Cloths
Refrigerant R-22
Nitrogen (Cylinder)
Tools (Paragraph 3.1)
Abrasive Cloth
Scale
Gloves

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

6.12 RECEIVER. - Continued

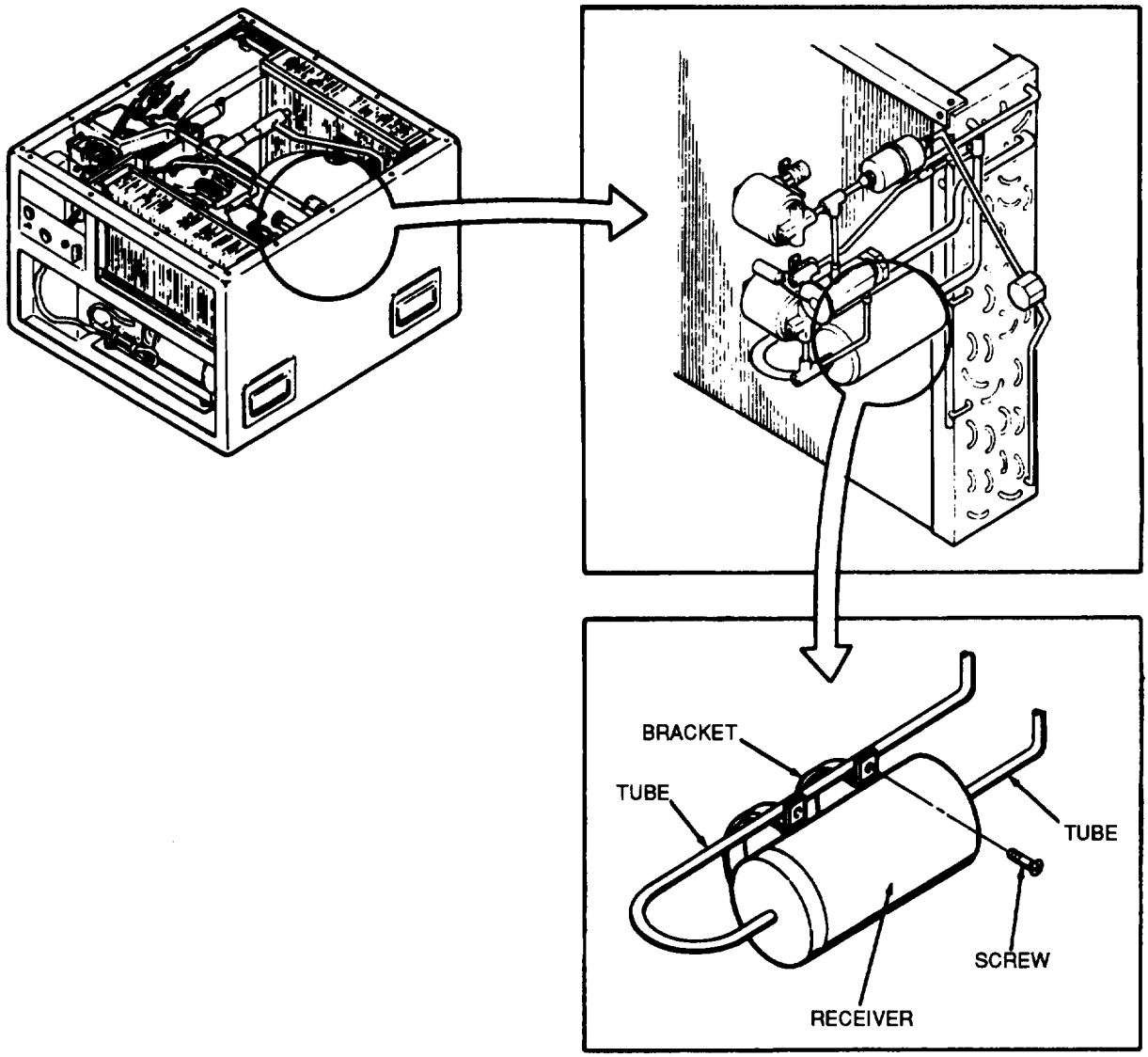


Figure 6-11. Receiver

Location/Item	Action	Remarks
Removal	a. Discharge refrigerant.	Paragraph 6.4
	b. Remove the top covers.	
	c. Remove drier/filter.	Paragraph 6.14
	d. Remove four screws and two mounting straps.	

6.12 RECEIVER. - Continued

Location/Item	Action	Remarks
Removal - Continued	e. Remove quench valve.	Paragraph 6.26
	f. Remove solenoid valves.	Paragraph 6.15
	g. Unsolder tubing to pull receiver from frame.	Paragraph 6.3
Installation	a. Install new drier/filter (dehydrator).	Paragraph 6.14
	b. Solder tubing to receiver.	Paragraph 6.3
	c. Install two straps.	
	d. Install all removed items.	
	e. Nitrogen purge system.	Paragraph 6.4
	f. Leak test and evacuate.	Paragraphs 6.2 and 6.4
	g. Charge system with liquid refrigerant.	Paragraph 6.8
	h. Replace covers.	

6.13 SIGHT GLASS. This task covers removal and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Brazing Flux
Brazing Alloy
Charging Manifold
Safety Glasses
Brazing and Soldering Set
Solvent P-D-680
Detergent Solution
Cleaning Cloths
Refrigerant R-22
Nitrogen (Cylinder)
Tools (Paragraph 3.1)
Abrasive Cloth
Scale
Gloves

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

6.13 SIGHT GLASS. - Continued

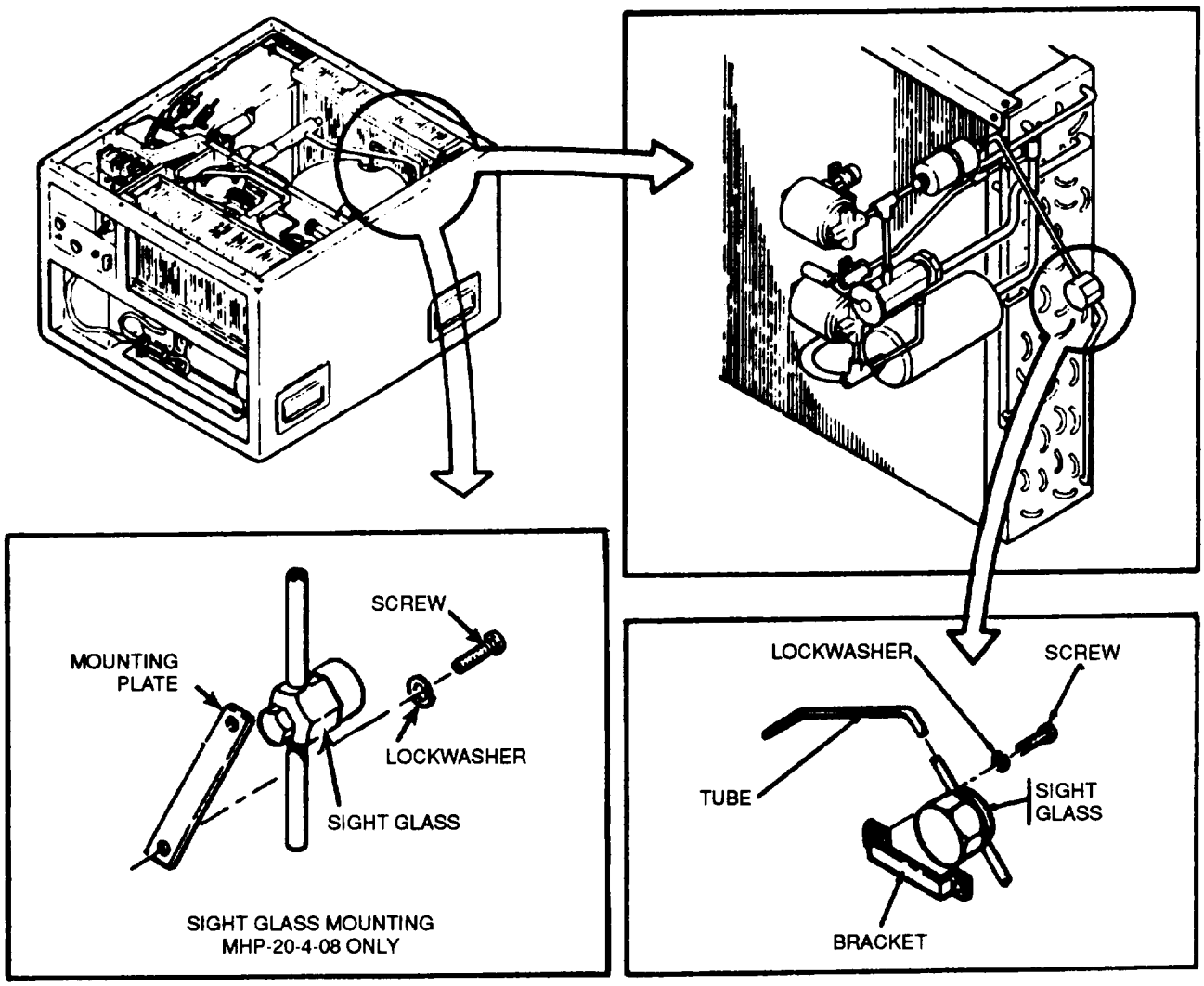


Figure 6-12. Sight Glass

Location/Item	Action	Remarks
Removal	a. Discharge refrigerant. b. Remove the top covers. c. Remove connector on inside of unit from input power connector J11. d. Remove two screws and lockwashers. e. Remove mounting bracket from inside housing.	Paragraph 6.4

6.13 SIGHT GLASS. - Continued

Location/Item	Action	Remarks
Removal - Continued	f. Remove condenser coil and sight glass as an assembly.	Paragraph 6.11
	g. Unsolder sight glass from tubing.	Paragraph 6.3
Installation	a. Install new drier/filter (dehydrator).	Paragraph 6.14
	b. Solder sight glass to condenser.	Paragraph 6.3
	c. Install condenser coil.	Paragraph 6.11
	d. Place bracket oversight glass on inside of housing.	
	e. Secure bracket with two screws and lockwashers.	
	f. Nitrogen purge system.	Paragraph 6.4
	g. Leak test and evacuate.	Paragraphs 6.2 and 6.6
	h. Charge system with liquid refrigerant.	Paragraph 6.8
	i. Replace covers.	

6.14 DRIER/FILTER (DEHYDRATOR). This task covers removal, cleaning, inspection and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Charging Manifold
Safety Glasses
Solvent P-D-680
Detergent Solution
Cleaning Cloths
Refrigerant R-22
Nitrogen (Cylinder)
Tools (Paragraph 3.1)
Scale
Gloves

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

Location/Item	Action	Remarks
Removal	a. Discharge refrigerant.	Paragraph 6.4
	b. Remove top covers.	
	c. Remove four screws and two straps.	
	d. Disconnect drier tube from refrigerant lines.	
Installation	a. Nitrogen purge system.	Paragraph 6.4
	b. Connect drier to tubing.	
	c. Install two straps.	

6.14 DRIER/FILTER (DEHYDRATOR). - Continued

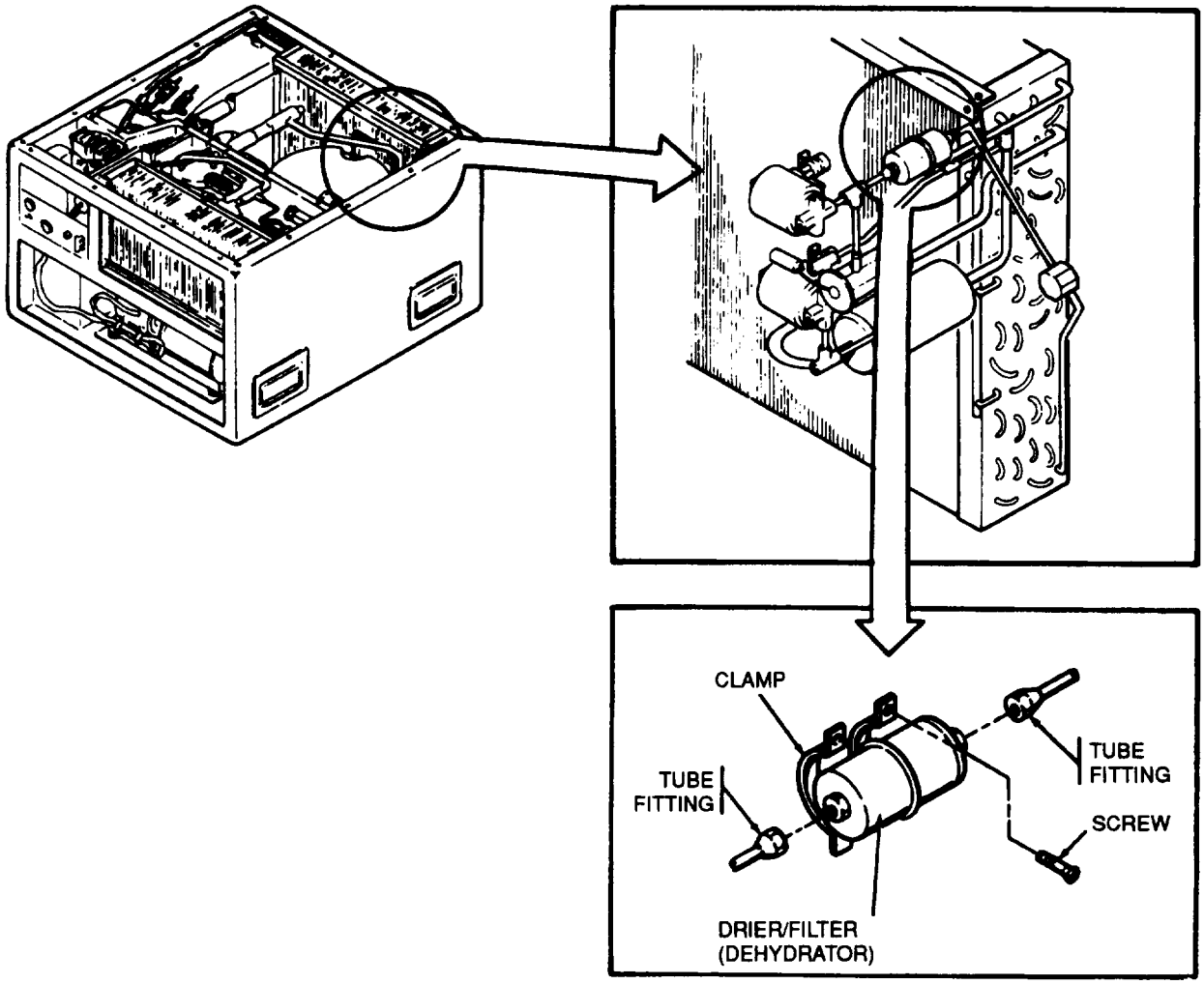


Figure 6-13. Drier/Filter

Location/Item	Action	Remarks
Installation - Continued	d. Leak test and evacuate.	Paragraphs 6.2 and 6.6
	e. Charge system with liquid refrigerant.	Paragraph 6.8
	f. Replace covers.	

6.15 SOLENOID VALVES. This task covers removal of solenoid valve, coil replacement, bonnet assembly and diaphragm replacement, cleaning and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Marerials/Parts:
Brazing Flux
Brazing Alloy
Charging Manifold
Safety Glasses
Brazing and Soldering Set
Solvent P-D-680
Detergent Solution
Cleaning Cloths
Refrigerant R-22
Nitrogen (Cylinder)
Tools (Paragraph 3.1)
Abrasive Cloth
Scale
Gloves

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

6.15 SOLENOID VALVES. - Continued

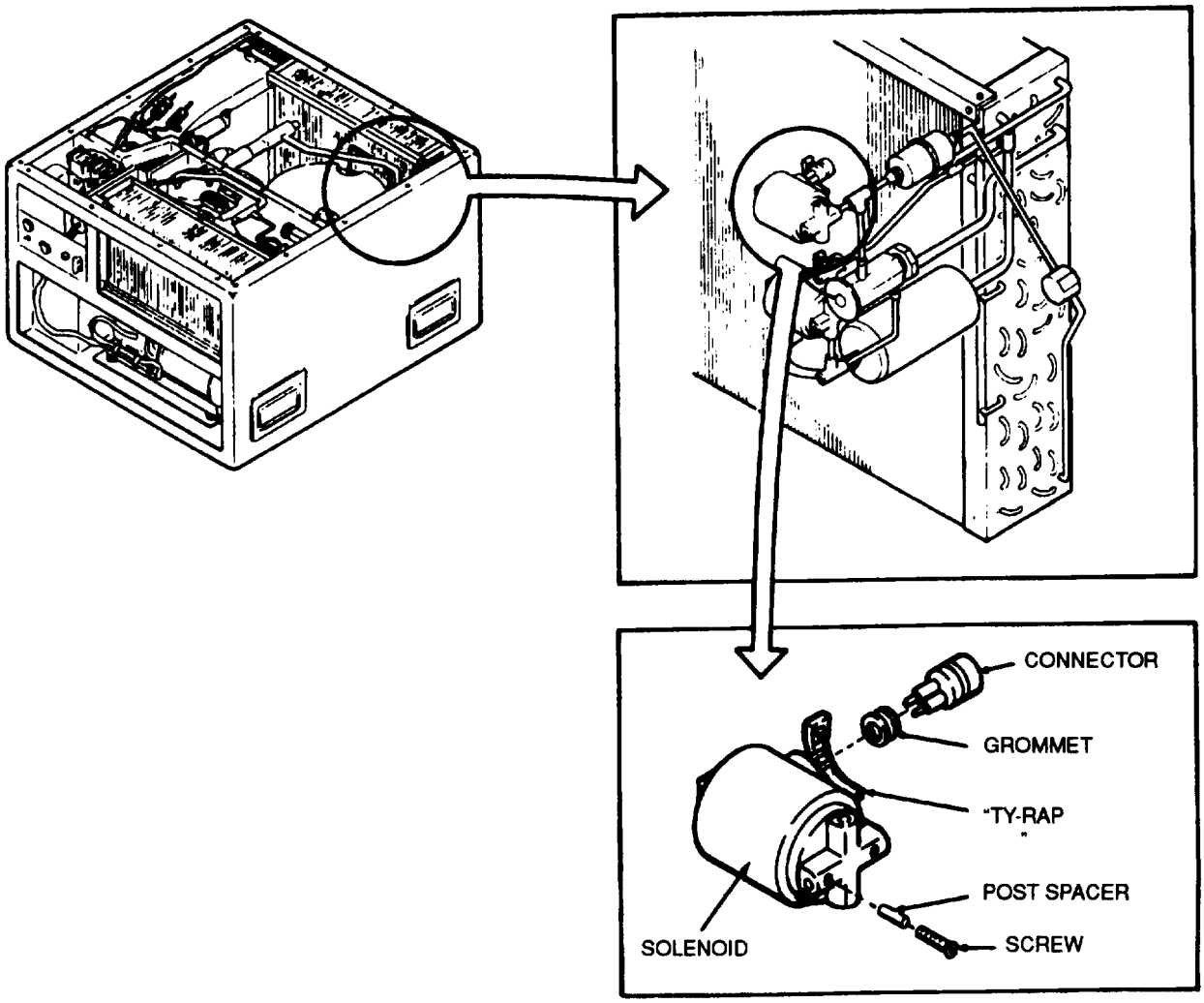


Figure 6-14. Solenoid Valve

6.15 SOLENOID VALVES. - Continued

NOTE

Replaceable parts are the coil, bonnet assembly, diaphragm and preformed packing.

Location/Item	Action	Remarks
Coil Replacement		**WARNING**
	a. Disconnect all power from unit.	High voltage can kill.
		NOTE Coil can be replaced without discharging refrigerant system.
	NOTE Removal, disassembly, cleaning, and inspection are the same for both solenoid valves.	
	b. Remove electrical connector from solenoid valve leads.	
	c. Remove nut on top of valve housing.	
	d. Lift data plate and coil assembly from body tube and plunger assembly	
	WARNING System under pressure. Do not remove tube and plunger assembly.	
	e. Install new coil assembly, data plate, and nut.	
	f. Connect electric wiring.	
Removal of Valve		**WARNING**
	a. Disconnect all power to unit.	High voltage can kill.
	b. Discharge refrigerant.	Paragraph 6.4
	c. Remove top covers.	
	d. Disconnect solenoid valve electrical connector.	

6.15 SOLENOID VALVES. - Continued

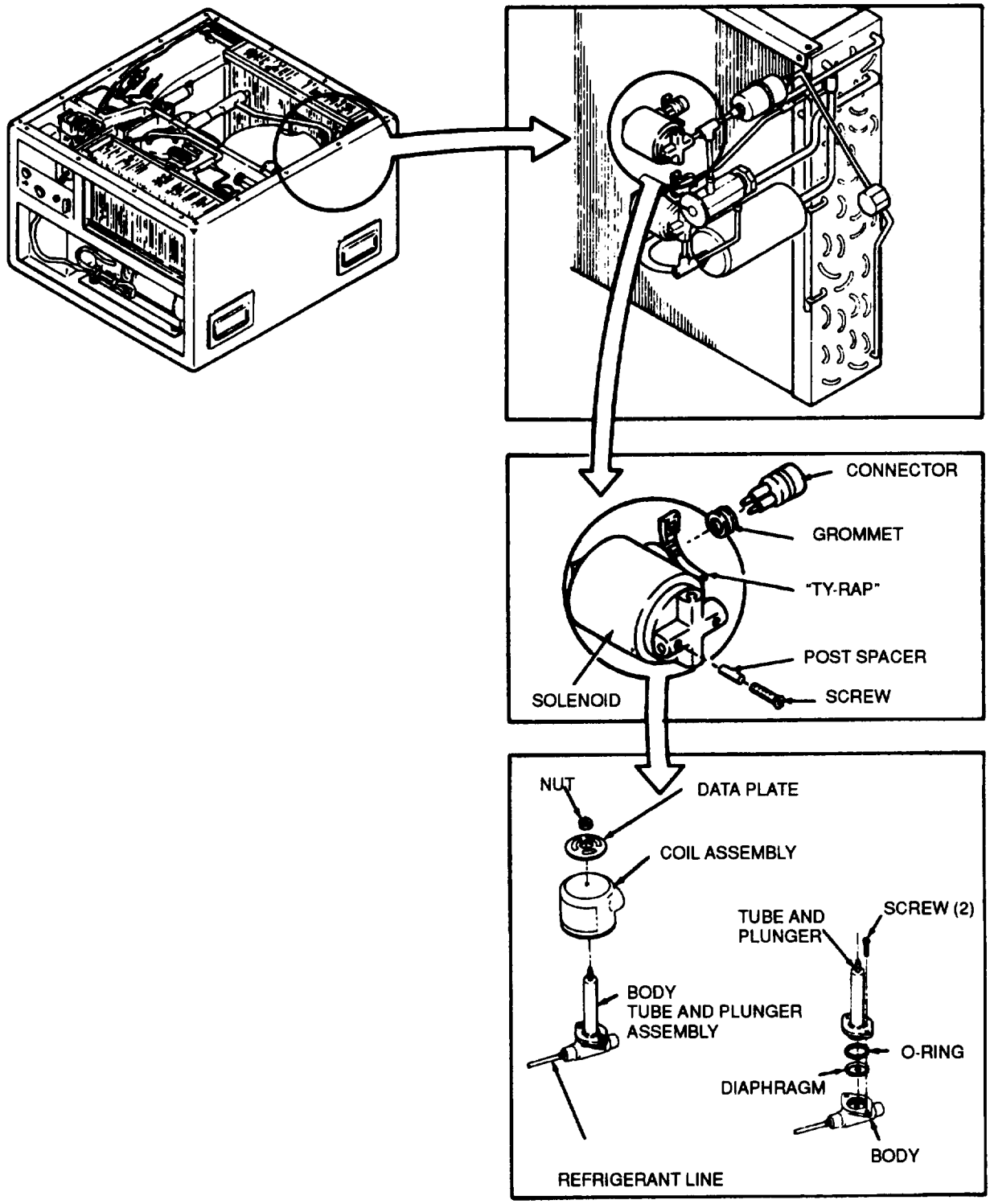


Figure 6-15. Solenoid Valve Disassembly

6.15 SOLENOID VALVES.- Continued

Location/Item	Action	Remarks
Removal of Valve Continued	**CAUTION** Body tube and plunger assembly must be removed before any heat is applied to valve body.	
	e. Remove two socket-head capscrews.	
	f. Carefully pull tube and plunger from valve body.	
	g. Remove diaphragm.	
	h. Unsolder valve body from tubing.	
Valve Installation	**CAUTION** Remove coil, body tube and plunger assembly, and diaphragm from new solenoid valve before soldering onto tubing.	
	a. Solder body on tubing.	
	CAUTION Allow valve body to cool before installing body tube and plunger.	
	b. Install body, tube and plunger assembly, and diaphragm.	
	c. Install coil.	See "Coil Replacement."
	d. Install electric wiring.	
	e. Install new drier/fitter.	Paragraph 6.14
	f. Nitrogen purge system.	Paragraph 6.5
	g. Leak test and evacuate.	Paragraphs 6.2 and 6.6
	h. Charge refrigerant system.	Paragraph 6.8
	i. Replace covers.	

6.16 EXPANSION VALVE. This task covers removal and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Part.s:
Brazing Flux
Brazing Alloy
Charging Manifold
Safety Glasses
Brazing and Soldering Set
Solvent P-D-680
Detergent Solution
Cleaning Cloths
Refrigerant R-22
Nitrogen (Cylinder)
Tools (paragraph 3.1)
Abrasive Cloth
Scale, Gloves
Thermal Mastic (97403) 13216E621O

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personel Required:
Direct Support

6.16 EXPANSION VALVE. - Continued

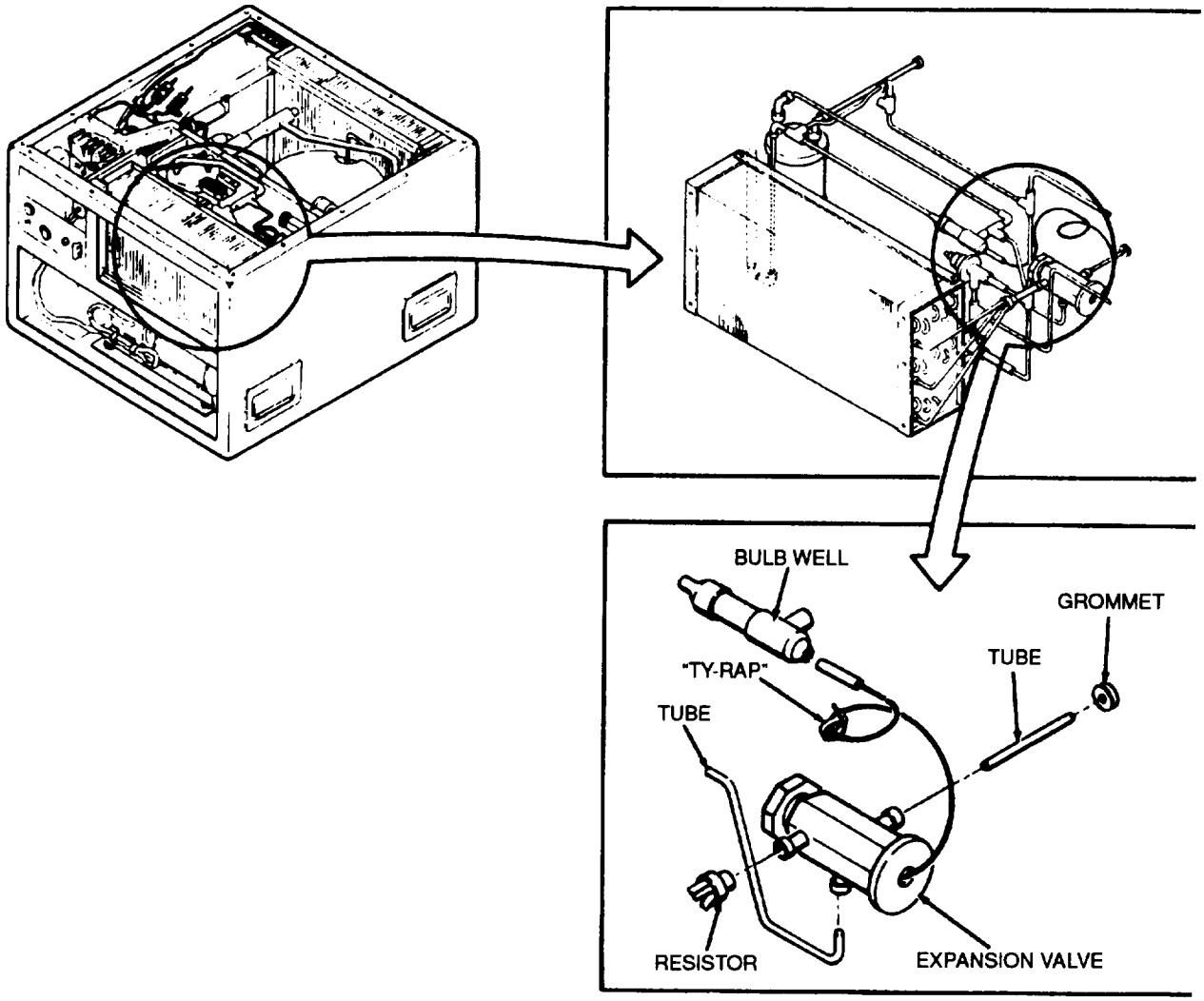


Figure 6-16. Expansion Valve

6.16 EXPANSION VALVE. -Continued

Location/Item	Action	Remarks
Removal	**NOTE** The main thermal expansion valve is hermetically sealed and cannot be repaired.	
	a. Discharge the refrigerant system.	Paragraph 6.4
	b. Remove housing top covers.	
	c. Remove mastic from bulb well.	
	d. Remove bulb from well.	
	e. Unsolder thermal expansion valve from tubing and restrictor (distributor).	Paragraph 6.3
Installation	a. Install new drier/fitter.	Paragraph 6.14
	b. Wrap valve with wet rag to prevent overheating valve during soldering.	
	c. Solder valve to tubing and restrictor (distributor).	
	d. Insert approximately one ounce of thermal mastic in bulb well.	
	e. Insert sensing bulb of expansion valve.	
	f. Move bulb back and forth to distribute mastic.	
	g. Set bulb approximately 1 inch beyond open end.	
	h. Nitrogen purge system.	Paragraph 6.5
	i. Leak test and evacuate.	Paragraphs 6.2 and 6.6
	j. Charge refrigerant system.	Paragraph 6.8
	k. Replace covers.	

6.17 EVAPORATOR COIL. This task covers removal, cleaning and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Brazing Flux
Brazing Alloy
Charging Manifold
Safety Glasses
Brazing and Soldering Set
Solvent P-D-680
Detergent Solution
Cleaning Cloths
Refrigerant R-22
Nitrogen (Cylinder)
Tools (paragraph 3.1)
Abrasive Cloth
Scale
Gloves

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

Location/Item	Action	Remarks
Removal	**NOTE** Remove restrictor (distributor) with the evaporator coil.	
	a. Discharge the refrigerant system.	Paragraph 6.4
	b. Remove top covers.	
	c. Remove evaporator air outlet louver.	
	d. Remove mist eliminator and brackets.	Paragraph 5.21
	e. Remove bulb well loop clamp.	
	f. Unsolder tubing from evaporator coil.	Paragraph 6.3

6.17 EVAPORATOR COIL. -Continued

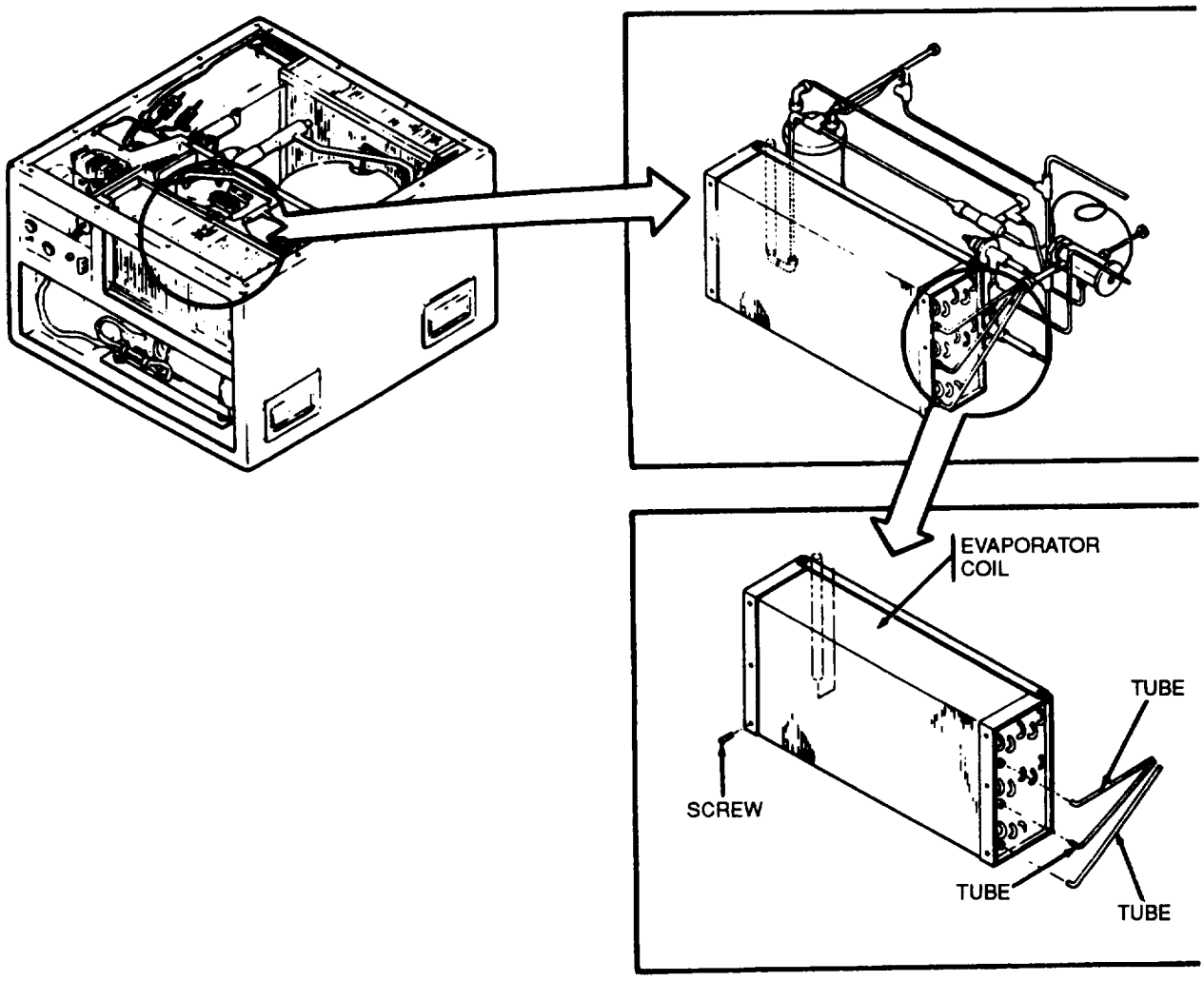


Figure 6-17. Evaporator Coil

Location/Item	Action	Remarks
Removal Continued	g. Remove six screws and lockwashers.	
	h. Lift evaporator from frame.	
Installation	a. Install new drier/filter.	Paragraph 6.14
	b. Install coil in frame.	
	c. Secure with six screws and lockwashers.	
	d. Solder tubing to coil.	Paragraph 6.3

6.17 EVAPORATOR COIL. - Continued

Location/Item	Action	Remarks
Installation - Continued	e. Clamp bulb well to coil.	
	f. Install mist eliminator.	Paragraph 5.21
	g. Install air outlet louver.	
	h. Nitrogen purge system.	Paragraph 6.4
	i. Leak test and evacuate.	Paragraphs 6.2 and 6.6
	j. Charge refrigerant system.	Paragraph 6.8
	k. Replace covers.	

6.18 BULB WELL. This task covers removal and installation.

I INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Brazing Flux
Brazing Alloy
Charging Manifold
Safety Glasses
Brazing and Soldering Set
Solvent P-D-680
Detergent Solution
Cleaning Cloths
Refrigerant R-22
Nitrogen (Cylinder)
Tools (paragraph 3.1)
Abrasive Cloth
Scale, Gloves
Thermal Mastic (97403) 13216E6210

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

6.18 BULB WELL. -Continued

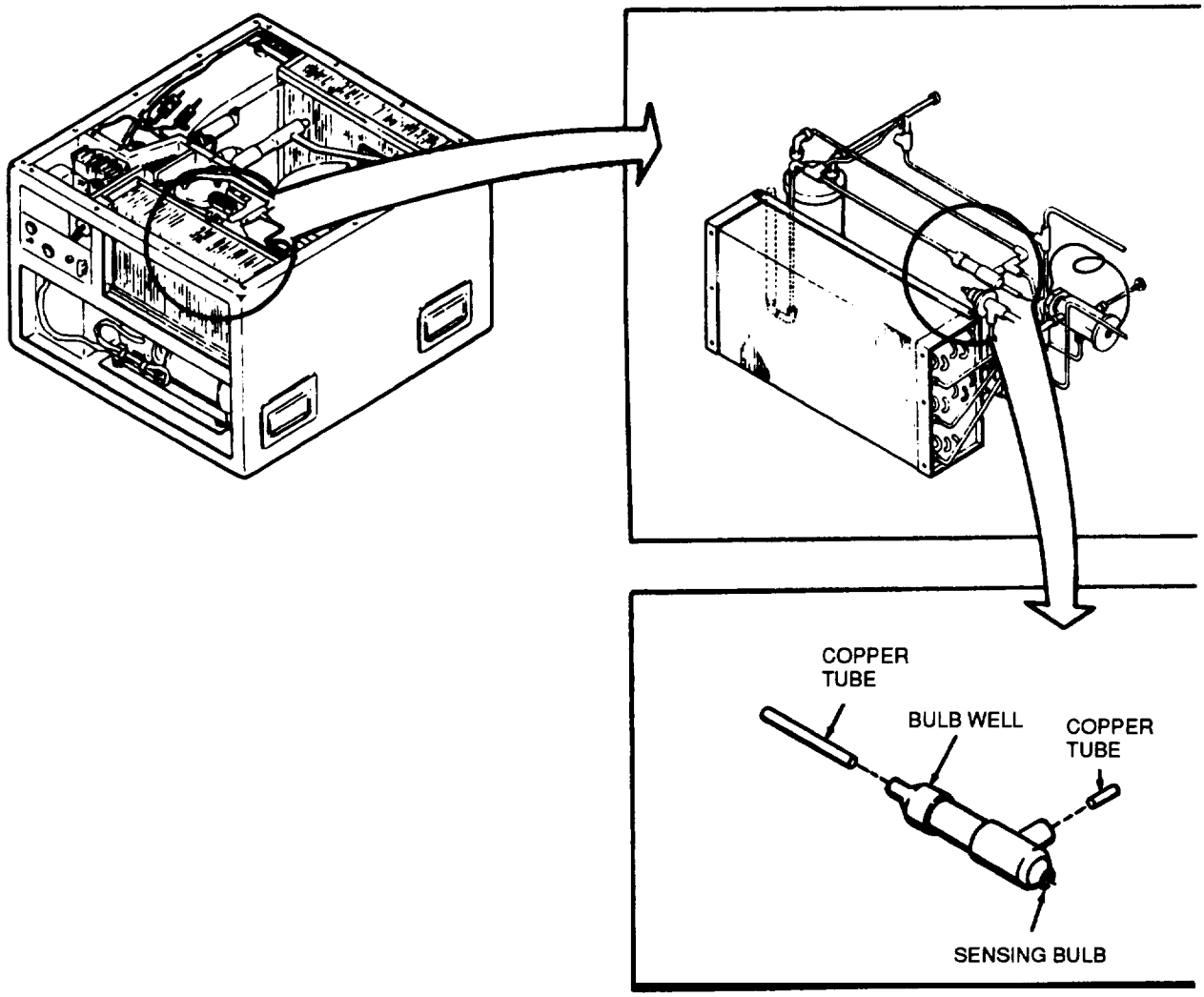


Figure 6-18. Bulb Well

Location/Item	Action	Remarks
Removal	a. Release refrigerant charge. b. Remove top rovers. c. Remove clamps. d. Remove mastic.	Paragraph 6.4

6.18 BULB WELL. - Continued

Location/item	Action	Remarks
Removal - Continued	**CAUTION** Use care to avoid breaking or kinking sensing line.	
	e. Remove sensing bulb.	
	f. Unsolder bulb well from tubing.	Paragraph 6.3
Installation	a. Replace drier/filter.	Paragraph 6.14
	b. Solder bulb well to tubing.	Paragraph 6.3
	c. Insert approximately one ounce of thermal mastic in bulb well.	
	d. Insert sensing bulb of expansion valve.	
	e. Move bulb back and forth to distribute mastic.	
	f. Set bulb approximatley 1 inch beyond open end.	
	g. Clamp bulb well to evaporator.	
	h. Nitrogen purge system.	Paragraph 6.5
	i. Leak test and evacuate.	Paragraphs 6.2 and 6.6
	j. Charge system.	Paragraph 6.8
	k. Replace covers.	

6.19 ACCUMULATOR. This task covers removal and installation.

I INITIAL SETUP I

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Brazing Flux
Brazing Alloy
Charging Manifold
Safety Glasses
Brazing and Soldering Set
Solvent P-D-680
Detergent Solution
Cleaning Cloths
Refrigerant R-22
Nitrogen (Cylinder)
Tools (paragraph 3.1)
Abrasive Cloth
Scale
Gloves

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

6.19 ACCUMULATOR -Continued

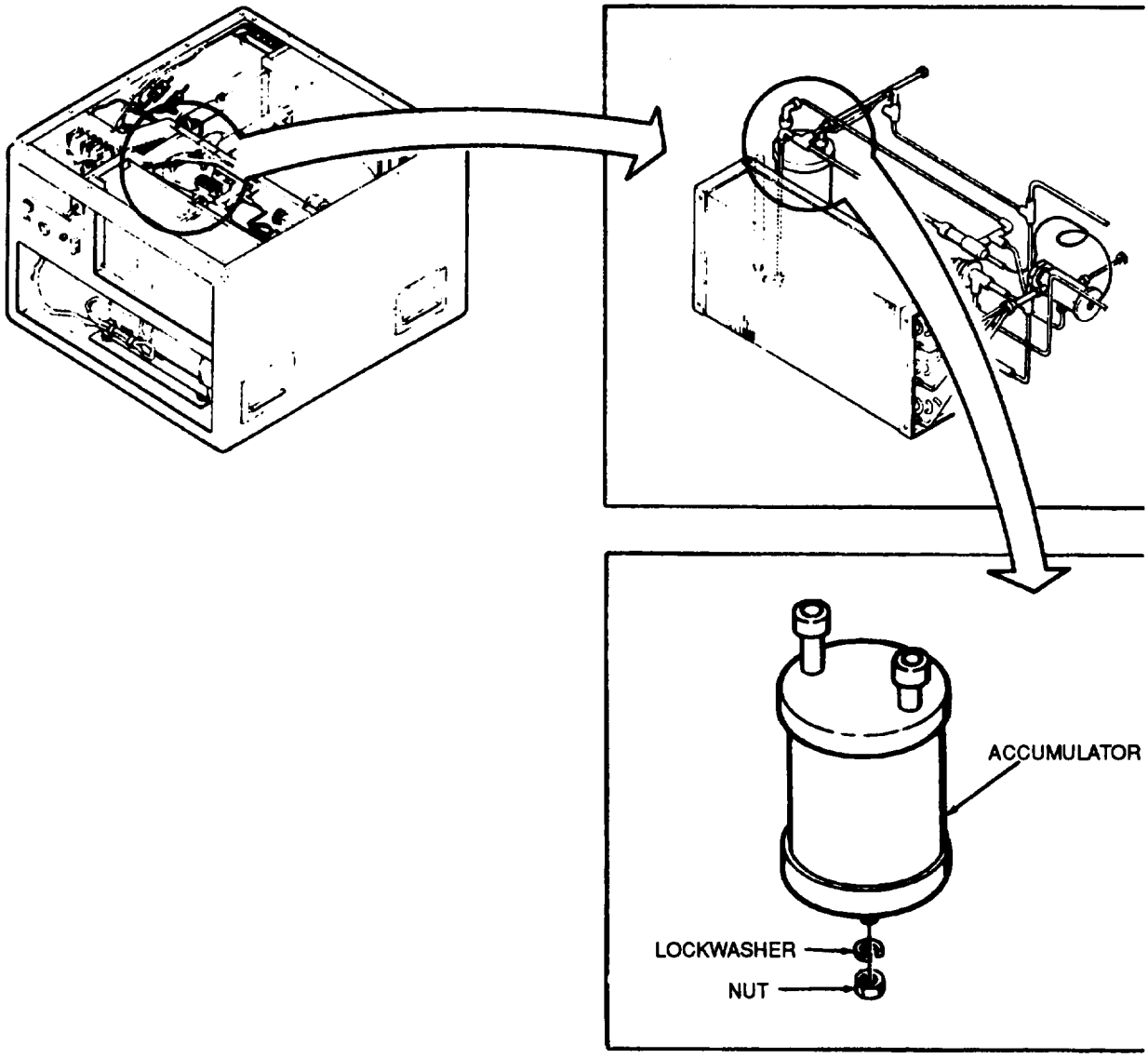


Figure 6-19. Accumulator

6.19 ACCUMULATOR. - Continued

Location/Item	Action	Remarks
Removal	a. Release entire refrigerant charge.	Paragraph 6.4
	b. Remove top covers.	
	c. Remove air inlet louver.	
	d. Remove nut and lockwasher from stud on bottom of accumulator.	
	e. Tag inlet and outlet piping. Disconnect piping.	
	f. Pull accumulator from frame.	
Installation	a. Install new drier/filter.	Paragraph 6.14
	b. Install accumulator with stud through hole in bottom of evaporator compartment.	
	c. Install lockwasher and nut.	
	d. Connect piping.	Paragraph 6.3
	CAUTION Inlet and outlet are imprinted with the words “Inlet,” “Outlet.” Inlet and outlet must be properly connected.	
	e. Install air inlet louver.	
	f. Nitrogen purge system.	Paragraph 6.5
	g. Leak test and evacuate.	Paragraphs 6.2 and 6.6
	h. Charge refrigerant system.	Paragraph 6.8
	i. Replace covers.	

6.20 CHARGING VALVES. This task covers removal and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Charging Manifold
Safety Glasses
Detergent Solution
cleaning cloths
Refrigerant R-22
Nitrogen (Cylinder)
Tools (paragraph 3.1)
Scale
Gloves

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

Location/Item	Action	Remarks
Removal	a. Release refrigerant charge.	Paragraph 6.4
	b. Remove top covers.	
	c. Remove loop clamps.	
	d. Remove valve from system.	
Installation	a. Install new valve.	
	b. Install loop clamps.	
	c. Leak test and evacuate.	Paragraphs 6.2 and 6.6
	d. Charge refrigerant system.	Paragraph 6.8
	e. Replace top covers.	

6.20 CHARGING VALVES.- Continued

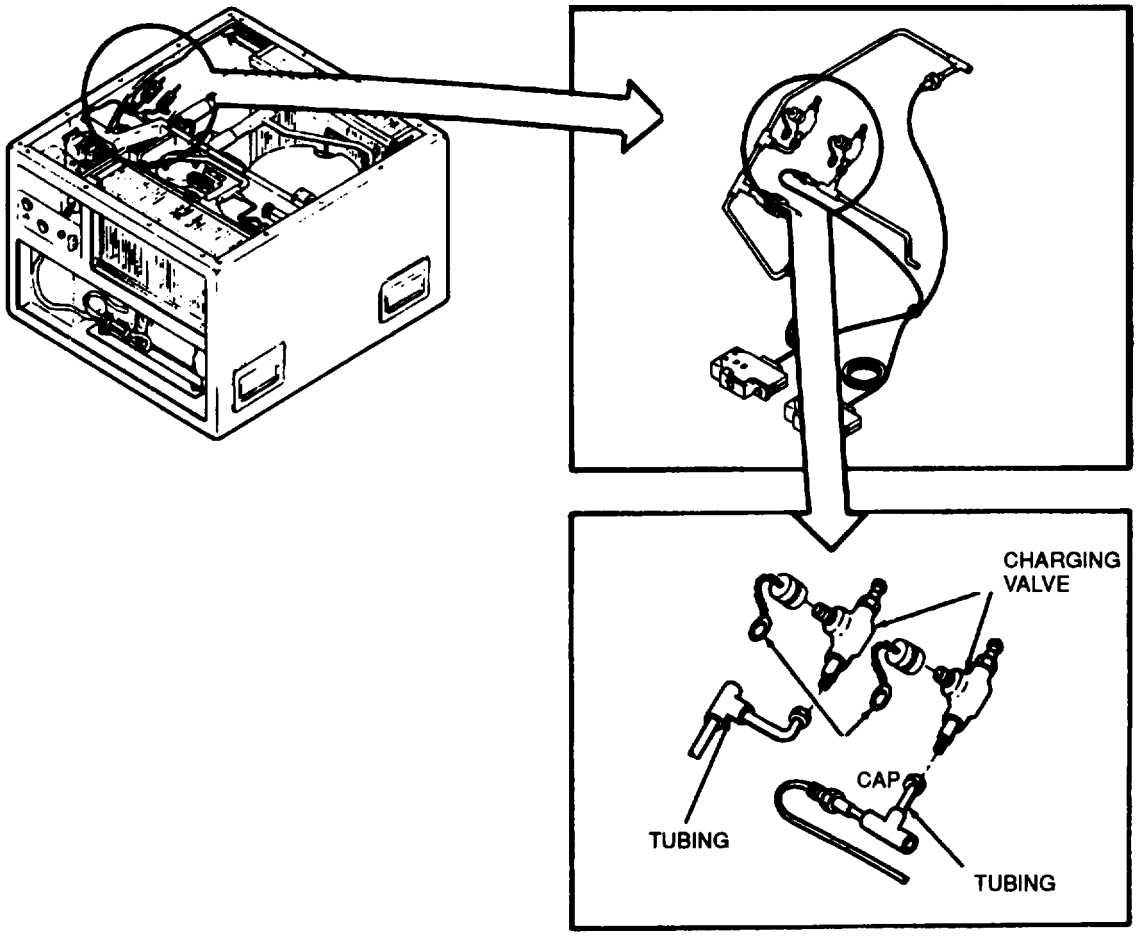


Figure 6-20. Charging Valve

6.21 PRESSURE RELIEF VALVE. This task covers removal and installation.

I INITIAL SETUP I

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Brazing Flux
Brazing Alloy
Charging Manifold
Safety Glasses
Brazing and Soldering Set
Solvent P-D-680
Detergent Solution
Cleaning Cloths
Refrigerant R-22
Nitrogen (Cylinder)
Tools (paragraph 3.1)
Abrasive Cloth
Scale
Gloves

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

Location/Item	Action	Remarks
Removal	a. Release refrigerant charge.	Paragraph 6.4
	b. Remove top covers.	
	c. Remove loop clamps.	
	d. Unthread valve from system.	Paragraph 6.3
Installation	a. Install new drier/filter.	Paragraph 6.14
	b. Thread valve into system.	Paragraph 6.3
	c. Install loop clamps.	

6.21 PRESSURE RELIEF VALVE. -Continued

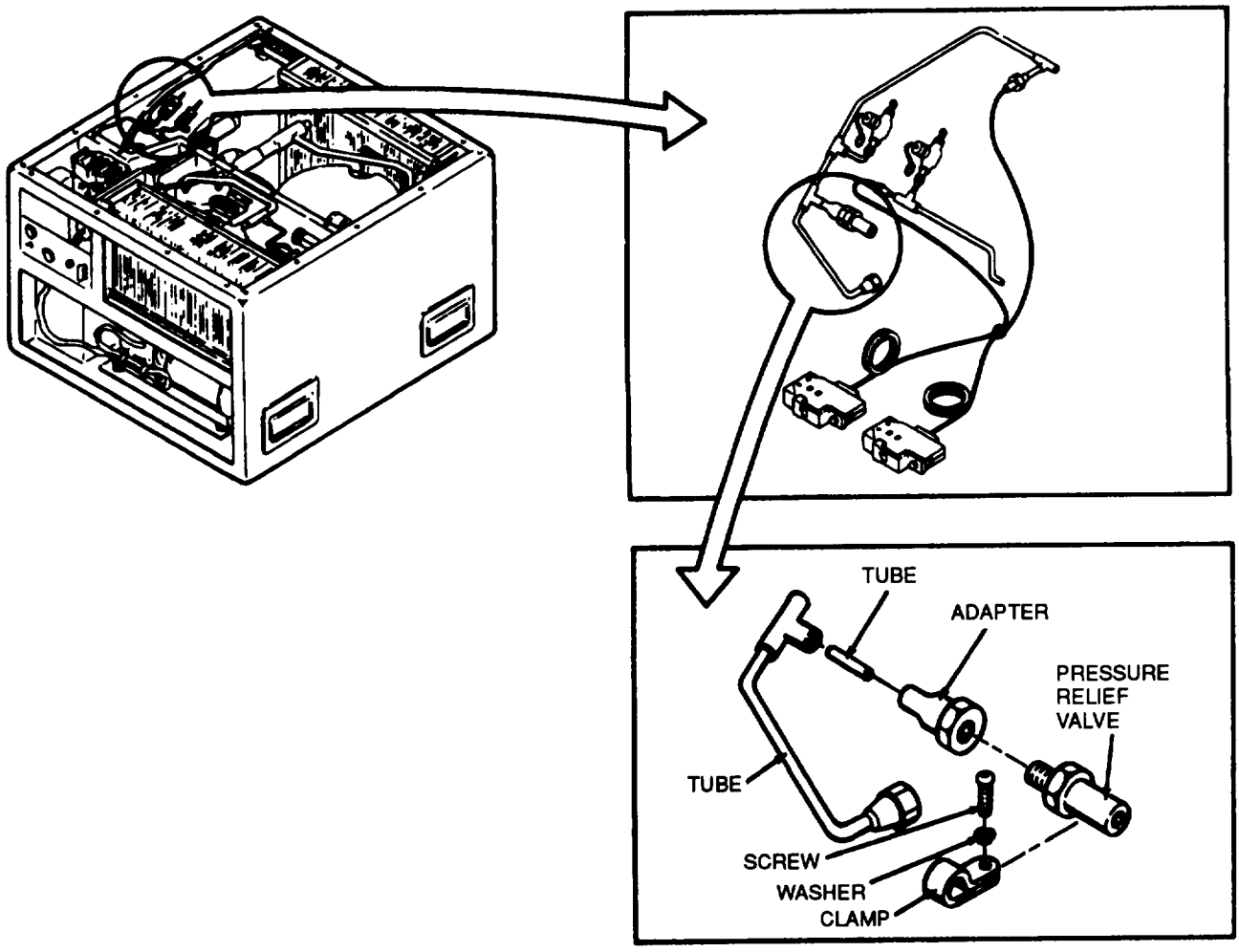


Figure 6-21. Pressure Valve

Location/Item	Action	Remarks
Installation - Continued	d. Nitrogen purge system.	Paragraph 6.5
	e. Leak test and evacuate.	Paragraphs 6.2 and 6.6
	f. Charge refrigerant system.	Paragraph 6.8
	g. Replace covers.	

6.22 ACTUATING CYLINDER. This task covers removal and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Charging Manifold
Safety Glasses
Solvent P-D-680
Detergent Solution
Cleaning Cloths
Refrigerant R-22
Nitrogen (Cylinder)
Tools (paragraph 3.1)
Abrasive Cloth
Scale
Gloves

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

6.22 ACTUATING CYLINDER .-Continued

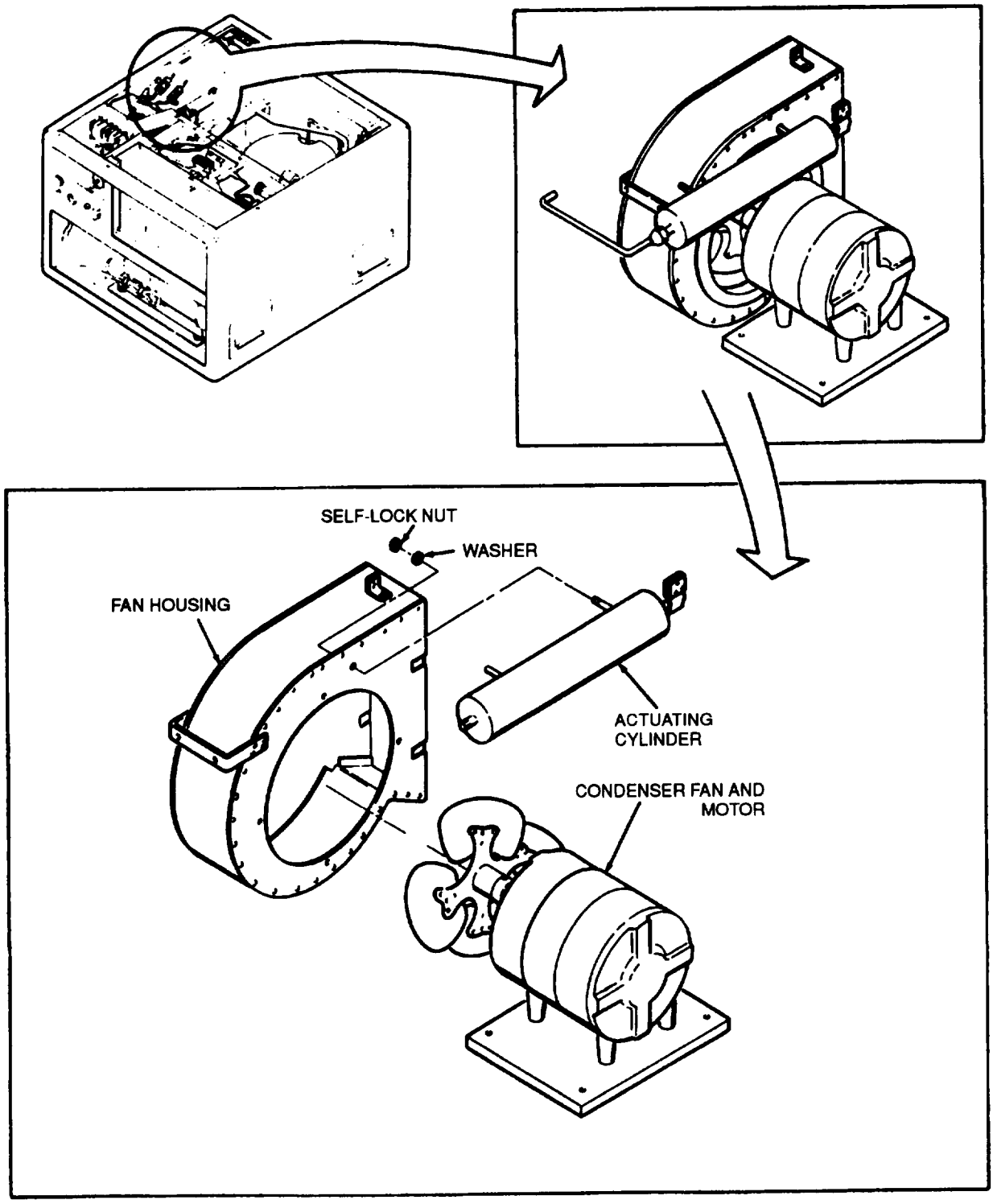


Figure 6-22. Actuating Cylinder

6.22 ACTUATING CYLINDER.- Continued

Locatin/Item	Action	Remarks
Removal	a Release entire refrigerant charge.	Paragraph 6.4
	b. Remove top cover.	
	c. Loosen post screw.	
	d. Loosen control wire.	
	e. Remove casing nuts at each end.	
	Remove push-pull control.	
	g. Disconnect elbow swivel nut from end of actuator cylinder.	
	h. Remove condenser guard.	
	Remove five screws and Iockwashers.	
	Remove louver assembly.	
	I. Remove two nuts and Iockwashers.	
Installation	a. Install actuating cylinder with studs through openings in fan housing.	
	b. Install Iockwashers and nuts on studs.	
	c. Connect elbow swivel nut.	
	d. Install condenser air discharge louver assembly.	
	B. Install five screws and Iockwashers and two screw base studs.	
	1. Install condenser guard.	
	g. Install push-pull control.	
	h. Place outer control casing nuts over wire.	
	i. Insert wire ends into openings in mechanical posts on louver lever and actuator cylinder.	
	j. Install control casing nuts on casing to hold casing in position.	
	k. Adjust control.	Paragraph 6.23
	NOTE Control and louver must be adjusted before system is charged with refrigerant.	

6.22 ACTUATING CYLINDER. - Continued

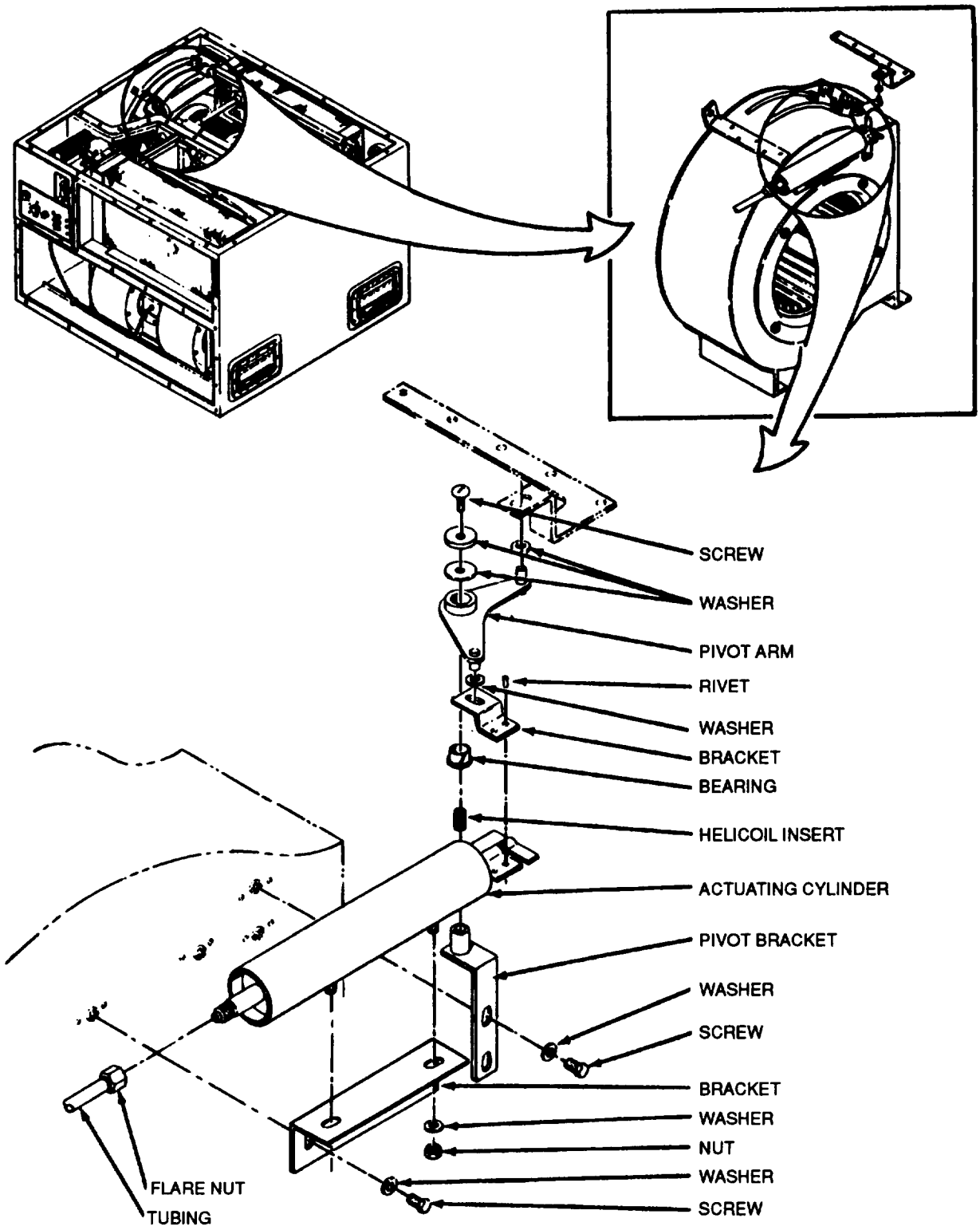


Figure 6-23. Actuating Cylinder - Model MHP-20-4-08

6.22 ACTUATING CYLINDER. - Contiued

Location/Item	Action	Remarks
Removal	a. Release entire refrigerant charge.	Paragraph 6.4
	b. Remove top cover.	
	c. Disconnect refrigeration tubing from actuating cylinder by loosening flare nut.	
	d. Loosen two bolts holding pivot bracket. Remove center screw, washers, pivot arm, and bearing insert from pivot bracket.	
	e. Remove two nuts, washers, and actuating cylinder from bracket. Inspect actuating cylinder and replace if damaged.	
Installation	a. Secure actuating cylinder to bracket with two nuts and washers.	
	b. Install bearing insert pivot arm, washers, and screw onto pivot bracket. Tighten two bolts holding pivot bracket.	
	c. Connect refrigeration tubing to actuating cylinder and tighten flare nut.	
	d. Replace dehydrator.	
	e. Install condenser guard.	

6.23 CONDENSER LOUVER ADJUSTMENT. This task covers replacement, cleaning and adjustment.

I INITIAL SETUP

Applicable Configumtions:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Detergent Solution
Cleaning Cloths
Tools (paragraph 3.1)

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

6.23 CONDENSOR LOUVER ADJUSTMENT - Continued

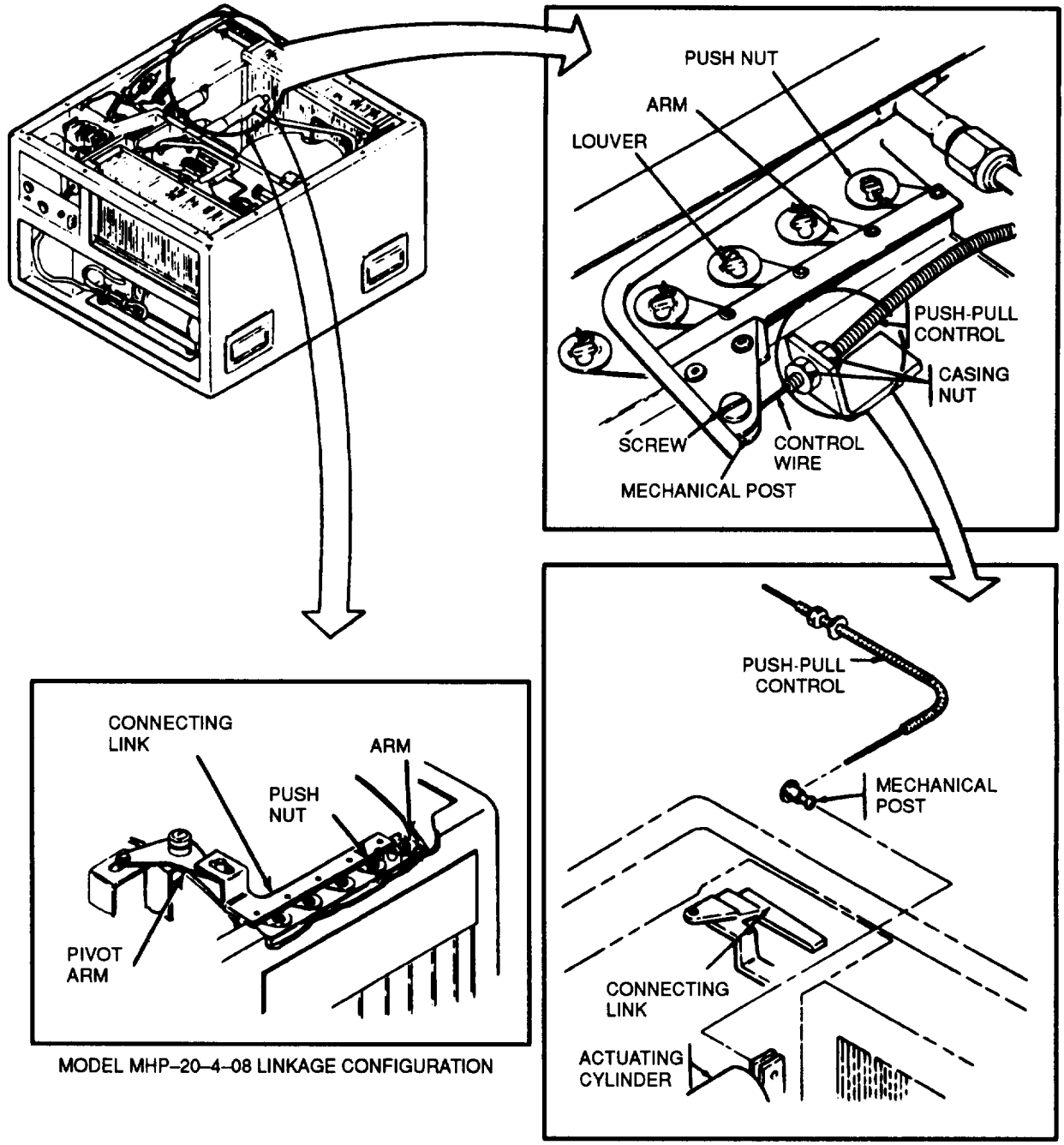


Figure 6-24. Adjusting Condenser Fan Louver

6.23 CONDENSOR LOUVER ADJUSTMENT.- Continued

Location/item	Action	Remarks
Adjustment (all models except MHP-20-4-08)	a. Before system is charged, adjust louver push-pull control. b. Close louver blades and tighten screw in mechanical post to lock wire on that end. c. Extend actuator rod until there is a 1/4-inch space between inner edge of mechanical post bracket and the face of the cylinder. d. Tighten the mechanical post screw. e. Nitrogen purge system. f. Leak test and evacuate. g. Charge refrigerant system. h. Replace covers.	Paragraphs 6.2 and 6.6
Louver MHP-20-4-08	None required.	
Louver Replacement	**NOTE** Individual louver blades are flexible enough for removal. a. Remove rear top cover. b. Remove “push-on” type nut from louver blade to be removed. c. Bend blade to remove ends from bearings. d. Remove blade. e. Bend new blade in same manner as removal. f. Install end bearings.	

6.23 CONDENSER LOUVER ADJUSTMENT. - Continued

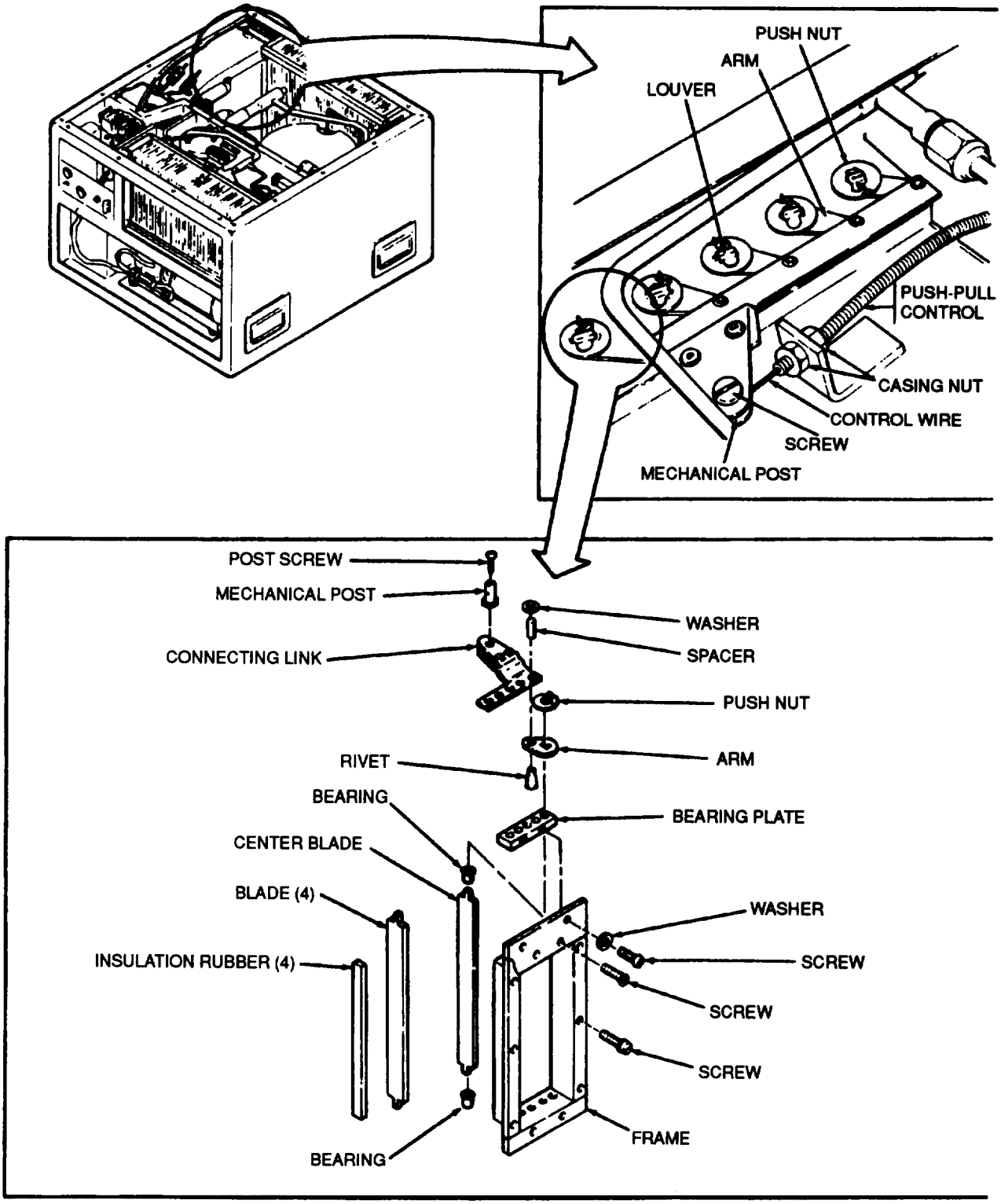
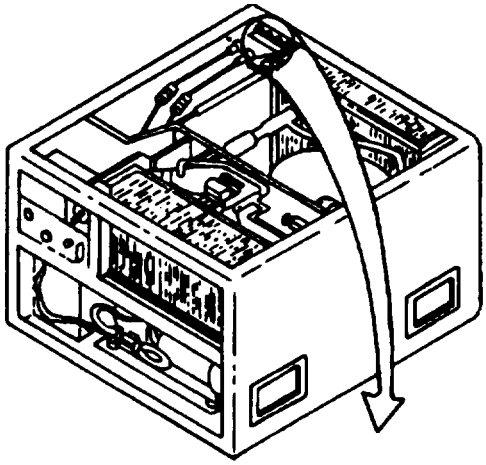


Figure 6-25. Removing Condenser Fan Louver

6.23 CONDENSER LOUVER ADJUSTMENT. - Continued



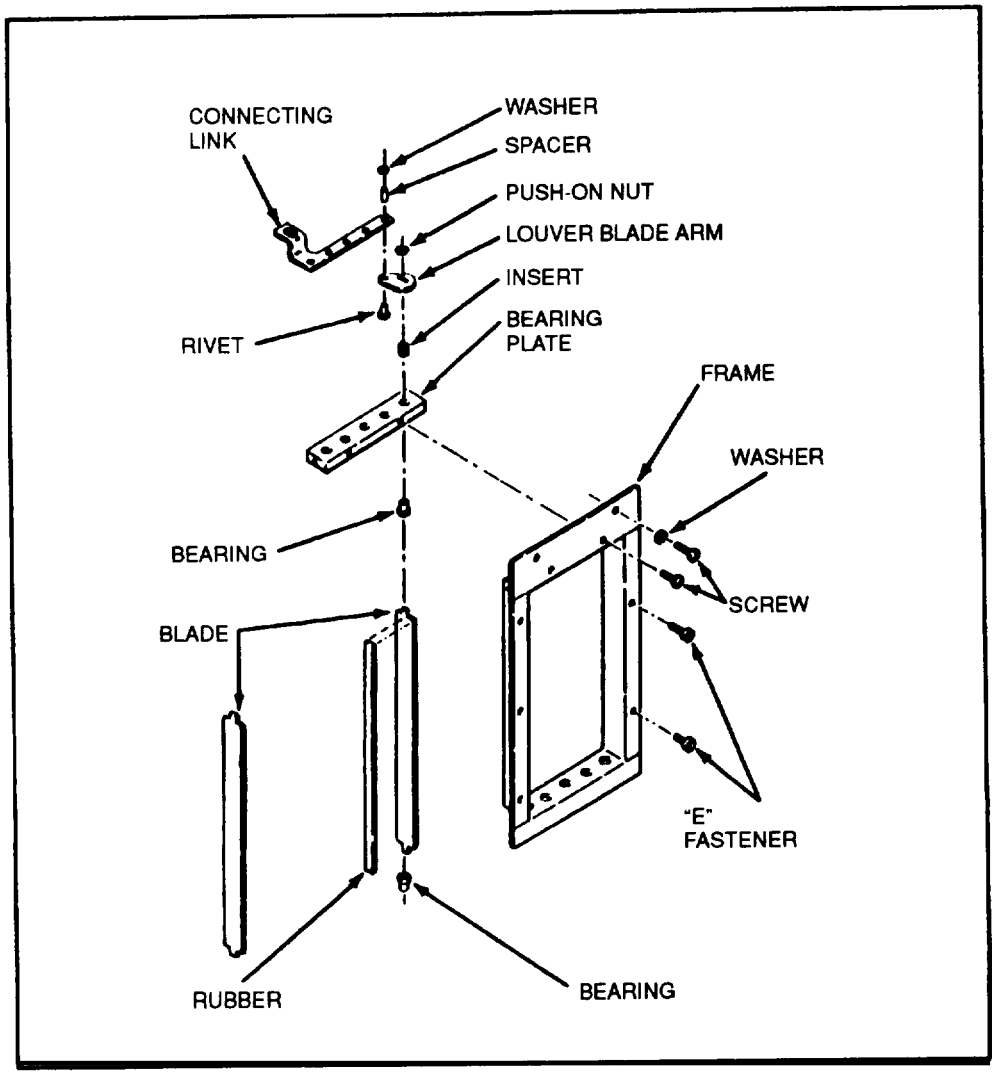


Figure 6-26. Removing Condenser Fan Louver - Model MHP-20-4-08

6.23 CONDENDER LOUVER ADJUSTMENT. - Continued

Location/Item	Action	Remarks
Louver Replacement Continued	g. Install “push-on” nut.	
Cleaning	a. Use a clean dry cloth. b. Use detergent solution.	
Adjustment (all models except MHP-20-4-08)	a. Turn off air conditioner and wait 4 hours or until air conditioner is uniformly at ambient temperature or head pressure is below 150 psig (10.516 kg/cm^2). b. Remove rear top cover. c. Loosen mechanical post screw. d. Close condenser louvers. e. Pull wire tight and tighten mechanical post screw. f. Louvers must be tightly closed when air conditioner is off and head pressure is below 150 psig (10.516 kg/cm^2).	
Model MHP-20-4-08	None required.	

6.24 CONDENSOR FAN AND MOTOR. This task covers removal, cleaning and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Safety Glasses
Solvent P-D-680
Detergent Solution
Cleaning Cloths
Tools (paragraph 3.1)
Gloves

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

Location/Item	Action	Remarks
Removal		**WARNING** High voltage can kill.
	a. Remove power from air conditioner.	
	b. Disconnect motor electrical connector.	Paragraph 6.4
	c. Remove four screws and bell inlet on MHP-20-4-08 model.	

6.24 CONDENSER FAN AND MOTOR. - Continued

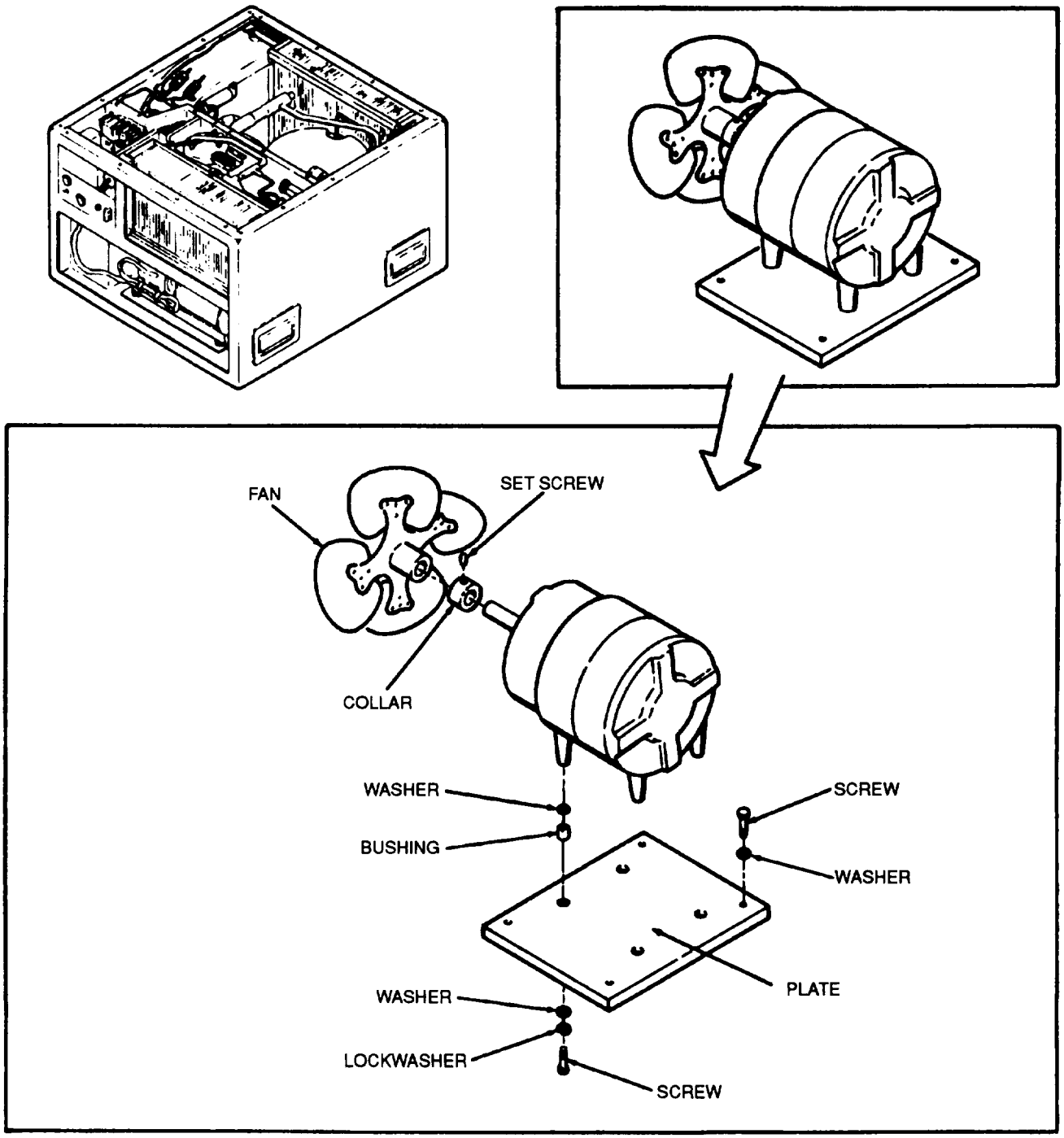
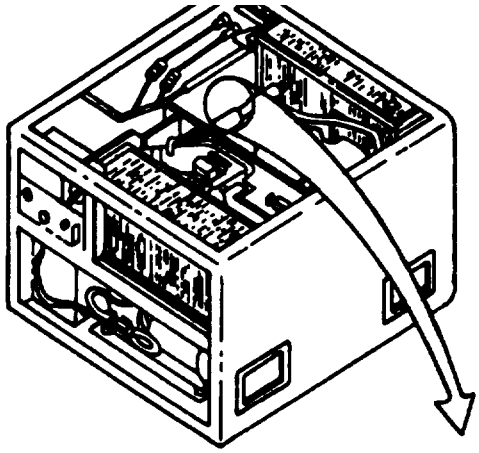


Figure 6-27. Condenser Fan and Motor

6.24 CONDENSER FAN AND MOTOR. - Continued



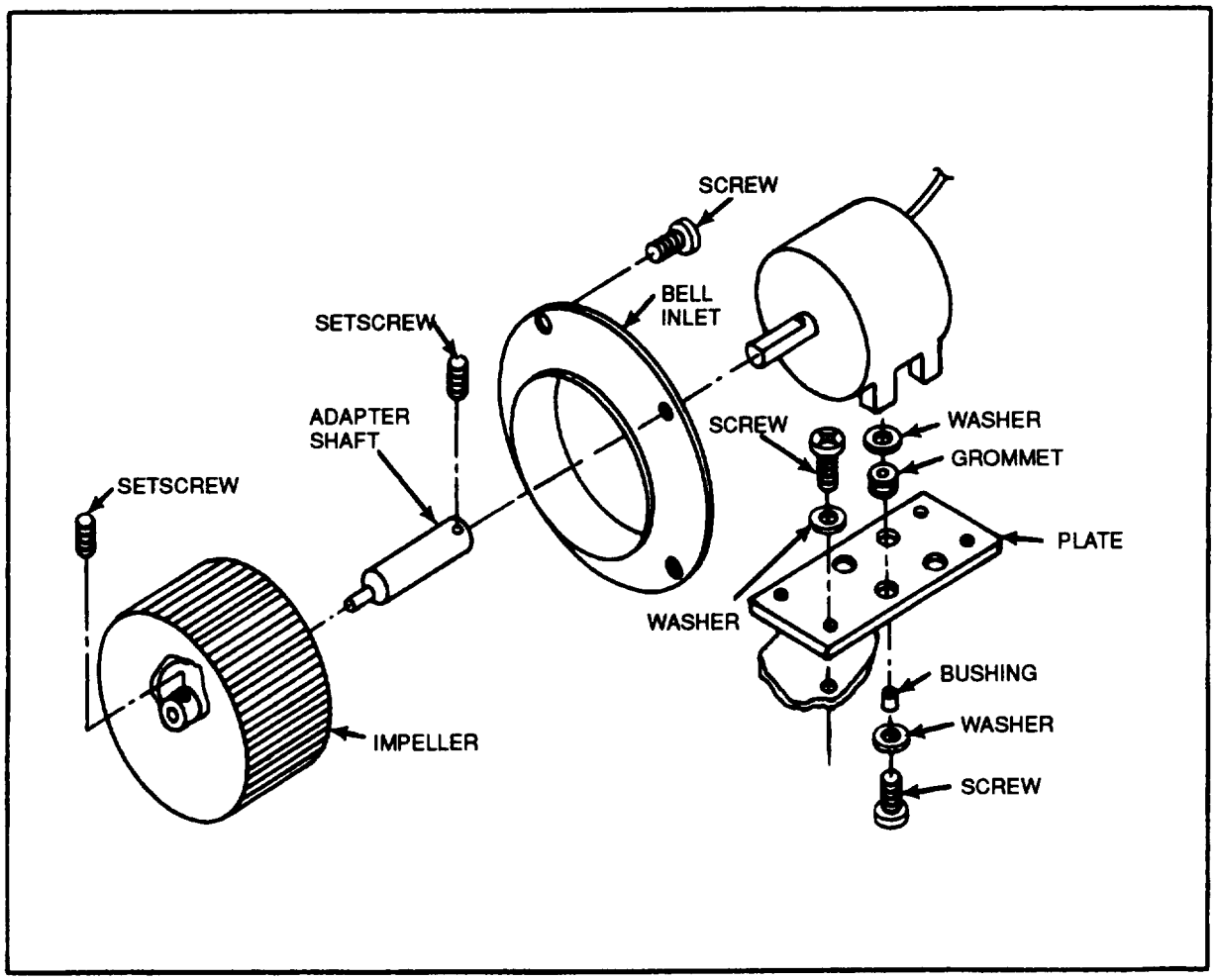


Figure 6-28. Condenser Fan and Motor - Model MHP-20-4-08

6.24 CONDENSER FAN AND MOTOR. - Continued

Location/Item	Action	Remarks
Removal Continued	**CAUTION** Do not hammer fan on or off motor shaft; motor bearings would be damaged. Dress out roughness with a fine file, stone, or abrasive cloth. Apply a coating of light machine oil to ease assembly. **NOTE** If fan only is to be replaced, it is not necessary to remove motor. d. Loosen setscrew in fan (impeller) hub. e. Pull fan (impeller) from motor shaft or adapter. Loosen setscrew. g. Pull collar or adapter from motor shaft. h. Remove four screws and washers which secure motor and fan assembly to the frame. Remove four screws, flat washers, bushings, and grommets. Lift motor from plate. k. See paragraphs 6.29 and 6.30 for motor repair.	
Installation	**CAUTION** Do not hammer fan on or off motor shaft; motor bearings would be damaged. Dress out roughness with a fine file, stone, or abrasive cloth. Apply a coating of light machine oil to ease assembly. a. Slide collar or adapter onto motor shaft. b. Tighten setscrew in collar or adapter. **NOTE** It maybe necessary to trial fit motor mount bushings so fan will be centered in fan inlet.	

6.24 CONDENSER FAN AND MOTOR. - Continued

Location/Item	Action	Remarks
Installation Continued	c. Secure motor and fan to plate using four screws, washers, bushings and grommets. d. Place motor and plate in the air conditioner frame. e. Slide bell inlet over motor shaft (MHP-20-4-08). f. Slide shaft adapter or collar onto motor shaft. g. Secure with setscrew. h. Press fan onto motor shaft and secure with set-screw. i. Mount bell inlet to scroll using four screws. j. If necessary, lift fan and motor out and change size of motor mount bushings. k. Secure motor and plate to frame using four screws and washers. 1. Connect motor electrical connector. m. Replace top cover.	

6.25 HIGH AND LOW PRESSURE SWITCHES. This task covers removal and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Charging Manifold
Safety Glasses
Cleaning Cloths
Refrigerant R-22
Nitrogen (Cylinder)
Tools (paragraph 3.1)
Scale
Gloves

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

6.25 HIGH AND LOW PRESSURE SWITCHES. - Continued

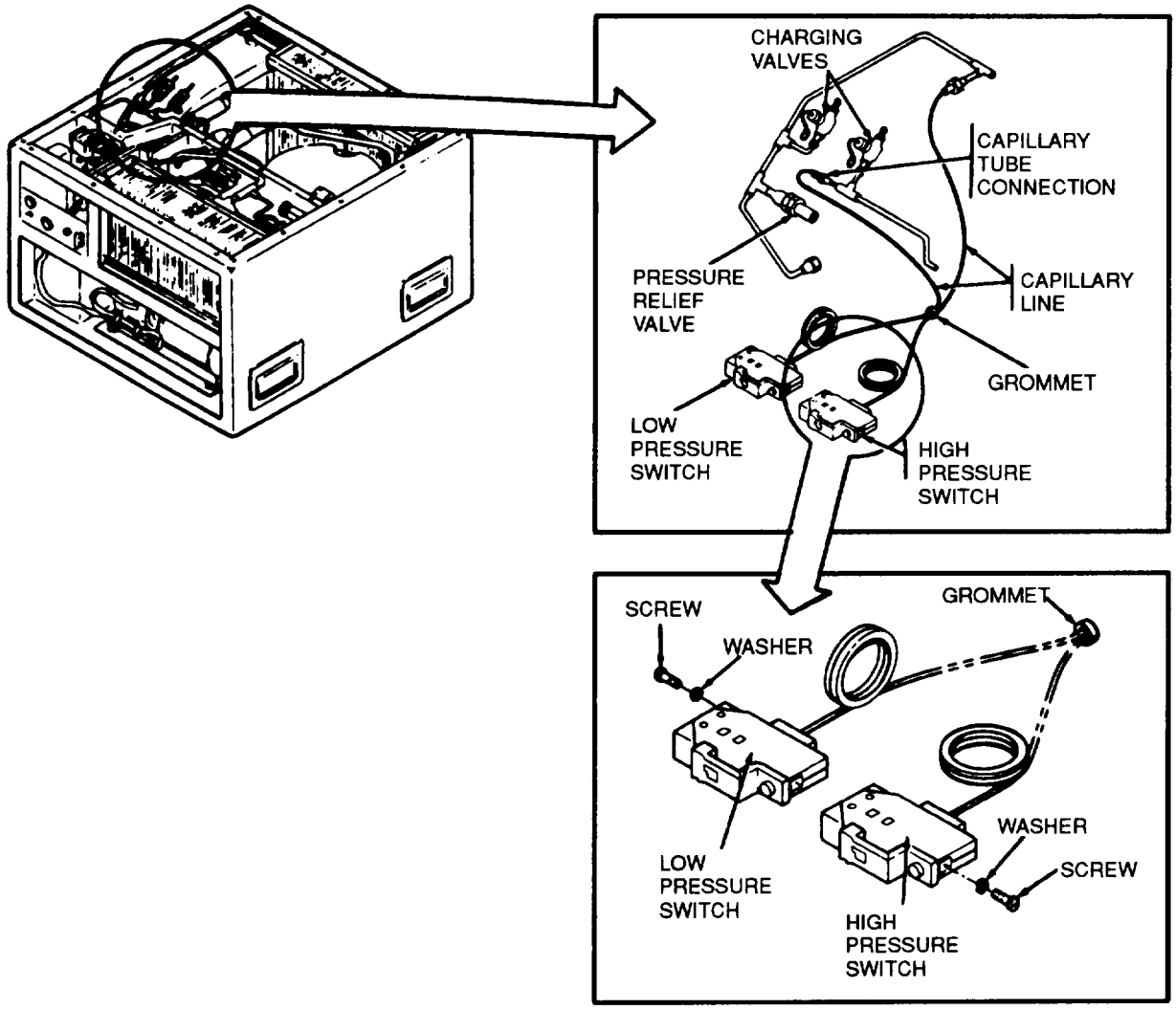


Figure 6-29. High and Low Pressure Switch

Location/Item	Action	Remarks
Removal		**WARNING**
	a. Disconnect electrical power to air conditioner.	High voltage can kill.
	b. Discharge refrigerant.	Paragraph 6.4

6.25 HIGH AND LOW PRESSURE SWITCHES. - Continued

Location/Item	Action	Remarks
Removal Continued	c. Pull junction box out of frame.	
	d. Remove two mounting screws and lockwashers.	
	e. Disconnect capillary tube connection.	
	f. Tag and disconnect electric wires from switch.	
	g. Pull capillary tube through grommet.	
	h. Pull switch from air conditioner.	
Installation	a. Insert capillary tube through grommet.	
	b. Connect capillary tube to fitting.	
	c. Install switches.	
	d. Secure with two screws and washers.	
	e. Connect electric wires.	
	f. Replace drier/filter.	Paragraph 6.15
	g. Nitrogen purge system.	Paragraph 6.5
	h. Leak test and evacuate.	Paragraphs 6.2 and 6.6
	i. Charge system with liquid refrigerant.	Paragraph 6.8
	j. Replace control panel.	
	k. Replace covers.	
	l. Connect electric power.	
	m. Test air conditioner.	

6.26 QUENCH VALVE. This task covers remval and installation.

INITIAL SETUP]

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Brazing FIux
Brazing Alloy
Charging Manifold
Safety Glasses
Brazing and Soldering Set
Solvent P-D-680
Detergent Solution
Cleaning Cloths
Refrigerant R-22
Nitrogen (Cylinder)
Tools (paragraph 3.1)
Abrasive Cloth, Scale
Gloves
Thermal Mastic (97403) 13216E6210

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

Location/Item	Action	Remarks
	NOTE The quench thermal expansion valve is hermetically sealed and cannot be repaired.	
Removal	a. Discharge the refrigerant system.	Paragraph 6.4
	b. Remove housing rear top cover.	
	c. Remove mastic in bulb well, remove bulb from well.	
	d. Remove two screws, spacers, self-locking nuts, and valve mounting brackets.	

6.26 QUENCH VALVE. - Continued

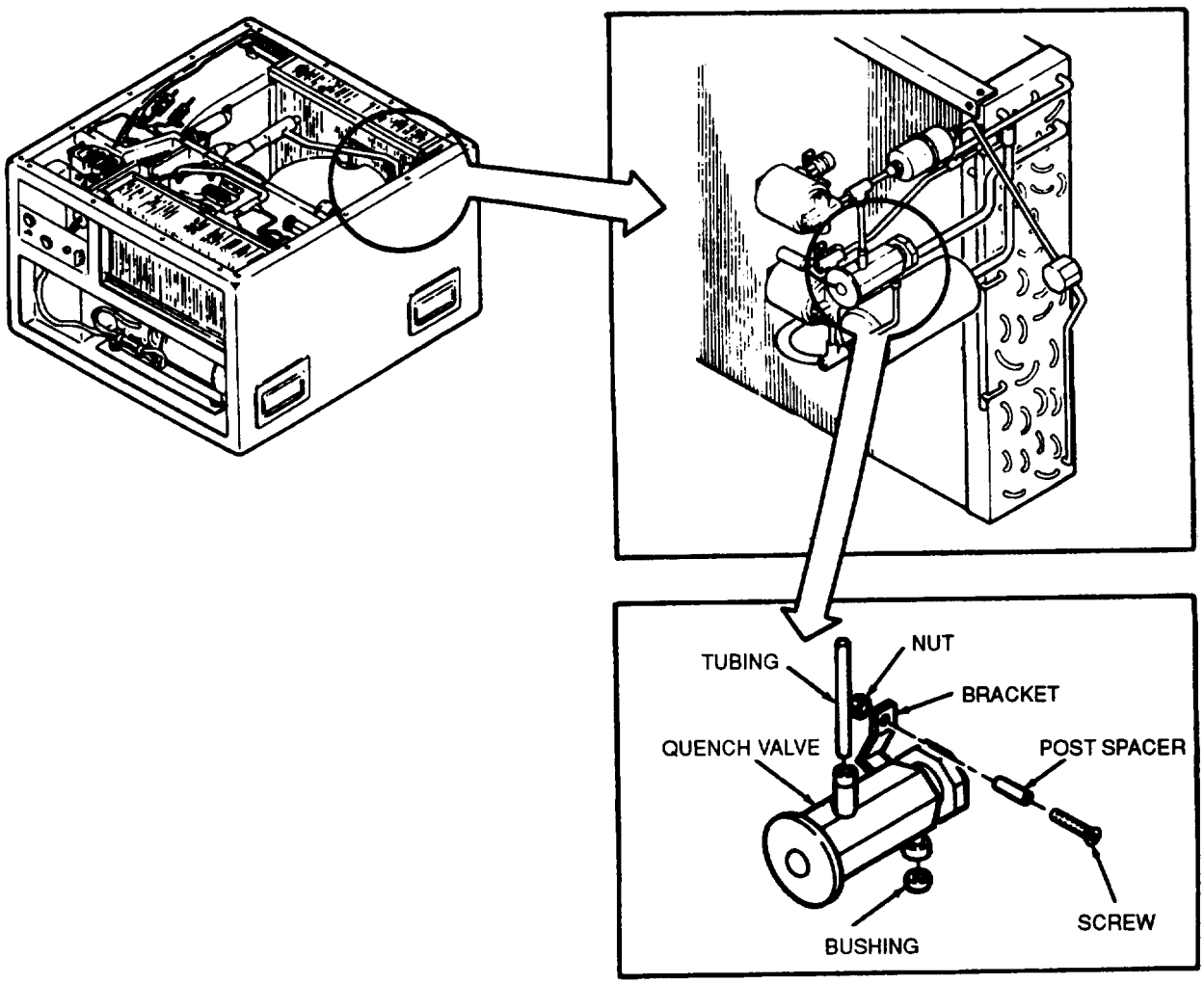


Figure 6-30. Quench Valve

Location/Item	Action	Remarks
Removal Continued	**NOTE** Wrap valve with wet cloth to prevent overheating valve during soldering. e. Unsolder tube at tee connection to pressure regulator. f. Unsolder tube at drier/filter tee.	

6.26 QUECH VALVE. - Continued

Location/Item	Action	Remarks
Installation	a. Solder valve to tubing.	Paragraph 6.3
	b. Install mounting bracket, two screws, spacers and self-locking nuts.	
	c. Insert approximately one ounce of thermal mastic in bulb well.	
	d. Insert sensing bulb of expansion valve.	
	e. Move bulb back and forth to distribute mastic.	
	f. Set bulb approximately 1 inch beyond open end.	
	g. Install new drier/filter.	Paragraph 6.15
	h. Nitrogen purge system.	Paragraph 6.5
	i. Leak test and evacuate.	Paragraphs 6.2 and 6.6
	j. Charge system with liquid refrigerant.	Paragraph 6.8
	k. Replace covers.	

6.27 PRESSURE REGULATORS. This task covers removal and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Brazing Flux
Brazing Alloy
Charging Manifold
Safety Glasses
Brazing and Soldering Set
Solvent P-D-680
Detergent Solution
Cleaning Cloths
Refrigerant R-22
Nitrogen (Cylinder)
Tools (paragraph 3.1)
Abrasive Cloth
Scale
Gloves

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

6.27 PRESSURE REGULATORS. - Continued

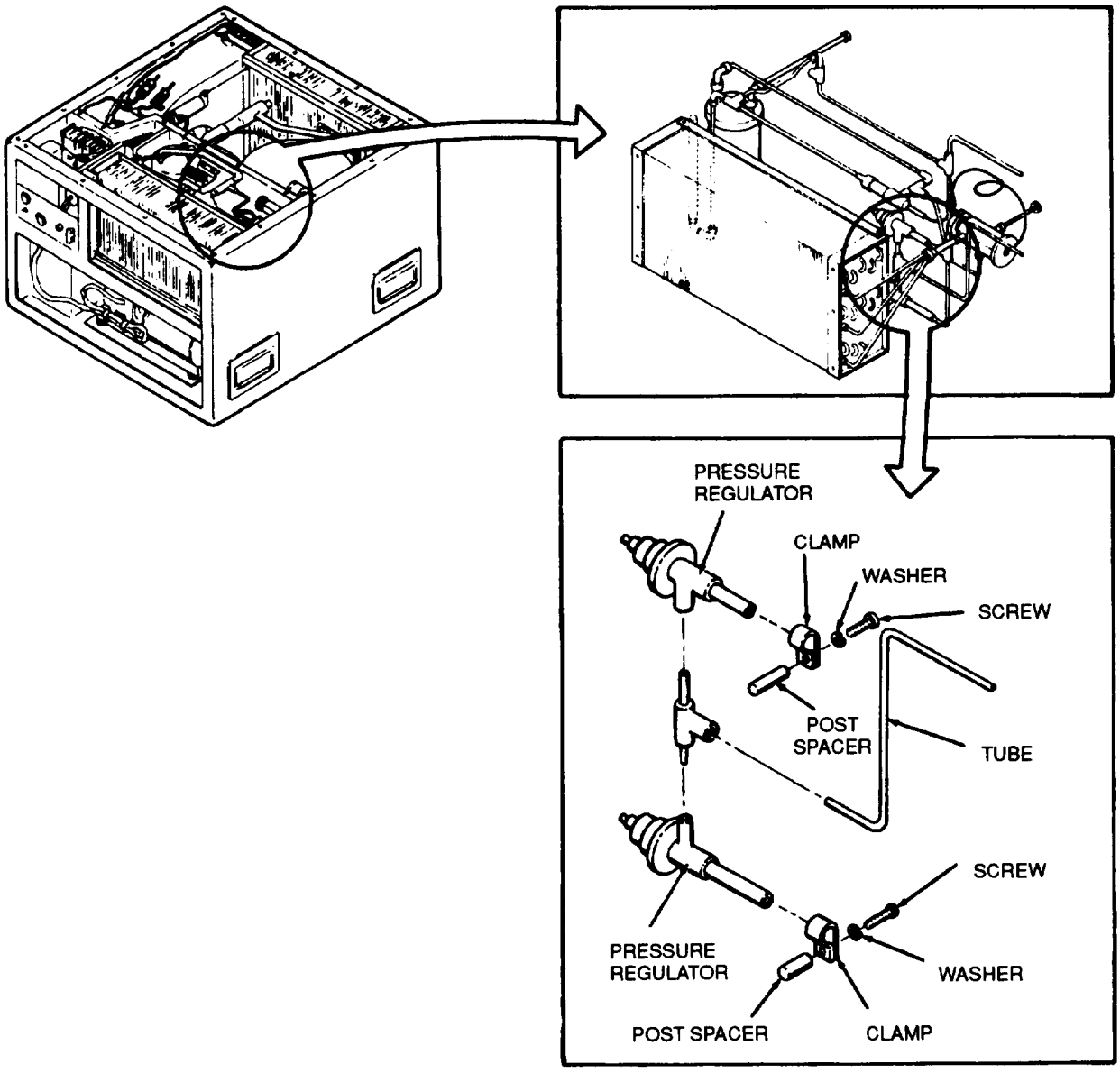


Figure 6-31. Pressure Regulator

6.27 PRESSURE REGULATORS. - Continued

Location/Item	Action	Remarks
Removal	a. Release refrigerant charge.	Paragraph 6.4
	b. Remove top covers.	
	c. Remove screws, lockwashers, loop clamps, and spacers.	
	d. Unsolder pressure regulator from tubing.	Paragraph 6.3
Installation	a. Install new drie/filter.	
	NOTE Pressure regulator is factory set and is not field adjustable.	
	b. Wrap pressure regulator with wet cloth to prevent overheating regulator during soldering.	
	c. Solder pressure regulator to tubing.	
	d. Install spacer, loop clamp, screw, and lockwasher.	
	e. Nitrogen purge system.	Paragraph 6.5
	f. Leak test and evacuate.	Paragraphs 6.2 and 6.6
	g. Charge system with liquid refrigerant.	
	h. Replace covers.	

6.28 EVAPORATOR BLOWER AND MOTOR. This task covers removal and installation.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Safety Glasses
Detergent Solution
Cleaning Cloths
Tools (paragraph 3.1)
Gloves

Equipment Descriptions:
Power OFF; installed or removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

Location/Item	Action	Remarks
Removal of Assembly		**WARNING** High voltage can kill.
	a. Disconnect electric power to air conditioner.	
	b. Remove air inlet louver and air filter.	Paragraph 5.20
	c. Disconnect condensate drain tubing.	Paragraph 5.24
	d. Remove three brackets (15 and 28) above fan to make it easier to remove fan and motor.	
	e. Remove nuts (14) and screws (26).	
	f. Remove temperature sensing bulb.	Paragraph 5.12
	9. Remove four screws and lockwashers which secure fan and motor base to mounts.	

6.28 EVAPORATOR BLOWER AND MOTOR. -Continued

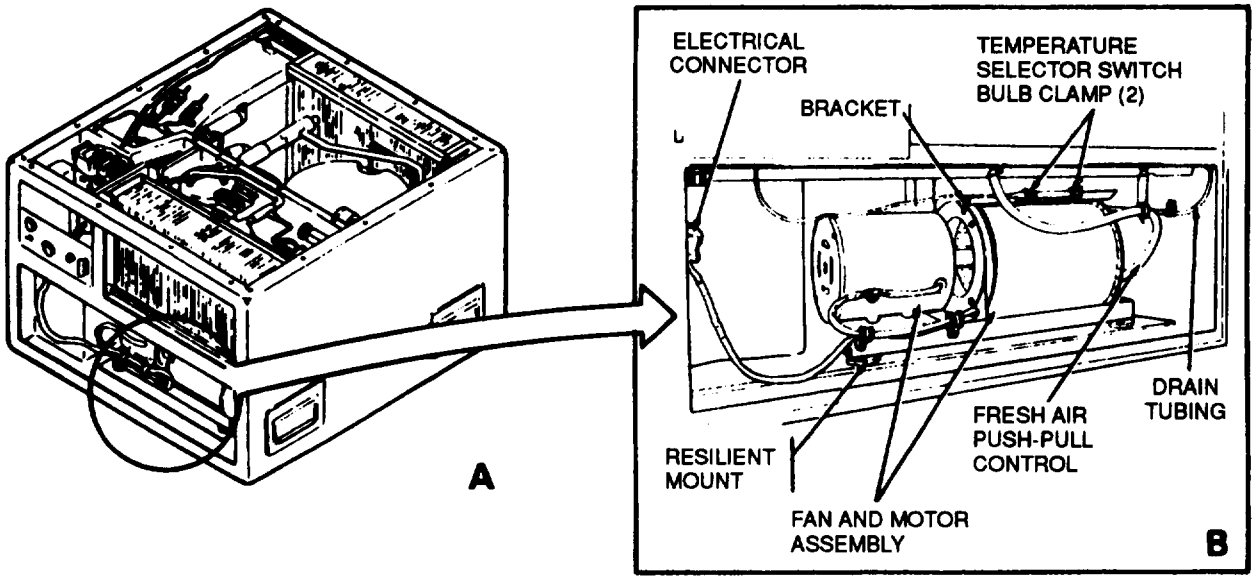


Figure 6-32. Evaporator Blower and Motor (Sheet 1 of 3)

Location/Item	Action	Remarks
Removal of Fan	a. Remove fan strap.	
	b. Remove motor and fan from base.	
	c. Remove flange from housing.	
	d. Remove the two fan inlets.	
	e. Separate the motor and fan impeller from the housing.	
	f. Loosen setscrew that holds shaft extension to motor shaft.	
	9. Note position of arrow on impeller.	Needed for assembly.
	h. Pull shaft extension and impeller off motor shaft.	

6.28 EVAPORATOR BLOWER AND MOTOR. .-Continued

Item No.	Nomenclature	Item No.	Nomenclature	Item No.	Nomenclature
1.	Screw	16.	Screw	31.	Fan inlet
2.	Lockwasher	17.	Lockwasher	32.	Impeller
3.	Clamp	18.	Screw	33.	Screw
4.	Screw	19.	Resilient mount	34.	Nut
5.	Lockwasher	20.	Resilient mount	35.	Flange
6.	Bracket assembly	21.	Fan assembly	36.	Nut
7.	Bracket	22.	Screw	37.	Washer
8.	Foam	23.	Washer	38.	Inlet
9.	Screw	24.	Spacer	39.	Screw
10.	Screw	25.	Strap	40.	Nut
11.	Lockwasher	26.	Screw	41.	Flange
12.	Bracket assembly	27.	Washer	42.	Housing
13.	Foam	28.	Strap	43.	Set screw
14.	Nut	29.	Nut	44.	Shaft
15.	Bracket	30.	Washer	45.	Base

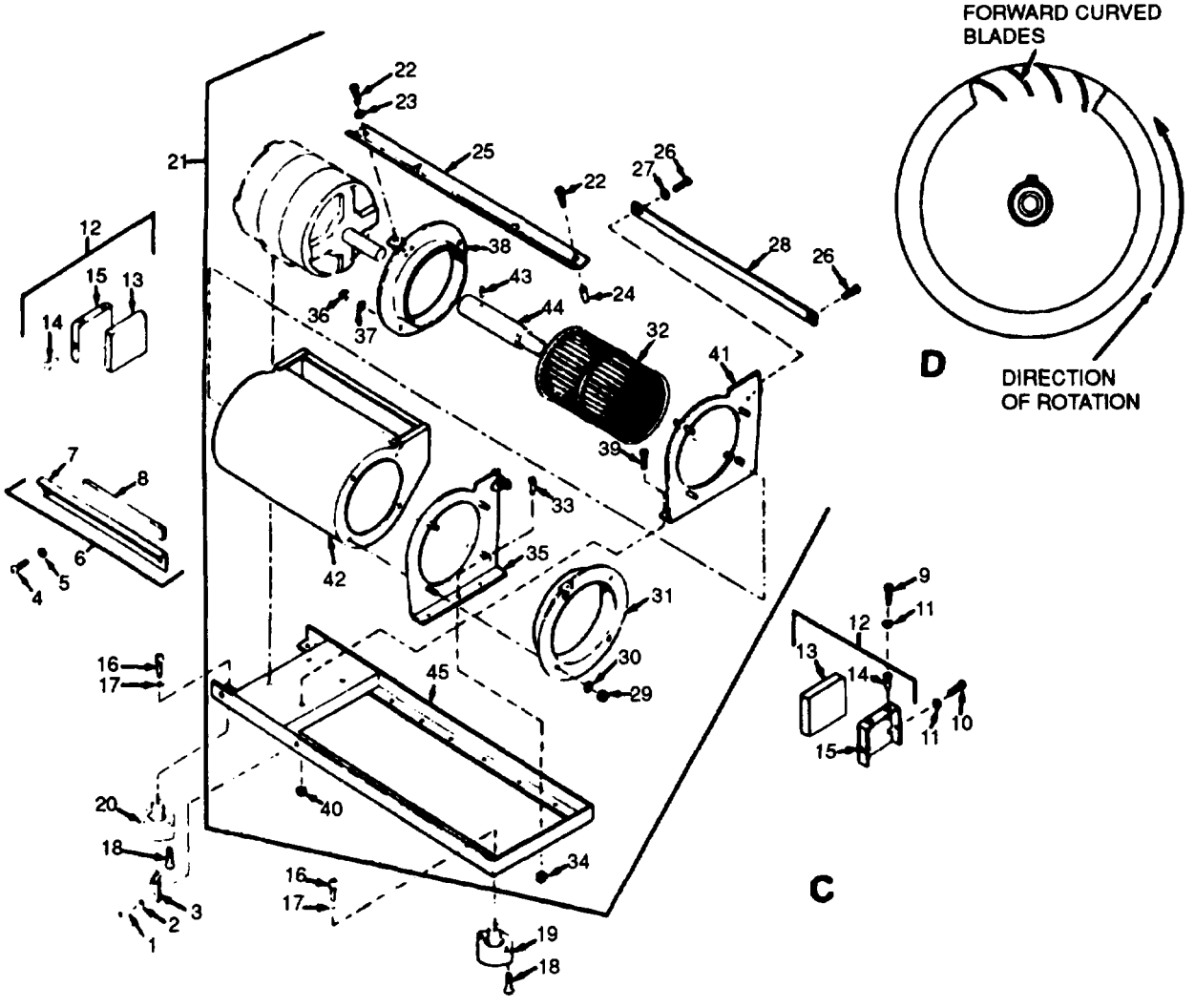


Figure 6-32. Evaporator Blower and Motor (Sheet 2 of 3)

6.28 EVAPORATOR BLOWER AND MOTOR. .-Continued

Location/Item	Action	Remarks
Removal of Motor	Removal of motor is same as removal of fan.	
Motor Repair	See paragraph 6.29.	
Installation	a. Place impeller on shaft extension.	
	b. Tighten setscrew to secure.	
	c. Place fan inlet onto face of motor.	
	d. With arrow on impeller in same direction as motor rotation arrow, place shaft extension on motor shaft.	
	e. Place fan inlet and flange in position against blower housing.	
	f. Secure inlet and flange to housing.	
	g. Slide housing over impeller.	
	h. Secure fan inlet to housing.	
	i. Secure fan strap to two fan inlets.	
	j. Secure four mounts to base.	
	k. Secure motor and housing to base.	
	l. Secure assembly into air conditioner.	
	m. Install three brackets.	
	n. Install condensate drain.	Paragraph 5.24
	o. Connect motor power connector.	
	p. Install temperature sensing bulb.	Paragraph 5.12
	q. Clean air filter.	Paragraph 5.20
	r. Install air filter and louver.	Paragraph 5.20
	s. Connect power supply.	

6.28 EVAPORATOR BLOWER AND MOTOR. .-Continued

Item No.	Nomenclature	Item No,	Nomenclature	Item No.	Nomenclature	Item No.	Nomenclature
1.	Screw	8.	Bar	15.	Bushing	22.	Screw
2.	Block	9.	Screw	16.	Pad	23.	Impeller
3.	Housing	10.	Support	17.	Housing	24.	Setscrew
4.	Impeller	11.	Screw	18.	Screw	25.	Setscrew
5.	Washer	12.	Screw	19.	Housing	26.	Screw
6.	Screw	13.	Washer	20.	Screw	27.	Housing
7.	Inlet	14.	Grommet	21.	Washer		

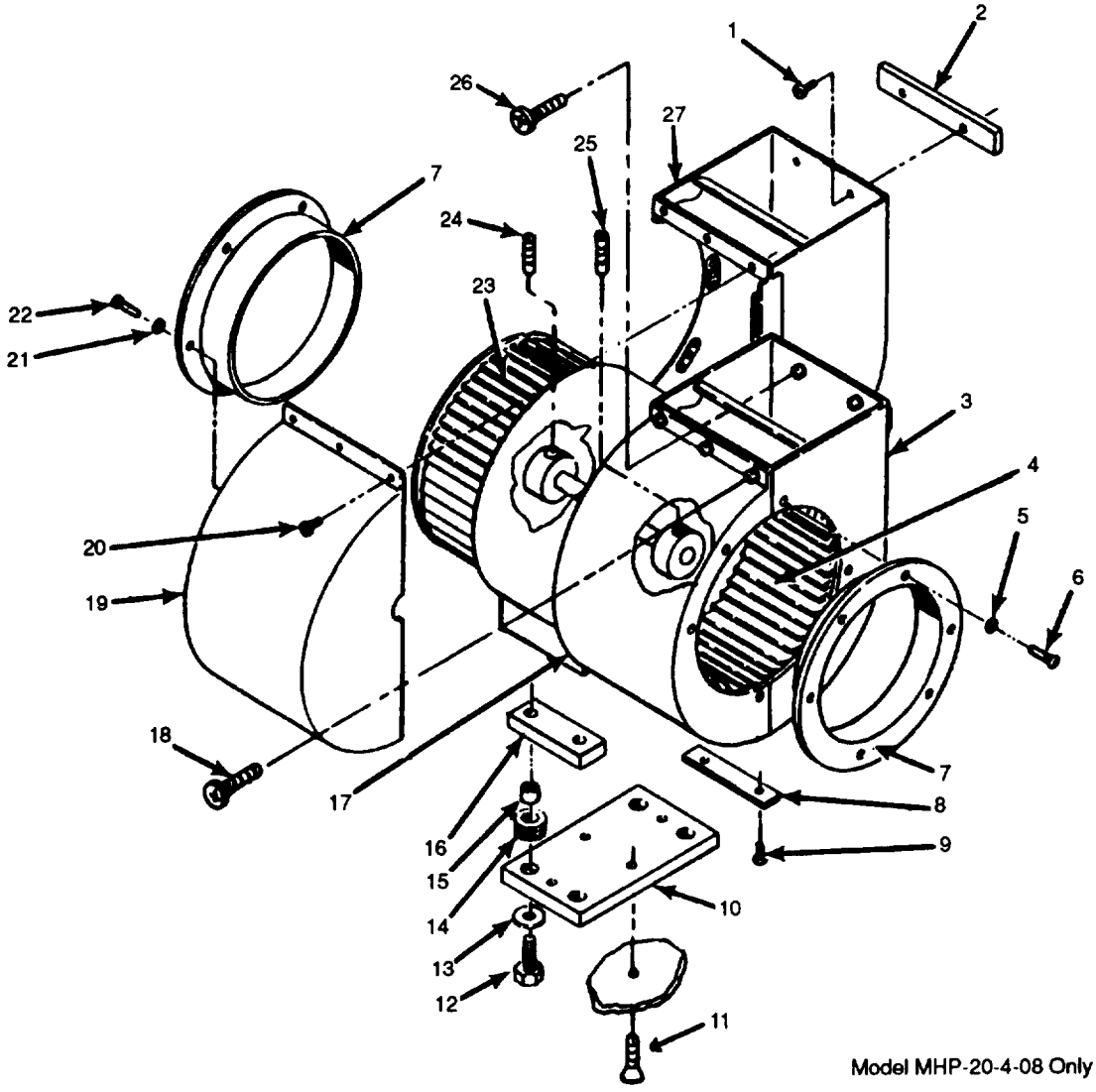


Figure 6-32. Evaporator Blower and Motor (Sheet 3 of 3)

6.28 EVAPORATOR BLOWER AND MOTOR. .-Continued

Location/Item	Action	Remarks
Removal of Housings (Model MHP-20-4-08 only)	a. Disconnect electric power to air conditioner.	**WARNING** High voltage can kill.
	b. Remove air inlet louver and air filter.	Paragraph 5.20
	c. Disconnect condensate drain tubing.	Paragraph 5.24
	d. Remove six screws and washers securing inlet to housing.	
	e. Remove three screws securing front of housing to rear.	
	f. Remove two screws securing housing rear to wall and remove block.	
	g. Remove two screws securing housing rear to floor and remove bar.	
	h. Repeat process for remaining fan housing.	
Removal of Impellers	a. Loosen setscrew inside impeller hub and remove impeller.	
	b. Repeat process for remaining impeller.	
Removal of Motor	a. Remove four flat-head screws securing motor and base assembly to unit floor.	
	b. Remove four bolts, washers, bushings, and grommets securing motor and pad to support.	
	c. See paragraph 6.30 for motor repair.	
Installation	a. Secure motor to support with four bolts, washers, bushings, and grommets, and two pads.	
	b. Mount support on unit floor and secure with four flat-head screws.	
	c. Mount impellers and secure setscrews.	
	d. Attach two rear blower housing halves to unit floor and wall, each with two fillers and four screws.	
	e. Attach front halves of blower housing and secure each with three screws.	
	f. Attach inlets and secure each with six screws and washers.	

6.29 MOTOR. This task covers disassembly, cleaning, inspection and assembly.

INITIAL SETUP

Applicable Configurations:
All except Model MHP-20-4-08

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Safety Glasses
Solvent P-D-680
Detergent Solution
Cleaning Cloths
Tools (paragraph 3.1)
Abrasive Cloth
Gloves

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

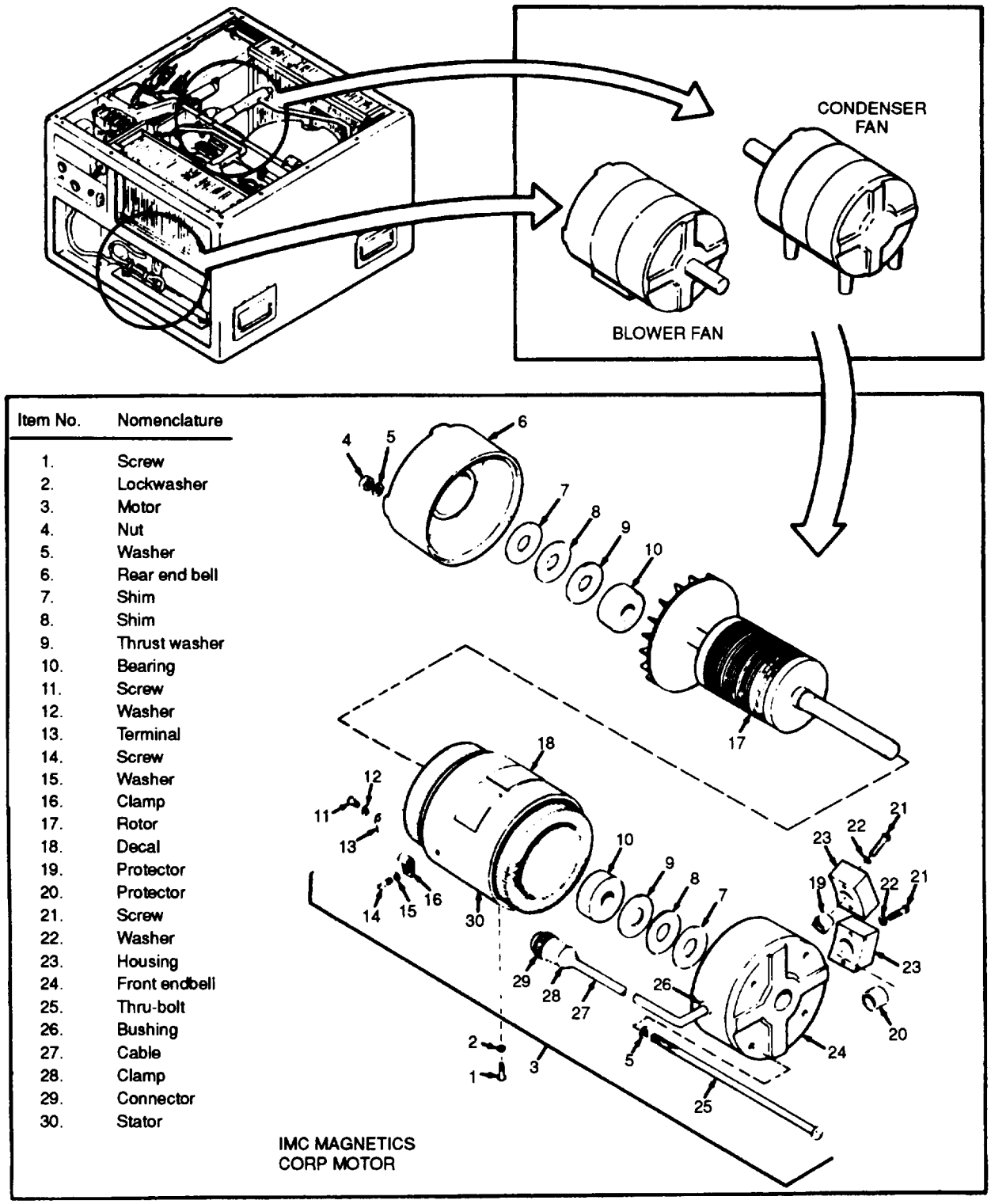
Personnel Required:
Direct Support

Location/Item	Action	Remarks
	NOTE Motors manufactured by IMC Magnetics Corp. do not come apart the same way as those manufactured by Welco Industries, Inc. See motor name plate to determine who made the motor. IMC MOTOR	
Disassembly	a. Remove four hex nuts, four through bolts, and eight flat washers. b. Remove rear end bell. c. Pull out rotor. d. Remove shims, bearing spacers and bearings. e. Remove screw, washer, and loop clamp. f. Remove screw, washer, and ground terminal.	

6.29 MOTOR. -Continued

Location/Item	Action	Remarks
Disassembly -Continued	g. Tag and disconnect leads and remove cable and strain relief bushing.	
	h. For single-phase motors, remove front end bell from stator.	
	i For three-phase motors, remove thermal protector housings, thermal protectors and attaching hardware.	
	j. Remove front end bell from stator.	
	WELCO MOTOR	
Disassembly	a. Remove four screws from both end brackets (covers).	
	b. Remove both end brackets (covers).	
	c. Remove load spring, washers, and bearings.	
	d. Remove rotor with shaft.	
	e. Remove eight screws and pull protector covers from motor frame to gain access to high and low speed overload protectors.	
Cleaning	a. Clean metal parts with cleaning solvent (Federal Specification P-D-680).	
	b. Wipe off electrical pans with a clean cloth.	
Inspection	a. Inspect wiring for damaged insulation and broken wiring.	
	b. Repair damaged insulation or replace defective wiring.	
	c. Inspect connector for damage.	
	d. Replace damaged connector.	
	e. Inspect bearing for wear, galling or flat spots.	
	f. Replace defective bearings.	
	g. Inspect shaft for gouges or worn bearing surface.	
	h. If defective, replace motor.	
	i. Inspect stator for damaged, broken or shorted wiring.	

6.29 MOTOR. -Continued



Item No.	Nomenclature
1.	Screw
2.	Lockwasher
3.	Motor
4.	Nut
5.	Washer
6.	Rear end bell
7.	Shim
8.	Shim
9.	Thrust washer
10.	Bearing
11.	Screw
12.	Washer
13.	Terminal
14.	Screw
15.	Washer
16.	Clamp
17.	Rotor
18.	Decal
19.	Protector
20.	Protector
21.	Screw
22.	Washer
23.	Housing
24.	Front endbell
25.	Thru-bolt
26.	Bushing
27.	Cable
28.	Clamp
29.	Connector
30.	Stator

Figure 6-33. IMC Motor

6.29 MOTOR. -continued

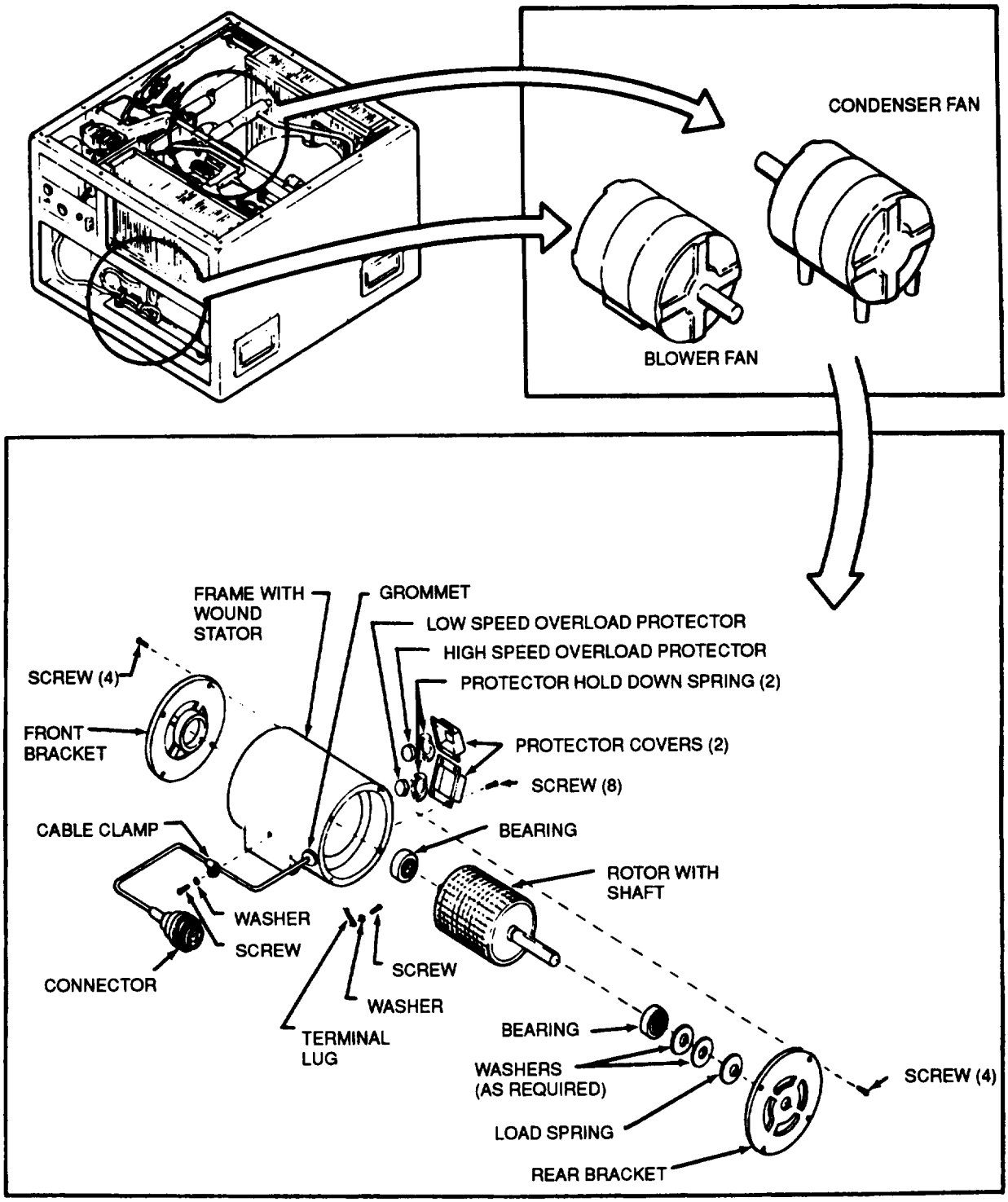


Figure 6-34. Welco Motor

6.29 MOTOR. -Continued

Location/Item	Action	Remarks
	IMC MOTOR	
Assembly	a. For three-phase motors, install thermal protectors and housings in front end bell.	
	b. Install connector and cable.	
	c. Install cable and strain relief bushing in end bell.	
	d. Partially install end bell on stator.	
	e. Connect terminal with screw and washer.	
	f. Make electrical connections.	
	g. Install shims, bearing spacers, bearings and rotor.	
	h. Install rear end bell.	
	i. Place a flat washer on each through bolt.	
	j. Install through bolts in motor.	
	k. Secure each with a nut and washer.	
	l. Install loop clamp on cable.	
	m. Secure clamp to stator frame with screw and washer.	
	WELCO MOTOR	
Assembly	a. Secure the high and low speed overload protectors with protector covers and eight screws.	
	b. Coat the shaft surfaces of the rotor and load springs with oil (MIL-L-2104, Grade 20).	
	c. Slide both bearings on shaft ends.	
	d. Slide load springs and washers on the long shaft end.	
	e. Slip rotor with shaft into frame with stator.	

6.29 MOTOR -Continued

Location/Item	Action	Remarks
Assembly Continued	f. Place end brackets on shafts and aline mounting holes. g. Tighten screws in end brackets evenly while checking rotor for freedom of rotation. There should be no drag. **NOTE** For further information on electric motor repair, refer to FM 20-31 (Electric Motor and Generator Repair).	

6.30 MOTOR. This task covers disassembly, cleaning, inspection and assembly.

INITIAL SETUP

Applicable Configurations:
Model MHP-20-4-08

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Safety Glasses
Solvent P-D-680
Detergent Solution
Cleaning cloths
Tools (paragraph 3.1)
Abrasive Cloth
Gloves

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

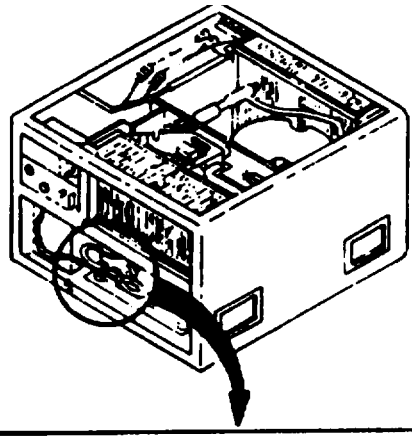
Personnel Required:
Direct Support

Location/Item	Action	Remarks
	EVAPORATOR MOTOR	
Disassembly	a. Remove four screws from both end brackets (rovers).	
	b. Remove both end brackets (covers).	
	c. Remove four screws securing bearing retainer.	
	d. Remove bearing retainer.	
	e. Remove load spring, washers, and bearings.	
	f. Remove rotor with shaft.	
	g. Tag and disconnect leads and remove cable.	
	CONDENSER MOTOR	
Disassembly	a. Remove four screws from both end brackets (covers).	
	b. Remove both end brackets (covers).	
	c. Remove bad spring, washers, and bearings.	

6.30 MOTOR. -Continued

Location/Item	Action	Remarks
Disassembly -Continued	d. Remove rotor with shaft.	
	e. Remove screw and ground terminal.	
	f. Tag and disconnect leads and remove cable.	
Cleaning	a. Clean metal parts with cleaning solvent (Federal Specification P-D-680).	
	b. Wipe off electrical parts with a clean cloth.	
Inspection	a. Inspect wiring for damaged insulation and broken wiring.	
	b. Repair damaged insulation or replace defective wiring.	
	c. Inspect connector for damage.	
	d. Replace damaged connector.	
	e. Inspect bearing for wear, galling or flat spots.	
	f. Replace defective bearings.	
	g Inspect shaft for gouges or worn bearing surface.	
	h. If defective, replace motor.	
	i. Inspect stator for damaged, broken or shorted wiring.	
	EVAPORATOR MOTOR	
Assembly	a. Coat the shaft surfaces of the rotor and load springs with oil (MIL-L-2104, Grade 20).	
	b. Slide bearing into recess on inside of rear bracket and secure with bearing retainer and four screws.	
	c. Slide bearing, load spring, and washers on the front end of shaft.	
	d. Slip rotor with shaft into frame with stator.	
	e. Place end brackets on shafts and aline mounting holes.	
	Tighten screws in end brackets evenly while checking rotor for freedom of rotation. There should be no drag.	

6.30 MOTOR. - Continued



Item No.	Nomenclature
1.	Motor
2.	Screw
3.	Rear bracket
4.	Screw
5.	Bearing retainer
6.	Bearing
7.	Front bracket
8.	Washer
9.	Load spring
10.	Rotor
11.	Cap
12.	Connector
13.	Sleeve
14.	Tape
15.	Grommet
16.	Screw
17.	Terminal
18.	Screw
19.	Nameplate
20.	Plate
21.	Arrow
22.	Stator

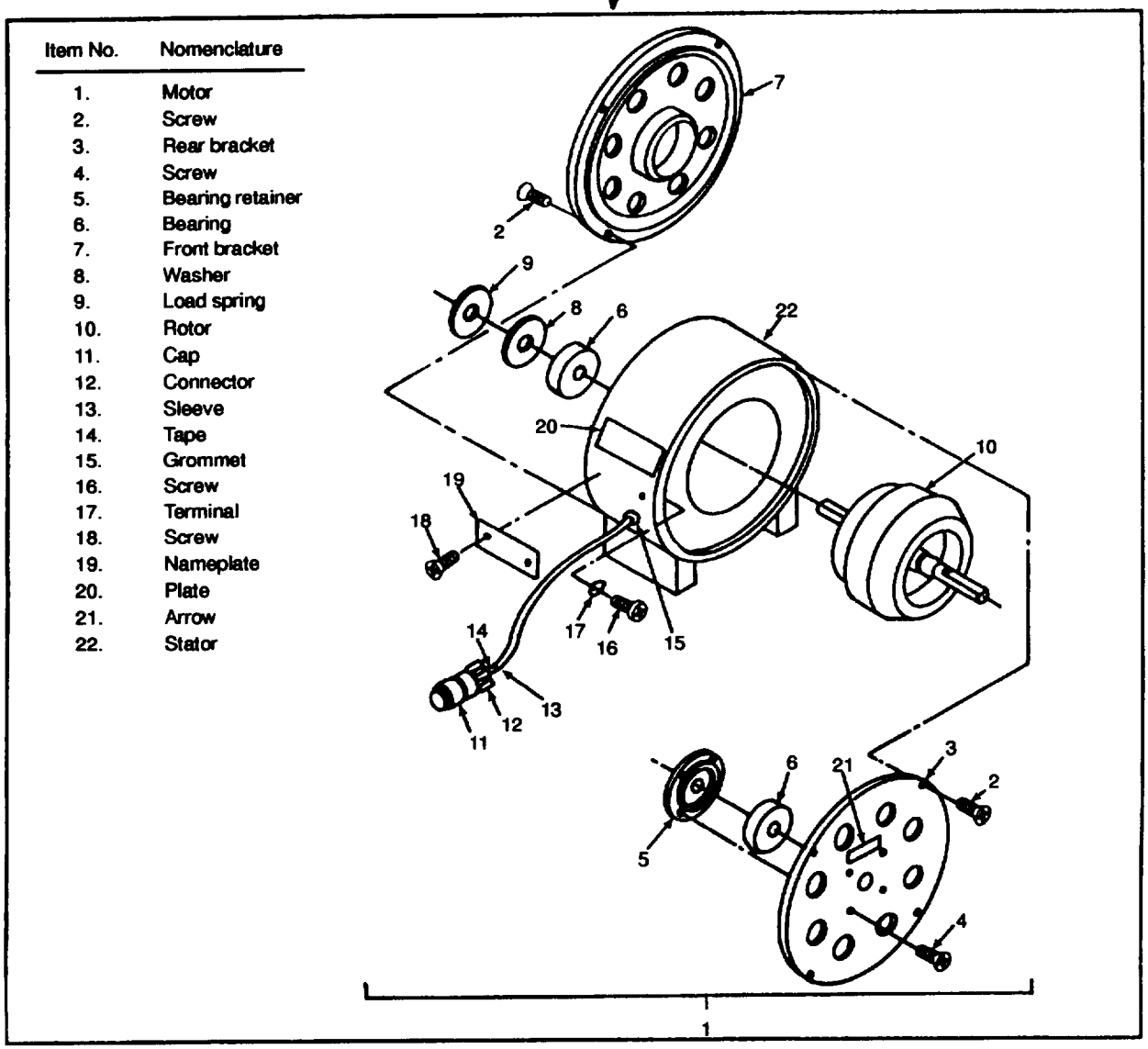
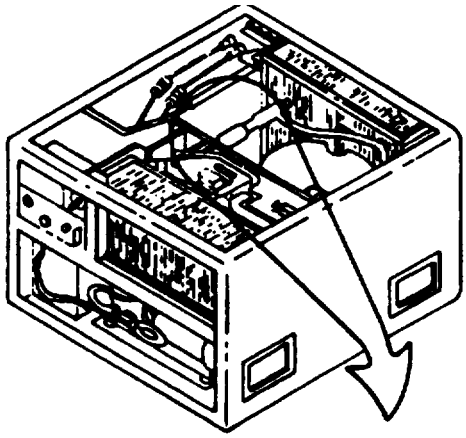


Figure 6-35. Welco Evaporator Motor - Model MHP-20-4-08

6.30 MOTOR. -Continued



Item No.	Nomenclature
1.	Motor
2.	Screw
3.	Rear bracket
4.	Screw
5.	Front bracket
6.	Load spring
7.	Washer
8.	Bearing
9.	Rotor
10.	Connector
11.	Sleeve
12.	Screw
13.	Terminal
14.	Stator
15.	Screw
16.	Plate
17.	Nameplate

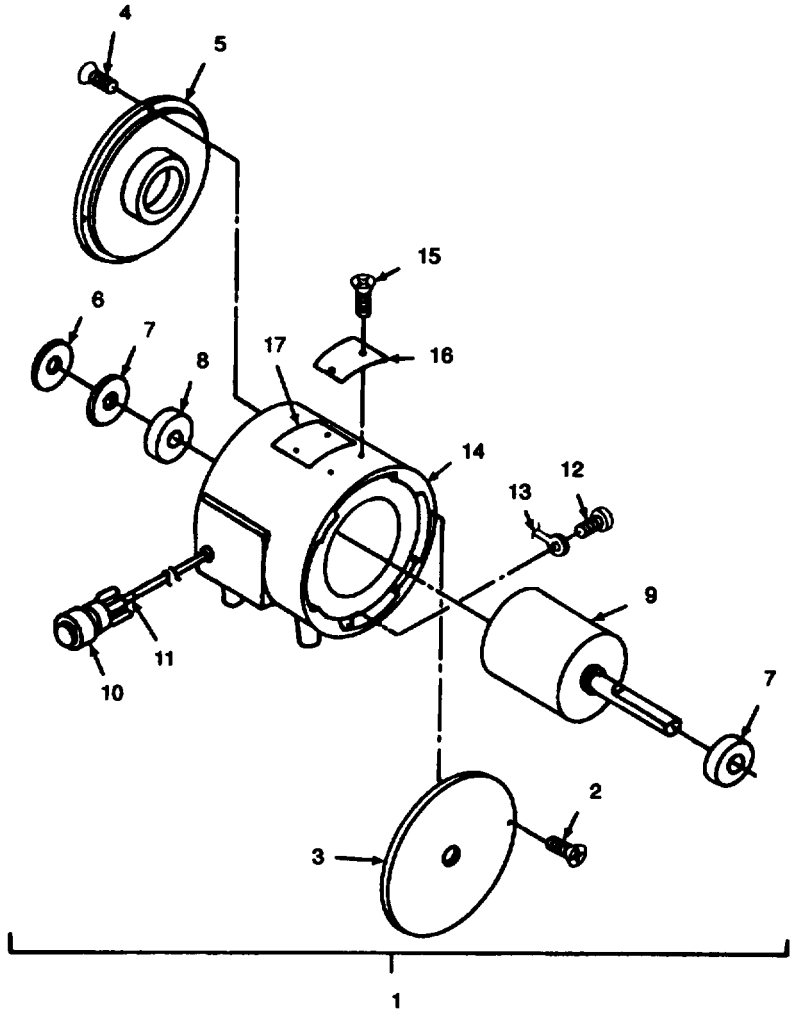


Figure 6-36. Welco Condenser Motor- Model MHP-20-4-08

6.30 MOTOR. -Continued

Location/Item	Action	Remarks
	CONDENSER MOTOR	
Assembly	a. Coat the shaft surfaces of the rotor and load springs with oil (MIL-L-2104, Grade 20). b. Slide both bearings on shaft ends. c. Slide load springs and washers onto shaft ends. d. Slip rotor with shaft into frame with stator. e. Place end brackets on shafts and aline mounting holes. f. Tighten screws in end brackets evenly while cheking rotor for freedom of rotation. There should be no drag.	

NOTE: For further information on electric motor repair, refer to FM 20-31 (Electric Motor and Generator Repair).

CHAPTER 7

PREPARATION FOR STORAGE OR SHIPMENT

7.1 STORAGE. This task coves storage.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Safety Glasses
Gloves
Heavy Duty Cover Material

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

Location/Item	Action	Remarks
Air Conditioner		
Short Term	a. Unroll the fabric rover.	
	b. Snap cover in place.	
Long Term	a. Unroll the fabric cover.	
	b. Snap cover in place.	
	c. Place air conditioner in a dry, covered area.	
	d. Cover air conditioner so that it will be protected from damage by high winds, water, snow, or dust and dirt.	

7.2 SHIPMENT. This task covers shipment.

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
None

Special Tools:
None

Materials/Parts:
Packing Materials
Wood for Base
Kraft Paper
Plastic Wrap
Tape
Strapping Material

Equipment Descriptions:
Power OFF; removed from shelter

Special Environmental Conditions:
None

General Safety Instructions:
See WARNING page

References:
None

Troubleshooting References:
None

Personnel Required:
Direct Support

Location/Item	Action	Remarks
Shipment	a. Bolt air conditioner to a heavy wood frame. b. Cover with plastic wrap, kraft paper, etc. c. Strap covering in place. d. Mark air conditioner per standard Army procedures.	2 x 4 or 4 x 4

APPENDIX A

REFERENCES

A.1 SCOPE. This appendix lists forms and publications pertinent to the air conditioner and associated equipment.

A.2 FORMS.

Recommended Change to Equipment Technical Publications . . . . . DA Form 2028-2

Equipment Inspection and Maintenance Worksheet . . . . . DA Form 2404

Report of Item Discrepancy . . . . . SF 364

Product Deficiency.... . . . . SF 368

A.3 FIELD MANUALS.

First Aidf for Soldiers . . . . . FM 21-11

Electric Motor and Generator Repair . . . . . FM 20-31

A.4 TECHNICAL BULLENTINS.

Hand Portable Fire Extinguisher for Army Users TB5-4200-200-10

A.5 TECHNICAL MANUALS.

Unit, Direct Support and General Support Repair Parts and
Special Tools List for Air Conditioner, Horizontal, Compact
18,000 BTU/HR TM9-4120-367-24P

Hand Receipt Manual TM5-4120-367-14HR

Painting Instructions for Field Use TM43-0139

Procedures for Destruction of Equipment to Prevent Enemy Use TM750-244-3

A.6 MISCELLANEOUS PUBLICATIONS.

Fuels, Lubicants, Oils and Waxes C91001L

Accident Reporting and Records AR385-40

The Army Maintenance Management System (TAMMS) . . . . . DA Pam 738-750

Preservatian, Package, Packing, and Marking Materials, Supplies.
and Equipment Used by the Army SB38-100

APPENDIX B

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B.1 THE ARMY MAITENANCE SYSTEM MAC.

B.1.1 This introduction (Section I) provides a general explanation of all maintenance and repair functions authorized at various maintenance levels under the standard Army Maintenance System concept.

B.1.2 The Maintenance Allocation Chart (MAC) in Section II designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be constant with the capacities and capabilities of the designated maintenance levels, which are shown in the MAC in column (4) as:

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

B.1.3 SectionIII lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from Section II.

B.1.4 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:

B.2.1 Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (i.e., by sight, sound, or feel).

B.2.2 Test. To verify serviceability by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

B.2.3 Service. Operations required periodically to keep an item inproper operating condition i.e., to clean (includes decontamination, when required), to preserve, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

B.2.4 Adjust. To maintain or regulate, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

B.2.5 Aline. To adjust specified variable elements of an item to bring about optimum or desired performance.

B.2.6 Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test, measuring, and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

B.2.7 Remove/Install. To remove and install the same item when required to perform service or other maintenance functions. Install maybe 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.

B.2.8 Replace. To remove an unserviceable item and install a serviceable counter part in its place. Replace is authrized by the MAC and is shown as the 3rd position code of the SMR code.

B.2.9 Repair. The application of maintenance services[1] including fault location/troubleshooting[2] removal/installation. and disassembly/assembly[3] procedures, and maintenance action[4] 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), and item, or system.

B.2.10 Overhaul. That maintenance effort (service/action) prescribed to restore an item to completely serviceable/ operational condition as required by maintenance standards in appropriate technical publications (i.e., DMWR). Overhaul in normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

B.2.11 Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like-new condition in acccordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipment and components.

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

B.3.1 Column 1 - Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify maintenance signification components, assemblies, subassemblies, and modules with the next higher assembly.

B.3.2 Column 2 - Component/Assembly. Column 2 contains the names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

B.3.3 Column 3 - Maintenance Function. 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).

---

[1]Service - Inspect, test, service, adjust, aline, calibrate, and/or replace.

[2]Fault location/troubleshooting -The process of investigating the detecting the cause of equipment malfunctioning; the act of isolating a fault within a system or unit under test (UUT).

[3]Disassembly/assembly - The step-by-step breakdown (taking apart) of a spare/functional group coded item to the level of its least component, that is assigned as SMR code for the level of maintenance under consideration (i.e., identification as maintenance significant).

[4]Actions - Welding, grinding, riveting, straightening, facing, machining, and/or resurfacing.

B.3.4 Column 4 - Maintenance Category. Column 4 specified, 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 that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance functionaries 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

0- Unit maintenance

F - Direct Support maintenance

H - General support maintenance

D - Depot maintenance

B.3.5 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.

B.3.6 Column 6 - Remarks. This column shall, when applicable. contain a letter code, in alphabetical order, which shall be keyed to the remarks contained in Section IV.

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

B.4.1 Column 1- Reference Code. The tool and test equipment reference code correlates with a code used in the MAC, Section II, Column 5.

B.4.2 Column 2- Maintenance Category. The lowest category of maintenance authorized to use the tool or test equipment.

B.4.3 Column 3- Nomenclature. Name or identification of the tool or test equipment.

B.4.4 Column 4- National Stock Number. The national stock number of the tool or test equipment.

B.4.5 Column 5- Tool Number. The manufacturer's part number.

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

B.5.1 Column 1- Reference Code. The code recorded in Column 6, Section II.

B.5.2 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)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Unit		Direct Support	General Support	Depot	Tools and	
Group Number	Component/ Assembly	Maintenance Function	C	O	F	H	D	Equip.	Remarks
01	Final Assembly								
	Connectors	Inspect		0.5					
		Replace		2.0					
	Capacitors	Inspect		0.5					
		Test		0.5					
		Replace		2.0					
	Information Plates	Inspect	.05						
		Service	.05						
		Replace		1.0					
	Installation Hardware	Inspect		0.5					
		Replace		0.5					
02	Housing Covers, Panels, Grilles, Screens, and Information Plates								
	Covers	Inspect	,05						
		Service		0.5					
		Repair			1.0	Replace Gasket and Insulation)			
		Replace			1.0				
	Panels	Inspect	0.5						
		Service		0.5					
		Repair			2.0	(Replace Gasket and Insulation)			
		Replace			1.0				
	Grilles (Louvers)	Inspect	0.5			(Include Operating instructions)			
		Adjust	0.2						
		Service	0.5						
		Replace			1.0				
	Screens and Guards	Inspect	0.5						
		Service	0.5						
		Replace			0.5				

Section II. MAINTENANCE ALLOCATION CHART - Continued

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Unit		Direct Support	General Support	Depot	Tools and	
Group Number	Component/ Assembly	Maintenance Function	C	O	F	H	D	Equip.	Remarks
	Information Plates	Inspect	0.2						
		Service	0.2						
		Replace			0.5				
03	Air Circulating and Condensate Drain System								
	Air Filters	Inspect	0.5						
		Service		0.5					
		Replace		1.0					
	Mist Eliminator	Inspect		0.5					
		Service		0.5					
		Replace		1.0					
	Condenser Discharge Louver Linkage	Inspect		0.5					
		Service		1.0					
		Adjust		1.0					
		Replace		1.0					
	Fresh Air Damper and Actuator	Inspect		0.5					
		Service		0.5					
		Adjust	0.5						
		Replace		1.0					
	Condensate Traps and Drain Tubes	Inspect	0.5						
		Service		0.5					
		Replace		1.0					
04	Electrical								
	Control Module	Inspect	0.5						
		Adjust	0.5						
		Test		2.0					
		Repair		2.0					
		Replace		2.0					

Section II. MAINTENANCE ALLOCATION CHART- Continued

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Unit		Direct support	General Support	Depot	Tools and	
Group Number	Component/ Assembly	Maintenance Function	C	O	F	H	D	Equip.	Remarks
	Junction Box	Inspect		0.5					
		Service		0.5					
		Test		2.0					
		Repair		2.0					
		Replace		2.0					
	Wiring Harness	Inspect		0.5					
		Test		0.5					
		Repair		2.0					
		Replace		4.0					
	Transformer	Test		0.5					
		Replace		1.0					
	Rectifier	Test		0.5					
		Replace		1.0					
	Condenser Fan Thermostat and Cable Assembly	Inspect		0.5					
		Test		1.0					
		Replace		1.0					
05	Evaporator Fan, Motor and Heater								
	Fan and Housing	Inspect		0.5					
		Service		1.0					
		Replace			2.0				
	Motor	Inspect		0.5					
		service		0.5					
		Test		0.5					
		Repair			2.0	(Replace Bearings and Electrical			
		Replace			3.0	Connector Only)			
	Heater Thermostat	Inspect		0.5					
		Test		0.5					
		Replace		0.5					
	Heater Element	Inspect		0.5					
		Test		0.5					
		Replace		2.0					

Section II. MAINTENANCE ALLOCATION CHART- Continued

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Unit		Direct support	General Support	Depot	Tools and	
Group Number	Component/ Assembly	Maintenance Function	C	O	F	H	D	Equip.	Remarks
06	Condenser Fan, Motor and Louver Actuating Cylinder								
	Fan and Housing	Inspect		0.5					
		Service		0.5					
		Replace			1.0				
	Motor	Inspect		0.5					
		Test		0.5					
		Repair			2.0	(Replace Bearings and Electrical			
		Replace			3.0	Connector Only)			
	Actuating Cylinder	Inspect		0.5					
		Adjust			1.0				
		Replace			1.0				
07	Refrigeration System								
	Evaporator Coil	Inspect		0.5					
		Service		0.5					
		Replace			8.0				
	Expansion Valves	Test			0.5				
		Addust							
		Replace			2.0 3.0				
	Pressure Switches	Test			0.5				
		Replace			1.0				
	Condenser Coil	Inspect		0.5					
		Service		0.5					
		Repair			8.0				
	Solenoid Valves	Test			0.5	(Coil Only)			
		Repair		1.0		(Replace Coil Only)			
		Replace			1.5				
	Liquid Indicator	Inspect	0.5						
		Service	0.5						
		Replace			4.0				

Section II. MAINTENANCE ALLOCATION CHART - Continued

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Unit		Direct Support	General Support	Depot	Tools and Equip.	
Group Number	Component/ Assembly	Maintenance Function	C	O	F	H	D		Remarks
	Dehydrator	Inspect Replace			0.5 1.5				
	Compressor	Test Repair Replace			0.5 0.5 12.0	(External Component Only)			
	Tubing & Fittings	Test Replace			0.5 1.5				
08	Housing	Inspect Service Replace					0.5 0.5 2.0		(Replace Insulation & Lifting Hand)

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS

(1)	(2)	(3)	(4)	(5)
Reference Code	Maintenance Level	Nomenclature	National/NATO Stock Number	Tool Number
		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:		
		Tool Kit, Service, Refrigeration Unit (SC 5180-90-CL-N18)	5180-00-586-1474	
		Soldering Gun Kit	3439-00-930-1638	
	F-H	Recovery and Recycling Unit, Refrigerant	4130-01-338-2707	17500B (07295)

Section IV. REMARKS

Reference Code	Remarks
	No supplemental instructions or explanatory remarks are required for the maintenance functions listed in Section II. All functions are sufficiently defined in Section I. 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 component of the end item and basic issue items for the air conditioner to help you inventory the items for safe and efficient operation of the equipment.

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

a. Section II, Components of End Item. This listing is for information purposes only, and is not authority to requisition replacements. These items are part of the air conditioner, but they are to be 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 help you find and identify the items.

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

C.3 EXPLANATION OF COLOUMNS.

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

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

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

d. If the item you need is not the same for different models of the equipment, a Usable On Code will appear on the right side of the description column on the same line as the part number.

e. Column (4), U/I (Unit of Issue), indicates how the item is issued for the National Stock Number shown on column two.

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

Section II. COMPONENTS OF END ITEM LIST

(1) Illus Number	(2) National Stock Number	(3) Description CAGEC and Part Number	Usable On Code	(4) U/I	(5) Qty rqr
	5340-01-042-5752	Mount, Resilient 13216E6137 (97403)			8
	4720-01-038-2334	Tube, Elastomeric 13216E6153 (97403)			4
	5310-00-566-9504	Washer 13216E6138-2 (97403)			4
	5305-00-269-2807	Screw, Cap, Hex HD MS90726-64			4

Section II. BASIC ISSUE ITEMS LIST

(1) Illus Number	(2) National Stock Number	(3) Description CAGEC and Part Number	Usable On Code	(4) U/I	(5) Qty rqr
	5220-00-559-9618	Case, Manual			1
		Department of the Army Technical Manual; Operator, Unit, Direct Support and General Support Maintenance Manual, TM 9-4120-367-14			1
		Department of the Amy Technical Manual; Unit, Direct Support and General Support Repair Parts and Special Tools List for Air Conditioner, Horizontal Compact, 18,000 Btu/hr, TM 9-4120-367-24P			1

APPENDIX D

EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

D.1 SCOPE. This appendix lists expendable durable supplies that you will need to operate and maintain the air conditioner. This listing is for information only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-790, Expendable/Durable Items (except medical, class V repair parts, and heraldic items), or CTA 8-100, Army Medical Department Expendable/Durable Items.

D.2 EXPLANATION OF COLUMNS.

D.2.1 Column 1. Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the item (e.g. "Use cleaning compound, item 5, Appendix D".)

D.2.2 Column 2. Level. This column identifies the lowest level of maintenance that requires the item.

C - Operator/crew
O - Unit maintenance
F - Direct support maintenance
H - General support maintenance

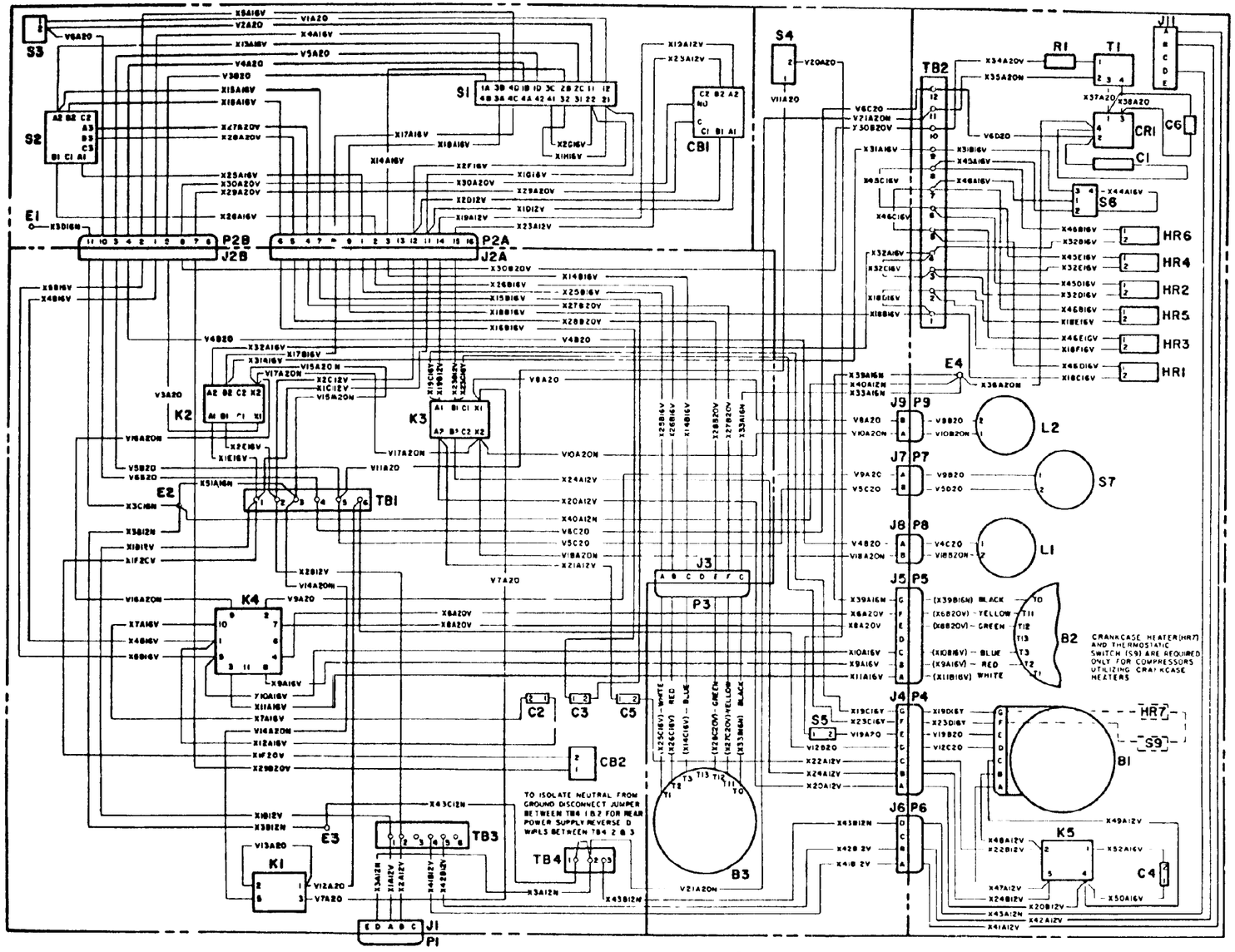
D.2.3 Column 3. National Stock Number. This is the national stock number assigned to the item which you can use to requisition it.

D.2.4 Column 4. Item Name, Description, Commercial and Government Entity Code (CAGEC), and Part Number. This provides the other information you need to identify the item.

D.2.5 Column 5. Unit of Measure. This code shows the physical measurement or count of an item, such as galllon, dozen, gross, etc.

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
1	0	4130-00-860-0042	Coater, Air Filter, 1 Pint Container	ea
2	0	3040-00-664-0439	Adhesive, General Purpose, 1 Pint Container	ea

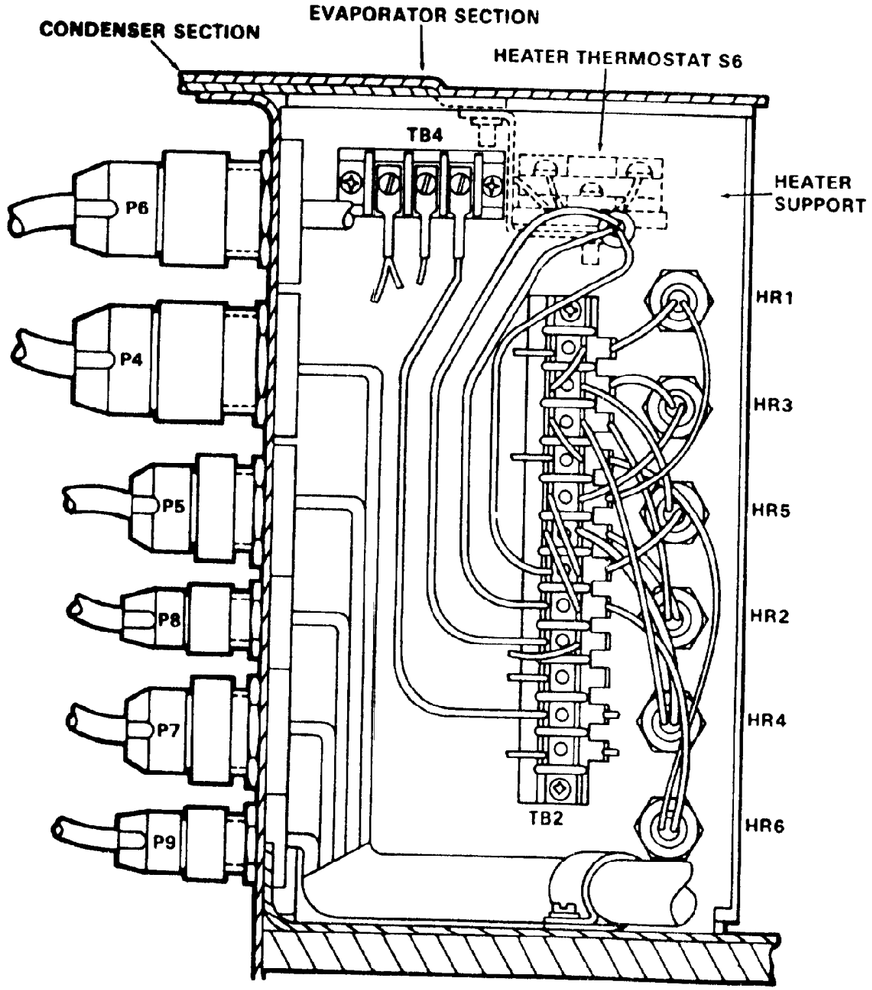


FO-1 Wiring Diagram, Single Phase, 50/60 Hertz, 230 Volts (Model F18H)

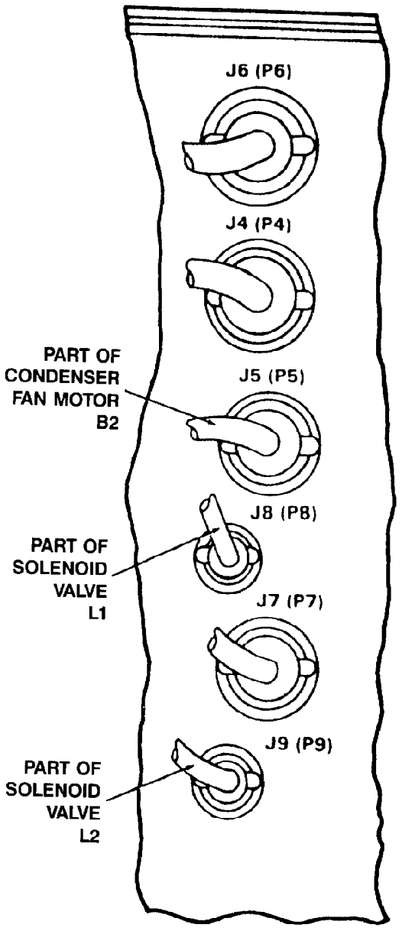
COMPONENT REFERENCE LIST

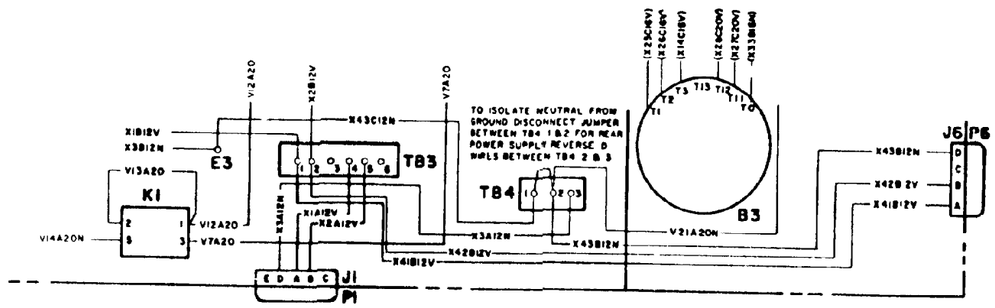
ELEC REF DESIG	DESCRIPTION
B1	COMPRESSOR ROTARY
B2	MOTOR, CONDENSER FAN
B3	MOTOR, EVAPORATOR FAN
C1	CAPACITOR FILTER
C2	CAPACITOR, CONDENSER RUN
C3	CAPACITOR, EVAPORATOR RUN
C4	CAPACITOR, COMPRESSOR START
C5	CAPACITOR, COMPRESSOR RUN
C6	CAPACITOR
CB1	CIRCUIT BREAKER COMPRESSOR
CB2	CIRCUIT BREAKER, CONTROL
CR1	RECTIFIER, SEMICONDUCTOR DEVICE
E1	TERMINAL STUD (CONTROL MODULE GRD)
E2	TERMINAL STUD (JUNCTION BOX GRD)
E3 AND E4	TERMINAL STUD (SYSTEM GRD)
HR1 THRU 6	HEATER ELEMENT
J1 AND J11	CONNECTOR, RECEPTACLE, POWER INPUT
J2	CONNECTOR RECEPTACLE, JUNCTION BOX
J3	CONNECTOR, RECEPTACLE EVAPORATOR FAN
J4	CONNECTOR, RECEPTACLE, COMPRESSOR
J5	CONNECTOR, RECEPTACLE, CONDENSER FAN
J6	CONNECTOR RECEPTACLE POWER INPUT
J7	CONNECTOR RECEPTACLE THERMOSTATIC SWITCH
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, COMPRESSOR START
L1	VALVE, SOLENOID BY-PASS
L2	VALVE, SOLENOID, PRESSURE EQUALIZER
P1	CONNECTOR, PLUG POWER INPUT
P2	CONNECTOR, PLUG, CONTROL MODULE
P3	CONNECTOR, PLUG, EVAPORATOR FAN
P4	CONNECTOR PLUG COMPRESSOR
P5	CONNECTOR PLUG CONDENSER FAN
P6	CONNECTOR PLUG, POWER INPUT
P7	CONNECTOR PLUG THERMOSTATIC SWITCH
P8	CONNECTOR PLUG SOLENOID VALVE BY PASS
P9	CONN PL SOL VALVE EQUALIZER
P10	CONNECTOR, PLUG, COMPRESSOR
R1	RESISTOR
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
S7	SWITCH, THERMOSTATIC
T1	TRANSFORMER
TB1	TERMINAL BOARD, JUNCTION BOX
TB2	TERMINAL BOARD
TB3	TERMINAL BOARD, POWER INPUT
TB4	TERMINAL BLOCK

NOTE Where Sheet 2 is referenced see FO-2



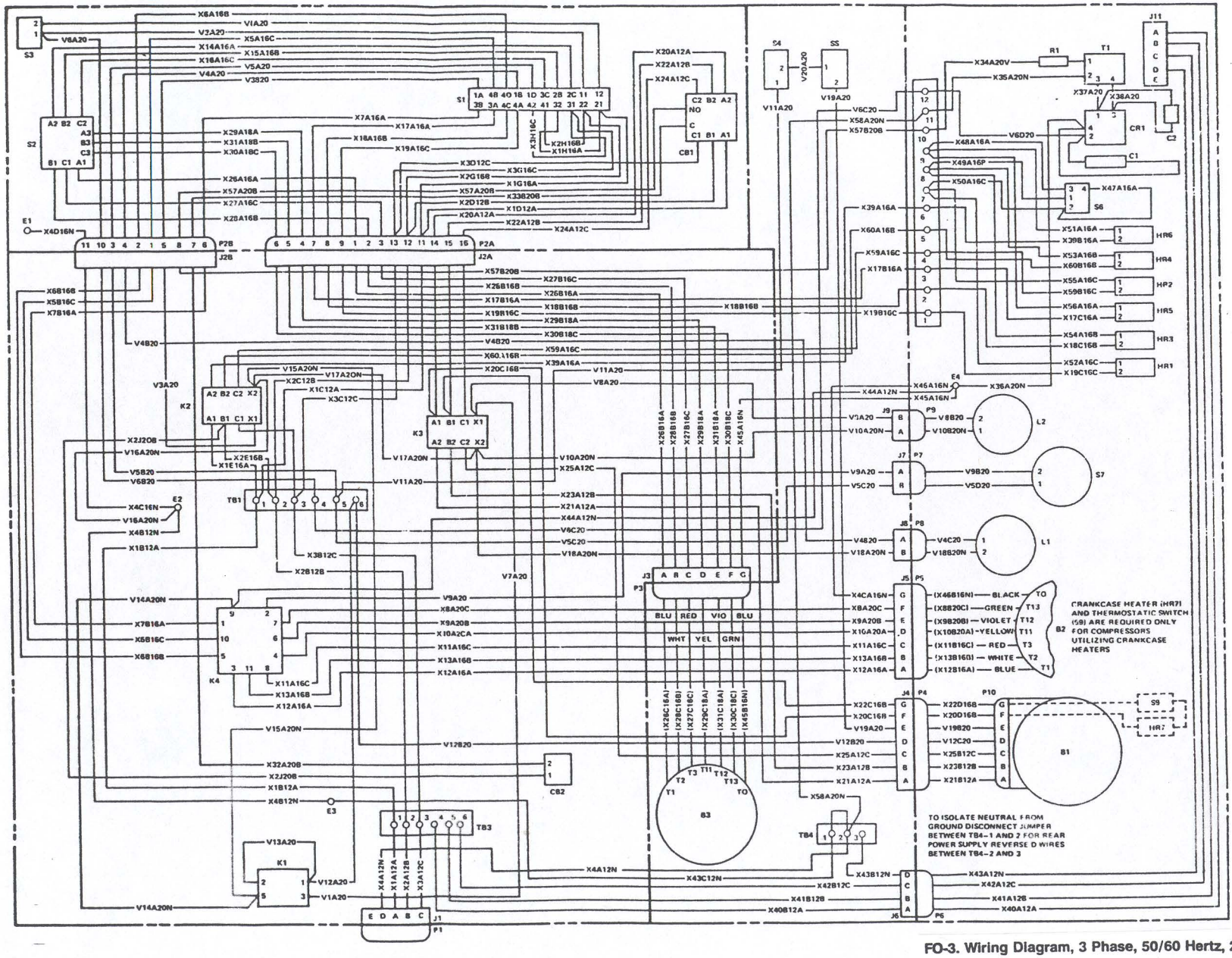
NOTE Where Sheet 1 is referenced see FO 1





FO-2 Wiring Diagram, Single Phase, 50/60 Hertz, 230 Volts (Model F18H)

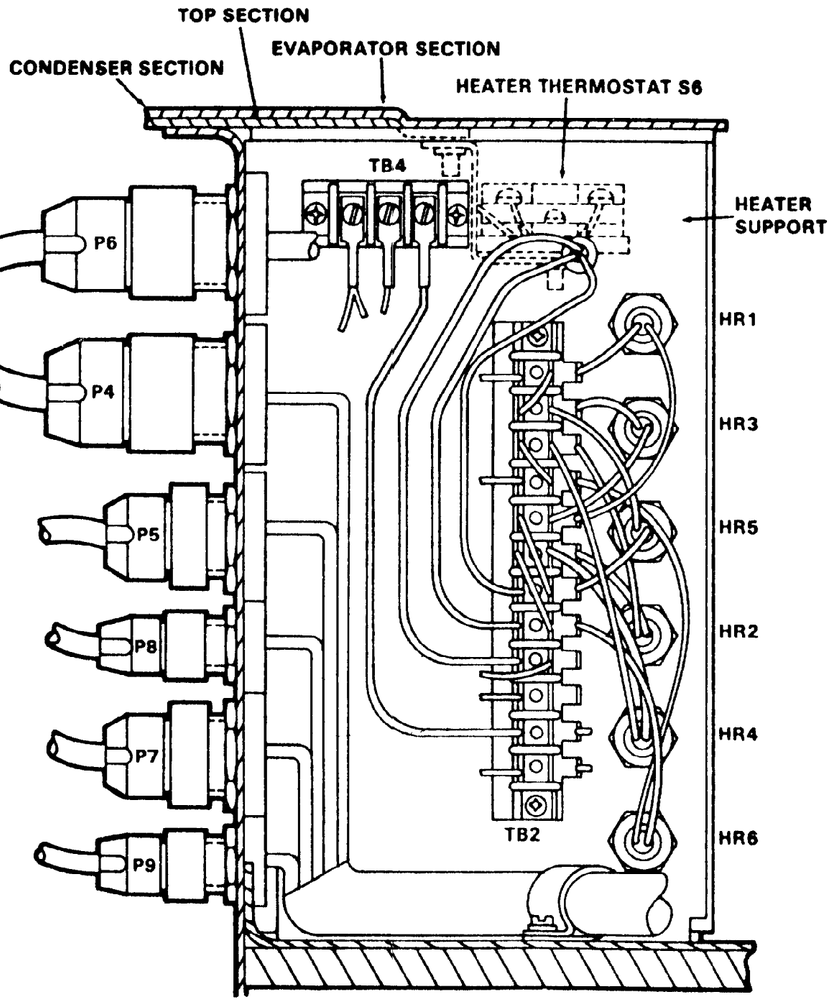
NOTE: Where Sheet 2 is referenced see FO-4.

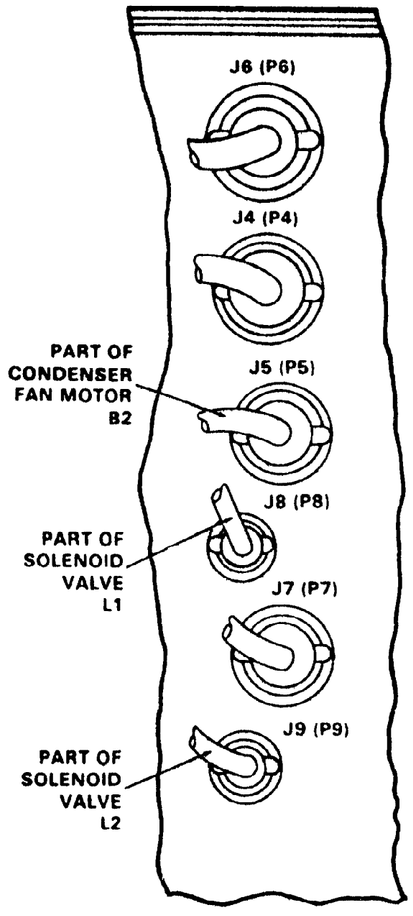


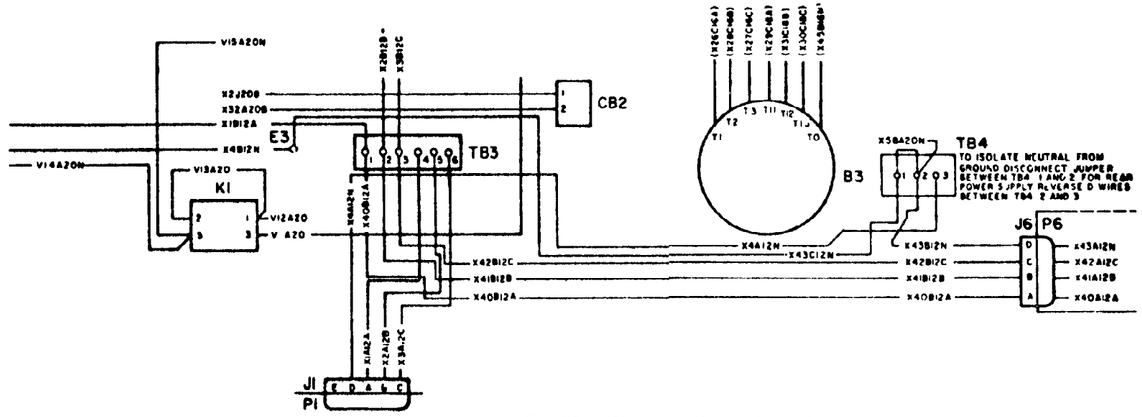
COMPONENT REFERENCE LIST

ELEC REF DESIG	DESCRIPTION
B1	COMPRESSOR, ROTARY
B2	MOTOR, CONDENSER FAN
B3	MOTOR, EVAPORATOR FAN
C1	CAPACITOR, FILTER (EMI)
C2	CAPACITOR (EMI)
CB1	CIRCUIT BREAKER, COMPRESSOR
CB2	CIRCUIT BREAKER, CONTROL
CR1	RECTIFIER, SEMICONDUCTOR DEVICE
E1	TERMINAL STUD (CONTROL MODULE GRD)
E2	TERMINAL STUD (JUNCTION BOX GRD)
E3 AND E4	TERMINAL STUD (SYSTEM GRD)
HR1 THRU 6	HEATER ELEMENT
J1 AND J11	CONNECTOR, RECEPTACLE, POWER INPUT
J2	CONNECTOR, RECEPTACLE, JUNCTION BOX
J3	CONNECTOR, RECEPTACLE, EVAPORATOR FAN
J4	CONNECTOR, RECEPTACLE, COMPRESSOR
J5	CONNECTOR, RECEPTACLE, CONDENSER FAN
J6	CONNECTOR, RECEPTACLE, POWER INPUT
J7	CONNECTOR, RECEPTACLE, THERMOSTATIC SWITCH
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
L1	VALVE, SOLENOID, BY-PASS
L2	VALVE, SOLENOID, PRESSURE EQUALIZER
P1	CONNECTOR, PLUG, POWER INPUT
P2	CONNECTOR, PLUG, CONTROL MODULE
P3	CONNECTOR, PLUG, EVAPORATOR FAN
P4	CONNECTOR, PLUG, COMPRESSOR
P5	CONNECTOR, PLUG, CONDENSER FAN
P6	CONNECTOR, PLUG, POWER INPUT
P7	CONNECTOR, PLUG, THERMOSTATIC SWITCH
P8	CONNECTOR, PLUG, SOLENOID VALVE BY-PASS
P9	CONNECTOR, PLUG, SOLENOID VALVE EQUALIZER
P10	CONNECTOR, PLUG, COMPRESSOR
R1	RESISTOR
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
S7	SWITCH, THERMOSTATIC
T1	TRANSFORMER
TB1	TERMINAL BOARD, JUNCTION BOX
TB2	TERMINAL BOARD
TB3	TERMINAL BOARD, POWER INPUT
TB4	TERMINAL BLOCK

FO-3. Wiring Diagram, 3 Phase, 50/60 Hertz, 208 Volts (Model F18H-3)

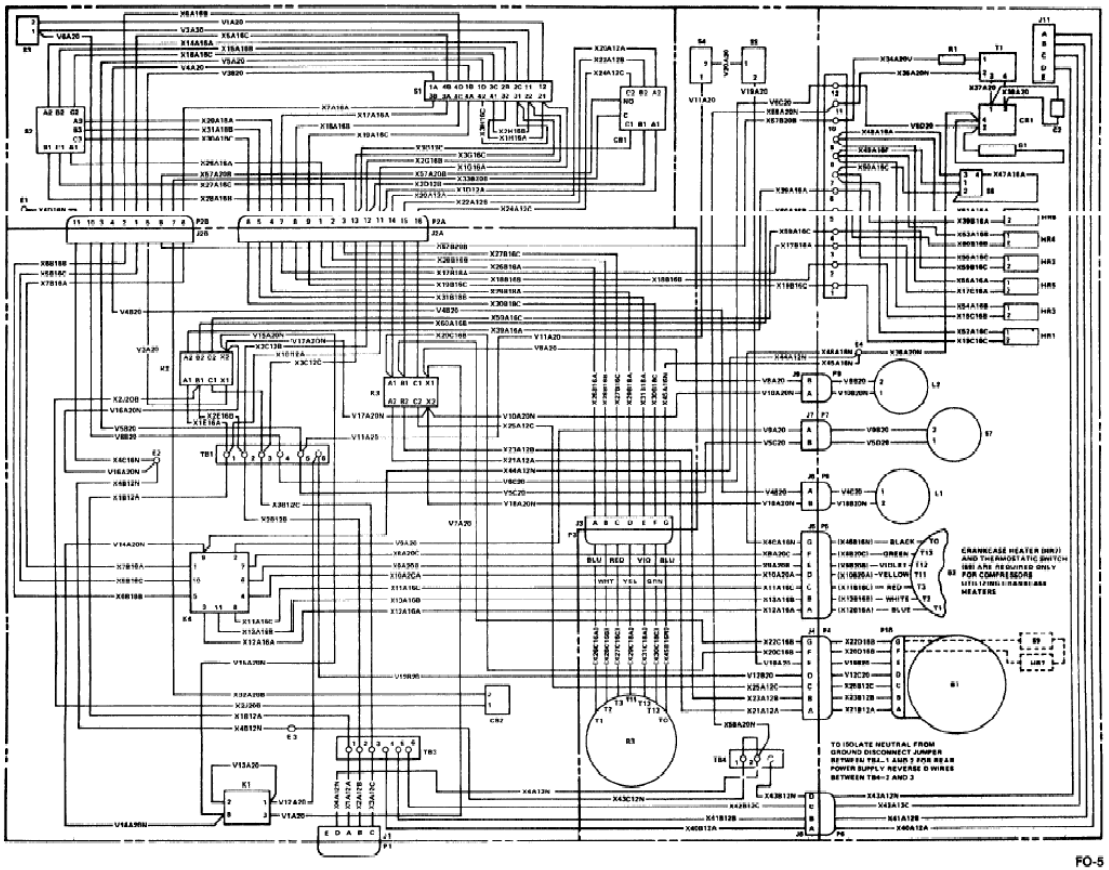






NOTE Where Sheet 1 is referenced see FO-3

FO-4 Wiring Diagram, 3 Phase, 50/60 Hertz, 208 Volts (Model F18H-3)

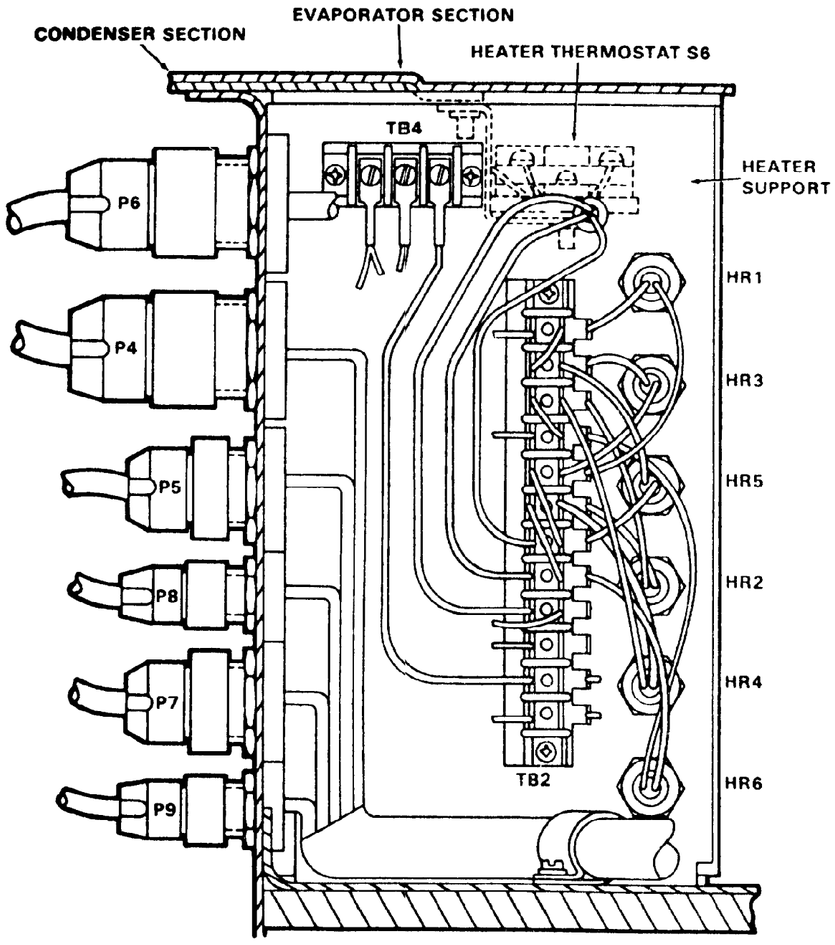


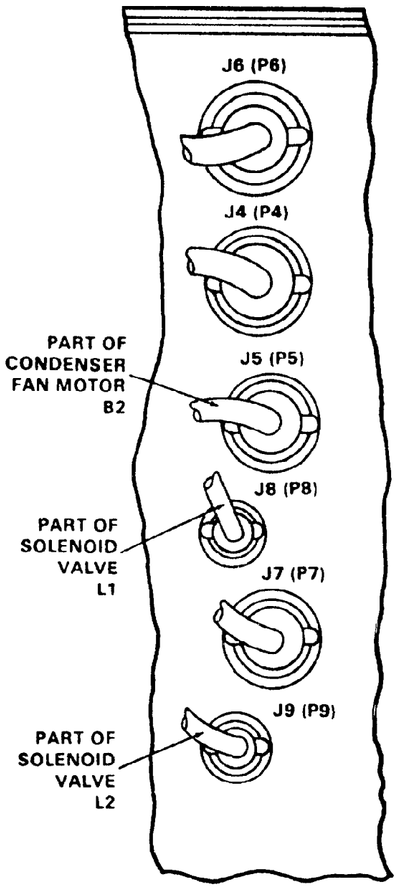
NOTE Where Sheet 2 is referenced see FO-6

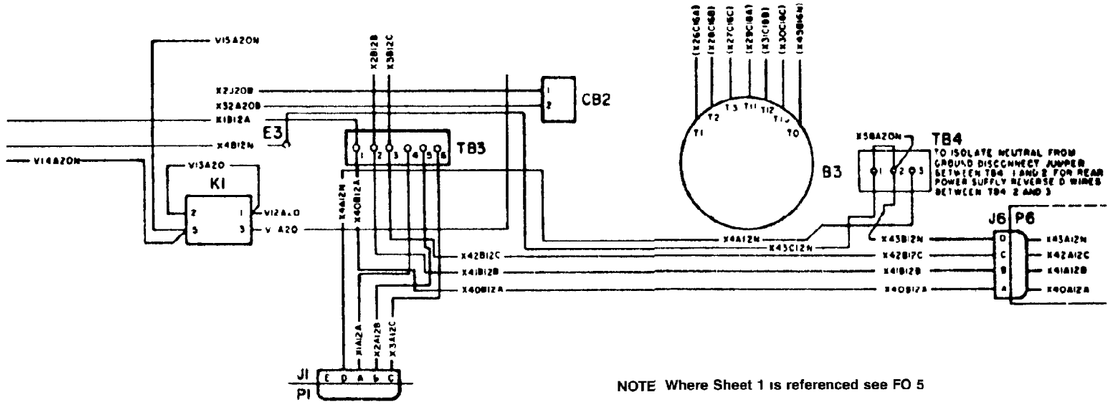
COMPONENT REFERENCE LIST

ELEC REF DESIG	DESCRIPTION
B1	COMPRESSOR, ROTARY
B2	MOTOR CONDENSER FAN
B3	MOTOR EVAPORATOR FAN
C1	CAPACITOR FILTER (EMI)
C2	CAPACITOR (EMI)
CB1	CIRCUIT BREAKER COMPRESSOR
CB2	CIRCUIT BREAKER CONTROL
CR1	RECTIFIER, SEMICONDUCTOR DEVICE
E1	TERMINAL STUD (CONTROL MODULE GRD)
E2	TERMINAL STUD (JUNCTION BOX GRD)
E3 AND E4	TERMINAL STUD (SYSTEM GRD)
HR1 THRU 6	HEATER ELEMENT
J1 AND J11	CONNECTOR RECEPTACLE, POWER INPUT
J2	CONNECTOR RECEPTACLE, JUNCTION BOX
	FAN
J4	CONNECTOR RECEPTACLE, COMPRESSOR
J5	CONNECTOR RECEPTACLE CONDENSER FAN
J6	CONNECTOR, RECEPTACLE POWER INPUT
J7	CONNECTOR RECEPTACLE THERMOSTATIC SWITCH
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
L1	VALVE SOLENOID BY PASS
L2	VALVE SOLENOID PRESSURE EQUALIZER
P1	CONNECTOR PLUG POWER INPUT
P2	CONNECTOR PLUG CONTROL MODULE
P3	CONNECTOR PLUG EVAPORATOR FAN
P4	CONNECTOR PLUG COMPRESSOR
P5	CONNECTOR PLUG CONDENSER FAN
P6	CONNECTOR PLUG POWER INPUT
P7	CONNECTOR PLUG THERMOSTATIC SWITCH
P8	CONNECTOR PLUG SOLENOID VALVE BY PASS
P9	CONNECTOR, PLUG, SOLENOID VALVE EQUALIZER
P10	CONNECTOR PLUG COMPRESSOR
R1	RESISTOR
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
S7	SWITCH THERMOSTATIC
T1	TRANSFORMER
TB1	TERMINAL BOARD, JUNCTION BOX
TB2	TERMINAL BOARD
TB3	TERMINAL BOARD POWER INPUT
TB4	TERMINAL BLOCK

FO-5 Wiring Diagram, 3 Phase, 400 Hertz, 208 Volts (Model F18H-4)



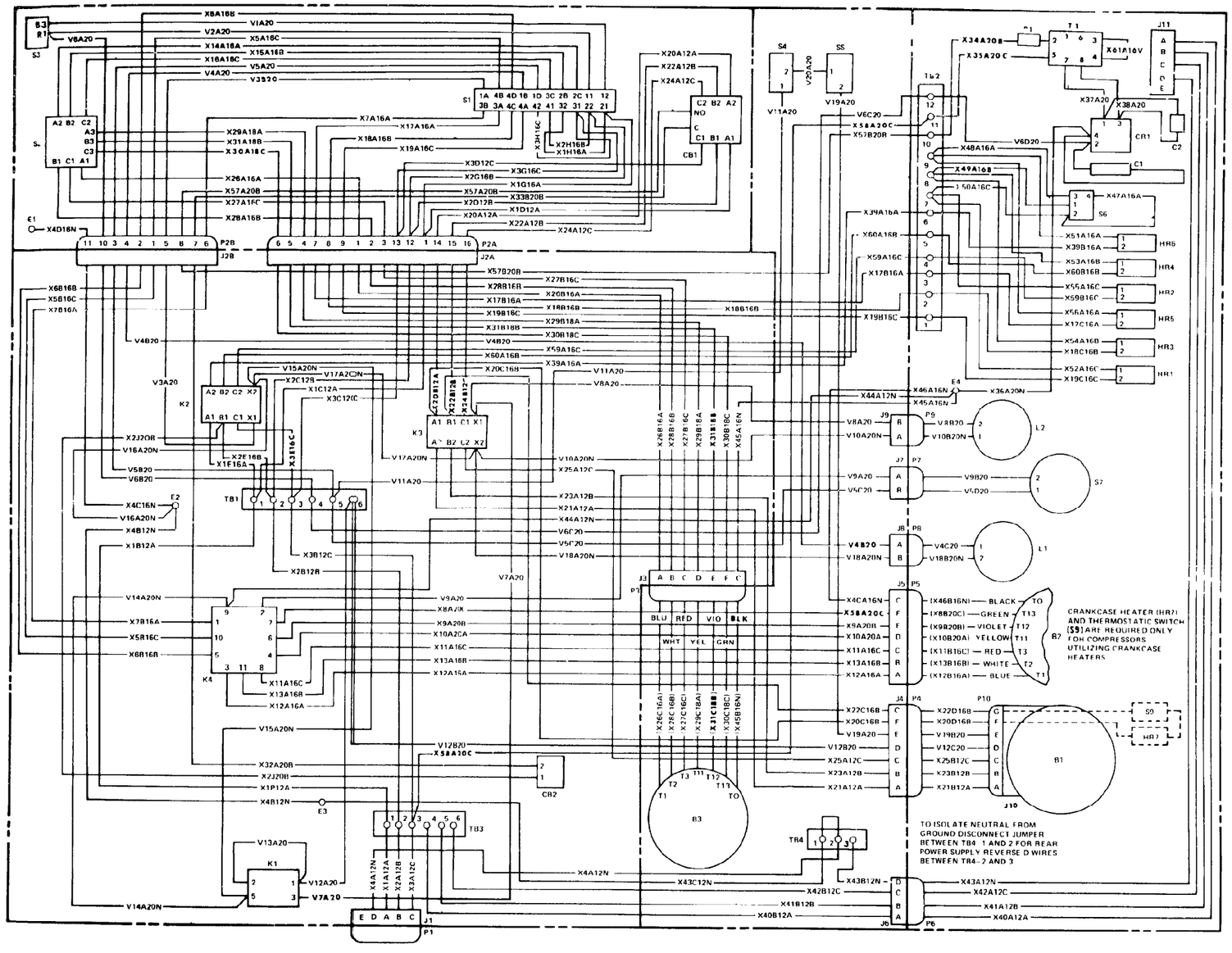




NOTE Where Sheet 1 is referenced see FO 5

FO-6 Wiring Diagram, 3 Phase, 400 Hertz, 208 Volts (Model F18H-4)

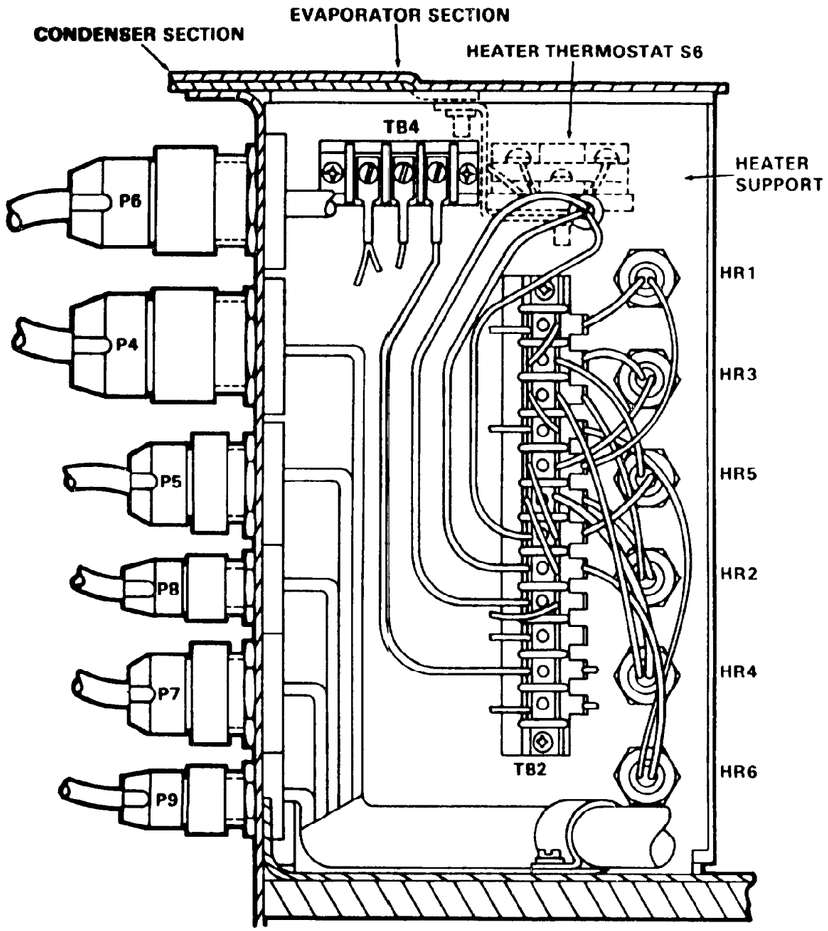
NOTE Where Sheet 2 is referenced see FO 8

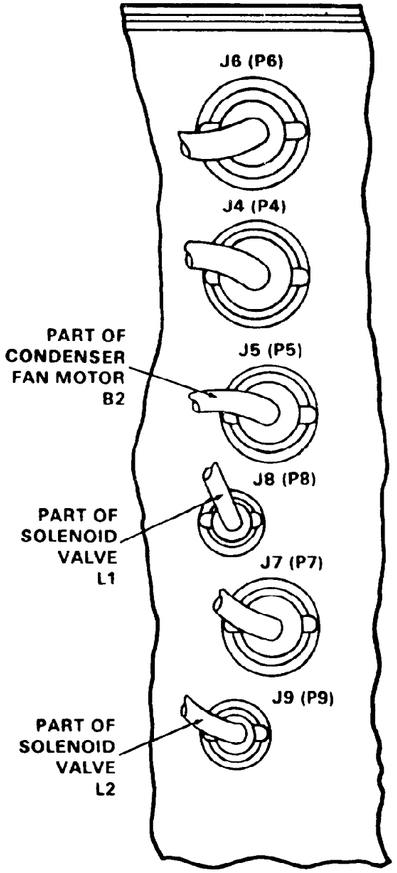


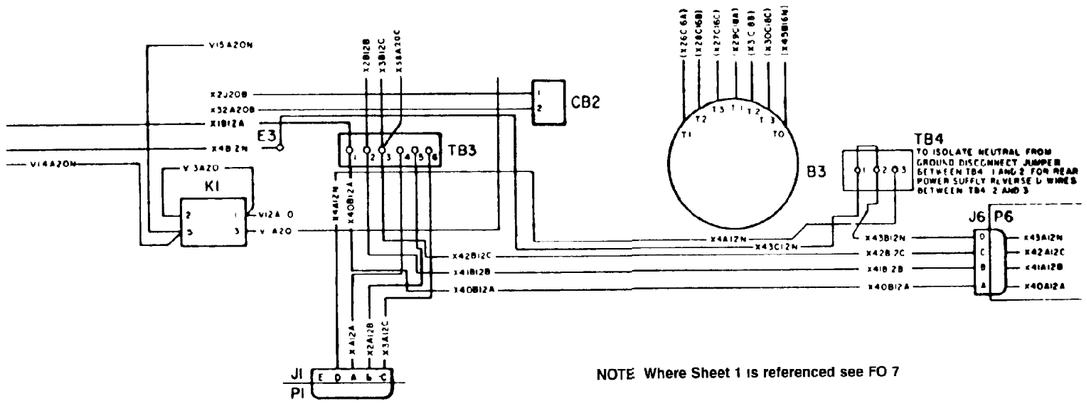
COMPONENT REFERENCE LIST

ELEC REF DESIG	DESCRIPTION
B1	COMPRESSOR
B2	MOTOR CONDENSER FAN
B3	MOTOR, EVAPORATOR FAN
C1	CAPACITOR FILTER (EMI)
C2	CAPACITOR (EMI)
CB1	CIRCUIT BREAKER COMPRESSOR
CB2	CIRCUIT BREAKER CONTROL
CR1	RECTIFIER SEMICONDUCTOR DEVICE
E1	TERMINAL STUD (CONTROL MODULE GRD)
E2	TERMINAL STUD (JUNCTION BOX GRD)
E3 AND E4	TERMINAL STUD (SYSTEM GRD)
HR1 THRU 6	HEATER ELEMENT
J1 AND 11	CONNECTOR RECEPTACLE POWER INPUT
J2	CONNECTOR RECEPTACLE JUNCTION BOX
J3	CONNECTOR RECEPTACLE EVAPORATOR FAN
J4	CONNECTOR RECEPTACLE COMPRESSOR
J5	CONNECTOR RECEPTACLE CONDENSER FAN
J6	CONNECTOR RECEPTACLE POWER INPUT
J7	CONNECTOR RECEPTACLE THERMOSTATIC SWITCH
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
L1	VALVE SOLENOID, BY PASS
L2	VALVE SOLENOID, PRESSURE EQUALIZER
P1	CONNECTOR, PLUG, POWER INPUT
P2	CONNECTOR, PLUG, CONTROL MODULE
P3	CONNECTOR, PLUG, EVAPORATOR FAN
P4	CONNECTOR, PLUG, COMPRESSOR
P5	CONNECTOR, PLUG, CONDENSER FAN
P6	CONNECTOR PLUG POWER INPUT
P7	CONNECTOR PLUG, THERMOSTATIC SWITCH
P8	CONNECTOR PLUG, SOLENOID VALVE BY PASS
P9	CONNECTOR, PLUG, SOLENOID VALVE EQUALIZER
P10	CONNECTOR, PLUG COMPRESSOR
R1	RESISTOR
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
S7	SWITCH THERMOSTATIC
T1	TRANSFORMER
TB1	TERMINAL BOARD, JUNCTION BOX
TB2	TERMINAL BOARD
TB3	TERMINAL BOARD POWER INPUT
TB4	TERMINAL BLOCK

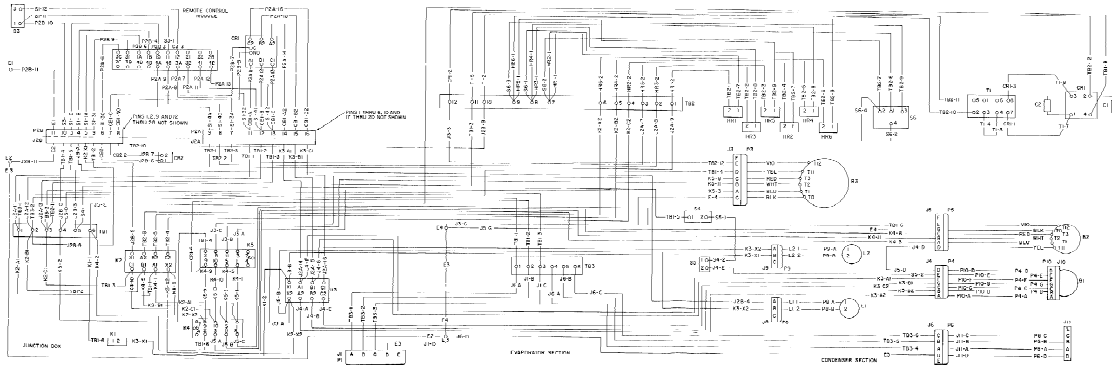
FO-7 Wiring Diagram, 3 Phase, 50/60 and 400 Hertz, 208 Volts (F18-3A and F18H-4A)







FO-8 Wiring Diagram, 3 Phase, 400 Hertz, 208 Volts (F18H-3A and F18H-4A)



EQ 6 Wiring Diagram, 3 Phase, 460 Meter, 208 Volts (MBB,MJL,MJB)

EQUIPMENT REFERENCE LIST

REFERENCE DESIGNATION	DESCRIPTION
B1	COMPRESSOR
B2	CONDENSER FAN MOTOR
B3	METAL CONDUCTOR
B4	EVAPORATOR FAN MOTOR
C1	CONDENSER, PAPER (MFD 5 MMFV)
C2	CAPACITOR
CR1	DIODE ST 500 A.C. RECTIFIER
CR2	DIODE ST 500 A.C. RECTIFIER
F1	FUSE, 15 AMP
F2	FUSE, 15 AMP
J1	TERMINAL BOARD (CONNECTION BOX PART)
J2	TERMINAL BOARD (CONNECTION BOX PART)
J3	CONNECTOR, RECEPTACLE, POWER INPUT
J4	CONNECTOR, RECEPTACLE, CONTROL BOX
J5	CONNECTOR, RECEPTACLE, EVAPORATOR FAN
J6	CONNECTOR, RECEPTACLE, CONDENSER
J7	CONNECTOR, RECEPTACLE, CONDENSER
J8	CONNECTOR, RECEPTACLE, POWER INPUT
K1	CONTACTOR, MAGNETIC, THREE POLE
K2	RELAY, ST 500
K3	RELAY, ST 500
L1	COIL
L2	COIL
L3	COIL
P1	CONNECTOR, RECEPTACLE, POWER INPUT
P2	CONNECTOR, RECEPTACLE, CONTROL BOX
P3	CONNECTOR, RECEPTACLE, EVAPORATOR FAN
P4	CONNECTOR, RECEPTACLE, CONDENSER
P5	CONNECTOR, RECEPTACLE, CONDENSER
P6	CONNECTOR, PLUG, SOLENOID VALVE (HTRS)
P7	CONNECTOR, PLUG, SOLENOID VALVE (HTRS)
P8	CONNECTOR, PLUG, SOLENOID VALVE (HTRS)
R1	CONTACTOR, PANEL, ELECTRONIC VALVE CONTROLLER
R2	CONNECTOR, PLUG, EVAPORATOR
R3	CONNECTOR, PLUG, CONDENSER
S1	SWITCH, HIGH PRESSURE CUTOUT
S2	SWITCH, LOW PRESSURE CUTOUT
S3	SWITCH, LOW PRESSURE CUTOUT
T1	TRANSFORMER
TB1	TERMINAL BOARD, ADAPTER BOX
TB2	TERMINAL BOARD
TB3	TERMINAL BOARD, POWER INPUT

NOTE: INDICATES THE BUS FROM THE EVAPORATOR POWER INPUT TO THE CONDENSER SECTION. THE BUS IS MADE UP OF THE FOLLOWING: PART NUMBERS 11-1, 11-2, 11-3, 11-4, 11-5, 11-6, 11-7, 11-8, 11-9, 11-10, 11-11, 11-12, 11-13, 11-14, 11-15, 11-16, 11-17, 11-18, 11-19, 11-20, 11-21, 11-22, 11-23, 11-24, 11-25, 11-26, 11-27, 11-28, 11-29, 11-30, 11-31, 11-32, 11-33, 11-34, 11-35, 11-36, 11-37, 11-38, 11-39, 11-40, 11-41, 11-42, 11-43, 11-44, 11-45, 11-46, 11-47, 11-48, 11-49, 11-50, 11-51, 11-52, 11-53, 11-54, 11-55, 11-56, 11-57, 11-58, 11-59, 11-60, 11-61, 11-62, 11-63, 11-64, 11-65, 11-66, 11-67, 11-68, 11-69, 11-70, 11-71, 11-72, 11-73, 11-74, 11-75, 11-76, 11-77, 11-78, 11-79, 11-80, 11-81, 11-82, 11-83, 11-84, 11-85, 11-86, 11-87, 11-88, 11-89, 11-90, 11-91, 11-92, 11-93, 11-94, 11-95, 11-96, 11-97, 11-98, 11-99, 11-100, 11-101, 11-102, 11-103, 11-104, 11-105, 11-106, 11-107, 11-108, 11-109, 11-110, 11-111, 11-112, 11-113, 11-114, 11-115, 11-116, 11-117, 11-118, 11-119, 11-120, 11-121, 11-122, 11-123, 11-124, 11-125, 11-126, 11-127, 11-128, 11-129, 11-130, 11-131, 11-132, 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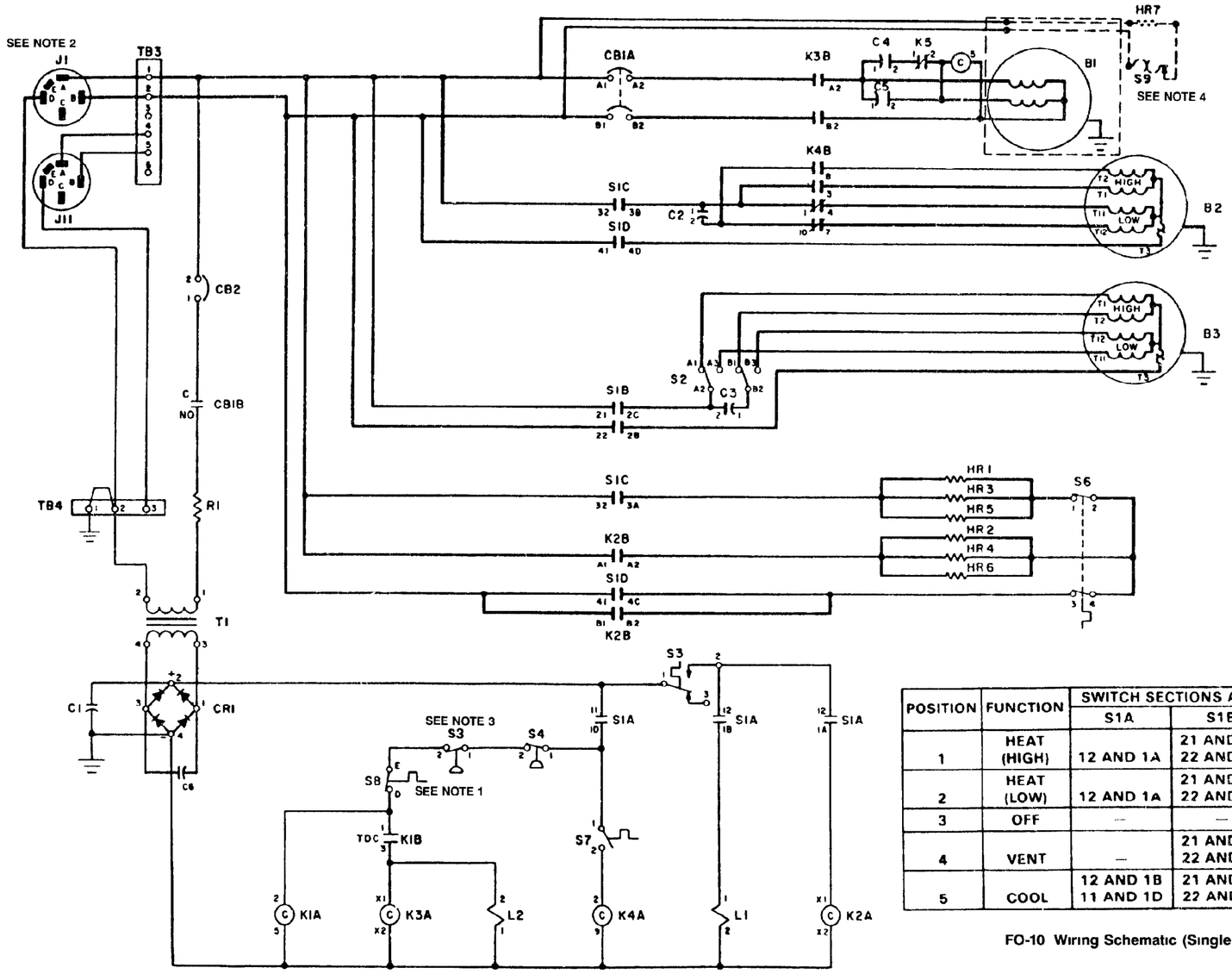


POSITION	FUNCTION	SWITCH SECTIONS AND TERMINALS CONNECTED			
		S1A	S1B	S1C	S1D
1	HEAT (HIGH)	12 AND 1A	21 AND 2C 22 AND 2B	32 AND 3A	41 AND 4C
2	HEAT (LOW)	12 AND 1a	21 AND 2C 22 AND 2B	—	—
3	OFF	—	—	—	—
4	VENT	—	21 AND 2C 22 AND 2B	—	—
5	COOL	12 AND 1B 11 AND 1D	21 AND 2C 22 AND 2B	32 AND 3B	41 AND 4D

FO-10 Wiring Schematic (Single Phase) (Model F18H)

NOTES

1 THERMAL SWITCH S8 IS PART OF COMPRESSOR MOTOR B1

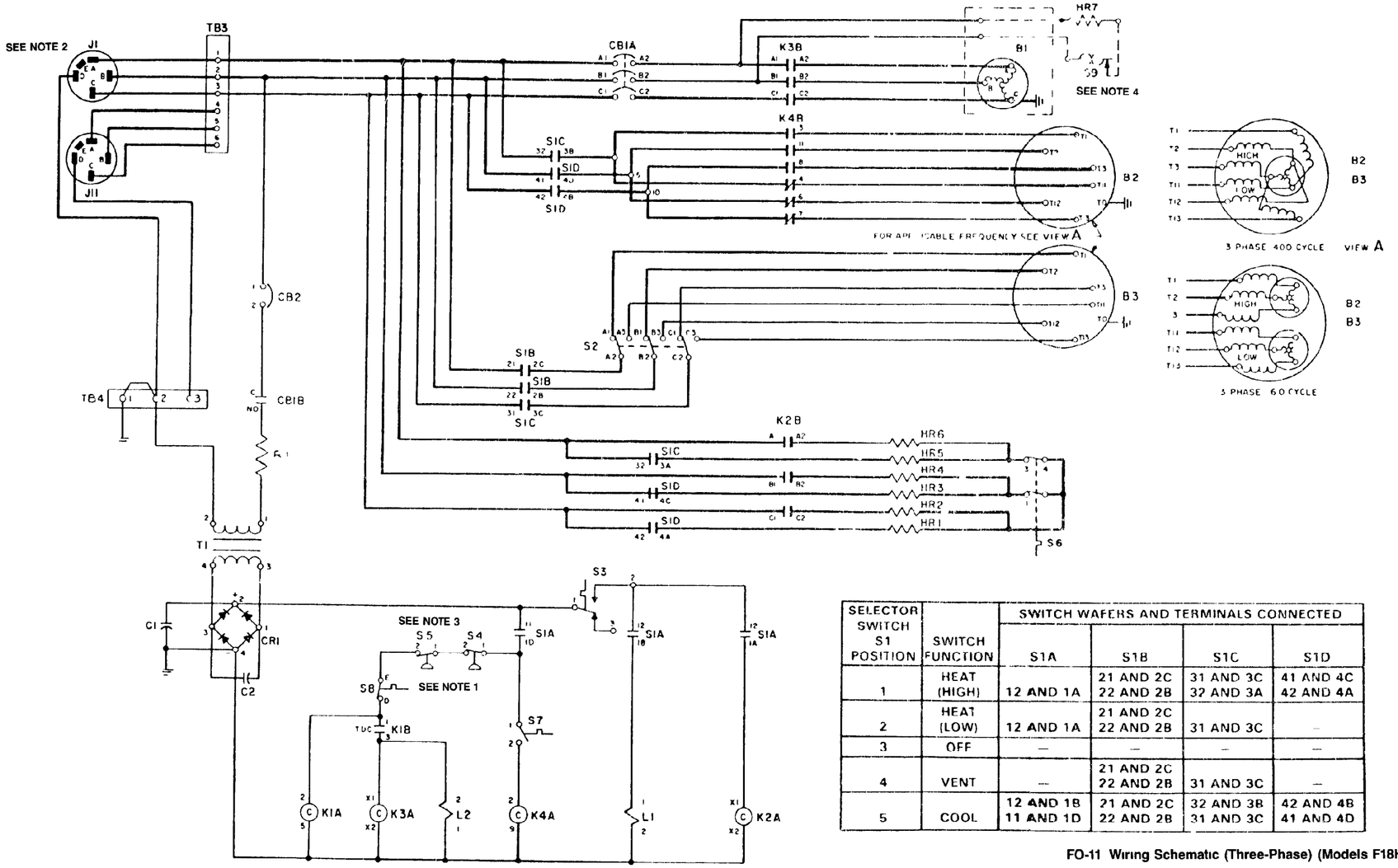
2 INPUT PHASE ORIENTATION FOR MAIN POWER RECEPTACLE J1 AND AUXILIARY POWER RECEPTACLE J11 SHALL BE AS FOLLOWS
PIN A - PHASE A
PIN B PHASE B
PIN C PHASE C
PIN D GROUND

3 SWITCH (S5) IS SHOWN IN PRESSURE ENERGIZED POSITION

4 CRANKCASE HEATER (HR7) AND THERMOSTATIC SWITCH (S9) ARE REQUIRED ONLY FOR COMPRESSORS UTILIZING CRANK CASE HEATERS

COMPONENT REFERENCE LIST

ELEC REF DESIG	DESCRIPTION
B1	COMPRESSOR ROTARY
B2	MOTOR CONDENSER FAN
B3	MOTOR EVAPORATOR FAN
C1	CAPACITOR, FILTER
C2	CAPACITOR CONDENSER RUN
C3	CAPACITOR EVAPORATOR RUN
C4	CAPACITOR COMPRESSOR START
C5	CAPACITOR, COMPRESSOR RUN
C6	CAPACITOR
CB1	CIRCUIT BREAKER, COMPRESSOR
CB2	CIRCUIT BREAKER CONTROL
CR1	RECTIFIER SEMICONDUCTOR DEVICE
HR1 THRU 6	HEATER ELEMENT
HR7	HEATER COMPRESSOR CRANKCASE
J1 AND J11	CONNECTOR RECEPTACLE POWER INPUT
K1	RELAY, TIME DELAY
K2	RELAY HEATER
K3	RELAY, COMPRESSOR MOTOR
K4	RELAY CONDENSER FAN
K5	RELAY COMPRESSOR START
L1	VALVE, SOLENOID BYPASS
L2	VALVE SOLENOID PRESSURE EQUALIZER
R1	RESISTOR
S1	SWITCH ROTARY SELECTOR
S2	SWITCH EVAPORATOR FAN
S3	SWITCH, TEMPERATURE CONTROL
S4	SWITCH HIGH PRESSURE CUTOUT
S5	SWITCH LOW PRESSURE CUTOUT
S6	SWITCH, HEATER THERMOSTAT
S7	SWITCH, CONDENSER FAN THERMOSTAT
S9	SWITCH COMPRESSOR OVERLOAD (INTERNAL)
T1	TRANSFORMER
TB3	TERMINAL BOARD POWER INPUT
TB4	TERMINAL BLOCK



NOTES

1 THERMAL SWITCH S8 IS PART OF COMPRESSOR MOTOR B1

2 INPUT PHASE ORIENTATION FOR MAIN POWER RECEPTACLE J1 AND AUXILIARY POWER RECEPTACLE J11 SHALL BE AS FOLLOWS
PIN A PHASE A
PIN B PHASE B
PIN C - PHASE C
PIN D GROUND

3 SWITCH (S5) IS SHOWN IN PRESSURE ENERGIZED POSITION

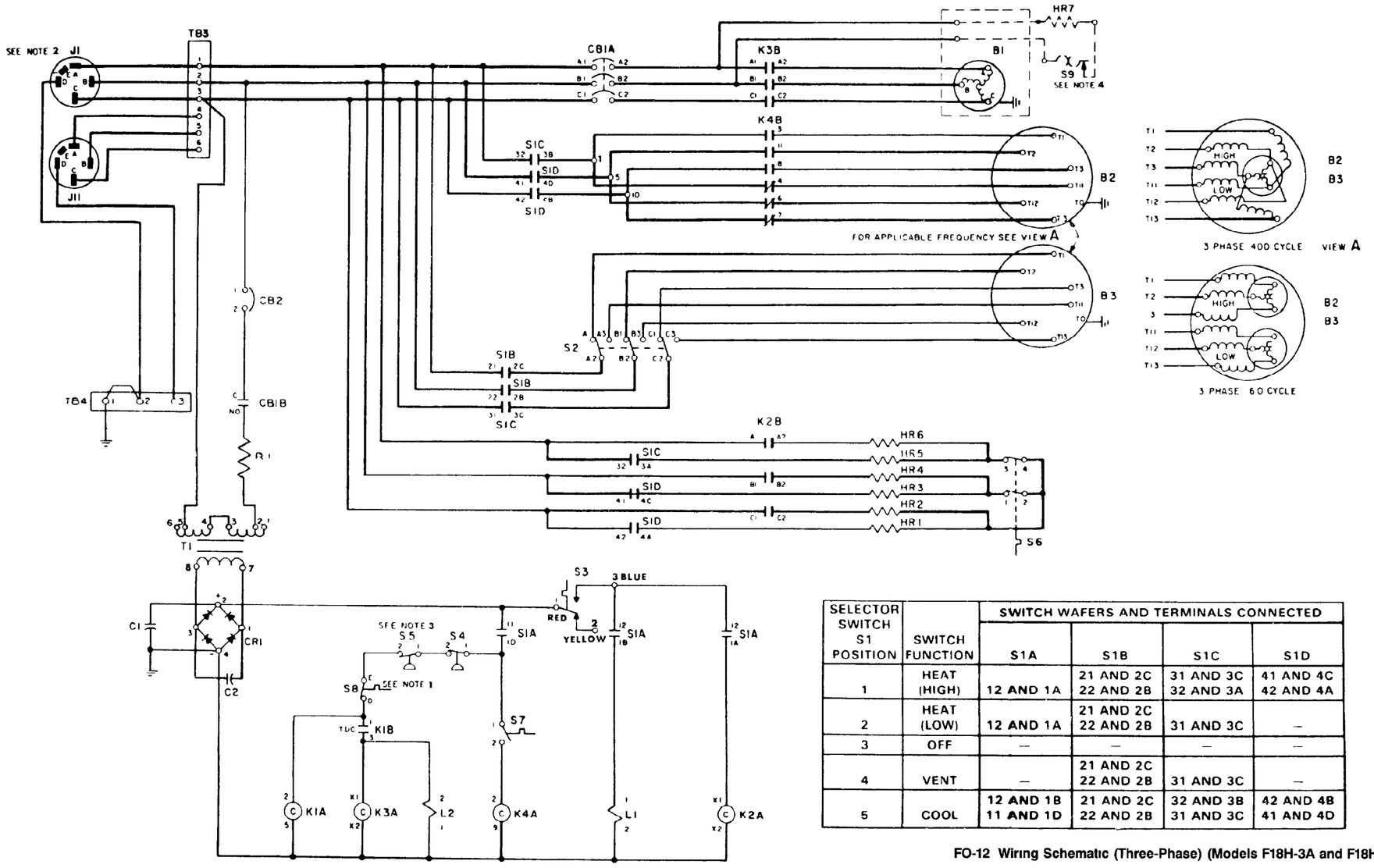
4 CRANKCASE HEATER (HR7) AND THERMOSTATIC SWITCH (S9) ARE REQUIRED ONLY FOR COMPRESSORS UTILIZING CRANK CASE HEATERS

COMPONENT REFERENCE LIST

ELEC REF DESIG	DESCRIPTION
B1	COMPRESSOR
B2	MOTOR, CONDENSER FAN
B3	MOTOR, EVAPORATOR FAN
C1	CAPACITOR, FILTER (EMI)
C2	CAPACITOR FILTER (EMI)
CB1	CIRCUIT BREAKER COMPRESSOR
CB2	CIRCUIT BREAKER, CONTROL
CR1	RECTIFIER
HR1 THRU 6	HEATER ELEMENT
HR7	HEATER, COMPRESSOR, CRANKCASE
J1 AND J11	CONNECTOR, POWER INPUT
K1	RELAY, TIME DELAY
K2	RELAY HEATER
K3	RELAY COMPRESSOR
K4	RELAY CONDENSER FAN
L1	VALVE SOLENOID, BYPASS
L2	VALVE SOLENOID EQUALIZER
R1	RESISTOR
S1	SWITCH ROTARY SELECTOR
S2	SWITCH, EVAPORATOR FAN
S3	SWITCH TEMPERATURE CONTROL
S4	SWITCH HIGH PRESSURE CUTOUT
S5	SWITCH, LOW PRESSURE CUTOUT
S6	SWITCH HEATER THERMOSTAT
S7	SWITCH CONDENSER FAN THERMOSTAT
S9	SWITCH COMPRESSOR OVERLOAD (INTERNAL)
T1	TRANSFORMER
TB3	TERMINAL BOARD POWER INPUT
TB4	TERMINAL BOARD

SELECTOR SWITCH S1 POSITION	SWITCH FUNCTION	SWITCH WAFERS AND TERMINALS CONNECTED			
		S1A	S1B	S1C	S1D
1	HEAT (HIGH)	12 AND 1A	21 AND 2C 22 AND 2B	31 AND 3C 32 AND 3A	41 AND 4C 42 AND 4A
2	HEAT (LOW)	12 AND 1A	21 AND 2C 22 AND 2B	31 AND 3C	—
3	OFF	—	—	—	—
4	VENT	—	21 AND 2C 22 AND 2B	31 AND 3C	—
5	COOL	12 AND 1B 11 AND 1D	21 AND 2C 22 AND 2B	32 AND 3B 31 AND 3C	42 AND 4B 41 AND 4D

FO-11 Wiring Schematic (Three-Phase) (Models F18H-3 and F18H-4)



NOTES

1 THERMAL SWITCH S8 IS PART OF COMPRESSOR MOTOR B1

2 INPUT PHASE ORIENTATION FOR MAIN POWER RECEPTACLE J1 AND AUXILIARY POWER RECEPTACLE J11 SHALL BE AS FOLLOWS
PIN A PHASE A
PIN B PHASE B
PIN C PHASE C
PIN D GROUND

3 SWITCH (S5) IS SHOWN IN PRESSURE ENERGIZED POSITION

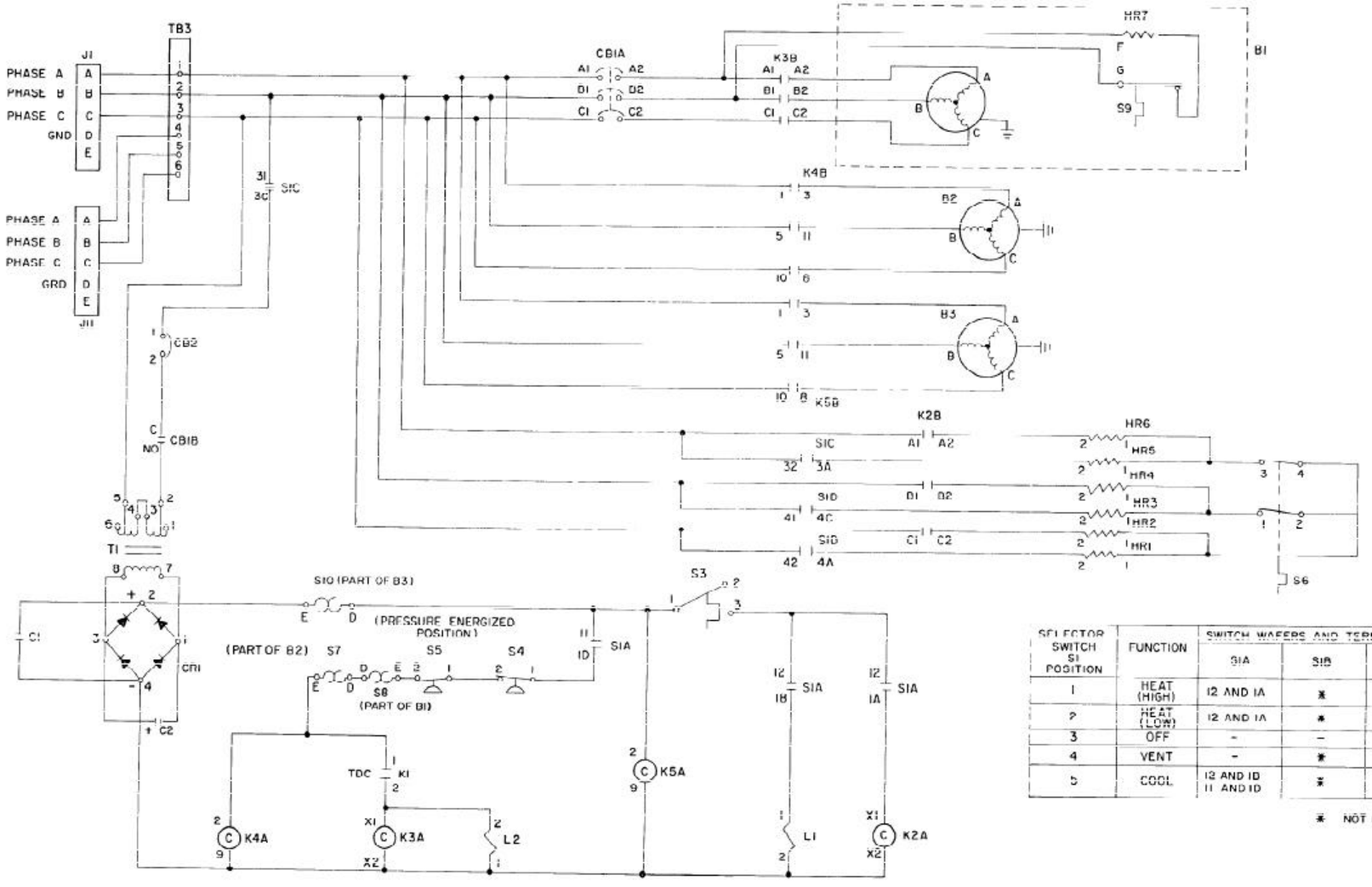
4 CRANKCASE HEATER (HR7) AND THERMOSTATIC SWITCH (S9) ARE REQUIRED ONLY FOR COMPRESSORS UTILIZING CRANK CASE HEATERS

COMPONENT REFERENCE LIST

ELEC REF DESIG	DESCRIPTION
B1	COMPRESSOR
B2	MOTOR CONDENSER FAN
B3	MOTOR, EVAPORATOR FAN
C1	CAPACITOR, FILTER (EMI)
C2	CAPACITOR FILTER (EMI)
CB1	CIRCUIT BREAKER COMPRESSOR
CB2	CIRCUIT BREAKER CONTROL
CR1	RECTIFIER
HR1 THRU 6	HEATER ELEMENT
HR7	HEATER COMPRESSOR CRANKCASE
J1 AND J11	CONNECTOR, POWER INPUT
K1	RELAY TIME DELAY
K2	RELAY HEATER
K3	RELAY, COMPRESSOR
K4	RELAY, CONDENSER FAN
L1	VALVE SOLENOID BYPASS
L2	VALVE SOLENOID EQUALIZER
R1	RESISTOR
S1	SWITCH ROTARY SELECTOR
S2	SWITCH EVAPORATOR FAN
S3	SWITCH, TEMPERATURE CONTROL
S4	SWITCH, HIGH PRESSURE CUTOUT
S5	SWITCH, LOW PRESSURE CUTOUT
S6	SWITCH HEATER THERMOSTAT
S7	SWITCH CONDENSER FAN THERMOSTAT
S9	SWITCH, COMPRESSOR OVERLOAD (INTERNAL)
T1	TRANSFORMER
TB3	TERMINAL BOARD POWER INPUT
TB4	TERMINAL BOARD

SELECTOR SWITCH S1 POSITION	SWITCH FUNCTION	SWITCH WAFERS AND TERMINALS CONNECTED			
		S1A	S1B	S1C	S1D
1	HEAT (HIGH)	12 AND 1A	21 AND 2C 22 AND 2B	31 AND 3C 32 AND 3A	41 AND 4C 42 AND 4A
2	HEAT (LOW)	12 AND 1A	21 AND 2C 22 AND 2B	31 AND 3C	—
3	OFF	—	—	—	—
4	VENT	—	21 AND 2C 22 AND 2B	31 AND 3C	—
5	COOL	12 AND 1B 11 AND 1D	21 AND 2C 22 AND 2B	32 AND 3B 31 AND 3C	42 AND 4B 41 AND 4D

FO-12 Wiring Schematic (Three-Phase) (Models F18H-3A and F18H-4A)



COMPONENT REFERENCE LIST

ELEC REF DESIG	DESCRIPTION
B1	COMPRESSOR
B2	MOTOR, CONDENSER FAN
B3	MOTOR, EVAPORATOR FAN
C1	CAPACITOR, FILTER (MIL C-29014/5)
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 6	HEATER ELEMENT
J1 AND 11	CONNECTOR RECEPTACLE, POWER INPUT
J2	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, COMPRESSOR START
L1	VALVE, SOLENOID, BY PASS
L2	VALVE SOLENOID, PRESSURE EQUALIZER
P1	CONNECTOR PLUG POWER INPUT
P2	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
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 INPUT SOURCE (J11) THE LEADS ORIGINATING FROM TB1-1, TB1 2 AND TB1-3 OR TB3-1 2 AND 3 MUST BE CHANGED TO TB3-4 6 AND 6 RESPECTIVELY

SELECTOR SWITCH S1 POSITION	FUNCTION	SWITCH WAFERS AND TERMINALS CONNECTED			
		S1A	S1B	S1C	S1D
1	HEAT (HIGH)	12 AND 1A	*	31 AND 3C 32 AND 3A	41 AND 4C 42 AND 4A
2	HEAT (LOW)	12 AND 1A	*	31 AND 3C	-
3	OFF	-	-	-	-
4	VENT	-	*	31 AND 3C	-
5	COOL	12 AND 1D 11 AND 1D	*	31 AND 3C	*

* NOT USED

FO-13 Wiring Schematic (Three Phase MHP-20-4-08)

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* U.S. GOVERNMENT PRINTING OFFICE: 1993 755-028/80379

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PREVIOUS EDITIONS ARE OBSOLETE.

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The Metric System and Equivalents

Linear Measure

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

Weights

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

Liquid Measure

1 centiliter = 10 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*
inches	centimeters	2.540	ounce-inches	newton-meters
feet	meters	.305	centimeters	inches
yards	meters	.914	meters	feet
miles	kilometers	1.609	meters	yards
square inches	square centimeters	6.451	kilometers	miles
square feet	square meters	.093	square centimeters	square inches
square yards	square meters	.836	square meters	square feet
square miles	square kilometers	2.590	square meters	square yards
acres	square hectometers	.405	square kilometers	square miles
cubic feet	cubic meters	.028	square hectometers	acres
cubic yards	cubic meters	.765	cubic meters	cubic feet
fluid ounces	milliliters	29,573	cubic meters	cubic yards
pints	liters	.473	milliliters	fluid ounces
quarts	liters	.946	liters	pints
gallons	liters	3.785	liters	quarts
ounces	grams	28.349	liters	gallons
pounds	kilograms	.454	grams	ounces
short tons	metric tons	.907	kilograms	pounds
pound-feet	newton-meters	1.356	metric tons	short tons
pound-inches	newton-meters	.11296		

Temperature (Exact)

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

PIN: 071689-001